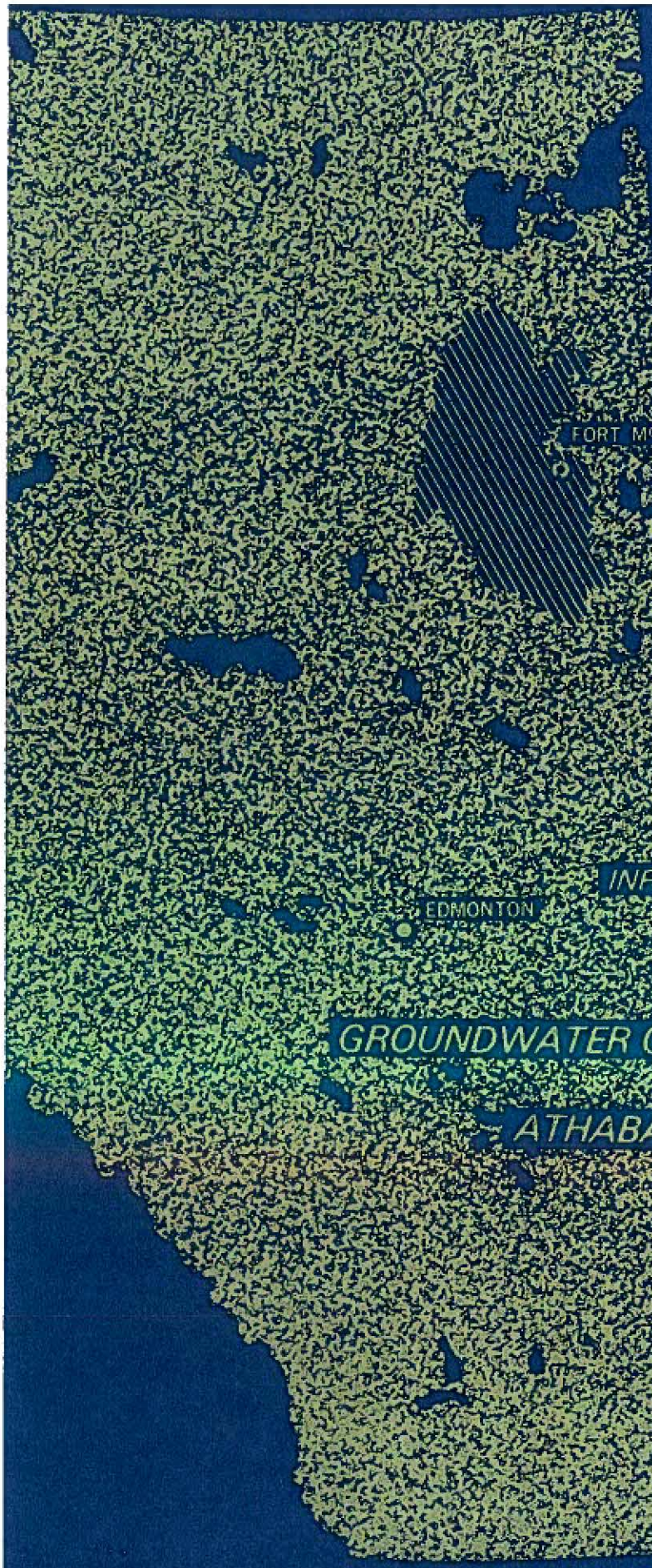



SITE ONE
8-15-96-11 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites, containing 36 individual wells, were instrumented in this manner during the winter of 1974-75.

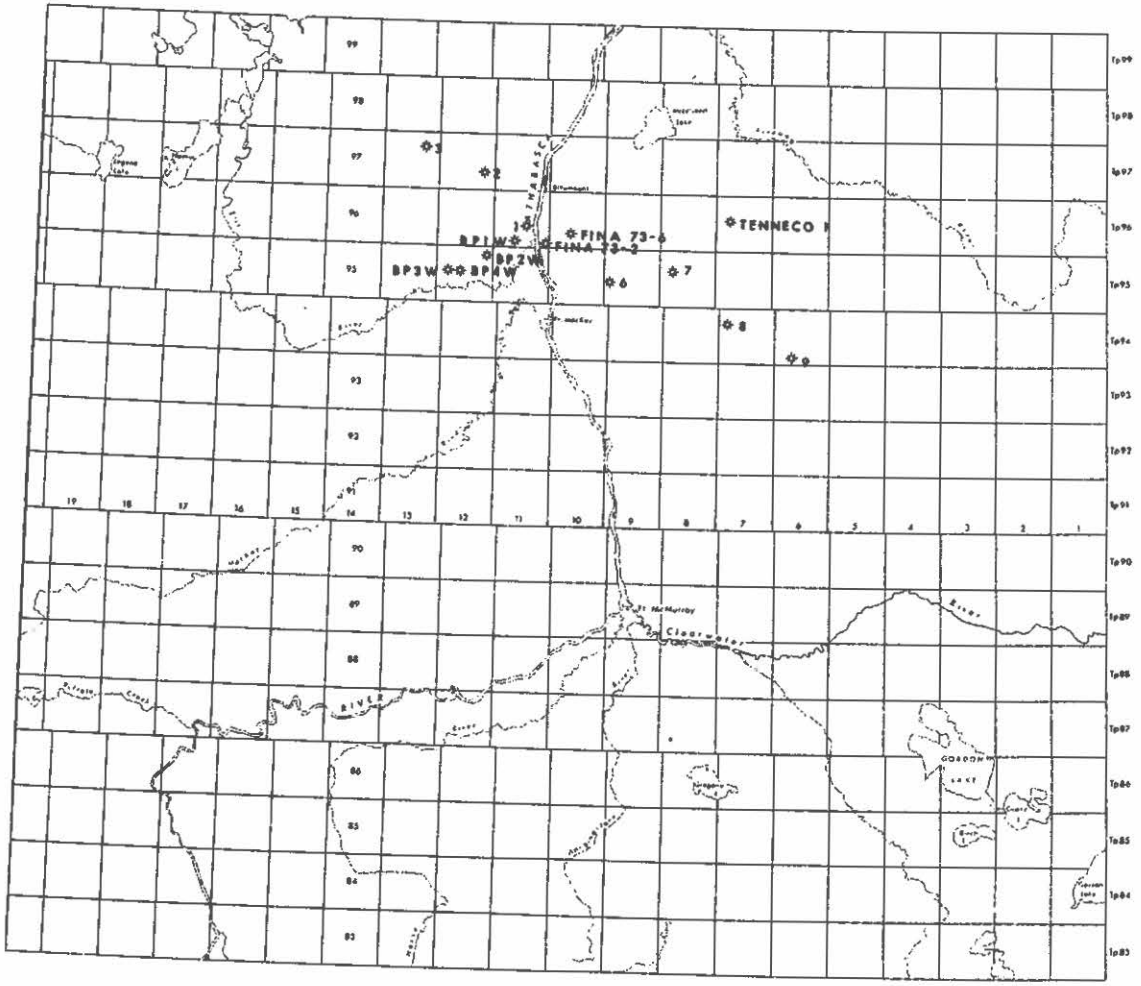
The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill-stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The loose-leaf format has been chosen to facilitate periodic updating with such information as hydrographs, water analyses and well history. The page indexing system is also consistent with the updating process. All updating packages will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this introduction and legend.

There were seven piezometer nests in the system on August 31, 1975. Four companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing. Table 1 lists the location of wells in the system as of August 31, 1975. Map 1 indicates the location of these wells. Publications available as of the date of this document include those for sites 1, 2, 3, 6, 7, 8 and 9.

Table 1
Athabasca Oil Sands Observation Wells
August 31, 1975

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |




6 0 6 12 18 MILES

**MAP 1**
**ATHABASCA OIL SANDS**
**OBSERVATION WELL NETWORK**
**August 31, 1975**

## Acknowledgments

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, C. Seibert, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1975: BOPG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., and Shell Canada Ltd.

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication
Well Number - the name used for designating the well
Subject Code - as follows:

- I - Introduction (no site number indicated)
- L - Legend (no site number indicated)
- G - General site information including geological logs, geophysical logs and site plan (no well number indicated)
- C - Well construction details
- D - Drill stem testing
- A - Aquifer testing
- E - Chemical analyses including spectral emission estimates and routine water analyses
- H - Annual hydrograph
- W - Well history

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within the tabbed section for that particular well.

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

| | | |
|---|---|---|
| Well Number | - | the name used for designating the well |
| Subject Code | - | as follows: |
| I | - | Introduction (no site number indicated) |
| L | - | Legend (no site number indicated) |
| G | - | General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents |
| C | - | Well construction details |
| D | - | Drill stem testing |
| A | - | Aquifer testing |
| E | - | Chemical analyses including multielement analyses and routine water analyses |
| H | - | Annual hydrograph |
| W | - | Well history |
| Year of Publication | - | the last two numerals of the year of publication. |

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within tha tabbed section for that particular well.

## SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| Mer | meridian |
| Meg/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diamter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| Sec. | section |
| ss | stainless steel |

| Symbol | Units or Parameter |
|---|---|
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) *or* time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| Wt | weight |

# SYMBOLS

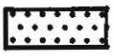
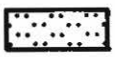
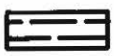
| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

| Symbol | Units or Parameter |
|---|---|
| Sec. | section |
| ss | stainless steel |
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) or time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| WILL | Analysis done at Western Industrial Laboratories Ltd. |
| Wt | weight |

GEOLOGICAL ABBREVIATIONS

| | |
|---|---|
| biocl | bioclast |
| brac | brachiopod |
| bry | bryozoan |
| calc | calcareous |
| carb | carbonaceous |
| cht | chert |
| fld | feldspar |
| glauc | glauconite, glauconitic |
| gvl | gravel |
| hvy | heavy |
| lt | light |
| mnrls | minerals |
| pbl | pebbles |
| qtz | quartz |
| strgr(s) | stringer(s) |
| stroms | stromotoporoids |
| subang | subangular |
| subrd | subrounded |

## GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
|  | sandstone |
| | arkosic sandstone |
| | silt |
|  | siltstone |
| | silt & sandstone |
| | clay |
| | sandy clay |
|  | shale |
| | sandstone & shale |
| | oilsand |
| | shaley dolomite |
| | gypsum |
| | dolomite |
| | limestone |

| Symbol | Stratigraphic Unit |
|---|---|
| Qd | unconsolidated deposits |
| Klb | La Biche Fm. |
| Kpl | Pelican Fm. |
| Kj | Joli Fou Fm. |
| Kg | Grand Rapids Fm. |
| Kc | Clearwater Fm. |
| Km | McMurray Fm. |
| Dbl | Beaverhill Lake Gp. |
| Dw | Waterways Fm. |
| Dpe | Prairie Evaporite Fm. |
| Dmt | Methy Fm. |
| Dmr | McLean River Fm. |
| Dl | La Loche Fm. |
| P$\epsilon$ | Precambrian |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: complete routine analysis and a spectral emission estimate for 29 elements. Many of the samples collected during 1975 appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years.

Most water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source".

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface

3. drill through the aquifer using very light mud
4. insert a screening device (if necessary).

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

Two drilling rigs were used simultaneously during the 1974-1975 drilling season. Both were Failing 1500; one was trailer mounted and capable of 2,000-foot depths, the other was truck mounted and capable of about 1,200-foot depths.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma and uncompensated density were the logs run during the 1974-75 drilling. The geological log presented represents an interpretation based upon the sample description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells when the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, all wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the

measuring tape sticking to the wet casing. Conventional oil-field drill stem testing equipment was selected in an attempt to produce permeability and head values in the wells with deep water levels. Information from these drill stem tests is presented in the section on "Drill Stem Testing". A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day
V = volume of production into drill collars and stem
t = total flow time of test
T = transmissivity in millidarcy-feet
M = slope of final shut-in pressure plot
k = permeability in millidarcys
h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot.

Values of transmissivity are expressed in the metric units of square metres per day. Permeability is expressed as centimetres per second.

OBSERVATION WELL SITE 1

8-15-96-11 W4th

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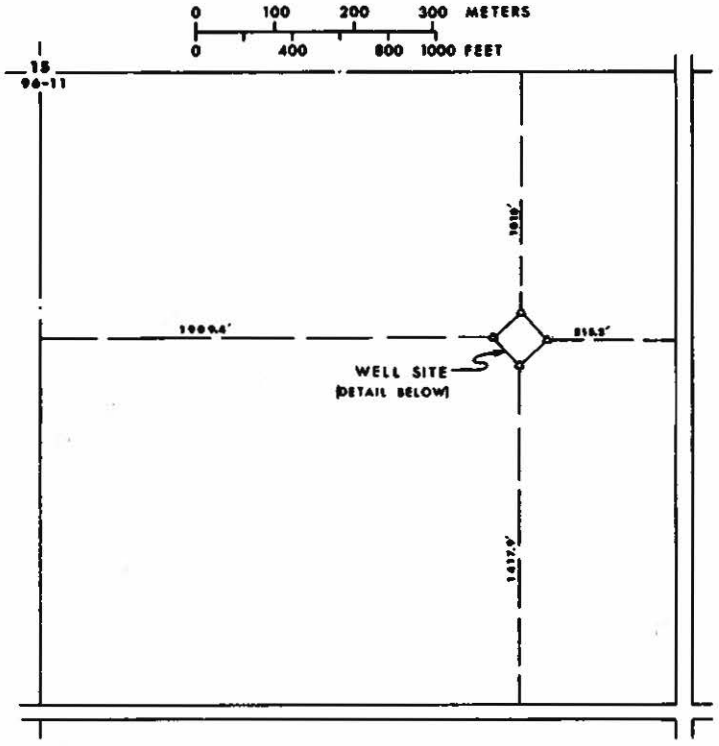


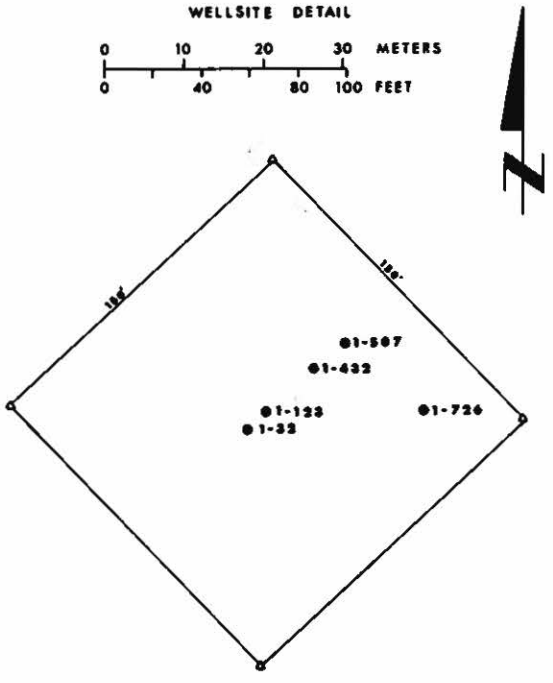

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One

Lsd 8 Sec 15 Twp 96 R 11W4th

Alberta Research Council

Ground elevation 850 Total depth 726

KB elevation 855

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 10 | Silty clay, grey, micaceous, carbonaceous, fissile, traces of pyrite | Drift |
| 10 | 50 | Same as above with rock fragments | McMurray |
| | 60 | Silty clay, grey, traces of fine grained sand, micaceous, carbonaceous, fissile, traces of pyrite | |
| | 70 | Shale, dark grey, micaceous, carbonaceous, fissile with fragments of siltstone | |
| | 80 | Slightly silty clay, grey, very fine grained | |
| | 90 | Clay, grey, micaceous, carbonaceous, with some fine grained quartz sand | |
| | 100 | Sandy siltstone, micaceous, carbonaceous, poorly sorted, rounded | |
| | 110 | Sand, grey, fine to medium grained, fair sorting with 10% to 15% clay | |
| | 120 | Sand, light grey, very fine to fine grained, well sorted, sub-angular to rounded | |
| | 130 | Sand, fine grained, light grey, carbonaceous, sub-angular, medium sorted | |
| | 150 | Sandstone, oil bearing fine to medium grained, carbonaceous, light grey, well sorted, sub-angular to rounded | |
| | 160 | Sand, sub-angular to rounded, light grey, carbonaceous, micaceous, medium to coarse grained | |
| | 170 | Sand, sub-angular to rounded, light grey, medium sized with fragments of carbonaceous, micaceous, fine grained sandstone | |
| | 180 | Quartz sand, micaceous, carbonaceous, (slightly oil-bearing) medium grain size, sub-angular to sub-rounded | |

GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One (continued)

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

| Interval from (feet below KB) to | Description | Formation |
|---|---|---|
| 190 | Sandstone, fine grained,micaceous, sub-rounded, to sub-angular, light grey and slightly oil bearing, brown to grey sand, medium grain size | |
| 200 | Sandstone, light grey, fine grained, sub-rounded to sub-angular, micaceous and sand grey-brown coloured, medium grain size micaceous, carbonaceous, sub-angular to sub-rounded | |
| 210 | Sand, light grey, carbonaceous, micaceous, sub-angular, sub-rounded, fine grained | |
| 220 | Sand, light grey, carbonaceous, fine grained, sub-angular (bituminous) | |
| 230 | Sand, light grey clean, carbonaceous, fine to medium grained, sub-angular | |
| 240 | Combination of 1. light grey sand as above, carbonaceous<br>2. brown to grey sand fine grained, carbonaceous<br>3. dark blue grey sand, fine grained, carbonaceous | |
| 250 | Silt, grey, fine, micaceous, well sorted | |
| 260 | Sand, fine grained, well sorted, grey to brown, sub-rounded | |
| 270 | Sand, well sorted, fine grained, silty, grey, smells bituminous, carbonaceous, sub-angular | |
| 280 | Sand, fine to medium grained quartz, grey coloured, carbonaceous, large quartz crystals, sub-angular, slightly calcareous | |
| 290 | Sand, fine to medium grained, sub-angular, carbonaceous, micaceous, with fragments of quartz and fine grained carbonaceous sandstone | |

GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One (continued)

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 300 | Sand, grey, fine to medium grained, sub-angular, carbonaceous, micaceous, with fragments of very fine bedded silty sandstone, yellow to brown | |
| | 310 | Sand, coarse quartz, oil bearing | |
| | 320 | Sand, oil bearing, light grey quartz, fine to medium grained, bigger quartz fragments, sub-angular, poorly sorted carbonaceous | |
| | 330 | Same as above, very poorly sorted, contains more oil than at 320' | |
| | 340 | Same as 320', very coarse quartz particles | |
| | 350 | Same as 320', very coarse quartz sand, little less oil | |
| | 360 | Same as 320', poorly sorted from silty sand to very coarse quartz sand, more fine than coarse sand | |
| | 370 | Sand, oil bearing, medium with some coarse quartz particles | |
| | 380 | Sand, bituminous, medium to coarse grained, poorly sorted, sub-angular | |
| | 390 | Clay, light grey, micaceous, good bitumen saturation, some quartz sand, coarse grained, sub-angular | |
| | 400 | Silty sand, light grey, fine grained, poorly sorted, sub-angular, poor bitumen | |
| | 410 | Silty sand, light grey, fine to medium grained, poorly sorted, sub-angular, poor bitumen | |
| | 420 | Quartz sand, light grey, fine to medium grained, poorly sorted, sub-angular to angular, poor bitumen | |
| 420 | 440 | Silty clay, light grey, fine grained, poorly sorted, poor bitumen | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 450 | Clay, greenish, slightly silty with traces of bitumen | |
| | 460 | Limestone, light grey | |
| | 470 | Clay, light grey, calcareous | |
| | 480 | Limestone, light grey, very fine grained, micritic (poorly consolidated) | |
| | 490 | Limestone, light grey, fine grained micaceous | |
| | 500 | Limestone, fine grained, poorly consolidated, micaceous, oolitic, carbonaceous | |
| | 510 | Limestone | |
| | 520 | Limestone, carbonaceous | |
| | 530 | Limestone, carbonaceous | |
| | 540 | Limestone, fine to medium grained, slightly bituminous | |
| | 550 | Limestone, bituminous, light grey, fine grained, micaceous, poorly consolidated | |
| | 560 | Limestone, light grey, bituminous, micaceous, fine grained | |
| | 570 | Light grey, bituminous limestone, fine grained | |
| | 580 | Limestone, fine grained, micaceous, bituminous, light gray | |
| | 590 | Limestone, fine to medium grained, very bituminous, consolidated | |
| | 600 | Limestone, light, bituminous, fine grained | |
| | 610 | Limestone, very slightly bituminous, light grey micaceous, fine grained, consolidated | Prairie Evaporite |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 620 | Limestone, consolidated, light grey, fine to medium grained, carbonaceous, micaceous gypsum | |
| | 630 | Limestone, light grey, fine grained, micaceous with white components and some light brown components, gypsum | |
| | 640 | Limestone, light grey, consolidated, slightly bituminous, fine to medium grained, carbonaceous | |
| | 650 | Limestone, light grey, consolidated, slightly bituminous, fine grained | |
| | 660 | Limestone, light grey, consolidated, carbonaceous | |
| | 670 | Limestone, bituminous, light grey with white fragments, consolidated, carbonaceous | |
| | 680 | Limestone, light grey and white, bituminous consolidated, fine grained, gypsum | |
| | 690 | Limestone, slightly bituminous, light grey and white | |
| | 698 | Light grey limestone, with some white fragments, carbonaceous, fine grained, consolidated | |
| 698 | 726 | Micritic limestone, light grey, very fine grained | |

## SUMMARY OF CONTENTS

SITE NUMBER ONE

sd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | | | | |
|---|---|---|---|---|---|---|---|
| | site | 1-32 | 1-123 | 1-432 | 1-507 | 1-726 | 1-1040 |
| Site Plan | 1* | — | — | — | — | — | — |
| Geological Sample Description | 4* | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1* | — | — | — | — | — | — |
| Well Construction | — | 0 | 1* | 0 | 0 | 1* | 1 |
| Drawdown Plot | — | 0 | 0 | 0 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 0 | 0 | 0 | 10 |
| Shut-In Pressure Data | — | 0 | 0 | 0 | 0 | 0 | 8 |
| Water Analysis | — | 1 | 1 | 2 | 2 | 1 | 3 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 |

*Supersedes pages distributed in 1976

## SUMMARY OF CONTENTS

SITE NUMBER ONE

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | site | 1-32 | 1-123 | 1-432 | 1-507 | 1-726 |
| Introduction | 4 | — | — | — | — | — |
| Legend | 8 | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — |
| Geological Sample Description | 5 | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 1 | 0 | 1 | 0 | 0 |
| Drill Stem Test | — | 0 | 2 | 2 | 2 | 2 |
| Shut-In Pressure Data | — | 0 | 1 | 1 | 2 | 2 |
| Water Analysis | — | 3 | 2 | 4 | 4 | 4 |
| Spectral Emission Estimates | — | 0 | 0 | 1 | 1 | 0 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 |

OBSERVATION WELL SITE 1

8-15-96-11 W4th

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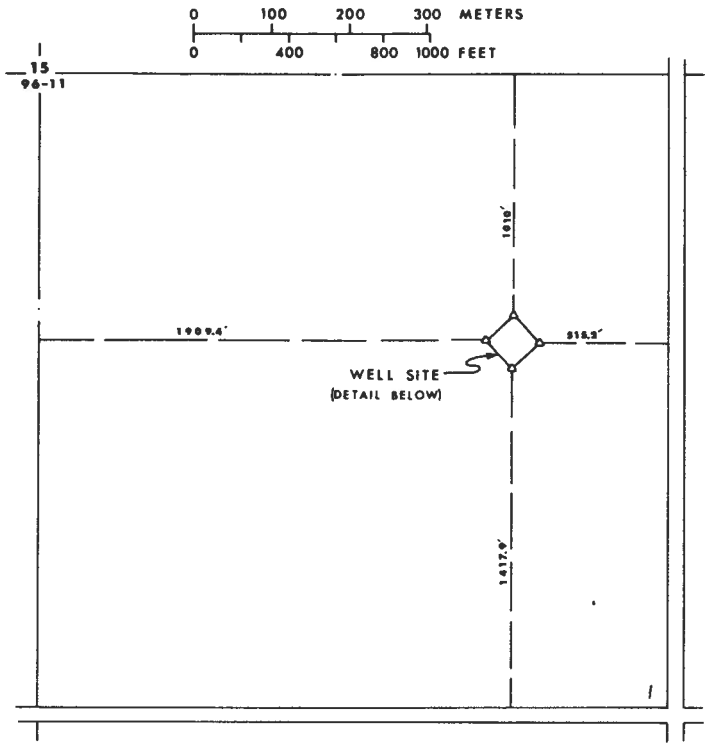
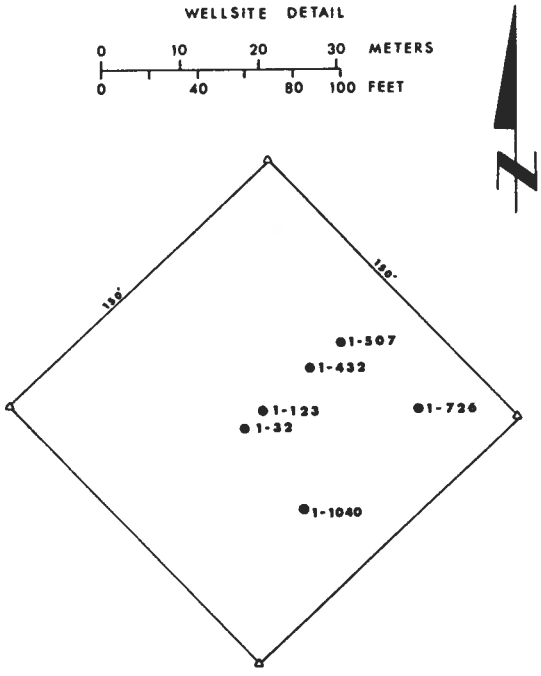



1523.9 N : 625.9 W

WELLSITE DETAIL



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Ground elevation 850 Total depth 1040

KB elevation 858

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 8 | 10 | Clay, medium grey, silty, calc, boulderchips (unsorted drift) | Drift |
| 10 | 30 | Clay, medium grey, silty, calc, ferruginous. Siltstone, medium grey, argillaceous, sandy, calcareous, as strgrs on the bottom | Clearwater |
| 30 | 35 | Siltstone, medium grey, sandy, calc cement, qtz, glauc. Silty clay strgrs | |
| 35 | 60 | Sandstone, medium green, fine grained, silty, subrounded, well sorted, fair porosity, glauc, qtz. Interbedded siltstone, medium grey, sandy and silty, medium grey, calcareous clay (up to 10%) | |
| 60 | 75 | Clay, medium grey, silty; calcareous siltstone medium grey, sandy, glauc on the bottom | |
| 75 | 85 | Sandstone, medium green, fine-medium grained, silty, subangular, medium sorted, good-excellent porosity, glauc, qtz. Thin clayey strgrs | Wabiskaw |
| 85 | 120 | Sandstone, lt brown, fine-coarse grained, subrounded, poorly sorted, fair porosity, moderate oil impregnation, qtz, lt cht, fld, ferruginous. Interbedded clay, medium grey, silty (up to 15%) | McMurray |
| 120 | 130 | Sandstone, lt brown, fine grained, subrounded, well sorted, good porosity, no oil stain. Clay, medium grey, silty strgrs | |
| 130 | 160 | Sandstone, lt brown, fine grained, argillaceous, subangular-subrounded, well sorted, fair porosity, slight-moderate oil impregnation, qtz, lt cht, pyrite, fld; shale, medium-dark grey, interbedded | |
| 160 | 210 | Sandstone, lt brown, fine grained, subrounded, well sorted, fair porosity, moderate oil impregnation in strgrs, qtz, lt cht. Shale, medium-dark grey, interbedded in the upper part | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One (continued)

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 210 | 230 | Sandstone, lt brown, fine grained, subrounded, well sorted, good porosity, slightly oil stained, qtz, lt cht, pyrite | |
| 230 | 270 | Sandstone as above, moderate oil impregnation in strgrs. Thin beds of dark shale, mostly in the lower part | |
| 270 | 340 | Sandstone, lt brown, fine-medium grained, coarse-grained strgrs, subangular-subrounded, well-medium sorted, excellent porosity, no oil stain, qtz, lt cht, traces of pyrite, ferruginous pellets and dark hvy mnrls. Very thin shale strgrs in the lower part | |
| 340 | 450 | Sandstone, lt brown, coarse-very coarse grained, strgr of granular grains (420-440 feet), angular-subangular, medium sorted, excellent porosity, very poorly oil stained in stringers, qtz, lt cht, traces of pyrite | |
| 450 | 460 | Limestone, lt grey-buff, mud supported and micro-granular, argillaceous, fossiliferous (crinoids, stroms, biocl). Poor vuggy porosity | Beaverhill Lake |
| 460 | 490 | Shale, medium grey, limy, grading to argillaceous limestone, fossiliferous (as above), pyrite | |
| 490 | 520 | Limestone, medium grey-buff, argillaceous, fossiliferous, poor vuggy porosity. Shale, medium grey, calcareous, fossiliferous in the lower part (10-20%) | |
| 520 | 550 | Shale, lt-medium grey, calcareous, fossiliferous, grading in stringers to limestone, lt grey, argillaceous, pyrite, poor vuggy porosity | |
| 550 | 560 | Shale, medium grey, calcareous, fossiliferous, interbedded with clayey siltstone, calcareous | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One (continued)

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 560 | 600 | Limestone, buff, slightly argillaceous in the upper part, fossiliferous (crinoids, stroms, brac, biocl), pyrite traces | |
| 600 | 612 | Limestone, light grey-buff, argillaceous, fossiliferous (crinoids), leaching, calcite recrystallization; anhydrite and pyrite traces | Slave Point and Watt Mountain |
| 612 | 620 | Dolomite, medium-dark grey, calcareous, argillaceous, fossil traces, partially replaced - partially recrystalized, associated with shale, medium grey, dolomitic | |
| 620 | 645 | Shale, medium grey, dolomitic with white to medium grey silty anhydrite interbedded in the lower part | |
| 645 | 665 | Anhydrite, white-grey, powdery in the upper part, crystalline in the lower part, well leached, recrystallization. Interbeds of dolomitic grey shale in the upper part | Prairie Evaporite |
| 665 | 740 | Rock salt, smoky grey, with grey anhydrite, gypsum and dolomitic shale in thin beds | |
| 740 | 750 | Anhydrite, white to grey, leaching, recrystallization, dolomitic traces | |
| 750 | 760 | Rock salt, smoky grey, interbedded with medium grey dolomitic shale | |
| 760 | 770 | Anhydrite, grey to white, dolomitic, crystalline, gypsum bands | |
| 770 | 820 | Anhydrite, grey to white, crystalline, mottled, dolomitic in the upper part; leaching and replacement with crystalline calcite in the lower part; pyrite traces | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One (continued)

Lsd 8 Sec 15 Twp 96 R 11 W4th

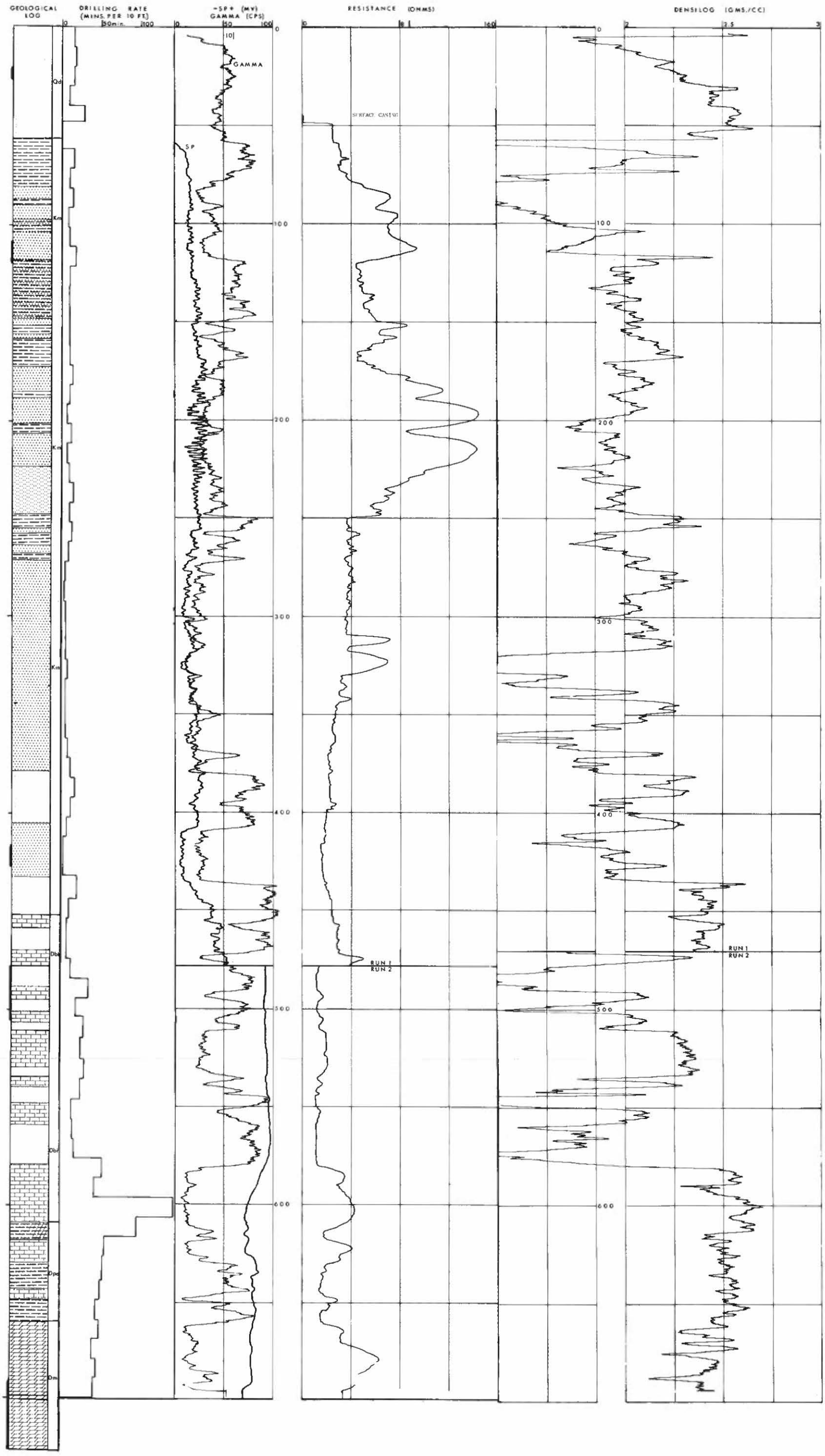
Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 820 | 840 | Dolomite, brown, fine-grained, fossiliferous, leaching, dolomite replacement, poor intergranular porosity | Methy |
| 840 | 850 | Limestone, brown, dolomitic, sucrosic, fossiliferous (biocl), pyrite traces bedded with gypsum, powdery, leaching, recrystallization | |
| 850 | 885 | Limestone, brown to buff, dolomitic in the bottom, fossiliferous (crinoids, bry, brac, biocl) fair vuggy porosity | |
| 885 | 895 | Shale, black, dolomitic, carbonaceous, fossiliferous | |
| 895 | 910 | Limestone, buff-brown, dolomitic, fossiliferous, poor-fair vuggy porosity, pyrite traces | |
| 910 | 930 | Dolomite, lt brown, grading to dolomitic limestone argillaceous on the lower part, fossiliferous (brac, biocl), calcite and pyrite traces | |
| 930 | 945 | Dolomite, buff-grey, argillaceous, calcite traces grading to dolomitic shale in the lower part | |
| 945 | 980 | Shale, red, dolomitic, qtz sand grains | McLean River |
| 980 | 990 | Anhydrite, white, dolomitic; dolomite, buff, argillaceous, fossiliferous | |
| 990 | 1005 | Shale, red, dolomitic, with gypsum beds | |
| 1005 | 1025 | Siltstone, red, sandy, dolomitic cement, qtz grains | |
| 1025 | 1040 | Sandstone, reddish, dolomitic, angular, poorly sorted, good-excellent porosity, qtz, fld, hvy dark mnrls, mica, ferruginous, argillaceous flakes. Granite, reddish in the bottom | La Loche<br>Precambrian |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 1
## 8-15-96-11 W4th
### ALBERTA RESEARCH COUNCIL

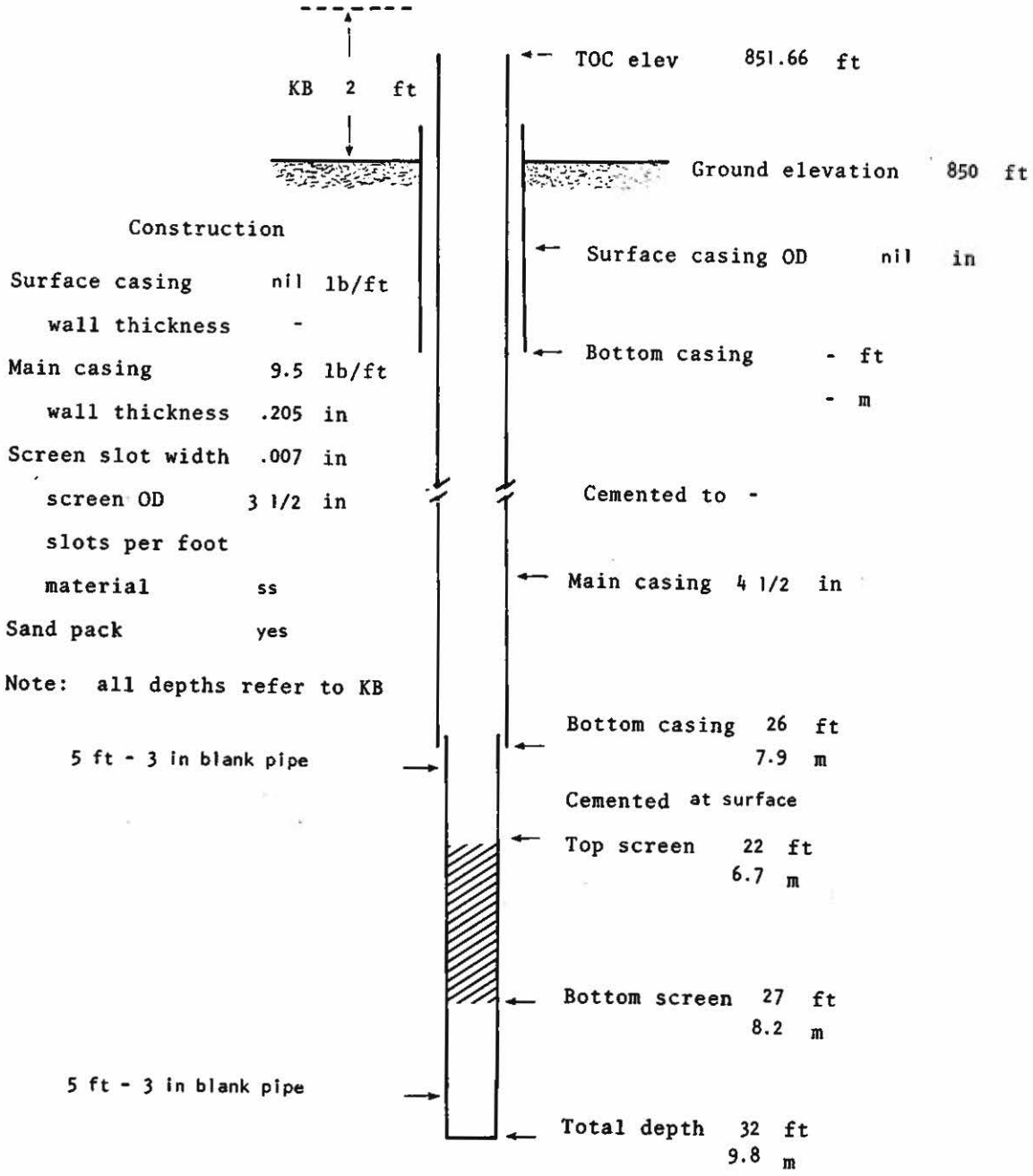


**WELL CONSTRUCTION.**

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Tp 96 R 11 W4th

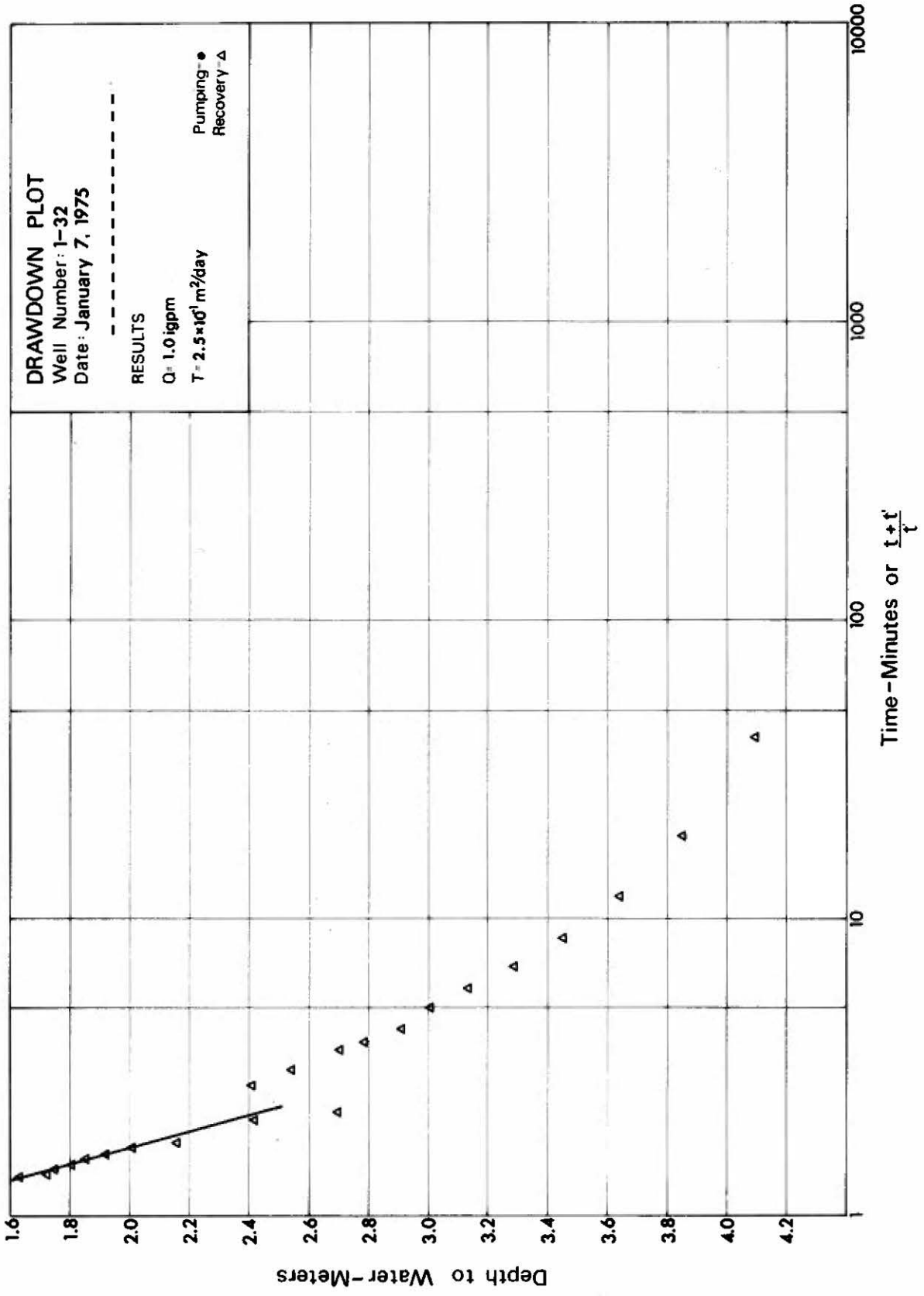
Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | nil | lb/ft |
| wall thickness | - | |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | yes | |

Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 1-32
Date: January 7, 1975
RESULTS
Q = 1.0 igpm
T = 2.5×10¹ m²/day
Pumping = ●
Recovery = △
Depth to Water-Meters
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
1
10
100
1000
10000
Time-Minutes or t+t'/t'

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed from 1-32

Date sampled January 13, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 10.5 | 0.52 | 1.5 |
| Magnesium ($Mg^{++}$) | 8.3 | 0.68 | 1.9 |
| Sodium ($Na^{+}$) | 780.0 | 33.93 | 96.3 |
| Potassium ($K^{+}$) | 4.2 | 0.11 | 0.3 |
| Carbonate ($CO_3^{=}$) | 80.0 | 2.67 | 8.4 |
| Bicarbonate ($HCO_3^{-}$) | 1229.0 | 20.14 | 63.2 |
| Sulfate ($SO_4^{=}$) | 187.5 | 3.90 | 12.3 |
| Chloride ($Cl^{-}$) | 180.0 | 5.08 | 15.9 |
| Nitrate ($NO_3^{=}$) | 4.5 | 0.07 | 0.2 |
| Silica ($SiO_2$) | 5.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1840.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 31.863 | Total Cations (epm) | 35.242 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3300 | Temperature (C) | 1.6 | |
| pH | 8.6 | pH | 8.2 | |
| Fluoride ($F^{-}$) | 1.0 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1679 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | 4500 | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed from 1-32

Date sampled January 13, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 15.0 | 0.75 | 2.0 |
| Magnesium ($Mg^{++}$) | 27.5 | 2.26 | 6.1 |
| Sodium ($Na^{+}$) | 775.0 | 33.71 | 91.5 |
| Potassium ($K^{+}$) | 5.0 | 0.13 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1332.0 | 21.83 | 69.2 |
| Sulfate ($SO_4^{=}$) | 250.0 | 5.21 | 16.5 |
| Chloride ($Cl^{-}$) | 158.0 | 4.46 | 14.1 |
| Nitrate ($NO_3^{=}$) | 2.9 | 0.05 | 0.1 |
| Silica ($SiO_2$) | 9.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1944.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 31.540 | Total Cations (epm) | 36.848 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 3300 | Temperature (C) | 1.6 |
| pH | 8.3 | pH | 8.2 |
| Fluoride ($F^{-}$) | 0.9 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1679 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | 4500 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.1 | 0.10 | 0 |
| Magnesium ($Mg^{++}$) | 6.8 | 0.56 | 2 |
| Sodium ($Na^{+}$) | 838 | 36.45 | 98 |
| Potassium ($K^{+}$) | 6.7 | 0.17 | 0 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1693 | 27.75 | 72 |
| Sulfate ($SO_4^{=}$) | 260 | 5.41 | 14 |
| Chloride ($Cl^{-}$) | 184 | 5.19 | 14 |
| Nitrate ($NO_3^{=}$) | 1.8 | 0.03 | 0 |
| Silica ($SiO_2$) | 3.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 3.4 | | |
| Magnesium (Acidified) | 6.6 | | |
| Total dissolved solids | 2220 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 38.38 | Total Cations (epm) | 37.29 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 4000 |
| pH | 8.3 |
| Fluoride ($F^{-}$) | 0.9 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 8.0 |
| pH | 9 |
| Carbonate ($CO_3^{=}$) | 144 ppm |
| Bicarbonate ($HCO_3^{-}$) | 1440 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 11.6 | 0.58 | 1 |
| Magnesium ($Mg^{++}$) | 7.2 | 0.59 | 1 |
| Sodium ($Na^{+}$) | 1013.0 | 44.06 | 97 |
| Potassium ($K^{+}$) | 7.5 | 0.19 | 0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1915.0 | 31.39 | 72 |
| Sulfate ($SO_4^{=}$) | 226.0 | 4.71 | 11 |
| Chloride ($Cl^{-}$) | 260.0 | 7.33 | 17 |
| Nitrate ($NO_3^{=}$) | 6.8 | 0.11 | 0 |
| Silica ($SiO_2$) | 5.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 30.8 | | |
| Magnesium (Acidified) | 7.3 | | |
| Total dissolved solids | 2480 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 43.54 | Total Cations (epm) | 45.43 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 4000 | Temperature (C) | 6.0 |
| pH | 8.1 | pH | 7.8 |
| Fluoride ($F^{-}$) | 0.6 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 2044 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 5, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 11.7 | 0.58 | 1.3 |
| Magnesium ($Mg^{++}$) | 7.7 | 0.63 | 1.4 |
| Sodium ($Na^{+}$) | 975.0 | 42.41 | 91.1 |
| Potassium ($K^{+}$) | 114.0 | 2.92 | 6.3 |
| Carbonate ($CO_3^{=}$) | 19.2 | 0.64 | 1.4 |
| Bicarbonate ($HCO_3^{-}$) | 1835.0 | 30.08 | 67.4 |
| Sulfate ($SO_4^{=}$) | 233.0 | 4.85 | 10.9 |
| Chloride ($Cl^{-}$) | 320.0 | 9.02 | 20.2 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 6.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 11.5 | | |
| Magnesium (Acidified) | 6.5 | | |
| Total dissolved solids | 2444.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 44.60 | Total Cations (epm) | 46.54 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3900 | Temperature (C) | 5.0 | |
| pH | 8.4 | pH | 8.5 | |
| Fluoride ($F^{-}$) | 0.9 ppm | Carbonate ($CO_3^{=}$) | 43 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1830 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

1-32-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.3 | 0.11 | 0.3 |
| Magnesium(Mg) | 4.2 | 0.35 | 0.8 |
| Sodium(Na) | 975.0 | 42.41 | 98.5 |
| Potassium(K) | 7.1 | 0.18 | 0.4 |
| Carbonate(CO3) | 62.0 | 2.07 | 4.9 |
| Bicarbonate(HCO3) | 1693.0 | 27.75 | 65.8 |
| Sulphate(SO4) | 160.0 | 3.33 | 7.9 |
| Chloride(Cl) | 320.0 | 9.02 | 21.4 |
| Nitrate(NO3) | 1.9 | 0.03 | 0.1 |
| Silica(SiO2) | 1.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 2.4 | | |
| Magnesium(Acidified) | 4.7 | | |
| TDS(mg/l) | 2248.0 | | |
| Total Anions(epm) | 42.20 | Total Cations(epm) | 43.05 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3240 | Temperature(C) | 4.00 | |
| pH | 8.7 | pH | 8.7 | |
| Fluoride(F) | 0.6 mg/l | Carbonate(CO3) | 110 | mg/l |
| | | Bicarbonate(HCO3) | 1586 | mg/l |
| | | Hydroxide(OH) | | |

1-32-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 8, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 7.3 | 0.36 | 0.9 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.1 |
| Sodium(Na) | 900.0 | 39.15 | 98.6 |
| Potassium(K) | 6.3 | 0.16 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1918.0 | 31.44 | 74.2 |
| Sulphate(SO4) | 278.0 | 5.79 | 13.7 |
| Chloride(Cl) | 182.0 | 5.13 | 12.1 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 3.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 11.1 | | |
| Magnesium(Acidified) | 0.6 | | |
| TDS(mg/l) | 2364.0 | | |
| Total Anions(epm) | 42.36 | Total Cations(epm) | 39.71 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3280 | | Temperature(C) | 4.00 | |
| pH | 8.3 | | pH | 8.8 | |
| Fluoride(F) | 0.7 | mg/l | Carbonate(CO3) | 96 | mg/l |
| | | | Bicarbonate(HCO3) | 1810 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 1-32-E-82

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1980

## Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 5.7 | 0.28 | 0.8 |
| Magnesium(Mg) | 12.0 | 1.00 | 3.0 |
| Sodium(Na) | 744.0 | 32.35 | 95.7 |
| Potassium(K) | 6.0 | 0.15 | 0.5 |
| Carbonate(CO3) | 19.7 | 0.66 | 1.9 |
| Bicarbonate(HCO3) | 1527.0 | 25.03 | 74.3 |
| Sulphate(SO4) | 175.0 | 3.65 | 10.8 |
| Chloride(Cl) | 154.0 | 4.34 | 12.9 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 2.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 5.5 | | |
| Magnesium(Acidified) | 11.7 | | |
| TDS(mg/l) | 1938.0 | | |
| Total Anions(epm) | 33.68 | Total Cations(epm) | 33.79 |

## Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 30000 | Temperature | 4.00 | |
| pH | 8.7 | pH | 8.8 | |
| Fluoride | 0.5 mg/l | Carbonate(CO3) | 110 | mg/l |
| | | Bicarbonate(HCO3) | 1361 | mg/l |
| | | Hydroxide(OH) | | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Date sampled: July 13, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .062 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 1738 |
| As | <.038 | Ni | <.010 |
| B | 2.65 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 23.5 | Si | 2.75 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .777 |
| Cr | <.006 | Te | <.065 |
| Cu | .041 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .077 | V | <.0008 |
| K | 33 | W | <.078 |
| Mg | 7.63 | Zn | .132 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

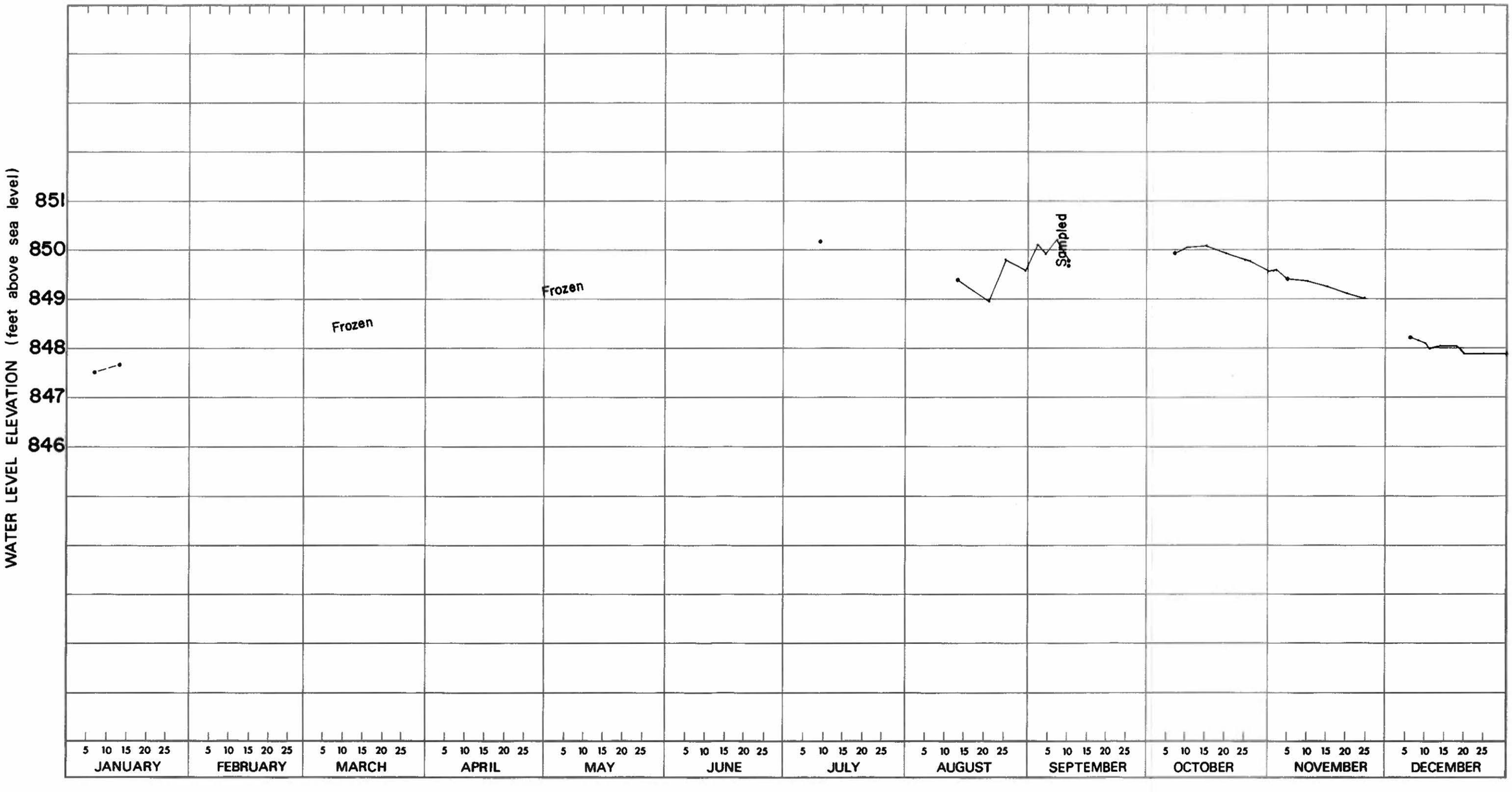
**WATER LEVEL HYDROGRAPH**

1-32-H-76

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council



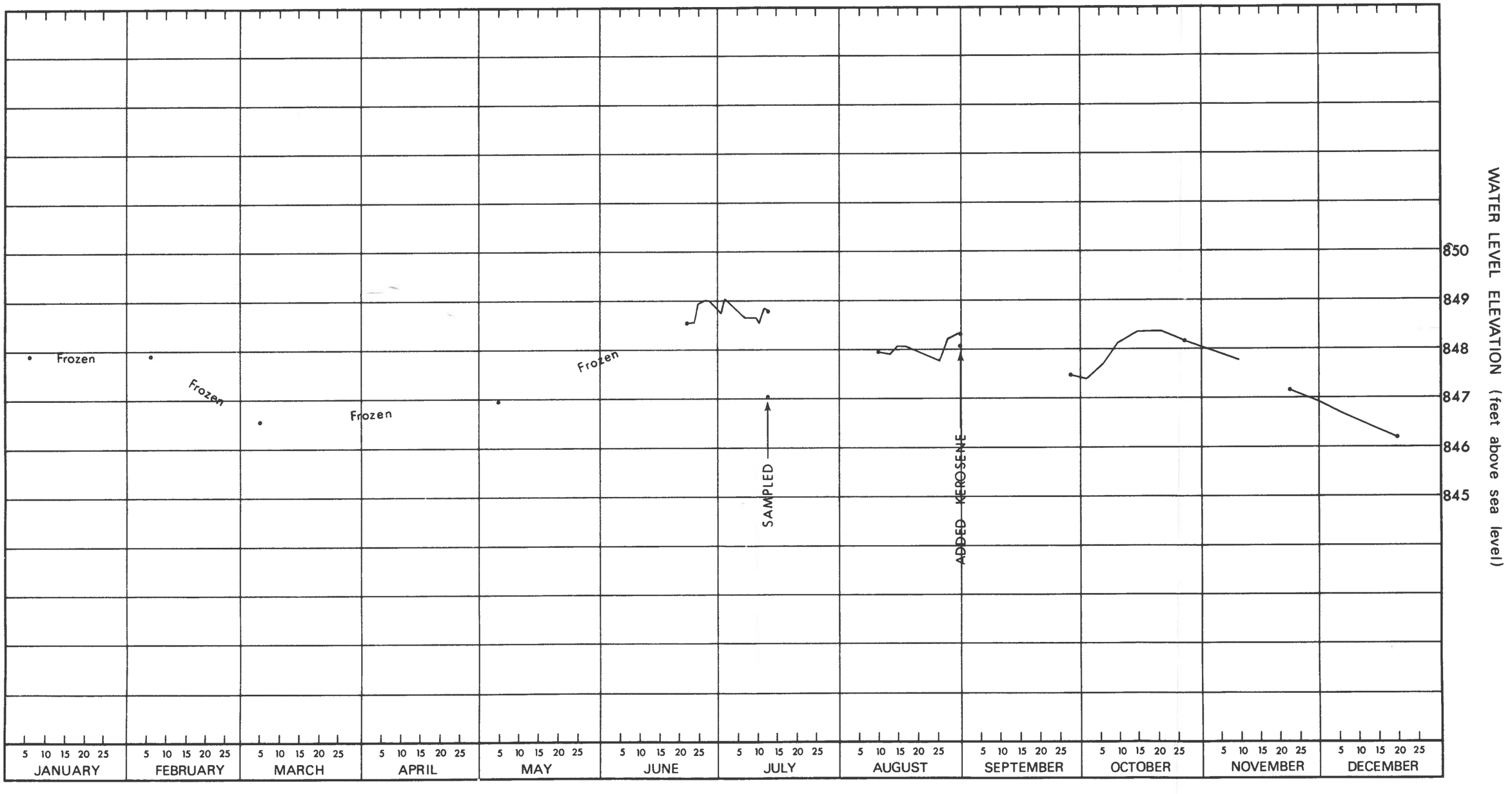
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

1 - 32 - H - 77




1976

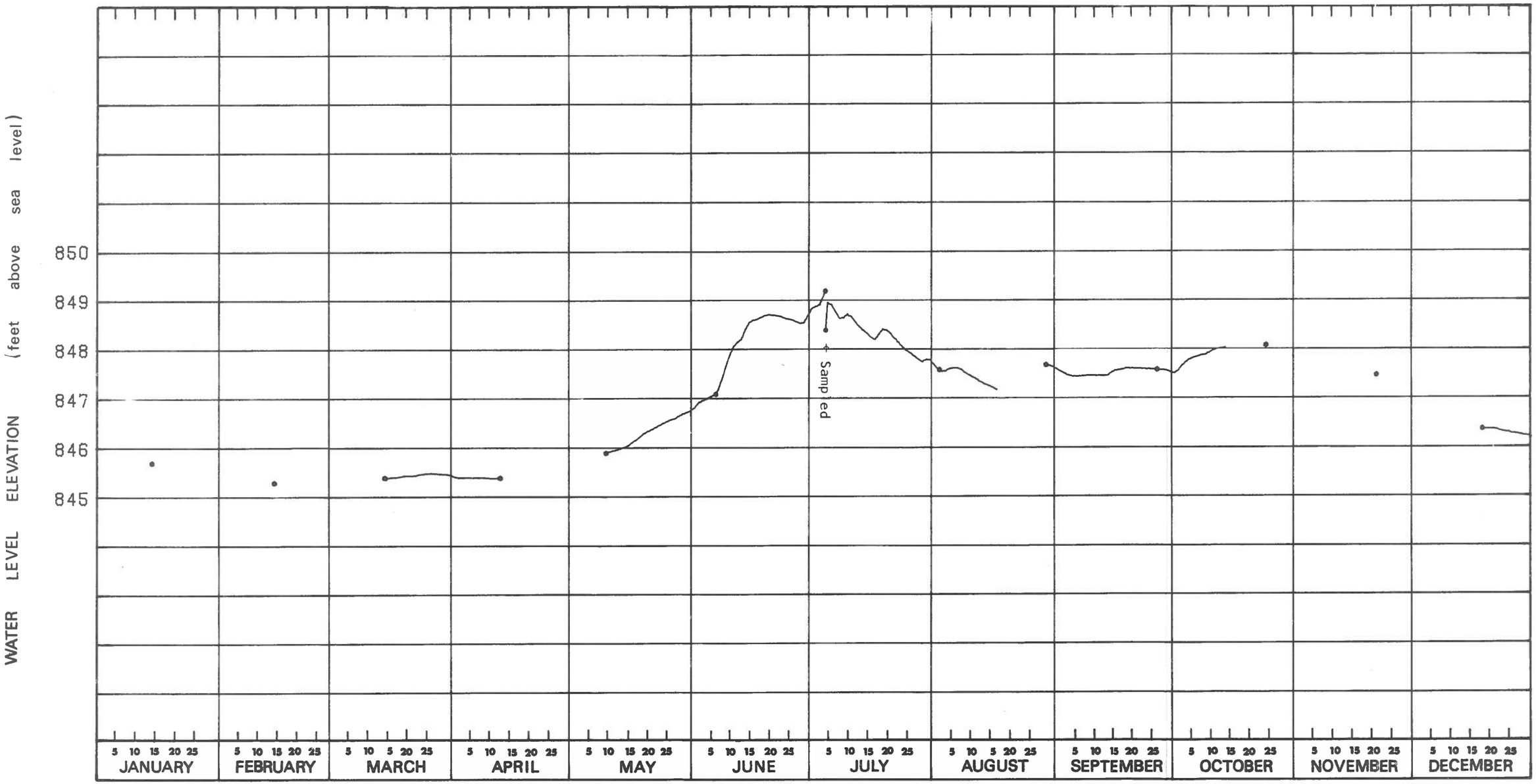
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-32

1-32-H-78

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council



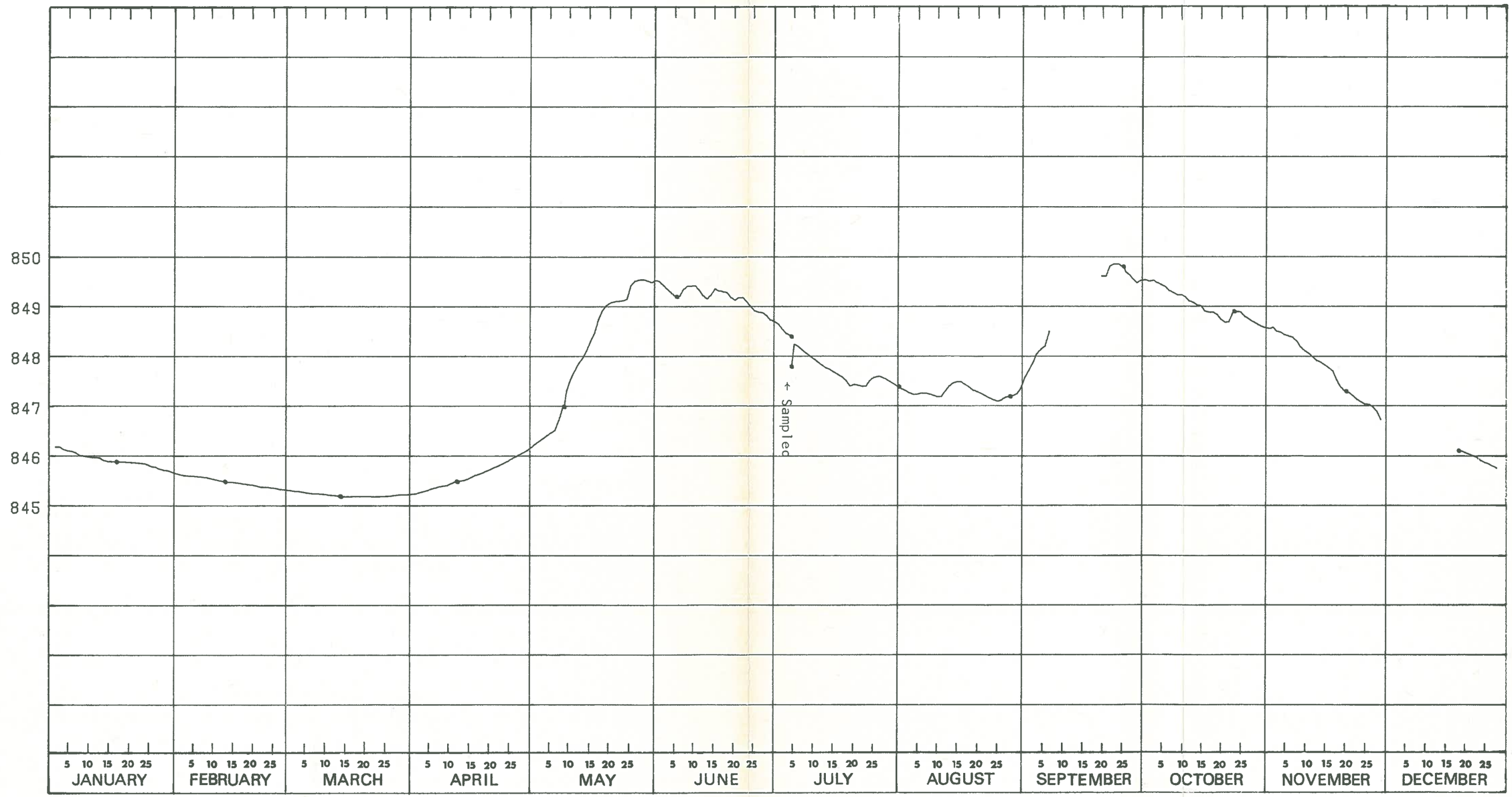
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-32

LSD 8 SEC 15 TWP 96 R 11 W4TH

Alberta Research Council

1-32-H-79




1978

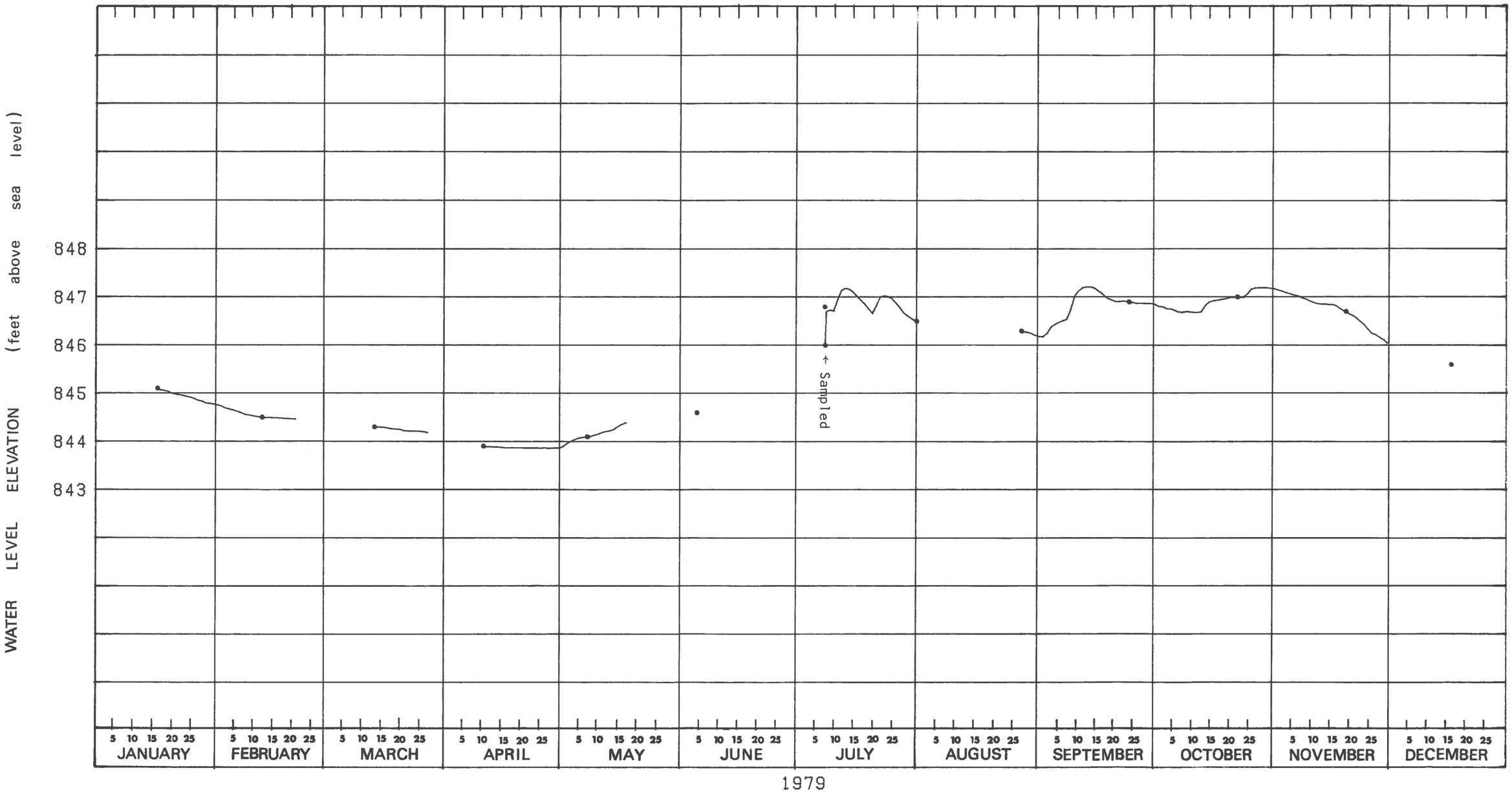
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-32

1-32-H-80

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council



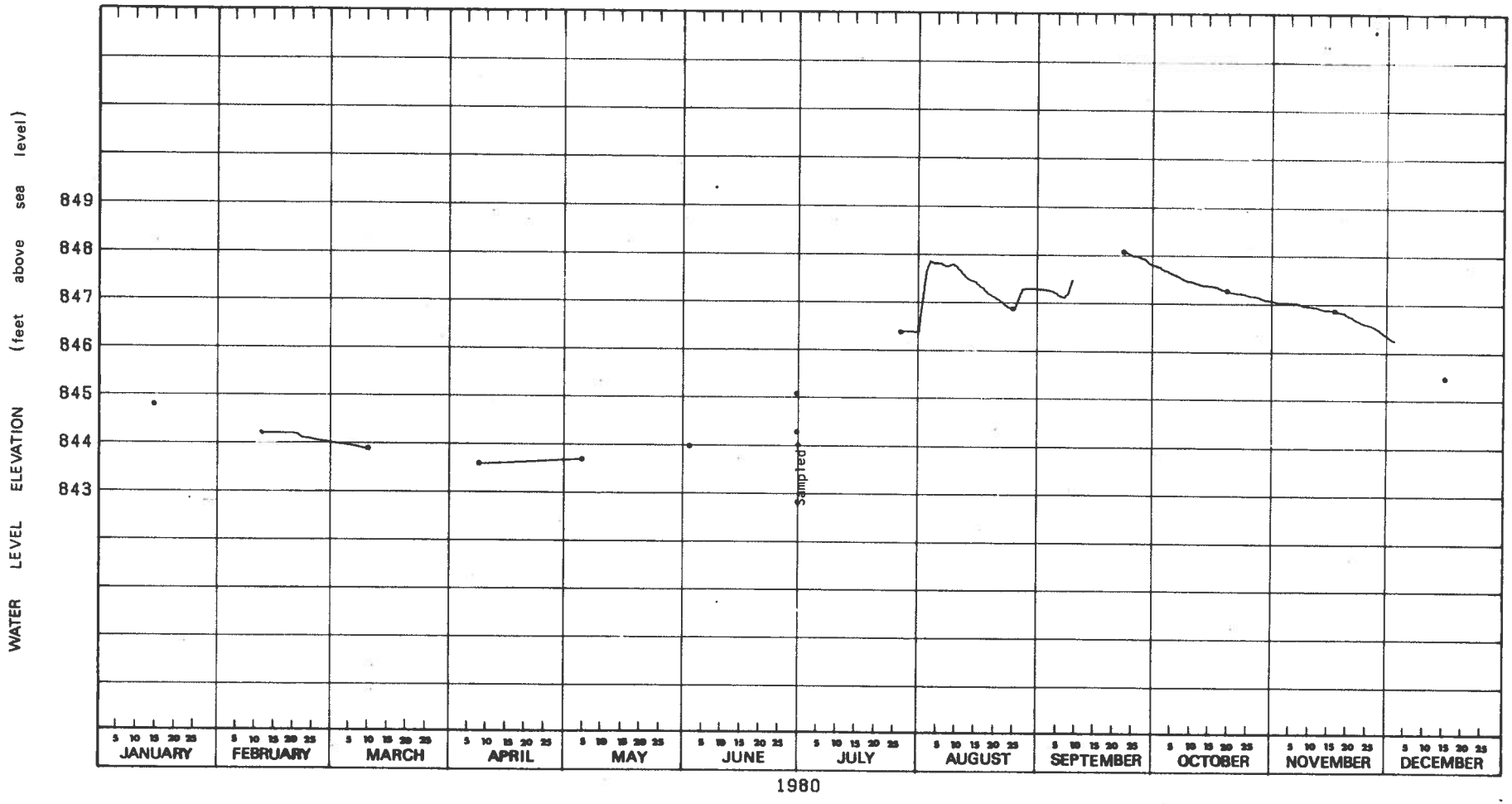
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-32-H-81



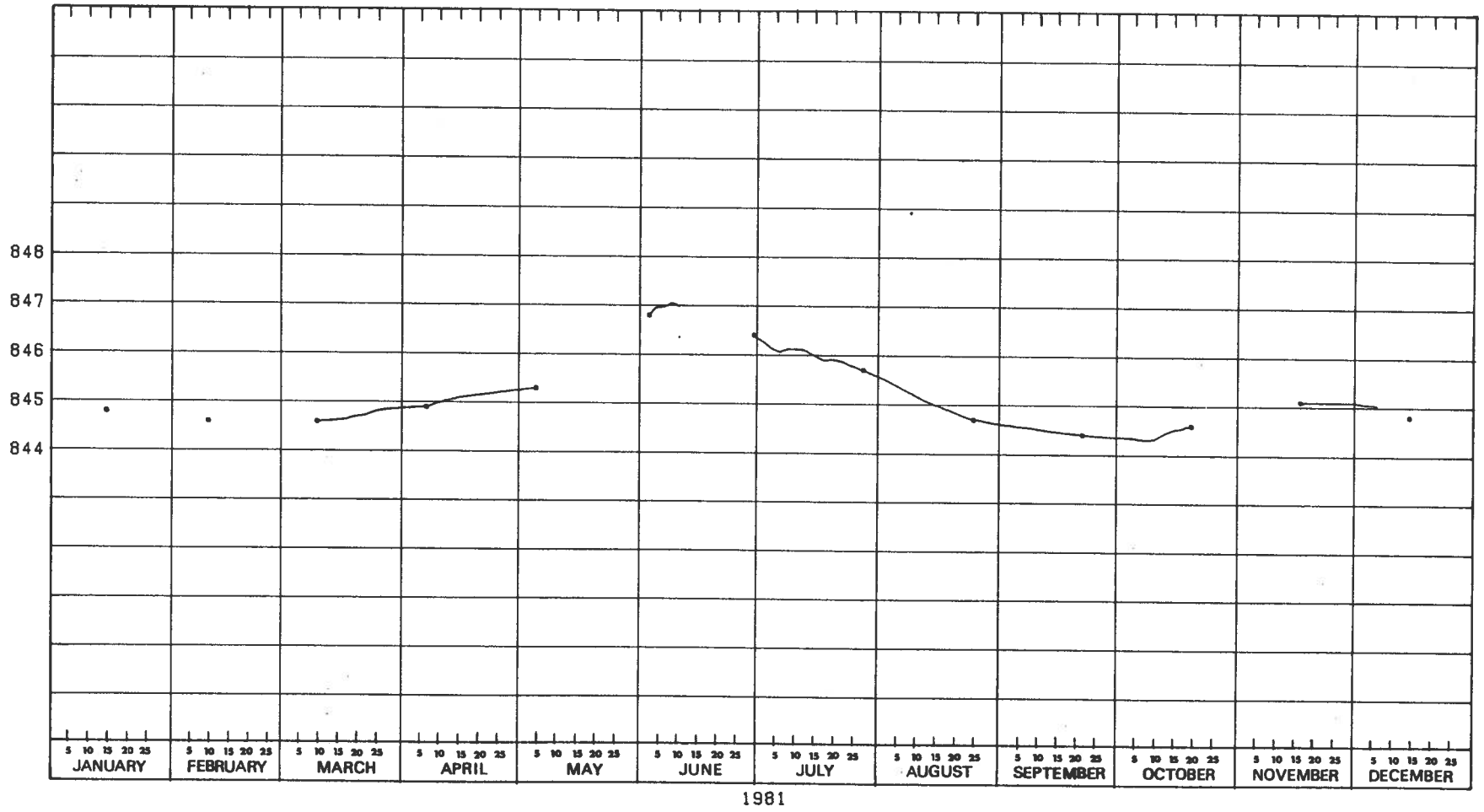
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-32-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.66

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 5/75 | | | Well completed |
| Jan 7/75 | 1.28 TOC | 847.43 | Bail test - 16 min. 10-15 gallons; T = 351GPD/Ft |
| Jan 13/75 | 1.24 TOC | 847.60 | Bail; water sample |
| Jan 15/75 | 1.32 TOC | 847.34 | |
| Feb 2/75 | Frozen | | |
| Feb 14/75 | Frozen | | |
| Mar 18/75 | Frozen | | Shelter installed |
| Apr 16/75 | Frozen | | MP = 3.15' TOC, (854.81) |
| May 12/75 | Frozen | | |
| June 9/75 | Frozen | | New MP = 36" TOC, (854.66) |
| July 9/75 | 1.38 MP | 850.13 | Recorder installed |
| Aug 13/75 | 1.61 MP | 849.38 | |
| Sept 10/75 | 1.31 MP | 850.36 | Sampled well; temp. 8°C |
| | 1.52 MP | 849.64 | after sample |
| Oct 7/75 | 1.45 MP | 849.90 | |
| Nov 5/75 | 1.59 MP | 849.44 | |
| Dec 6/75 | 1.96 MP | 848.23 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.66

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 2.06 MP | 847.9 | MP (854.7) |
| Feb 6/76 | 2.06 MP | 847.9 | Frozen |
| Feb 22/76 | | | Well blown down with air |
| Mar 5/76 | 2.47 MP | 846.5 | Frozen; MP = 0.91 m TOC, (854.6) |
| Apr 6/76 | | | Frozen |
| May 5/76 | 2.34 MP | 846.9 | Frozen |
| June 1/76 | 5.68 MP | 836.0 | Frozen |
| June 22/76 | 1.85 MP | 848.5 | |
| July 13/76 | 1.78 MP | 848.8 | |
| | 2.32 MP | 847.0 | After sample; temp. 6°C |
| Aug 10/76 | 2.03 MP | 847.9 | |
| Aug 31/76 | 1.92 MP | 848.3 | |
| | 1.40 MP | 848.1 | Added 5 gallons of kerosene; water level elevation adjusted downward by 1.9 ft after this date |
| Sept 28/76 | 1.58 MP | 847.5 | |
| Oct 26/76 | 1.37 MP | 848.2 | |
| Nov 23/76 | 1.67 MP | 847.2 | |
| Dec 20/76 | 1.98 MP | 846.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.66

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 2.14 MP | 845.7 | MP (854.6) water level elevation adjusted downward by 1.9 ft to compensate for kerosene |
| Feb 15/77 | 2.24 MP | 845.3 | |
| Mar 15/77 | 2.22 MP | 845.4 | |
| Apr 13/77 | 2.23 MP | 845.4 | |
| May 10/77 | 2.08 MP | 845.9 | |
| June 7/77 | 1.70 MP | 847.1 | |
| July 5/77 | 1.08 MP | 849.2 | |
| | 1.32 MP | 848.4 | After sample; temp. 5°C |
| Aug 3/77 | 1.55 MP | 847.6 | |
| Aug 30/77 | 1.53 MP | 847.7 | |
| Sept 27/77 | 1.55 MP | 847.6 | |
| Oct 25/77 | 1.39 MP | 848.1 | Temp. 3.3°C |
| Nov 22/77 | 1.58 MP | 847.5 | |
| Dec 19/77 | 1.91 MP | 846.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.66

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 2.08 MP | 845.9 | MP (854.6); water level elevation adjusted downward by 1.9 ft to compensate kerosene |
| Feb 13/78 | 2.19 MP | 845.5 | |
| Mar 14/78 | 2.27 MP | 845.2 | |
| Apr 12/78 | 2.19 MP | 845.5 | |
| May 9/78 | 1.74 MP | 847.0 | |
| June 6/78 | 1.06 MP | 849.2 | |
| July 5/78 | 1.31 MP | 848.4 | |
| | 1.50 MP | 847.8 | After sample; temp. 4°C |
| Aug 1/78 | 1.62 MP | 847.4 | |
| Aug 29/78 | 1.66 MP | 847.2 | |
| Sept 26/78 | 0.89 MP | 849.8 | |
| Oct 24/78 | 0.84 MP | 848.9 | New MP 0.58 m TOC (853.6) |
| Nov 21/78 | 1.35 MP | 847.3 | |
| Dec 19/78 | 1.71 MP | 846.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.66

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 2.01 MP | 845.1 | MP (853.6) water level elevation adjusted downward by 1.9 ft to compensate for kerosene |
| Feb 13/79 | 2.20 MP | 844.5 | |
| Mar 14/79 | 2.26 MP | 844.3 | |
| Apr 11/79 | 2.37 MP | 843.9 | |
| May 8/79 | 2.32 MP | 844.1 | |
| June 5/79 | 2.15 MP | 844.6 | |
| July 8/79 | 1.49 MP | 846.8 | |
| | 1.74 MP | 846.0 | After sample; temp. 4°C |
| Aug 1/79 | 1.60 MP | 846.5 | |
| Aug 28/79 | 1.64 MP | 846.3 | |
| Sept 25/79 | 1.45 MP | 846.9 | |
| Oct 23/79 | 1.42 MP | 847.0 | |
| Nov 20/79 | 1.51 MP | 846.7 | |
| Dec 17/79 | 1.85 MP | 845.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.66

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 2.11 MP | 844.8 | |
| Feb 12/80 | 2.27 MP | 844.2 | |
| Mar 11/80 | 2.39 MP | 843.9 | |
| Apr 9/80 | 2.46 MP | 843.6 | |
| May 6/80 | 2.45 MP | 843.7 | |
| June 3/80 | 2.35 MP | 844.0 | |
| July 1/80 | 2.00 MP | 845.1 | |
| | 2.25 MP | 844.3 | After Sample; temp. 4°C |
| July 28/80 | 1.60 MP | 846.4 | |
| Aug 26/80 | 1.45 MP | 846.9 | |
| Sept 24/80 | 1.09 MP | 848.1 | |
| Oct 21/80 | 1.34 MP | 847.3 | |
| Nov 18/80 | 1.47 MP | 846.9 | |
| Dec 17/80 | 1.90 MP | 845.5 | |
| Jan 15/81 | 2.10 MP | 844.8 | |
| Feb 10/81 | 2.15 MP | 844.6 | |
| Mar 10/81 | 2.20 MP | 844.6 | |
| Apr 7/81 | 2.06 MP | 844.9 | |
| May 5/81 | 1.96 MP | 845.3 | |
| June 3/81 | 1.48 MP | 846.8 | |
| June 30/81 | 1.63 MP | 846.4 | |
| July 28/81 | 1.84 MP | 845.7 | |
| Aug 25/81 | 2.12 MP | 844.7 | |
| Sept 22/81 | 2.24 MP | 844.4 | |
| Oct 20/81 | 2.16 MP | 844.6 | |
| Nov 17/81 | 2.02 MP | 845.1 | |
| Dec 15/81 | 2.11 MP | 844.8 | |

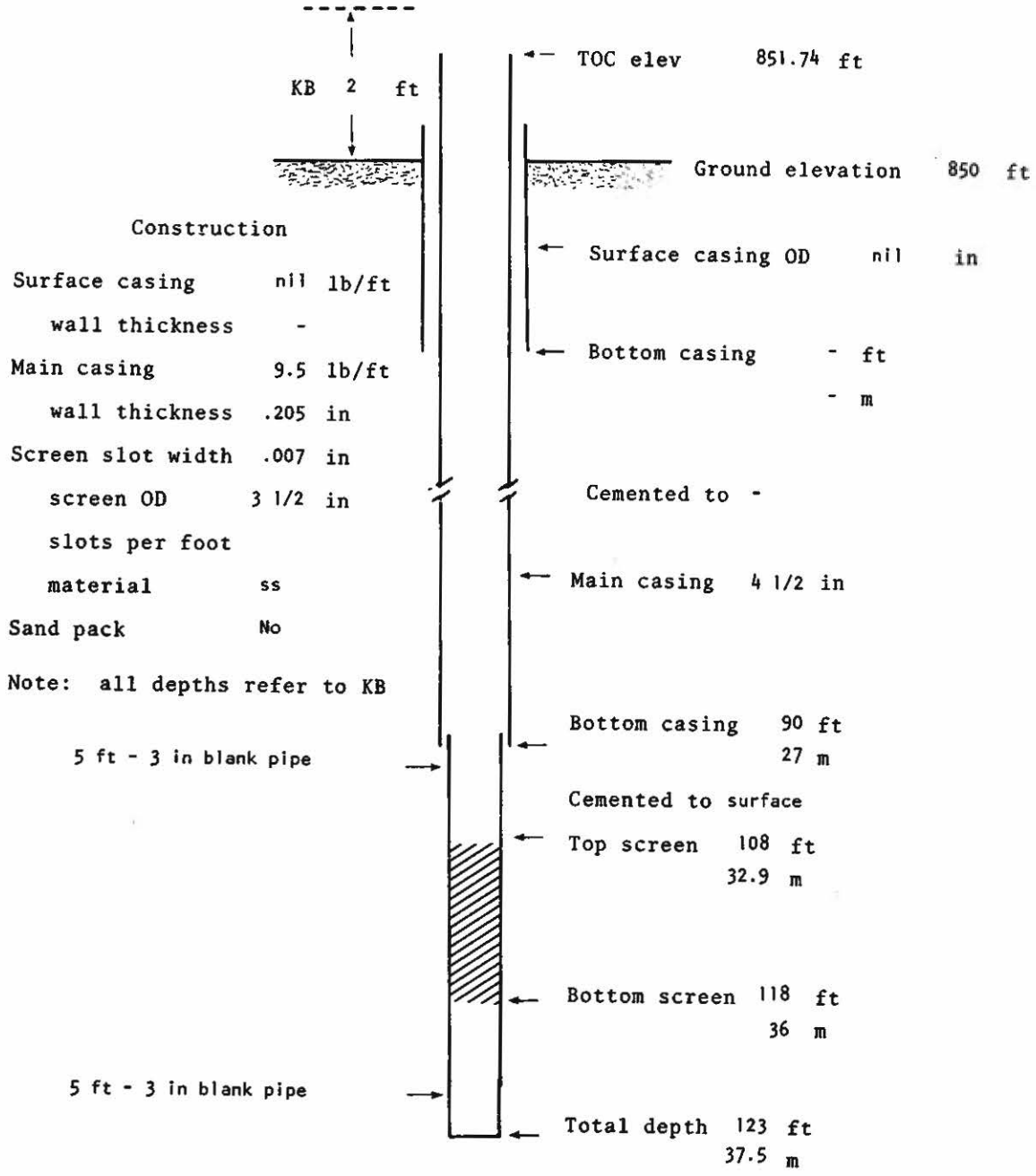
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Tp 96 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | nil | lb/ft |
| wall thickness | - | |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

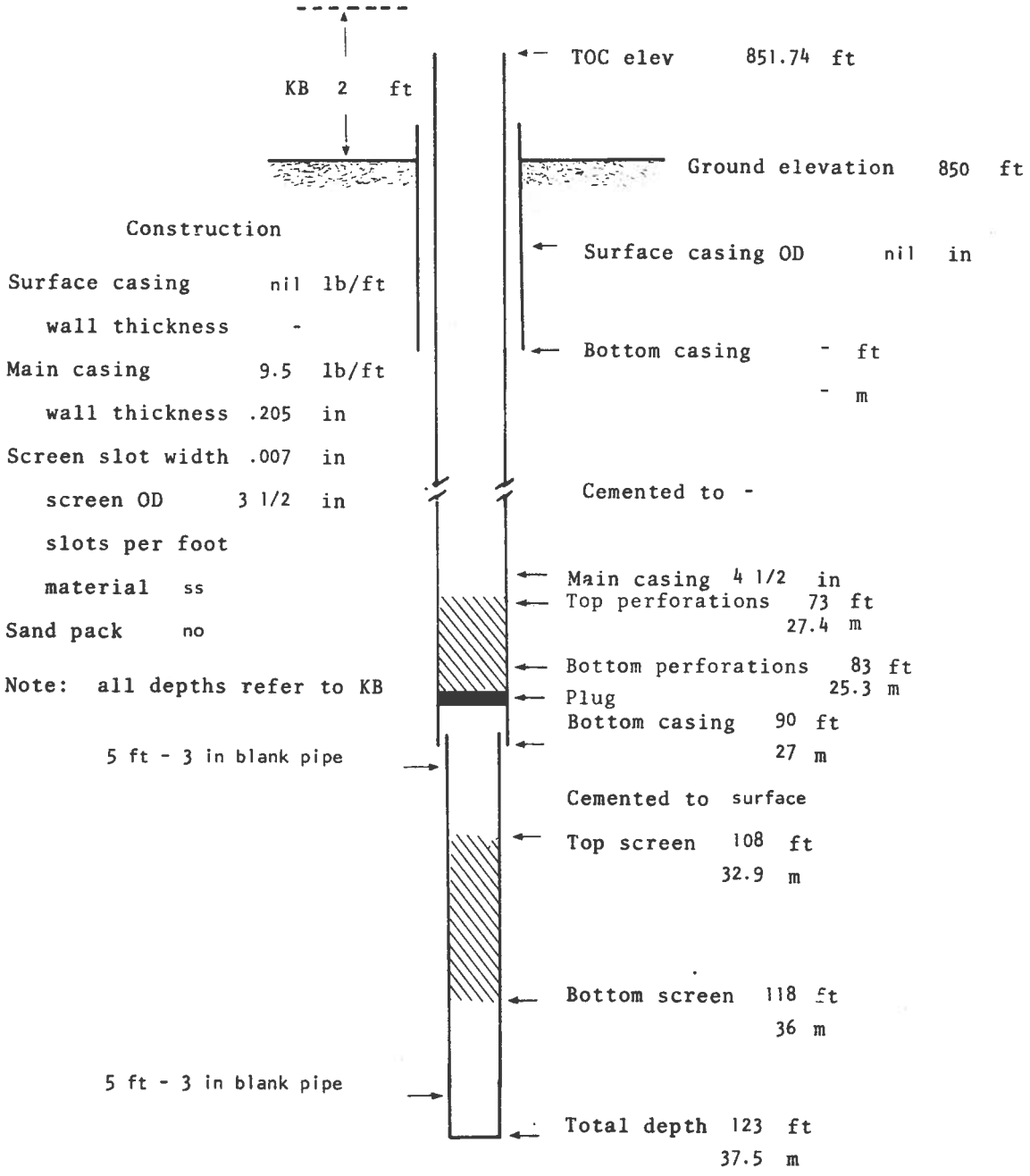
Note: all depths refer to KB

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Tp 96 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | nil | lb/ft |
| wall thickness | - | |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | no | |

Note: all depths refer to KB

N.B. - Perforation done with 20 gram charges at three charges per foot

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 852

Type of test - Casing Positrieve

Date of test March 17, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1640 | hrs |
| Tool opened | 1654 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 45 | min |
| Pulled loose at | 1835 | hrs |
| Out of hole at | 1840 | hrs |
| Wt on packers | 1000 | lbs |
| Description of blow | Fair initial puff, weak air blow decreasing to nil in one minute | |
| Total water recovered | 5 | ft |
| Water sample No. | DH 3 | |
| Gas blow | No | |
| Remarks | Test satisfactory<br>4-1/2" RBP set at 71'<br>3-1/8" MFE set at 69' | |

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 108-118

Formation tested McMurray

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.05 | |
| MFE Tool | 10.05 | |
| Sub | 0.65 | |
| Positrieve Packer | 1.35 | 4-1/2 IN |
| Total | 13.10 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

### PRESSURE DATA (psi)

| Instrument No. | | RPG-89N | RPG-92N |
|---|---|---|---|
| Capacity (psig) | | 400 | 431 |
| Instrument set at (ft) | | 75 | 83 |
| Initial hydrostatic | A | 29 | 29 |
| First flow | B | 10 | 8 |
| | B1 | 10 | 8 |
| Initial shut in | C | 13 | 13 |
| Second flow | D | 12 | 11 |
| | D1 | 11 | 11 |
| Final shut in | G | 12 | 12 |
| Final hydrostatic | H | 29 | 29 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

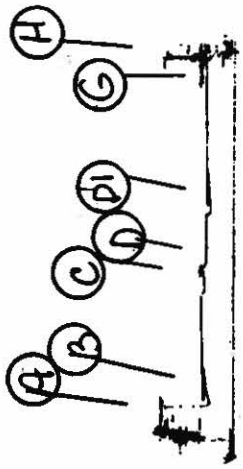
OBSERVATION WELL NUMBER 1-123

PRESSURE INCREMENTS

Recorder RPG-92N

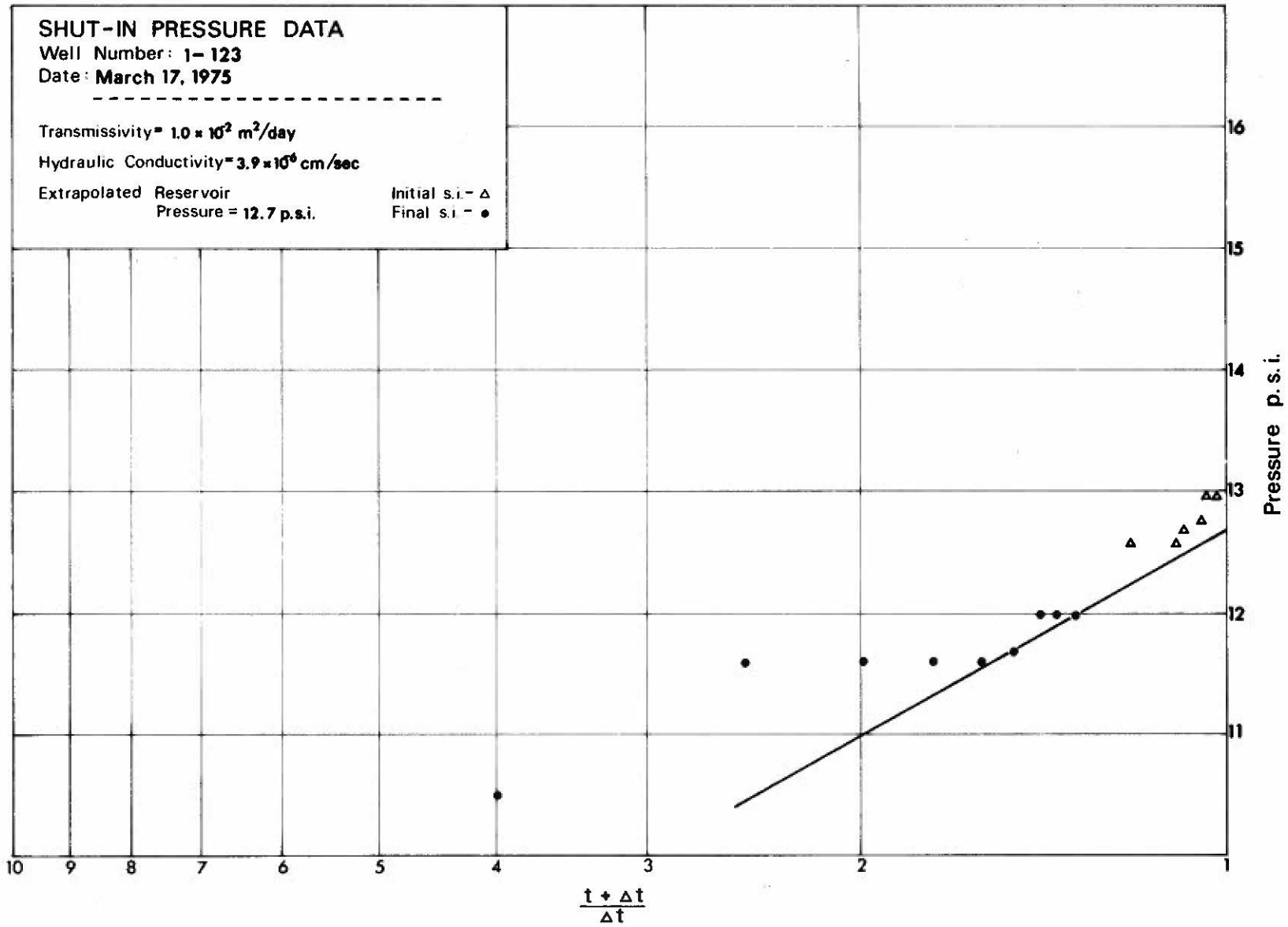
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 12.6 | 1.20 |
| 10 | 12.6 | 1.10 |
| 15 | 12.7 | 1.07 |
| 20 | 12.8 | 1.05 |
| 25 | 13.0 | 1.04 |
| 30 | 13.0 | 1.03 |




Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 10.5 | 4.00 |
| 10 | 11.6 | 2.50 |
| 15 | 11.6 | 2.00 |
| 20 | 11.6 | 1.75 |
| 25 | 11.6 | 1.60 |
| 30 | 11.7 | 1.50 |
| 35 | 12.0 | 1.428 |
| 40 | 12.0 | 1.376 |
| 45 | 12.0 | 1.333 |


SHUT-IN PRESSURE DATA
Well Number: 1-123
Date: March 17, 1975
Transmissivity = 1.0 × 10² m²/day
Hydraulic Conductivity = 3.9 × 10⁴ cm/sec
Extrapolated Reservoir Pressure = 12.7 p.s.i.
Initial s.i. - △
Final s.i. - ●
16
15
14
13
12
11
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

1-123-D-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed from 1-123

Date sampled January 13, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 715.0 | 35.68 | 82.0 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0.0 |
| Sodium ($Na^{+}$) | 137.5 | 5.98 | 13.7 |
| Potassium ($K^{+}$) | 71.7 | 1.83 | 4.2 |
| Carbonate ($CO_3^{=}$) | 80.0 | 2.67 | 3.1 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 81.5 | 1.70 | 2.0 |
| Chloride ($Cl^{-}$) | 522.0 | 14.72 | 17.3 |
| Nitrate ($NO_3^{=}$) | 7.2 | 0.12 | 0.1 |
| Silica ($SiO_2$) | 2.2 | | |
| Hydroxide ($OH^{-}$) | 1120.0 | 65.84 | 77.4 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1974.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 85.044 | Total Cations (epm) | 43.502 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 7000 | Temperature (C) | 1.7 |
| pH | 12.4 | pH | 12.9 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | 43.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| | | Hydroxide ($OH^{-}$) | 391.0 ppm |
| | | Conductivity | 6700 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 6.1 | 0.30 | 1 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 575 | 25.01 | 93 |
| Potassium ($K^{+}$) | 66 | 1.69 | 6 |
| Carbonate ($CO_3^{=}$) | 110 | 3.67 | 12 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 62 | 1.29 | 4 |
| Chloride ($Cl^{-}$) | 652 | 18.39 | 63 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 16.3 | | |
| Hydroxide ($OH^{-}$) | 102 | 6 | 20 |
| Calcium (Acidified) | 19.2 | | |
| Magnesium (Acidified) | 2.8 | | |
| Total dissolved solids | 1680 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 29.35 | Total Cations (epm) | 27.00 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 440 |
| pH | 11.2 |
| Fluoride ($F^{-}$) | 0.7 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 3.0 |
| pH | 12.1 |
| Carbonate ($CO_3^{=}$) | 144 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| Hydroxide ($OH^{-}$) | 91.8 ppm |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 8.9 | 0.44 | 4 |
| Magnesium ($Mg^{++}$) | 21.2 | 1.74 | 15 |
| Sodium ($Na^{+}$) | 168.0 | 7.31 | 62 |
| Potassium ($K^{+}$) | 93.0 | 2.38 | 20 |
| Carbonate ($CO_3^{=}$) | 50.0 | 1.67 | 13 |
| Bicarbonate ($HCO_3^{-}$) | 561.0 | 9.20 | 72 |
| Sulfate ($SO_4^{=}$) | 13.4 | 0.28 | 2 |
| Chloride ($Cl^{-}$) | 56.0 | 1.58 | 12 |
| Nitrate ($NO_3^{=}$) | 2.5 | 0.04 | 0 |
| Silica ($SiO_2$) | 2.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 11.3 | | |
| Magnesium (Acidified) | 21.1 | | |
| Total dissolved solids | 718 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.76 | Total Cations (epm) | 11.88 |

Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 1200 | |
| pH | 8.9 | |
| Fluoride ($F^{-}$) | 0.4 | Mg/L |

Field:

| | | |
|---|---|---|
| Temperature (C) | 4.0 | |
| pH | 9.1 | |
| Carbonate ($CO_3^{=}$) | 101 | Mg/L |
| Bicarbonate ($HCO_3^{-}$) | 488 | Mg/L |
| Hydroxide ($OH^{-}$) | | |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 5, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 10.5 | 0.52 | 4.3 |
| Magnesium ($Mg^{++}$) | 21.6 | 1.78 | 14.4 |
| Sodium ($Na^{+}$) | 151.0 | 6.57 | 53.3 |
| Potassium ($K^{+}$) | 135.0 | 3.45 | 28.0 |
| Carbonate ($CO_3^{=}$) | 33.6 | 1.12 | 10.0 |
| Bicarbonate ($HCO_3^{-}$) | 542.0 | 8.88 | 79.4 |
| Sulfate ($SO_4^{=}$) | 15.7 | 0.33 | 2.9 |
| Chloride ($Cl^{-}$) | 30.0 | 0.85 | 7.6 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 3.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 11.2 | | |
| Magnesium (Acidified) | 20.0 | | |
| Total dissolved solids | 610.0 | | |
| Total Anions (epm) | 11.19 | Total Cations (epm) | 12.32 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 970 | Temperature (C) | 7.0 |
| pH | 8.7 | pH | 8.8 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | 43.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 512.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

1-123-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 9.2 | 0.46 | 4.5 |
| Magnesium(Mg) | 25.0 | 2.06 | 20.3 |
| Sodium(Na) | 139.0 | 6.05 | 59.6 |
| Potassium(K) | 62.0 | 1.59 | 15.6 |
| Carbonate(CO3) | 16.8 | 0.56 | 5.1 |
| Bicarbonate(HCO3) | 554.0 | 9.08 | 82.5 |
| Sulphate(SO4) | 10.2 | 0.21 | 1.9 |
| Chloride(Cl) | 40.0 | 1.13 | 10.3 |
| Nitrate(NO3) | 1.4 | 0.02 | 0.2 |
| Silica(SiO2) | 1.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 9.0 | | |
| Magnesium(Acidified) | 22.4 | | |
| TDS(mg/l) | 496.0 | | |
| Total Anions(epm) | 11.00 | Total Cations(epm) | 10.15 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 830 | | Temperature(C) | 4.00 | |
| pH | 8.5 | | pH | 8.7 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | 34 | mg/l |
| | | | Bicarbonate(HCO3) | 512 | mg/l |
| | | | Hydroxide(OH) | | |

1-123-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 8, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 42.0 | 2.10 | 13.7 |
| Magnesium(Mg) | 26.0 | 2.14 | 14.0 |
| Sodium(Na) | 228.0 | 9.92 | 64.9 |
| Potassium(K) | 43.8 | 1.12 | 7.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 605.0 | 9.92 | 62.4 |
| Sulphate(SO4) | 9.9 | 0.21 | 1.3 |
| Chloride(Cl) | 204.0 | 5.75 | 36.2 |
| Nitrate(NO3) | 0.6 | 0.01 | 0.1 |
| Silica(SiO2) | 4.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 40.0 | | |
| Magnesium(Acidified) | 25.0 | | |
| TDS(mg/l) | 852.0 | | |
| Total Anions(epm) | 15.89 | Total Cations(epm) | 15.27 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1315 | Temperature(C) | 3.50 | |
| pH | 8.0 | pH | 7.5 | |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 220 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 1-123-E-82

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 21.0 | 1.05 | 9.4 |
| Magnesium(Mg) | 28.0 | 2.33 | 20.9 |
| Sodium(Na) | 150.0 | 6.52 | 58.4 |
| Potassium(K) | 49.0 | 1.26 | 11.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 559.0 | 9.16 | 85.4 |
| Sulphate(SO4) | 2.0 | 0.04 | 0.4 |
| Chloride(Cl) | 54.0 | 1.52 | 14.2 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 1.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 17.9 | | |
| Magnesium(Acidified) | 24.5 | | |
| TDS(mg/l) | 570.0 | | |
| Total Anions(epm) | 10.73 | Total Cations(epm) | 11.16 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 10000 | Temperature | 5.00 | |
| pH | 8.4 | pH | 8.1 | |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 590 | mg/l |
| | | Hydroxide(OH) | | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Date sampled: July 13, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .061 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 184 |
| As | <.038 | Ni | <.010 |
| B | .695 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 11.33 | Si | 1.59 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .481 |
| Cr | <.006 | Te | <.065 |
| Cu | 1.30 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 0.14 | V | <.0008 |
| K | 99 | W | <.078 |
| Mg | 22.7 | Zn | .044 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

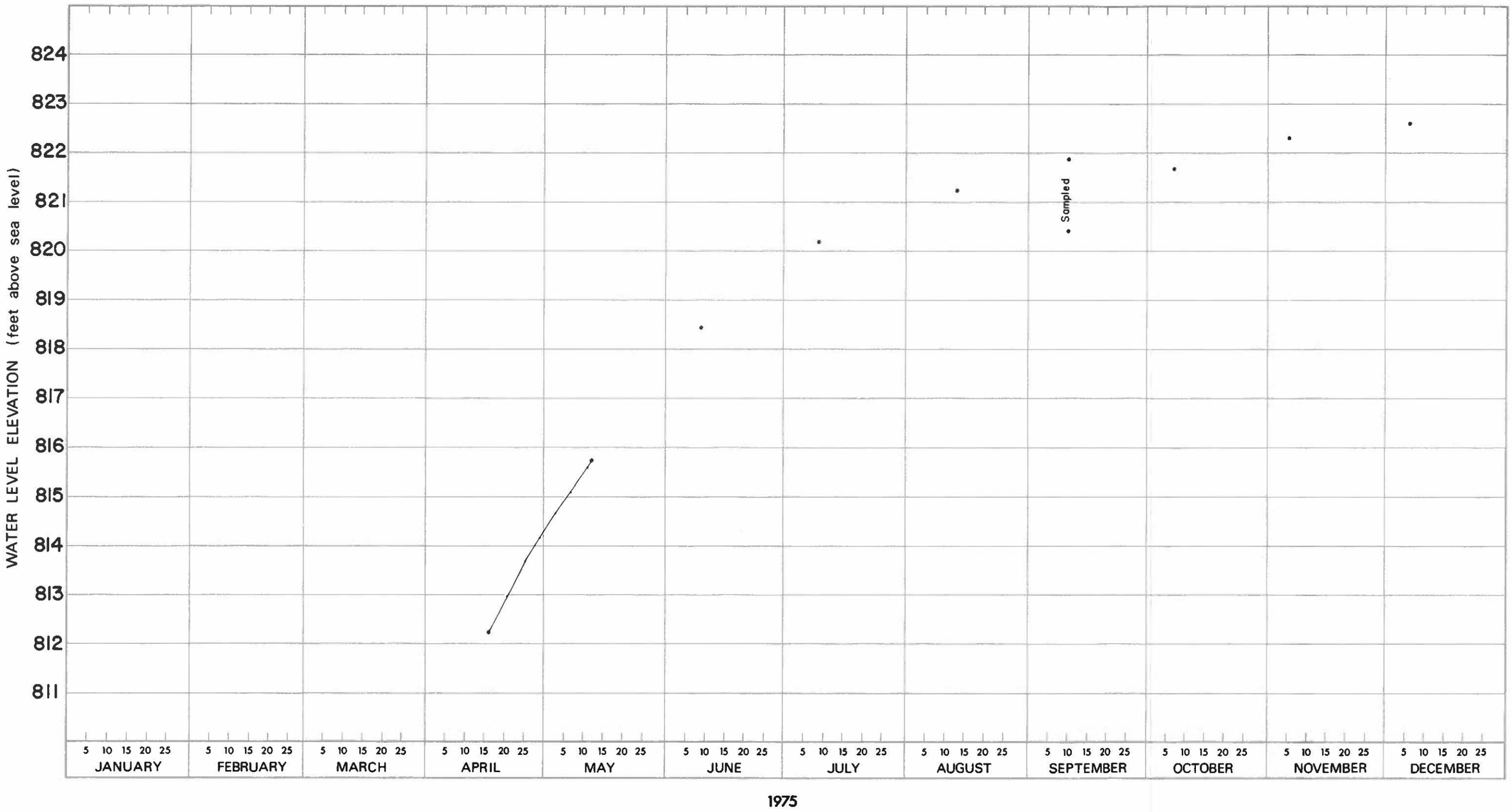
**WATER LEVEL HYDROGRAPH**

1-123-H-76

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council



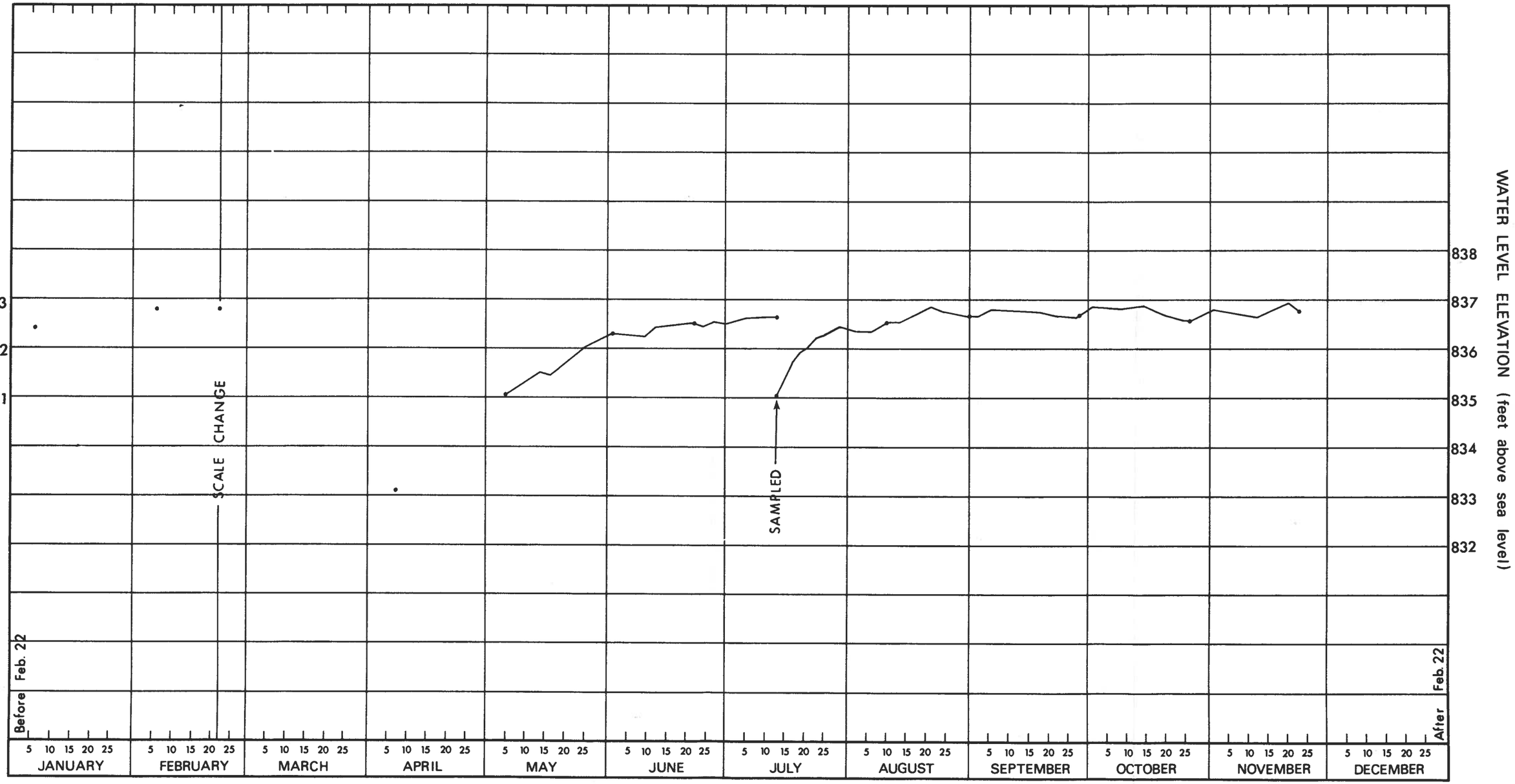
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **1-123**

Lsd **8** Sec **15** Twp **96** R **11** W4th

Alberta Research Council

**1 - 123 - H - 77**




1976

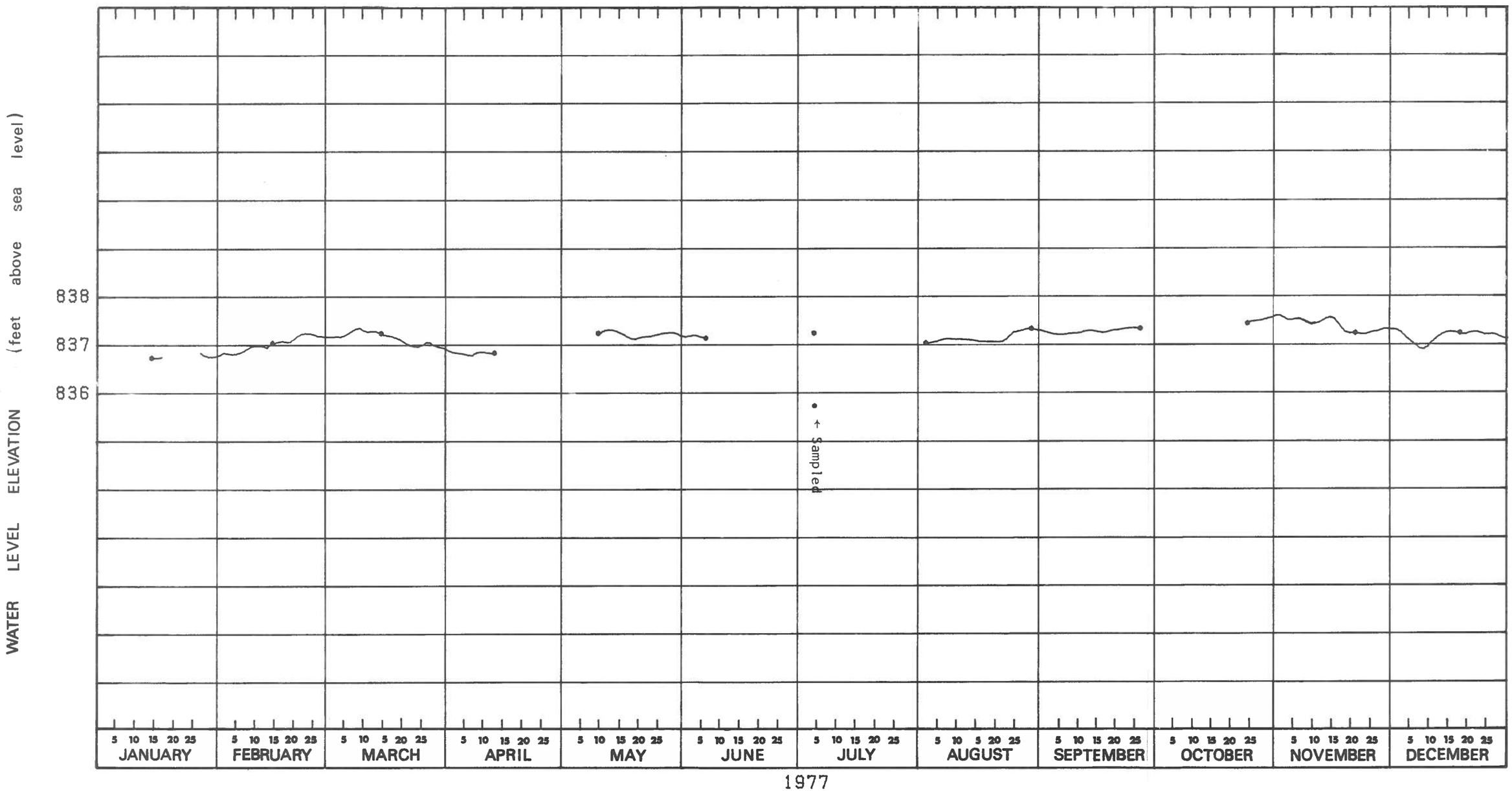
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-123

1-123-H-78

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council




1977

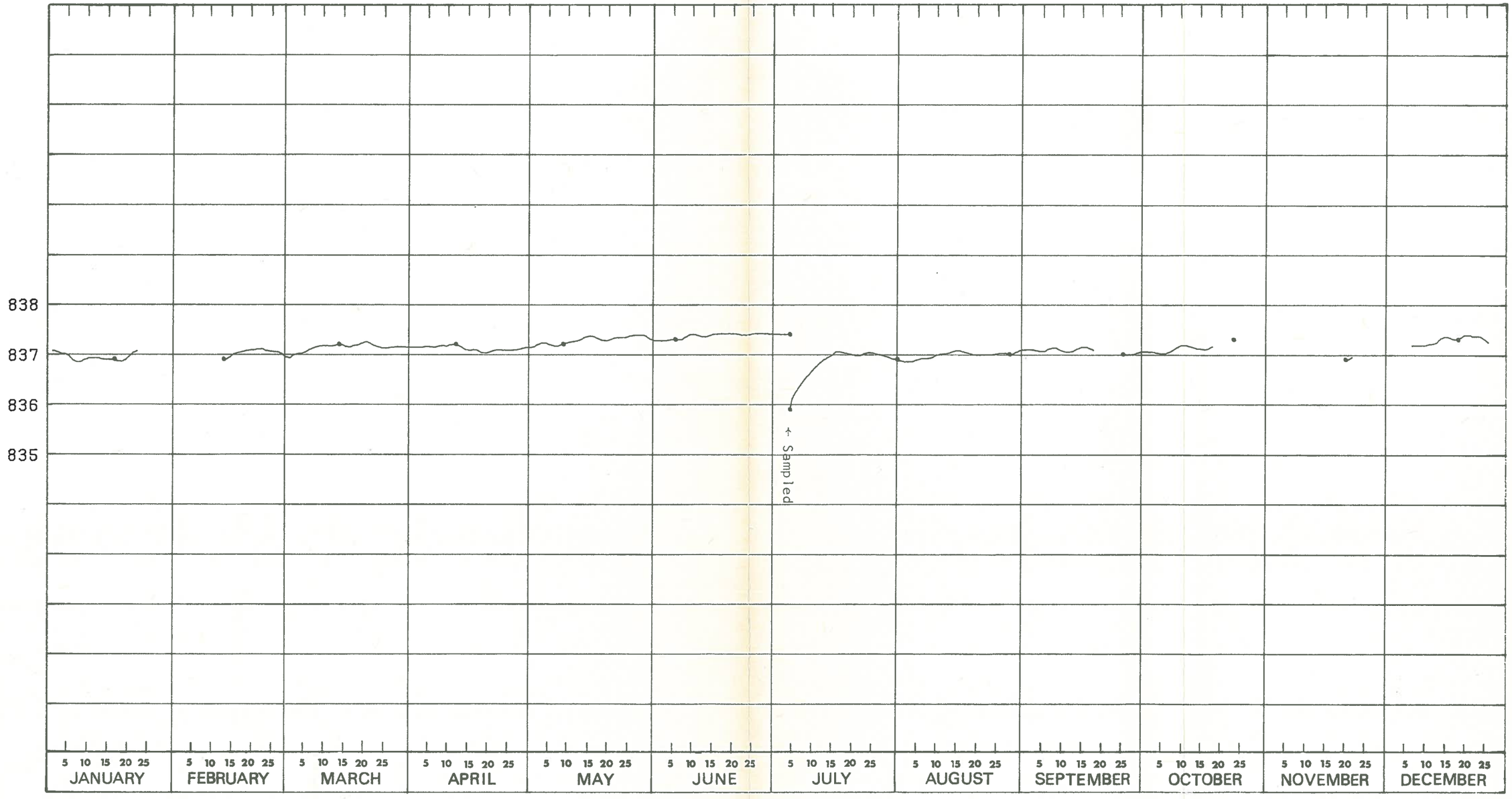
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-123

LSD 8 SEC 15 TWP 96 R 11 W4TH

Alberta Research Council

1-123-H-79




1978

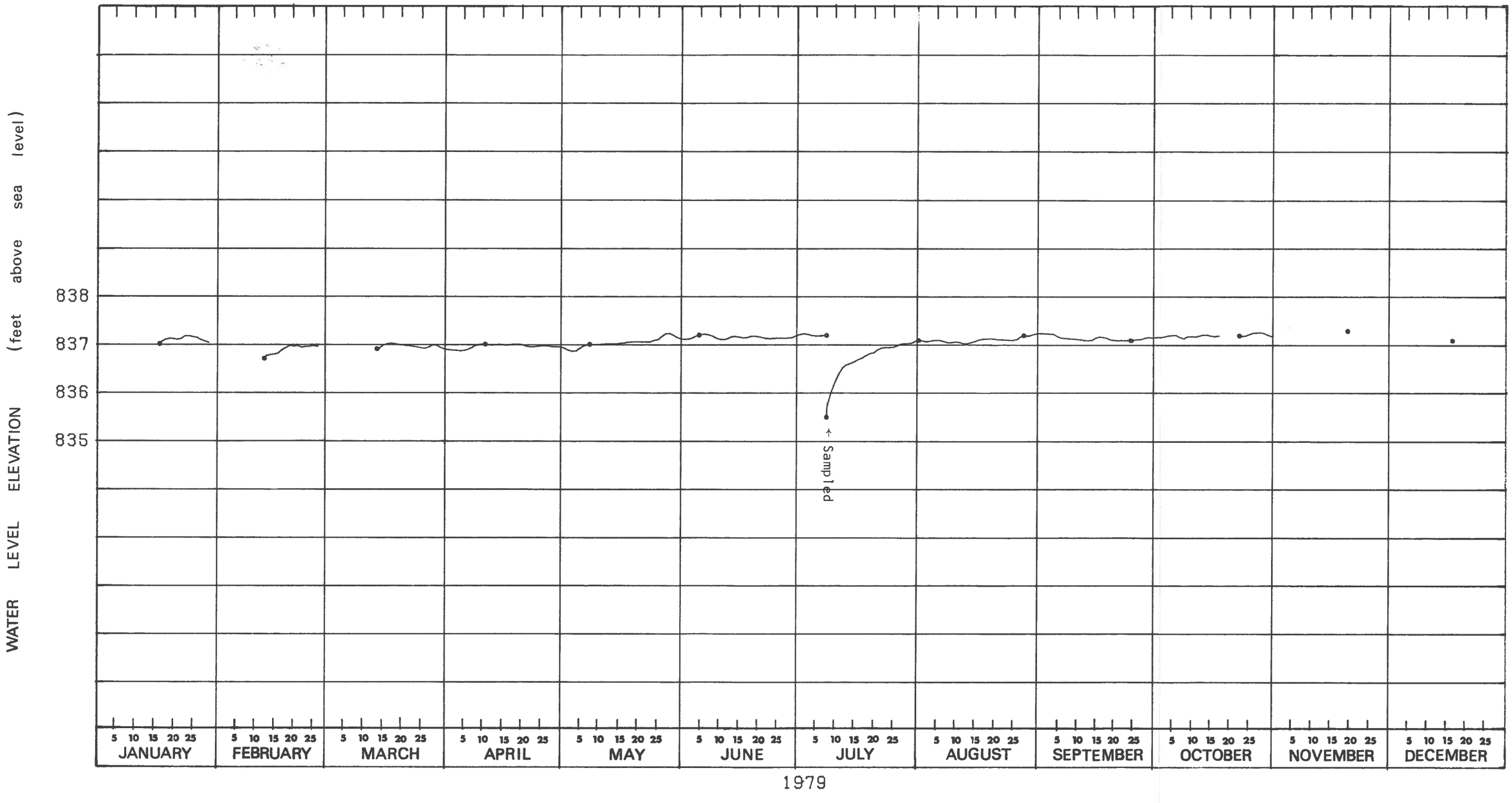
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-123

1-123-H-80

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council



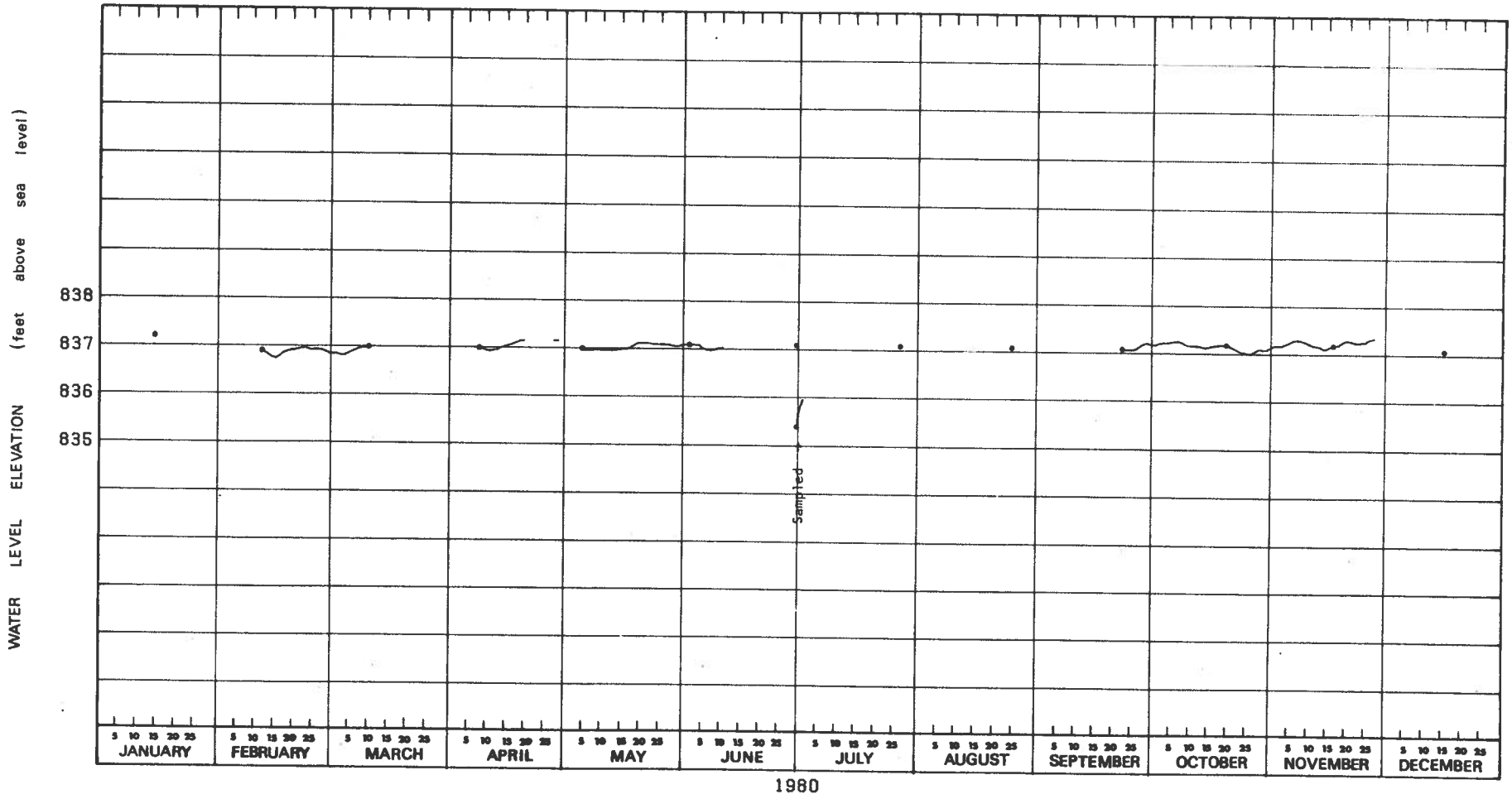
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-123-H-81



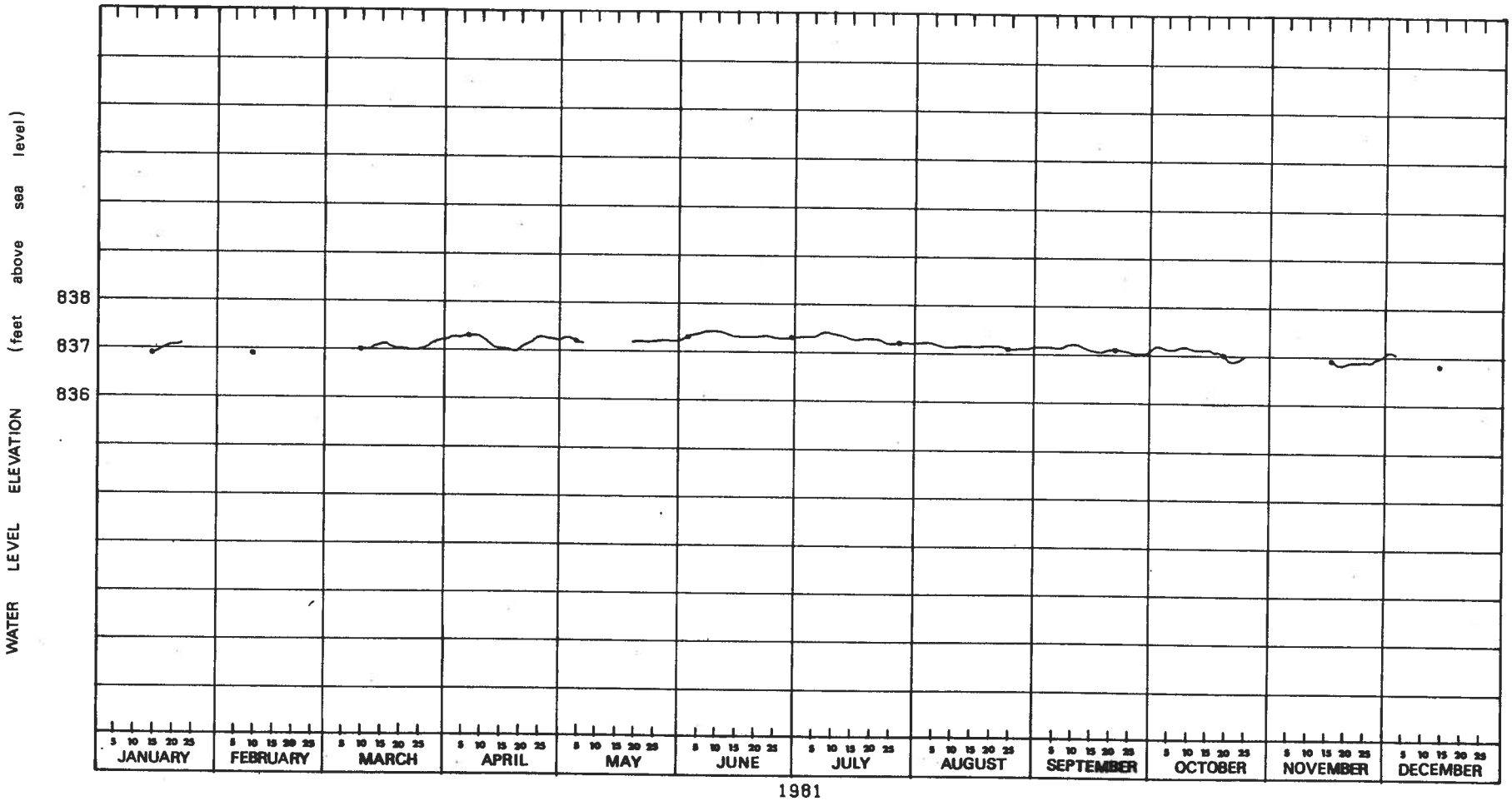
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-123-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/75 | | | Well completed |
| Jan 8/75 | 19.38 TOC | 832.36 | Bail dry - 35 gallons |
| Jan 13/75 | 72.62 TOC | 779.12 | Bail; water sample |
| Jan 15/75 | 78.79 TOC | 772.95 | |
| Feb 5/75 | 62.29 TOC | 789.45 | Tar floating in well |
| Feb 14/75 | 18.39 MP | 794.26 | Install shelter; MP = 2.84' TOC, (854.58); install recorder |
| Mar 17/75 | | | DST; water sample; FSI = 12# from 75'; pour in 2 gallons of Diesel |
| Mar 18/75 | 14.37 MP | 807.99 | Reinstall shelter; MP = 3.38' TOC, (855.12); install recorder |
| Apr 16/75 | 12.66 MP | 813.60 | |
| May 12/75 | 12.02 old MP | 815.71 | New MP = 34.75" TOC, (854.84) |
| June 9/75 | 11.03 MP | 818.46 | |
| July 9/75 | 10.51 MP | 820.17 | Recorder stuck |
| Aug 13/75 | 10.19 MP | 821.21 | |
| Sept 10/75 | 10.00 MP | 821.84 | Sampled well; temp. 3°C |
| | 10.44 MP | 820.39 | after sample |
| Oct 7/75 | 10.05 MP | 821.67 | |
| Nov 5/75 | 9.86 MP | 822.30 | |
| Dec 6/75 | 9.80 MP | 822.50 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 9.82 MP | 822.4 | MP (854.6) |
| Feb 6/76 | 9.69 MP | 822.8 | Recorder did not worked |
| Feb 22/76 | 9.68 MP | 822.8 | Recorder malfunction (float sunk) |
| Mar 2/76 | | | Well blown down with air; heavy oil in well |
| | | | Well perforated with 65 gram shots at 3 per foot, interval 71 to 82 |
| Mar 5/76 | | | Place plug at 84 ft |
| Apr 7/76 | 6.66 MP | 833.2 | MP = 0.98 m TOC, (855.0) |
| May 5/76 | 6.06 MP | 835.1 | |
| June 1/76 | 5.68 MP | 836.4 | |
| June 22/76 | 5.62 MP | 836.6 | |
| July 13/76 | 5.58 MP | 836.7 | |
| | 6.07 MP | 835.1 | After sample; temp. 4°C |
| Aug 10/76 | 5.61 MP | 836.6 | |
| Aug 31/76 | 5.57 MP | 836.7 | |
| Sept 28/76 | 5.56 MP | 836.8 | |
| Oct 26/76 | 5.61 MP | 836.6 | |
| Nov 23/76 | 5.54 MP | 836.8 | |
| Dec 20/76 | 5.52 MP | 836.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 5.57 MP | 836.7 | MP (855.0) |
| Feb 15/77 | 5.49 MP | 837.0 | |
| Mar 15/77 | 5.44 MP | 837.2 | |
| Apr 13/77 | 5.54 MP | 836.8 | |
| May 10/77 | 5.43 MP | 837.2 | |
| June 7/77 | 5.45 MP | 837.1 | |
| July 5/77 | 5.41 MP | 837.2 | |
| | 5.88 MP | 835.7 | After sample; temp. 7°C |
| Aug 3/77 | 5.50 MP | 837.0 | |
| Aug 30/77 | 5.40 MP | 837.3 | |
| Sept 27/77 | 5.40 MP | 837.3 | |
| Oct 25/77 | 5.36 MP | 837.4 | Temp. 3.1°C |
| Nov 22/77 | 5.44 MP | 837.2 | |
| Dec 19/77 | 5.42 MP | 837.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 5.52 MP | 836.9 | MP (855.0) |
| Feb 13/78 | 5.53 MP | 836.9 | |
| Mar 14/78 | 5.42 MP | 837.2 | |
| Apr 12/78 | 5.41 MP | 837.2 | |
| May 9/78 | 5.43 MP | 837.2 | |
| June 6/78 | 5.40 MP | 837.3 | |
| July 5/78 | 5.36 MP | 837.4 | |
| | 5.83 MP | 835.9 | After sample; temp. 4°C |
| Aug 1/78 | 5.38 MP | 836.9 | New MP 0.88 m TOC (854.6) |
| Aug 29/78 | 5.37 MP | 837.0 | |
| Sept 26/78 | 5.36 MP | 837.0 | |
| Oct 24/78 | 5.12 MP | 837.3 | New MP 0.71 m TOC (854.1) |
| Nov 21/78 | 5.25 MP | 836.9 | |
| Dec 19/78 | 5.13 MP | 837.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 5.22 MP | 837.0 | MP (854.1) |
| Feb 13/79 | 5.30 MP | 836.7 | |
| Mar 14/79 | 5.23 MP | 836.9 | |
| Apr 11/79 | 5.20 MP | 837.0 | |
| May 8/79 | 5.21 MP | 837.0 | |
| June 5/79 | 5.14 MP | 837.2 | |
| July 8/79 | 5.15 MP | 837.2 | |
| | 5.67 MP | 835.5 | After sample; temp. 3.5°C |
| Aug 1/79 | 5.18 MP | 837.1 | |
| Aug 28/79 | 5.16 MP | 837.2 | |
| Sept 25/79 | 5.17 MP | 837.1 | |
| Oct 23/79 | 5.14 MP | 837.2 | |
| Nov 20/79 | 5.12 MP | 837.3 | |
| Dec 17/79 | 5.19 MP | 837.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 5.15 MP | 837.2 | |
| Feb 12/80 | 5.23 MP | 836.9 | |
| Mar 11/80 | 5.20 MP | 837.0 | |
| Apr 9/80 | 5.20 MP | 837.0 | |
| May 6/80 | 5.22 MP | 837.0 | |
| June 3/80 | 5.18 MP | 837.1 | |
| July 1/80 | 5.18 MP | 837.1 | Temp. 5°C |
| | 5.69 MP | 835.4 | After Sample |
| July 28/80 | 5.19 MP | 837.1 | |
| Aug 26/80 | 5.18 MP | 837.1 | |
| Sept 24/80 | 5.17 MP | 837.1 | |
| Oct 21/80 | 5.16 MP | 837.2 | |
| Nov 18/80 | 5.15 MP | 837.2 | |
| Dec 17/80 | 5.18 MP | 837.1 | |
| Jan 15/81 | 5.24 MP | 836.9 | |
| Feb 10/81 | 5.24 MP | 836.9 | |
| Mar 10/81 | 5.20 MP | 837.0 | |
| Apr 7/81 | 5.11 MP | 837.3 | |
| May 5/81 | 5.15 MP | 837.2 | |
| June 3/81 | 5.13 MP | 837.3 | |
| June 30/81 | 5.11 MP | 837.3 | |
| July 28/81 | 5.16 MP | 837.2 | |
| Aug 25/81 | 5.19 MP | 837.1 | |
| Sept 22/81 | 5.19 MP | 837.1 | |
| Oct 20/81 | 5.21 MP | 837.0 | |
| Nov 17/81 | 5.25 MP | 836.9 | |
| Dec 15/81 | 5.28 MP | 836.8 | |

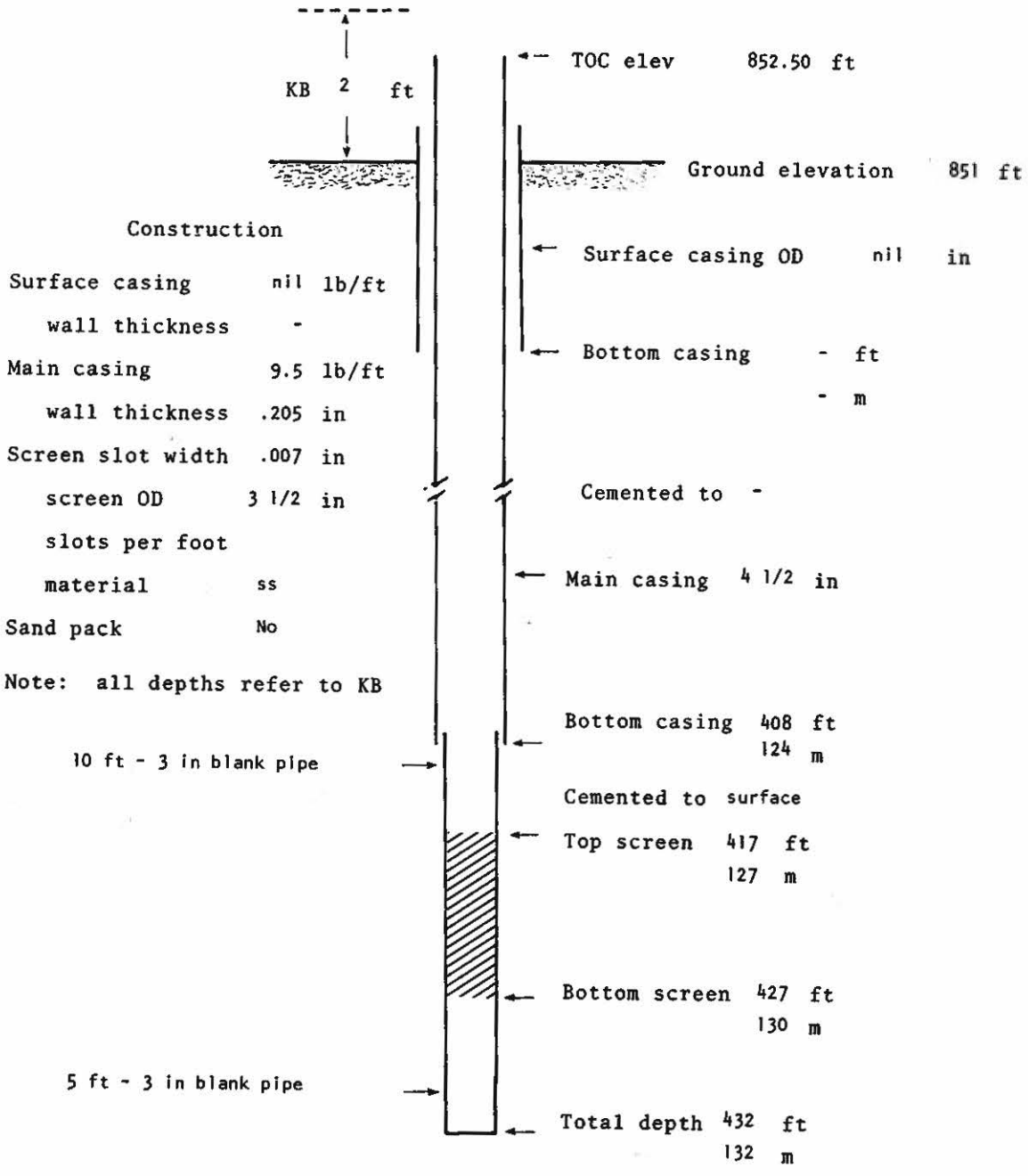
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Tp 96 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | nil | lb/ft |
| wall thickness | - | |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

# DRILL STEM TEST

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 851
KB 853

Type of test - Casing Positrieve

Date of test March 12, 1975

Testing company Johnston Testers

## TEST DATA

| | | |
|---|---|---|
| Time started | 1730 | hrs |
| Tool opened | 1836 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 734 | min |
| Pulled loose at | 0800 | hrs |
| Out of hole at | 0830 | hrs |
| Wt on packers | 3000 | lbs |
| Description of blow | Fair initial puff strong air blow decreasing to nil in 25 minutes. | |
| Total water recovered | 220 | ft |
| Water sample No. | DH 5 | |
| Gas blow | No | |
| Remarks | Test satisfactory<br>4-1/2" RBP set @ 379'<br>3-1/8" MFE set @ 377' | |

## HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 417 - 427

Formation tested McMurray

## TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.05 | |
| MFE Tool | 10.05 | |
| Sub | 0.65 | |
| Positrieve Packer | 1.35 | 4-1/2 IN |
| Total | 13.10 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Total Interval | 11.20 | |

## PRESSURE DATA (psi)

| | | |
|---|---|---|
| Instrument No. | | RPG-92N |
| Capacity (psig) | | 431 |
| Instrument set at (ft) | | 383 |
| Initial hydrostatic | A | 127 |
| First flow | B | 11 |
| | B1 | 11 |
| Initial shut in | C | 125 |
| Second flow | D | 26 |
| | D1 | 122 |
| Final shut in | G | 126 |
| Final hydrostatic | H | 127 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 1-432

PRESSURE INCREMENTS

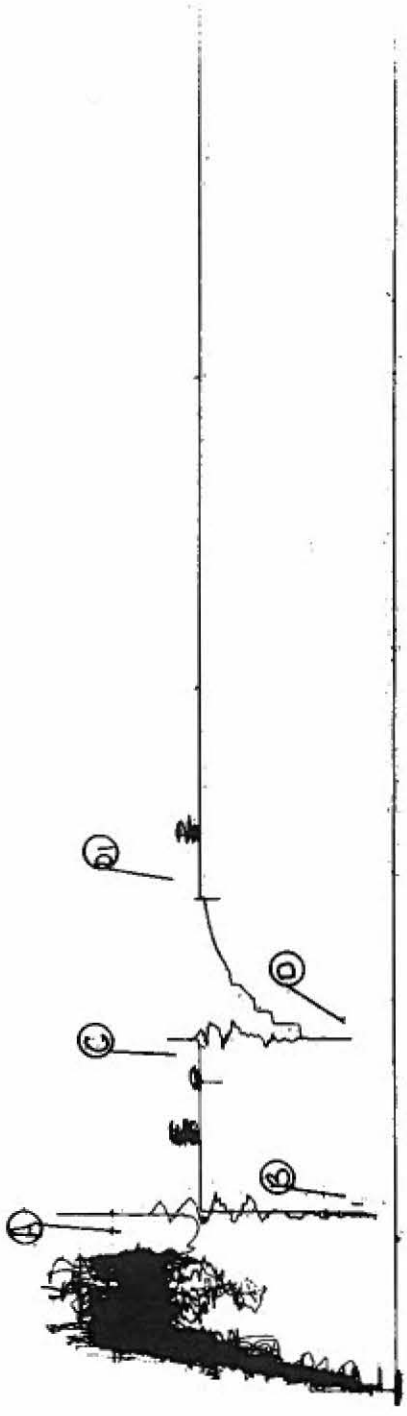
Recorder RPG-92N

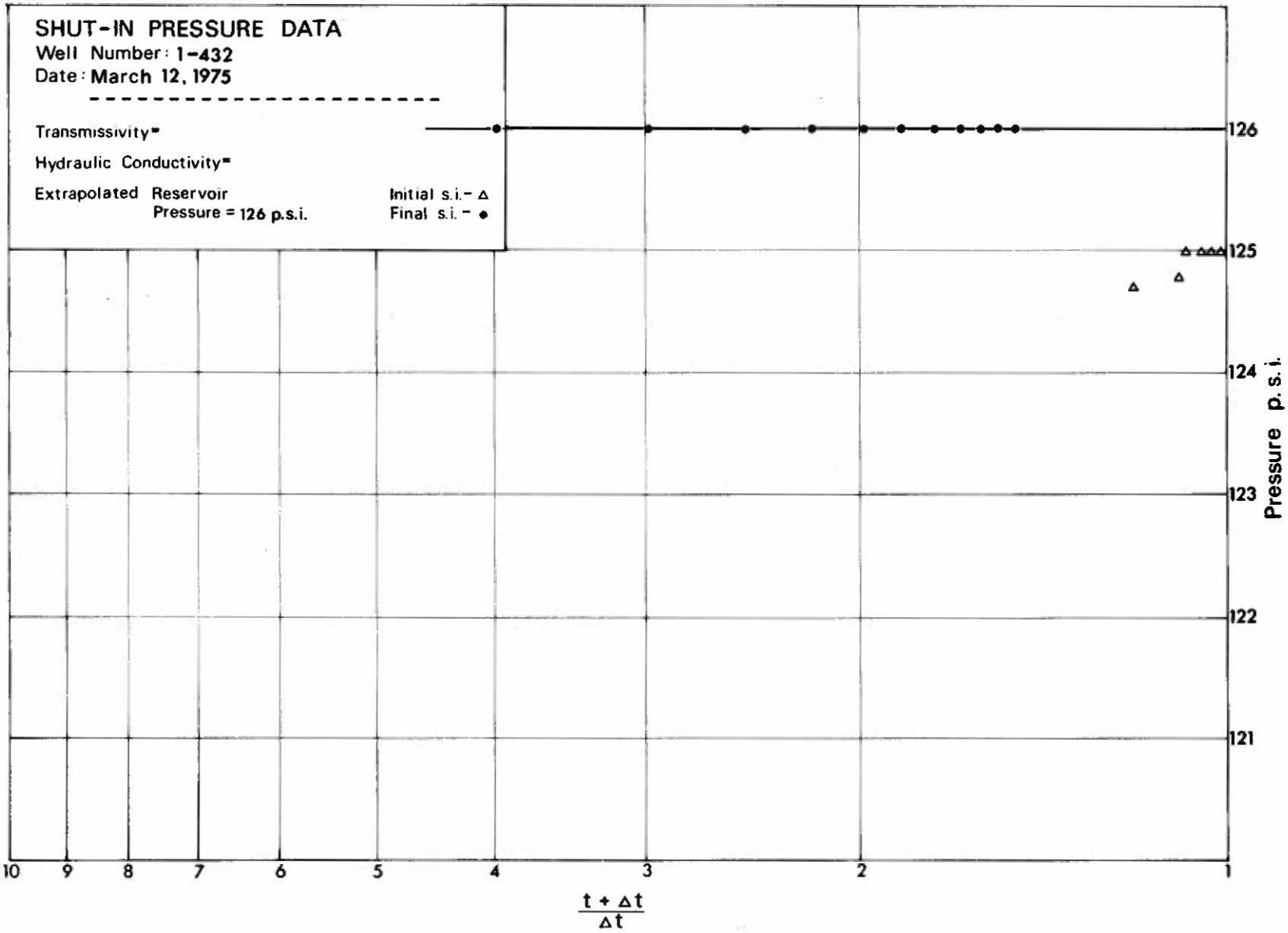
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 0 | 11 | --- |
| 5 | 124.7 | 1.20 |
| 10 | 124.8 | 1.10 |
| 15 | 125.0 | 1.07 |
| 20 | 125.0 | 1.05 |
| 25 | 125.0 | 1.04 |
| 30 | 125.0 | 1.033 |

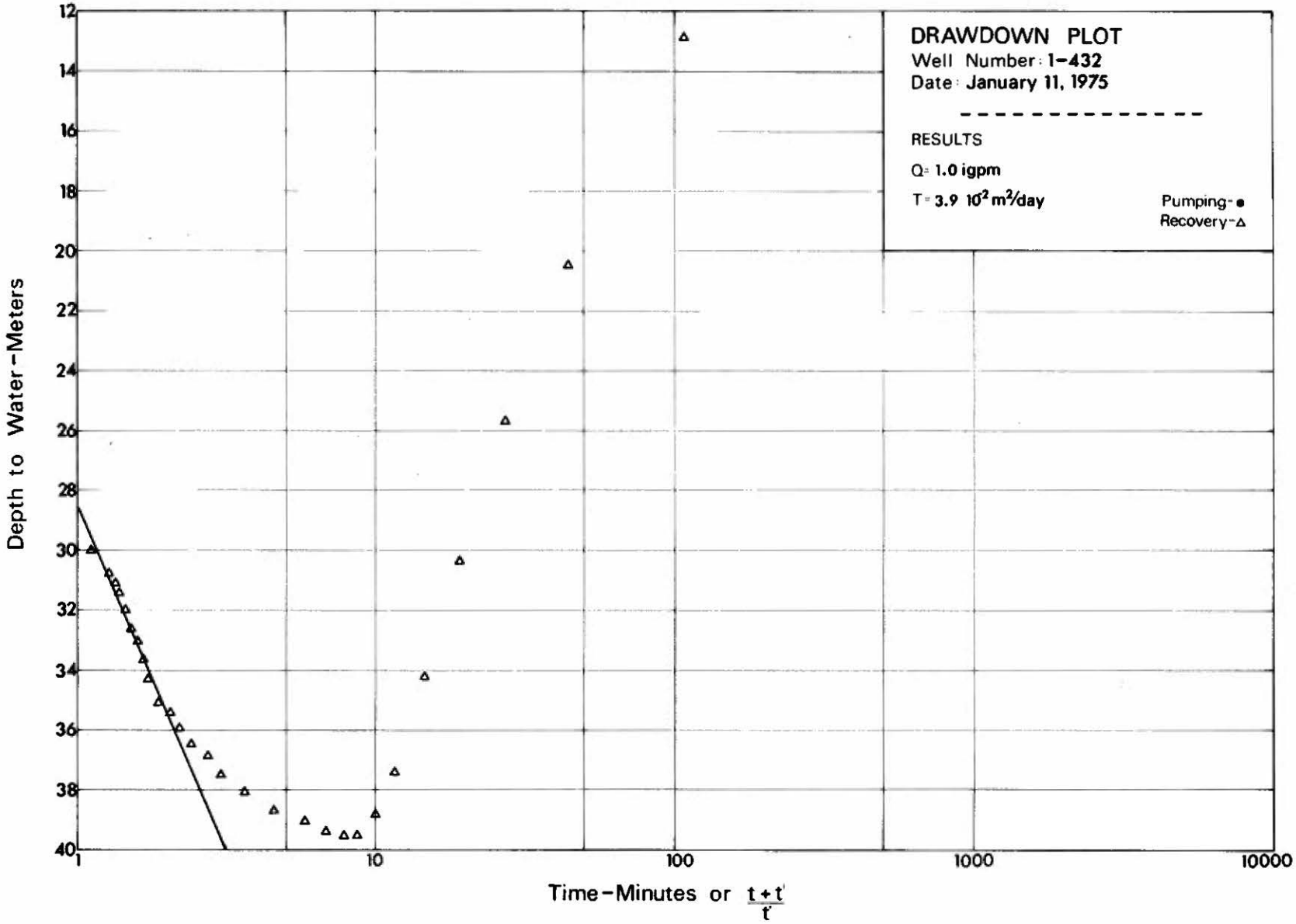
Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 0 | 122 | --- |
| 5 | 126 | 7.00 |
| 10 | 126 | 4.00 |
| 15 | 127 | 3.00 |
| 20 | 126 | 2.50 |
| 25 | 126 | 2.20 |
| 30 | 126 | 2.00 |
| 35 | 126 | 1.86 |
| 40 | 126 | 1.75 |
| 45 | 126 | 1.67 |
| 50 | 126 | 1.60 |
| 55 | 126 | 1.55 |
| 60 | 126 | 1.50 |




SHUT-IN PRESSURE DATA
Well Number: 1-432
Date: March 12, 1975
Transmissivity*
Hydraulic Conductivity*
Extrapolated Reservoir Pressure = 126 p.s.i.
Initial s.i.- Δ
Final s.i. - •
126
125
124
123
122
121
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-432-C-76


DRAWDOWN PLOT
Well Number: 1-432
Date: January 11, 1975
RESULTS
Q= 1.0 igpm
T= 3.9 10² m²/day
Pumping-●
Recovery-△
Depth to Water-Meters
Time-Minutes or (t+t')/t'
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
1
10
100
1000
10000

1-432-A-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed from 1-432

Date sampled February 14, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 978 | 48.9 | 1.1 |
| Magnesium ($Mg^{++}$) | 318 | 26.5 | 0.6 |
| Sodium ($Na^{+}$) | 98125 | 4266.3 | 98.2 |
| Potassium ($K^{+}$) | 99 | 2.5 | 0.1 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 281 | 4.6 | 0.1 |
| Sulfate ($SO_4^{=}$) | 3375 | 70.3 | 1.9 |
| Chloride ($Cl^{-}$) | 130400 | 3673.0 | 98.0 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0 | 0 |
| Silica ($SiO_2$) | 3.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 220440 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3748.2 | Total Cations (epm) | 4344.2 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 8000+ |
| pH | 7.2 |
| Fluoride ($F^{-}$) | 0.1 ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 6.3 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 346 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed from 1-432

Date sampled January 13, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 75.0 | 3.74 | 58.1 |
| Magnesium ($Mg^{++}$) | 14.6 | 1.20 | 18.6 |
| Sodium ($Na^{+}$) | 32.5 | 1.41 | 21.9 |
| Potassium ($K^{+}$) | 3.3 | 0.08 | 1.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 227.0 | 3.72 | 50.0 |
| Sulfate ($SO_4^{=}$) | 154.0 | 3.21 | 43.1 |
| Chloride ($Cl^{-}$) | 18.0 | 0.51 | 6.8 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 6.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 394.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 7.438 | Total Cations (epm) | 6.441 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 600 | Temperature (C) | 2.8 |
| pH | 8.2 | pH | 8.4 |
| Fluoride ($F^{-}$) | 1.30 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 356 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Drill stem test on well 1-432

Date sampled March 13, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1084 | 54.2 | 1.1 |
| Magnesium ($Mg^{++}$) | 252 | 21.0 | 0.4 |
| Sodium ($Na^{+}$) | 114062 | 4959.2 | 98.5 |
| Potassium ($K^{+}$) | 117 | 3.0 | 0.1 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 249 | 4.1 | 0.4 |
| Sulfate ($SO_4^{=}$) | 3660 | 76.3 | 8.2 |
| Chloride ($Cl^{-}$) | 30320 | 854.1 | 91.4 |
| Nitrate ($NO_3^{=}$) | 07 | 0.5 | 0.1 |
| Silica ($SiO_2$) | 37 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 251680 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 934.9 | Total Cations (epm) | 5037.4 |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 8000+ |
| pH | 7.1 |
| Fluoride ($F^{-}$) | 0.1 ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | | |
| pH | 6.8 | |
| Carbonate ($CO_3^{=}$) | 0 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 332 | ppm |
| Hydroxide ($OH^{-}$) | | |
| Conductivity | | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Drill stem test on well 1-432

Date of sampling March 13,1975

Total dissolved solids 251,680 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .001 | Mg | .003 |
| As | <.01 | Mn | ND |
| B | .002 | Mo | ND |
| Ba | ND | Ni | .001 |
| Be | ND | Pb | ND |
| Bi | ND | Sb | ND |
| Ca | .05 | Si | .001 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | ND | V | ND |
| Fe | ND | Zn | <.005 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1400 | 69.86 | 2 |
| Magnesium ($Mg^{++}$) | 205 | 16.86 | 0 |
| Sodium ($Na^{+}$) | 97000 | 4219.23 | 98 |
| Potassium ($K^{+}$) | 108 | 2.76 | 0 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 220 | 3.61 | 0 |
| Sulfate ($SO_4^{=}$) | 344 | 7.16 | 0 |
| Chloride ($Cl^{-}$) | 87998 | 2481.61 | 100 |
| Nitrate ($NO_3^{=}$) | 44 | 0.71 | 0 |
| Silica ($SiO_2$) | 4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1560 | | |
| Magnesium (Acidified) | 204 | | |
| Total dissolved solids | 263380 | | |

Total Anions (epm) 2493.09 Total Cations (epm) 4308.71

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | |
| pH | 6.4 |
| Fluoride ($F^{-}$) | |

Field:

| | | |
|---|---|---|
| Temperature (C) | 4.0 | |
| pH | 7 | |
| Carbonate ($CO_3^{=}$) | 0 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 264 | ppm |
| Hydroxide ($OH^{-}$) | | |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Blown from 1-432

Date sampled February 24, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1300.0 | 64.87 | 1.4 |
| Magnesium ($Mg^{++}$) | 181.0 | 14.90 | 0.3 |
| Sodium ($Na^{+}$) | 106250.0 | 4621.57 | 98.3 |
| Potassium ($K^{+}$) | 81.0 | 2.07 | 0.0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 254.0 | 4.16 | 0.1 |
| Sulfate ($SO_4^{=}$) | 2900.0 | 60.38 | 1.3 |
| Chloride ($Cl^{-}$) | 164800.0 | 4647.49 | 98.6 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 7.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 275720.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4712.0 | Total Cations (epm) | 4703.4 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | |
| pH | 6.8 | pH | 7.0 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 500 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

Major Constituents

| | Mg/l | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1320.0 | 65.87 | 2 |
| Magnesium ($Mg^{++}$) | 293.0 | 24.12 | 1 |
| Sodium ($Na^{+}$) | 89000.0 | 3871.25 | 98 |
| Potassium ($K^{+}$) | 108.0 | 2.76 | 0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 403.0 | 6.61 | 0 |
| Sulfate ($SO_4^{=}$) | 2690.0 | 56.01 | 1 |
| Chloride ($Cl^{-}$) | 144400.0 | 4072.19 | 99 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | 3.7 | | |
| Calcium (Acidified) | 1254.0 | | |
| Magnesium (Acidified) | 308.0 | | |
| Total dissolved solids | 270340 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4134.82 | Total Cations (epm) | 3964.00 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 6.0 |
| pH | 6.7 | pH | 6.6 |
| Fluoride ($F^{-}$) | 0.1 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 595 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 5, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1280.0 | 63.87 | 1.4 |
| Magnesium ($Mg^{++}$) | 247.0 | 20.33 | 0.4 |
| Sodium ($Na^{+}$) | 105250.0 | 4578.08 | 98.1 |
| Potassium ($K^{+}$) | 188.0 | 4.81 | 0.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 193.0 | 3.16 | 0.1 |
| Sulfate ($SO_4^{=}$) | 3260.0 | 67.87 | 1.4 |
| Chloride ($Cl^{-}$) | 165200.0 | 4658.77 | 98.5 |
| Nitrate ($NO_3^{=}$) | 4.3 | 0.07 | 0.0 |
| Silica ($SiO_2$) | 3.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1070.0 | | |
| Magnesium (Acidified) | 222.0 | | |
| Total dissolved solids | 275520.0 | | |
| Total Anions (epm) | 4729.88 | Total Cations (epm) | 4667.09 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 6.0 |
| pH | 5.8 | pH | 6.3 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 317.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Date sampled: July 13, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .968 |
| Au | <.003 | Mo | <.006 |
| Al | 1.1 | Na | 99,330 |
| As | <.038 | Ni | <.010 |
| B | 8.04 | P | 6.6 |
| Ba | <.200 | Pb | <.088 |
| Be | .022 | Se | <.060 |
| Ca | 1188 | Si | 4.84 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 27.4 |
| Cr | <.006 | Te | <.065 |
| Cu | 0.11 | Ti | .033 |
| Eu | <.015 | U | <.020 |
| Fe | 46.3 | V | .088 |
| K | 880 | W | <.078 |
| Mg | 231 | Zn | 0.44 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

1-432-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1060.0 | 52.89 | 1.2 |
| Magnesium(Mg) | 280.0 | 23.05 | 0.5 |
| Sodium(Na) | 103750.0 | 4512.83 | 98.3 |
| Potassium(K) | 167.0 | 4.27 | 0.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 66.0 | 1.08 | 0.0 |
| Sulphate(SO4) | 3280.0 | 68.29 | 1.5 |
| Chloride(Cl) | 161000.0 | 4540.33 | 98.5 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 2.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 990.0 | | |
| Magnesium(Acidified) | 240.0 | | |
| TDS(mg/l) | 266300.0 | | |
| Total Anions(epm) | 4609.70 | Total Cations(epm) | 4593.04 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | | | Temperature(C) | 6.00 | |
| pH | 5.4 | | pH | 6.1 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 215 | mg/l |
| | | | Hydroxide(OH) | | |

1-432-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 8, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1040.0 | 51.90 | 1.1 |
| Magnesium(Mg) | 240.0 | 19.75 | 0.4 |
| Sodium(Na) | 111250.0 | 4839.06 | 98.5 |
| Potassium(K) | 133.0 | 3.40 | 0.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 3660.0 | 76.20 | 1.6 |
| Chloride(Cl) | 168500.0 | 4751.83 | 98.4 |
| Nitrate(NO3) | 5.4 | 0.09 | 0.0 |
| Silica(SiO2) | 3.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1010.0 | | |
| Magnesium(Acidified) | 255.0 | | |
| TDS(mg/l) | 275600.0 | | |
| Total Anions(epm) | 4828.12 | Total Cations(epm) | 4914.11 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 19500 | | Temperature(C) | 5.50 | |
| pH | 3.0 | | pH | 6.1 | |
| Fluoride(F) | 0.0 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 127 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 1-432-E-82

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1030.0 | 51.50 | 1.1 |
| Magnesium(Mg) | 246.0 | 20.50 | 0.5 |
| Sodium(Na) | 101563.0 | 4415.78 | 98.3 |
| Potassium(K) | 113.0 | 2.90 | 0.1 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 3900.0 | 81.25 | 1.7 |
| Chloride(Cl) | 171800.0 | 4839.43 | 98.3 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 1.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 970.0 | | |
| Magnesium(Acidified) | 278.0 | | |
| TDS(mg/l) | 278340.0 | | |
| Total Anions(epm) | 4920.68 | Total Cations(epm) | 4490.68 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 21400 | Temperature | 6.00 | |
| pH | 2.7 | pH | 6.5 | |
| Fluoride | 0.1 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 78 | mg/l |
| | | Hydroxide(OH) | | |

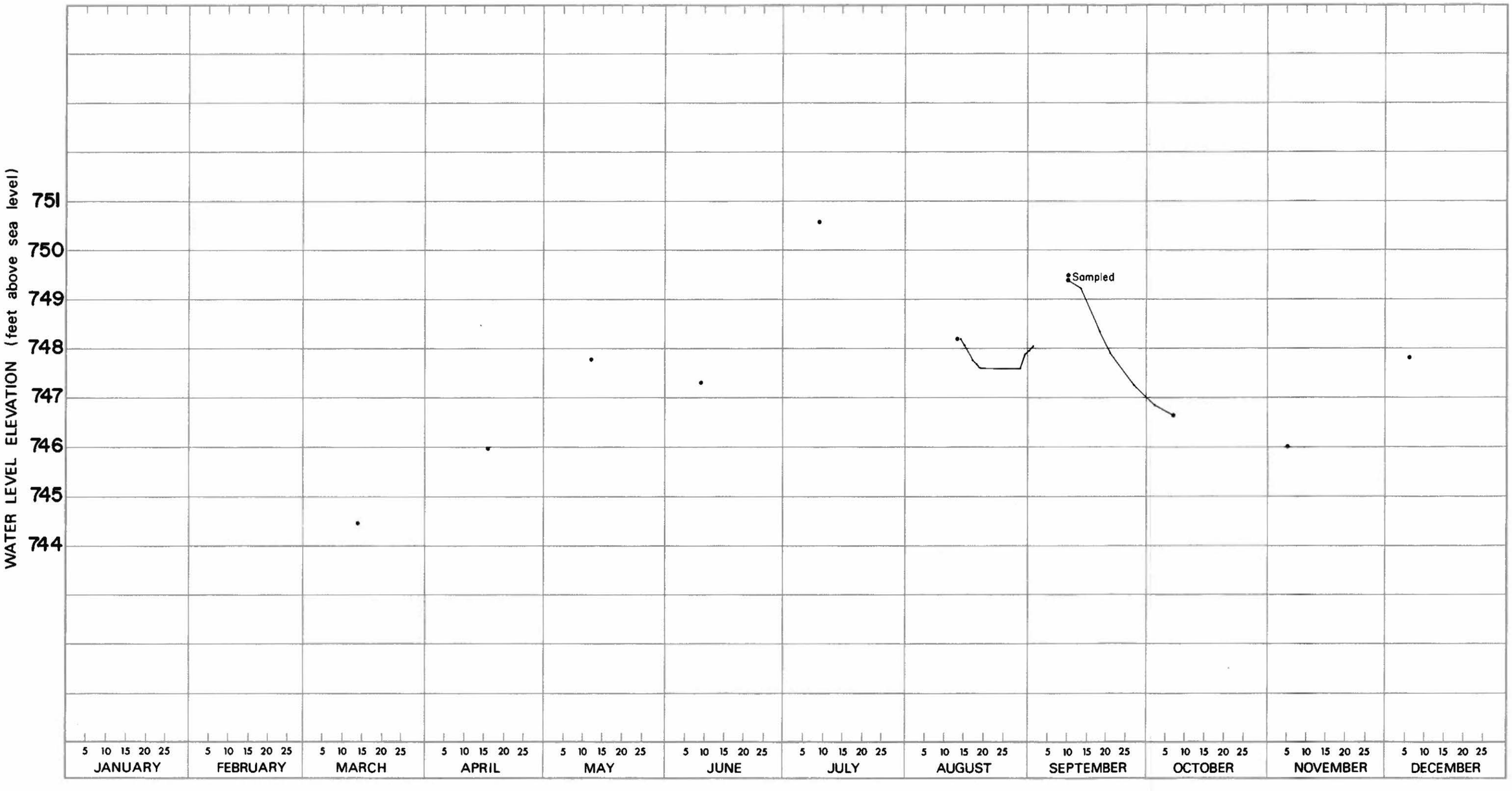
**WATER LEVEL HYDROGRAPH**

1-432-H-76

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council



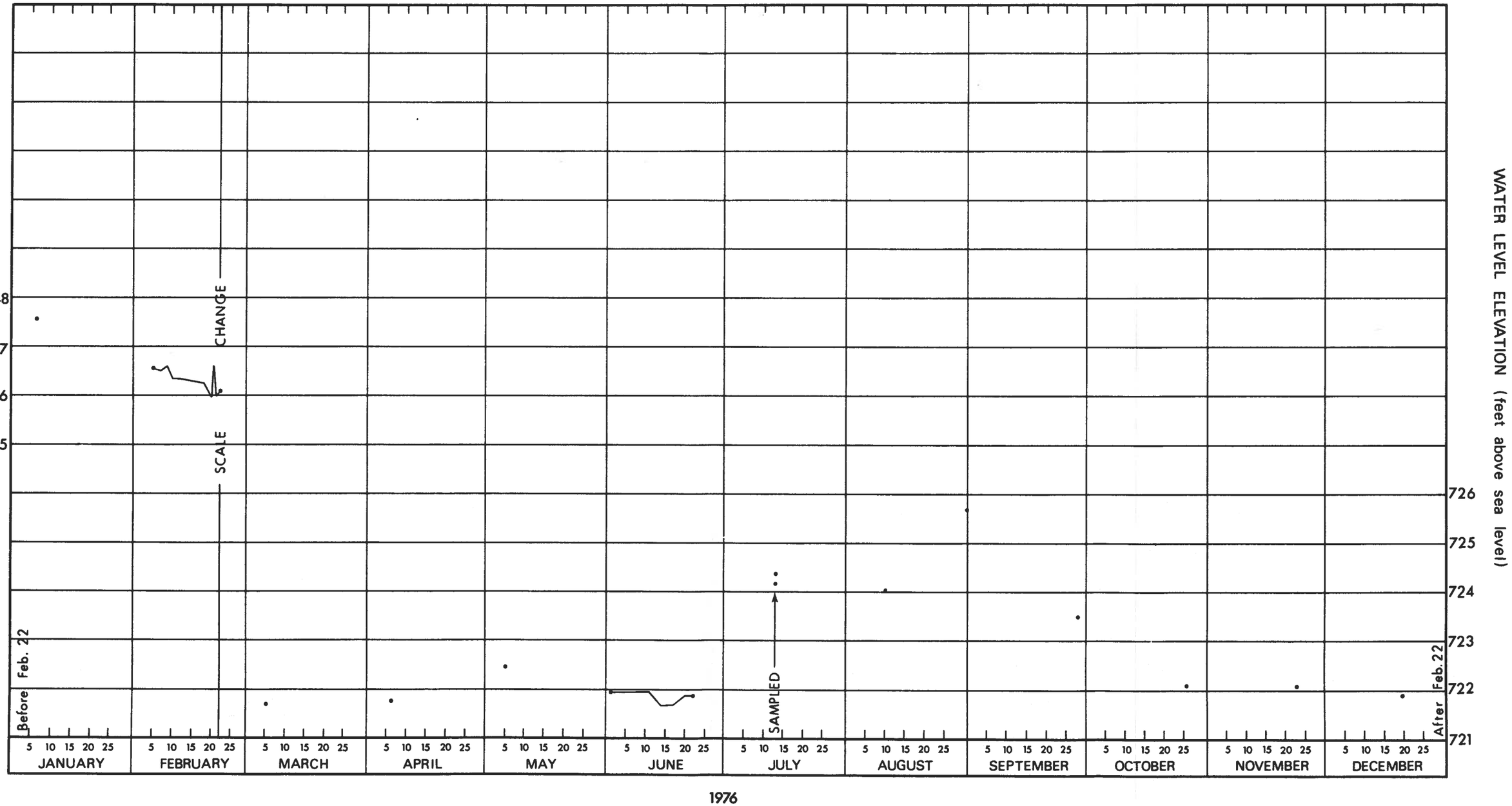
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **1-432**

Lsd **8** Sec **15** Twp **96** R **11** W4th

Alberta Research Council

**1 - 432 - H - 77**



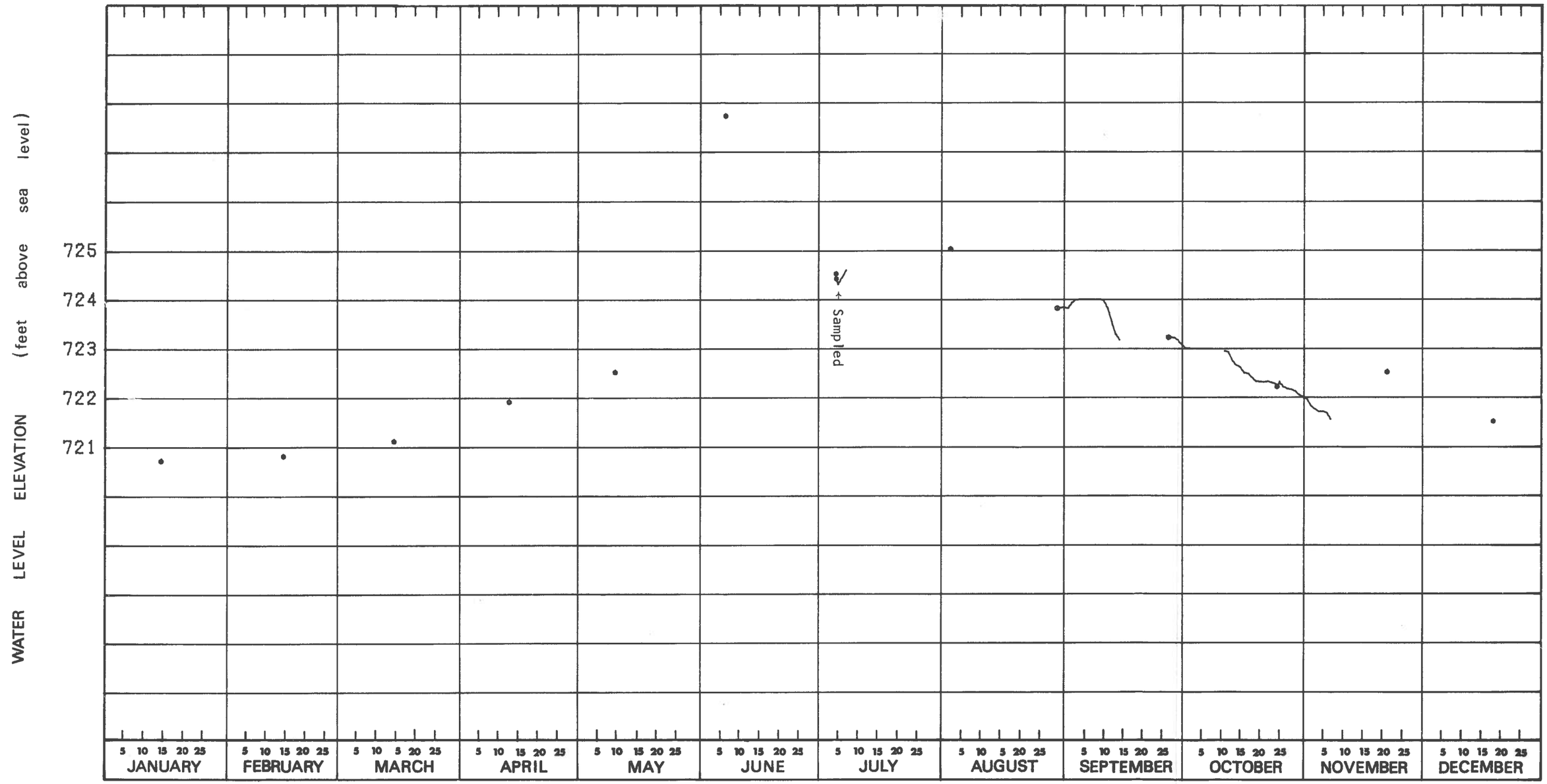
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-432

1-432-H-78

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council




1977

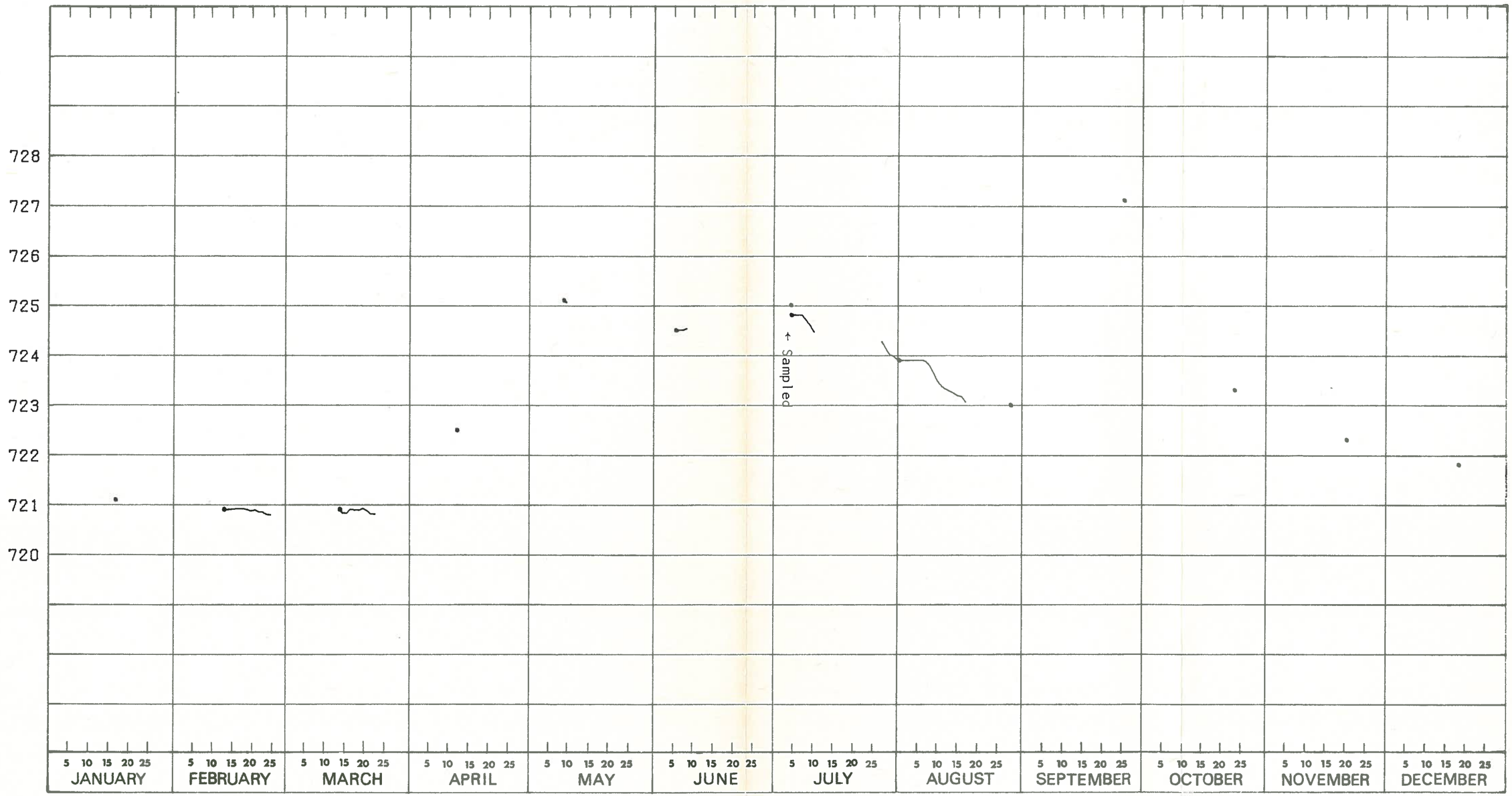
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-432

LSD 8 SEC 15 TWP 96 R 11 W4TH

1-432-H-79

Alberta Research Council




1978

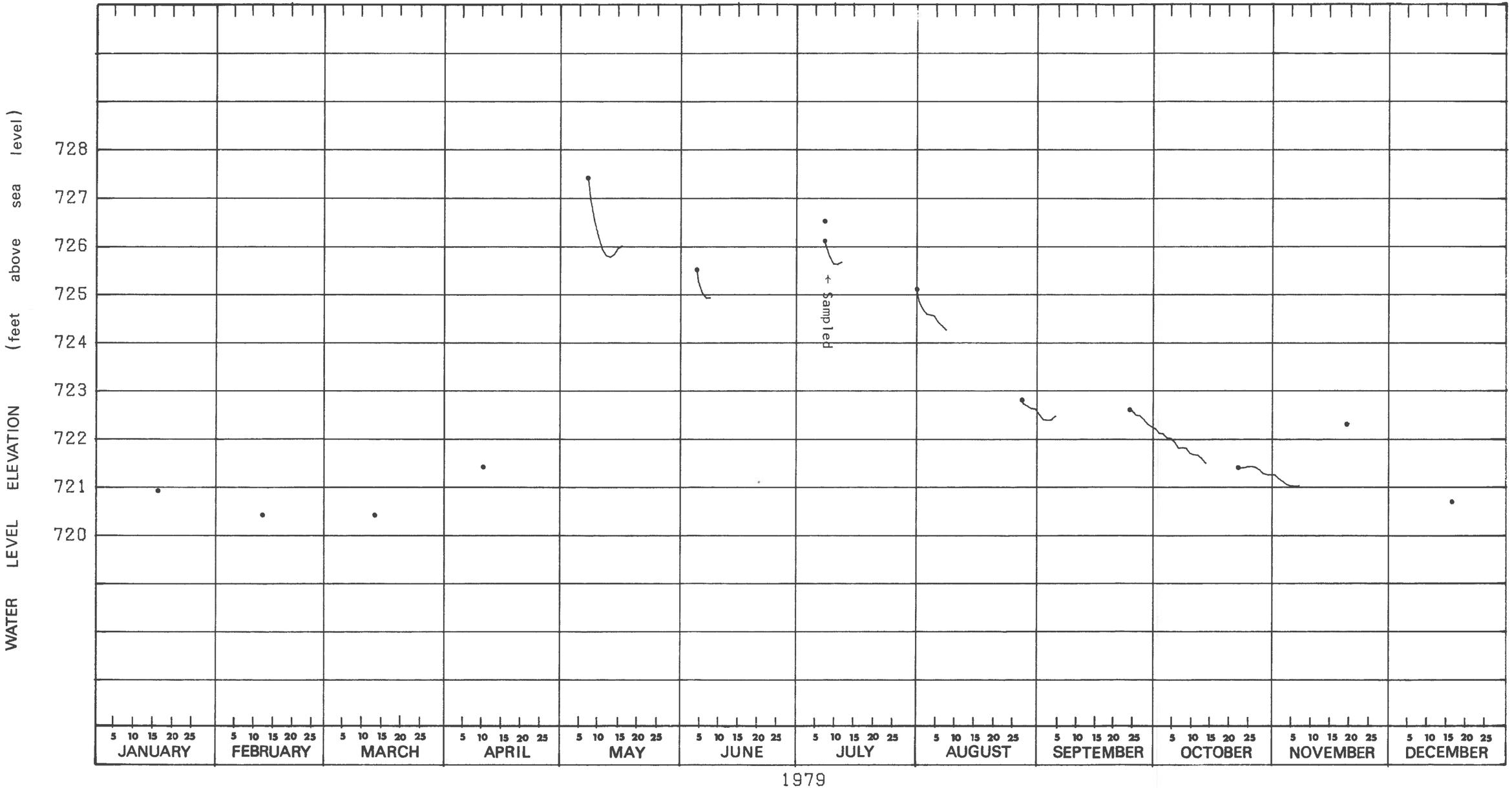
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-432

1-432-H-80

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council



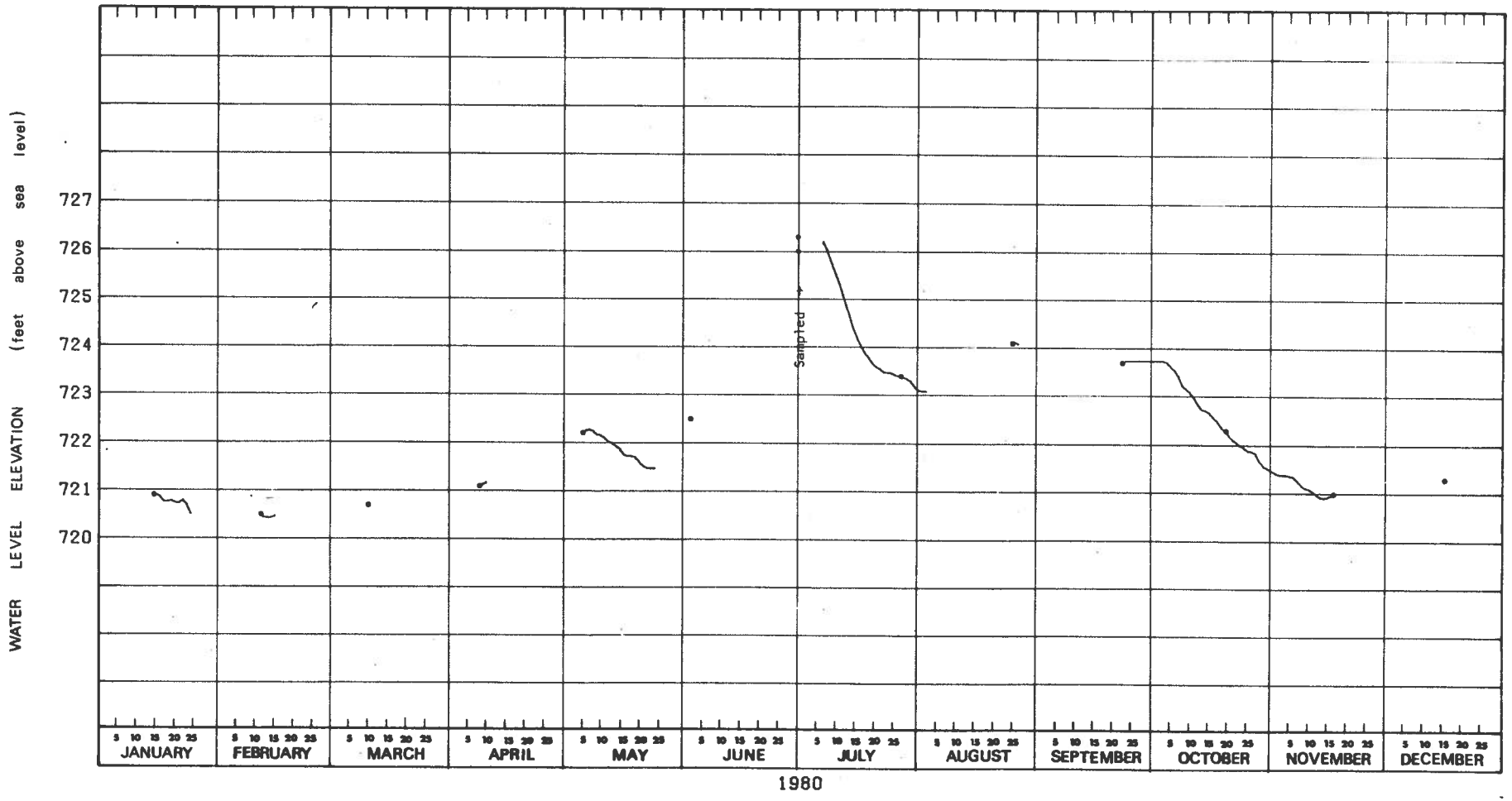
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-432-H-81



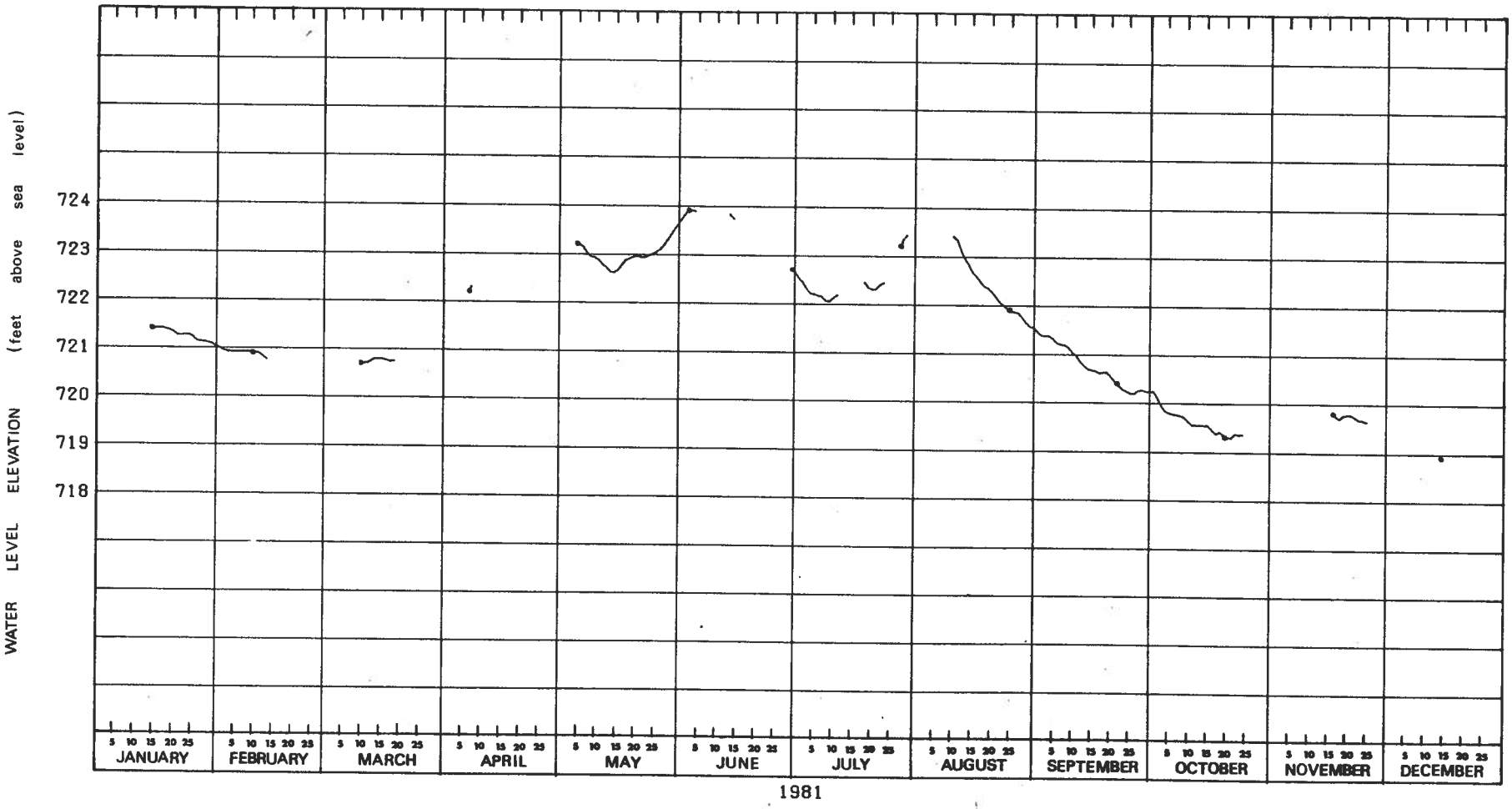
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta · Research Council

1-432-H-82



WELL HISTORY

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/75 | | | Well completed |
| Jan 11/75 | 88.49 TOC | 764.01 | Pump test; 21 GMP for 32 min. |
| Jan 13/75 | 99.84 TOC | 752.66 | Bail water sample |
| Feb 5/75 | 102.14 MP | 753.86 | Shelter installed; MP = 250' TOC, (855.00) |
| Feb 14/75 | 103.61 MP | 752.39 | Water sample; install recorder |
| Mar 13/75 | | | DST; water sample; FSI = 126# from 383' |
| Mar 14/75 | 33.75 MP | 744.42 | Reinstall recorder; MP = 262' TOC, (855.12) |
| Apr 16/75 | 33.29 MP | 745.94 | |
| May 12/75 | 32.73 old MP | 747.76 | New MP = 28.75" TOC, (854.90) |
| June 9/75 | 32.81 MP | 747.28 | |
| July 9/75 | 31.82 MP | 750.53 | Recorder stuck |
| Aug 13/75 | 32.55 MP | 748.14 | |
| Sept 10/75 | 32.16 MP | 749.41 | Sampled well; temp. 4°C |
| | 32.17 MP | 749.38 | after sample |
| Oct 7/75 | 33.02 MP | 746.59 | |
| Nov 5/75 | 33.21 MP | 745.97 | |
| Dec 6/75 | 32.65 MP | 747.80 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 32.73 MP | 747.5 | MP (854.9) |
| Feb 6/76 | 33.03 MP | 746.6 | |
| Feb 22/76 | 33.17 MP | 746.1 | Well blown down with air |
| Mar 5/76 | 40.67 MP | 721.7 | MP = 0.79 m TOC, (855.1) |
| Apr 6/76 | 40.66 MP | 721.7 | |
| May 5/76 | 40.44 MP | 722.4 | |
| June 1/76 | 40.60 MP | 721.9 | |
| June 22/76 | 40.61 MP | 721.9 | |
| July 13/76 | 39.85 MP | 724.4 | |
| | 39.91 MP | 724.2 | After sample; temp. 6°C |
| Aug 10/76 | 39.96 MP | 724.0 | |
| Aug 31/76 | 39.45 MP | 725.7 | |
| Sept 28/76 | 40.12 MP | 723.5 | |
| Oct 26/76 | 40.54 MP | 722.1 | |
| Nov 23/76 | 40.55 MP | 722.1 | |
| Dec 20/76 | 40.91 MP | 720.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 40.96 MP | 720.7 | MP (855.1) |
| Feb 15/77 | 40.94 MP | 720.8 | |
| Mar 15/77 | 40.85 MP | 721.1 | |
| Apr 13/77 | 40.62 MP | 721.9 | |
| May 10/77 | 40.41 MP | 722.5 | |
| June 7/77 | 38.84 MP | 727.7 | |
| July 5/77 | 39.81 MP | 724.5 | |
| | 39.86 MP | 724.4 | After sample; temp. 6°C |
| Aug 3/77 | 39.69 MP | 725.0 | |
| Aug 30/77 | 40.02 MP | 723.8 | |
| Sept 27/77 | 40.22 MP | 723.2 | |
| Oct 25/77 | 40.53 MP | 722.2 | Temp. 5°C |
| Nov 21/77 | 40.41 MP | 722.5 | |
| Dec 19/77 | 40.73 MP | 721.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 40.84 MP | 721.1 | MP (855.1) |
| Feb 13/78 | 40.91 MP | 720.9 | |
| Mar 14/78 | 40.92 MP | 720.9 | |
| Apr 12/78 | 40.42 MP | 722.5 | |
| May 9/78 | 39.64 MP | 725.1 | |
| June 6/78 | 39.82 MP | 724.5 | |
| July 5/78 | 39.64 MP | 725.0 | New MP 0.75m TOC (855.0) |
| | 39.68 MP | 724.8 | After sample; temp. 6°C |
| Aug 1/78 | 39.97 MP | 723.9 | |
| Aug 29/78 | 40.23 MP | 723.0 | |
| Sept 26/78 | 38.99 MP | 727.1 | |
| Oct 24/78 | 40.14 MP | 723.3 | |
| Nov 21/78 | 40.47 MP | 722.3 | |
| Dec 19/78 | 40.62 MP | 721.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 40.89 MP | 720.9 | MP (855.0) |
| Feb 13/79 | 41.03 MP | 720.4 | |
| Mar 14/79 | 41.04 MP | 720.4 | |
| Apr 11/79 | 40.73 MP | 721.4 | |
| May 8/79 | 38.90 MP | 727.4 | |
| June 5/79 | 39.48 MP | 725.5 | |
| July 8/79 | 39.18 MP | 726.5 | |
| | 39.29 MP | 726.1 | After sample; temp. 5.5°C |
| Aug 1/79 | 39.58 MP | 725.1 | |
| Aug 28/79 | 40.29 MP | 722.8 | |
| Sept 25/79 | 40.37 MP | 722.6 | |
| Oct 23/79 | 40.72 MP | 721.4 | |
| Nov 20/79 | 40.47 MP | 722.3 | |
| Dec 17/79 | 40.93 MP | 720.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 40.88 MP | 720.9 | |
| Feb 12/80 | 40.99 MP | 720.5 | |
| Mar 11/80 | 40.95 MP | 720.7 | |
| Apr 9/80 | 40.83 MP | 721.1 | |
| May 6/80 | 40.49 MP | 722.2 | |
| June 3/80 | 40.32 MP | 722.5 | New MP 0.69 Toc (854.8) |
| July 1/80 | 39.19 MP | 726.3 | Temp. 6°C |
| | 39.27 MP | 726.0 | After Sample |
| July 28/80 | 40.06 MP | 723.4 | |
| Aug 26/80 | 39.85 MP | 724.1 | |
| Sept 24/80 | 39.96 MP | 723.7 | |
| Oct 21/80 | 40.41 MP | 722.3 | |
| Nov 18/80 | 40.79 MP | 721.0 | |
| Dec 17/80 | 40.70 MP | 721.3 | |
| Jan 15/81 | 40.67 MP | 721.4 | |
| Feb 10/81 | 40.82 MP | 720.9 | |
| Mar 10/81 | 40.87 MP | 720.7 | |
| Apr 7/81 | 40.42 MP | 722.2 | |
| May 5/81 | 40.12 MP | 723.2 | |
| June 3/81 | 39.90 MP | 723.9 | |
| June 30/81 | 40.28 MP | 722.7 | |
| July 28/81 | 40.13 MP | 723.2 | |
| Aug 25/81 | 40.53 MP | 721.9 | |
| Sept 22/81 | 40.97 MP | 720.4 | |
| Oct 20/81 | 41.30 MP | 719.3 | |
| Nov 17/81 | 41.16 MP | 719.8 | |
| Dec 15/81 | 41.42 MP | 718.9 | |

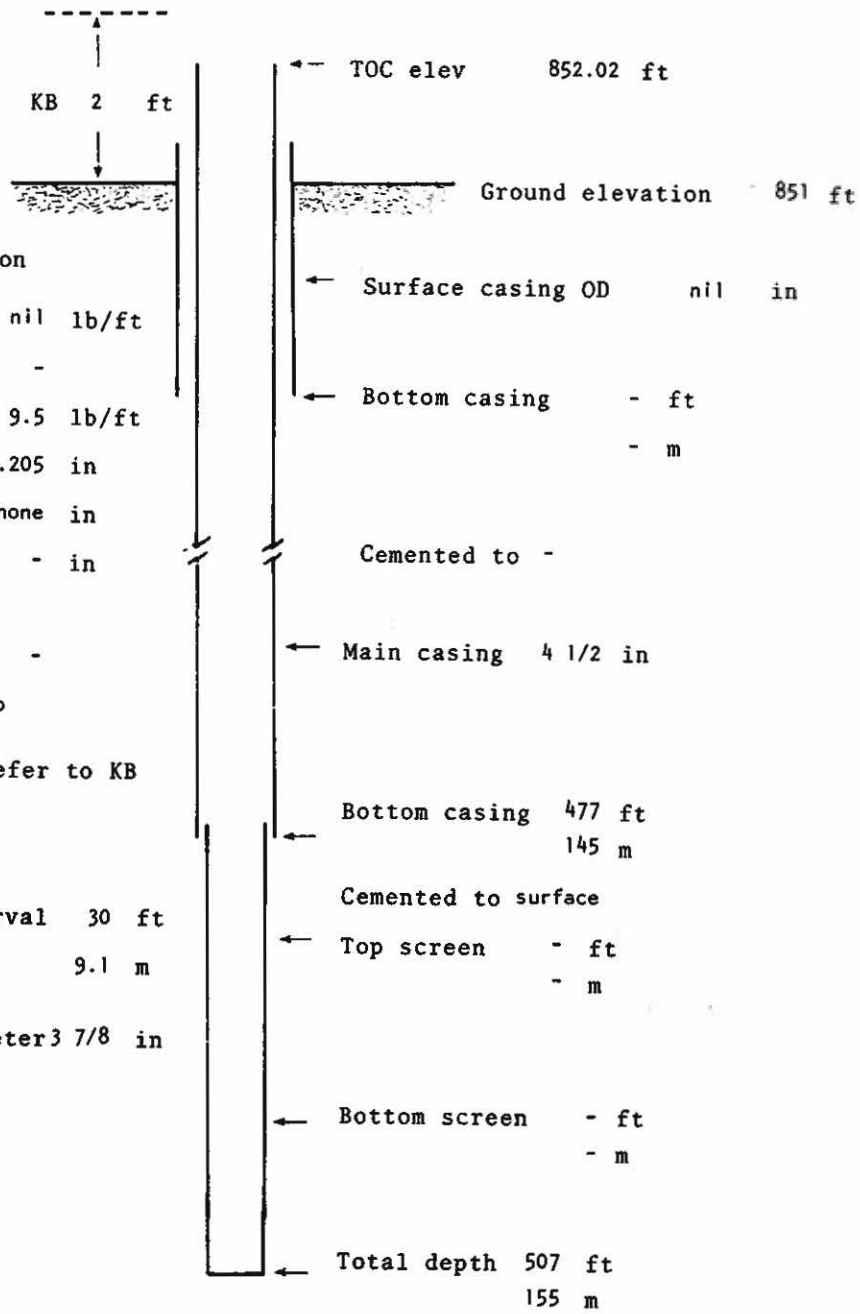
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Tp 96 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | nil | lb/ft |
| wall thickness | - | |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | none | in |
| screen OD | - | in |
| slots per foot | | |
| material | - | |
| Sand pack | No | |

Note: all depths refer to KB

Open hole interval 30 ft
9.1 m

Open hole diameter 3 7/8 in

# DRILL STEM TEST

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 851
KB 853

Type of test - Casing Positrieve

Date of test March 12, 1975

Testing company Johnston Testers

## TEST DATA

| | | |
|---|---|---|
| Time started | 1300 | hrs |
| Tool opened | 1420 | hrs |
| First flow | 2 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 30 | min |
| Pulled loose at | 1545 | hrs |
| Out of hole at | 1615 | hrs |
| Wt on packers | 3000 | lbs |

Description of blow Strong initial puff on preflow. Weak blow on final flow decreasing to nil in 20 sec.

Total water recovered 50 ft

Water sample No. DH 8

Gas blow No

Remarks Test satisfactory
4-1/2" RBP @ 463'
3-1/8" MFE @ 461'

## HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 477-507

Formation tested Beaverhill Lake

## TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.05 | |
| MFE Tool | 10.05 | |
| Sub | 0.65 | |
| Positrieve Packer | 1.35 | 4-1/2 IN |
| Total | 13.10 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Total Interval | 11.20 | |

## PRESSURE DATA (psi)

| | | |
|---|---|---|
| Instrument No. | | RPG-92N |
| Capacity (psig) | | 431 |
| Instrument set at (ft) | | 467 |
| Initial hydrostatic | A | 184 |
| First flow | B | 26 |
| | B1 | 26 |
| Initial shut in | C | 126 |
| Second flow | D | 34 |
| | D1 | 35 |
| Final shut in | G | 103 |
| Final hydrostatic | H | 184 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

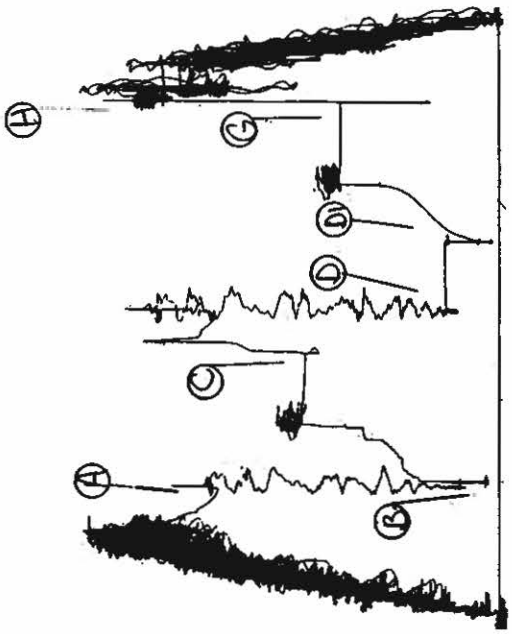
OBSERVATION WELL NUMBER 1-507

PRESSURE INCREMENTS

Rec order RPG-92N

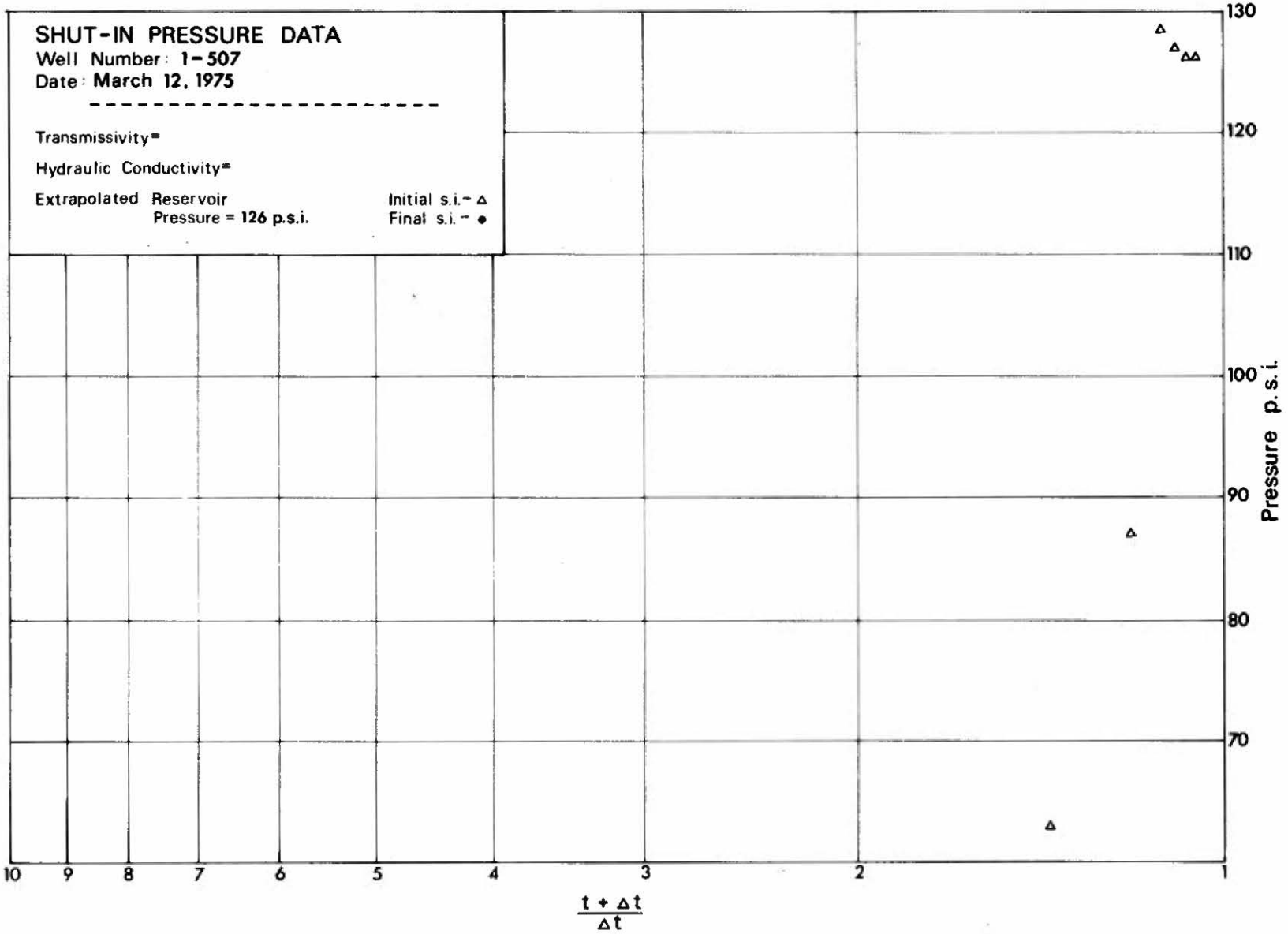
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 62.8 | 1.40 |
| 10 | 86.8 | 1.20 |
| 15 | 128.1 | 1.13 |
| 20 | 126.8 | 1.10 |
| 25 | 126.0 | 1.08 |
| 30 | 126.0 | 1.066 |

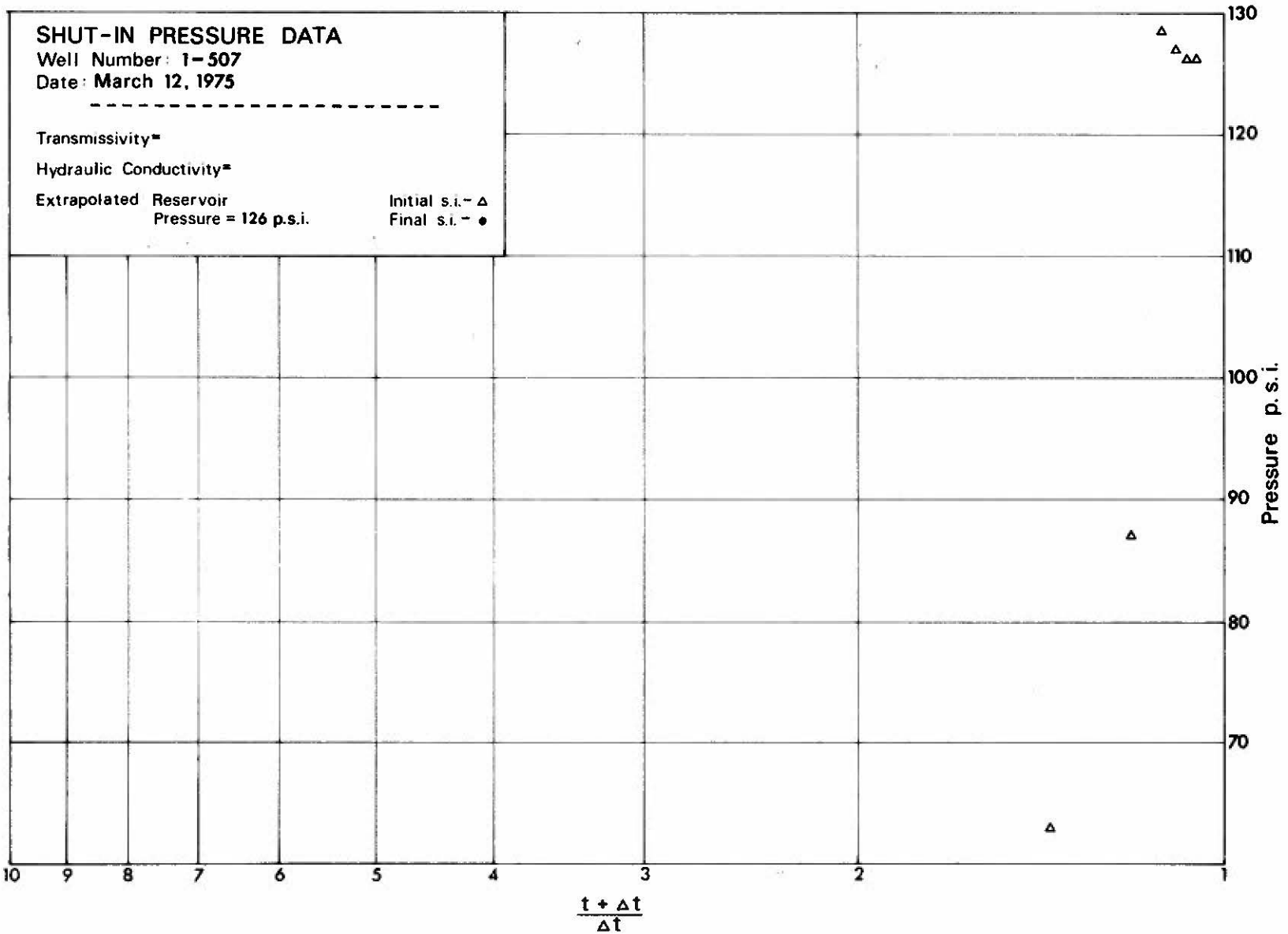


Final Shut In

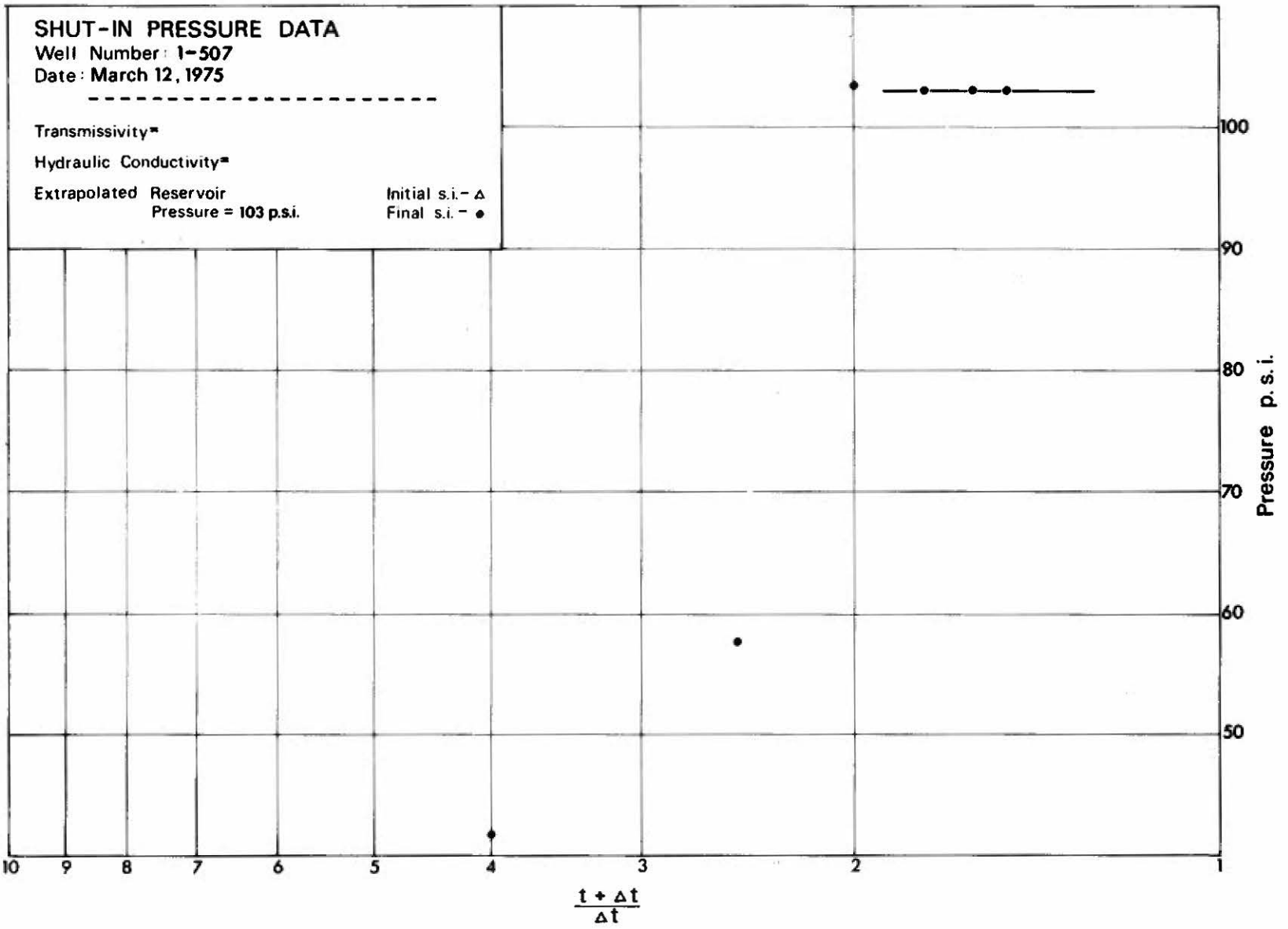
| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 41.8 | 4.00 |
| 10 | 57.5 | 2.50 |
| 15 | 103.0 | 2.00 |
| 20 | 103.0 | 1.75 |
| 25 | 103.0 | 1.60 |
| 30 | 103.0 | 1.50 |


SHUT-IN PRESSURE DATA
Well Number: 1-507
Date: March 12, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 126 p.s.i.
Initial s.i.- Δ
Final s.i.- ●
130
120
110
100
90
80
70
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-507-D-76


SHUT-IN PRESSURE DATA
Well Number: 1-507
Date: March 12, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 126 p.s.i.
Initial s.i.- △
Final s.i. - ●
130
120
110
100
90
80
70
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-507-D-76


SHUT-IN PRESSURE DATA
Well Number: 1-507
Date: March 12, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 103 p.s.i.
Initial s.i. - Δ
Final s.i. - •
100
90
80
70
60
50
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-507-D-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Pump test on well 1-507

Date sampled January 13, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 930 | 46.50 | 3.9 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.03 | 0 |
| Sodium ($Na^{+}$) | 26375 | 1146.74 | 95.9 |
| Potassium ($K^{+}$) | 86 | 2.21 | 0.2 |
| Carbonate ($CO_3^{=}$) | 36 | 0.09 | 1.2 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 1535 | 2.31 | 2.3 |
| Chloride ($Cl^{-}$) | 48000 | 97.60 | 97.6 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0 | 0.1 |
| Silica ($SiO_2$) | 3.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 73300 | | |
| Total Anions (epm) | 1385.3 | Total Cations (epm) | 1195.5 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 8000+ | Temperature (C) | 4.4 | |
| pH | 11.6 | pH | 11.9 | |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | 49 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 | ppm |
| | | Hydroxide ($OH^{-}$) | 137 | ppm |
| | | Conductivity | | |

SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Drill stem test on well 1-507

Date of sampling March 13, 1975

Total dissolved solids 259,760 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | < .01 |
| Al | .004 | Mg | .002 |
| As | < .01 | Mn | ND |
| B | .002 | Mo | ND |
| Ba | ND | Ni | .001 |
| Be | ND | Pb | .004 |
| Bi | ND | Sb | ND |
| Ca | .04 | Si | .001 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .002 | V | ND |
| Fe | ND | Zn | <.005 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Drill stem test on 1-507

Date sampled March 13, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1000 | 50.0 | 1.0 |
| Magnesium ($Mg^{++}$) | 340 | 28.3 | 0.6 |
| Sodium ($Na^{+}$) | 109688 | 4769.0 | 98.3 |
| Potassium ($K^{+}$) | 150 | 3.9 | 0.1 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 44 | 0.7 | 0 |
| Sulfate ($SO_4^{=}$) | 3735 | 77.8 | 1.8 |
| Chloride ($Cl^{-}$) | 152000 | 4281.7 | 98.2 |
| Nitrate ($NO_3^{=}$) | 1 | 0.1 | 0 |
| Silica ($SiO_2$) | 5.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 259760 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4360.3 | Total Cations (epm) | 4851.2 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 8000+ | | Temperature (C) | | |
| pH | 7.5 | | pH | | |
| Fluoride ($F^{-}$) | 0 | ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | | Bicarbonate ($HCO_3^{-}$) | 88 | ppm |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed from 1-507

Date sampled February 14, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1084 | 54.2 | 1.0 |
| Magnesium ($Mg^{++}$) | 380 | 31.7 | 0.6 |
| Sodium ($Na^{+}$) | 120313 | 5231.0 | 98.3 |
| Potassium ($K^{+}$) | 108 | 2.8 | 0.1 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 264 | 4.3 | 0.1 |
| Sulfate ($SO_4^{=}$) | 4150 | 87.5 | 1.9 |
| Chloride ($Cl^{-}$) | 160000 | 4507.0 | 98.0 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0 | 0 |
| Silica ($SiO_2$) | 15.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 274280 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4597.9 | Total Cations (epm) | 5319.6 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 8000+ | Temperature (C) | | |
| pH | 6.7 | pH | 6.8 | |
| Fluoride ($F^{-}$) | 0 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 517 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1240 | 61.88 | 1 |
| Magnesium ($Mg^{++}$) | 252 | 20.72 | 0 |
| Sodium ($Na^{+}$) | 99250 | 4317.09 | 98 |
| Potassium ($K^{+}$) | 119 | 3.04 | 0 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 4000 | 83.28 | 2 |
| Chloride ($Cl^{-}$) | 155998 | 4399.27 | 98 |
| Nitrate ($NO_3^{=}$) | 340 | 5.48 | 0 |
| Silica ($SiO_2$) | 2.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1180 | | |
| Magnesium (Acidified) | 223 | | |
| Total dissolved solids | 268810 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4488.03 | Total Cations (epm) | 4402.73 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | 4.5 |
| pH | 4.1 | pH | 6 |
| Fluoride ($F^{-}$) | 0 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 73.2 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Blown from 1-507

Date sampled February 24, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1200.0 | 59.88 | 1.4 |
| Magnesium ($Mg^{++}$) | 174.0 | 14.32 | 0.3 |
| Sodium ($Na^{+}$) | 96000.0 | 4175.73 | 98.2 |
| Potassium ($K^{+}$) | 138.0 | 3.53 | 0.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 46.4 | 0.76 | 0.0 |
| Sulfate ($SO_4^{=}$) | 2600.0 | 54.13 | 1.2 |
| Chloride ($Cl^{-}$) | 159200.0 | 4489.57 | 98.8 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 2.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 272200.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4544.4 | Total Cations (epm) | 4253.4 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | >8000 |
| pH | 7.5 |
| Fluoride ($F^{-}$) | 0.1 ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 6.5 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | 54 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1530.0 | 76.35 | 2 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 78000.0 | 3392.78 | 98 |
| Potassium ($K^{+}$) | 95.0 | 2.43 | 0 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 2690.0 | 56.01 | 2 |
| Chloride ($Cl^{-}$) | 129200.0 | 3643.54 | 98 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.0 | | |
| Hydroxide ($OH^{-}$) | 28.6 | 1.68 | 0 |
| Calcium (Acidified) | 1419.0 | | |
| Magnesium (Acidified) | 2.0 | | |
| Total dissolved solids | 217700 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3702.04 | Total Cations (epm) | 3471.57 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 7.0 | |
| pH | 10.8 | pH | 10.4 | |
| Fluoride ($F^{-}$) | 0.1 Mg/L | Carbonate ($CO_3^{=}$) | 53 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 20 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 5, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1430.0 | 71.36 | 2.3 |
| Magnesium ($Mg^{++}$) | 1.7 | 0.14 | 0.0 |
| Sodium ($Na^{+}$) | 70000.0 | 3044.80 | 97.6 |
| Potassium ($K^{+}$) | 178.0 | 4.55 | 0.1 |
| Carbonate ($CO_3^{=}$) | 12.0 | 0.40 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 9.6 | 0.16 | 0.0 |
| Sulfate ($SO_4^{=}$) | 2150.0 | 44.76 | 1.5 |
| Chloride ($Cl^{-}$) | 106200.0 | 2994.92 | 98.5 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 0.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1300.0 | | |
| Magnesium (Acidified) | 1.5 | | |
| Total dissolved solids | 181260.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3040.25 | Total Cations (epm) | 3120.85 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 9.0 |
| pH | 8.7 | pH | 8.8 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 14.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 15.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

ERRATUM - 1978

GROUNDWATER OBSERVATION WELL NETWORK:
ATHABASCA OIL SANDS AREA
ALBERTA RESEARCH COUNCIL

INFORMATION SERIES 69

## General Statement

An error in some of the WATER ANALYSIS reports for water samples collected in 1976 has been noted. The error involved the failure to report hydroxide ion with the result that errors in calculation occurred in the total anions and in anion percentages. The WATER ANALYSIS pages contained herein should replace the 1976 pages where appropriate.

## Site One

1. Well 1-1040: the SHUT-IN PRESSURE DATA sheet dated February 24, 1976 for the final shut-in contains an error in the scale. The number 390 on the right-hand scale should read 360.

2. Well 1-1040: the DRILL STEM TEST sheet of February 25, 1976 for the depth interval 928 to 1040 ft should list Methy, McLean River and LaLoche as the formations tested.

3. Well 1-1040: the DRILL STEM TEST sheet of February 25, 1976 for the depth interval 824 to 936 ft should list Methy as the formation tested.

## Site 16

1. Well 16-325: the elevation of the top of casing on the WELL CONSTRUCTION sheet should be 1124.10 ft rather than 1224.10 ft.

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1260.0 | 62.87 | 2.3 |
| Magnesium(Mg) | 6.0 | 0.49 | 0.0 |
| Sodium(Na) | 62125.0 | 2702.26 | 97.5 |
| Potassium(K) | 229.0 | 5.86 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 31.7 | 0.52 | 0.0 |
| Sulphate(SO4) | 1800.0 | 37.48 | 1.3 |
| Chloride(Cl) | 102000.0 | 2876.48 | 98.7 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 0.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1270.0 | | |
| Magnesium(Acidified) | 7.4 | | |
| TDS(mg/l) | 161400.0 | | |
| Total Anions(epm) | 2914.48 | Total Cations(epm) | 2771.49 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | | | Temperature(C) | 6.00 | |
| pH | 8.3 | | pH | 8.3 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 29 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 1-507-E-82

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1980

## Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1370.0 | 68.50 | 2.6 |
| Magnesium(Mg) | 29.0 | 2.42 | 0.1 |
| Sodium(Na) | 59000.0 | 2565.22 | 97.1 |
| Potassium(K) | 187.0 | 4.79 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 1650.0 | 34.38 | 1.3 |
| Chloride(Cl) | 94400.0 | 2659.15 | 98.7 |
| Nitrate(NO3) | 0.8 | 0.01 | 0.0 |
| Silica(SiO2) | 0.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1240.0 | | |
| Magnesium(Acidified) | 9.8 | | |
| TDS(mg/l) | 156080.0 | | |
| Total Anions(epm) | 2693.54 | Total Cations(epm) | 2640.93 |

## Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 165000 |
| pH | 4.1 |
| Fluoride | 0.1 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 6.00 | |
| pH | 6.1 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 20 | mg/l |
| Hydroxide(OH) | | |

1-507-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 8, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1240.0 | 61.88 | 2.3 |
| Magnesium(Mg) | 23.0 | 1.89 | 0.1 |
| Sodium(Na) | 60750.0 | 2642.45 | 97.5 |
| Potassium(K) | 192.0 | 4.91 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 2.4 | 0.04 | 0.0 |
| Sulphate(SO4) | 1425.0 | 29.67 | 1.0 |
| Chloride(Cl) | 101000.0 | 2848.28 | 99.0 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.0 |
| Silica(SiO2) | 0.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1310.0 | | |
| Magnesium(Acidified) | 24.0 | | |
| TDS(mg/l) | 164700.0 | | |
| Total Anions(epm) | 2878.00 | Total Cations(epm) | 2711.13 |

Other Constituents

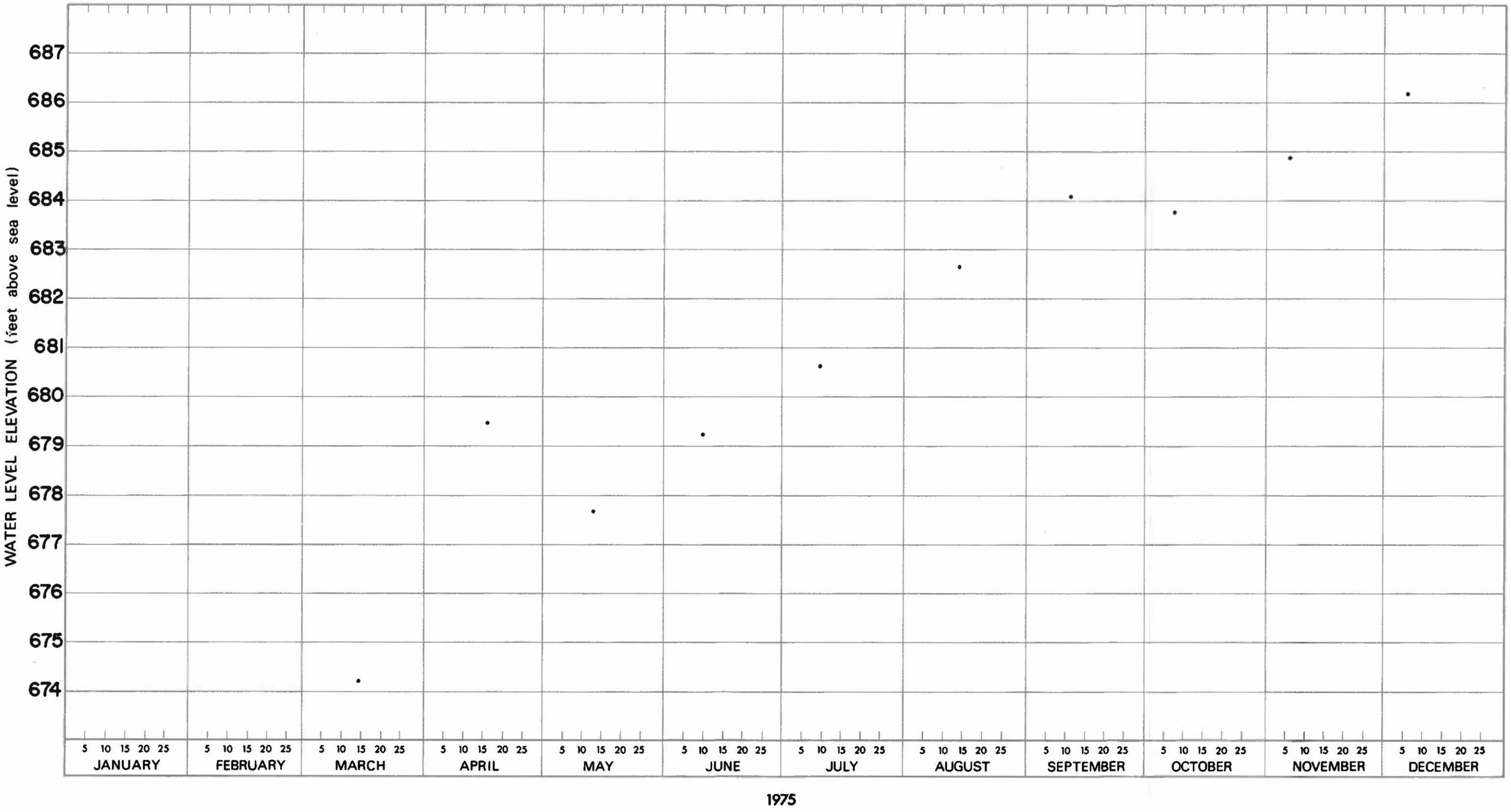
| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 15500 | | Temperature(C) | 6.00 | |
| pH | 6.7 | | pH | 6.1 | |
| Fluoride(F) | 0.0 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 10 | mg/l |
| | | | Hydroxide(OH) | | |

**WATER LEVEL HYDROGRAPH**

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council



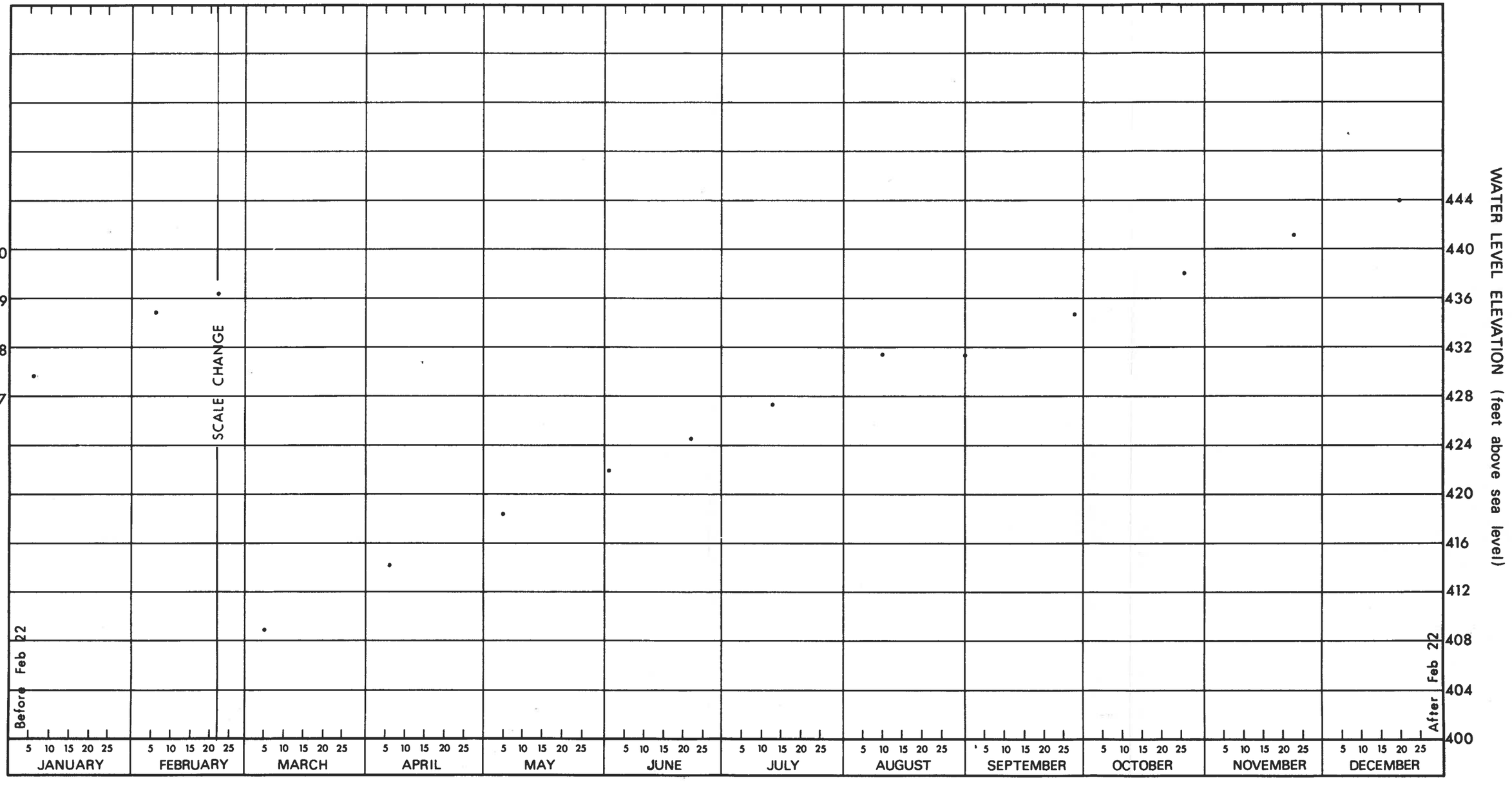
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

1 - 507 - H - 77




1976

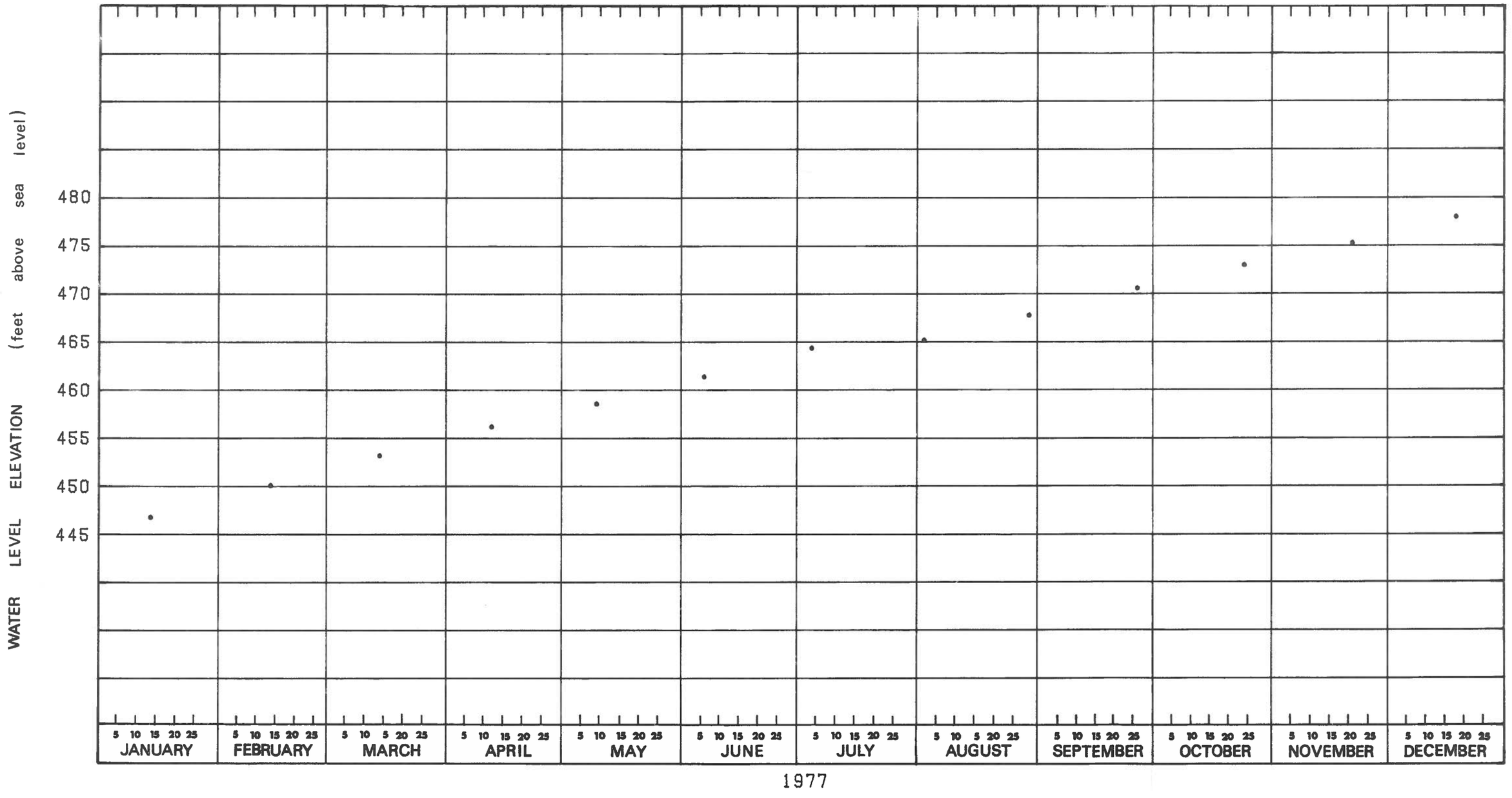
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-507

1-507-H-78

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council




1977

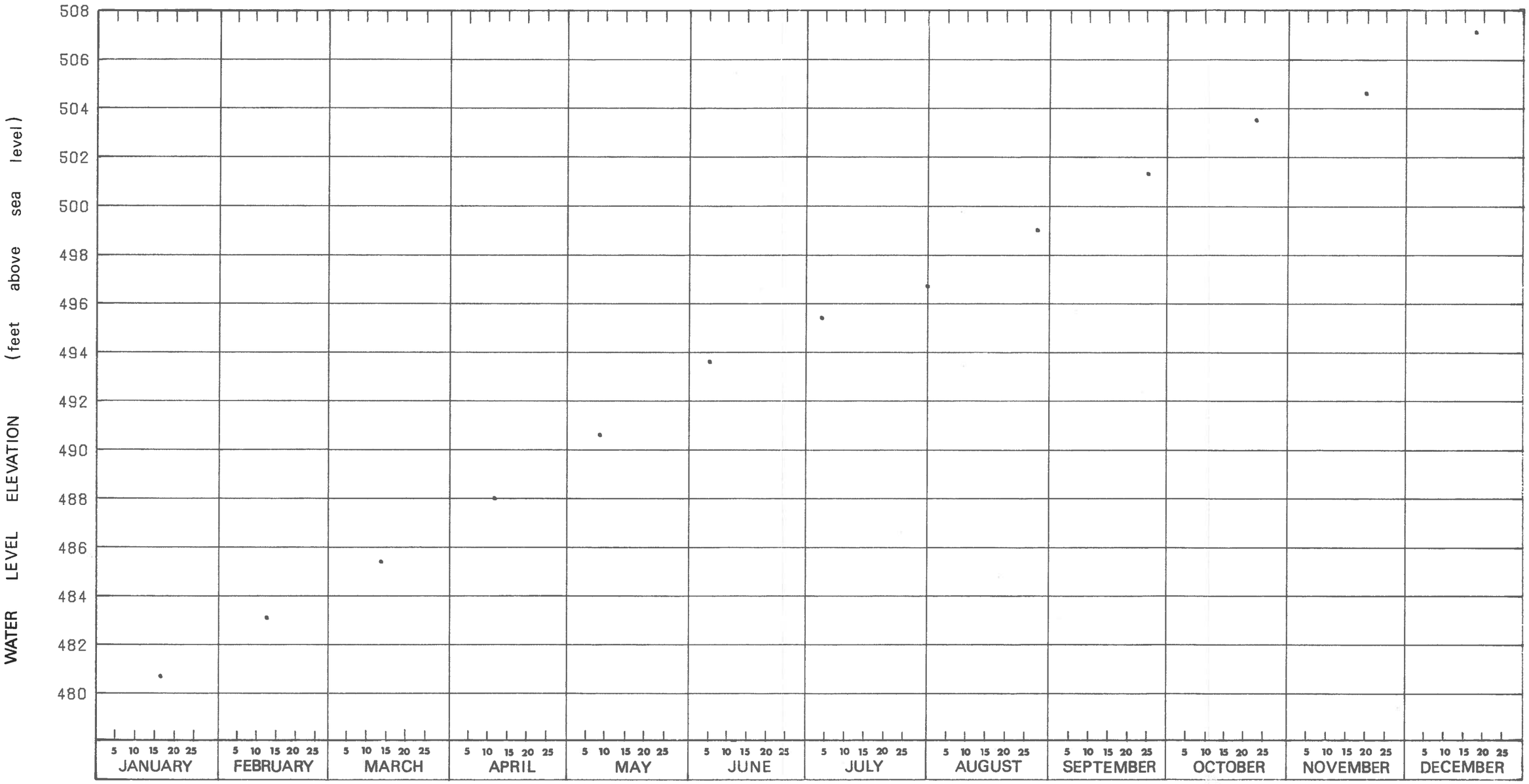
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-507

LSD 8 SEC 15 TWP 96 R 11 W4TH

1-507-H-79

Alberta Research Council



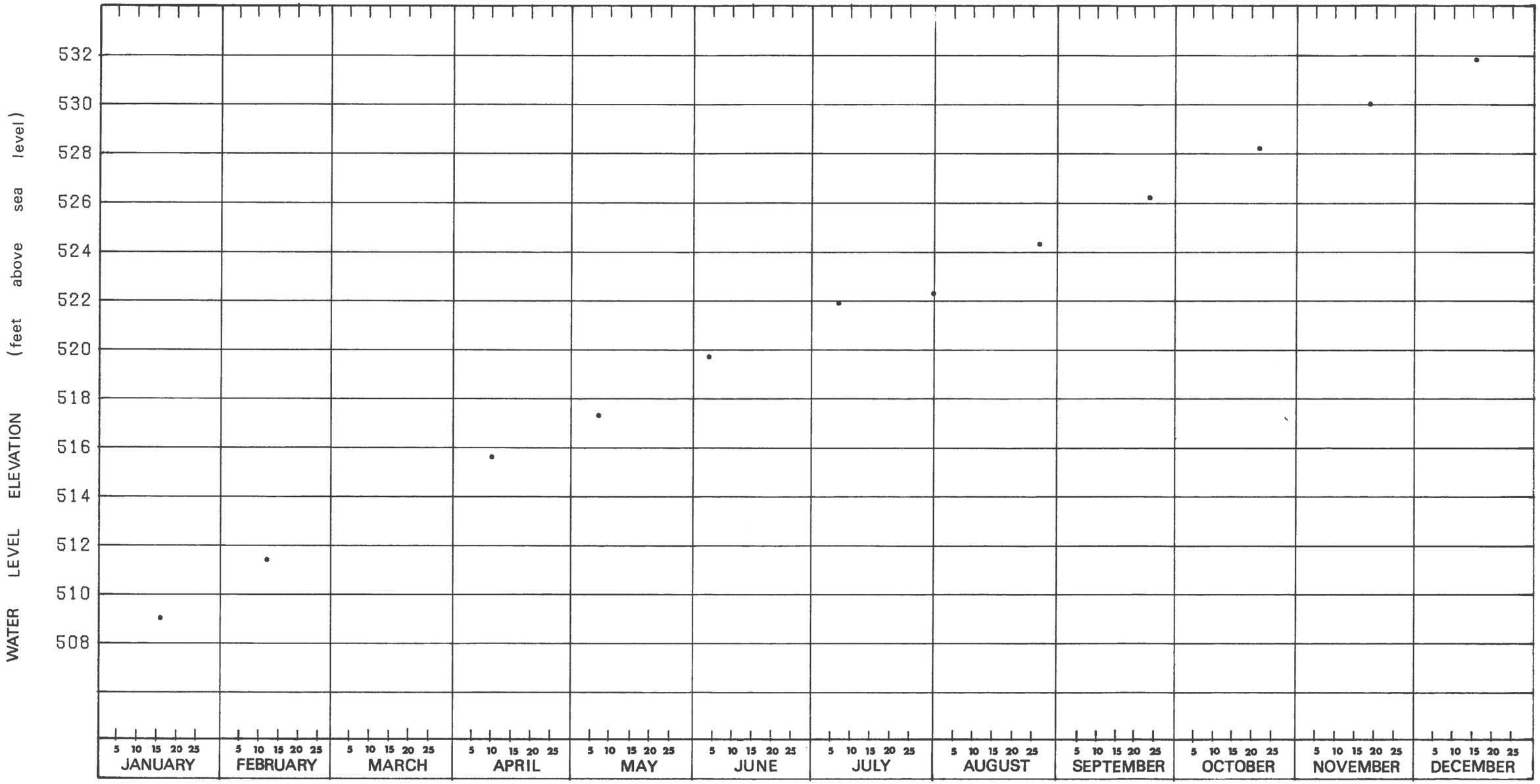
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-507

1-507-H-80

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council



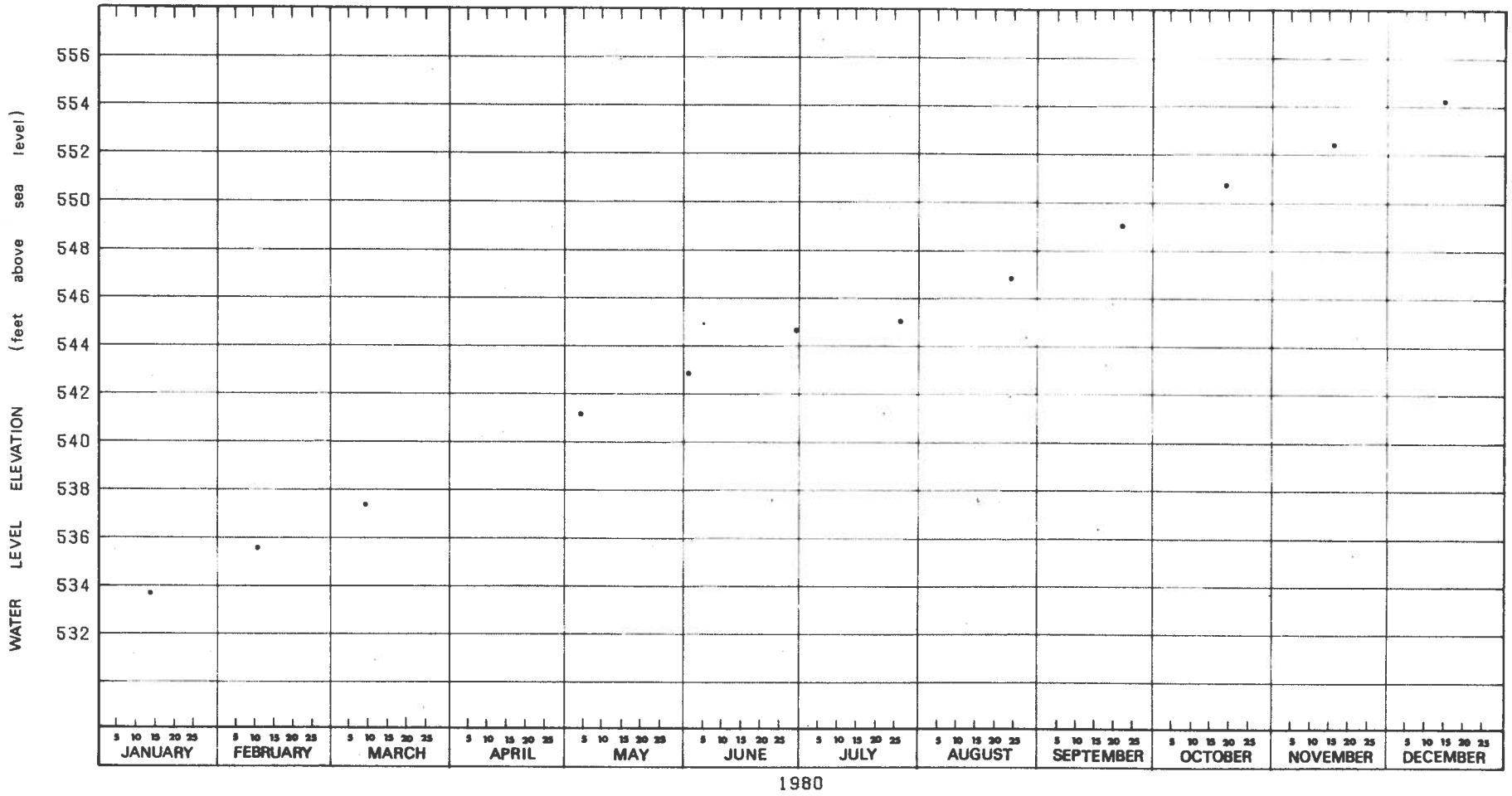
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-507-H-81



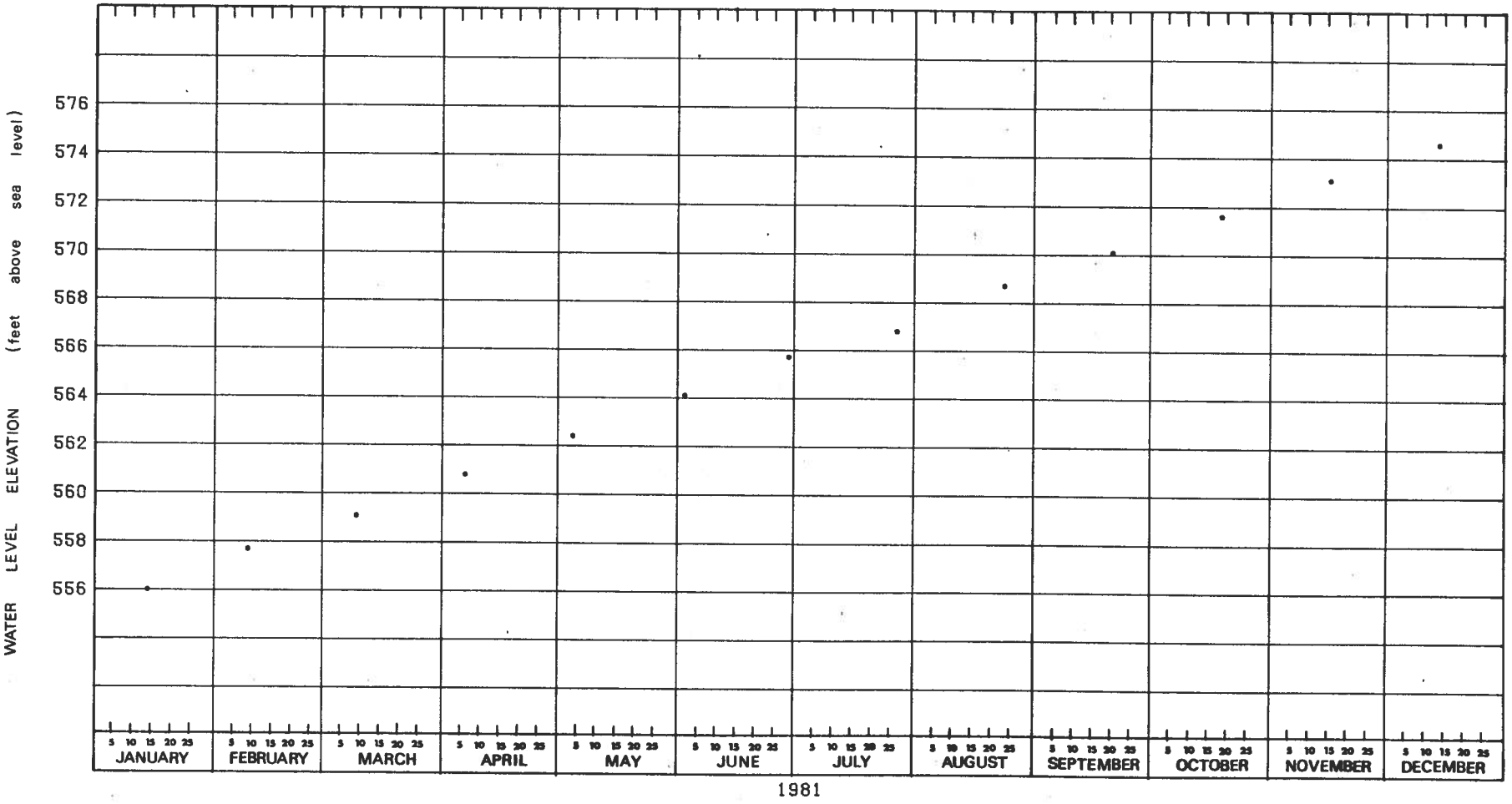
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-507-H-82



WELL HISTORY

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 10/75 | | | Well completed |
| Jan 11/75 | 22.73 TOC | 777.47 | Bail 84 gallons |
| Jan 12/75 | 22.73 TOC | 777.47 | Pump test @ 10 GPM for 57 min. |
| Jan 13/75 | 37.50 TOC | 729.02 | Pump 100 gallons; water sample |
| Feb 2/75 | 37.43 MP | 732.09 | Install shelter; MP = 2.84' TOC, (854.86) |
| Feb 14/75 | 38.30 MP | 729.24 | Install recorder |
| Mar 13/75 | | | DST; water sample |
| Mar 14/75 | 55.14 MP | 674.0 | |
| Mar 18/75 | | | Reinstall shelter; MP = 3.02' TOC, (855.04) |
| Apr 16/75 | 53.52 MP | 679.49 | |
| May 12/75 | 54.07 old MP | 677.69 | New MP = 36" TOC, (855.02) |
| June 9/75 | 53.59 MP | 679.24 | |
| July 9/75 | 53.19 MP | 680.55 | Recorder stuck |
| Aug 13/75 | 52.53 MP | 682.72 | |
| Sept 10/75 | 52.11 MP | 684.09 | Sampled well; temp. 4.5°C |
| | 52.60 MP | 682.49 | after sample |
| Oct 7/75 | 52.22 MP | 683.73 | |
| Nov 5/75 | 51.86 MP | 684.92 | |
| Dec 6/75 | 51.48 MP | 686.16 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 51.10 MP | 687.4 | MP (855.0) Recorder stuck float line too short |
| Feb 6/76 | 50.70 MP | 688.7 | " |
| Feb 22/76 | 50.58 MP | 689.1 | Well blown down with air |
| Mar 5/76 | 136.12 MP | 408.9 | MP = 1.02 m TOC, (855.4) |
| Apr 6/76 | 134.51 MP | 414.2 | |
| May 5/76 | 133.28 MP | 418.2 | |
| June 1/76 | 132.15 MP | 421.9 | |
| June 22/76 | 131.32 MP | 424.7 | |
| July 13/76 | 130.50 MP | 427.4 | Sampled; temp. 7°C |
| Aug 10/76 | 129.22 MP | 431.6 | |
| Aug 31/76 | 129.22 MP | 431.6 | |
| Sept 28/76 | 128.22 MP | 434.8 | |
| Oct 26/76 | 127.22 MP | 438.1 | |
| Nov 23/76 | 126.29 MP | 441.2 | |
| Dec 20/76 | 125.40 MP | 444.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 124.56 MP | 446.8 | MP (855.4) |
| Feb 15/77 | 123.57 MP | 450.1 | |
| Mar 15/77 | 122.62 MP | 453.2 | |
| Apr 13/77 | 121.70 MP | 456.2 | |
| May 10/77 | 120.98 MP | 458.6 | |
| June 7/77 | 120.12 MP | 461.4 | Temp. 12°C |
| July 5/77 | 119.20 MP | 464.4 | Sampled; temp. 9°C |
| Aug 3/77 | 118.97 MP | 465.2 | |
| Aug 30/77 | 118.17 MP | 467.8 | |
| Sept 27/77 | 117.33 MP | 470.6 | |
| Oct 25/77 | 116.57 MP | 473.0 | Temp. 5.7°C |
| Nov 22/77 | 115.88 MP | 475.3 | |
| Dec 19/77 | 115.05 MP | 478.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 114.25 MP | 480.7 | MP (855.4) |
| Feb 13/78 | 113.49 MP | 483.1 | |
| Mar 14/78 | 112.80 MP | 485.4 | |
| Apr 12/78 | 112.02 MP | 488.0 | |
| May 9/78 | 111.22 MP | 490.6 | |
| June 6/78 | 110.30 MP | 493.6 | |
| July 5/78 | 109.76 MP | 495.4 | Sampled; temp. 6°C |
| Aug 1/78 | 109.35 MP | 496.7 | |
| Aug 29/78 | 108.66 MP | 499.0 | |
| Sept 26/78 | 107.97 MP | 501.3 | |
| Oct 24/78 | 107.29 MP | 503.5 | |
| Nov 21/78 | 106.94 MP | 504.6 | |
| Dec 19/78 | 106.20 MP | 507.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 105.60 MP | 509.0 | MP (855.4) |
| Feb 13/79 | 104.89 MP | 511.4 | |
| Mar 14/79 | | | Could not measure |
| Apr 11/79 | 103.61 MP | 515.6 | |
| May 8/79 | 103.08 MP | 517.3 | |
| June 5/79 | 102.35 MP | 519.7 | |
| July 8/79 | 101.69 MP | 521.9 | Sample; temp. 6°C |
| Aug 1/79 | 101.54 MP | 522.3 | |
| Aug 28/79 | 100.96 MP | 524.3 | |
| Sept 25/79 | 100.35 MP | 526.2 | |
| Oct 23/79 | 99.74 MP | 528.2 | |
| Nov 20/79 | 99.21 MP | 530.0 | |
| Dec 17.79 | 98.65 MP | 531.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 95 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 98.08 MP | 533.7 | |
| Feb 12/80 | 97.51 MP | 535.6 | |
| Mar 11/80 | 96.94 MP | 537.4 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 95.79 MP | 541.2 | |
| June 3/80 | 95.27 MP | 542.9 | |
| July 1/80 | 94.52 MP | 544.7 | New MP 0.82 Toc (854.7) temp. 6°C |
| July 28/80 | 94.40 MP | 545.1 | |
| Aug 26/80 | 93.85 MP | 546.9 | |
| Sept 24/80 | 93.16 MP | 549.1 | |
| Oct 21/80 | 92.65 MP | 550.8 | |
| Nov 18/80 | 92.12 MP | 552.5 | |
| Dec 17/80 | 91.60 MP | 554.3 | |
| Jan 15/81 | 91.06 MP | 556.0 | |
| Feb 10/81 | 90.54 MP | 557.7 | |
| Mar 10/81 | 90.12 MP | 559.1 | |
| Apr 7/81 | 89.61 MP | 560.8 | |
| May 5/81 | 89.11 MP | 562.4 | |
| June 3/81 | 88.60 MP | 564.1 | |
| June 30/81 | 88.12 MP | 565.7 | |
| July 28/81 | 87.76 MP | 566.8 | |
| Aug 25/81 | 87.19 MP | 568.7 | |
| Sept 22/81 | 86.78 MP | 570.1 | |
| Oct 20/81 | 86.32 MP | 571.6 | |
| Nov 17/81 | 85.85 MP | 573.1 | |
| Dec 15/81 | 85.40 MP | 574.6 | |

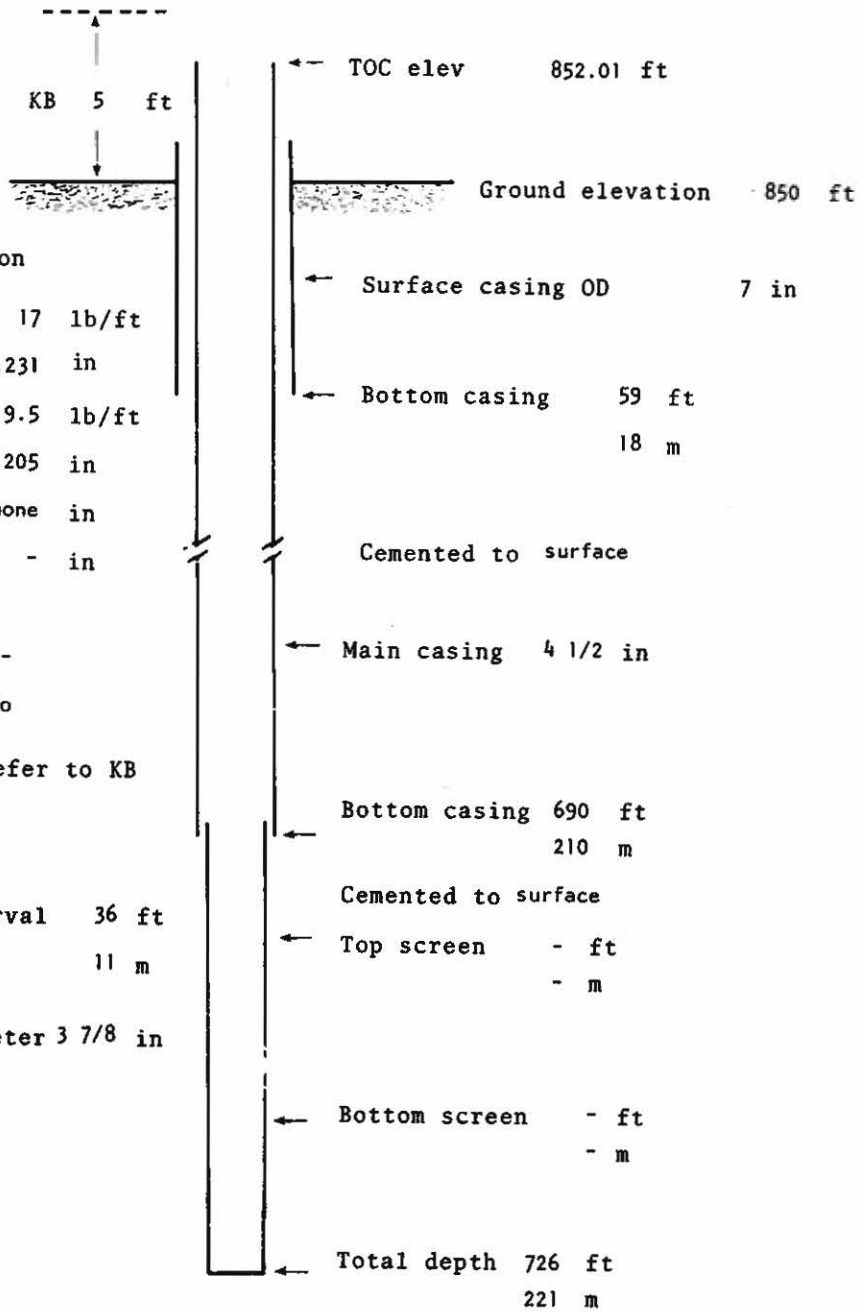
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Tp 96 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | none | in |
| screen OD | - | in |
| slots per foot | | |
| material | - | |
| Sand pack | No | |

Note: all depths refer to KB

Open hole interval 36 ft
11 m

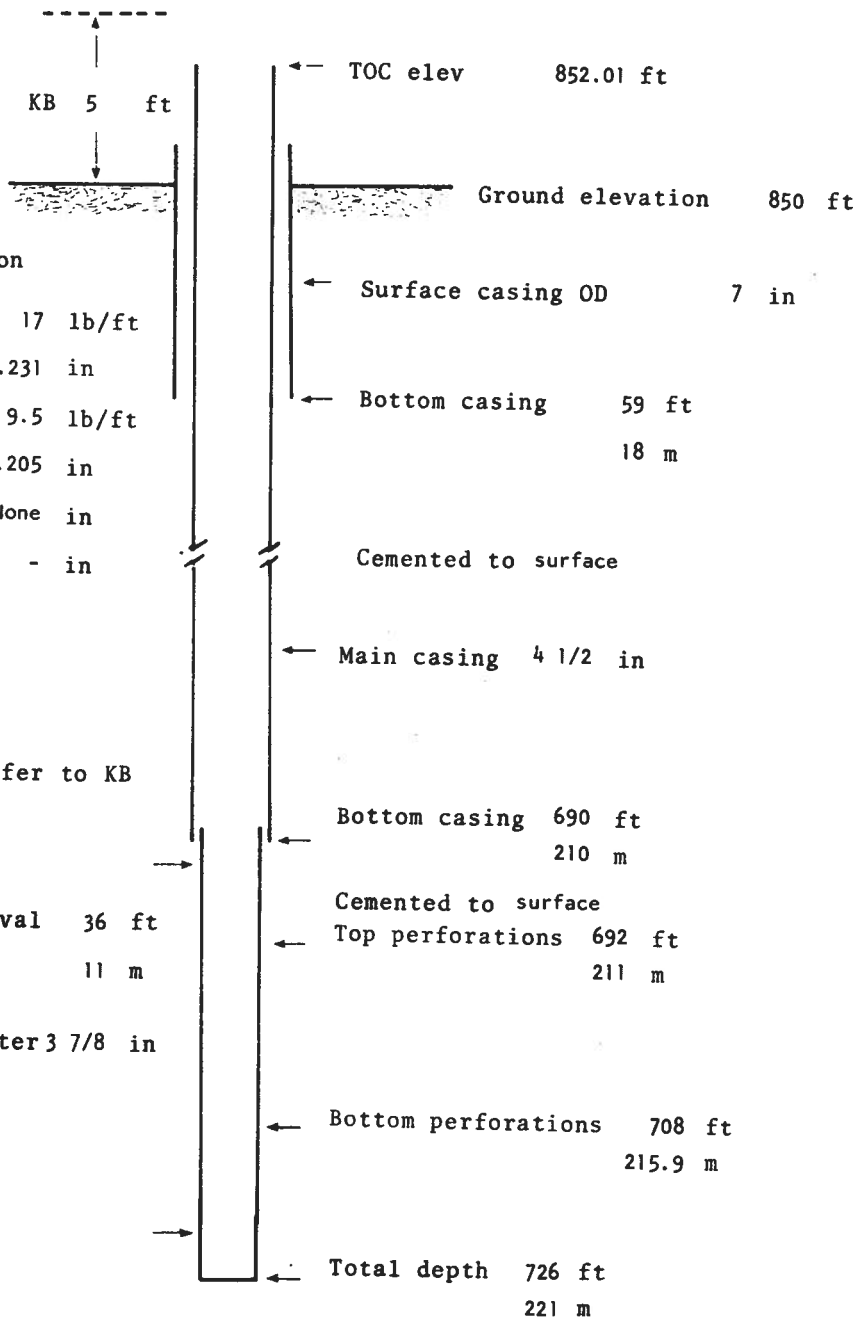
Open hole diameter 3 7/8 in

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Tp 96 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | None | in |
| screen OD | - | in |
| slots per foot | | |
| material | - | |
| Sand pack | No | |

Note: all depths refer to KB

Open hole interval 36 ft
11 m

Open hole diameter 3 7/8 in

N.B. - Perforation done with 80 gram charges at two charges per foot

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 852

Type of test - Casing Positrieve

Date of test March 18, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0830 | hrs |
| Tool opened | 1024 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1220 | hrs |
| Out of hole at | 1300 | hrs |
| Wt on packers | 3000 | lbs |

Description of blow: Weak initial puff, faint air blow decreasing to nil in 10 seconds

Total water recovered 5 ft

Water sample No. DH 11

Gas blow No

Remarks: Test satisfactory
4-1/2" RPB set at 667'
3-1/8" MFE set at 665'

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 690-726

Formation tested Methy

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.05 | |
| MFE Tool | 10.05 | |
| Sub | 0.65 | |
| Positrieve Packer | 1.35 | 4-1/2 IN |
| Total | 13.10 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

### PRESSURE DATA (psi)

| Instrument No. | | RPG-89N | RPG-92N |
|---|---|---|---|
| Capacity (psig) | | 400 | 431 |
| Instrument set at (ft) | | 678 | 686 |
| Initial hydrostatic | A | 111 | 115 |
| First flow | B | 2 | 4 |
| | B1 | 2 | 4 |
| Initial shut in | C | 36 | 39 |
| Second flow | D | 9 | 12 |
| | D1 | 9 | 12 |
| Final shut in | G | 14 | 18 |
| Final hydrostatic | H | 111 | 115 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

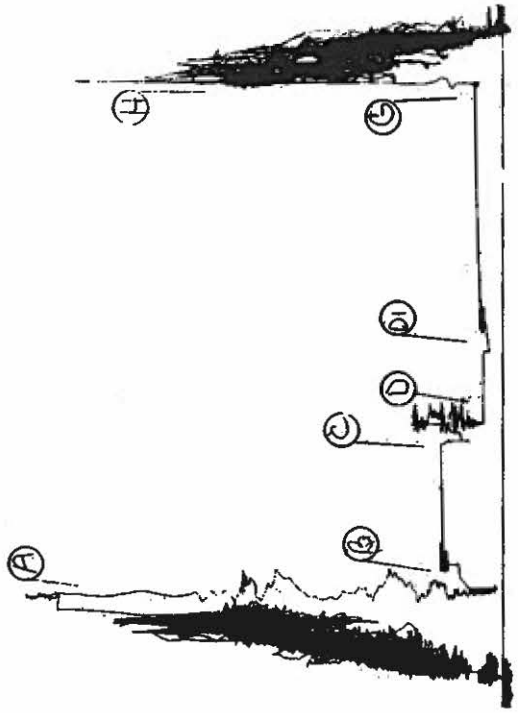
OBSERVATION WELL NUMBER 1-726

PRESSURE INCREMENTS

Recorder RPG-92 N

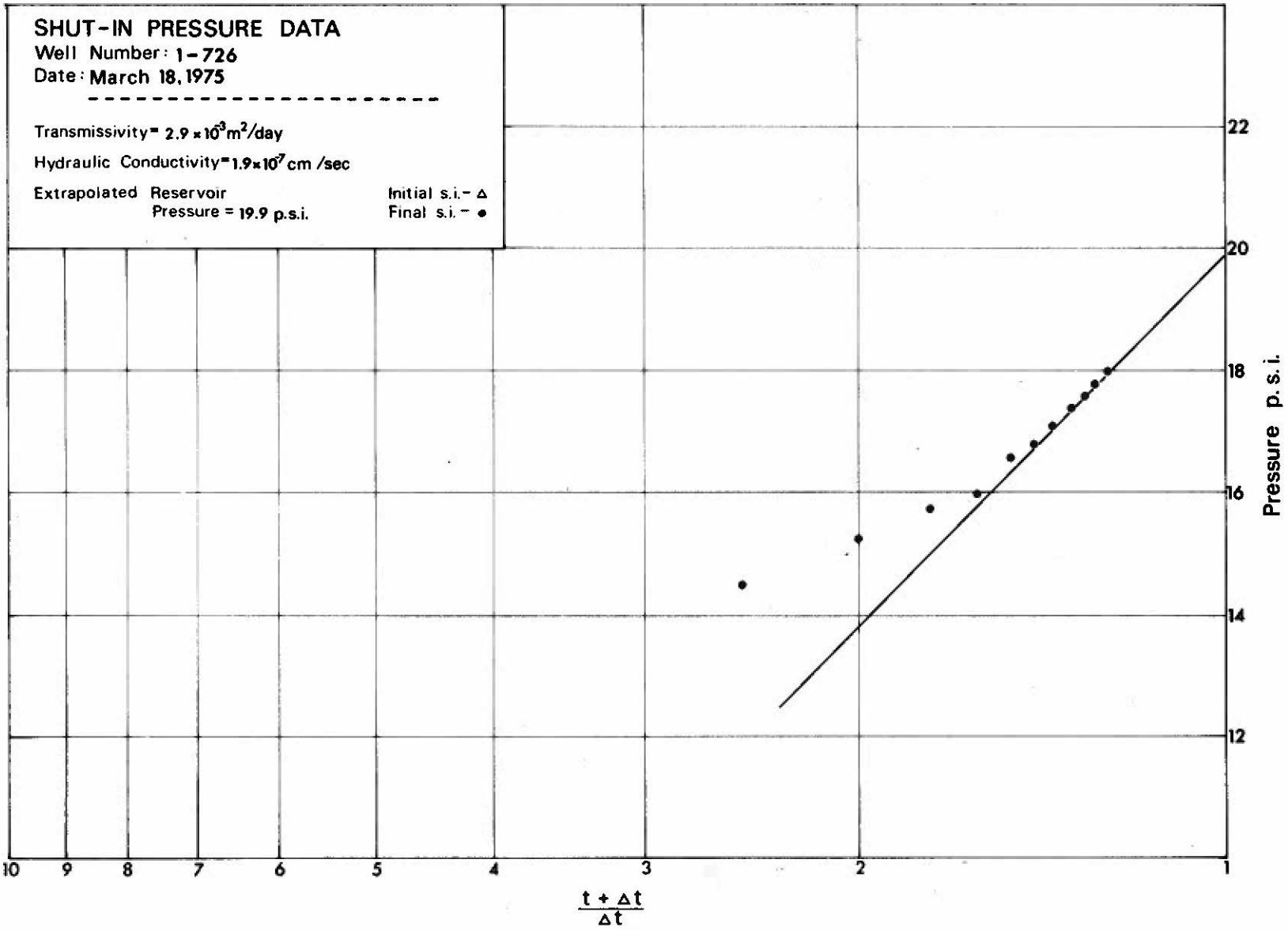
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 27.7 | 1.20 |
| 10 | 38.1 | 1.10 |
| 15 | 38.3 | 1.07 |
| 20 | 38.6 | 1.05 |
| 25 | 39 | 1.04 |
| 30 | 39 | 1.033 |

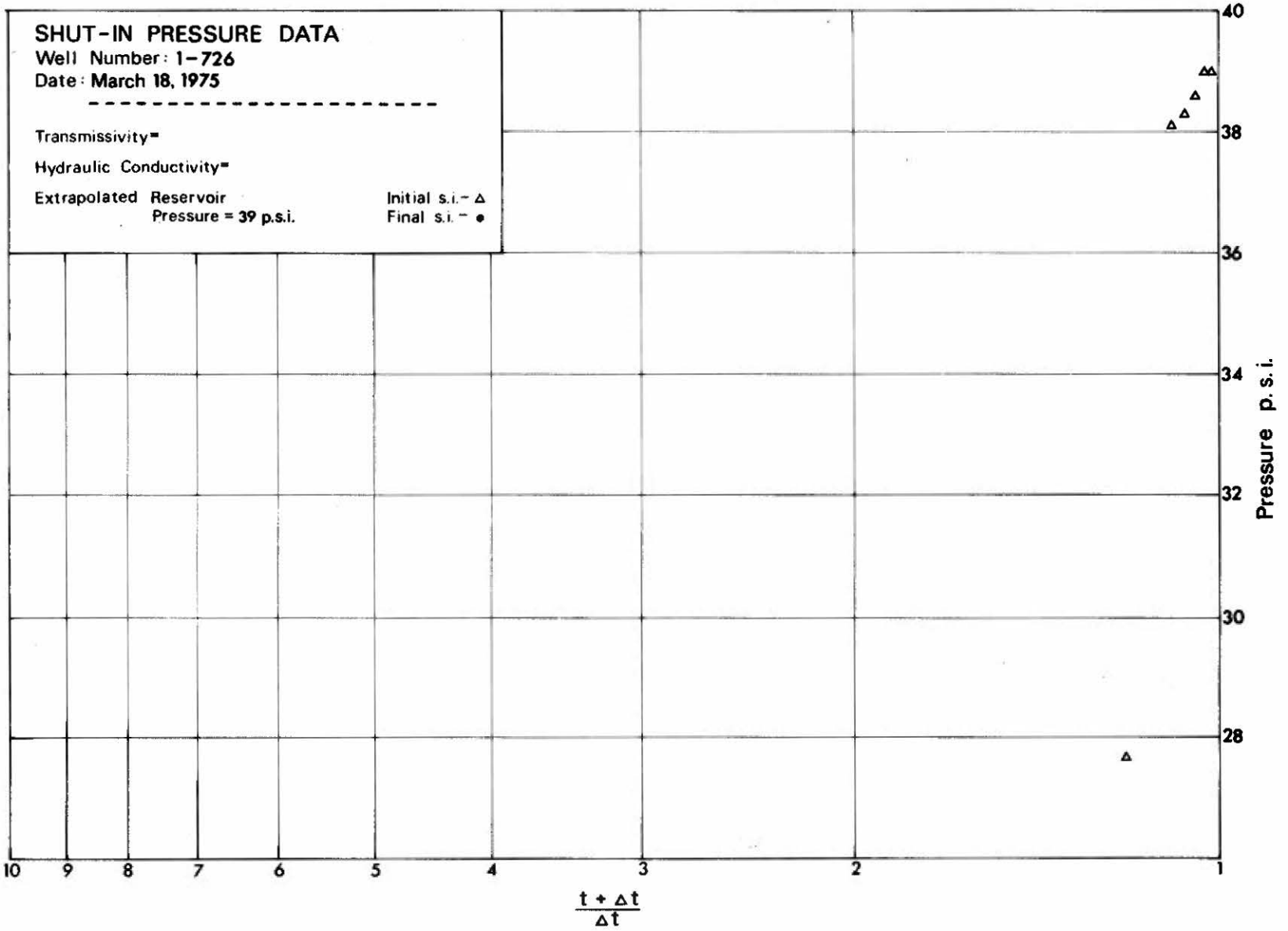


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 10.8 | 4.00 |
| 10 | 14.5 | 2.50 |
| 15 | 15.2 | 2.00 |
| 20 | 15.7 | 1.75 |
| 25 | 16.0 | 1.60 |
| 30 | 16.6 | 1.50 |
| 35 | 16.8 | 1.43 |
| 40 | 17.1 | 1.38 |
| 45 | 17.4 | 1.33 |
| 50 | 17.6 | 1.30 |
| 55 | 17.8 | 1.27 |
| 60 | 18.0 | 1.25 |


SHUT-IN PRESSURE DATA
Well Number: 1-726
Date: March 18, 1975
Transmissivity = 2.9 x 10³ m²/day
Hydraulic Conductivity = 1.9 x 10⁻⁷ cm/sec
Extrapolated Reservoir Pressure = 19.9 p.s.i.
Initial s.i. - Δ
Final s.i. - •
22
20
18
16
14
12
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-726-D-76


SHUT-IN PRESSURE DATA
Well Number: 1-726
Date: March 18, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 39 p.s.i.
Initial s.i.- Δ
Final s.i. - •
40
38
36
34
32
30
28
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-726-D-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed from 1-726

Date sampled January 13, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 974.0 | 48.60 | 66.3 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.02 | 0.0 |
| Sodium ($Na^{+}$) | 534.0 | 23.23 | 31.7 |
| Potassium ($K^{+}$) | 57.0 | 1.46 | 2.0 |
| Carbonate ($CO_3^{=}$) | 40.8 | 1.36 | 1.9 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 1415.0 | 29.46 | 41.8 |
| Chloride ($Cl^{-}$) | 850.0 | 23.97 | 34.0 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0.0 |
| Silica ($SiO_2$) | 1.9 | | |
| Hydroxide ($OH^{-}$) | 267.0 | 15.70 | 22.3 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 4,264 | | |
| Total Anions (epm) 70.507 | | Total Cations (epm) | 73.313 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 8000 + |
| pH | 12.0 |
| Fluoride ($F^{-}$) | 0.20 ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | 3.9 | |
| pH | 12.5 | |
| Carbonate ($CO_3^{=}$) | 36 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 | ppm |
| Hydroxide ($OH^{-}$) | 322 | ppm |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Drill stem test on 1-726

Date sampled March 18, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 842.0 | 42.02 | 70.8 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.02 | 0.0 |
| Sodium ($Na^{+}$) | 361.0 | 15.70 | 26.5 |
| Potassium ($K^{+}$) | 62.0 | 1.59 | 2.7 |
| Carbonate ($CO_3^{=}$) | 40.8 | 1.36 | 2.1 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 1290.0 | 26.86 | 41.2 |
| Chloride ($Cl^{-}$) | 874.0 | 24.65 | 37.8 |
| Nitrate ($NO_3^{=}$) | 5.5 | 0.09 | 0.1 |
| Silica ($SiO_2$) | 1.3 | | |
| Hydroxide ($OH^{-}$) | 207.0 | 12.17 | 18.7 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 3970.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 65.124 | Total Cations (epm) | 59.329 |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 7000 |
| pH | 11.9 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 12.2 |
| Carbonate ($CO_3^{=}$) | 25 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| Hydroxide ($OH^{-}$) | 279 ppm |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed from 1-726

Date sampled February 14, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 992 | 49.6 | 47.8 |
| Magnesium ($Mg^{++}$) | 0.1 | 0 | 0 |
| Sodium ($Na^{+}$) | 1200 | 52.2 | 50.3 |
| Potassium ($K^{+}$) | 76 | 2.0 | 1.9 |
| Carbonate ($CO_3^{=}$) | 36 | 1.2 | 1.4 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 1410 | 29.4 | 33.4 |
| Chloride ($Cl^{-}$) | 2040 | 57.5 | 65.3 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0 | 0 |
| Silica ($SiO_2$) | 1.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 6692 | | |
| Total Anions (epm) 103.7 | | Total Cations (epm) | 88.1 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 8000+ |
| pH | 12.0 |
| Fluoride ($F^{-}$) | 0.7 ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 11.9 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| Hydroxide ($OH^{-}$) | 349 ppm |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 9, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 950 | 47.41 | 32 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 2269 | 98.70 | 67 |
| Potassium ($K^{+}$) | 77 | 1.97 | 1 |
| Carbonate ($CO_3^{=}$) | 192 | 6.40 | 4 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 2250 | 46.85 | 28 |
| Chloride ($Cl^{-}$) | 2100 | 59.22 | 35 |
| Nitrate ($NO_3^{=}$) | 27.5 | 0.44 | 0 |
| Silica ($SiO_2$) | 6.4 | | |
| Hydroxide ($OH^{-}$) | 925 | 54.38 | 33 |
| Calcium (Acidified) | 1020 | | |
| Magnesium (Acidified) | 8.3 | | |
| Total dissolved solids | 9528 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 167.29 | Total Cations (epm) | 148.08 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | 6.5 |
| pH | 11.8 | pH | 12.3 |
| Fluoride ($F^{-}$) | 1.2 ppm | Carbonate ($CO_3^{=}$) | 60.5 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| | | Hydroxide ($OH^{-}$) | 187 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Blown from 1-726

Date sampled February 25, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 790.0 | 39.42 | 40.1 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.02 | 0.0 |
| Sodium ($Na^{+}$) | 1275.0 | 55.46 | 56.5 |
| Potassium ($K^{+}$) | 129.0 | 3.30 | 3.4 |
| Carbonate ($CO_3^{=}$) | 55.0 | 1.83 | 2.0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 1120.0 | 23.32 | 25.9 |
| Chloride ($Cl^{-}$) | 1920.0 | 54.15 | 60.2 |
| Nitrate ($NO_3^{=}$) | 1.3 | 0.02 | 0.0 |
| Silica ($SiO_2$) | 0.7 | | |
| Hydroxide ($OH^{-}$) | 180.0 | 10.58 | 11.8 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 6000.0 | | |
| Total Anions (epm) | 89.90 | Total Cations (epm) | 98.2 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | |
| pH | 10.7 | pH | 12.3 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | 48 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| | | Hydroxide ($OH^{-}$) | 197 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 5, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 760.0 | 37.92 | 40.2 |
| Magnesium ($Mg^{++}$) | 60.0 | 4.94 | 5.2 |
| Sodium ($Na^{+}$) | 1112.0 | 48.37 | 51.2 |
| Potassium ($K^{+}$) | 126.0 | 3.22 | 3.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 354.0 | 5.80 | 7.6 |
| Sulfate ($SO_4^{=}$) | 1330.0 | 27.69 | 36.4 |
| Chloride ($Cl^{-}$) | 1510.0 | 42.58 | 56.0 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 32.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 660.0 | | |
| Magnesium (Acidified) | 56.0 | | |
| Total dissolved solids | 6864.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 76.09 | Total Cations (epm) | 94.46 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 8000 | Temperature (C) | 9.0 |
| pH | 7.4 | pH | 7.2 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 356.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

1-726-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 500.0 | 24.95 | 24.7 |
| Magnesium(Mg) | 6.1 | 0.50 | 0.5 |
| Sodium(Na) | 1700.0 | 73.95 | 73.2 |
| Potassium(K) | 63.0 | 1.61 | 1.6 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 173.0 | 2.84 | 3.1 |
| Sulphate(SO4) | 1128.0 | 23.49 | 25.6 |
| Chloride(Cl) | 2320.0 | 65.43 | 71.3 |
| Nitrate(NO3) | 0.7 | 0.01 | 0.0 |
| Silica(SiO2) | 11.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 515.0 | | |
| Magnesium(Acidified) | 5.6 | | |
| TDS(mg/l) | 7598.0 | | |
| Total Anions(epm) | 91.76 | Total Cations(epm) | 101.01 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 8700 | Temperature(C) | 8.00 | |
| pH | 7.5 | pH | 7.9 | |
| Fluoride(F) | 0.5 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 175 | mg/l |
| | | Hydroxide(OH) | | |

1-726-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 8, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 276.0 | 13.77 | 20.2 |
| Magnesium(Mg) | 26.0 | 2.14 | 3.1 |
| Sodium(Na) | 1175.0 | 51.11 | 75.1 |
| Potassium(K) | 40.8 | 1.04 | 1.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 2.0 | 0.03 | 0.1 |
| Sulphate(SO4) | 600.0 | 12.49 | 20.3 |
| Chloride(Cl) | 1740.0 | 49.07 | 79.7 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 3.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 266.0 | | |
| Magnesium(Acidified) | 26.0 | | |
| TDS(mg/l) | 4738.0 | | |
| Total Anions(epm) | 61.60 | Total Cations(epm) | 68.07 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 6000 | | Temperature(C) | 9.00 | |
| pH | 7.2 | | pH | 7.8 | |
| Fluoride(F) | 0.3 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 195 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 1-726-E-82

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 340.0 | 17.00 | 17.2 |
| Magnesium(Mg) | 9.4 | 0.78 | 0.8 |
| Sodium(Na) | 1812.0 | 78.78 | 79.7 |
| Potassium(K) | 87.0 | 2.23 | 2.3 |
| Carbonate(CO3) | 9.6 | 0.32 | 0.3 |
| Bicarbonate(HCO3) | 36.6 | 0.60 | 0.6 |
| Sulphate(SO4) | 800.0 | 16.67 | 17.5 |
| Chloride(Cl) | 2750.0 | 77.46 | 81.5 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 1.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 324.0 | | |
| Magnesium(Acidified) | 9.3 | | |
| TDS(mg/l) | 6678.0 | | |
| Total Anions(epm) | 95.05 | Total Cations(epm) | 98.80 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 96000 | Temperature | 8.00 | |
| pH | 8.6 | pH | 10.5 | |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | 53 | mg/l |
| | | Bicarbonate(HCO3) | 0 | mg/l |
| | | Hydroxide(OH) | 22 | mg/l |

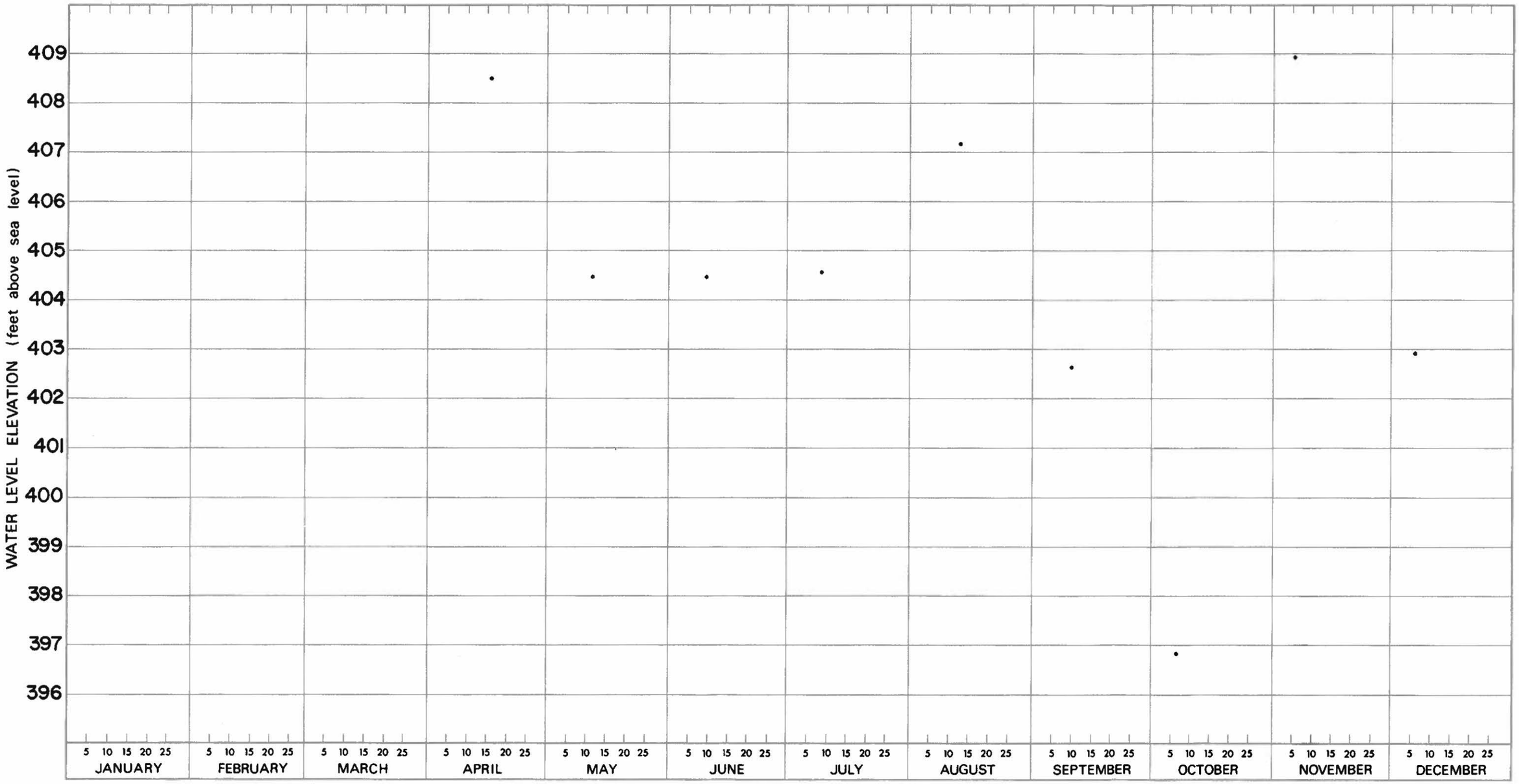
WATER LEVEL HYDROGRAPH

1-726-H-76

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council



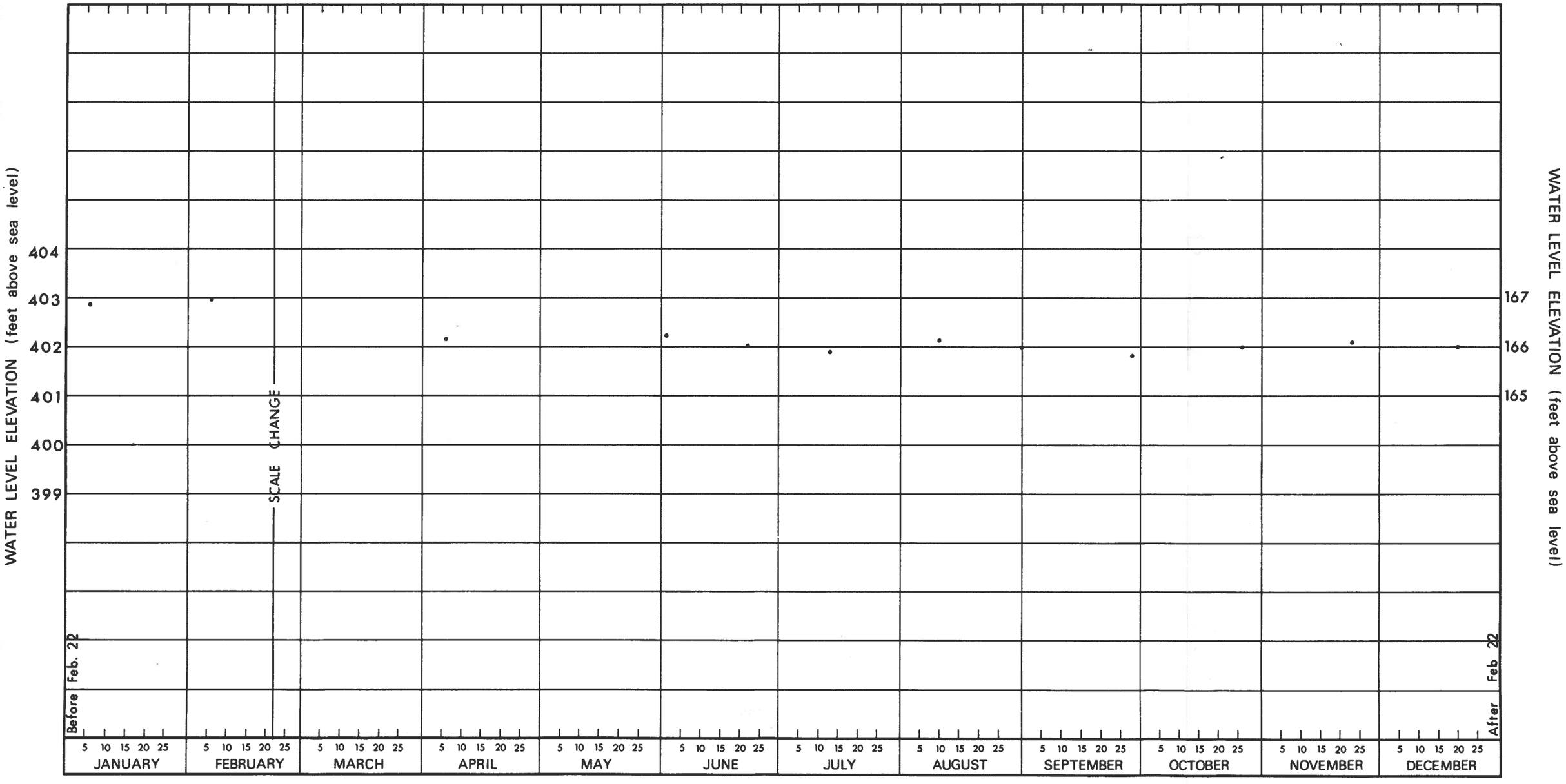
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

1 - 726 - H - 77




1976

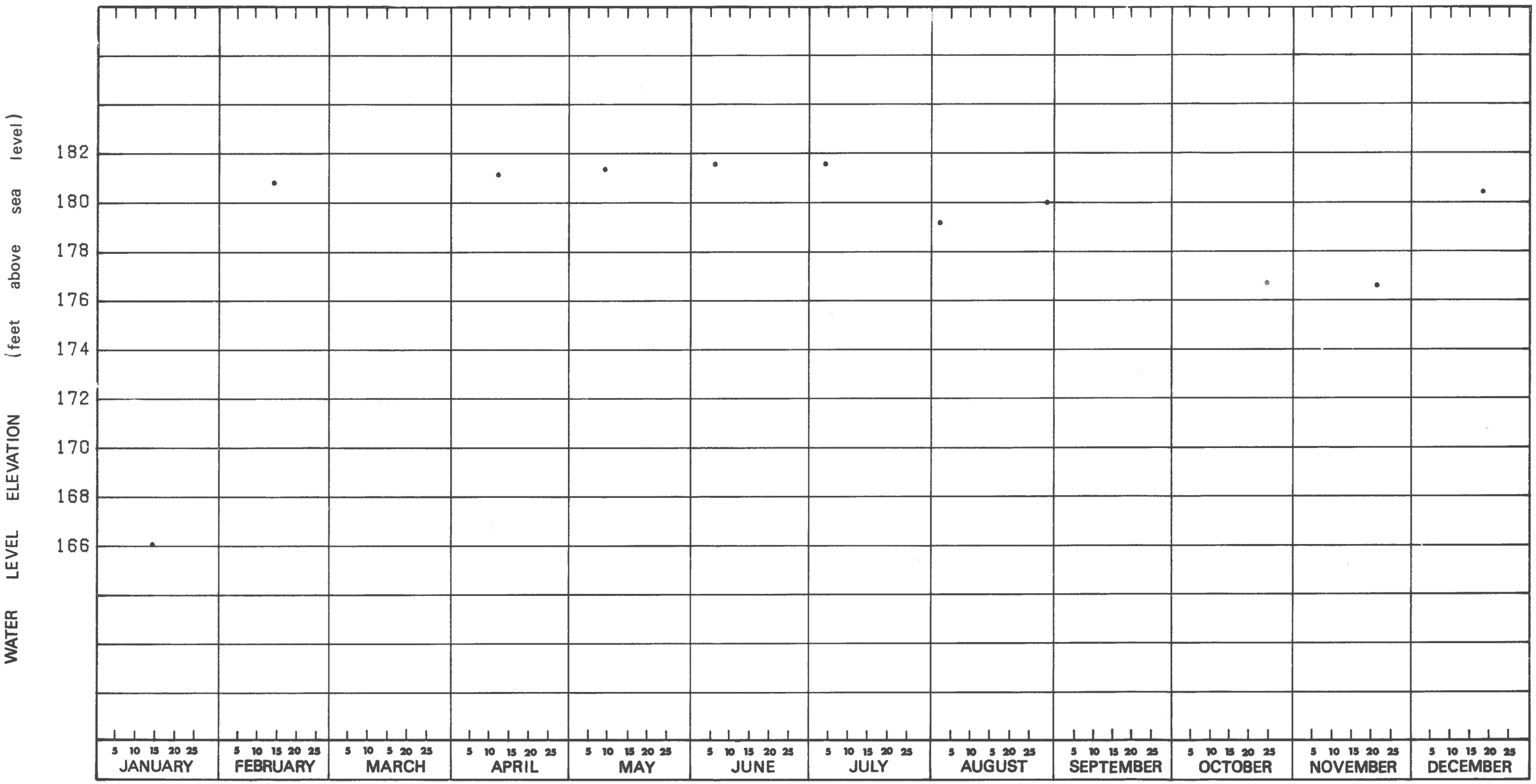
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-726-H-78



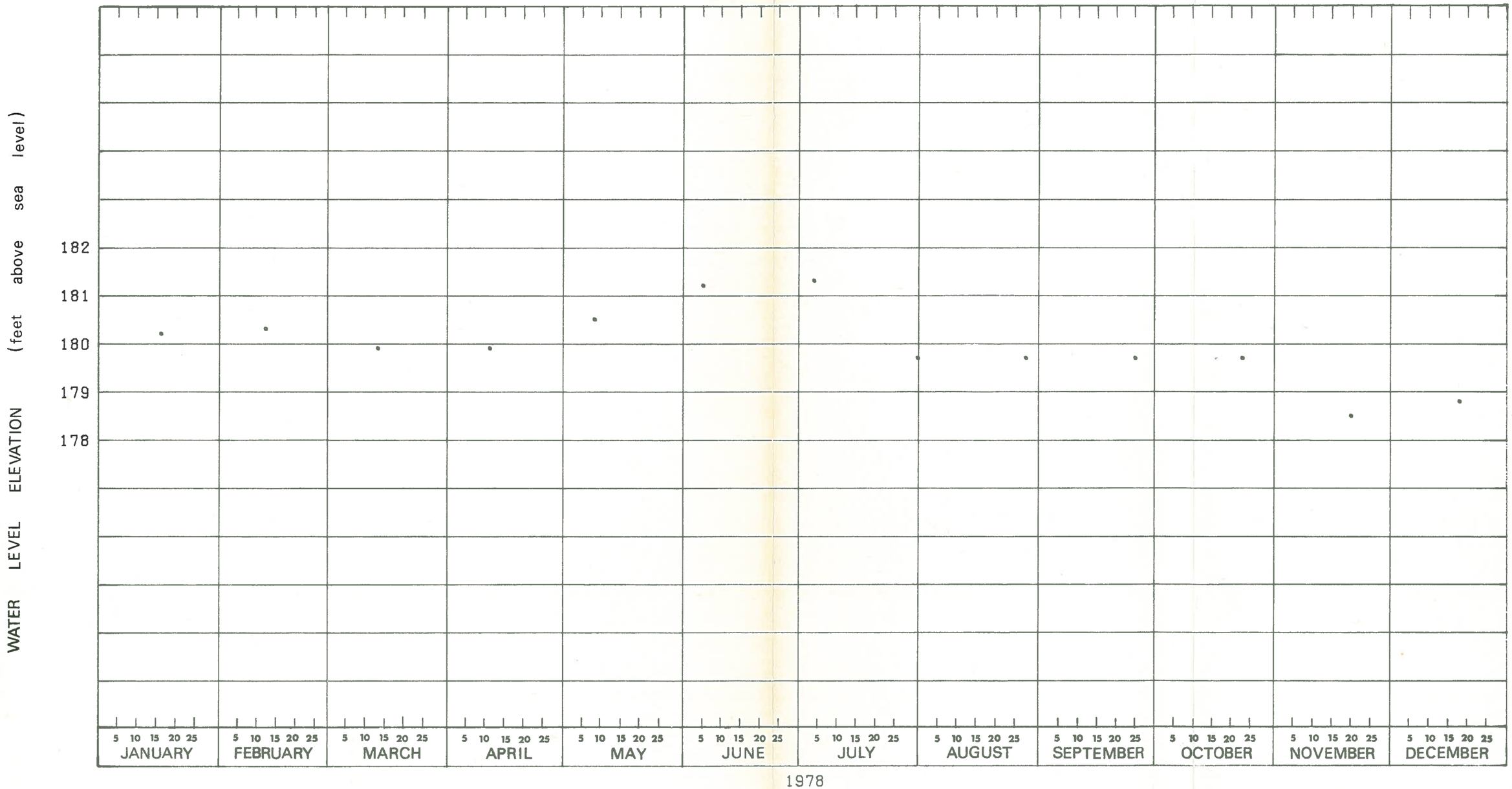
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-726

LSD 8 SEC 15 TWP 96 R 11 W4TH

1-726-H-79

Alberta Research Council



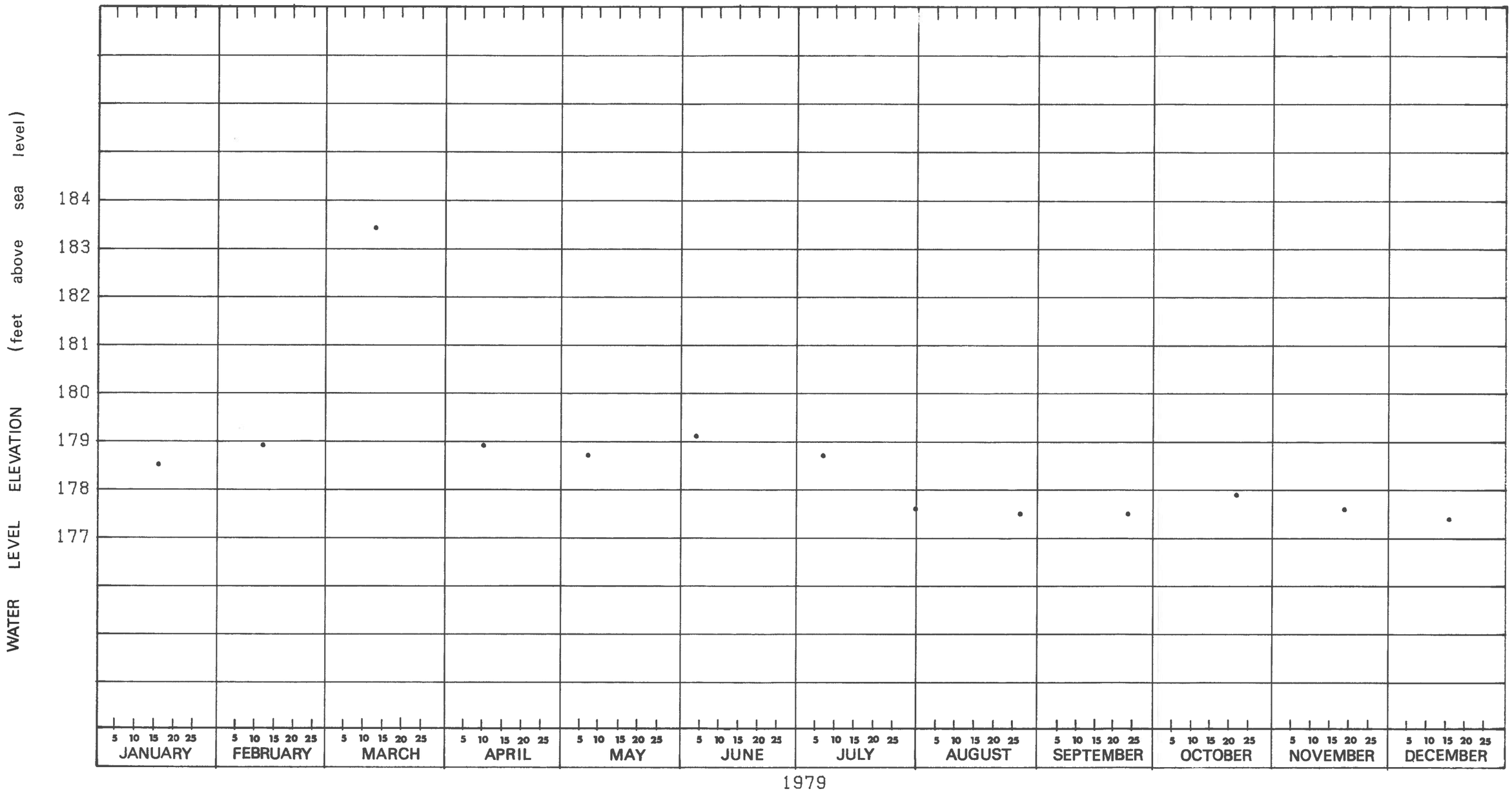
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-726

1-726-H-80

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council



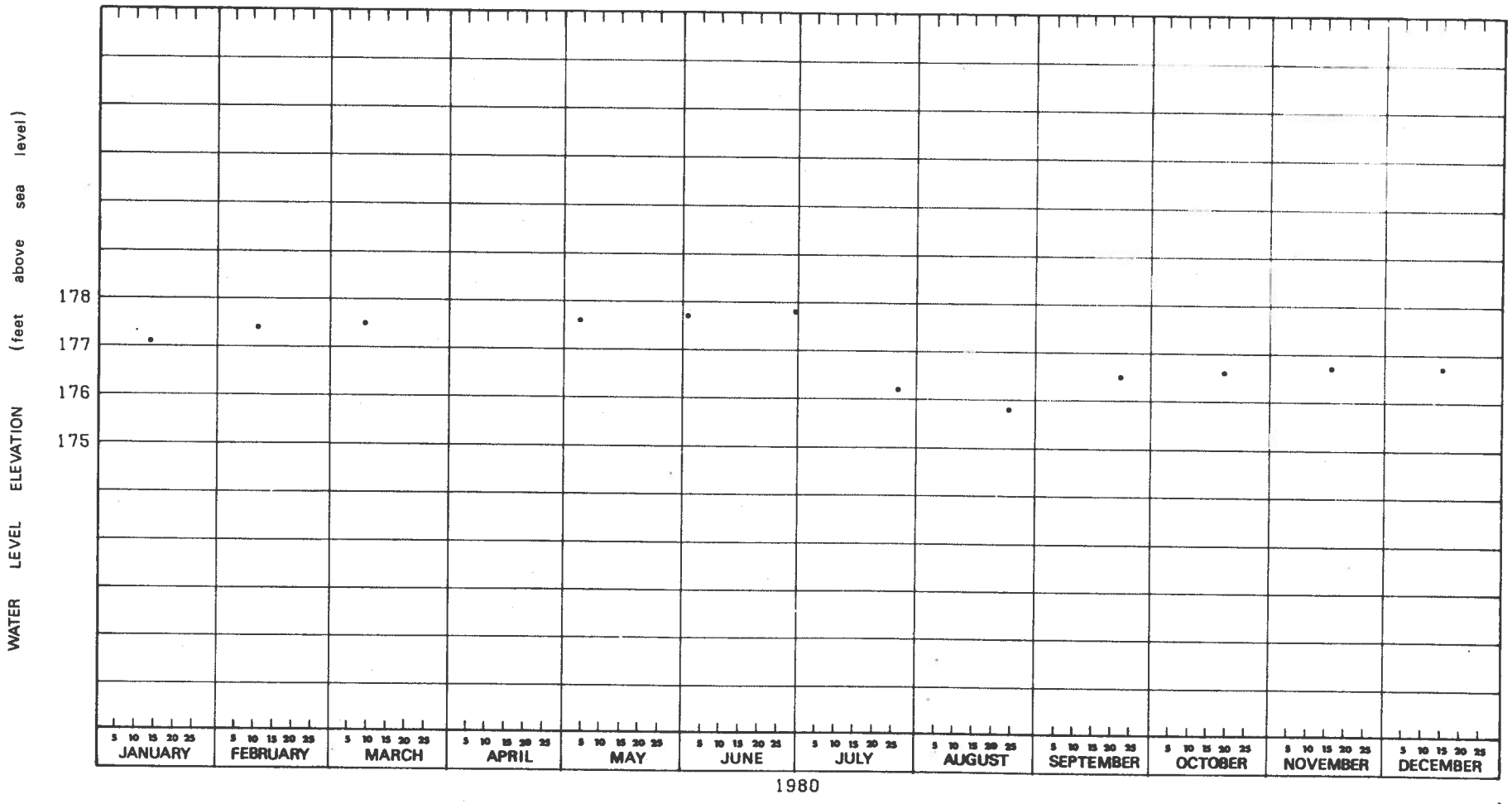
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-726-H-81



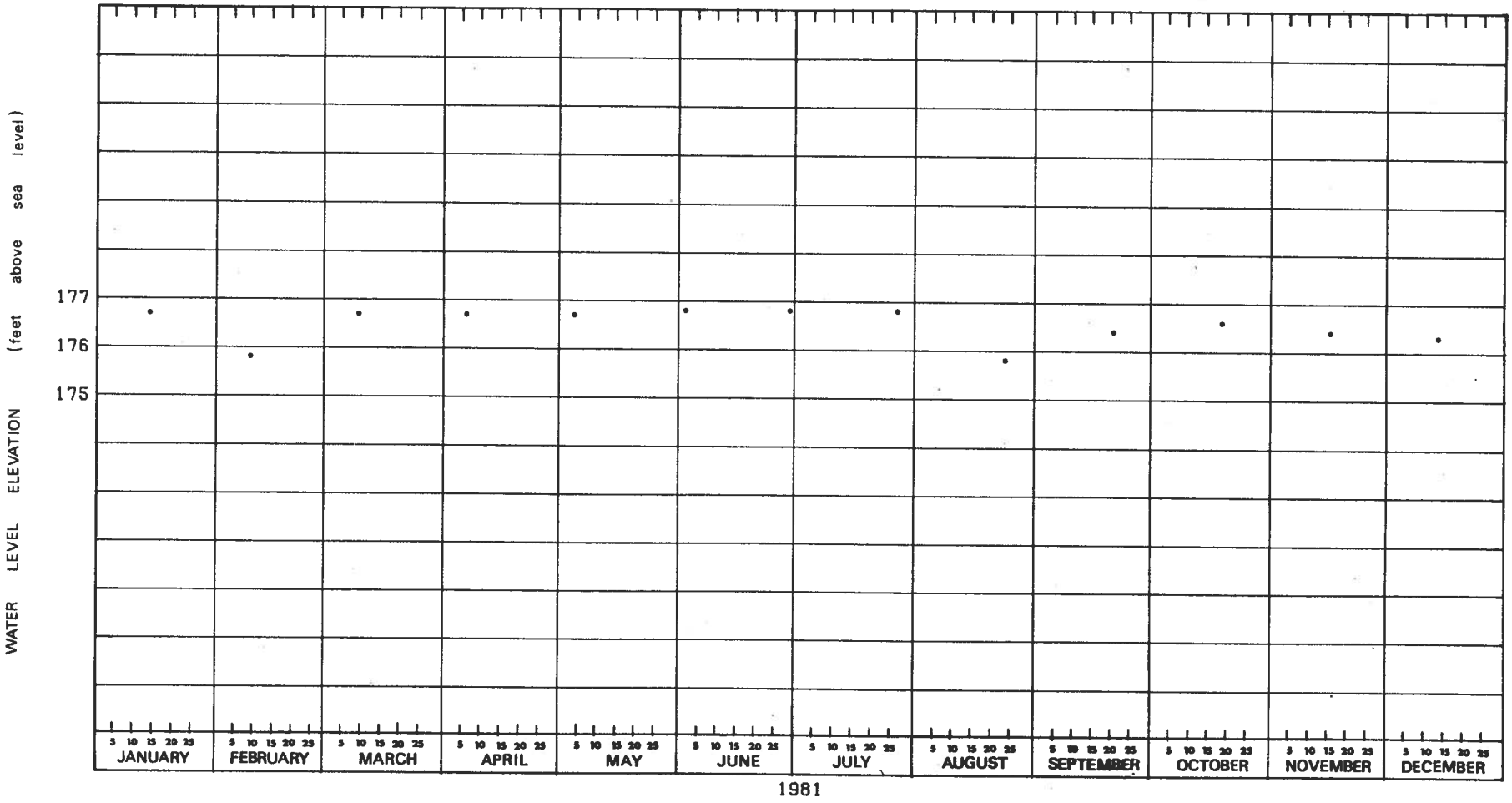
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-726-H-82



WELL HISTORY

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 10/75 | | | Well completed |
| Jan 11/75 | 22.62 TOC | 777.82 | Bail 140-150 gallons; water sample |
| Jan 13/75 | 99.09 TOC | 526.96 | |
| Jan 15/75 | 103.11 TOC | 513.49 | |
| Feb 2/75 | 103.40 TOC | 512.86 | |
| Feb 14/75 | 104.16 TOC | 510.37 | Bail 30 gallons; water sample |
| Mar 18/75 | | | DST; water sample; FSI = 39# from 678'; shelter installed |
| Apr 16/75 | 446 MP | 408.47 | MP = 2.46' TOC, (854.47) |
| May 12/75 | 137.21 MP | 404.42 | |
| June 9/75 | 137.20 MP | 404.45 | |
| July 9/75 | 137.18 MP | 404.55 | |
| Aug 13/75 | 136.38 MP | 407.14 | |
| Sept 10/75 | 137.76 MP | 402.62 | Sampled well; temp. 6.5°C |
| Oct 7/75 | 139.53 MP | 396.81 | |
| Nov 5/75 | 135.53 MP | 409.93 | |
| Dec 6/75 | 137.67 MP | 402.91 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 137.68 MP | 402.9 | MP (854.5) |
| Feb 6/76 | 137.65 MP | 403.0 | |
| Feb 22/76 | | | Well blown down with air |
| Mar 2/76 | | | Perforated with 80 gram shots; interval 692 - 708 KB |
| Apr 6/76 | 209.89 MP | 166.2 | MP = 0.80 m TOC, (854.6) |
| May 5/76 | | | Could not measure |
| June 1/76 | 209.87 MP | 166.2 | |
| June 22/76 | 209.93 MP | 166.0 | |
| July 13/76 | 209.97 MP | 165.9 | Could not sample; no water (mud) |
| Aug 10/76 | 209.90 MP | 166.1 | |
| Aug 31/76 | 209.95 MP | 166.0 | |
| Sept 28/76 | 210.00 MP | 165.8 | |
| Oct 26/76 | 209.93 MP | 166.0 | |
| Nov 23/76 | 209.92 MP | 166.1 | |
| Dec 20/76 | 209.92 MP | 166.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 209.93 MP | 166.0 | MP (854.6) |
| Feb 3/77 | | | Treated with 140 lb NU-WELL acid well conditioner; added 90 gallons of water |
| Feb 13/77 | | | Blown with air |
| Feb 15/77 | 205.46 MP | 180.7 | New MP = 0.79 m, TOC (854.6) |
| Mar 15/77 | | | >200 meters |
| Apr 13/77 | 205.35 MP | 181.0 | |
| May 10/77 | 205.30 MP | 181.2 | |
| June 7/77 | 205.25 MP | 181.4 | Temp. 12°C |
| July 5/77 | 205.25 MP | 181.4 | Sampled; temp. 9°C |
| Aug 3/77 | 205.96 MP | 179.0 | |
| Aug 30/77 | 205.73 MP | 179.8 | |
| Sept 27/77 | | | Could not measure |
| Oct 25/77 | 206.75 MP | 176.5 | |
| Nov 22/77 | 206.77 MP | 176.4 | |
| Dec 19/77 | 205.62 MP | 180.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 205.62 MP | 180.2 | MP (854.6) |
| Feb 13/78 | 205.57 MP | 180.3 | |
| Mar 14/78 | 205.70 MP | 179.9 | |
| Apr 12/78 | 205.69 MP | 179.9 | |
| May 9/78 | 205.52 MP | 180.5 | |
| June 6/78 | 205.32 MP | 181.2 | |
| July 5/78 | 205.28 MP | 181.3 | Sampled; temp. 8°C |
| Aug 1/78 | 205.77 MP | 179.7 | |
| Aug 29/78 | 205.76 MP | 179.7 | |
| Sept 26/78 | 205.75 MP | 179.7 | |
| Oct 24/78 | 205.75 MP | 179.7 | |
| Nov 21/78 | 206.14 MP | 178.5 | |
| Dec 19/78 | 206.04 MP | 178.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 206.14 MP | 178.5 | MP (854.6) |
| Feb 13/79 | 206.00 MP | 178.9 | |
| Mar 14/79 | 204.63 MP | 183.4 | |
| Apr 11/79 | 206.00 MP | 178.9 | |
| May 8/79 | 206.08 MP | 178.7 | |
| June 5/79 | 205.93 MP | 179.1 | |
| July 8/79 | 206.01 MP | 178.7 | New MP 0.73m TOC (854.4) Sampled; temp. 9°C |
| Aug 1/79 | 206.35 MP | 177.6 | |
| Aug 28/79 | 206.36 MP | 177.5 | |
| Sept 25/79 | 206.37 MP | 177.5 | |
| Oct 23/79 | 206.24 MP | 177.9 | |
| Nov 20/79 | 206.33 MP | 177.6 | |
| Dec 17/79 | 206.40 MP | 177.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 206.49 MP | 177.1 | |
| Feb 12/80 | 206.39 MP | 177.4 | |
| Mar 11/80 | 206.37 MP | 177.5 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 206.33 MP | 177.6 | |
| June 3/80 | 206.30 MP | 177.7 | |
| July 1/80 | 206.29 MP | 177.8 | Temp. 8°C |
| July 28/80 | 206.77 MP | 176.2 | |
| Aug 26/80 | 206.90 MP | 175.8 | |
| Sept 24/80 | 206.66 MP | 176.5 | |
| Oct 21/80 | 206.64 MP | 176.6 | |
| Nov 18/80 | 206.62 MP | 176.7 | |
| Dec 17/80 | 206.63 MP | 176.7 | |
| Jan 15/81 | 206.62 MP | 176.7 | |
| Feb 10/81 | 206.90 MP | 175.8 | |
| Mar 10/81 | 206.63 MP | 176.7 | |
| Apr 7/81 | 206.61 MP | 176.7 | |
| May 5/81 | 206.61 MP | 176.7 | |
| June 3/81 | 206.60 MP | 176.8 | |
| June 30/81 | 206.59 MP | 176.8 | |
| July 28/81 | 206.60 MP | 176.8 | |
| Aug 25/81 | 206.90 MP | 175.8 | |
| Sept 22/81 | 206.70 MP | 176.4 | |
| Oct 20/81 | 206.65 MP | 176.6 | |
| Nov 17/81 | 206.72 MP | 176.4 | |
| Dec 15/81 | 206.74 MP | 176.3 | |

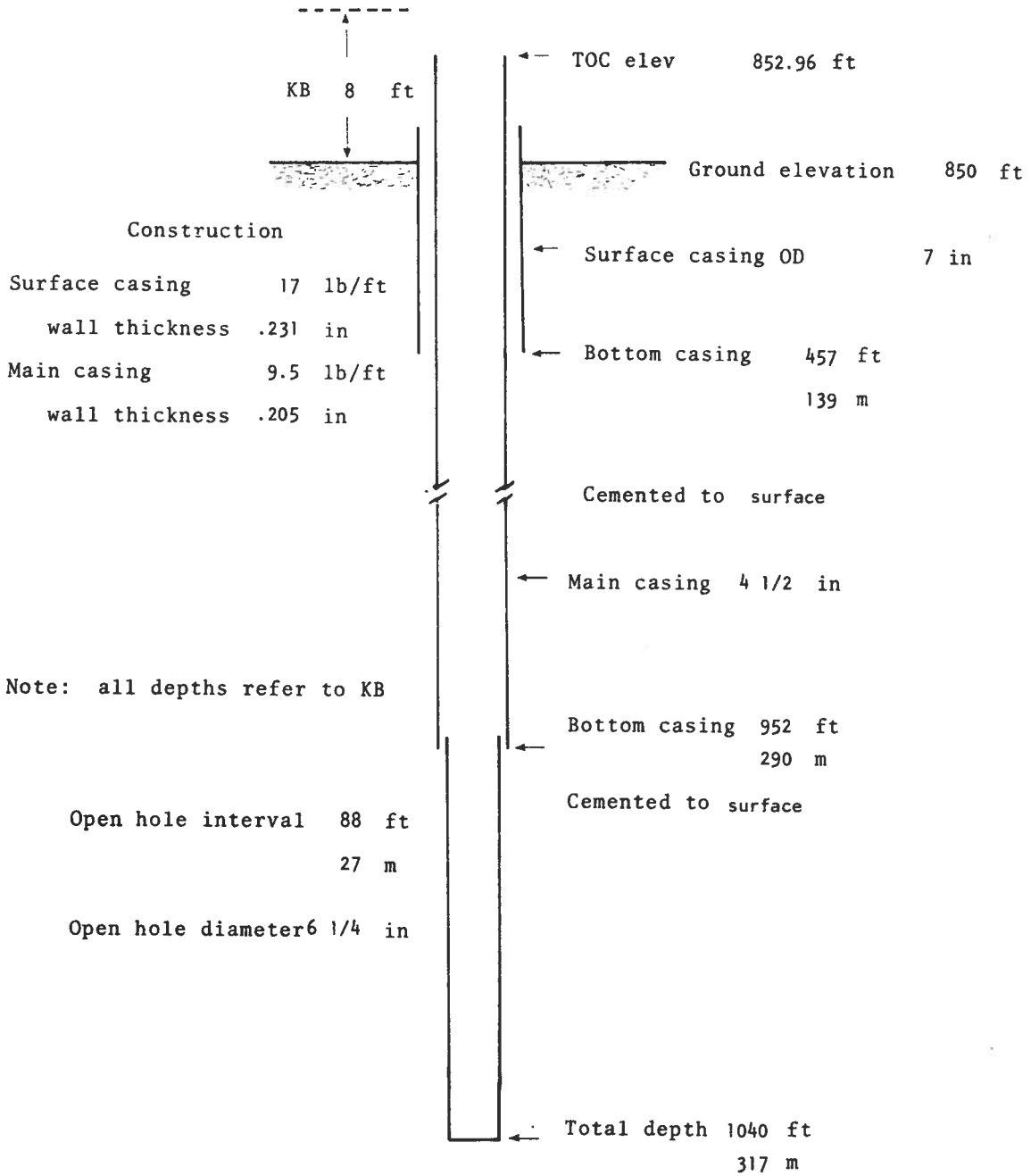
MP - Depth from measuring point
TOC - Depth from top of casing

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |

Note: all depths refer to KB

Open hole interval 88 ft
27 m

Open hole diameter 6 1/4 in

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 858

Type of test Open hole, Bottom hole

Date of test February 22, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1430 | hrs |
| Tool opened | 1459 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1645 | hrs |
| Out of hole at | 1730 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff, faint in one min. Weak air blow on second opening, very faint in one minute

Total water recovered 10 ft

Water sample No. - (drilling mud)

Gas blow Nil

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 488-600'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 495 | 500 |
| Initial hydrostatic | A | 234 | 218 |
| First flow | B | 14 | 10 |
| | B1 | 12 | 8 |
| Initial shut in | C | 147 | 143 |
| Second flow | D | 15 | 12 |
| | D1 | 15 | 12 |
| Final shut in | G | 192 | 189 |
| Final hydrostatic | H | 218 | 215 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

1-1040-D-77

OBSERVATION WELL NUMBER 1-1040

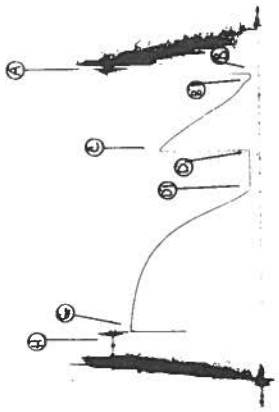
INTERVAL TESTED 488-600

PRESSURE INCREMENTS

Recorder AK1-65
February 22, 1976

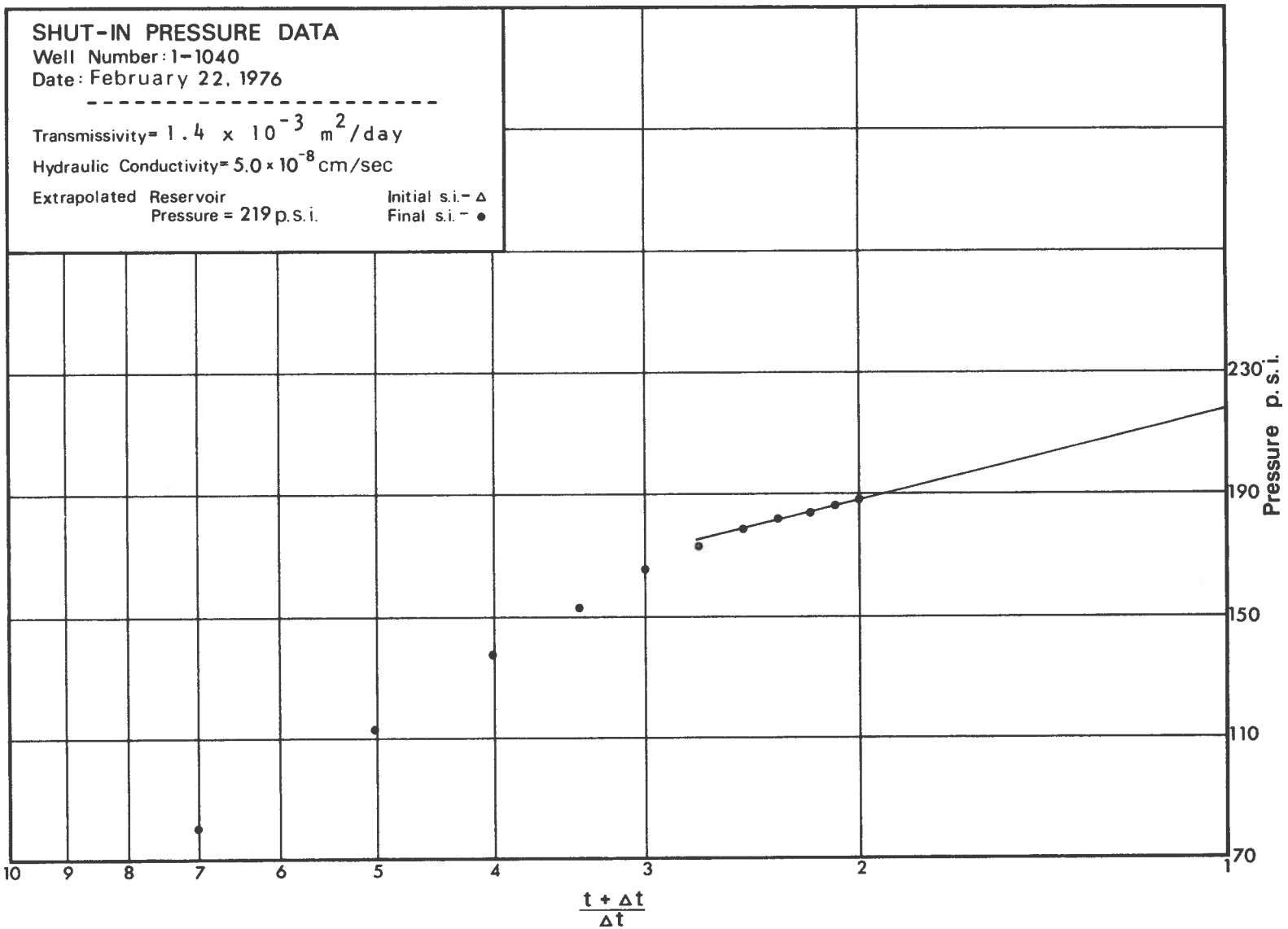
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 27.5 | 7.00 |
| 10 | 46.2 | 4.00 |
| 15 | 74.0 | 3.00 |
| 20 | 100.2 | 2.50 |
| 25 | 124.5 | 2.20 |
| 30 | 144.0 | 2.00 |

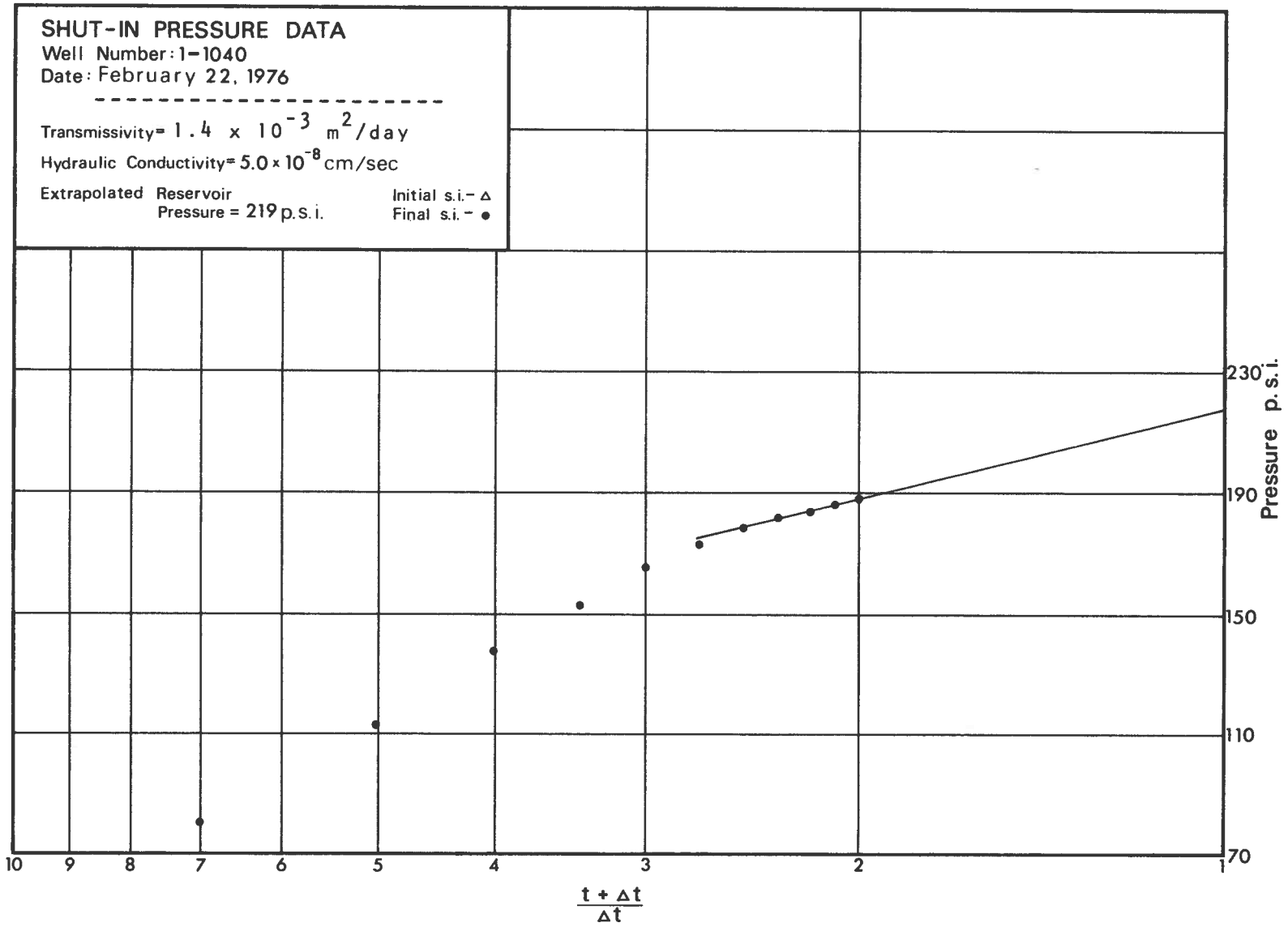


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 40.0 | 13.00 |
| 10 | 79.0 | 7.00 |
| 15 | 112.5 | 5.00 |
| 20 | 136.2 | 4.00 |
| 25 | 152.5 | 3.40 |
| 30 | 164.5 | 3.00 |
| 35 | 172.5 | 2.71 |
| 40 | 178.0 | 2.50 |
| 45 | 182.2 | 2.33 |
| 50 | 185.0 | 2.20 |
| 55 | 187.5 | 2.09 |
| 60 | 188.5 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 22, 1976
Transmissivity = 1.4 x 10^-3 m^2/day
Hydraulic Conductivity = 5.0 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 219 p.s.i.
Initial s.i. - Δ
Final s.i. - •
230
190
150
110
70
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-1040-D-77


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 22, 1976
Transmissivity= 1.4 x 10^-3 m^2/day
Hydraulic Conductivity= 5.0 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 219 p.s.i.
Initial s.i.- Δ
Final s.i. - •
230
190
150
110
70
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-1040-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 858

Type of test Open hole, Bottom hole

Date of test February 23, 1976 I

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0300 | hrs |
| Tool opened | 0429 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0615 | hrs |
| Out of hole at | 0700 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff - faint in one minute. Blow faint on second opening decreasing to nil in 2 min

Total water recovered 10 ft

Water sample No. - (drilling mud)

Gas blow Nil

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 600-712'

Formation tested Prairie Evaporite

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 606 | 610 |
| Initial hydrostatic | A | 275 | 273 |
| First flow | B | 15 | 13 |
| | B1 | 15 | 13 |
| Initial shut in | C | 206 | 204 |
| Second flow | D | 16 | 14 |
| | D1 | 16 | 14 |
| Final shut in | G | 236 | 233 |
| Final hydrostatic | H | 257 | 255 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

1-1040-D-77

OBSERVATION WELL NUMBER 1-1040

INTERVAL TESTED 600-712

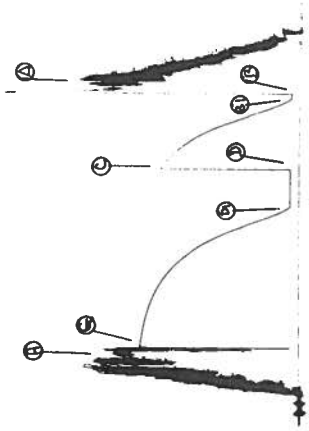
PRESSURE INCREMENTS

Recorder AK1-65

February 23, 1976 |

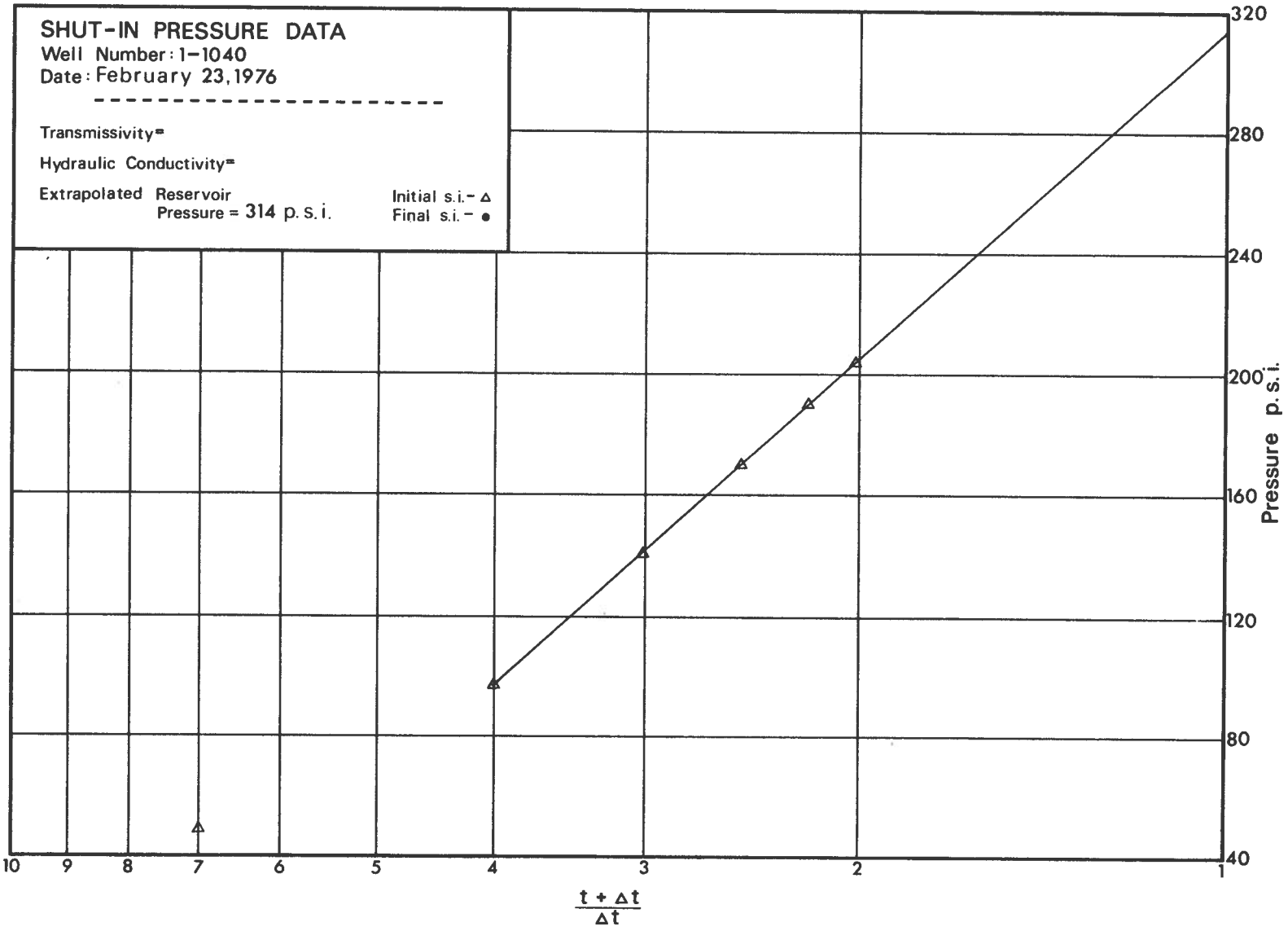
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 48.7 | 7.00 |
| 10 | 97.7 | 4.00 |
| 15 | 140.3 | 3.00 |
| 20 | 169.4 | 2.50 |
| 25 | 189.8 | 2.20 |
| 30 | 204.0 | 2.00 |

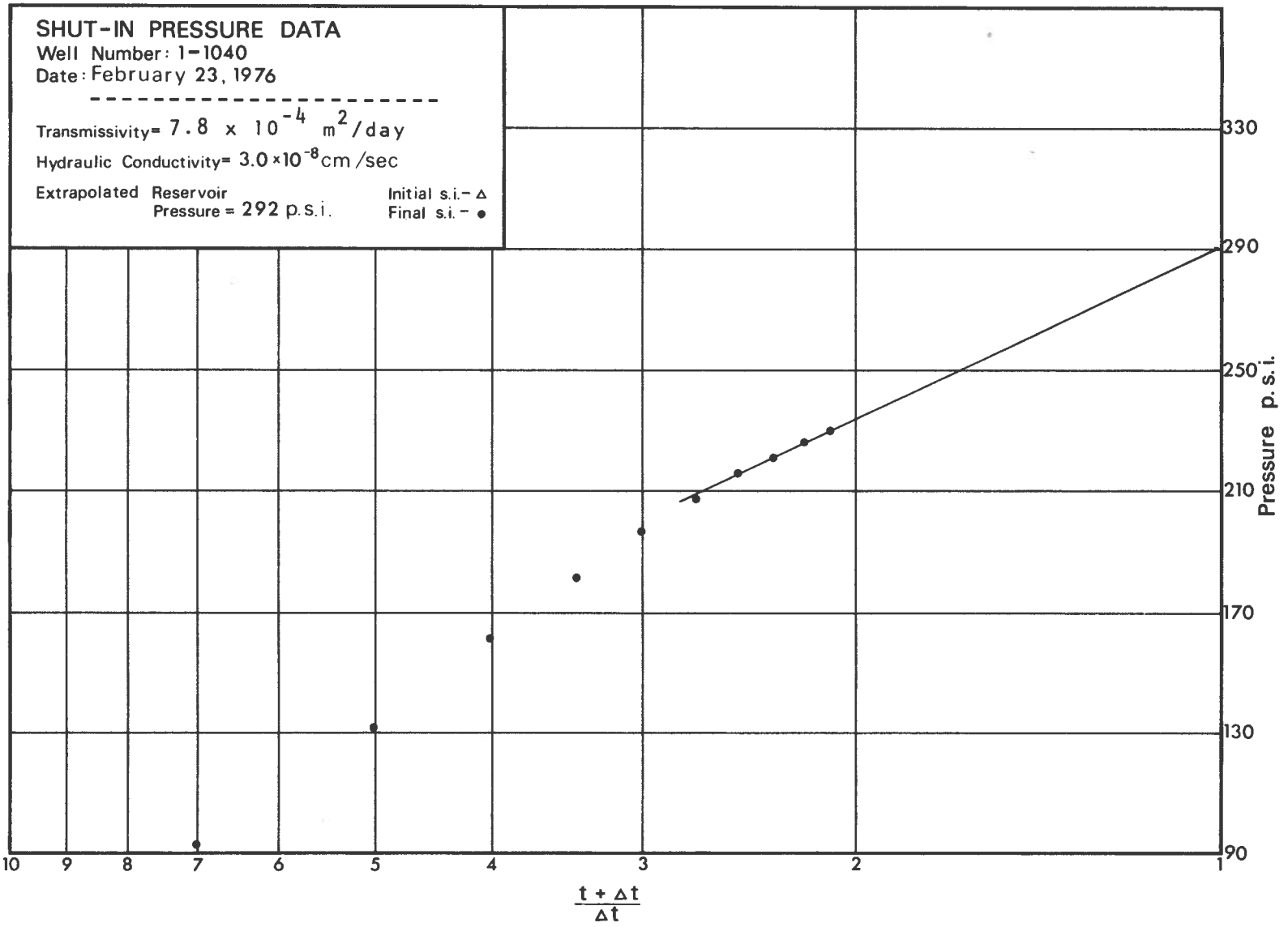


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 44.4 | 13.00 |
| 10 | 92.1 | 7.00 |
| 15 | 131.6 | 5.00 |
| 20 | 160.2 | 4.00 |
| 25 | 181.1 | 3.40 |
| 30 | 196.4 | 3.00 |
| 35 | 207.9 | 2.71 |
| 40 | 216.3 | 2.50 |
| 45 | 222.7 | 2.33 |
| 50 | 227.5 | 2.20 |
| 55 | 230.9 | 2.09 |
| 60 | 233.7 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 23, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 314 p. s. i.
Initial s.i.- Δ
Final s.i. - •
320
280
240
200
160
120
80
40
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-1040-D-77


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 23, 1976
Transmissivity= 7.8 x 10^-4 m^2/day
Hydraulic Conductivity= 3.0 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 292 p.s.i.
Initial s.i.- Δ
Final s.i. - •
330
290
250
210
170
130
90
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
(t + Δt)/Δt

1-1040-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 858

Type of test Open hole, Bottom hole

Date of test February 23, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | - | hrs |
| Tool opened | - | hrs |
| First flow | - | min |
| Initial shut in | - | min |
| Second flow | - | min |
| Final shut in | - | min |
| Pulled loose at | - | hrs |
| Out of hole at | 2100 | hrs |
| Wt on packers | 10,000 | lbs |
| Description of blow | Nil | |
| Total water recovered | Nil | ft |
| Water sample No. | | |
| Gas blow | Nil | |
| Remarks | Misrun. Unable to obtain packer seat | |

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 712-824'

Formation tested Prairie Evaporite

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| Instrument No. | | 64 | 65 |
|---|---|---|---|
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 717 | 722 |
| Initial hydrostatic | A | - | - |
| First flow | B | - | - |
| | B1 | - | - |
| Initial shut in | C | - | - |
| Second flow | D | - | - |
| | D1 | No pressures available | |
| Final shut in | G | - | - |
| Final hydrostatic | H | - | - |

B1, D1, etc. Initial Hyd. Pressure

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 858

Type of test Open hole, Bottom hole

Date of test February 23, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 2200 | hrs |
| Tool opened | - | hrs |
| First flow | - | min |
| Initial shut in | - | min |
| Second flow | - | min |
| Final shut in | - | min |
| Pulled loose at | - | hrs |
| Out of hole at | 2345 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Nil

Total water recovered Nil ft

Water sample No. -

Gas blow Nil

Remarks Misrun;
unable to obtain packer seat

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 681-824'

Formation tested Prairie Evaporite

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.70 | |
| Drill Pipe | 124.00 | |
| Sub & Bull Nose | 2.70 | |
| Total Interval | 143.00 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 688 | 672 |
| Initial hydrostatic | A | - | - |
| First flow | B | - | - |
| | B1 | - | - |
| Initial shut in | C | - | - |
| Second flow | D | - | - |
| | D1 | No pressures available | |
| Final shut in | G | - | - |
| Final hydrostatic | H | - | - |

B1, D1, etc. Initial Hyd. Pressure

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 858

Type of test Open hole, Bottom hole

Date of test February 24, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 2230 | hrs |
| Tool opened | 2359 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0145 | hrs |
| Out of hole at | - | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Fair initial puff on preflow. Fair air blow remaining steady throughout final flow period

Total water recovered 150 ft

Water sample No. - (drilling mud)

Gas blow No

Remarks Test satisfactory
Lost 3' of mud in annulus during test

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 824-936'

Formation tested Prairie Evaporite

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| Instrument No. | | 64 | 65 |
|---|---|---|---|
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 830 | 834 |
| Initial hydrostatic | A | 364 | 367 |
| First flow | B | 20 | 23 |
| | B1 | 24 | 27 |
| Initial shut in | C | 365 | 367 |
| Second flow | D | 33 | 34 |
| | D1 | 94 | 97 |
| Final shut in | G | 362 | 365 |
| Final hydrostatic | H | 365 | 366 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

1-1040-D-77

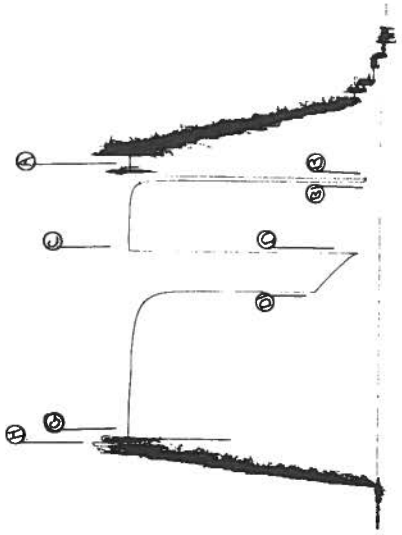
OBSERVATION WELL NUMBER 1-1040

INTERVAL TESTED 824-936

PRESSURE INCREMENTS
Recorder AK1-65
February 24, 1976

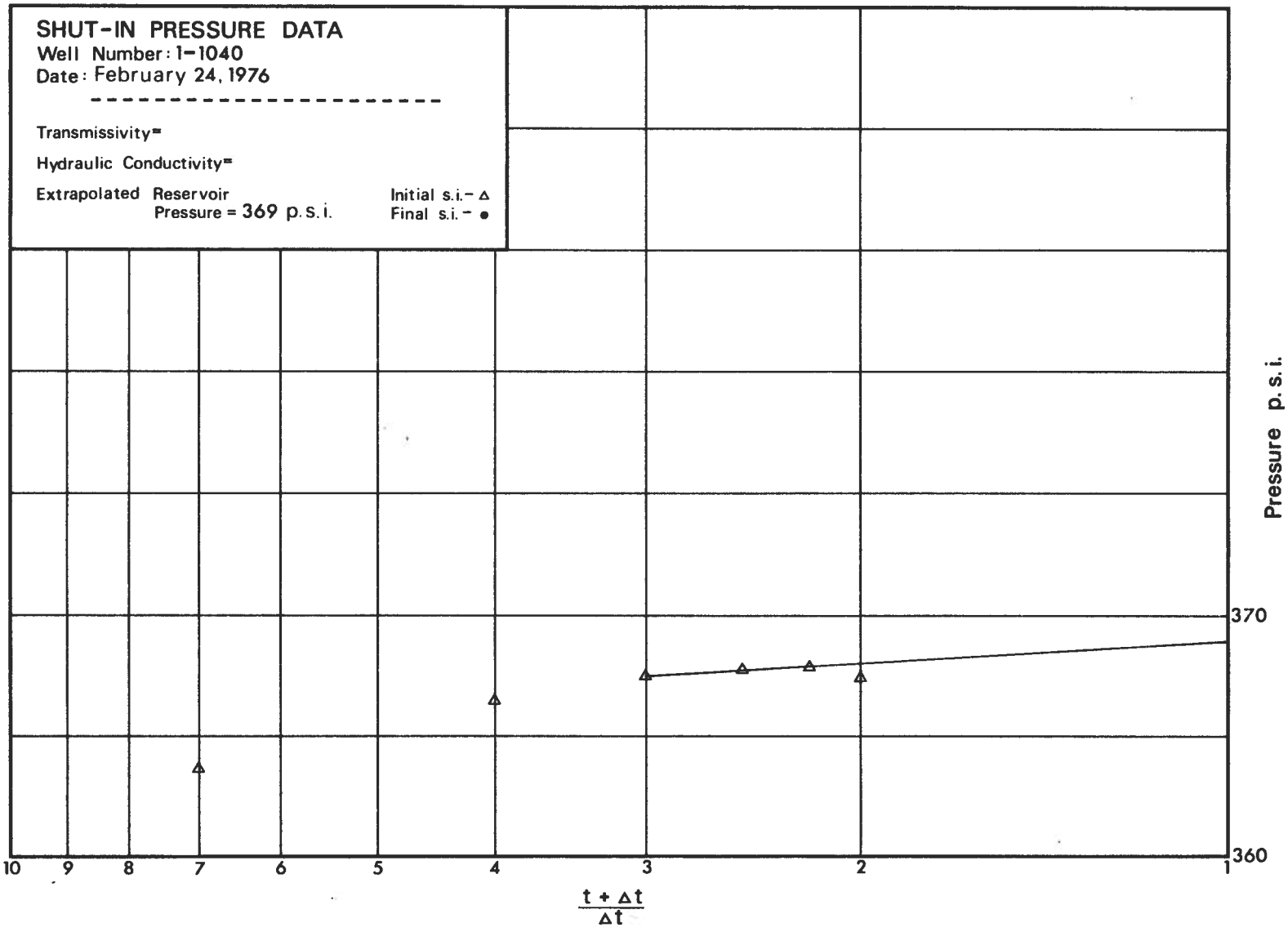
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 363.6 | 7.00 |
| 10 | 366.4 | 4.00 |
| 15 | 367.4 | 3.00 |
| 20 | 367.7 | 2.50 |
| 25 | 367.8 | 2.20 |
| 30 | 367.4 | 2.00 |

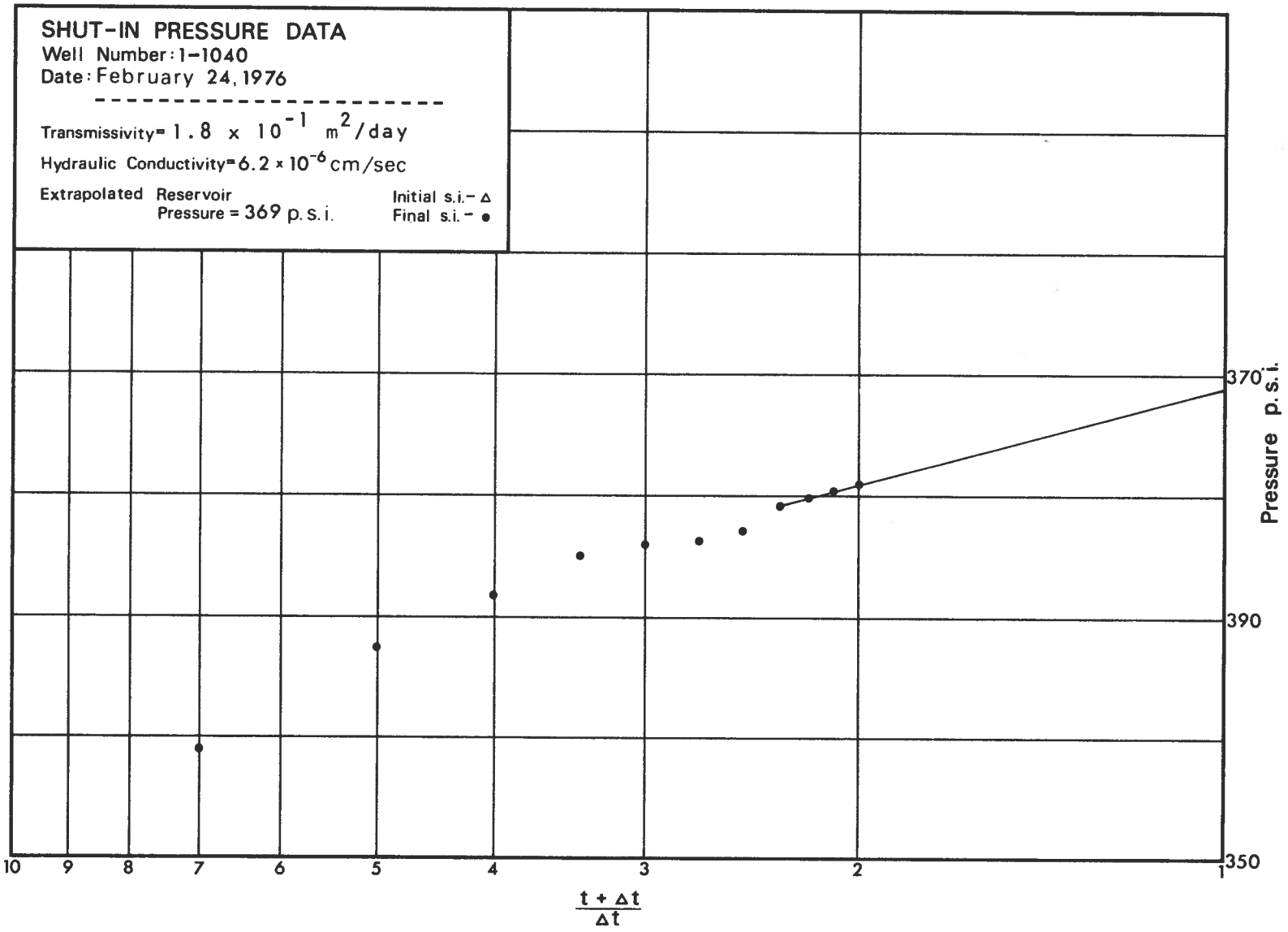


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 344.7 | 13.00 |
| 10 | 354.3 | 7.00 |
| 15 | 358.6 | 5.00 |
| 20 | 360.8 | 4.00 |
| 25 | 362.4 | 3.40 |
| 30 | 362.9 | 3.00 |
| 35 | 363.0 | 2.71 |
| 40 | 363.5 | 2.50 |
| 45 | 364.6 | 2.33 |
| 50 | 365.0 | 2.20 |
| 55 | 365.2 | 2.09 |
| 60 | 365.4 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 24, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 369 p.s.i.
Initial s.i.- Δ
Final s.i. - ●
Pressure p.s.i.
370
360
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

1-1040-D-77


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 24, 1976
Transmissivity = 1.8 x 10^-1 m^2/day
Hydraulic Conductivity = 6.2 x 10^-6 cm/sec
Extrapolated Reservoir Pressure = 369 p.s.i.
Initial s.i. - Δ
Final s.i. - ●
370
390
350
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-1040-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 858

Type of test Open hole, Bottom hole

Date of test February 25, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 2230 | hrs |
| Tool opened | 2344 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0130 | hrs |
| Out of hole at | 0300 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Good initial puff on preflow. Good air flow remaining steady throughout final flow period.

Total water recovered 210 ft

Water sample No. - (water)

Gas blow Nil

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 928-1040'

Formation tested Prarie Evaporite, Ashern and Meadow Lake.

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| Instrument No. | | 64 | 65 |
|---|---|---|---|
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 935 | 939 |
| Initial hydrostatic | A | 417 | 416 |
| First flow | B | 21 | 18 |
| | B1 | 29 | 23 |
| Initial shut in | C | 440 | 440 |
| Second flow | D | 34 | 32 |
| | D1 | 116 | 115 |
| Final shut in | G | 439 | 439 |
| Final hydrostatic | H | 422 | 412 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

1-1040-D-77

OBSERVATION WELL NUMBER 1-1040

INTERVAL TESTED 928-1040

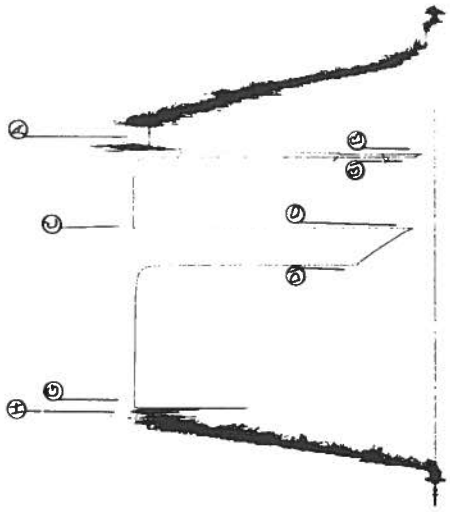
PRESSURE INCREMENTS

Recorder AK1-65

February 25, 1976

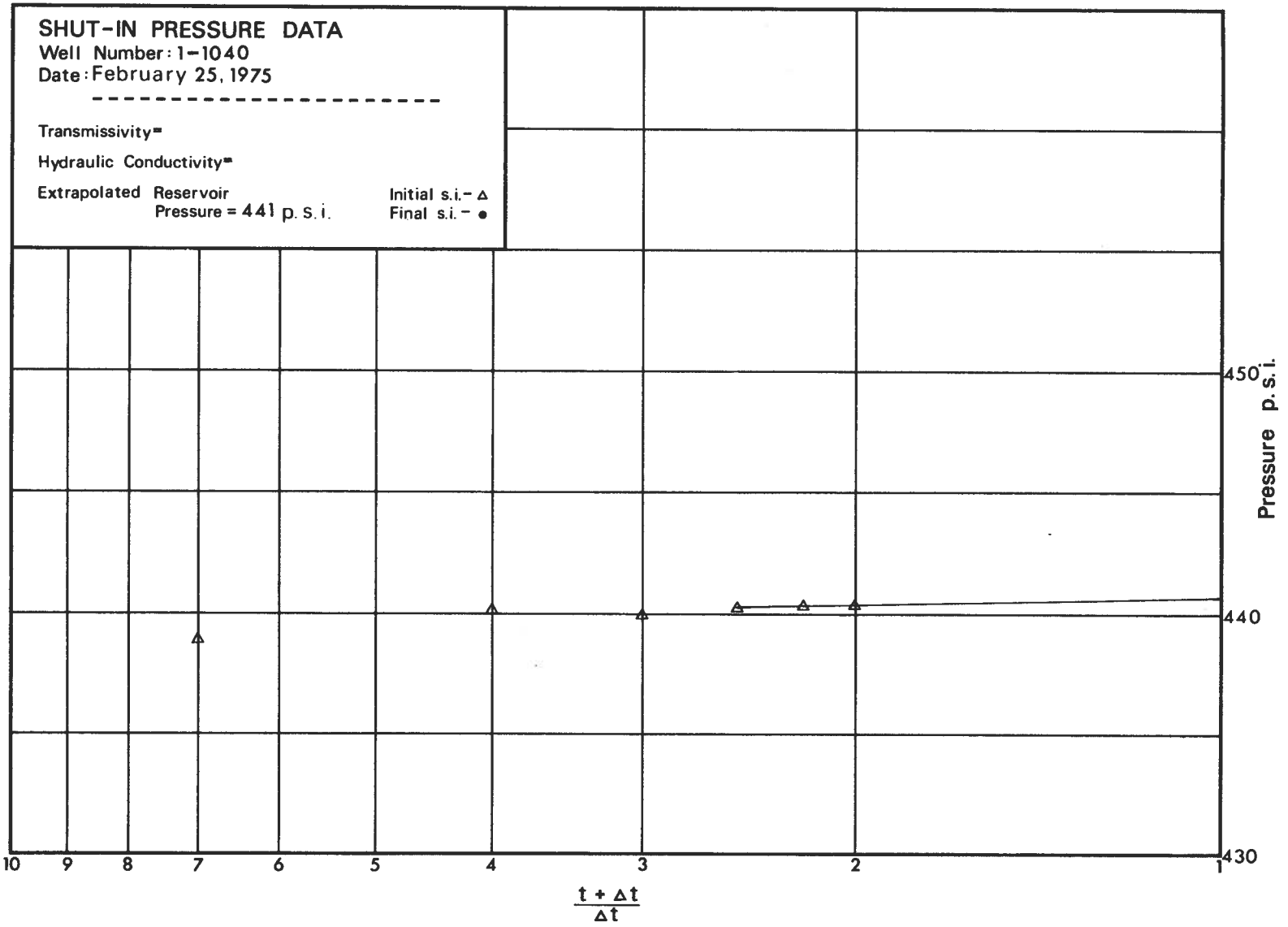
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 438.9 | 7.00 |
| 10 | 440.2 | 4.00 |
| 15 | 439.9 | 3.00 |
| 20 | 440.3 | 2.50 |
| 25 | 440.4 | 2.20 |
| 30 | 440.4 | 2.00 |

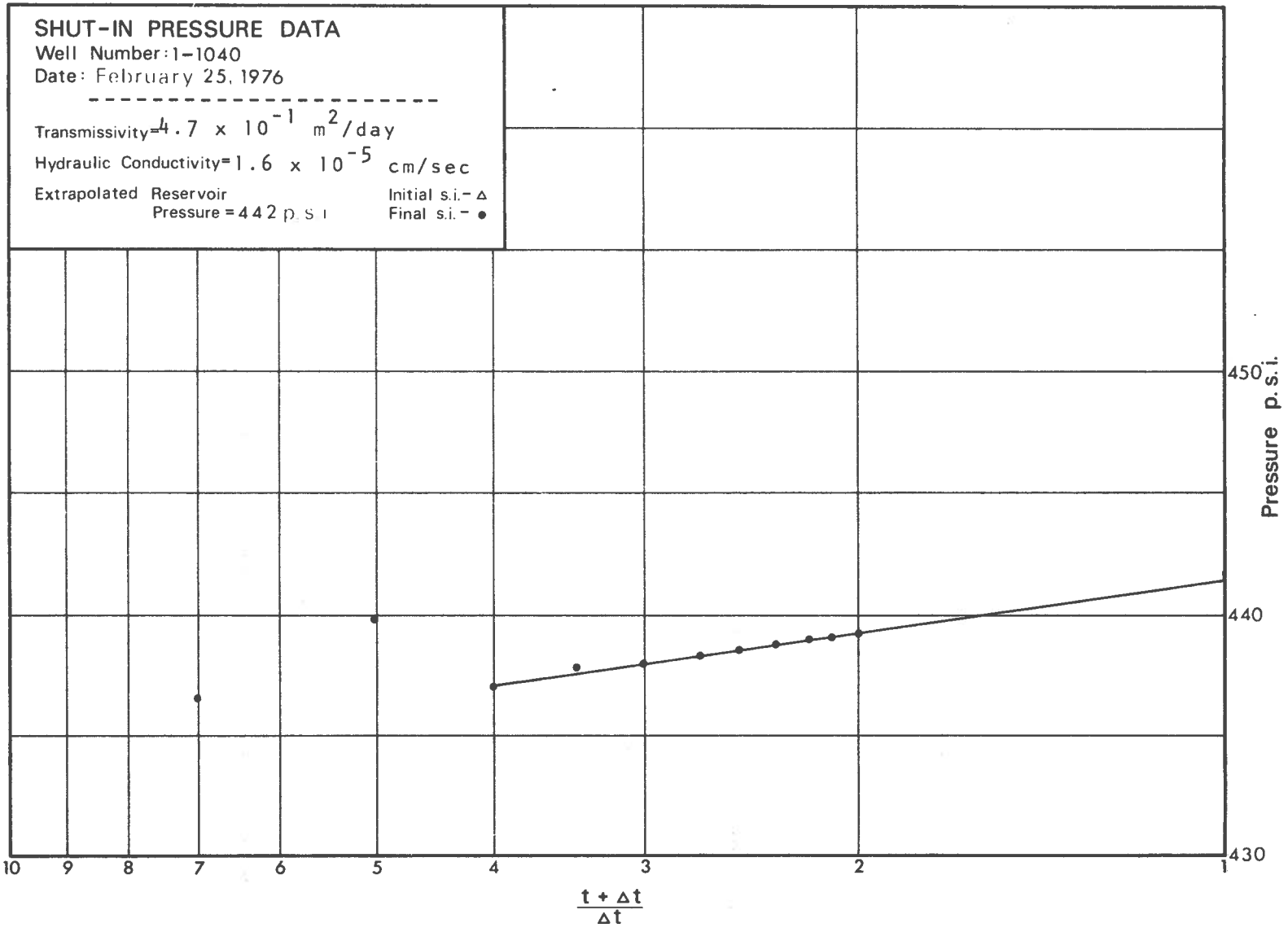


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 433.8 | 13.00 |
| 10 | 436.6 | 7.00 |
| 15 | 439.9 | 5.00 |
| 20 | 437.1 | 4.00 |
| 25 | 437.9 | 3.40 |
| 30 | 438.1 | 3.00 |
| 35 | 438.3 | 2.71 |
| 40 | 438.6 | 2.50 |
| 45 | 438.9 | 2.33 |
| 50 | 439.1 | 2.20 |
| 55 | 439.1 | 2.09 |
| 60 | 439.3 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 25, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 441 p. s. i.
Initial s.i.- Δ
Final s.i. - •
450
440
430
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-1040-D-77


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 25, 1976
Transmissivity = 4.7 x 10^-1 m^2/day
Hydraulic Conductivity = 1.6 x 10^-5 cm/sec
Extrapolated Reservoir Pressure = 442 p.s.i.
Initial s.i. - Δ
Final s.i. - •
450
440
430
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
(t + Δt)/Δt

1-1040-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source DST #5 on 1-1040

Date sampled February 24, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1650.0 | 82.34 | 9.8 |
| Magnesium ($Mg^{++}$) | 72.0 | 5.93 | 0.7 |
| Sodium ($Na^{+}$) | 17250.0 | 750.33 | 89.4 |
| Potassium ($K^{+}$) | 27.5 | 0.70 | 0.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 190.0 | 3.11 | 0.4 |
| Sulfate ($SO_4^{=}$) | 3640.0 | 75.79 | 8.8 |
| Chloride ($Cl^{-}$) | 27800.0 | 783.98 | 90.9 |
| Nitrate ($NO_3^{=}$) | 1.3 | 0.02 | 0.0 |
| Silica ($SiO_2$) | 3.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 50660.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 862.9 | Total Cations (epm) | 839.2 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | | |
| pH | 7.2 | pH | 6.9 | |
| Fluoride ($F^{-}$) | 0.9 ppm | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 359 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source DST #6 on 1-1040

Date sampled February 26, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1370.0 | 68.36 | 16.9 |
| Magnesium ($Mg^{++}$) | 105.0 | 8.64 | 2.1 |
| Sodium ($Na^{+}$) | 7500.0 | 326.23 | 80.7 |
| Potassium ($K^{+}$) | 41.7 | 1.07 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 68.0 | 1.11 | 0.3 |
| Sulfate ($SO_4^{=}$) | 2760.0 | 57.46 | 14.1 |
| Chloride ($Cl^{-}$) | 12400.0 | 349.69 | 85.6 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 2.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 24700.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 408.2 | Total Cations (epm) | 404.3 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | |
| pH | 7.0 | pH | 7.7 |
| Fluoride ($F^{-}$) | 1.0 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 95 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3500.0 | 174.65 | 5 |
| Magnesium ($Mg^{++}$) | 320.0 | 26.34 | 1 |
| Sodium ($Na^{+}$) | 81500.0 | 3545.02 | 95 |
| Potassium ($K^{+}$) | 175.0 | 4.48 | 0 |
| Carbonate ($CO_3^{=}$) | 21.6 | 0.72 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 12.2 | 0.20 | 0 |
| Sulfate ($SO_4^{=}$) | 2510.0 | 52.26 | 1 |
| Chloride ($Cl^{-}$) | 133600.0 | 3767.63 | 99 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 0.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1661.0 | | |
| Magnesium (Acidified) | 319.0 | | |
| Total dissolved solids | 241840 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3820.82 | Total Cations (epm) | 3750.49 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 7.0 |
| pH | 8.9 | pH | 7.9 |
| Fluoride ($F^{-}$) | 0.1 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 59 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Date sampled: July 13, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .154 |
| Au | <.003 | Mo | <.006 |
| Al | 2.2 | Na | 77550 |
| As | <.038 | Ni | <.010 |
| B | 7.95 | P | .121 |
| Ba | <.200 | Pb | <.088 |
| Be | .044 | Se | <.060 |
| Ca | 3410 | Si | 1.87 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 55.2 |
| Cr | <.006 | Te | <.065 |
| Cu | .187 | Ti | .066 |
| Eu | <.015 | U | <.020 |
| Fe | 0.22 | V | .154 |
| K | 1870 | W | <.078 |
| Mg | 262 | Zn | 0.66 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 5, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3980.0 | 198.60 | 4.8 |
| Magnesium ($Mg^{++}$) | 110.0 | 9.05 | 0.2 |
| Sodium ($Na^{+}$) | 90000.0 | 3914.75 | 94.9 |
| Potassium ($K^{+}$) | 160.0 | 4.09 | 0.1 |
| Carbonate ($CO_3^{=}$) | 28.8 | 0.96 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 2450.0 | 51.01 | 1.3 |
| Chloride ($Cl^{-}$) | 139800.0 | 3942.47 | 98.7 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 1.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 3480.0 | | |
| Magnesium (Acidified) | 107.0 | | |
| Total dissolved solids | 241500.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3994.45 | Total Cations (epm) | 4126.50 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 12.0 |
| pH | 9.3 | pH | 9.1 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 29.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 10.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

1-1040-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3450.0 | 172.16 | 4.4 |
| Magnesium(Mg) | 121.0 | 9.96 | 0.3 |
| Sodium(Na) | 85750.0 | 3729.88 | 95.3 |
| Potassium(K) | 83.0 | 2.12 | 0.1 |
| Carbonate(CO3) | 33.6 | 1.12 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 2405.0 | 50.07 | 1.2 |
| Chloride(Cl) | 150000.0 | 4230.12 | 98.8 |
| Nitrate(NO3) | 12.1 | 0.20 | 0.0 |
| Silica(SiO2) | 1.6 | | |
| Hydroxide(OH) | 1.4 | 0.08 | 0.0 |
| Calcium(Acidified) | 1700.0 | | |
| Magnesium(Acidified) | 110.0 | | |
| TDS(mg/l) | 244000.0 | | |
| Total Anions(epm) | 4281.59 | Total Cations(epm) | 3914.12 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | | | Temperature(C) | 12.00 | |
| pH | 9.2 | | pH | 9.3 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | 34 | mg/l |
| | | | Bicarbonate(HCO3) | 14 | mg/l |
| | | | Hydroxide(OH) | | |

1-1040-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 8, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3650.0 | 182.14 | 4.0 |
| Magnesium(Mg) | 50.0 | 4.12 | 0.1 |
| Sodium(Na) | 101250.0 | 4404.09 | 95.8 |
| Potassium(K) | 225.0 | 5.76 | 0.1 |
| Carbonate(CO3) | 31.0 | 1.03 | 0.0 |
| Bicarbonate(HCO3) | 17.1 | 0.28 | 0.0 |
| Sulphate(SO4) | 2410.0 | 50.18 | 1.1 |
| Chloride(Cl) | 155000.0 | 4371.12 | 98.8 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 2.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 3500.0 | | |
| Magnesium(Acidified) | 54.0 | | |
| TDS(mg/l) | 245900.0 | | |
| Total Anions(epm) | 4422.61 | Total Cations(epm) | 4596.10 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 18400 | Temperature(C) | 12.00 | |
| pH | 9.0 | pH | 9.3 | |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) | 38 | mg/l |
| | | Bicarbonate(HCO3) | 10 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 1-1040-E-82

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3870.0 | 193.50 | 4.6 |
| Magnesium(Mg) | 91.0 | 7.58 | 0.2 |
| Sodium(Na) | 91500.0 | 3978.26 | 95.2 |
| Potassium(K) | 3.5 | 0.09 | 0.0 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 44.0 | 0.72 | 0.2 |
| Sulphate(SO4) | 2450.0 | 51.04 | 10.9 |
| Chloride(Cl) | 14800.0 | 416.90 | 89.0 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 2.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 3190.0 | | |
| Magnesium(Acidified) | 86.0 | | |
| TDS(mg/l) | 252100.0 | | |
| Total Anions(epm) | 468.67 | Total Cations(epm) | 4179.43 |

Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 210000 | |
| pH | 8.3 | |
| Fluoride | 0.2 | mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 12.00 | |
| pH | 8.7 | |
| Carbonate(CO3) | 19 | mg/l |
| Bicarbonate(HCO3) | 15 | mg/l |
| Hydroxide(OH) | | |

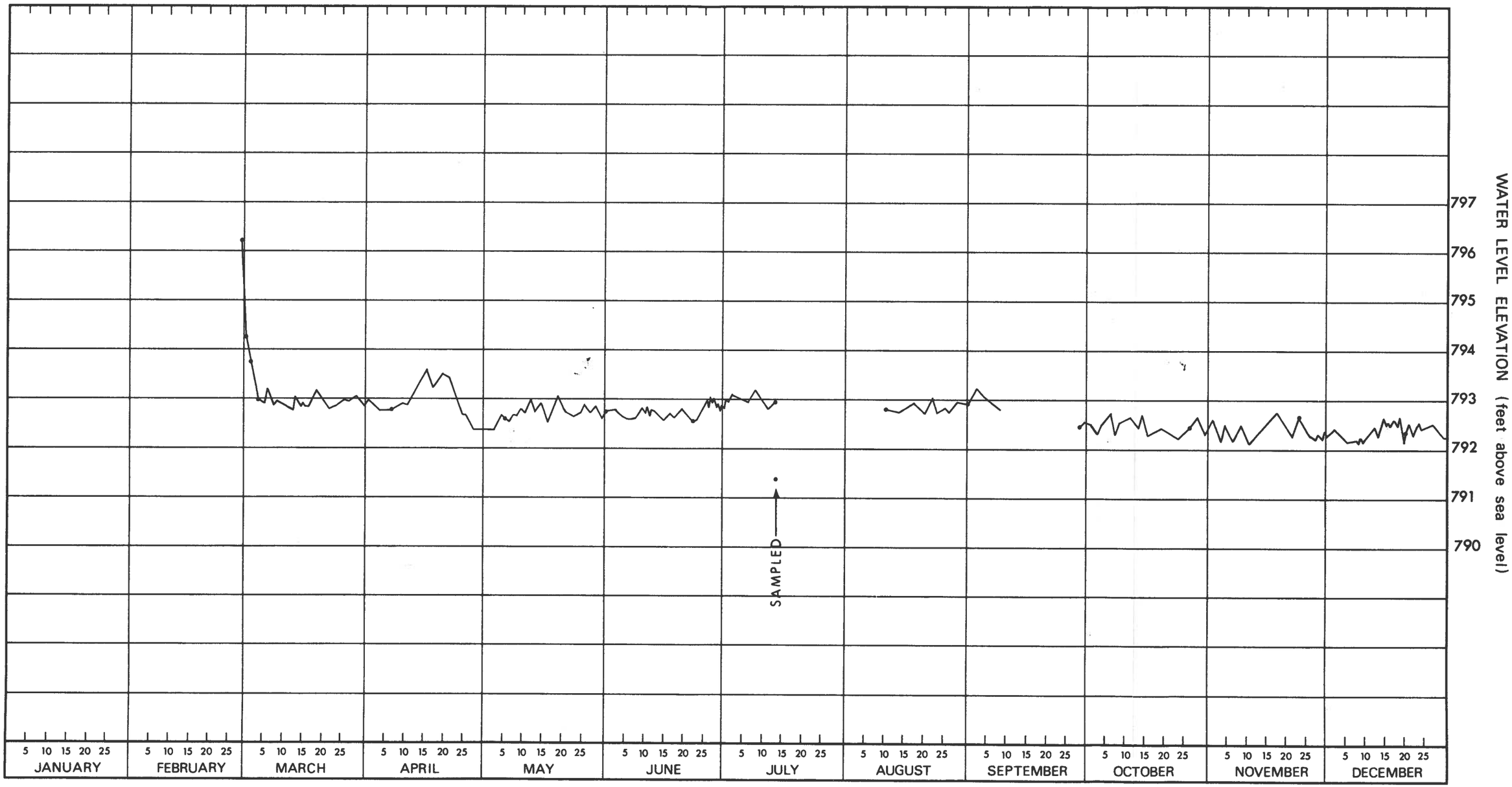
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **1-1040**

Lsd **8** Sec **15** Twp **96** R **11** W4th

Alberta Research Council

1 - 1040 - H - 77




1976

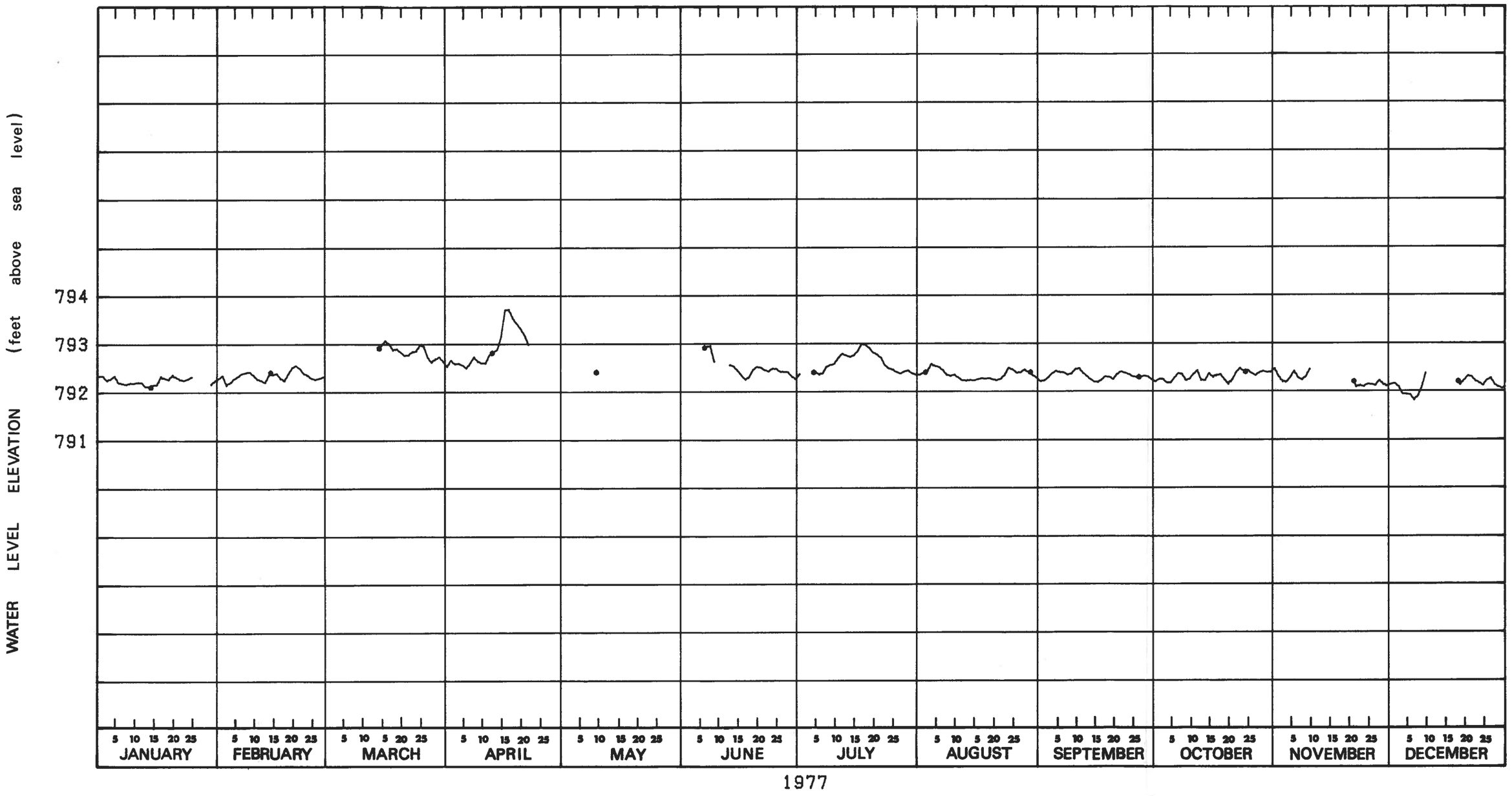
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-1040-H-78



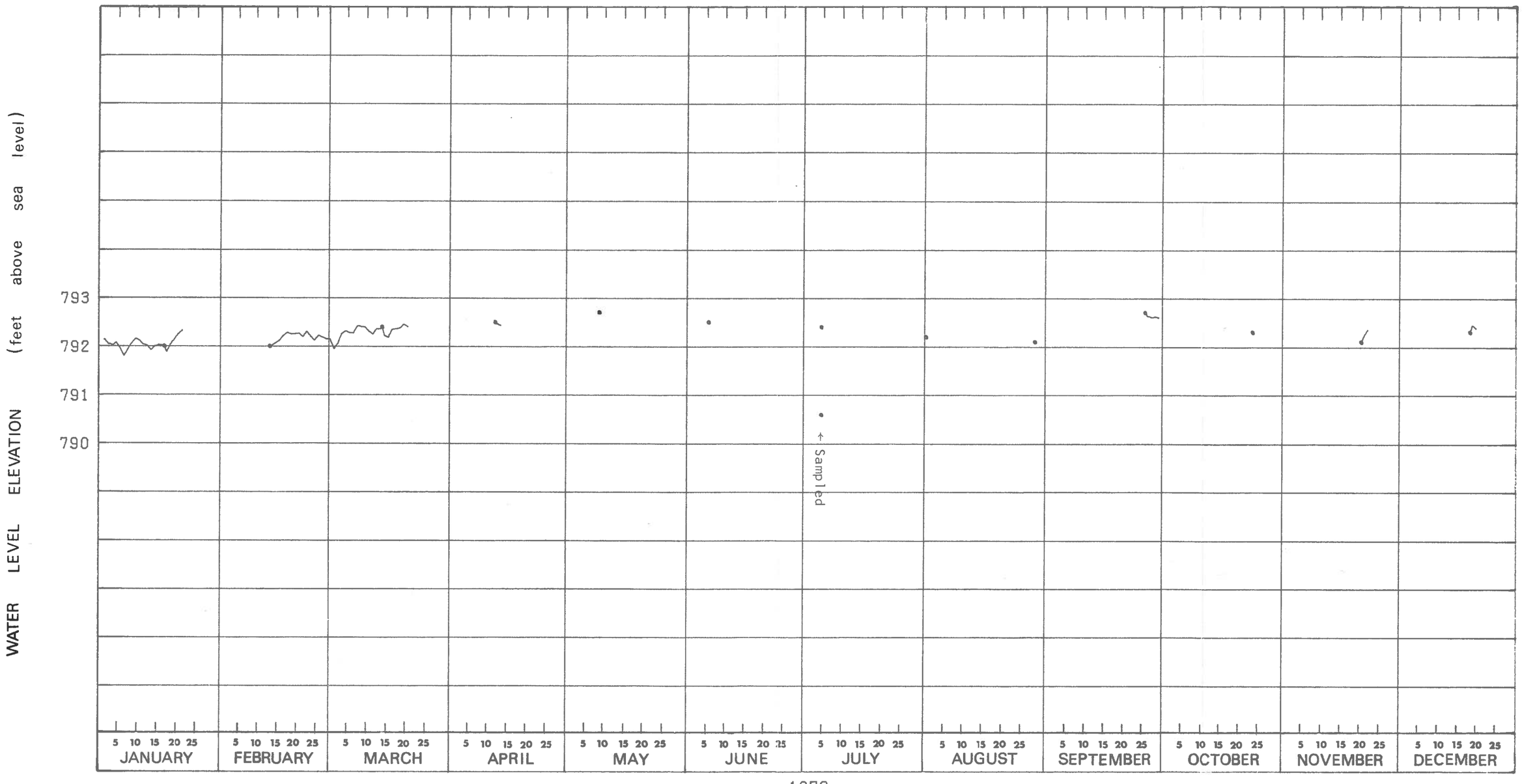
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-1040

LSD 8 SEC 15 TWP 96 R 11 W4TH

1-1040-H-79

Alberta Research Council




1978

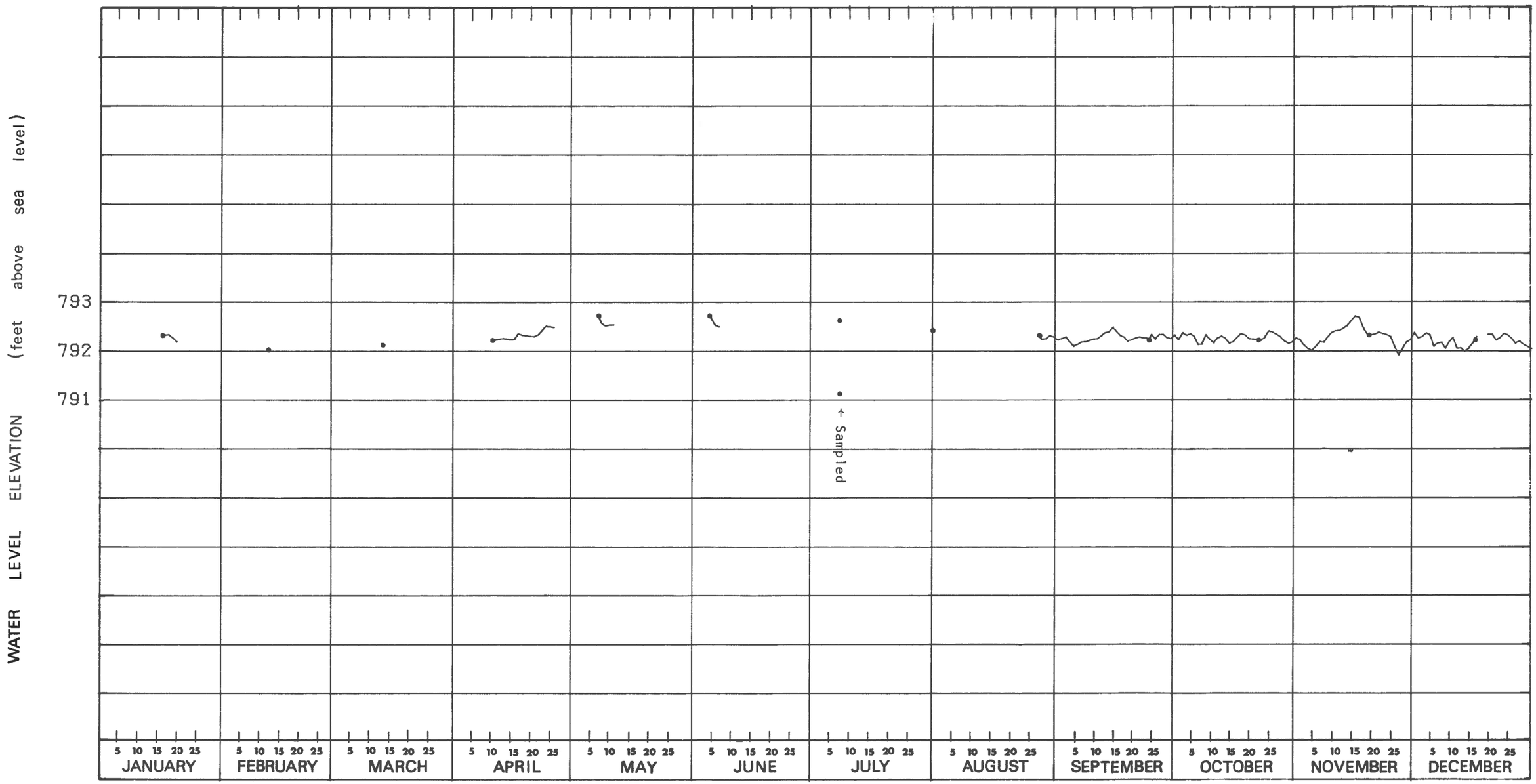
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-1040

1-1040-H-80

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council



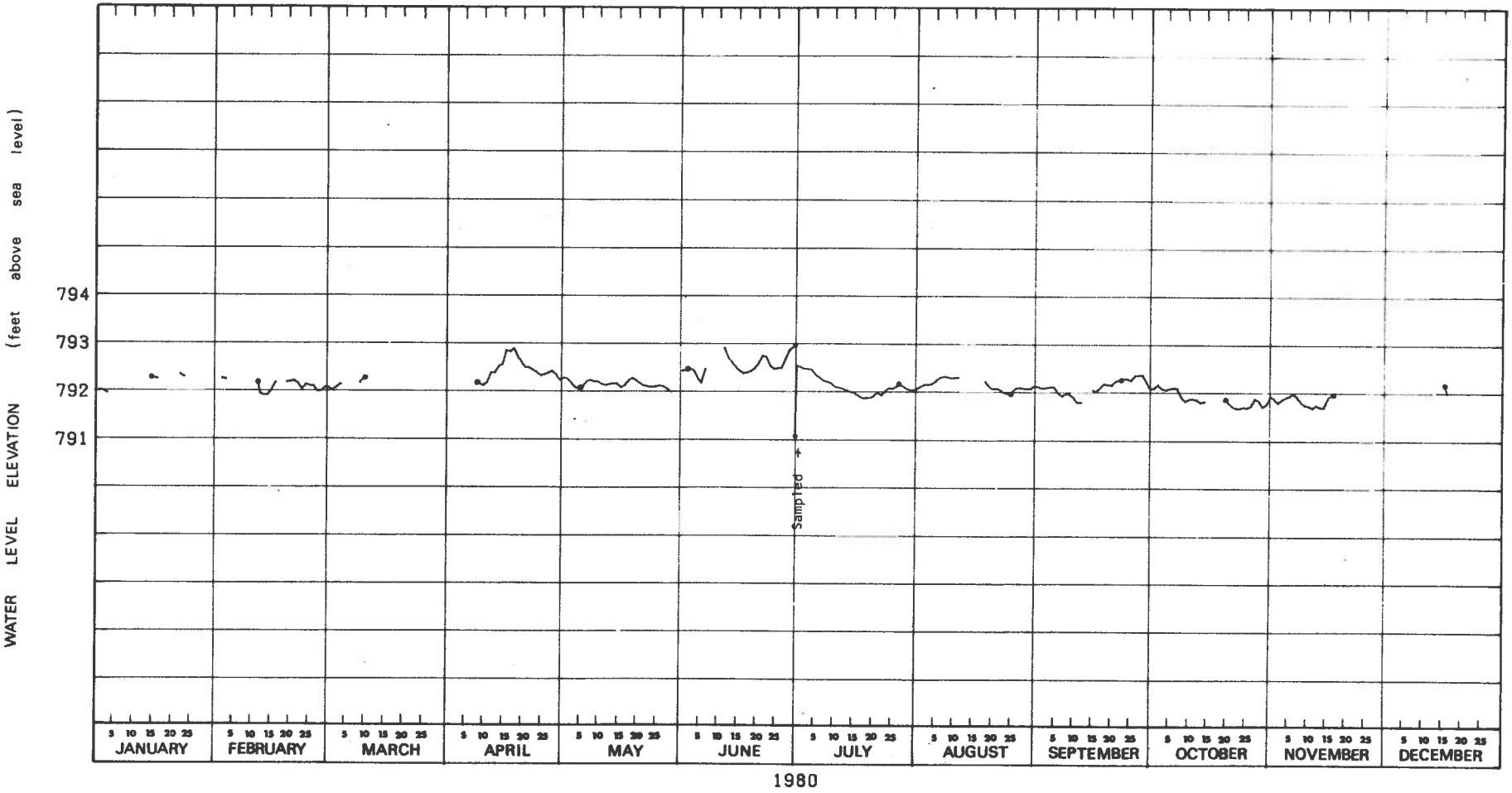
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-1040-H-81



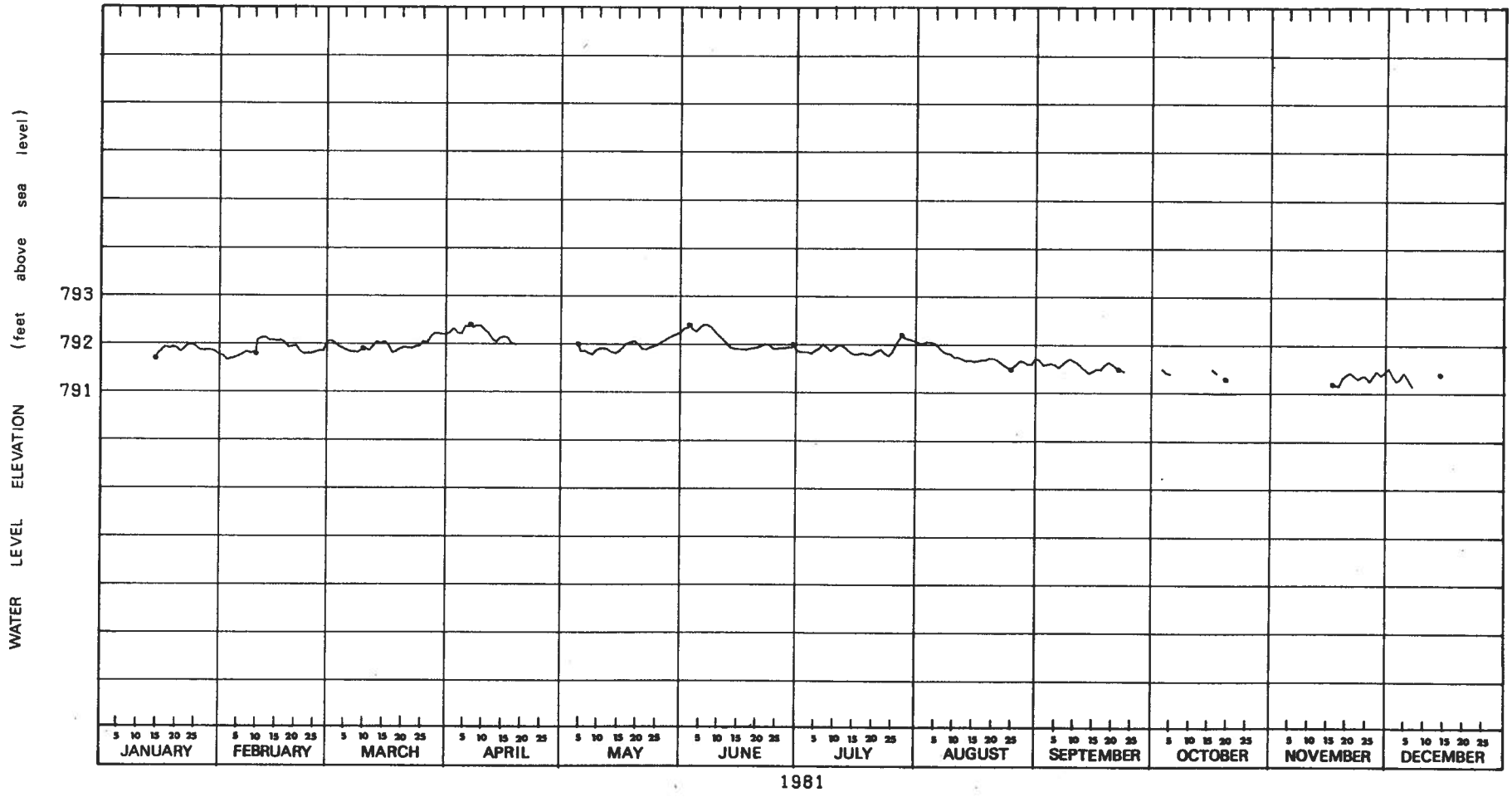
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4 th

Alberta Research Council

1-1040-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 26/76 | | | Well completed |
| Feb 28/76 | 17.3 TOC | 796.3 | |
| Feb 29/76 | 17.9 TOC | 794.3 | |
| Mar 1/76 | 18.05 TOC | 793.8 | |
| Mar 3/76 | 19.10 MP | 792.9 | MP = 0.81 m TOC, (855.6) |
| Apr 6/76 | 19.16 MP | 792.7 | |
| May 5/76 | 19.22 MP | 792.6 | |
| June 1/76 | 19.18 MP | 792.7 | |
| June 22/76 | 19.24 MP | 792.5 | |
| July 13/76 | 19.12 MP | 792.9 | |
| | 19.60 MP | 791.3 | After sample; temp. 7°C |
| Aug 10/76 | 19.16 MP | 792.7 | |
| Aug 31/76 | 19.13 MP | 792.8 | |
| Sept 28/76 | 19.27 MP | 792.4 | |
| Oct 26/76 | 19.26 MP | 792.4 | |
| Nov 23/76 | 19.22 MP | 792.6 | |
| Dec 20/76 | 19.31 MP | 792.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 19.36 MP | 792.1 | MP (855.6) |
| Feb 15/77 | 19.28 MP | 792.4 | |
| Mar 15/77 | 19.15 MP | 792.9 | |
| Apr 13/77 | 19.14 MP | 792.8 | |
| May 10/77 | 19.27 MP | 792.4 | |
| June 7/77 | 19.10 MP | 792.9 | Temp. 15°C |
| July 5/77 | 19.26 MP | 792.4 | |
| | 19.75 MP | 790.8 | After sample; temp. 12°C |
| Aug 3/77 | 19.26 MP | 792.4 | |
| Aug 30/77 | 19.26 MP | 792.4 | |
| Sept 27/77 | 19.31 MP | 792.3 | |
| Oct 25/77 | 19.28 MP | 792.4 | Temp. at 200 m = 7.5°C |
| Nov 22/77 | 19.32 MP | 792.2 | |
| Dec 19/77 | 19.33 MP | 792.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 19.38 MP | 792.0 | MP (855.6) |
| Feb 13/78 | 19.40 MP | 792.0 | |
| Mar 14/78 | 19.28 MP | 792.4 | |
| Apr 12/78 | 19.23 MP | 792.5 | |
| May 9/78 | 19.18 MP | 792.7 | |
| June 6/78 | 19.23 MP | 792.5 | |
| July 5/78 | 19.26 MP | 792.4 | |
| | 19.81 MP | 790.6 | After sample; temp. 12°C |
| Aug 1/78 | 19.33 MP | 792.2 | |
| Aug 29/78 | 19.35 MP | 792.1 | |
| Sept 26/78 | 19.17 MP | 792.7 | |
| Oct 24/78 | 19.30 MP | 792.3 | |
| Nov 21/78 | 19.37 MP | 792.1 | |
| Dec 19/78 | 19.30 MP | 792.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 19.31 MP | 792.3 | MP (855.6) |
| Feb 13/79 | 19.39 MP | 792.0 | |
| Mar 14/79 | 19.37 MP | 792.1 | |
| Apr 11/79 | 19.34 MP | 792.2 | |
| May 8/79 | 19.18 MP | 792.7 | |
| June 5/79 | 19.17 MP | 792.7 | |
| July 8/79 | 19.20 MP | 792.6 | |
| | 19.67 MP | 791.1 | After sample; temp. 12°C |
| Aug 1/79 | 19.27 MP | 792.4 | |
| Aug 28/79 | 19.29 MP | 792.3 | |
| Sept 25/79 | 19.33 MP | 792.2 | |
| Oct 23/79 | 19.32 MP | 792.2 | |
| Nov 20/79 | 19.30 MP | 792.3 | |
| Dec 17/79 | 19.33 MP | 792.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 1-1040

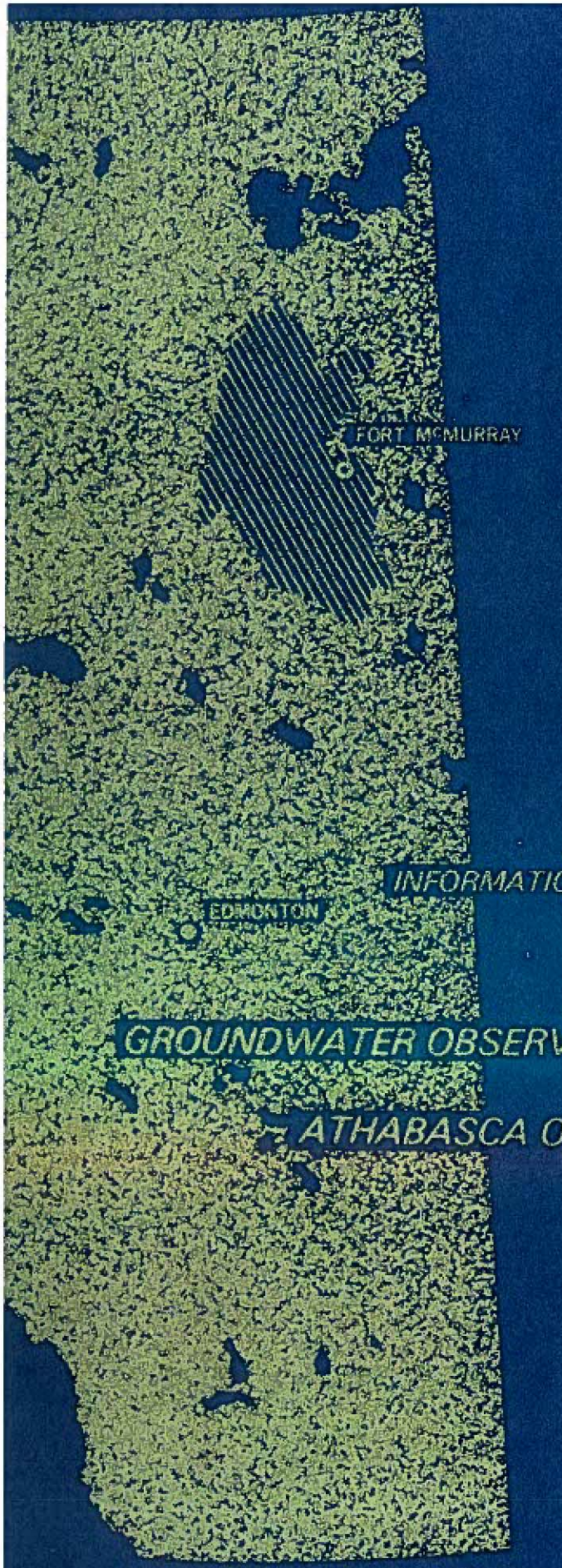
Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 19.31 MP | 792.3 | |
| Feb 12/80 | 19.34 MP | 792.2 | |
| Mar 11/80 | 19.30 MP | 792.3 | |
| Apr 9/80 | 19.33 MP | 792.2 | |
| May 6/80 | 19.37 MP | 792.1 | |
| June 3/80 | 19.19 MP | 792.5 | New MP 0.75 Toc (855.4) |
| July 1/80 | 19.03 MP | 793.0 | Temp. 12°C |
| | 19.61 MP | 791.1 | After Sample |
| July 28/80 | 19.27 MP | 792.2 | |
| Aug 26/80 | 19.32 MP | 792.0 | |
| Sept 24/80 | 19.24 MP | 792.3 | |
| Oct 21/80 | 19.35 MP | 791.9 | |
| Nov 18/80 | 19.32 MP | 792.0 | |
| Dec 17/80 | 19.27 MP | 792.2 | |
| Jan 15/81 | 19.41 MP | 791.7 | |
| Feb 10/81 | 19.39 MP | 791.8 | |
| Mar 10/81 | 19.36 MP | 791.9 | |
| Apr 7/81 | 19.20 MP | 792.4 | |
| May 5/81 | 19.33 MP | 792.0 | |
| June 3/81 | 19.20 MP | 792.4 | |
| June 30/81 | 19.32 MP | 792.0 | |
| July 28/81 | 19.28 MP | 792.2 | |
| Aug 25/81 | 19.47 MP | 791.5 | |
| Sept 22/81 | 19.47 MP | 791.5 | |
| Oct 20/81 | 19.53 MP | 791.3 | |
| Nov 17/81 | 19.56 MP | 791.2 | |
| Dec 15/81 | 19.50 MP | 791.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing




SITE TWO
1-11 97-12 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites, containing 36 individual wells, were instrumented in this manner during the winter of 1974-75.

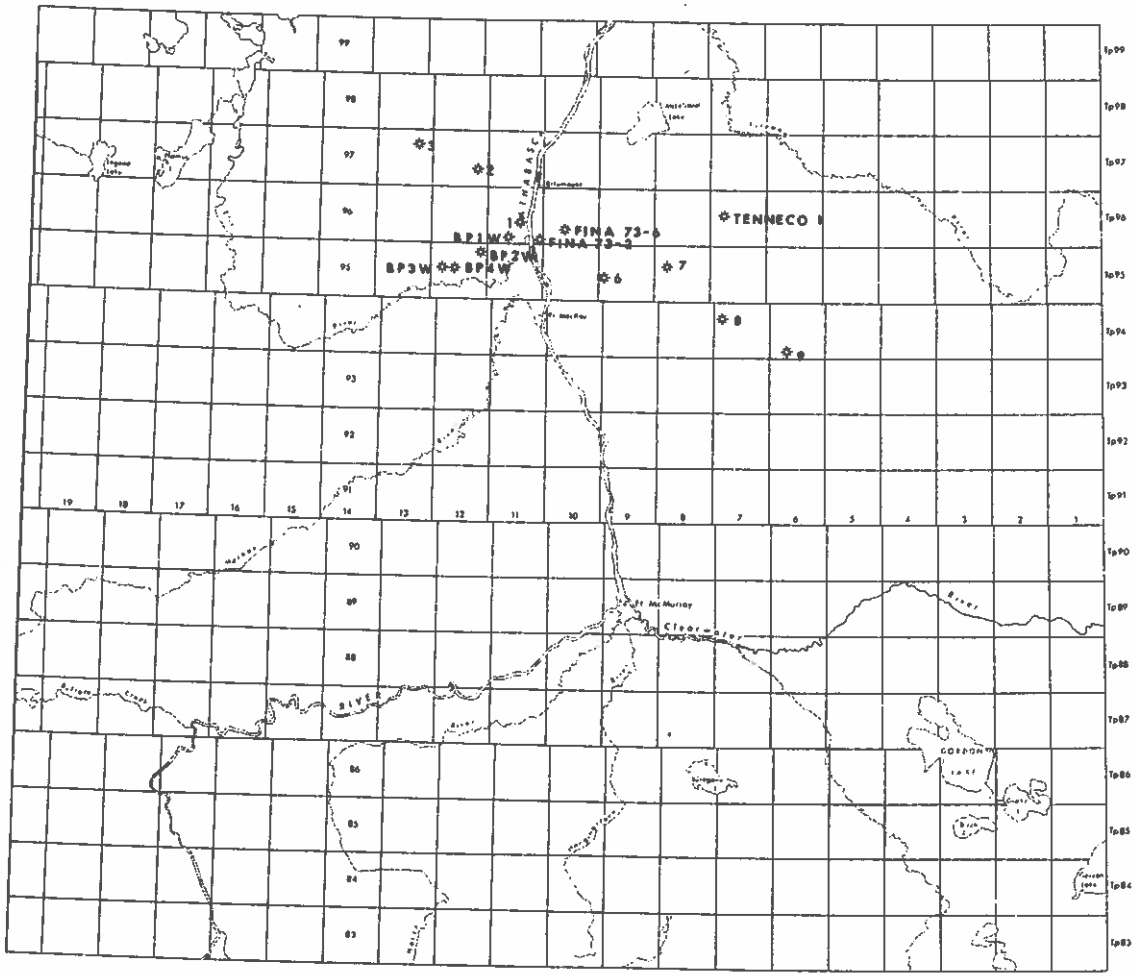
The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill-stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The loose-leaf format has been chosen to facilitate periodic updating with such information as hydrographs, water analyses and well history. The page indexing system is also consistent with the updating process. All updating packages will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this introduction and legend.

There were seven piezometer nests in the system on August 31, 1975. Four companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing. Table 1 lists the location of wells in the system as of August 31, 1975. Map 1 indicates the location of these wells. Publications available as of the date of this document include those for sites 1, 2, 3, 6, 7, 8 and 9.

Table 1
Athabasca Oil Sands Observation Wells
August 31, 1975

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |




MAP 1
ATHABASCA OIL SANDS
OBSERVATION WELL NETWORK
August 31, 1975

## Acknowledgments

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, C. Seibert, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1975: BOPG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., and Shell Canada Ltd.

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

Well Number - the name used for designating the well

Subject Code - as follows:

- I - Introduction (no site number indicated)
- L - Legend (no site number indicated)
- G - General site information including geological logs, geophysical logs and site plan (no well number indicated)
- C - Well construction details
- D - Drill stem testing
- A - Aquifer testing
- E - Chemical analyses including spectral emission estimates and routine water analyses
- H - Annual hydrograph
- W - Well history

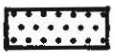
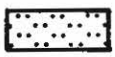
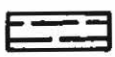
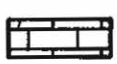
So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within the tabbed section for that particular well.

## SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| Mer | meridian |
| Meg/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diamter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| Sec. | section |
| ss | stainless steel |

| Symbol | Units or Parameter |
|---|---|
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) *or* time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| Wt | weight |

## GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
|  | sandstone |
| | arkosic sandstone |
| | silt |
|  | siltstone |
| | silt & sandstone |
| | clay |
| | sandy clay |
|  | shale |
| | sandstone & shale |
| | oilsand |
| | shaley dolomite |
| | gypsum |
| | dolomite |
|  | limestone |

| Symbol | Stratigraphic Unit |
|---|---|
| Qd | unconsolidated deposits |
| Klb | La Biche Fm. |
| Kpl | Pelican Fm. |
| Kj | Joli Fou Fm. |
| Kg | Grand Rapids Fm. |
| Kc | Clearwater Fm. |
| Km | McMurray Fm. |
| Dbl | Beaverhill Lake Gp. |
| Dw | Waterways Fm. |
| Dpe | Prairie Evaporite Fm. |
| Dmt | Methy Fm. |
| Dmr | McLean River Fm. |
| Dl | La Loche Fm. |
| P$\epsilon$ | Precambrian |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: complete routine analysis and a spectral emission estimate for 29 elements. Many of the samples collected during 1975 appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years.

Most water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source".

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface

3. drill through the aquifer using very light mud
4. insert a screening device (if necessary).

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

Two drilling rigs were used simultaneously during the 1974-1975 drilling season. Both were Failing 1500; one was trailer mounted and capable of 2,000-foot depths, the other was truck mounted and capable of about 1,200-foot depths.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma and uncompensated density were the logs run during the 1974-75 drilling. The geological log presented represents an interpretation based upon the sample description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells when the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, all wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the

measuring tape sticking to the wet casing. Conventional oil-field drill stem testing equipment was selected in an attempt to produce permeability and head values in the wells with deep water levels. Information from these drill stem tests is presented in the section on "Drill Stem Testing". A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day
V = volume of production into drill collars and stem
t = total flow time of test
T = transmissivity in millidarcy-feet
M = slope of final shut-in pressure plot
k = permeability in millidarcys
h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot.

Values of transmissivity are expressed in the metric units of square metres per day. Permeability is expressed as centimetres per second.

## SUMMARY OF CONTENTS

SITE NUMBER TWO

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | |
|---|---|---|---|---|---|
| | site | 2-46 | 2-222 | 2-402 | 2-525 |
| Introduction | 4 | — | — | — | — |
| Legend | 8 | — | — | — | — |
| Site Plan | 1 | — | — | — | — |
| Geological Sample Description | 2 | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 1 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 2 | 2 | 1 |
| Shut-In Pressure Data | — | 0 | 1 | 2 | 0 |
| Water Analysis | — | 2 | 2 | 4 | 3 |
| Spectral Emissions Estimates | — | 0 | 1 | 1 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER TWO

Lsd 1 Sec 11 Twp 96 R 12 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | |
|---|---|---|---|---|
| | 2-46 | 2-222 | 2-402 | 2-525 |
| Shut-In Pressure Data | 0 | 1* | 0 | 0 |
| Water Analysis | 1 | 1 | 1 | 1 |
| Well Construction | 0 | 1* | 0 | 0 |
| Water Level Hydrograph | 1 | 1 | 1 | 1 |
| Well History | 1 | 1 | 1 | 1 |

*Supersedes page issued in 1976

### ERRATUM STATEMENT

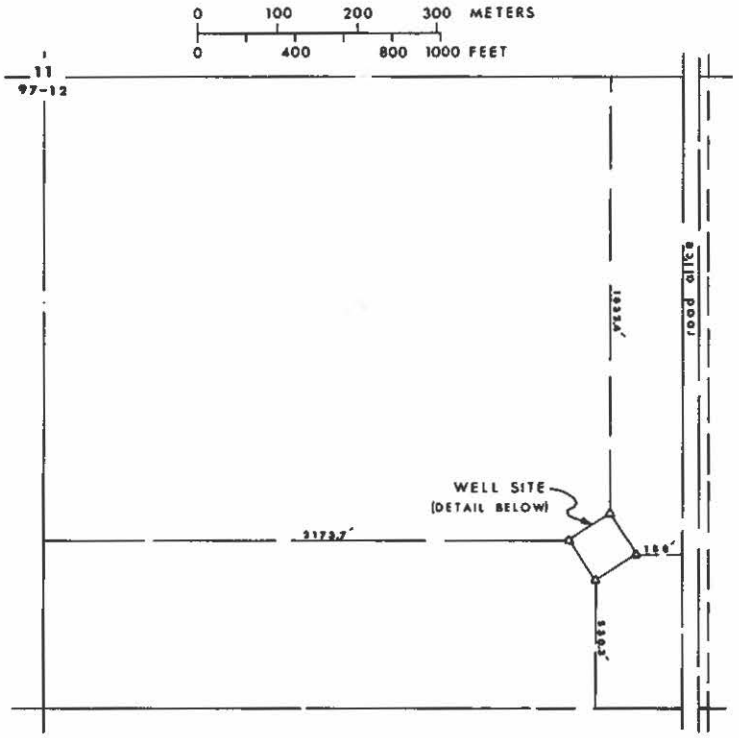
Material Distributed in 1976

1. McMurray Formation should be listed on the GEOLOGICAL SAMPLE DESCRIPTION at the interval 120 to 130 and from depths of 130 to 464 feet on the GEOPHYSICAL AND GEOLOGICAL LOGS.
2. The "formation tested" on the DRILL STEM TEST for well 2-222 (page 2-222-D-76) should be changed to "McMurray".
3. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
4. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.
5. A new SHUT-IN PRESSURE DATA page has been issued for well 2-222. The page indexed 2-222-D-77 has replaced 2-222-D-76.

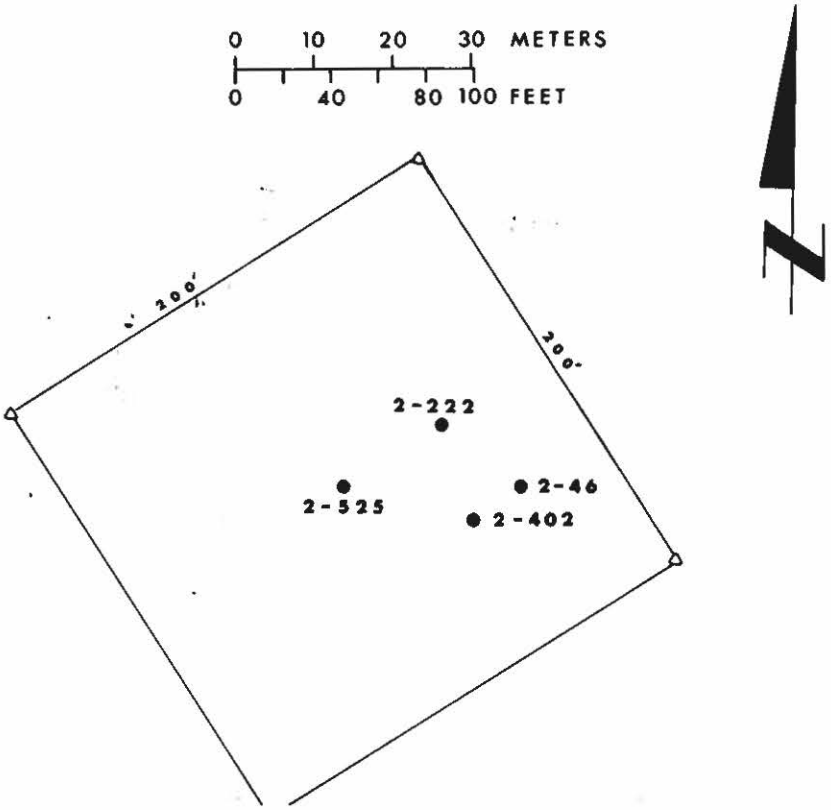
OBSERVATION WELL SITE 2

1-11-97-12 W4th

ALBERTA RESEARCH COUNCIL




WELLSITE DETAIL



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Two

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Ground elevation 1059 Total depth 525

KB elevation 1064

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 10 | Grey silt with sands up to .5 mm, poor sorting, sands angular to sub-angular, quartz K-feldspar | Drift |
| | 20 | Grey silt and very fine sands, occasional coarse sub-rounded quartz 5% | |
| | 30 | Well sorted, light grey silt - very fine sand | Clearwater |
| 30 | 60 | Clay,medium gray | |
| 60 | 80 | Clay, and silt, medium grey | |
| 80 | 110 | Clay, medium grey | |
| | 120 | Clay to medium sand, clay and silt 50% very fine and fine sand, 45%, very poor sorting, glauconite abundant in clay silt range | |
| | 130 | Clay, medium grey | |
| | 140 | Silt and clay, medium grey | |
| | 150 | Fine - very fine sand and silt, some bitumen impregnation, poor sorting, sand angular to sub-rounded, moderate sphericity, overall brownish medium grey | |
| | 160 | Very fine sand, medium brown to grey, well sorted, some bitumen | |
| | 220 | Sand | |
| | 230 | Sand, very fine to fine grained, well sorted, minor oil stain | |
| | 240 | Sand and clay, sand-brown, very fine to fine grained, well sorted, minor oil stain, clay - silty grey | |
| | 250 | Clay and sand, clay-dark grey, very silty sand, angular | McMurray |
| | 260 | Sand and clay, sand-light brown, very fine grained, minor oilstain, clay-silty, micaceous, pod of oil sand | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Two (continued)

Lsd 1 Sec 11 Twp 97 R 12 W4th

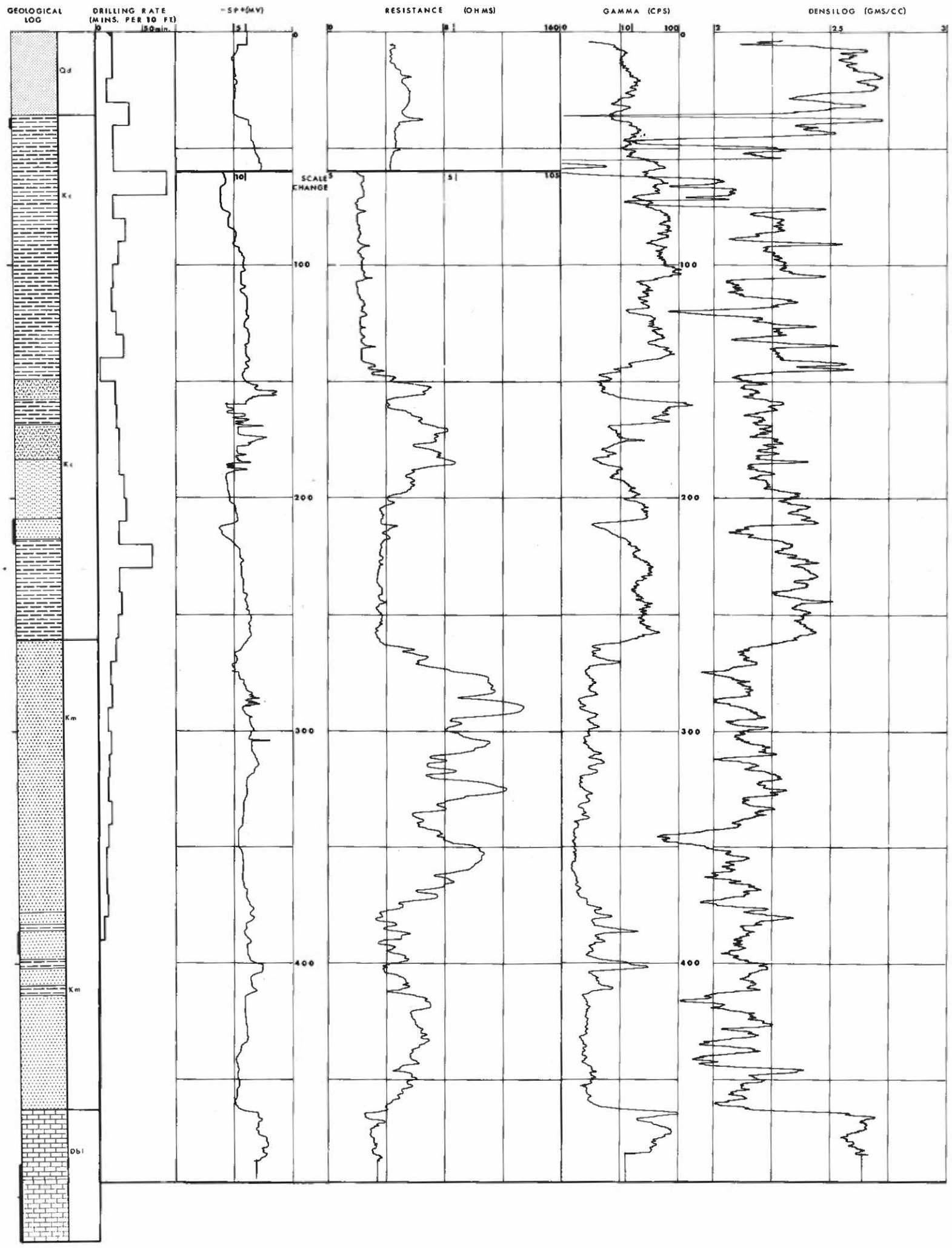
Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 260 | 420 | Oil sand, black, very fine to medium grained well sorted, minor inclusions of barren sand | |
| 420 | 470 | Quartz sand, coarse grained, sub-rounded to rounded, clear and translucent grains, well sorted | |
| 470 | 480 | Tar, traces of limestone | Beaverhill Lake |
| | 490 | Limestone, light grey, micritic, fine mudstone | |
| | 525 | Limey mudstone, light grey, micritic | |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 2
### 1-11-97-12 W4th
### ALBERTA RESEARCH COUNCIL

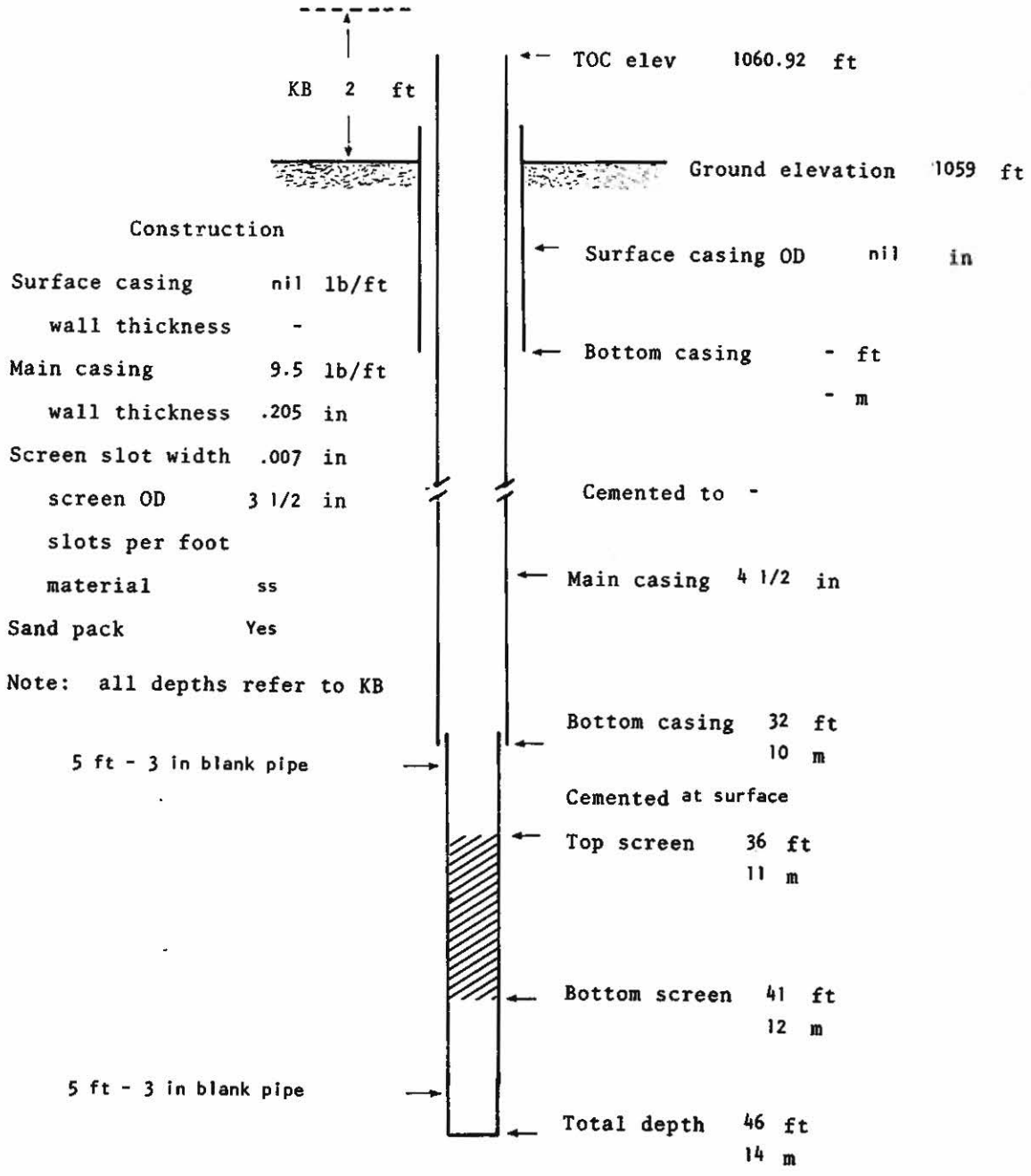


WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Tp 97 R 12 W 4th

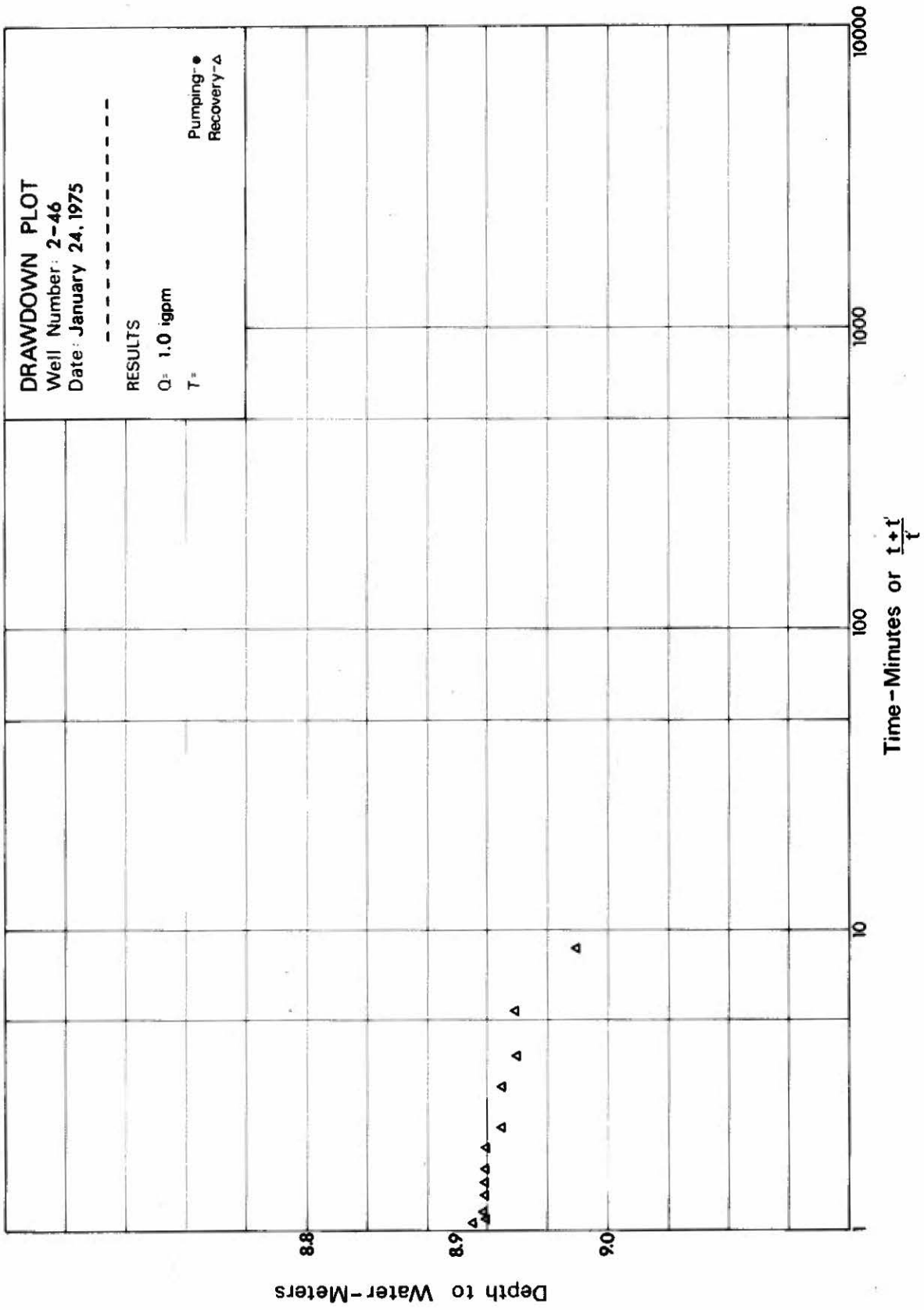
Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | nil | lb/ft |
| wall thickness | - | |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | Yes | |

Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 2-46
Date: January 24, 1975
RESULTS
Q= 1.0 igpm
T=
Pumping-●
Recovery-△
Depth to Water-Meters
8.8
8.9
9.0
1
10
100
1000
10000
Time-Minutes or (t+t')/t

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed from 2-46

Date sampled January 17, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 73.0 | 3.64 | 16.8 |
| Magnesium ($Mg^{++}$) | 44.0 | 3.62 | 16.7 |
| Sodium ($Na^{+}$) | 328.0 | 14.27 | 65.8 |
| Potassium ($K^{+}$) | 6.3 | 0.16 | 0.7 |
| Carbonate ($CO_3^{=}$) | 4.8 | 0.16 | 0.7 |
| Bicarbonate ($HCO_3^{-}$) | 188.0 | 3.08 | 14.3 |
| Sulfate ($SO_4^{=}$) | 775.0 | 16.14 | 75.0 |
| Chloride ($Cl^{-}$) | 72.0 | 2.03 | 9.4 |
| Nitrate ($NO_3^{=}$) | 6.0 | 0.10 | 0.5 |
| Silica ($SiO_2$) | 3.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1510.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 21.504 | Total Cations (epm) | 21.689 |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1870 |
| pH | 8.5 |
| Fluoride ($F^{-}$) | 0.9 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 2.2 |
| pH | 8.9 |
| Carbonate ($CO_3^{=}$) | 22 ppm |
| Bicarbonate ($HCO_3^{-}$) | 155 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | 2600 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 9, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 50 | 2.50 | 5 |
| Magnesium ($Mg^{++}$) | 46 | 3.78 | 8 |
| Sodium ($Na^{+}$) | 1000 | 43.50 | 87 |
| Potassium ($K^{+}$) | 8.8 | 0.23 | 0 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1269 | 20.80 | 40 |
| Sulfate ($SO_4^{=}$) | 1085 | 22.59 | 44 |
| Chloride ($Cl^{-}$) | 284 | 8.01 | 16 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 5.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 700 | | |
| Magnesium (Acidified) | 251 | | |
| Total dissolved solids | 3182 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 51.40 | Total Cations (epm) | 50.01 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 5750 | Temperature (C) | 4.0 |
| pH | 8.0 | pH | 7.4 |
| Fluoride ($F^{-}$) | 0.8 ppm | Carbonate ($CO_3^{=}$) | 60 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1220 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 21.0 | 1.05 | 3 |
| Magnesium ($Mg^{++}$) | 63.0 | 5.19 | 15 |
| Sodium ($Na^{+}$) | 625.0 | 27.19 | 81 |
| Potassium ($K^{+}$) | 6.7 | 0.17 | 1 |
| Carbonate ($CO_3^{=}$) | 7.2 | 0.24 | 1 |
| Bicarbonate ($HCO_3^{-}$) | 503.0 | 8.24 | 27 |
| Sulfate ($SO_4^{=}$) | 800.0 | 16.66 | 54 |
| Chloride ($Cl^{-}$) | 198.0 | 5.58 | 18 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 30.8 | | |
| Magnesium (Acidified) | 55.0 | | |
| Total dissolved solids | 2070 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 30.74 | Total Cations (epm) | 33.59 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 3100 |
| pH | 8.4 |
| Fluoride ($F^{-}$) | 0.5 Mg/L |

Field:

| | | |
|---|---|---|
| Temperature (C) | 4.0 | |
| pH | 8.8 | |
| Carbonate ($CO_3^{=}$) | 38 | Mg/L |
| Bicarbonate ($HCO_3^{-}$) | 459 | Mg/L |
| Hydroxide ($OH^{-}$) | | |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 5, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 59.0 | 2.94 | 5.8 |
| Magnesium ($Mg^{++}$) | 65.0 | 5.35 | 10.5 |
| Sodium ($Na^{+}$) | 906.0 | 39.41 | 77.4 |
| Potassium ($K^{+}$) | 126.0 | 3.22 | 6.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 830.0 | 13.60 | 28.8 |
| Sulfate ($SO_4^{=}$) | 1155.0 | 24.05 | 50.9 |
| Chloride ($Cl^{-}$) | 340.0 | 9.59 | 20.3 |
| Nitrate ($NO_3^{=}$) | 0.1 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 3.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 50.0 | | |
| Magnesium (Acidified) | 58.0 | | |
| Total dissolved solids | 2942.0 | | |
| Total Anions (epm) | 47.24 | Total Cations (epm) | 50.93 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 4300 | Temperature (C) | 4.0 |
| pH | 8.2 | pH | 8.2 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 820.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Date sampled: July 14, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .046 |
| Au | <.003 | Mo | <.006 |
| Al | .22 | Na | 609 |
| As | <.038 | Ni | <.010 |
| B | .925 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 26.5 | Si | 0.73 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .604 |
| Cr | <.006 | Te | <.065 |
| Cu | .019 | Ti | .003 |
| Eu | <.015 | U | <.020 |
| Fe | .077 | V | .009 |
| K | 77 | W | <.078 |
| Mg | 54.0 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

2-46-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 99.0 | 4.94 | 10.6 |
| Magnesium(Mg) | 118.0 | 9.71 | 20.8 |
| Sodium(Na) | 733.0 | 31.88 | 68.3 |
| Potassium(K) | 6.7 | 0.17 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 359.0 | 5.88 | 11.7 |
| Sulphate(SO4) | 1535.0 | 31.96 | 63.5 |
| Chloride(Cl) | 442.0 | 12.46 | 24.8 |
| Nitrate(NO3) | 2.1 | 0.03 | 0.1 |
| Silica(SiO2) | 2.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 87.0 | | |
| Magnesium(Acidified) | 98.0 | | |
| TDS(mg/l) | 3058.0 | | |
| Total Anions(epm) | 50.34 | Total Cations(epm) | 46.71 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3700 | | Temperature(C) | 4.50 | |
| pH | 7.8 | | pH | 7.8 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 351 | mg/l |
| | | | Hydroxide(OH) | | |

2-46-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 4, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 67.0 | 3.34 | 6.5 |
| Magnesium(Mg) | 124.0 | 10.21 | 19.9 |
| Sodium(Na) | 865.0 | 37.63 | 73.4 |
| Potassium(K) | 4.2 | 0.11 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 610.0 | 10.00 | 20.2 |
| Sulphate(SO4) | 1672.0 | 34.81 | 70.4 |
| Chloride(Cl) | 164.0 | 4.62 | 9.3 |
| Nitrate(NO3) | 2.4 | 0.04 | 0.1 |
| Silica(SiO2) | 2.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 76.0 | | |
| Magnesium(Acidified) | 96.0 | | |
| TDS(mg/l) | 3390.0 | | |
| Total Anions(epm) | 49.47 | Total Cations(epm) | 51.28 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4070 | Temperature(C) | 5.00 | |
| pH | 8.1 | pH | 8.2 | |
| Fluoride(F) | 0.8 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 708 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 2-46-E-82

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 78.0 | 3.90 | 7.7 |
| Magnesium(Mg) | 93.0 | 7.75 | 15.3 |
| Sodium(Na) | 894.0 | 38.87 | 76.6 |
| Potassium(K) | 8.3 | 0.21 | 0.4 |
| Carbonate(CO3) | 13.0 | 0.43 | 0.9 |
| Bicarbonate(HCO3) | 271.0 | 4.44 | 8.8 |
| Sulphate(SO4) | 1400.0 | 29.17 | 57.8 |
| Chloride(Cl) | 580.0 | 16.34 | 32.4 |
| Nitrate(NO3) | 6.6 | 0.11 | 0.2 |
| Silica(SiO2) | 1.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 75.0 | | |
| Magnesium(Acidified) | 78.0 | | |
| TDS(mg/l) | 3308.0 | | |
| Total Anions(epm) | 50.49 | Total Cations(epm) | 50.73 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 48200 | Temperature | 5.00 | |
| pH | 8.7 | pH | 8.4 | |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | 10 | mg/l |
| | | Bicarbonate(HCO3) | 268 | mg/l |
| | | Hydroxide(OH) | | |

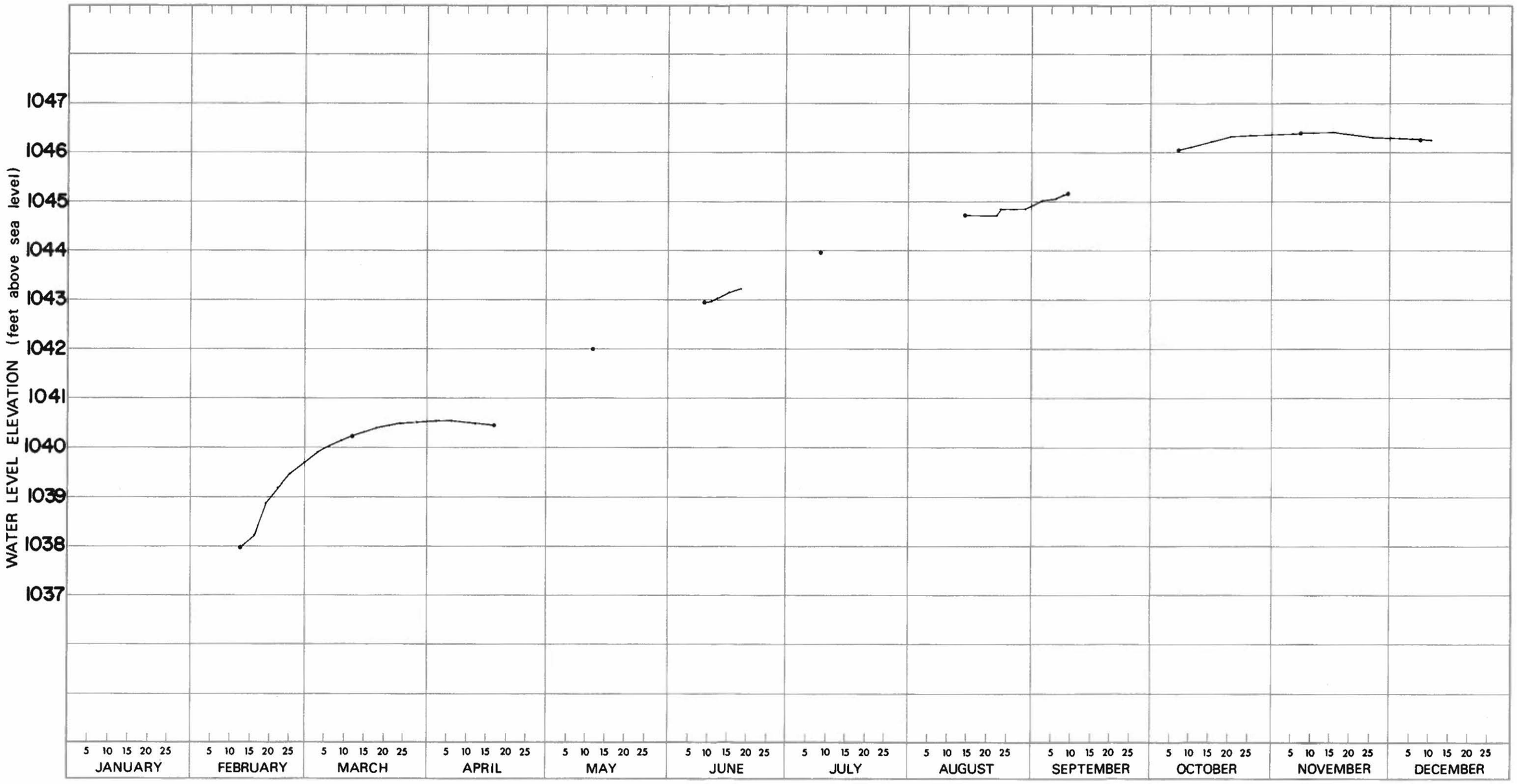
**WATER LEVEL HYDROGRAPH**

2-46-H-76

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council



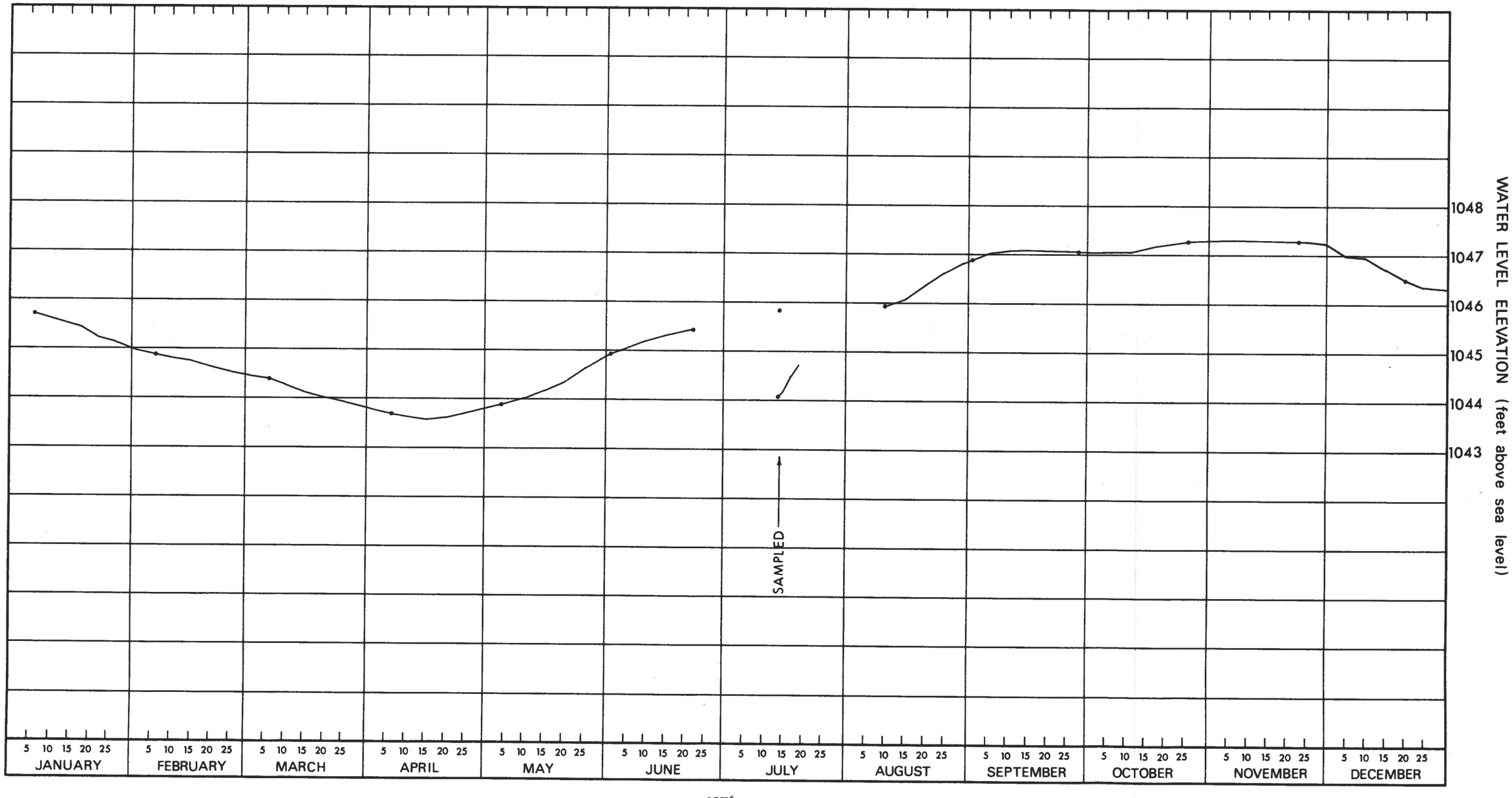
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **2-46**

Lsd **1** Sec **11** Twp **97** R **12** W4th

Alberta Research Council

**2 - 46 - H - 77**




1976

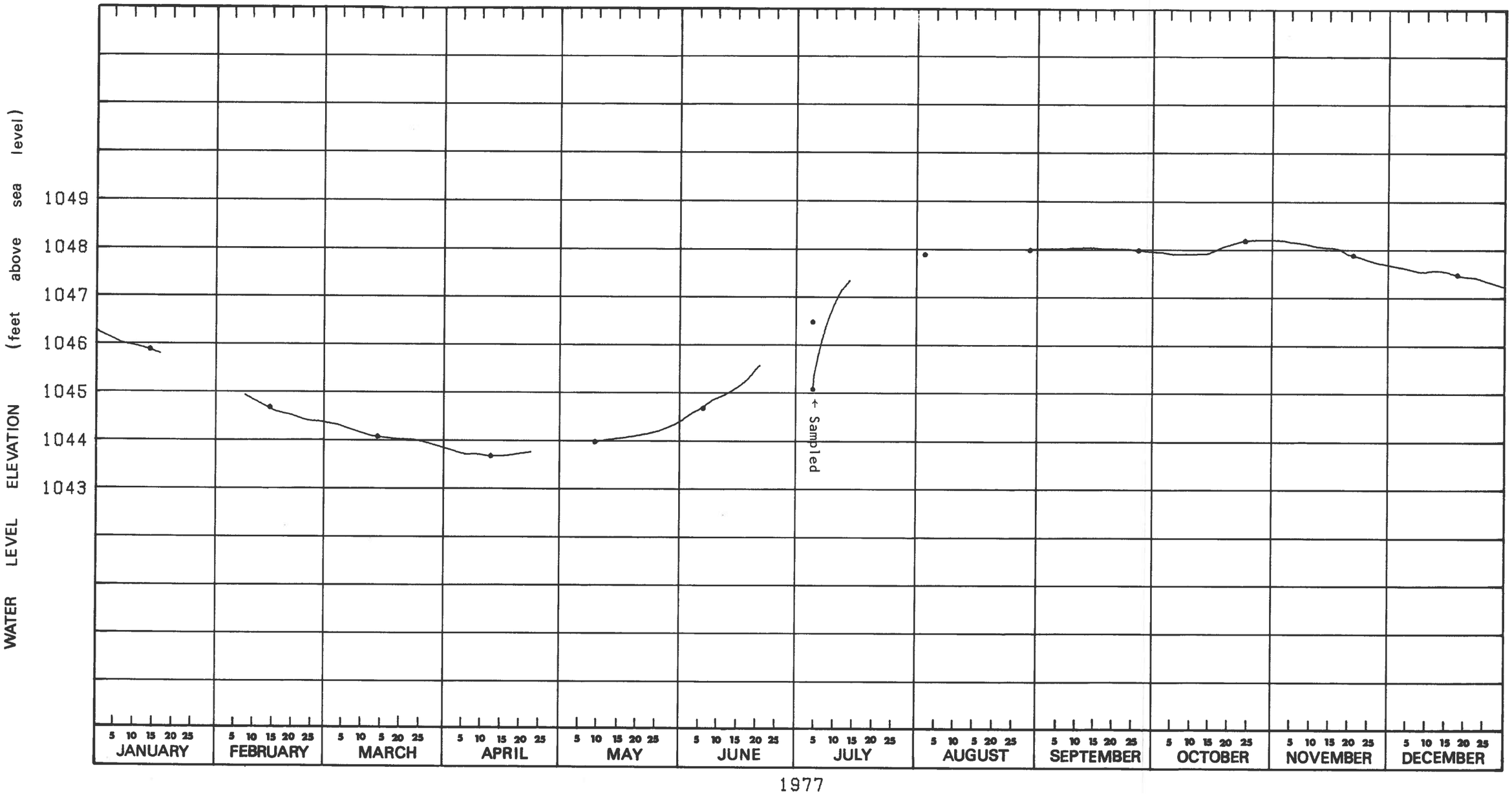
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-46-H-78




1977

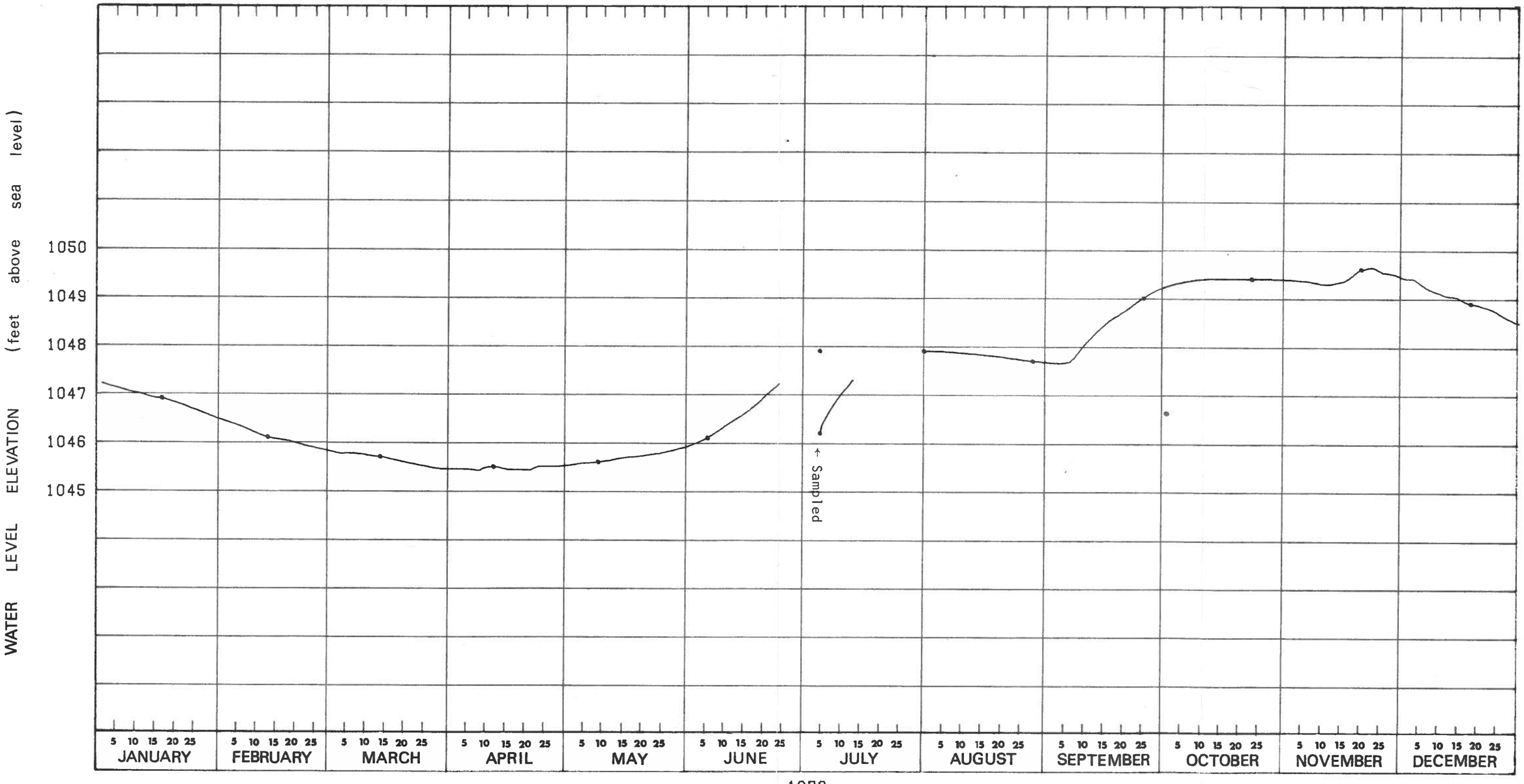
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-46

LSD 1 SEC 11 TWP 97 R 12 W4TH

Alberta Research Council

2-46-H-79




1978

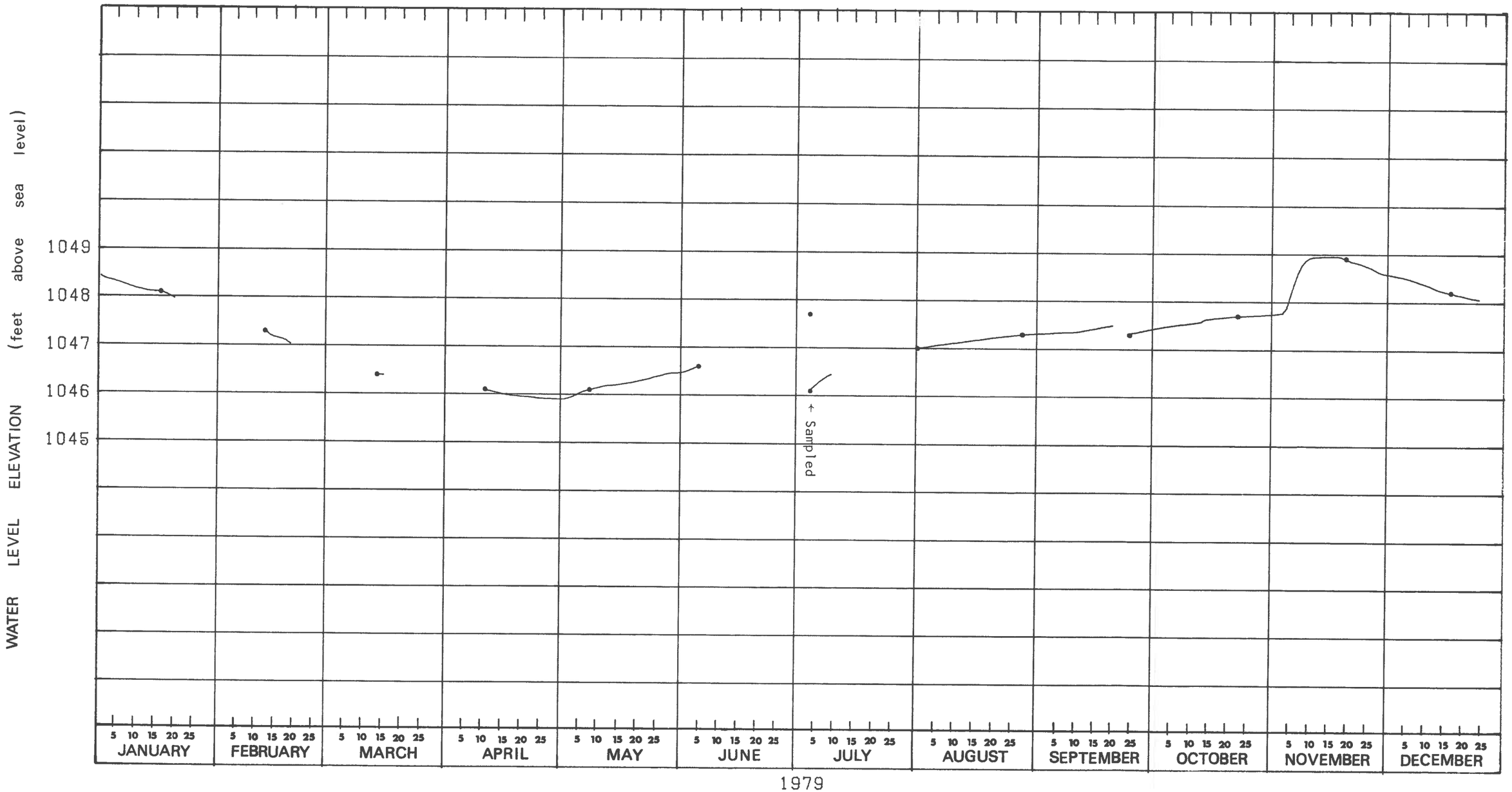
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-46-H-80




1979

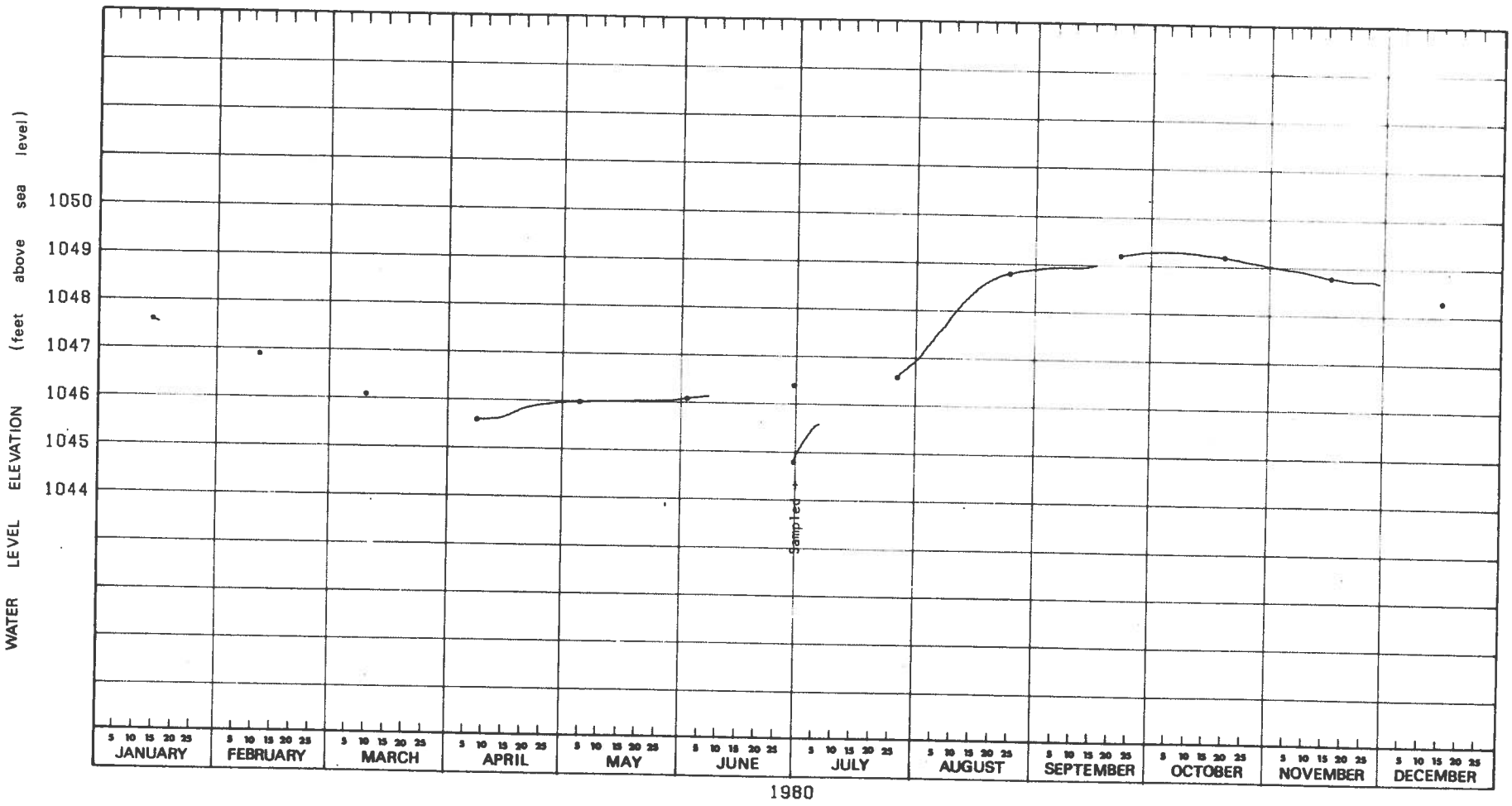
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-46-H-81



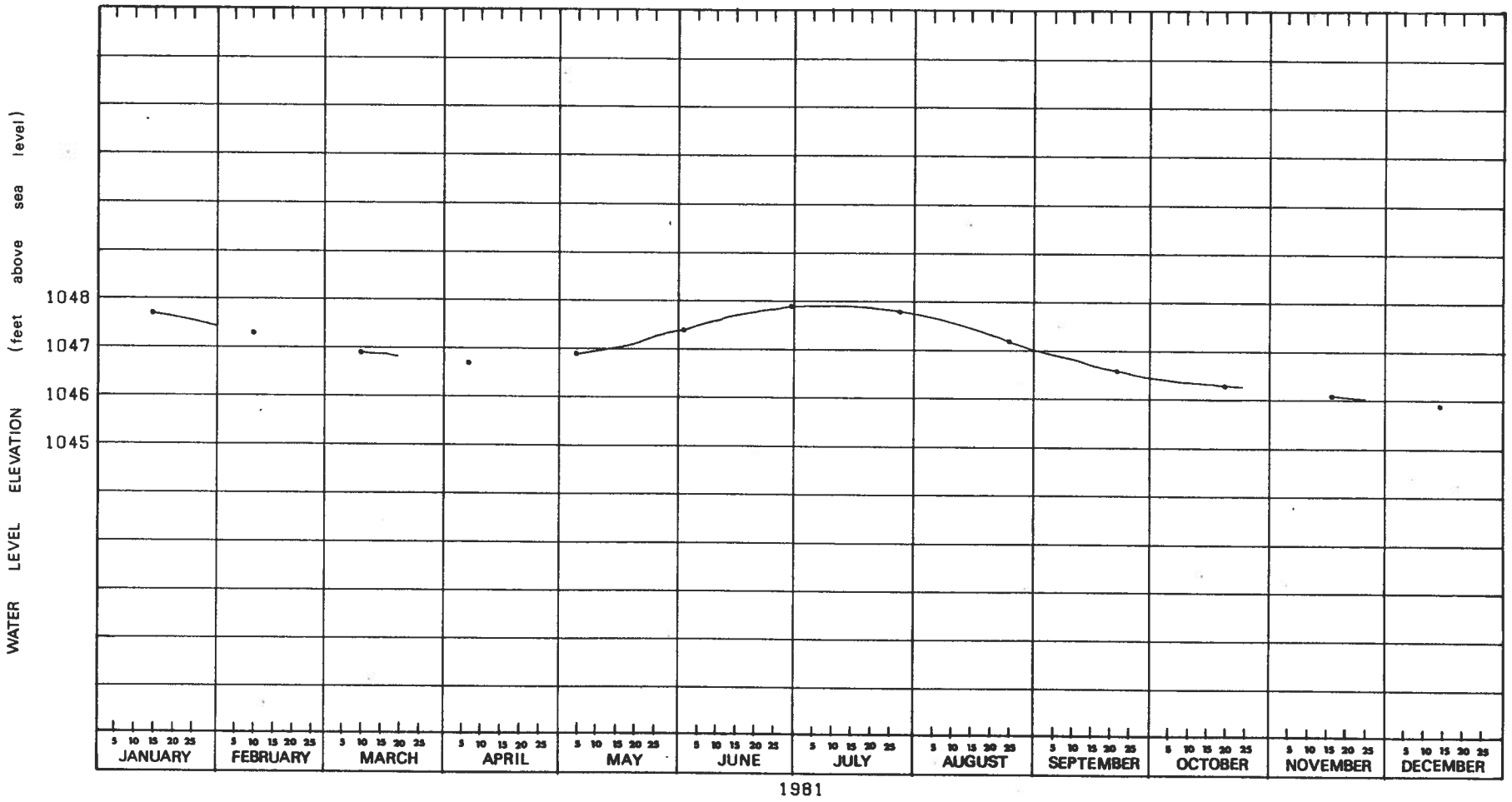
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-46-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/75 | | | Well completed |
| Jan 16/75 | 5.10 TOC | 1044.19 | Bail dry |
| Jan 17/75 | | | Water sample, bail |
| Jan 23/75 | 8.73 TOC | 1032.24 | |
| Jan 24/75 | 8.63 TOC | 1032.61 | Bail dry |
| Jan 26/75 | 8.54 TOC | 1032.91 | |
| Feb 13/75 | 7.64 MP | 1038.55 | Install recorder; install shelter MP = 2.69' TOC, (1063.61) |
| Mar 12/75 | 6.95 MP | 1040.81 | |
| Apr 17/75 | 6.87 MP | 1041.08 | |
| May 12/75 | 7.32 old MP | 1039.61 | New MP = 31" (1063.50) |
| June 9/75 | 6.27 MP | 1042.93 | |
| July 9/75 | 5.80 MP | 1044.48 | |
| Aug 14/75 | 5.57 MP | 1045.23 | |
| Sept 9/75 | 5.43 MP | 1045.68 | Sampled well; temp. 3°C |
| | 5.92 MP | 1044.08 | after sample |
| Oct 7/75 | 5.32 MP | 1046.05 | |
| Nov 6/75 | 5.21 MP | 1046.41 | |
| Dec 6/75 | 5.25 MP | 1046.28 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 5.42 MP | 1045.7 | MP (1063.5) |
| Feb 6/76 | 5.67 MP | 1044.9 | |
| Mar 6/76 | 5.82 MP | 1044.4 | |
| Apr 6/76 | 6.04 MP | 1043.7 | |
| May 4/76 | 5.98 MP | 1043.9 | |
| June 1/76 | 5.66 MP | 1044.9 | |
| June 22/76 | 5.51 MP | 1045.4 | |
| July 14/76 | 5.38 MP | 1045.8 | |
| | 5.92 MP | 1044.1 | After sample; temp. 4°C |
| Aug 10/76 | 5.35 MP | 1045.9 | |
| Sept 1/76 | 5.06 MP | 1046.9 | |
| Sept 28/76 | 5.01 MP | 1047.1 | |
| Oct 26/76 | 4.94 MP | 1047.3 | |
| Nov 23/76 | 4.95 MP | 1047.3 | |
| Dec 20/76 | 5.18 MP | 1046.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 5.37 MP | 1045.9 | MP (1063.5) |
| Feb 15/77 | 5.73 MP | 1044.7 | |
| Mar 15/77 | 5.92 MP | 1044.1 | |
| Apr 13/77 | 6.03 MP | 1043.7 | |
| May 10/77 | 5.95 MP | 1044.0 | |
| June 7/77 | 5.72 MP | 1044.7 | |
| July 5/77 | 5.17 MP | 1046.5 | |
| | 5.62 MP | 1045.1 | After sample; temp. 4°C |
| Aug 3/77 | 4.75 MP | 1047.9 | |
| Aug 30/77 | 4.72 MP | 1048.0 | |
| Sept 27/77 | 4.73 MP | 1048.0 | |
| Oct 25/77 | 4.67 MP | 1048.2 | |
| Nov 22/77 | 4.74 MP | 1047.9 | |
| Dec 19/77 | 4.86 MP | 1047.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 5.06 MP | 1046.9 | MP (1063.5) |
| Feb 13/78 | 5.29 MP | 1046.1 | |
| Mar 14/78 | 5.42 MP | 1045.7 | |
| Apr 12/78 | 5.49 MP | 1045.5 | |
| May 9/78 | 5.46 MP | 1045.6 | |
| June 6/78 | 5.29 MP | 1046.1 | |
| July 5/78 | 4.76 MP | 1047.9 | |
| | 5.26 MP | 1046.2 | After sample; temp. 4.5°C |
| Aug 1/78 | 4.76 MP | 1047.9 | |
| Aug 29/78 | 4.83 MP | 1047.7 | |
| Sept 26/78 | 4.42 MP | 1049.0 | |
| Oct 24/78 | 4.29 MP | 1049.4 | |
| Nov 21/78 | 4.25 MP | 1049.6 | |
| Dec 19/78 | 4.44 MP | 1048.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 4.69 MP | 1048.1 | MP (1063.5) |
| Feb 13/79 | 4.95 MP | 1047.3 | |
| Mar 14/79 | 5.20 MP | 1046.4 | |
| Apr 11/79 | 5.31 MP | 1046.1 | |
| May 8/79 | 5.29 MP | 1046.1 | |
| June 5/79 | 5.16 MP | 1046.6 | |
| July 4/79 | 4.82 MP | 1047.7 | |
| | 5.30 MP | 1046.1 | After sample; temp. 5°C |
| Aug 1/79 | 5.04 MP | 1047.0 | |
| Aug 28/79 | 4.95 MP | 1047.3 | |
| Sept 25/79 | 4.94 MP | 1047.3 | |
| Oct 23/79 | 4.83 MP | 1047.7 | |
| Nov 20/79 | 4.46 MP | 1048.9 | New MP 0.80m TOC (1063.5) |
| Dec 17/79 | 4.65 MP | 1048.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

2-46-W-82

WELL HISTORY

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 4.84 MP | 1047.6 | |
| Feb 12/80 | 5.07 MP | 1046.9 | |
| Mar 11/80 | 5.29 MP | 1046.1 | |
| Apr 9/80 | 5.46 MP | 1045.6 | |
| May 6/80 | 5.34 MP | 1046.0 | |
| June 3/80 | 5.31 MP | 1046.1 | |
| July 1/80 | 5.22 MP | 1046.4 | Temp. 5°C |
| | 5.71 MP | 1044.8 | After Sample |
| July 28/80 | 5.16 MP | 1046.6 | |
| Aug 26/80 | 4.48 MP | 1048.8 | |
| Sept 24/80 | 4.37 MP | 1049.2 | |
| Oct 21/80 | 4.37 MP | 1049.2 | |
| Nov 18/80 | 4.48 MP | 1048.8 | |
| Dec 17/80 | 4.63 MP | 1048.3 | |
| Jan 15/81 | 4.82 MP | 1047.7 | |
| Feb 10/81 | 4.95 MP | 1047.3 | |
| Mar 10/81 | 5.07 MP | 1046.9 | |
| Apr 7/81 | 5.12 MP | 1046.7 | |
| May 5/81 | 5.07 MP | 1046.9 | |
| June 2/81 | 4.91 MP | 1047.4 | |
| June 30/81 | 4.77 MP | 1047.9 | |
| July 28/81 | 4.79 MP | 1047.8 | |
| Aug 25/81 | 4.97 MP | 1047.2 | |
| Sept 22/81 | 5.16 MP | 1046.6 | |
| Oct 20/81 | 5.23 MP | 1046.3 | |
| Nov 17/81 | 5.32 MP | 1046.1 | |
| Dec 15/81 | 5.36 MP | 1045.9 | |

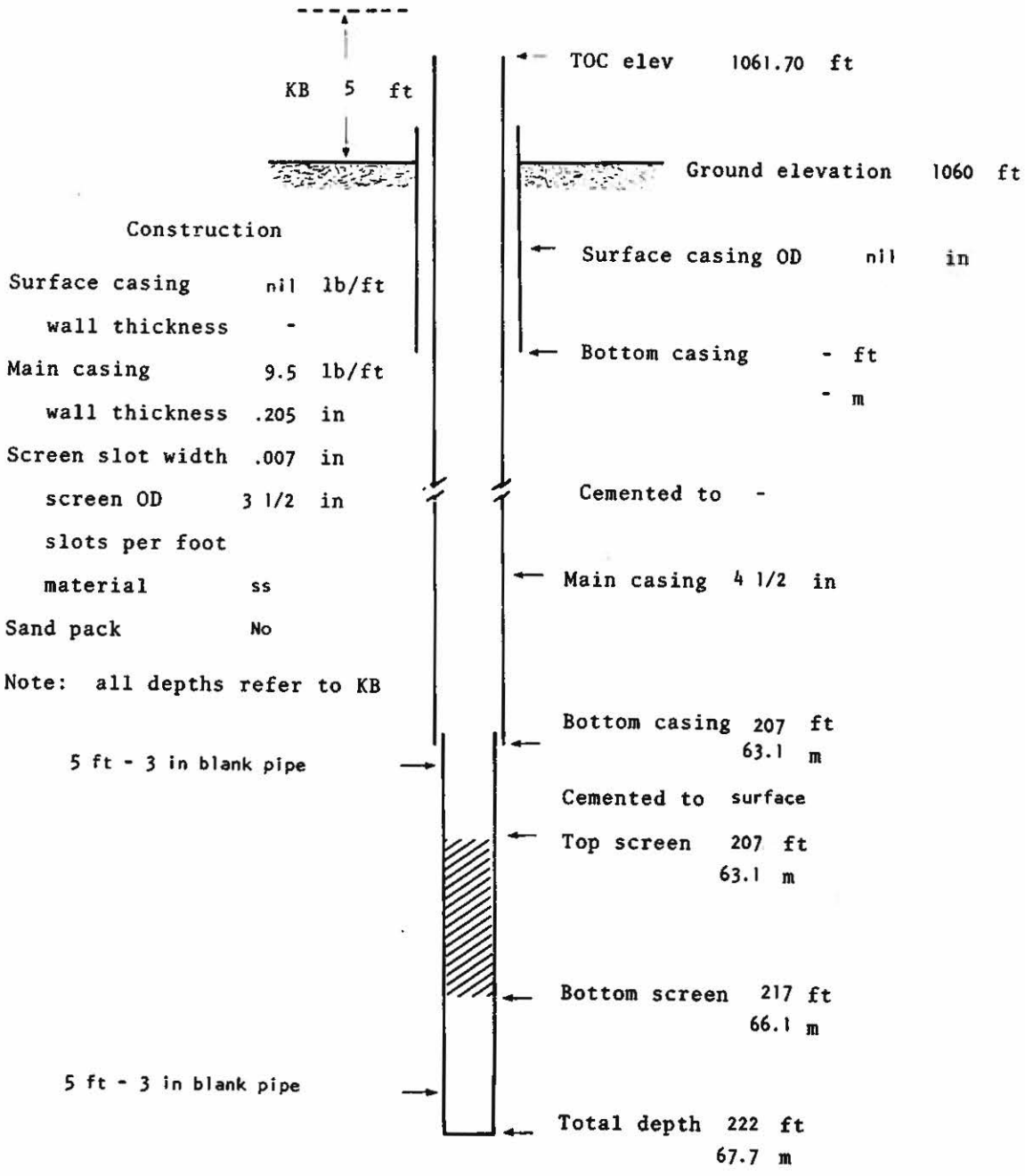
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Tp 97 R 12 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | nil | lb/ft |
| wall thickness | - | |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

# DRILL STEM TEST

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Tp 97 R 12 W4th

Alberta Research Council

Elevation: gl 1060
KB 1062

Type of test - Casing Positrieve

Date of test March 14, 1975

Testing company Johnston Testers

## TEST DATA

| | | |
|---|---|---|
| Time started | 0940 | hrs |
| Tool opened | 1005 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 30 | min |
| Pulled loose at | 1145 | hrs |
| Out of hole at | 1200 | hrs |
| Wt on packers | 2000 | lbs |

Description of blow Strong initial puff, strong blow, gas to surface in two minutes.

Total water recovered 60 ft

Water sample No. DH 14

Gas blow Yes, T S T M

Remarks Test satisfactory
4-1/2" RBP @ 191'
3-1/8" MFE @ 189'

## HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 207-217

Formation tested Clearwater

## TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.05 | |
| MFE Tool | 10.05 | |
| Sub | 0.65 | |
| Positrieve Packer | 1.35 | 4-1/2 IN |
| Total | 13.10 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Total Interval | 11.20 | |

## PRESSURE DATA (psi)

| | | |
|---|---|---|
| Instrument No. | | RPG-92N |
| Capacity (psig) | | 431 |
| Instrument set at (ft) | | 195 |
| Initial hydrostatic | A | 39 |
| First flow | B | 16 |
| | B1 | 16 |
| Initial shut in | C | 27 |
| Second flow | D | 21 |
| | D1 | 24 |
| Final shut in | G | 29 |
| Final hydrostatic | H | 39 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

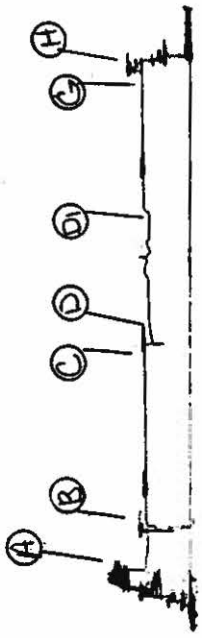
OBSERVATION WELL NUMBER 2-222

PRESSURE INCREMENTS

Recorder RPG-92N

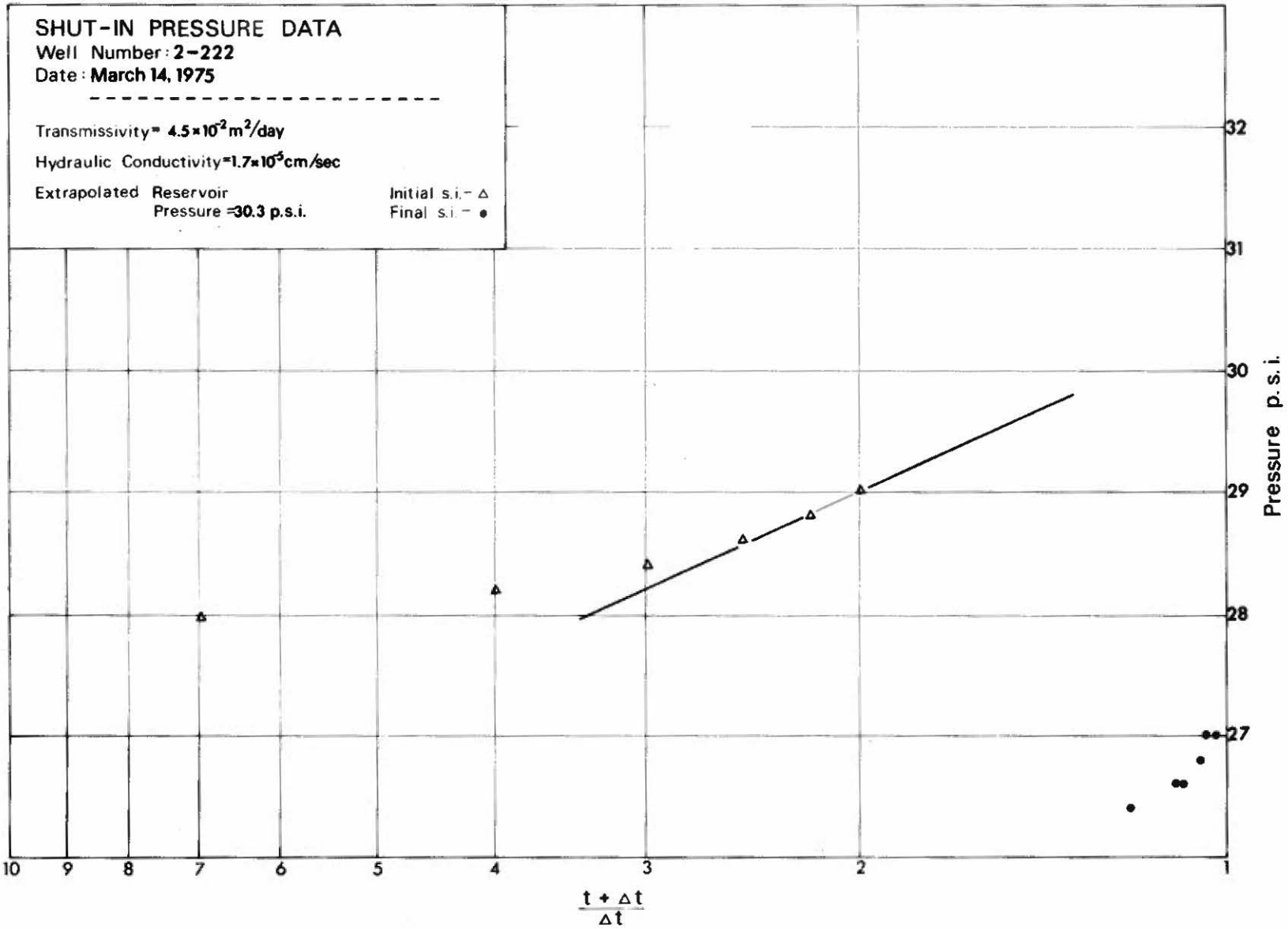
Initial Shut In

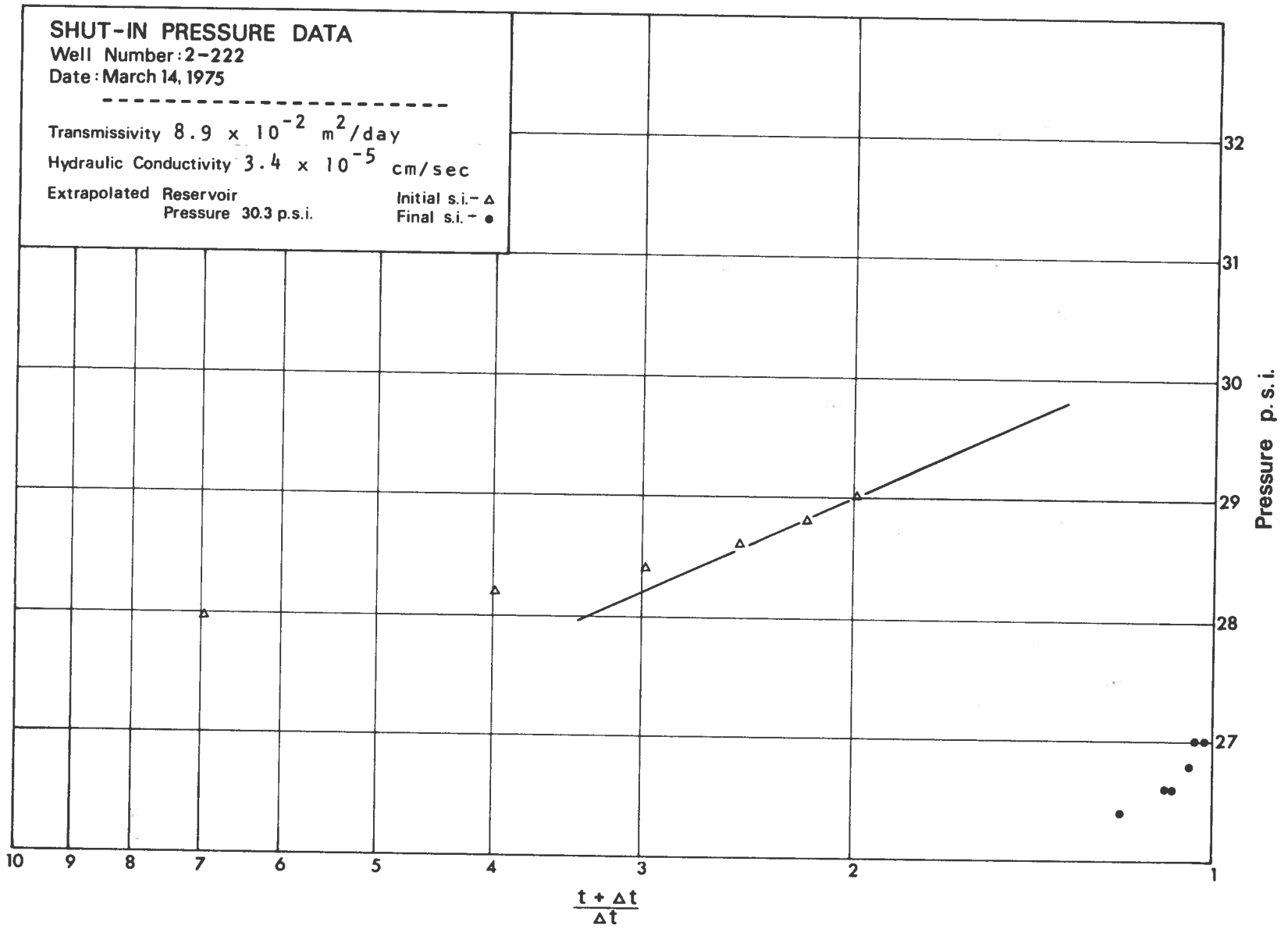
| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 0 | 16 | --- |
| 5 | 26.4 | 1.20 |
| 10 | 26.6 | 1.10 |
| 15 | 26.6 | 1.07 |
| 20 | 26.8 | 1.05 |
| 25 | 27.0 | 1.04 |
| 30 | 27.0 | 1.033 |



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 0 | 24.0 | --- |
| 5 | 28.0 | 7.00 |
| 10 | 28.2 | 4.00 |
| 15 | 28.4 | 3.00 |
| 20 | 28.6 | 2.50 |
| 25 | 28.8 | 2.20 |
| 30 | 29.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 2-222
Date: March 14, 1975
Transmissivity= 4.5×10⁻² m²/day
Hydraulic Conductivity=1.7×10⁻⁵ cm/sec
Extrapolated Reservoir Pressure =30.3 p.s.i.
Initial s.i.- Δ
Final s.i. - •
32
31
30
29
28
27
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt


SHUT-IN PRESSURE DATA
Well Number: 2-222
Date: March 14, 1975
Transmissivity 8.9 x 10^-2 m^2/day
Hydraulic Conductivity 3.4 x 10^-5 cm/sec
Extrapolated Reservoir Pressure 30.3 p.s.i.
Initial s.i. - △
Final s.i. - ●
32
31
30
29
28
27
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

2-222-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Drill stem test on 2-222

Date sampled March 14, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 54.0 | 2.69 | 1.1 |
| Magnesium ($Mg^{++}$) | 152.0 | 12.50 | 5.1 |
| Sodium ($Na^{+}$) | 5225.0 | 227.27 | 93.3 |
| Potassium ($K^{+}$) | 44.6 | 1.14 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.0 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 3916.0 | 64.19 | 25.2 |
| Sulfate ($SO_4^{=}$) | 32.3 | 0.67 | 0.3 |
| Chloride ($Cl^{-}$) | 6720.0 | 189.51 | 74.5 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 16.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 14536.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 254.383 | Total Cations (epm) | 243.608 |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 8000 + |
| pH | 7.9 |
| Fluoride ($F^{-}$) | 0.5 ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 7.4 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 4368 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed from 2-222

Date sampled January 17, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 19.1 | 0.95 | 0.4 |
| Magnesium ($Mg^{++}$) | 137.0 | 11.27 | 4.6 |
| Sodium ($Na^{+}$) | 5300.0 | 230.54 | 94.6 |
| Potassium ($K^{+}$) | 39.6 | 1.01 | .4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 3733.0 | 61.19 | 24.5 |
| Sulfate ($SO_4^{=}$) | 16.2 | 0.34 | 0.1 |
| Chloride ($Cl^{-}$) | 6680.0 | 188.38 | 75.4 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0.0 |
| Silica ($SiO_2$) | 8.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 13976.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 249.925 | Total Cations (epm) | 243.768 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 8000 + | Temperature (C) | 2.8 | |
| pH | 8.2 | pH | 7.1 | |
| Fluoride ($F^{-}$) | 0.40 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 4100 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Drill stem test on well 2-222

Date of sampling March 14, 1975

Total dissolved solids 14,536 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | 0.03 | Mg | .005 |
| As | <.01 | Mn | ND |
| B | .01 | Mo | ND |
| Ba | .02 | Ni | .006 |
| Be | ND | Pb | .005 |
| Bi | ND | Sb | ND |
| Ca | .05 | Si | .04 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .002 | V | ND |
| Fe | .02 | Zn | .05 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Flowing under gas pressure

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 94.0 | 4.69 | 2 |
| Magnesium ($Mg^{++}$) | 193.0 | 15.88 | 6 |
| Sodium ($Na^{+}$) | 5575.0 | 242.50 | 92 |
| Potassium ($K^{+}$) | 38.3 | 0.98 | 0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 4135.0 | 67.78 | 25 |
| Sulfate ($SO_4^{=}$) | 6.2 | 0.13 | 0 |
| Chloride ($Cl^{-}$) | 7300.0 | 205.87 | 75 |
| Nitrate ($NO_3^{=}$) | 1.3 | 0.02 | 0 |
| Silica ($SiO_2$) | 8.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 133.1 | | |
| Magnesium (Acidified) | 167.2 | | |
| Total dissolved solids | 15060 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 273.79 | Total Cations (epm) | 264.05 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 78000 |
| pH | 7.9 |
| Fluoride ($F^{-}$) | 0.5 Mg/L |

Field:

| | |
|---|---|
| Temperature (C) | 9.0 |
| pH | 7.4 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | 4367 Mg/L |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Flowing under gas pressure

Date sampled July 5, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 117.0 | 5.84 | 2.3 |
| Magnesium ($Mg^{++}$) | 136.0 | 11.19 | 4.3 |
| Sodium ($Na^{+}$) | 5500.0 | 239.23 | 92.3 |
| Potassium ($K^{+}$) | 118.0 | 3.02 | 1.2 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 4124.0 | 67.60 | 25.2 |
| Sulfate ($SO_4^{=}$) | 12.8 | 0.27 | 0.1 |
| Chloride ($Cl^{-}$) | 7100.0 | 200.23 | 74.7 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 8.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 104.0 | | |
| Magnesium (Acidified) | 127.0 | | |
| Total dissolved solids | 14640.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 268.09 | Total Cations (epm) | 259.29 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 11.0 |
| pH | 7.4 | pH | 7.4 |
| Fluoride ($F^{-}$) | 0.8 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 3806.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Date sampled: July 14, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .058 |
| Au | <.003 | Mo | <.006 |
| Al | .33 | Na | 4939 |
| As | <.038 | Ni | <.010 |
| B | 3.78 | P | 0.88 |
| Ba | 10.9 | Pb | <.088 |
| Be | .001 | Se | <.060 |
| Ca | 113 | Si | 3.56 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 10.85 |
| Cr | <.006 | Te | <.065 |
| Cu | .018 | Ti | .005 |
| Eu | <.015 | U | <.020 |
| Fe | 0.14 | V | .018 |
| K | 198 | W | <.078 |
| Mg | 153 | Zn | 0.11 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Date sampled: July 14, 1976
(duplicate of other sample of this date)

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .075 |
| Au | <.003 | Mo | <.006 |
| Al | 0.44 | Na | 5544 |
| As | <.038 | Ni | <.010 |
| B | 3.88 | P | 0.77 |
| Ba | 11.99 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 122 | Si | 3.6 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 11.7 |
| Cr | <.006 | Te | <.065 |
| Cu | .014 | Ti | .006 |
| Eu | <.015 | U | <.020 |
| Fe | .014 | V | .019 |
| K | 176 | W | <.078 |
| Mg | 164 | Zn | 5.85 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 76.0 | 3.79 | 1.5 |
| Magnesium(Mg) | 136.0 | 11.19 | 4.4 |
| Sodium(Na) | 5475.0 | 238.15 | 93.6 |
| Potassium(K) | 45.8 | 1.17 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 4441.0 | 72.79 | 25.9 |
| Sulphate(SO4) | 2.0 | 0.04 | 0.0 |
| Chloride(Cl) | 7400.0 | 208.69 | 74.1 |
| Nitrate(NO3) | 1.1 | 0.02 | 0.0 |
| Silica(SiO2) | 7.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 63.0 | | |
| Magnesium(Acidified) | 85.0 | | |
| TDS(mg/l) | 15032.0 | | |
| Total Anions(epm) | 281.54 | Total Cations(epm) | 254.30 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 21000 | | Temperature(C) | 7.00 | |
| pH | 7.4 | | pH | 7.0 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 4660 | mg/l |
| | | | Hydroxide(OH) | | |

2-222-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 4, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 70.0 | 3.49 | 1.6 |
| Magnesium(Mg) | 120.0 | 9.88 | 4.4 |
| Sodium(Na) | 4825.0 | 209.87 | 93.7 |
| Potassium(K) | 25.0 | 0.64 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 3611.0 | 59.19 | 25.3 |
| Sulphate(SO4) | 16.2 | 0.34 | 0.1 |
| Chloride(Cl) | 6200.0 | 174.84 | 74.6 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 5.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 73.0 | | |
| Magnesium(Acidified) | 111.0 | | |
| TDS(mg/l) | 12604.0 | | |
| Total Anions(epm) | 234.37 | Total Cations(epm) | 223.88 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 18400 | Temperature(C) | 0.00 | |
| pH | 7.6 | pH | 7.2 | |
| Fluoride(F) | 0.7 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 3660 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 2-222-E-82

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 74.0 | 3.70 | 1.6 |
| Magnesium(Mg) | 14.0 | 1.17 | 0.5 |
| Sodium(Na) | 5150.0 | 223.91 | 97.3 |
| Potassium(K) | 48.0 | 1.23 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 3531.0 | 57.89 | 24.1 |
| Sulphate(SO4) | 6.0 | 0.13 | 0.1 |
| Chloride(Cl) | 6450.0 | 181.69 | 75.8 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 2.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 73.0 | | |
| Magnesium(Acidified) | 11.7 | | |
| TDS(mg/l) | 13308.0 | | |
| Total Anions(epm) | 239.70 | Total Cations(epm) | 230.01 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 21000 |
| pH | 8.3 |
| Fluoride | 0.4 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | -1.00 | |
| pH | 7.5 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 4021 | mg/l |
| Hydroxide(OH) | | |

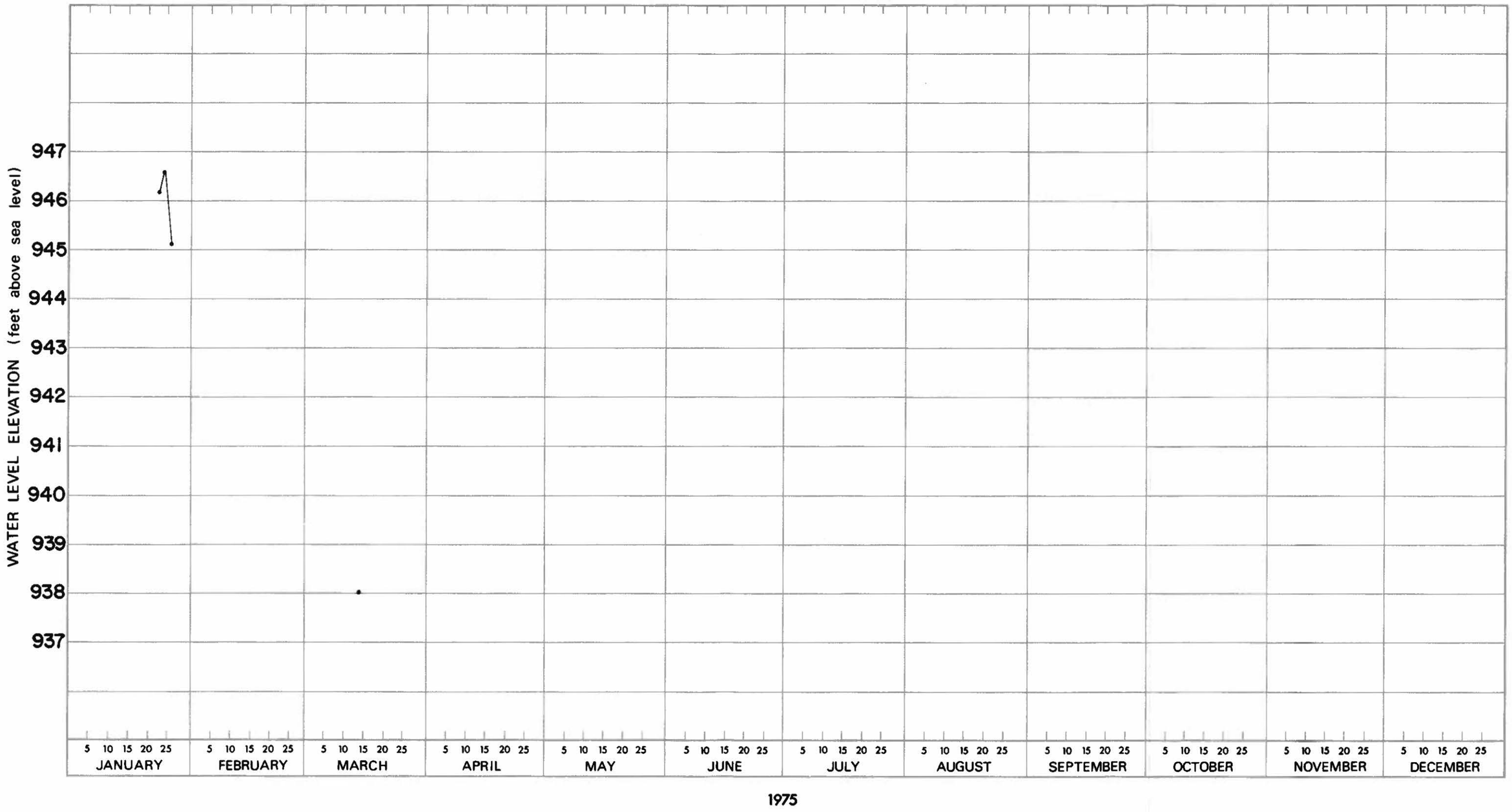
WATER LEVEL HYDROGRAPH

2-222-H-76

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council



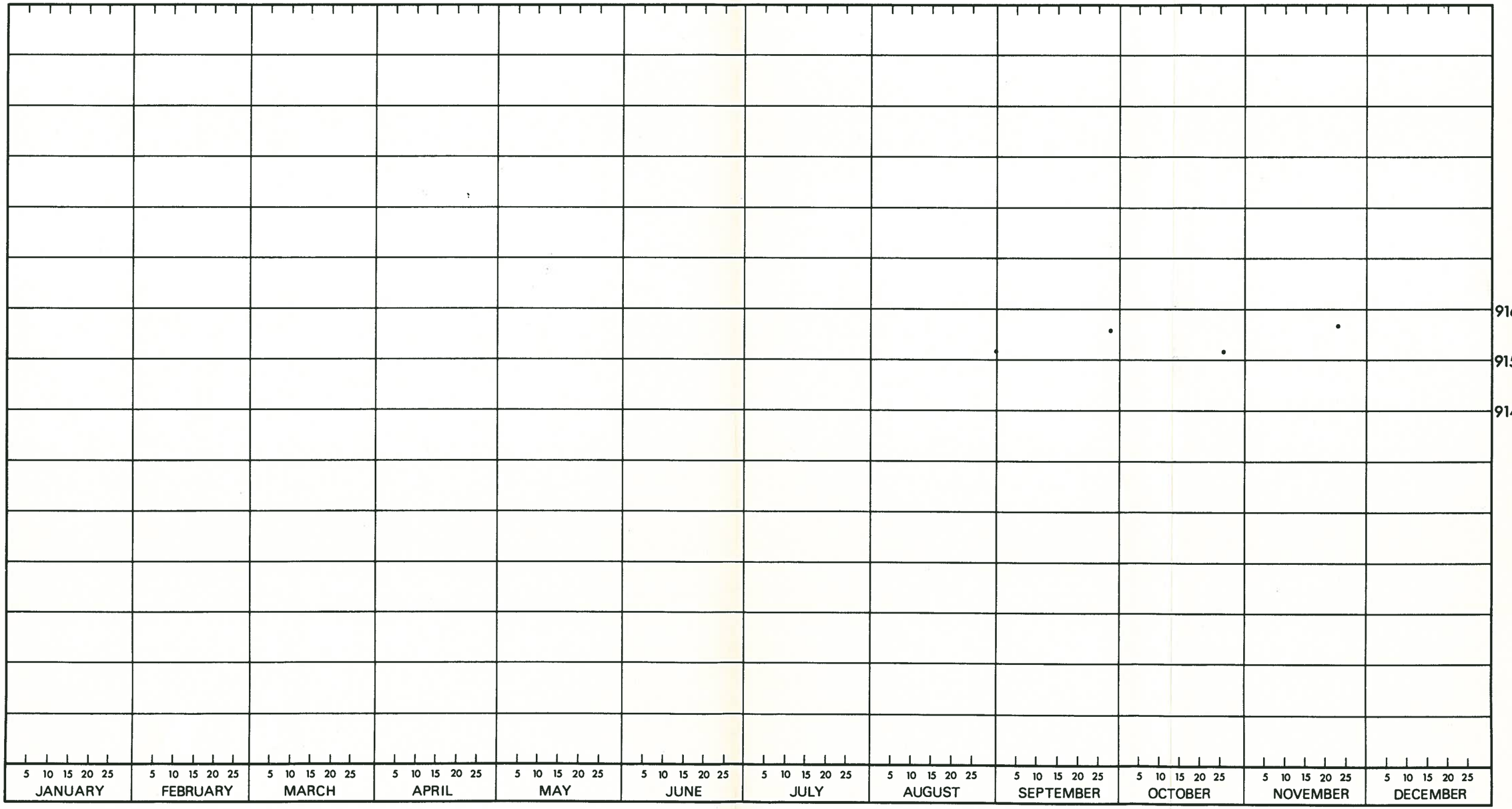
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **2-222**

Lsd **1** Sec **11** Twp **97** R **12** W4th

Alberta Research Council

**2 - 222 - H - 77**




1976

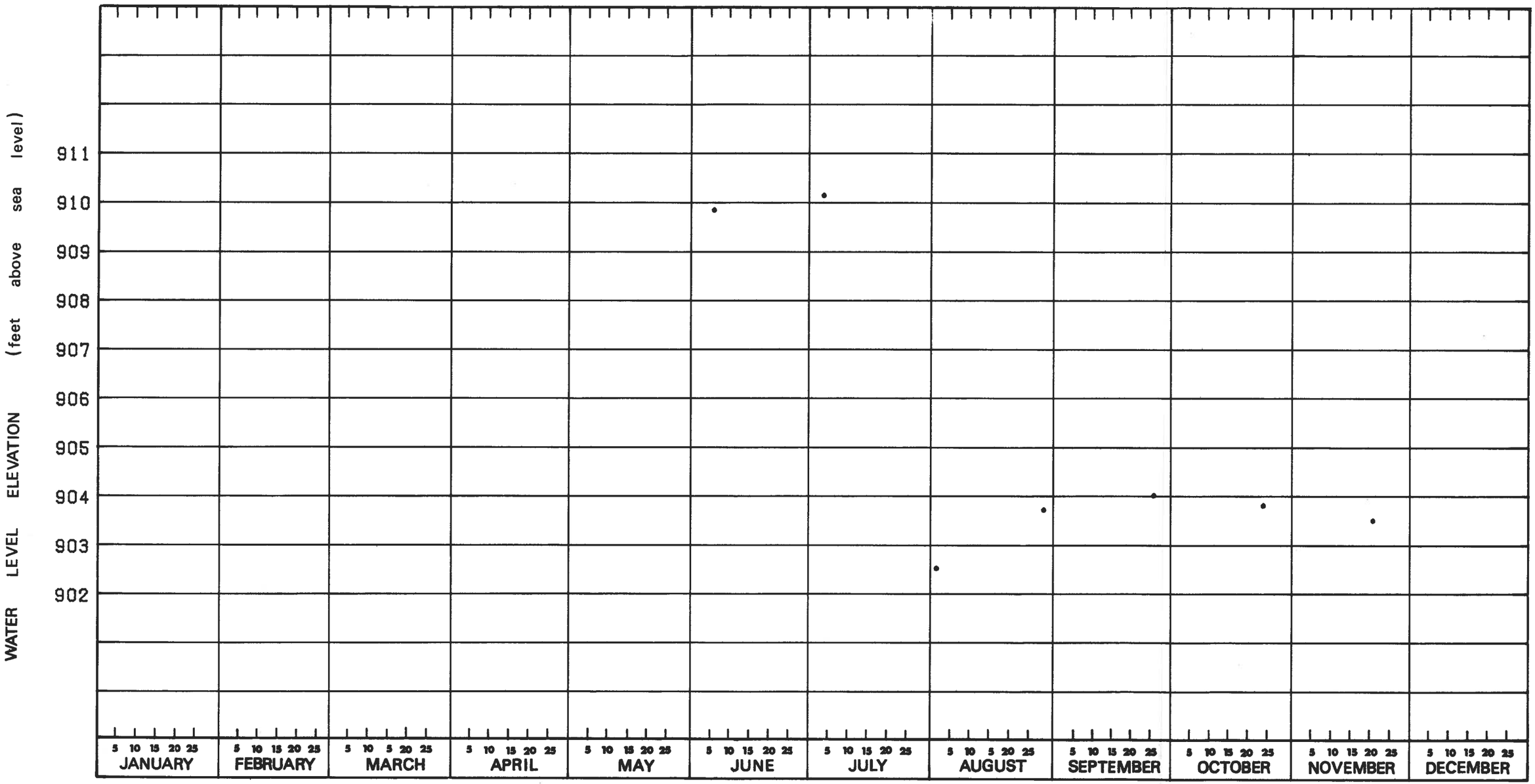
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-222-H-78




1977

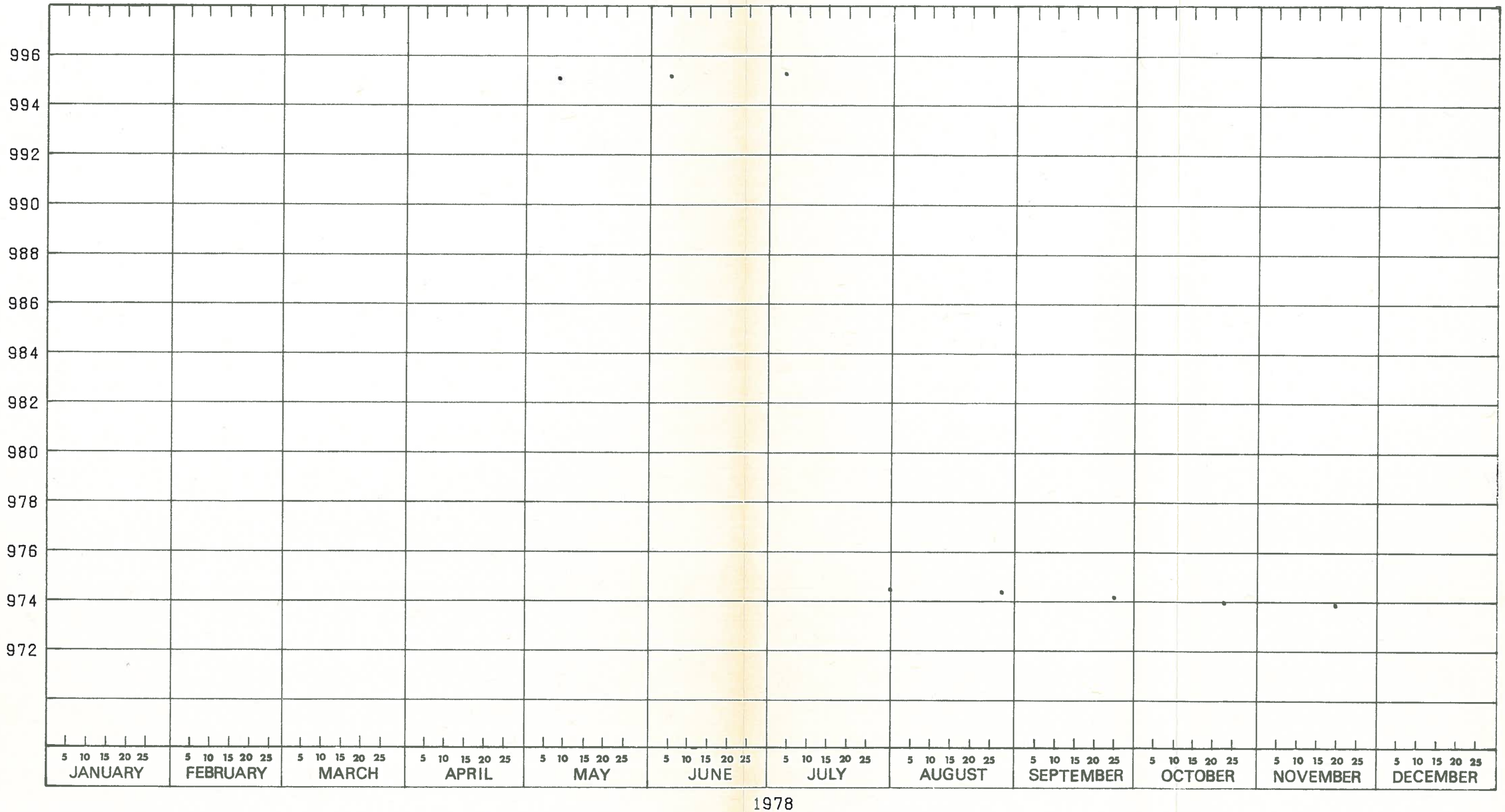
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-222

LSD 1 SEC 11 TWP 97 R 12 W4TH

Alberta Research Council

2-222-H-79




1978

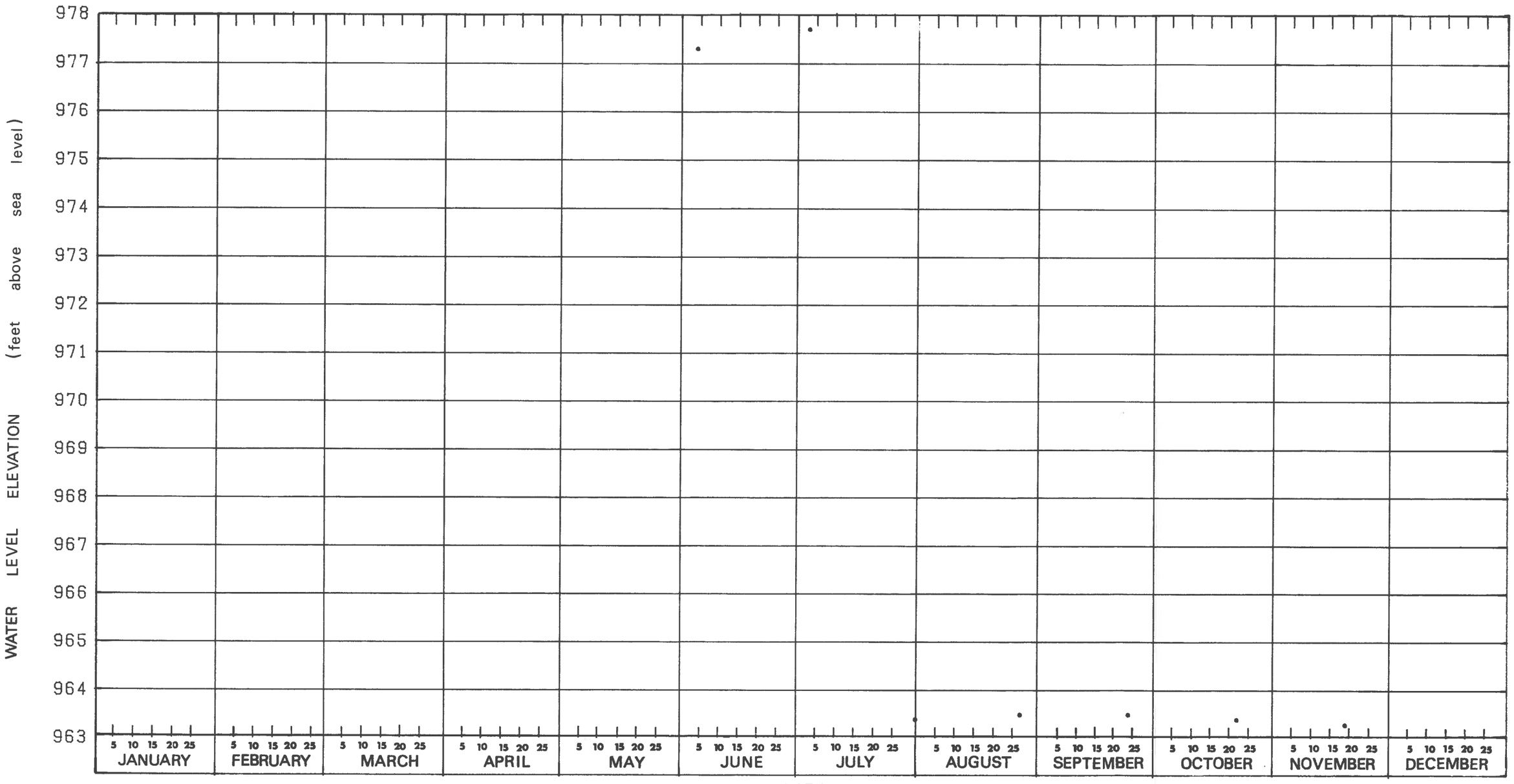
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-222-H-80



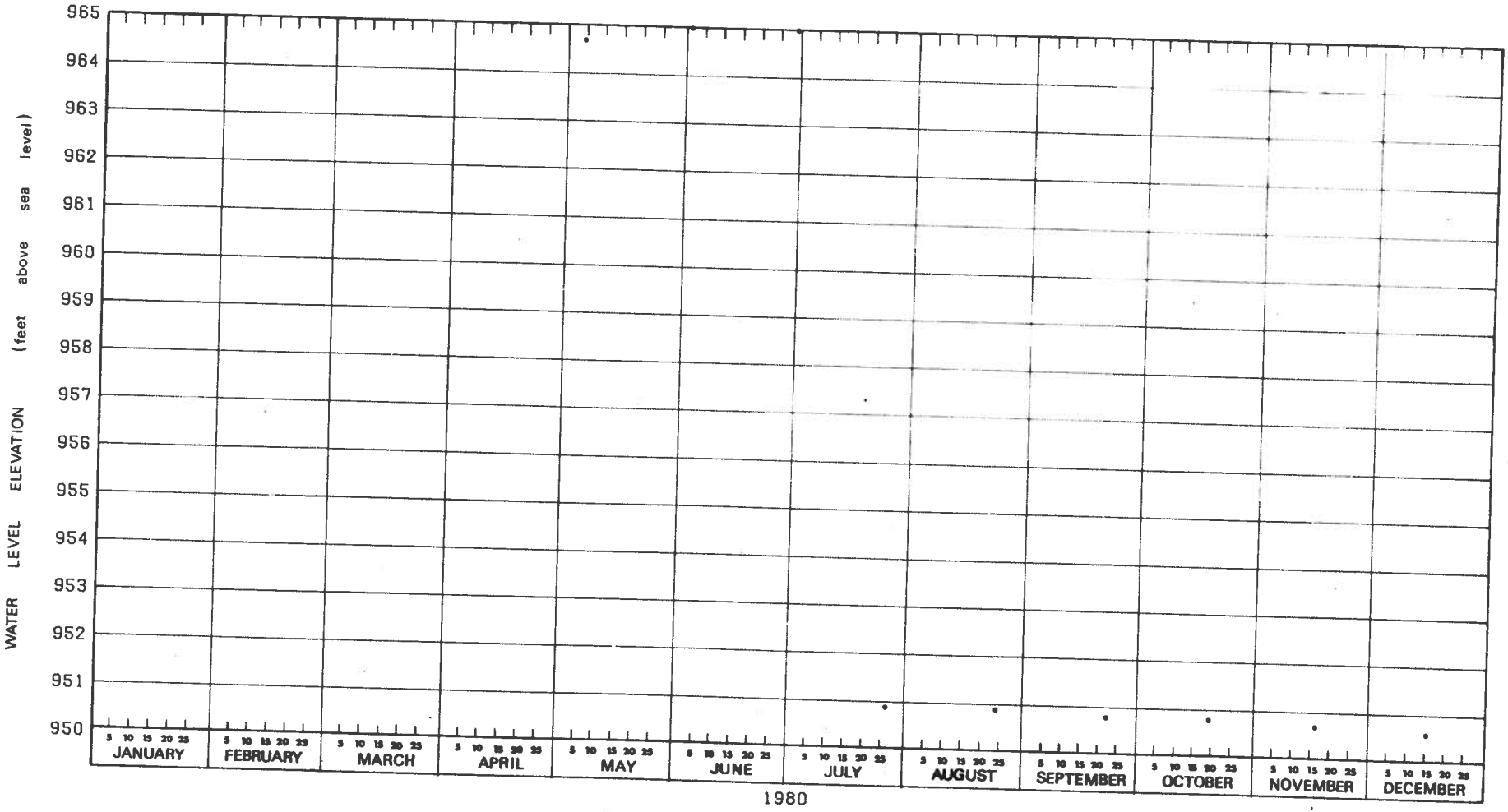
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-222-H-81



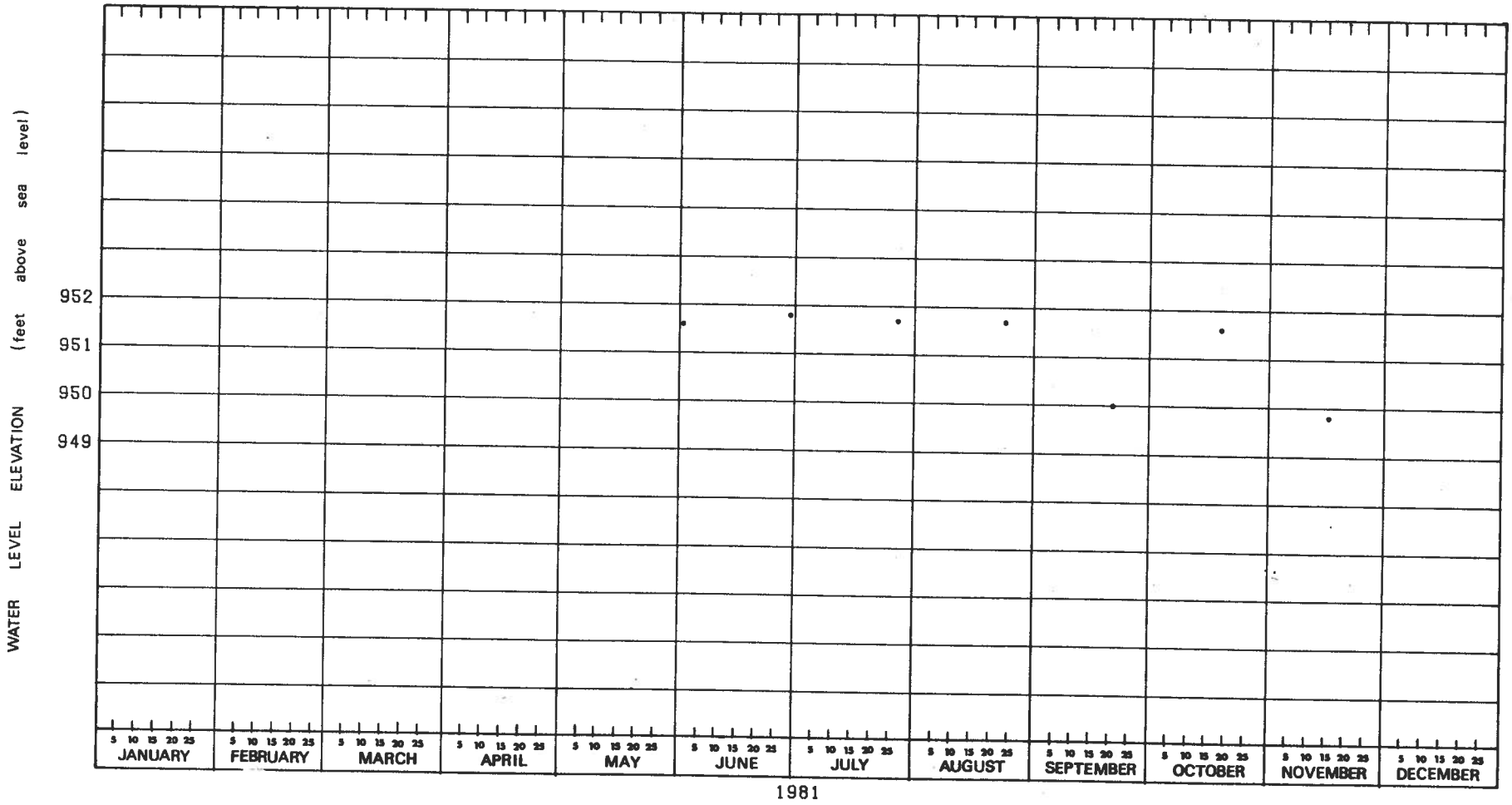
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-222-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1062.95 (Until Feb 27/75)
1061.70 (After Feb 27/75)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 12/75 | | | Well completed |
| Jan 17/75 | | | Water sample |
| Jan 23/75 | 35.22 TOC | 946.15 | |
| Jan 24/75 | 35.09 TOC | 946.57 | |
| Jan 26/75 | 35.54 TOC | 945.10 | Bailed; gas flow to surface |
| Feb 14/75 | | | Gas flow still |
| Feb 27/75 | | | Flange welded on casing to seal; gas flow |
| Mar 14/75 | | | DST; water sample; FSI = 29# from 195'; gas sample; reinstall shelter |
| Apr 17/75 | | | MP = 225' TOC, (1063.95) |
| May 12/75 | | | Gas |
| June 9/75 | | | Gas |
| | | | No measurements in 1975 due to gas flow. |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.70

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| June 1/76 | 51 TOC approx | | In casing; install plastic pipe |
| | 38 TOC approx | | In plastic pipe |
| July 14/76 | | | Sampled; temp. 9°C |
| Aug 10/76 | >62.1 TOC approx | | End of plastic pipe |
| Sept 1/76 | 39.60 TOC approx | | Inside casing; gas lifting water |
| | 44.65 TOC | 915.2 | Inside plastic pipe |
| Sept 28/76 | 44.55 TOC | 915.6 | |
| Oct 26/76 | 44.65 TOC | 915.2 | |
| Nov 23/76 | 44.52 TOC | 915.7 | |
| Dec 20/76 | | | Frost in pipe<br>Could not measure |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.70

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | | | Could not measure |
| Feb 15/77 | | | Could not measure |
| Mar 15/77 | | | Could not measure |
| Apr 13/77 | | | Could not measure |
| May 10/77 | | | Could not measure; frost in pipe at 1.9 m |
| June 7/77 | 46.29 TOC | 909.9 | |
| July 5/77 | 46.20 TOC | 910.2 | Sampled; temp. 11°C |
| Aug 3/77 | 48.51 TOC | 902.6 | |
| Aug 30/77 | 48.15 TOC | 903.8 | |
| Sept 27/77 | 48.05 TOC | 904.1 | |
| Oct 25/77 | 48.11 TOC | 903.9 | |
| Nov 22/77 | 48.20 TOC | 903.6 | |
| Dec 19/77 | | | Could not measure |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.70

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | | | Could not measure |
| Feb 13/78 | | | Could not measure |
| Mar 14/78 | | | Could not measure |
| Apr 12/78 | | | Could not measure |
| May 9/78 | 20.29 TOC | 995.1 | |
| June 6/78 | 20.27 TOC | 995.2 | |
| July 5/78 | 20.25 TOC | 995.3 | Sampled; temp. 7°C |
| Aug 1/78 | 26.57 TOC | 974.5 | |
| Aug 29/78 | 26.62 TOC | 974.4 | |
| Sept 26/78 | 26.68 TOC | 974.2 | |
| Oct 24/78 | 26.73 TOC | 974.0 | |
| Nov 21/78 | 26.76 TOC | 973.9 | |
| Dec 19/78 | | | Could not measure |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.70

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | | | Could not measure |
| Feb 13/79 | | | Could not measure |
| Mar 14/79 | | | Could not measure |
| Apr 11/79 | | | Could not measure |
| May 8/79 | | | Could not measure |
| June 5/79 | 25.72 TOC | 977.3 | |
| July 4/79 | 25.61 TOC | 977.7 | |
| Aug 1/79 | 29.96 TOC | 963.4 | |
| Aug 28/79 | 29.93 TOC | 963.5 | |
| Sept 25/79 | 29.95 TOC | 963.5 | |
| Oct 23/79 | 29.97 TOC | 963.4 | |
| Nov 20/79 | 29.99 TOC | 963.3 | |
| Dec 17/79 | | | Could not measure |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.70

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | | | could not measure |
| Feb 12/80 | | | could not measure |
| Mar 11/80 | | | could not measure |
| Apr 9/80 | | | |
| May 6/80 | 29.56 TOC | 964.7 | |
| June 3/80 | 29.48 TOC | 965.0 | |
| July 1/80 | 29.47 TOC | 965.0 | |
| July 28/80 | 33.77 TOC | 950.9 | |
| Aug 26/80 | 33.79 TOC | 950.9 | |
| Sept 24/80 | 33.80 TOC | 950.8 | |
| Oct 21/80 | 33.82 TOC | 950.8 | |
| Nov 18/80 | 33.84 TOC | 950.7 | |
| Dec 17/80 | 33.86 TOC | 950.6 | |
| Jan 15/81 | Frozen | | |
| Feb 10/81 | Frozen | | |
| Mar 10/81 | Frozen | | |
| Apr 7/81 | Frozen | | |
| May 5/81 | Frozen | | |
| June 2/81 | 33.56 TOC | 951.6 | |
| June 30/81 | 33.52 TOC | 951.8 | |
| July 28/81 | 33.53 TOC | 951.7 | |
| Aug 25/81 | 33.54 TOC | 951.7 | |
| Sept 22/81 | 34.05 TOC | 950.0 | |
| Oct 20/81 | 33.57 TOC | 951.6 | |
| Nov 17/81 | 34.12 TOC | 949.8 | |
| Dec 15/81 | Frozen | | Could not measure |

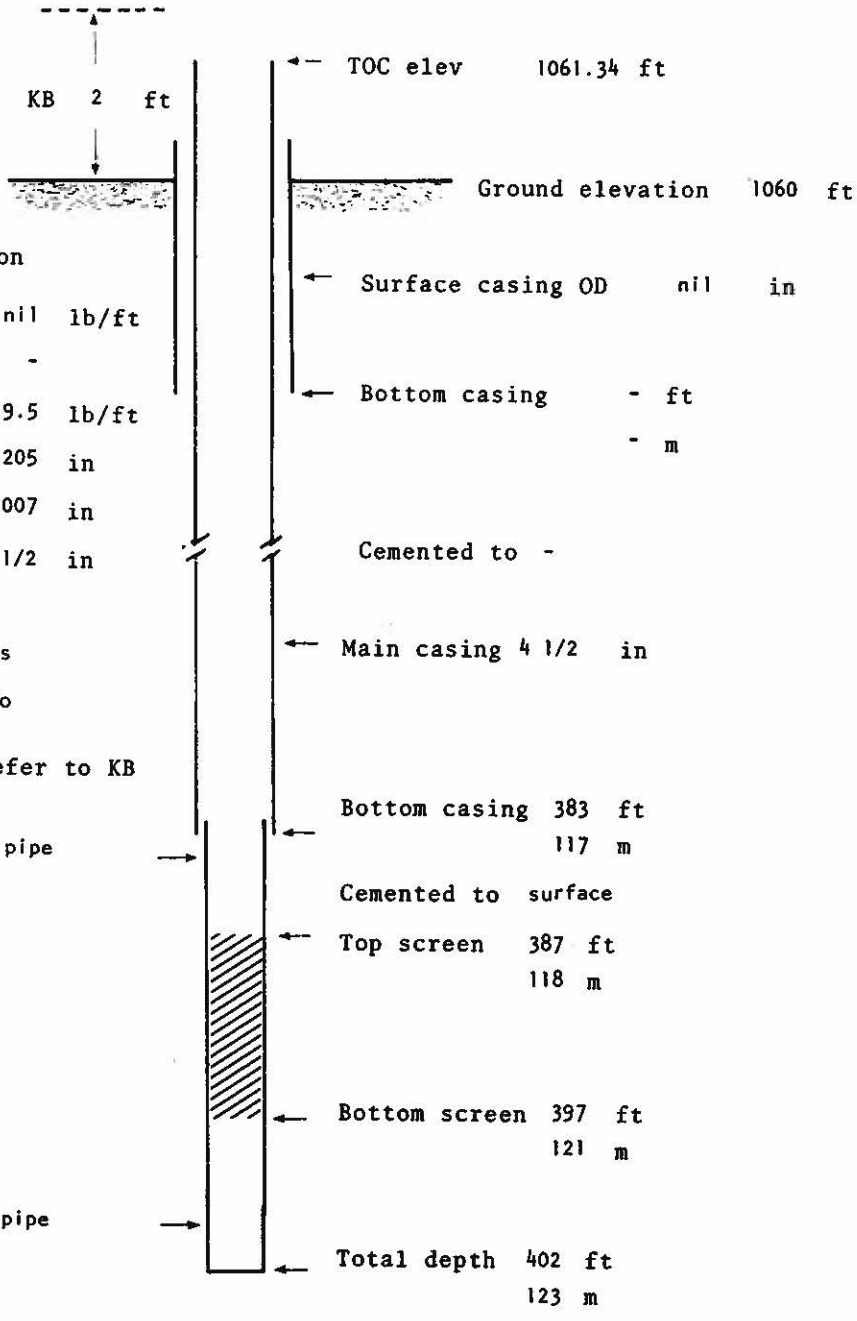
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Tp 97 R 12 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | nil | lb/ft |
| wall thickness | - | |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

# DRILL STEM TEST

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Tp 97 R 12 W4th

Alberta Research Council

Elevation: gl 1060
KB 1062

Type of test - Casing Positrieve

Date of test March 13, 1975

Testing company Johnston Testers

## TEST DATA

| | | |
|---|---|---|
| Time started | 1100 | hrs |
| Tool opened | 1154 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 30 | min |
| Pulled loose at | 1335 | hrs |
| Out of hole at | 1400 | hrs |
| Wt on packers | 3000 | lbs |
| Description of blow | Fair initial puff, weak air blow decreasing to very faint | |
| Total water recovered | 80 | ft |
| Water sample No. | DH 16 | |
| Gas blow | No | |
| Remarks | Test satisfactory<br>4 1/2" RBP set at 369'<br>3 1/8" MFE set at 367' | |

## HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 3/8" IF

Drill collar size (ID) 2 3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 387-397

Formation tested McMurray

## TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.05 | |
| MFE Tool | 10.05 | |
| Sub | 0.65 | |
| Positrieve Packer | 1.35 | 4 1/2 IN |
| Total | 13.10 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Total Interval | 11.20 | |

## PRESSURE DATA (psi)

| | | |
|---|---|---|
| Instrument No. | | RPG-97N |
| Capacity (psig) | | 431 |
| Instrument set at (ft) | | 373 |
| Initial hydrostatic | A | 159 |
| First flow | B | 7 |
| | B1 | 10 |
| Initial shut in | C | 103 |
| Second flow | D | 19 |
| | D1 | 41 |
| Final shut in | G | 96 |
| Final hydrostatic | H | 159 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

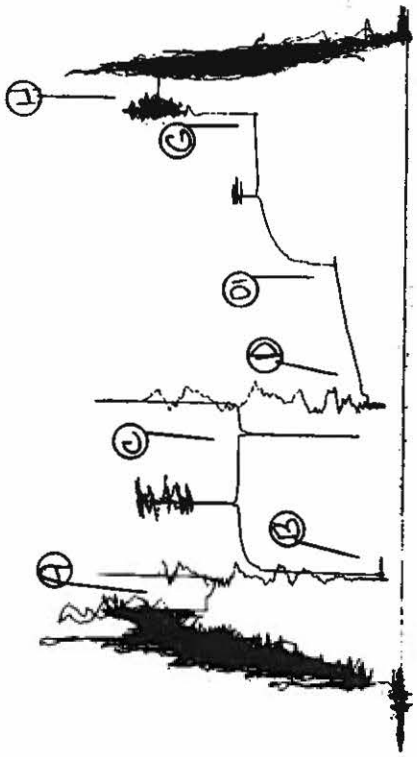
OBSERVATION WELL NUMBER 2-402

PRESSURE INCREMENTS

Recorder RPG-97N

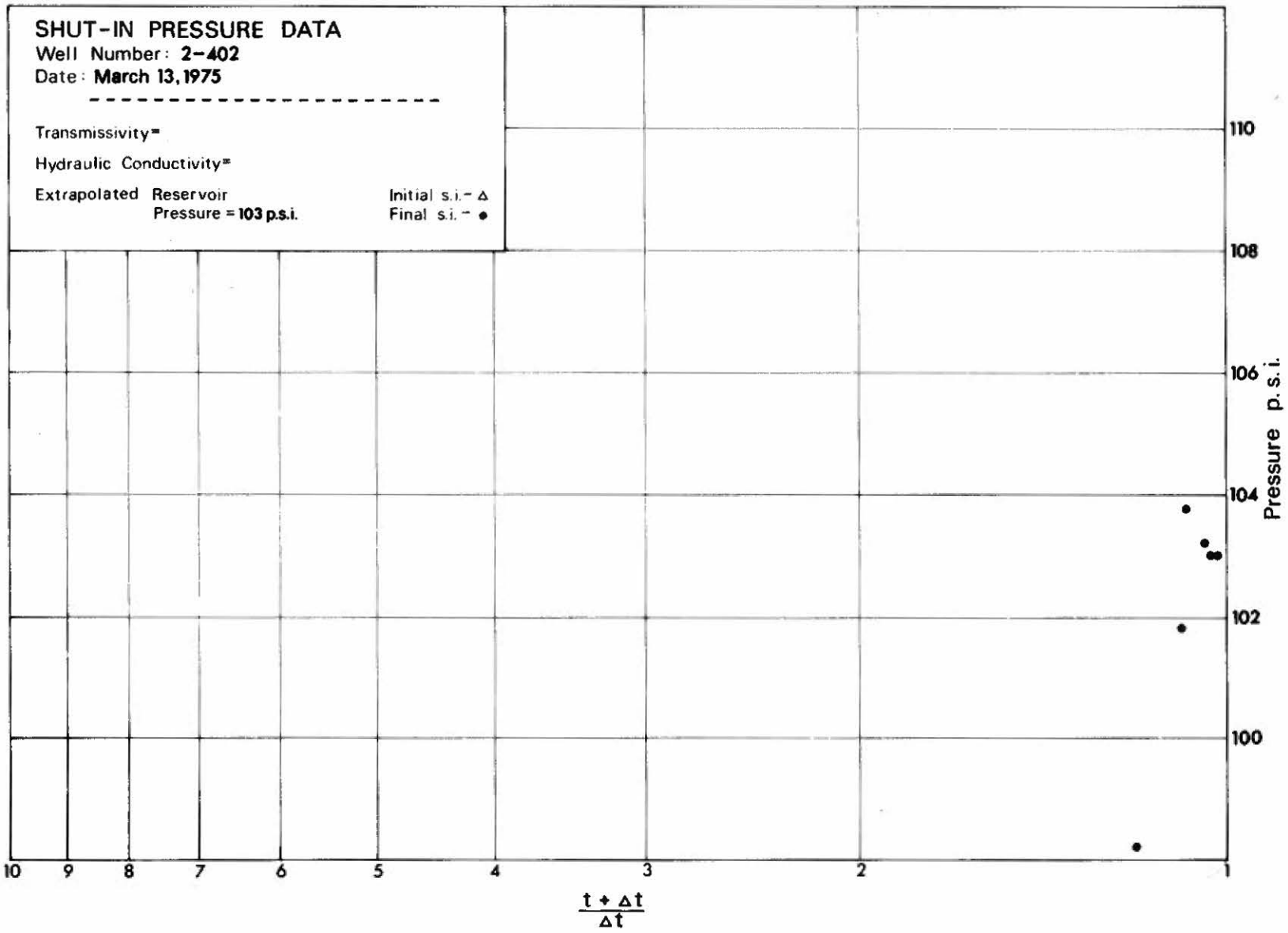
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 98.2 | 1.20 |
| 10 | 101.8 | 1.10 |
| 15 | 103.8 | 1.07 |
| 20 | 103.2 | 1.05 |
| 25 | 103.0 | 1.04 |
| 30 | 103.0 | 1.03 |

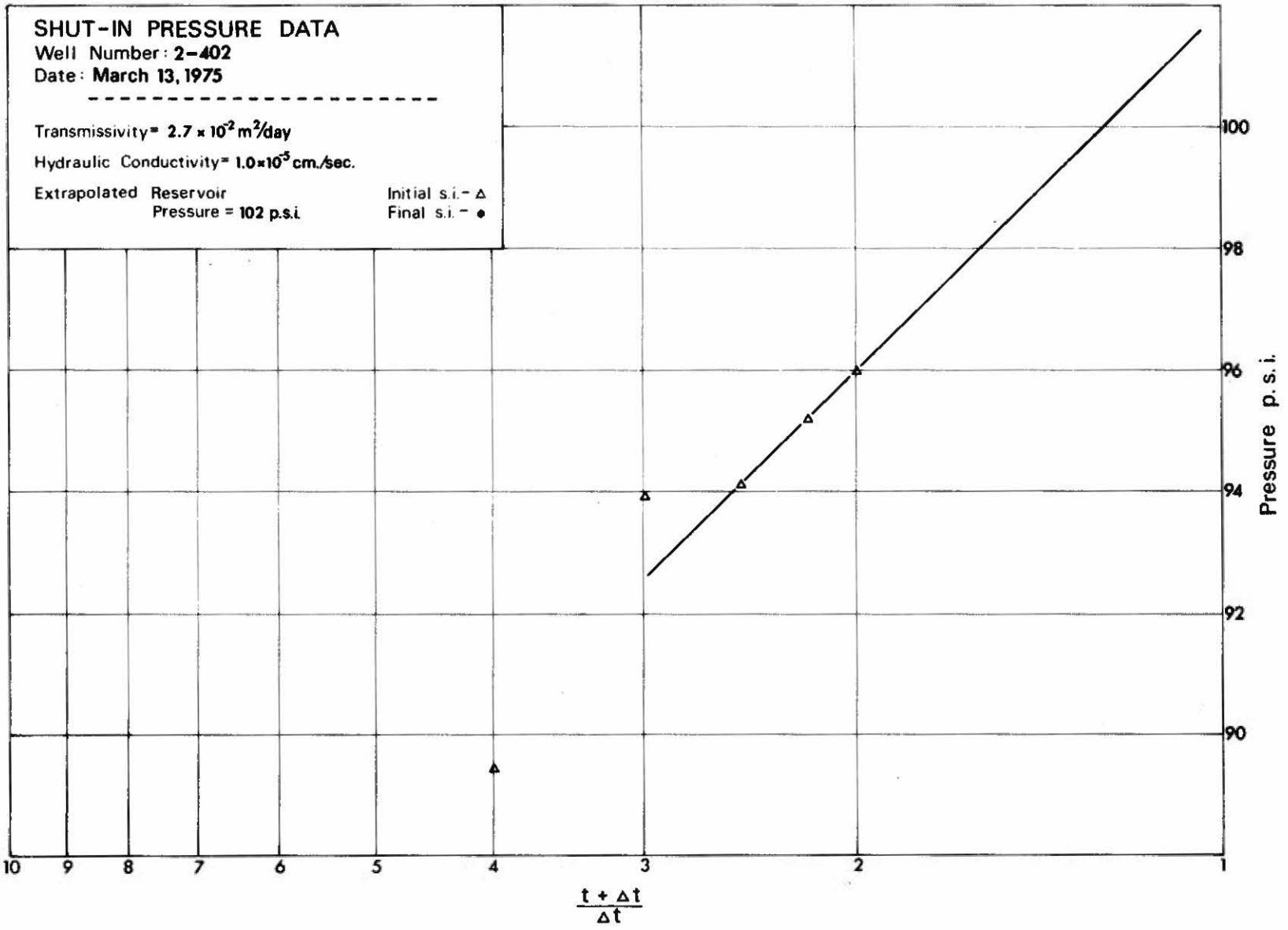


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 83.4 | 7.00 |
| 10 | 89.4 | 4.00 |
| 15 | 93.9 | 3.00 |
| 20 | 94.1 | 2.50 |
| 35 | 95.2 | 2.20 |
| 30 | 96.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 2-402
Date: March 13, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 103 p.s.i.
Initial s.i. - Δ
Final s.i. - •
110
108
106
104
102
100
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

2-402-D-76


SHUT-IN PRESSURE DATA
Well Number: 2-402
Date: March 13, 1975
Transmissivity = 2.7 × 10⁻² m²/day
Hydraulic Conductivity = 1.0×10⁻⁵ cm./sec.
Extrapolated Reservoir Pressure = 102 p.s.i.
Initial s.i. - Δ
Final s.i. - •
100
98
96
94
92
90
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

2-402-D-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Drill stem test on well 2-402

Date sampled March 13, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 188 | 9.4 | 2.4 |
| Magnesium ($Mg^{++}$) | 309 | 25.8 | 6.6 |
| Sodium ($Na^{+}$) | 8063 | 350.6 | 90.5 |
| Potassium ($K^{+}$) | 72.1 | 387.6 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 3026 | 49.6 | 12.3 |
| Sulfate ($SO_4^{=}$) | 23.5 | 0.5 | 0.1 |
| Chloride ($Cl^{-}$) | 12520 | 352.7 | 87.5 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.1 | 0 |
| Silica ($SiO_2$) | 8.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 23706 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 402.9 | Total Cations (epm) | 387.6 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 8000+ | Temperature (C) | 7.1 | |
| pH | 7.2 | pH | 0 | |
| Fluoride ($F^{-}$) | 0.3 ppm | Carbonate ($CO_3^{=}$) | 4368 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | 8000+ | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed from 2-402

Date sampled January 17, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 65.0 | 3.24 | 28.6 |
| Magnesium ($Mg^{++}$) | 25.3 | 2.08 | 18.3 |
| Sodium ($Na^{+}$) | 135.0 | 5.87 | 51.8 |
| Potassium ($K^{+}$) | 5.8 | 0.15 | 1.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 576.0 | 9.44 | 79.0 |
| Sulfate ($SO_4^{=}$) | 22.5 | 0.47 | 3.9 |
| Chloride ($Cl^{-}$) | 66.0 | 1.86 | 15.6 |
| Nitrate ($NO_3^{=}$) | 10.7 | 0.17 | 1.4 |
| Silica ($SiO_2$) | 11.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 710.0 | | |
| Total Anions (epm) | 11.943 | Total Cations (epm) | 11.345 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 990 | Temperature (C) | 3.3 |
| pH | 8.1 | pH | 7.2 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 661 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | 1375 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Drill stem test on well 2-402

Date sampled March 13, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 188 | 9.4 | 2.4 |
| Magnesium ($Mg^{++}$) | 309 | 25.8 | 6.6 |
| Sodium ($Na^{+}$) | 8063 | 350.6 | 90.5 |
| Potassium ($K^{+}$) | 72.1 | 387.6 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 3026 | 49.6 | 12.3 |
| Sulfate ($SO_4^{=}$) | 23.5 | 0.5 | 0.1 |
| Chloride ($Cl^{-}$) | 12520 | 352.7 | 87.5 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.1 | 0 |
| Silica ($SiO_2$) | 8.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 23706 | | |

Total Anions (epm) 402.9 Total Cations (epm) 387.6

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 8000+ |
| pH | 7.2 |
| Fluoride ($F^{-}$) | 0.3 ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 7.1 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 4368 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | 8000+ |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Drill stem test on well 2-402

Date of sampling March 13, 1975

Total dissolved solids 23,706 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .001 | Mg | .05 |
| As | <.01 | Mn | ND |
| B | .02 | Mo | ND |
| Ba | .005 | Ni | .001 |
| Be | ND | Pb | ND |
| Bi | ND | Sb | ND |
| Ca | .05 | Si | .01 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | ND | V | ND |
| Fe | .02 | Zn | <.005 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 9, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 167 | 8.33 | 2 |
| Magnesium ($Mg^{++}$) | 237 | 19.49 | 5 |
| Sodium ($Na^{+}$) | 8000 | 347.98 | 92 |
| Potassium ($K^{+}$) | 68 | 1.74 | 1 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 2699 | 44.24 | 18 |
| Sulfate ($SO_4^{=}$) | 5 | 0.10 | 0 |
| Chloride ($Cl^{-}$) | 7198 | 202.99 | 82 |
| Nitrate ($NO_3^{=}$) | 15 | 0.24 | 0 |
| Silica ($SiO_2$) | 12.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 206 | | |
| Magnesium (Acidified) | 245 | | |
| Total dissolved solids | 22998 | | |
| Total Anions (epm) | 247.57 | Total Cations (epm) | 377.54 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | |
| pH | 7.3 |
| Fluoride ($F^{-}$) | 0.3 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 4.0 |
| pH | 7.4 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 2916 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 83.0 | 4.14 | 1 |
| Magnesium ($Mg^{++}$) | 313.0 | 25.76 | 7 |
| Sodium ($Na^{+}$) | 8313.0 | 361.59 | 92 |
| Potassium ($K^{+}$) | 94.0 | 2.40 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 2479.0 | 40.63 | 10 |
| Sulfate ($SO_4^{=}$) | 3.3 | 0.07 | 0 |
| Chloride ($Cl^{-}$) | 12700.0 | 358.15 | 90 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0.00 | 0 |
| Silica ($SiO_2$) | 9.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 79.2 | | |
| Magnesium (Acidified) | 302.5 | | |
| Total dissolved solids | 22760 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 398.86 | Total Cations (epm) | 393.90 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 6.5 | |
| pH | 7.8 | pH | 7.3 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 2518 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 5, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 146.0 | 7.29 | 1.7 |
| Magnesium ($Mg^{++}$) | 298.0 | 24.53 | 5.7 |
| Sodium ($Na^{+}$) | 9000.0 | 391.47 | 91.7 |
| Potassium ($K^{+}$) | 144.0 | 3.68 | 0.9 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 2904.0 | 47.60 | 11.3 |
| Sulfate ($SO_4^{=}$) | 15.7 | 0.33 | 0.1 |
| Chloride ($Cl^{-}$) | 13300.0 | 375.07 | 88.7 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 9.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 136.0 | | |
| Magnesium (Acidified) | 244.0 | | |
| Total dissolved solids | 23588.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 423.00 | Total Cations (epm) | 426.97 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 7.0 |
| pH | 7.4 | pH | 7.0 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 2967.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Date sampled: July 14, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .189 |
| Au | <.003 | Mo | <.006 |
| Al | 0.66 | Na | 7513 |
| As | <.038 | Ni | <.010 |
| B | 3.84 | P | 0.77 |
| Ba | 0.99 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 72.5 | Si | 5.35 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 9.83 |
| Cr | <.006 | Te | <.065 |
| Cu | .023 | Ti | .004 |
| Eu | <.015 | U | <.020 |
| Fe | 14.2 | V | .022 |
| K | 44 | W | <.078 |
| Mg | 277 | Zn | .176 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 28.0 | 1.40 | 0.4 |
| Magnesium(Mg) | 290.0 | 23.87 | 6.2 |
| Sodium(Na) | 8300.0 | 361.03 | 93.0 |
| Potassium(K) | 67.0 | 1.71 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 2294.0 | 37.60 | 9.2 |
| Sulphate(SO4) | 0.0 | 0.00 | 0.0 |
| Chloride(Cl) | 13200.0 | 372.25 | 90.8 |
| Nitrate(NO3) | 0.8 | 0.01 | 0.0 |
| Silica(SiO2) | 11.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 29.0 | | |
| Magnesium(Acidified) | 232.0 | | |
| TDS(mg/l) | 22458.0 | | |
| Total Anions(epm) | 409.86 | Total Cations(epm) | 388.01 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 32000 | | Temperature(C) | 7.00 | |
| pH | 8.0 | | pH | 7.7 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 2264 | mg/l |
| | | | Hydroxide(OH) | | |

2-402-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 4, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 20.2 | 1.01 | 0.3 |
| Magnesium(Mg) | 235.0 | 19.34 | 5.1 |
| Sodium(Na) | 8250.0 | 358.85 | 94.4 |
| Potassium(K) | 33.3 | 0.85 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 2.8 | 0.05 | 0.0 |
| Sulphate(SO4) | 6.2 | 0.13 | 0.0 |
| Chloride(Cl) | 12600.0 | 355.33 | 100.0 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 11.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 18.8 | | |
| Magnesium(Acidified) | 225.0 | | |
| TDS(mg/l) | 22234.0 | | |
| Total Anions(epm) | 355.51 | Total Cations(epm) | 380.05 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 31900 | | Temperature(C) | 5.50 | |
| pH | 8.1 | | pH | 8.1 | |
| Fluoride(F) | 0.3 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 2181 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 2-402-E-82

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 105.0 | 5.25 | 1.2 |
| Magnesium(Mg) | 293.0 | 24.42 | 5.7 |
| Sodium(Na) | 9062.0 | 394.00 | 92.6 |
| Potassium(K) | 67.0 | 1.72 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 2257.0 | 37.00 | 9.0 |
| Sulphate(SO4) | 7.0 | 0.15 | 0.0 |
| Chloride(Cl) | 13350.0 | 376.06 | 91.0 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 3.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 114.0 | | |
| Magnesium(Acidified) | 225.0 | | |
| TDS(mg/l) | 23106.0 | | |
| Total Anions(epm) | 413.20 | Total Cations(epm) | 425.38 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 37000 | Temperature | 7.00 | |
| pH | 8.0 | pH | 7.3 | |
| Fluoride | 0.1 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 2674 | mg/l |
| | | Hydroxide(OH) | | |

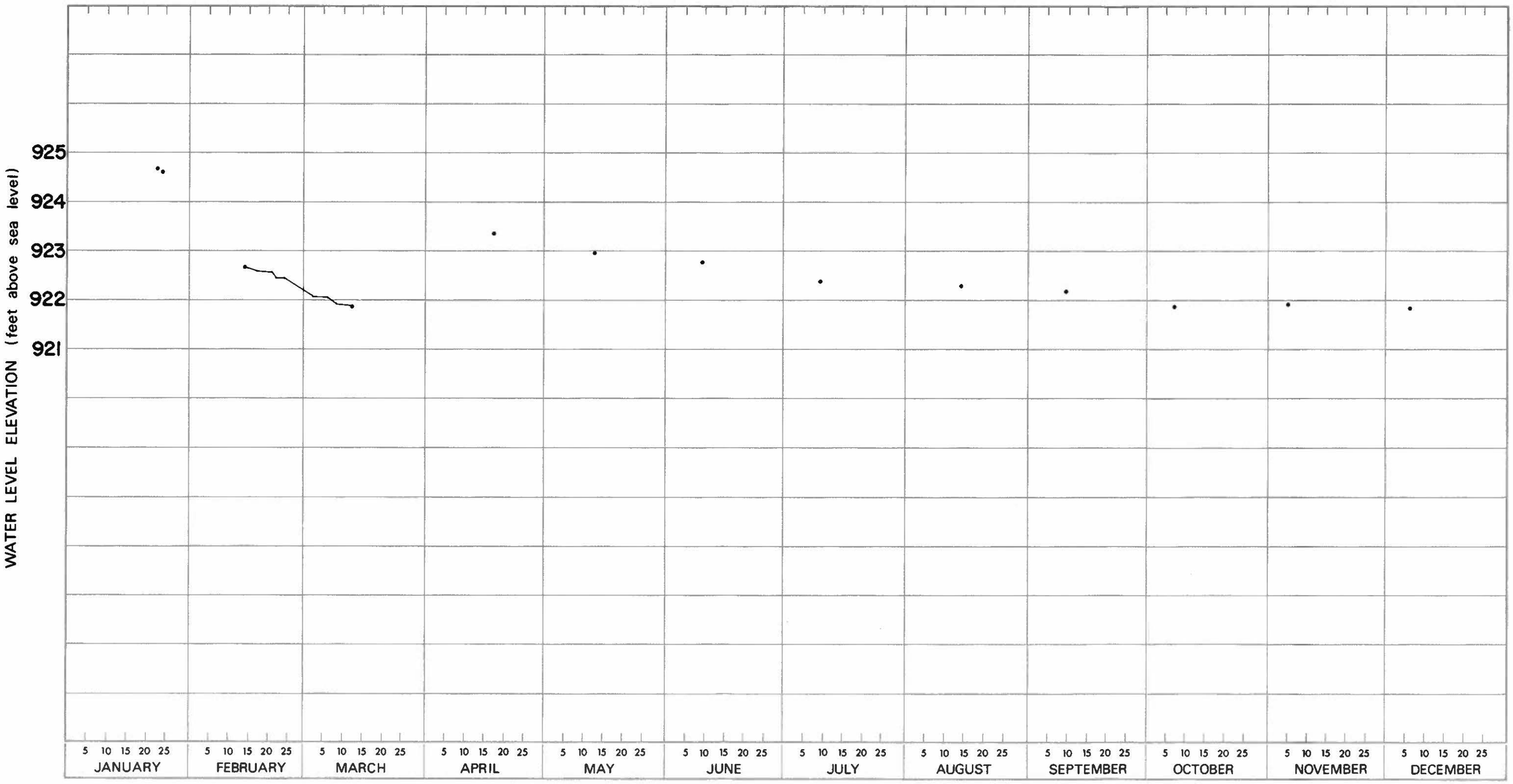
## WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

2-402-H-76



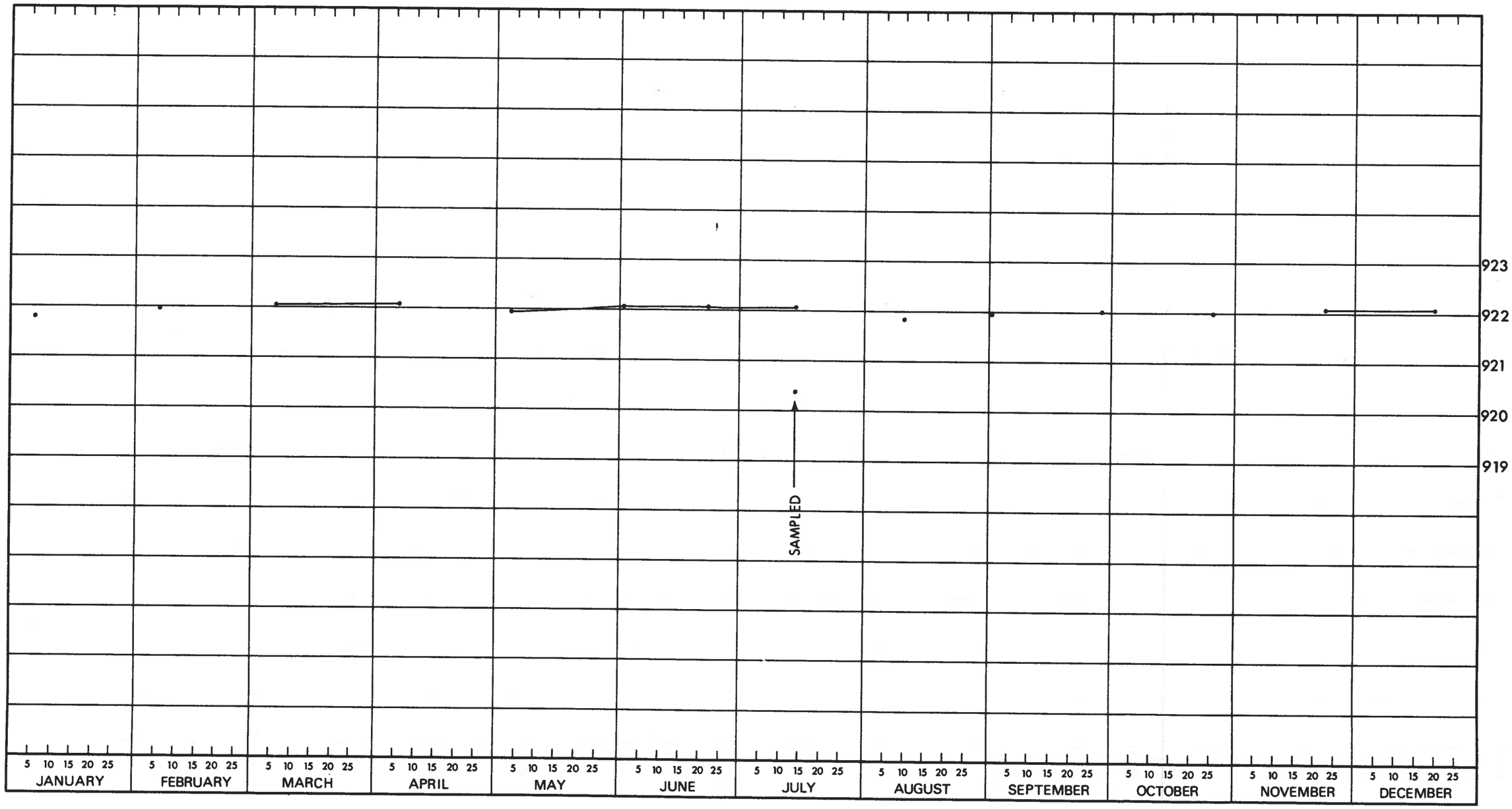
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **2-402**

Lsd **1** Sec **11** Twp **97** R **12** W4th

Alberta Research Council

**2 - 402 - H - 77**




1976

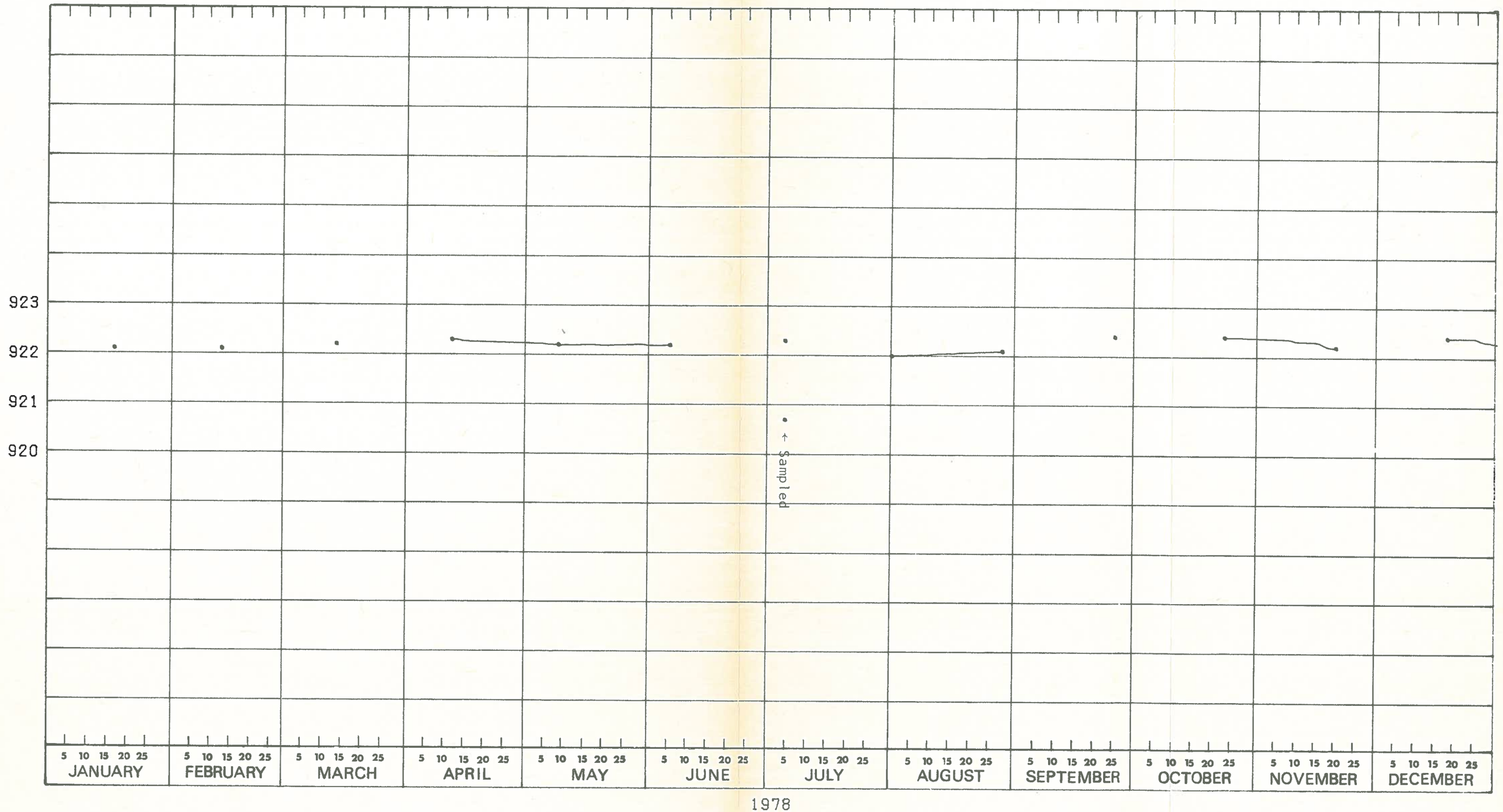
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-402

LSD 1 SEC 11 TWP 97 R 12 W4TH

Alberta Research Council

2-402-H-79



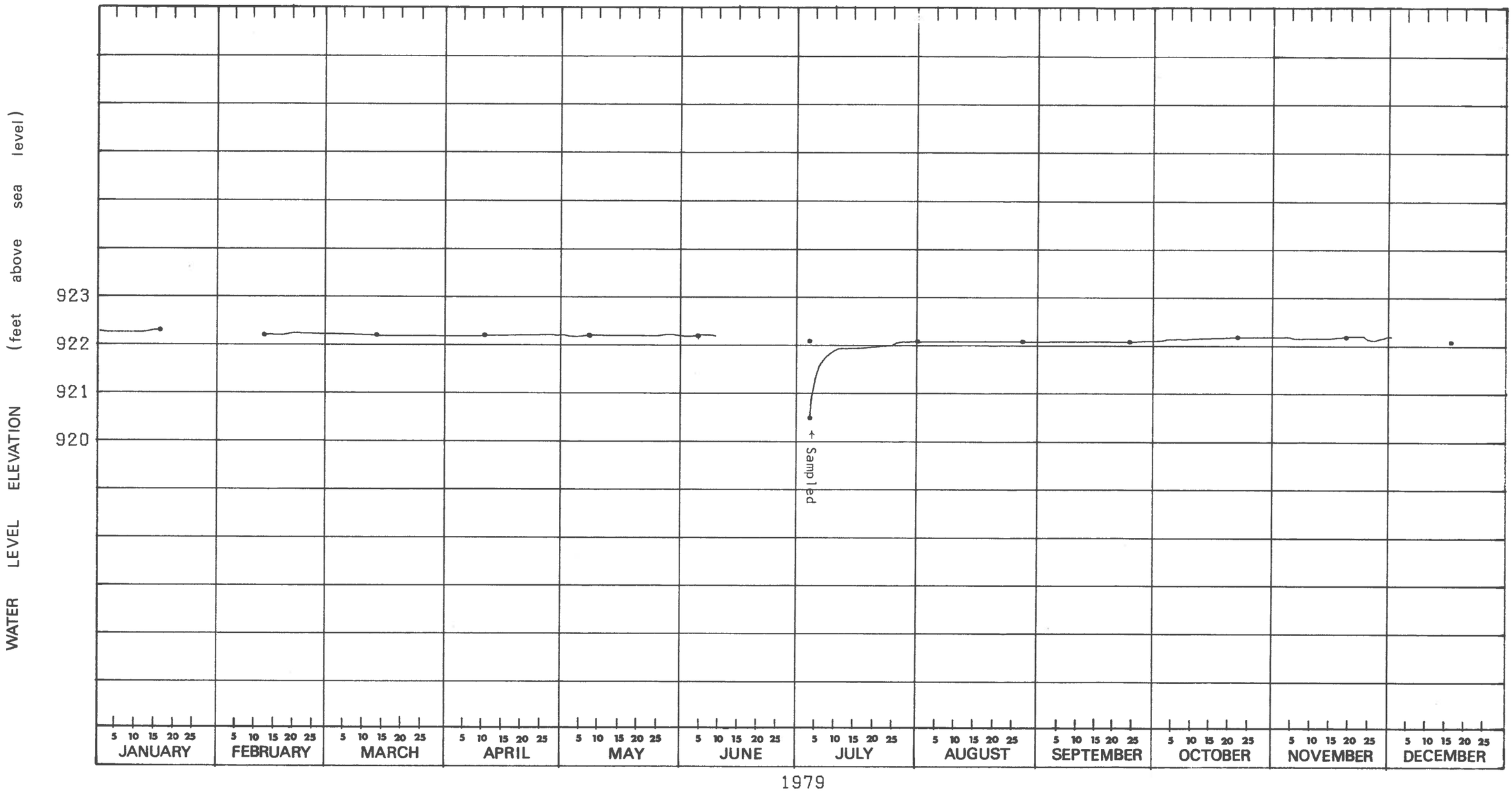
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-402-H-80



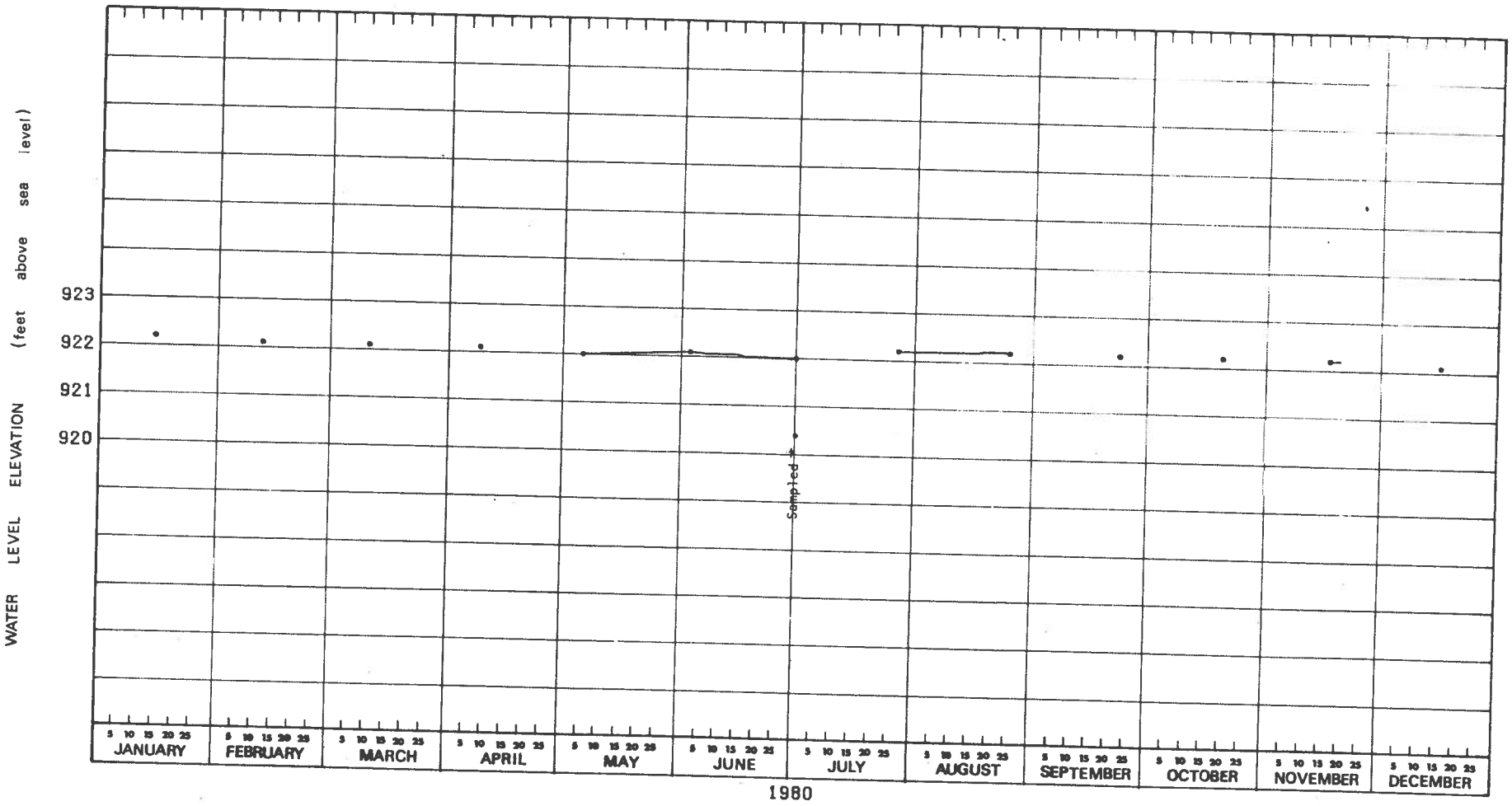
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-402-H-81



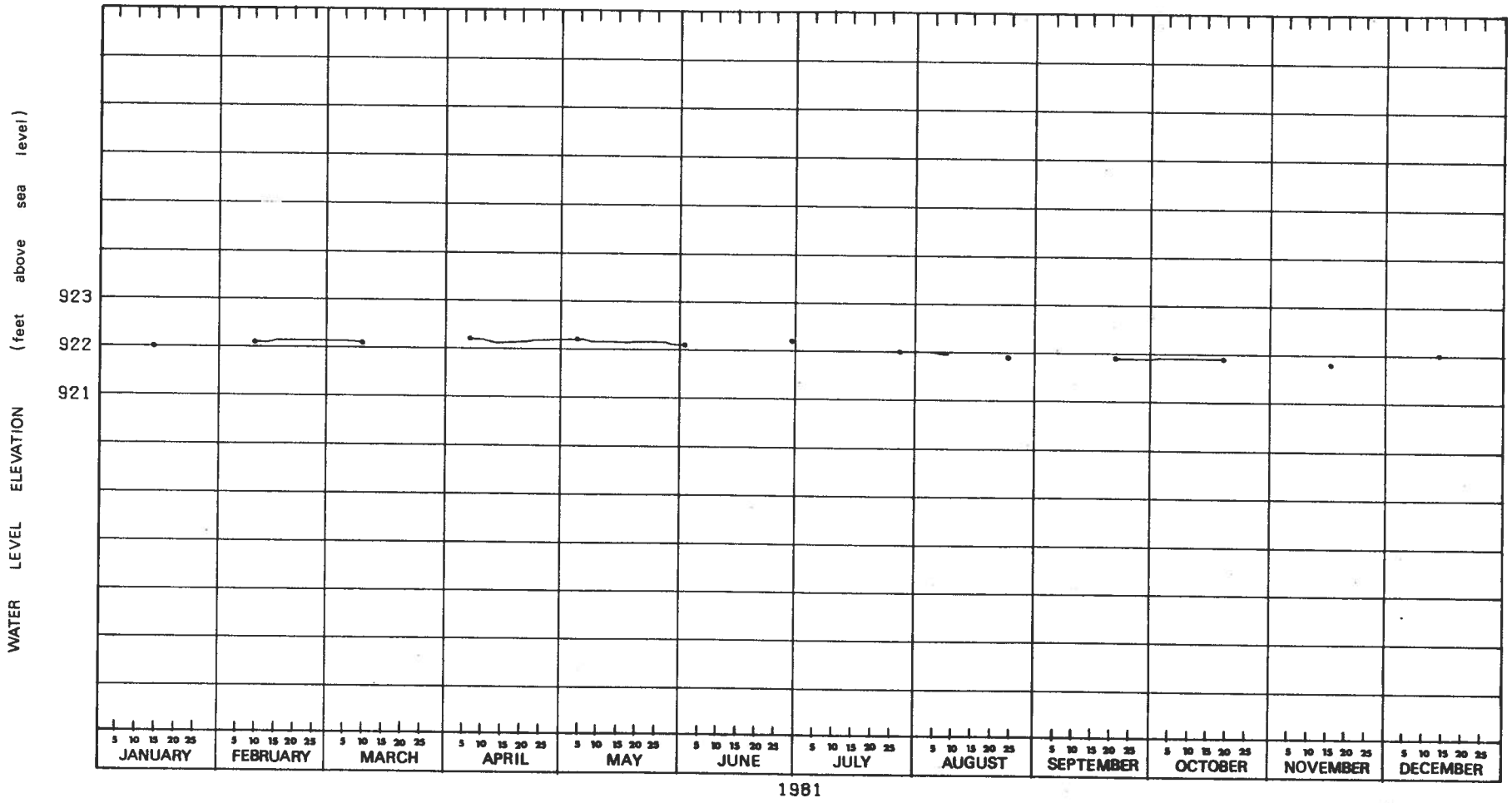
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-402-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.34

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 12/75 | | | Well completed |
| Jan 23/75 | 41.67 TOC | 924.63 | |
| Jan 24/75 | 41.68 TOC | 924.59 | Bail 125 gallons |
| Jan 26/75 | 45.32 TOC | 912.66 | |
| Feb 14/75 | 43.04 MP | 922.66 | Install recorder; install shelter; MP = 256' TOC, (1063.90) |
| Mar 12/75 | 43.30 MP | 921.84 | Remove shelter |
| Mar 13/75 | | | DST; water sample; FSI = 96# from 373' |
| Mar 14/75 | | | Reinstall shelter; MP = 265' TOC, (1064.29) |
| Apr 17/75 | 42.97 MP | 923.32 | |
| May 12/75 | 43.08 old MP | 922.95 | New MP = 26" (1063.50) |
| June 9/75 | 42.92 MP | 922.72 | |
| July 9/75 | 43.02 MP | 922.39 | |
| Aug 14/75 | 43.05 MP | 922.29 | |
| Sept 9/75 | 43.08 MP | 922.19 | Sampled well, temp. 4°C |
| | 43.57 MP | 920.59 | after sample |
| Oct 7/75 | 43.18 MP | 921.86 | |
| Nov 6/75 | 43.18 MP | 921.87 | |
| Dec 6/75 | 43.20 MP | 921.80 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.34

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 43.20 MP | 921.8 | MP (1063.5) |
| Feb 6/76 | 43.15 MP | 922.0 | |
| Mar 6/76 | 43.12 MP | 922.1 | |
| Apr 6/76 | 43.11 MP | 922.1 | |
| May 4/76 | 43.16 MP | 921.9 | |
| June 1/76 | 43.12 MP | 922.1 | |
| June 22/76 | 43.12 MP | 922.1 | |
| July 14/76 | 43.11 MP | 922.1 | |
| | 43.63 MP | 920.4 | After sample; temp. 6.5°C |
| Aug 10/76 | 43.18 MP | 921.9 | |
| Sept 1/76 | 43.15 MP | 922.0 | |
| Sept 28/76 | 43.13 MP | 922.0 | |
| Oct 26/76 | 43.15 MP | 922.0 | |
| Nov 23/76 | 43.11 MP | 922.1 | |
| Dec 20/76 | 43.12 MP | 922.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.34

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 43.06 MP | 922.3 | MP (1063.5) |
| Feb 15/77 | 43.20 MP | 921.8 | |
| Mar 15/77 | 43.05 MP | 922.3 | |
| Apr 13/77 | 43.06 MP | 922.3 | |
| May 10/77 | 43.15 MP | 922.0 | |
| June 7/77 | 43.17 MP | 921.9 | |
| July 5/77 | 43.06 MP | 922.3 | |
| | 43.53 MP | 920.7 | After sample; temp. 7°C |
| Aug 3/77 | 43.11 MP | 922.1 | |
| Aug 30/77 | 43.08 MP | 922.2 | |
| Sept 27/77 | 43.11 MP | 922.1 | |
| Oct 25/77 | 43.05 MP | 922.3 | |
| Nov 22/77 | 43.10 MP | 922.1 | |
| Dec 19/77 | 43.07 MP | 922.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.34

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 43.10 MP | 922.1 | MP (1063.5) |
| Feb 13/78 | 43.11 MP | 922.1 | |
| Mar 14/78 | 43.07 MP | 922.2 | |
| Apr 12/78 | 43.06 MP | 922.3 | |
| May 9/78 | 43.07 MP | 922.2 | |
| June 6/78 | 43.08 MP | 922.2 | |
| July 5/78 | 43.05 MP | 922.3 | |
| | 43.54 MP | 920.7 | After sample; temp. 7°C |
| Aug 1/78 | 43.13 MP | 922.0 | |
| Aug 29/78 | 43.11 MP | 922.1 | |
| Sept 26/78 | 43.03 MP | 922.4 | |
| Oct 24/78 | 43.01 MP | 922.4 | |
| Nov 21/78 | 43.07 MP | 922.2 | |
| Dec 19/78 | 43.01 MP | 922.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.34

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 43.04 MP | 922.3 | MP (1063.5) |
| Feb 13/79 | 43.09 MP | 922.2 | |
| Mar 14/79 | 43.07 MP | 922.2 | |
| Apr 11/79 | 43.08 MP | 922.2 | |
| May 8/79 | 43.08 MP | 922.2 | |
| June 5/79 | 43.07 MP | 922.2 | |
| July 5/79 | 43.10 MP | 922.1 | |
| | 43.59 MP | 920.5 | After sample; temp. 5.5°C |
| Aug 1/79 | 43.11 MP | 922.1 | |
| Aug 28/79 | 43.10 MP | 922.1 | |
| Sept 25/79 | 43.10 MP | 922.1 | |
| Oct 23/79 | 43.09 MP | 922.2 | |
| Nov 20/79 | 43.09 MP | 922.2 | |
| Dec 17/79 | 43.10 MP | 922.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.34

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 43.07 MP | 922.2 | |
| Feb 12/80 | 43.11 MP | 922.1 | |
| Mar 11/80 | 43.10 MP | 922.1 | |
| Apr 9/80 | 43.10 MP | 922.1 | |
| May 6/80 | 43.14 MP | 922.0 | |
| June 3/80 | 43.12 MP | 922.1 | |
| July 1/80 | 43.14 MP | 922.0 | Temp. 7°C |
| | 43.62 MP | 920.4 | After Sample |
| July 28/80 | 43.09 MP | 922.2 | |
| Aug 26/80 | 43.09 MP | 922.2 | |
| Sept 24/80 | 43.08 MP | 922.2 | |
| Oct 21/80 | 43.09 MP | 922.2 | |
| Nov 18/80 | 43.09 MP | 922.2 | |
| Dec 17/80 | 43.10 MP | 922.1 | |
| Jan 15/81 | 43.13 MP | 922.0 | |
| Feb 10/81 | 43.10 MP | 922.1 | |
| Mar 10/81 | 43.12 MP | 922.1 | |
| Apr 7/81 | 43.08 MP | 922.2 | |
| May 5/81 | 43.09 MP | 922.2 | |
| June 2/81 | 43.12 MP | 922.1 | |
| June 30/81 | 43.09 MP | 922.2 | |
| July 29/81 | 43.13 MP | 922.0 | |
| Aug 25/81 | 43.18 MP | 921.9 | |
| Sept 22/81 | 43.17 MP | 921.9 | |
| Oct 20/81 | 43.16 MP | 921.9 | |
| Nov 17/81 | 43.20 MP | 921.8 | |
| Dec 15/81 | 43.15 MP | 922.0 | |

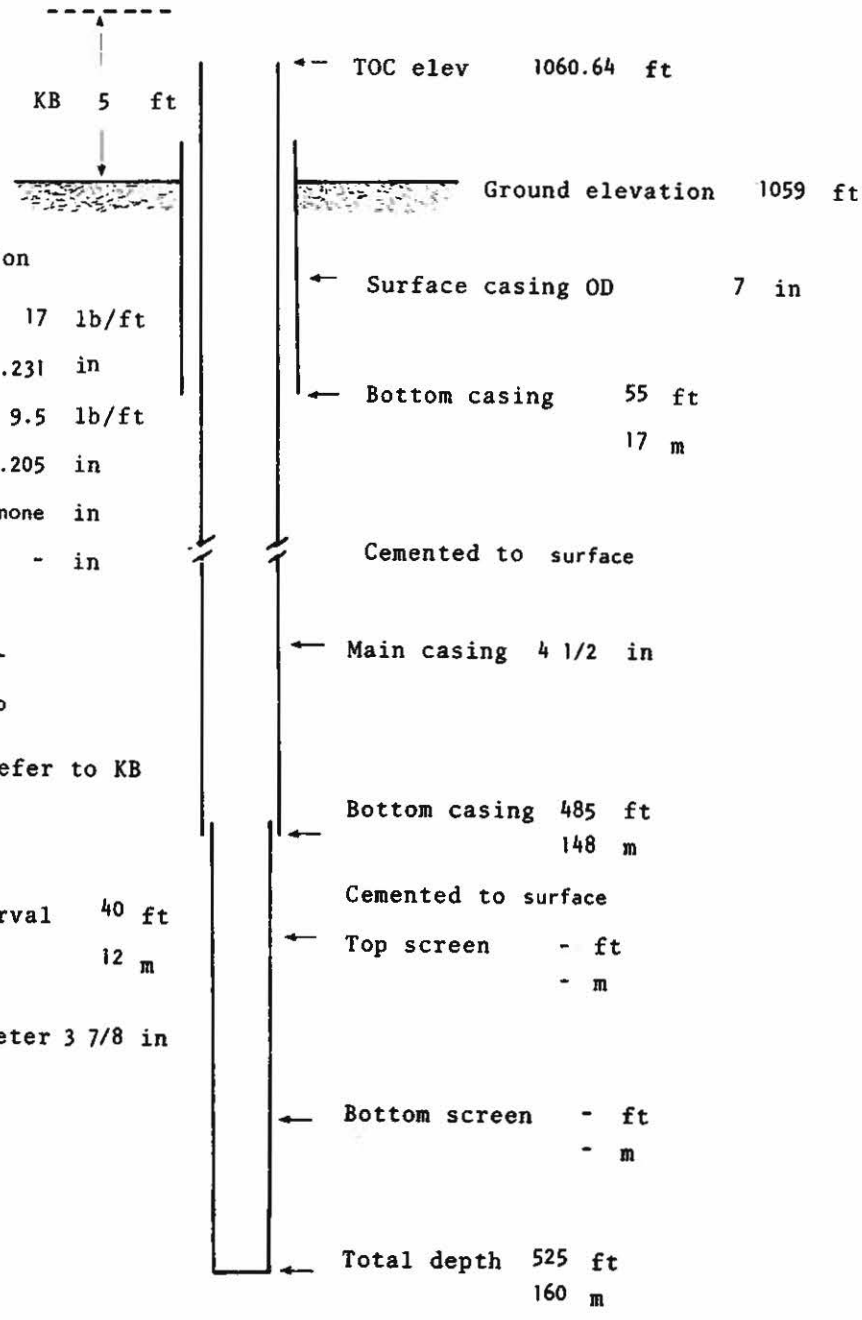
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Tp 97 R 12 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | none | in |
| screen OD | - | in |
| slots per foot | | |
| material | - | |
| Sand pack | No | |

Note: all depths refer to KB

Open hole interval 40 ft
12 m

Open hole diameter 3 7/8 in

# DRILL STEM TEST

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Tp 97 R 12 W4th

Alberta Research Council

Elevation: gl 1059
KB 1061

Type of test - Casing Positrieve

Date of test March 13, 1975

Testing company Johnston Testers

## TEST DATA

| | | |
|---|---|---|
| Time started | 1700 | hrs |
| Tool opened | 1812 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 780 | min |
| Pulled loose at | 0805 | hrs |
| Out of hole at | 0830 | hrs |
| Wt on packers | 3000 | lbs |

Description of blow Very faint initial puff blow decreasing to nil in 10 seconds.

Total water recovered Nil ft

Water sample No. -

Gas blow No

Remarks Misrun, tool set above fluid level.

## HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 485-525

Formation tested Beaverhill Lake

## TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.05 | |
| MFE Tool | 10.05 | |
| Sub | 0.65 | |
| Positrieve Packer | 1.35 | 4-1/2 IN |
| Total | 13.10 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Total Interval | 11.20 | |

## PRESSURE DATA (psi)

| | |
|---|---|
| Instrument No. | |
| Capacity (psig) | |
| Instrument set at (ft) | |
| Initial hydrostatic | A |
| First flow | B |
| | B1 |
| Initial shut in | C |
| Second flow | D |
| | D1 |
| Final shut in | G |
| Final hydrostatic | H |

B1, D1, etc. Initial Hyd. Pressure

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed from 2-525

Date sampled February 13, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 10.0 | 0.50 | 1.5 |
| Magnesium ($Mg^{++}$) | 10.9 | 0.90 | 2.7 |
| Sodium ($Na^{+}$) | 731.0 | 31.80 | 94.5 |
| Potassium ($K^{+}$) | 18.3 | 0.47 | 1.4 |
| Carbonate ($CO_3^{=}$) | 43.2 | 1.44 | 4.1 |
| Bicarbonate ($HCO_3^{-}$) | 351.0 | 5.75 | 16.3 |
| Sulfate ($SO_4^{=}$) | 101.0 | 2.10 | 6.0 |
| Chloride ($Cl^{-}$) | 920.0 | 25.94 | 73.5 |
| Nitrate ($NO_3^{=}$) | 4.0 | 0.06 | 0.2 |
| Silica ($SiO_2$) | 3.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 2090.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 35.305 | Total Cations (epm) | 33.660 |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 3600 |
| pH | 9.0 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 3 |
| pH | 9.5 |
| Carbonate ($CO_3^{=}$) | 197 ppm |
| Bicarbonate ($HCO_3^{-}$) | 107 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | 1200 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed from 2-525

Date sampled January 17, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 56.6 | 2.82 | 24.5 |
| Magnesium ($Mg^{++}$) | 23.3 | 1.92 | 16.6 |
| Sodium ($Na^{+}$) | 151.0 | 6.57 | 56.9 |
| Potassium ($K^{+}$) | 9.2 | 0.24 | 2.0 |
| Carbonate ($CO_3^{=}$) | 16.0 | 0.53 | 4.3 |
| Bicarbonate ($HCO_3^{-}$) | 505.0 | 8.28 | 67.0 |
| Sulfate ($SO_4^{=}$) | 30.2 | 0.63 | 5.1 |
| Chloride ($Cl^{-}$) | 98.0 | 2.76 | 22.4 |
| Nitrate ($NO_3^{=}$) | 9.0 | 0.15 | 1.2 |
| Silica ($SiO_2$) | 12.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 716.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.348 | Total Cations (epm) | 11.544 |

### Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1000 | Temperature (C) | 3.3 |
| pH | 7.9 | pH | 8.5 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 32 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 503 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | 1200 |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 17 R 12 W4th

Alberta Research Council

Sample source Bailed from well 2-525

Date of sampling February 13, 1975

Total dissolved solids 2090 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | 0.05 | Mg | .01 |
| As | <.01 | Mn | .002 |
| B | .01 | Mo | ND |
| Ba | .001 | Ni | .001 |
| Be | ND | Pb | .001 |
| Bi | ND | Sb | ND |
| Ca | M | Si | .05 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .003 | V | ND |
| Fe | .05 | Zn | .05 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 9, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 7.9 | 0.39 | 0 |
| Magnesium ($Mg^{++}$) | 3.6 | 0.30 | 0 |
| Sodium ($Na^{+}$) | 2850 | 123.97 | 99 |
| Potassium ($K^{+}$) | 30.8 | 0.79 | 1 |
| Carbonate ($CO_3^{=}$) | 20.0 | 0.67 | 1 |
| Bicarbonate ($HCO_3^{-}$) | 156 | 2.56 | 4 |
| Sulfate ($SO_4^{=}$) | 205 | 4.27 | 6 |
| Chloride ($Cl^{-}$) | 2298 | 64.81 | 90 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 2.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 89 | | |
| Magnesium (Acidified) | 40 | | |
| Total dissolved solids | 7596 | | |
| Total Anions (epm) 72.31 | | Total Cations (epm) 125.45 | |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | 6.0 |
| pH | 9.7 | pH | 10.9 |
| Fluoride ($F^{-}$) | 1.4 ppm | Carbonate ($CO_3^{=}$) | 240 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 12.3 | 0.61 | 0 |
| Magnesium ($Mg^{++}$) | 70.0 | 5.76 | 3 |
| Sodium ($Na^{+}$) | 4775.0 | 207.70 | 97 |
| Potassium ($K^{+}$) | 48.8 | 1.25 | 1 |
| Carbonate ($CO_3^{=}$) | 122.0 | 4.07 | 2 |
| Bicarbonate ($HCO_3^{-}$) | 439.0 | 7.20 | 3 |
| Sulfate ($SO_4^{=}$) | 259.0 | 5.39 | 2 |
| Chloride ($Cl^{-}$) | 7240.0 | 204.17 | 92 |
| Nitrate ($NO_3^{=}$) | 1.3 | 0.02 | 0 |
| Silica ($SiO_2$) | 0.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 12.8 | | |
| Magnesium (Acidified) | 69.3 | | |
| Total dissolved solids | 12360 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 220.85 | Total Cations (epm) | 215.32 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 78000 |
| pH | 9.4 |
| Fluoride ($F^{-}$) | 0.6 Mg/L |

Field:

| | | |
|---|---|---|
| Temperature (C) | 9.0 | |
| pH | 9.2 | |
| Carbonate ($CO_3^{=}$) | 168 | Mg/L |
| Bicarbonate ($HCO_3^{-}$) | 361 | Mg/L |
| Hydroxide ($OH^{-}$) | | |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 5, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 32.0 | 1.60 | 0.4 |
| Magnesium ($Mg^{++}$) | 135.0 | 11.11 | 3.0 |
| Sodium ($Na^{+}$) | 8125.0 | 353.41 | 95.7 |
| Potassium ($K^{+}$) | 131.0 | 3.35 | 0.9 |
| Carbonate ($CO_3^{=}$) | 38.4 | 1.28 | 0.4 |
| Bicarbonate ($HCO_3^{-}$) | 7.5 | 0.12 | 0.0 |
| Sulfate ($SO_4^{=}$) | 860.0 | 17.91 | 5.3 |
| Chloride ($Cl^{-}$) | 11200.0 | 315.85 | 94.2 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 2.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 28.0 | | |
| Magnesium (Acidified) | 126.0 | | |
| Total dissolved solids | 19092.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 335.16 | Total Cations (epm) | 369.47 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 7.0 |
| pH | 8.6 | pH | 8.7 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | 72.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 649.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Date sampled: July 14, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .018 |
| Au | <.003 | Mo | <.006 |
| Al | 0.33 | Na | 4741 |
| As | <.038 | Ni | <.010 |
| B | 1.06 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 14.4 | Si | 0.65 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 1.46 |
| Cr | <.006 | Te | <.065 |
| Cu | .018 | Ti | .005 |
| Eu | <.015 | U | <.020 |
| Fe | 0.55 | V | .012 |
| K | 121 | W | <.078 |
| Mg | 59.9 | Zn | .033 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 27.0 | 1.35 | 0.4 |
| Magnesium(Mg) | 134.0 | 11.03 | 3.2 |
| Sodium(Na) | 7675.0 | 333.84 | 96.0 |
| Potassium(K) | 67.0 | 1.71 | 0.5 |
| Carbonate(CO3) | 72.0 | 2.40 | 0.7 |
| Bicarbonate(HCO3) | 561.0 | 9.20 | 2.7 |
| Sulphate(SO4) | 367.0 | 7.64 | 2.2 |
| Chloride(Cl) | 11600.0 | 327.13 | 94.4 |
| Nitrate(NO3) | 0.9 | 0.01 | 0.0 |
| Silica(SiO2) | 1.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 24.0 | | |
| Magnesium(Acidified) | 121.0 | | |
| TDS(mg/l) | 19518.0 | | |
| Total Anions(epm) | 346.38 | Total Cations(epm) | 347.93 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 29000 | | Temperature(C) | 7.00 | |
| pH | 8.7 | | pH | 8.7 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | 87 | mg/l |
| | | | Bicarbonate(HCO3) | 531 | mg/l |
| | | | Hydroxide(OH) | | |

2-525-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 4, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 33.0 | 1.65 | 0.4 |
| Magnesium(Mg) | 170.0 | 13.99 | 3.4 |
| Sodium(Na) | 9050.0 | 393.65 | 95.9 |
| Potassium(K) | 41.7 | 1.07 | 0.3 |
| Carbonate(CO3) | 38.4 | 1.28 | 0.3 |
| Bicarbonate(HCO3) | 537.0 | 8.80 | 2.1 |
| Sulphate(SO4) | 390.0 | 8.12 | 2.0 |
| Chloride(Cl) | 14100.0 | 397.63 | 95.6 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 1.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 30.0 | | |
| Magnesium(Acidified) | 163.0 | | |
| TDS(mg/l) | 24500.0 | | |
| Total Anions(epm) | 415.84 | Total Cations(epm) | 410.35 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 35600 | | Temperature(C) | 8.50 | |
| pH | 8.5 | | pH | 8.8 | |
| Fluoride(F) | 0.5 | mg/l | Carbonate(CO3) | 86 | mg/l |
| | | | Bicarbonate(HCO3) | 698 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 2-525-E-82

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Rge 12 Twp 97 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1980

Major constituents

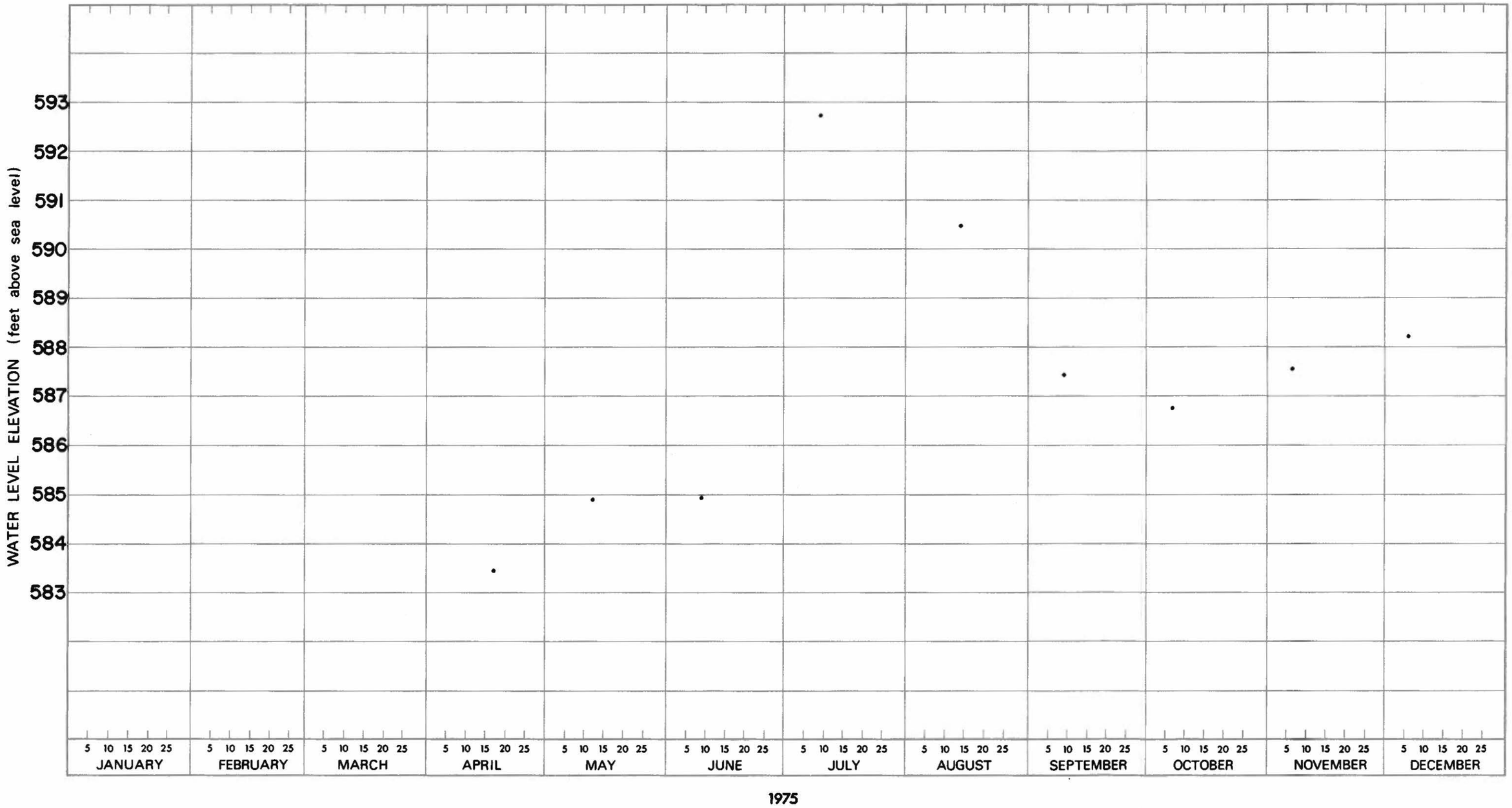
| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 45.0 | 2.25 | 0.5 |
| Magnesium(Mg) | 223.0 | 18.58 | 3.9 |
| Sodium(Na) | 10375.0 | 451.09 | 95.2 |
| Potassium(K) | 81.0 | 2.08 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 793.0 | 13.00 | 2.8 |
| Sulphate(SO4) | 375.0 | 7.81 | 1.7 |
| Chloride(Cl) | 15850.0 | 446.48 | 95.5 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 0.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 38.0 | | |
| Magnesium(Acidified) | 173.0 | | |
| TDS(mg/l) | 26685.0 | | |
| Total Anions(epm) | 467.30 | Total Cations(epm) | 474.00 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 41000 | Temperature | 7.00 | |
| pH | 8.3 | pH | 8.6 | |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | 43 | mg/l |
| | | Bicarbonate(HCO3) | 732 | mg/l |
| | | Hydroxide(OH) | | |

**WATER LEVEL HYDROGRAPH**

OBSERVATION WELL NUMBER 2-525
Lsd 1 Sec 11 Twp 97 R 12 W4th
Alberta Research Council



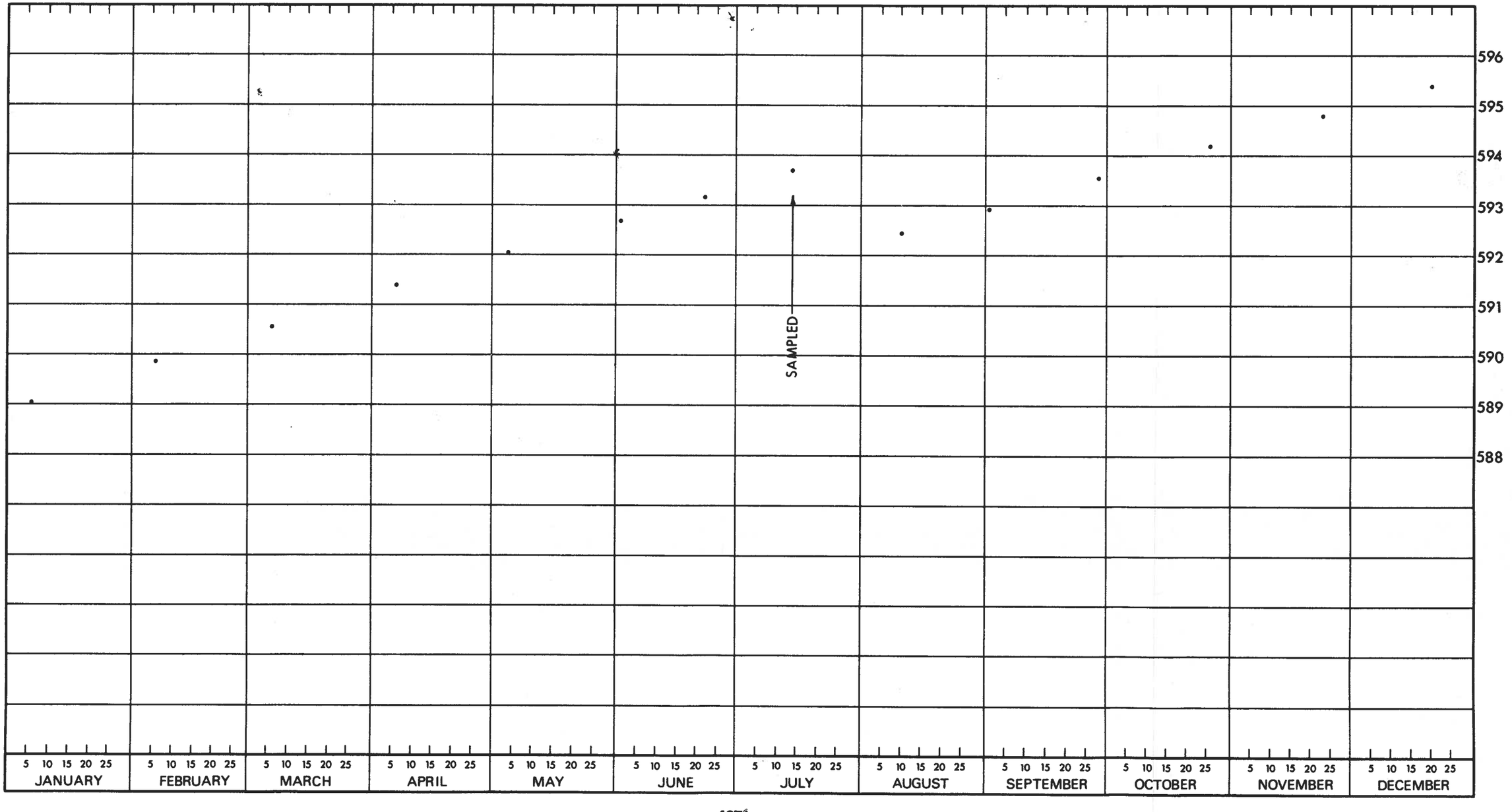
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **2-525**

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

2 - 525 - H - 77




1976

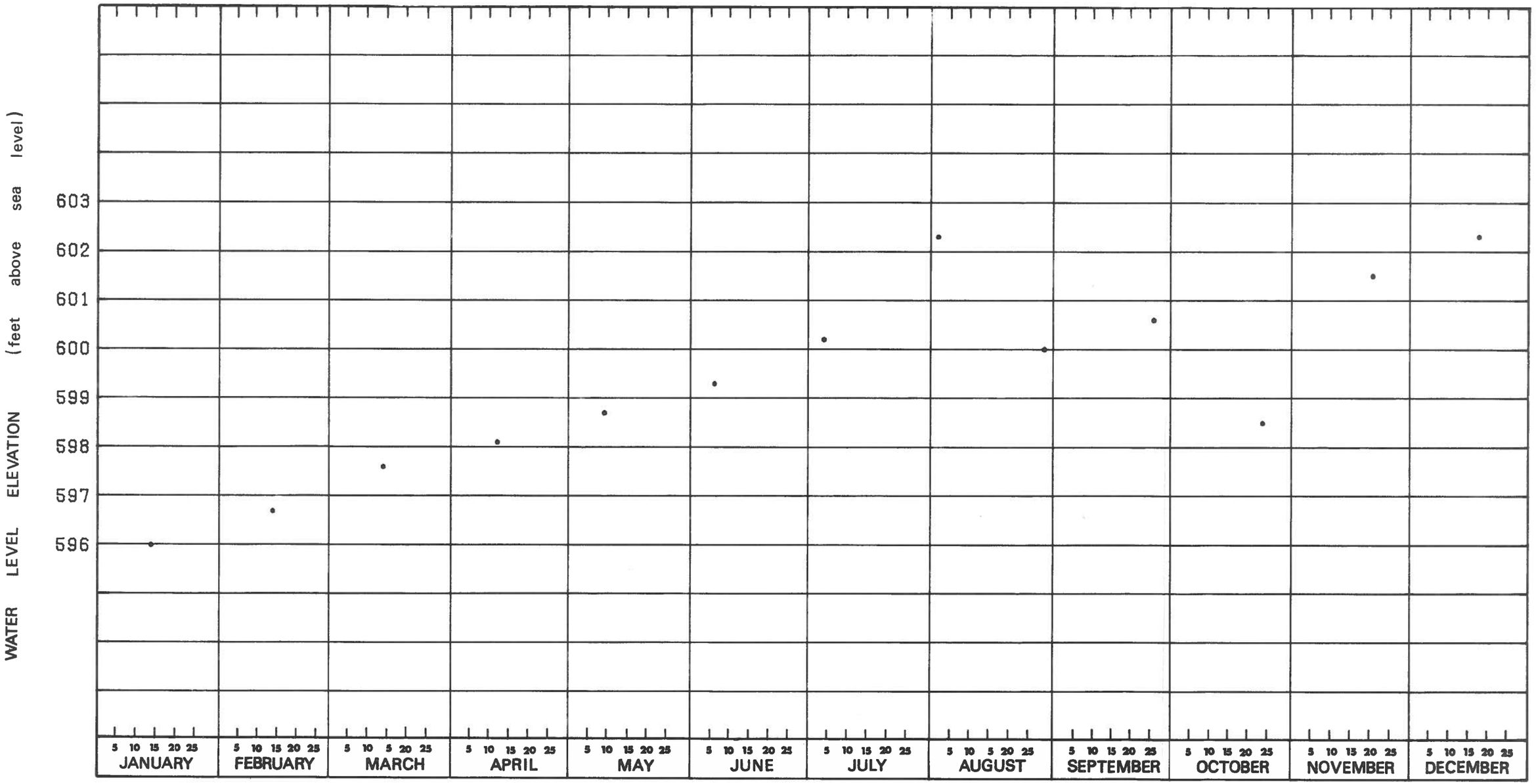
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-525-H-78



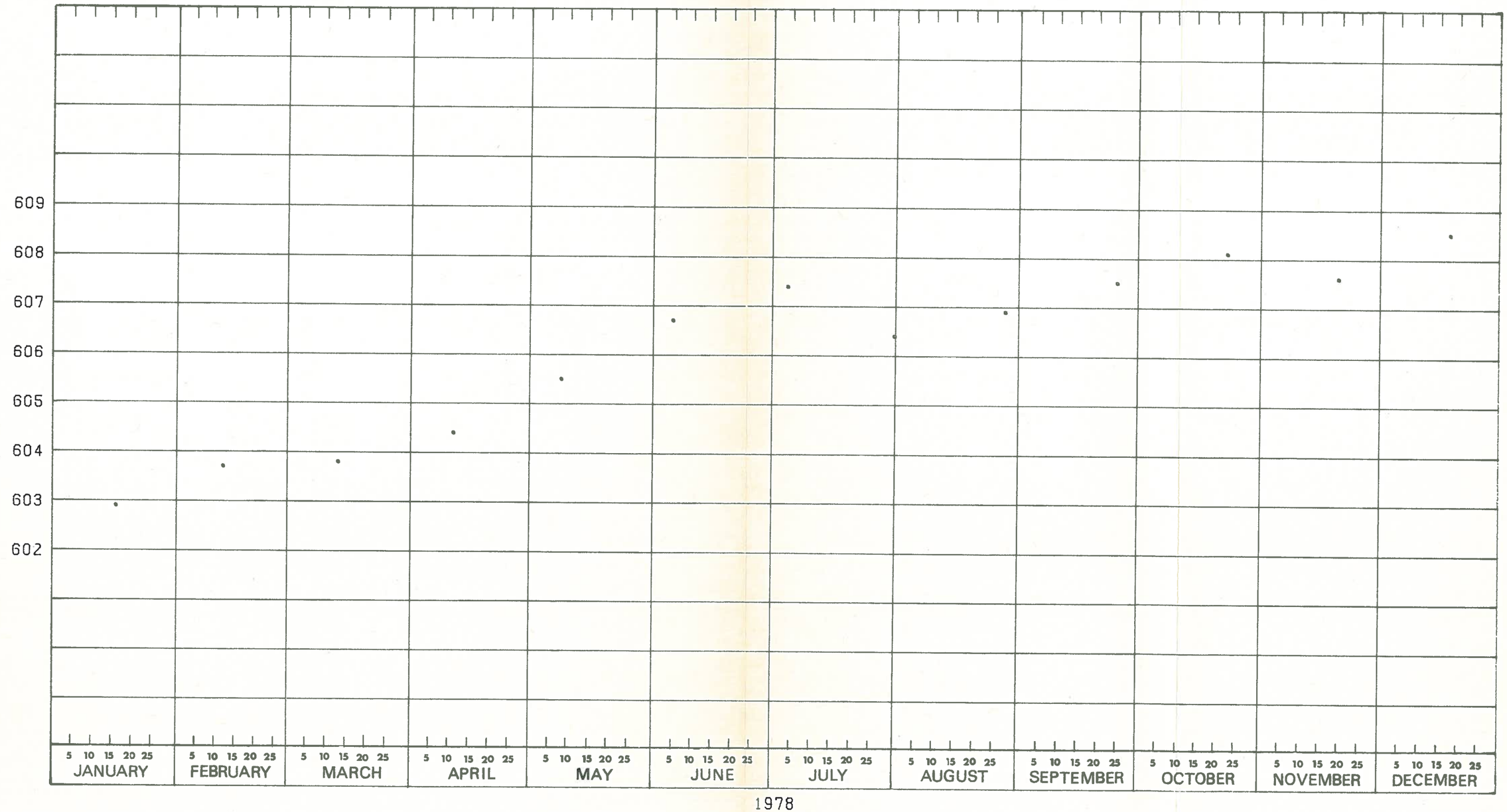
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-525

LSD 1 SEC 11 TWP 97 R 12 W4TH

Alberta Research Council

2-525-H-79




1978

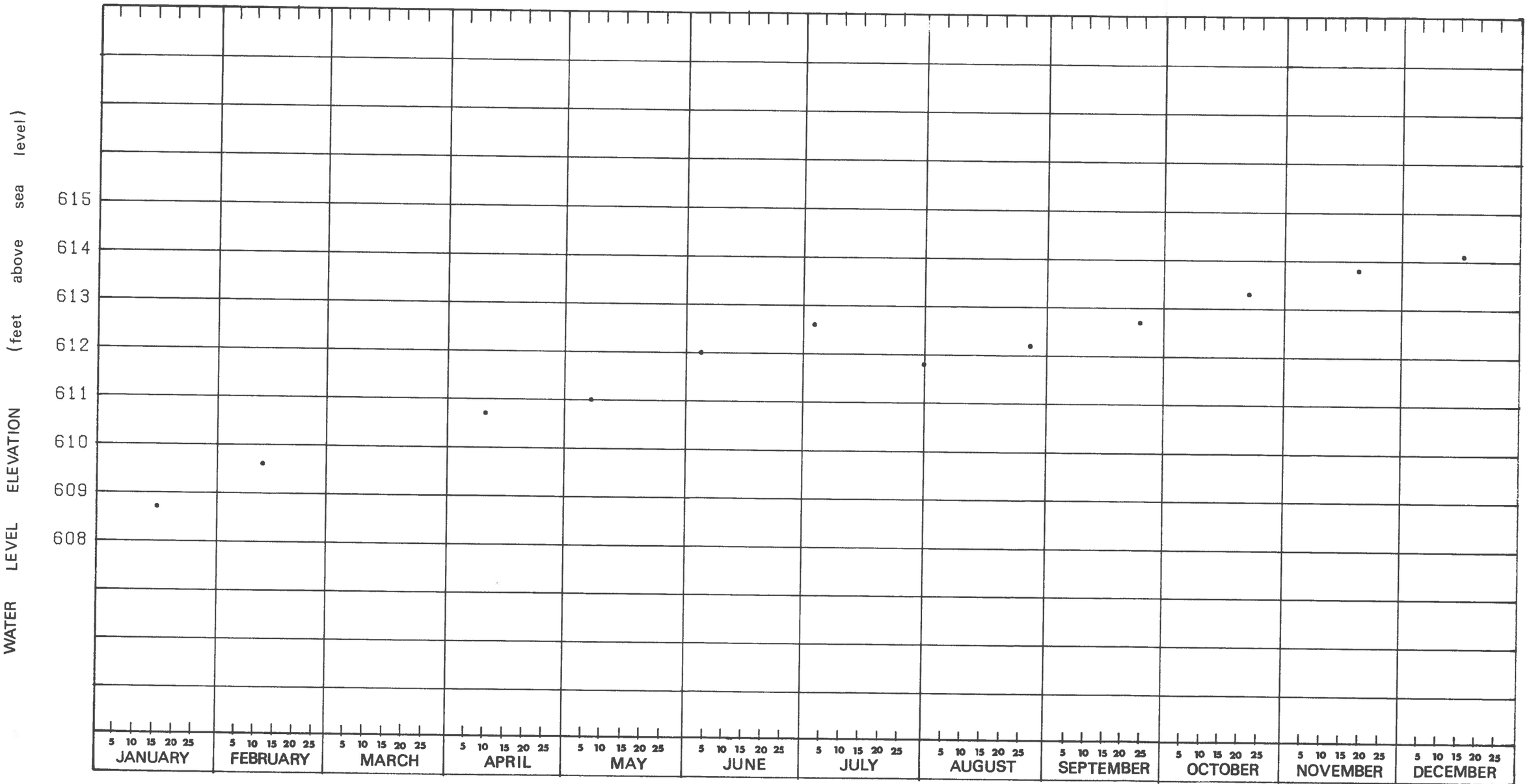
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-525-H-80



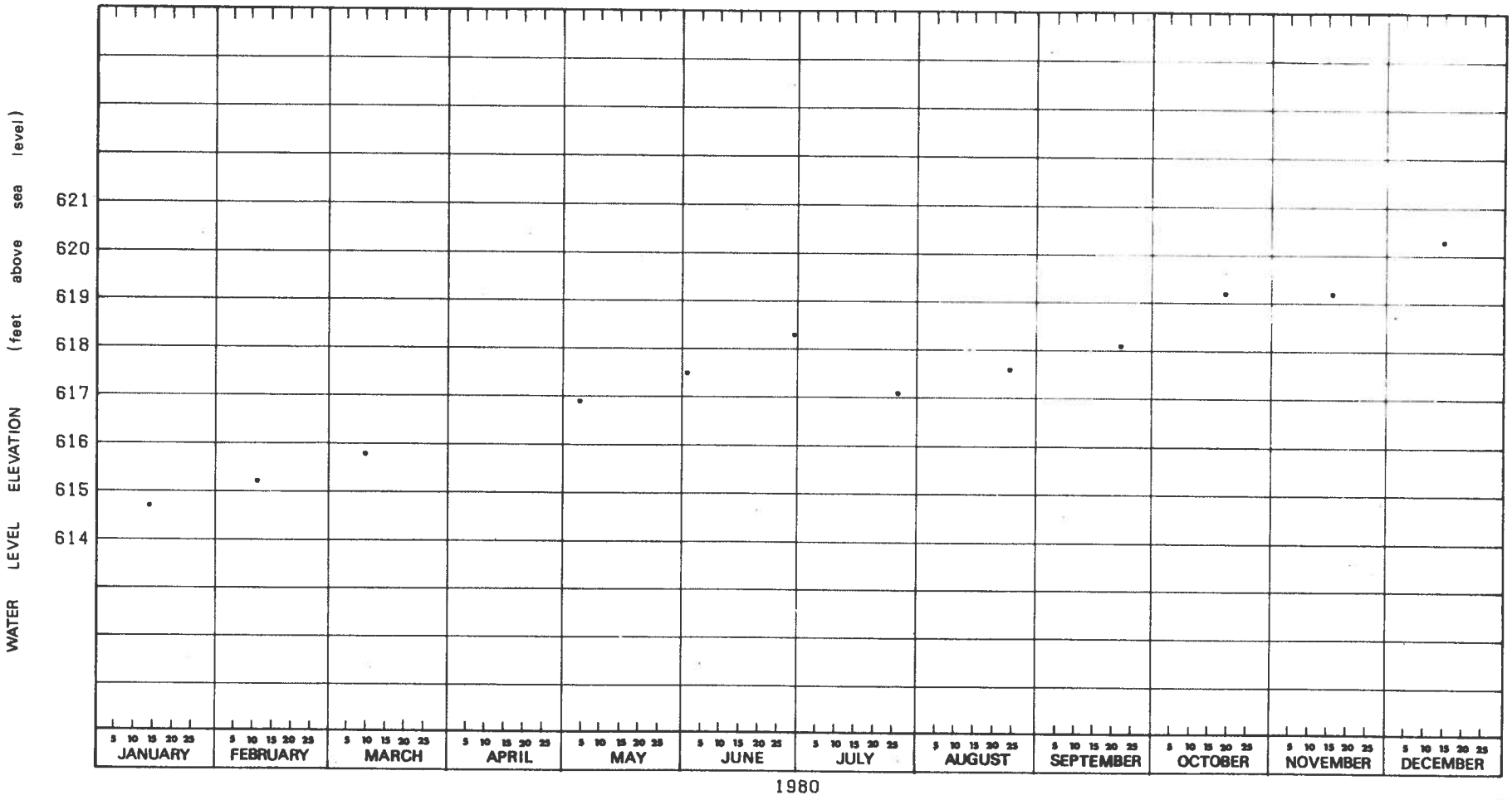
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-525-H-81



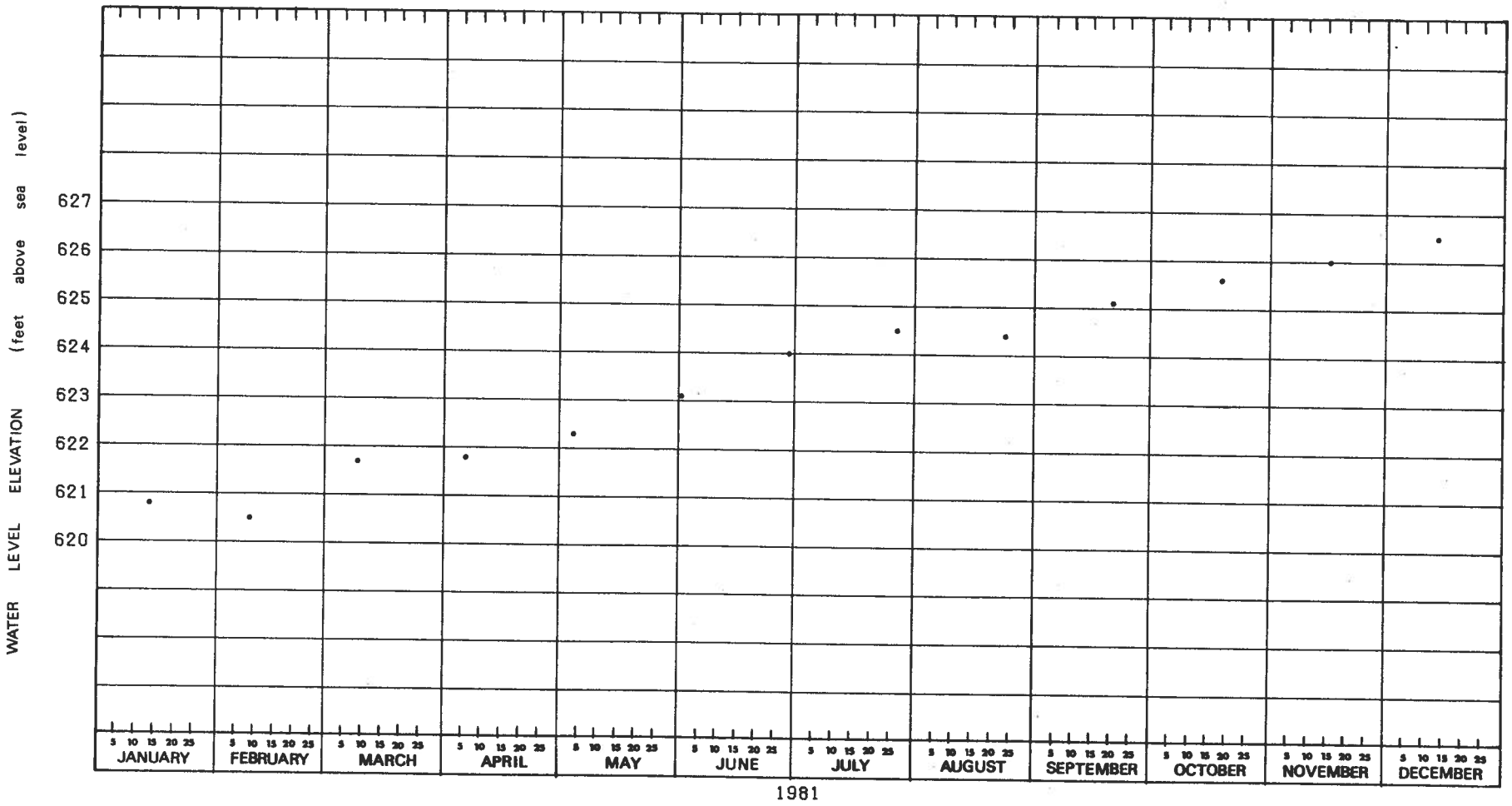
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4 th

Alberta Research Council

2-525-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.22 (Until March 13/75)
1060.64 (After March 13/75)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/75 | | | Well completed |
| Jan 17/75 | | | Water sample |
| Jan 23/75 | 108.80 TOC | 703.68 | |
| Jan 24/75 | 108.79 TOC | 703.72 | |
| Jan 26/75 | 107.88 TOC | 706.70 | |
| Feb 14/75 | 108.28 MP | 707.41 | Water sample; install shelter; MP = 2.03' TOC, (1062.67) |
| Mar 12/75 | | | Remove shelter |
| Mar 13/75 | | | Cut off casing; water sample; DST; misrun - set tool above water |
| Mar 14/75 | | | Reinstall shelter |
| Apr 17/75 | 146.13 | 583.46 | MP = 2.95' TOC, (1063.59) |
| May 12/75 | 145.69 new MP | 584.90 | MP = 69 CM TOC, (1062.90) |
| June 9/75 | 145.72 MP | 584.95 | |
| July 9/75 | 143.35 MP | 592.71 | |
| Aug 14/75 | 144.03 MP | 590.48 | Installed heater |
| Sept 9/75 | 144.92 MP | 587.56 | Sampled well; temp. 6°C |
| Oct 7/75 | 145.16 MP | 586.77 | |
| Nov 6/75 | 144.93 MP | 587.53 | |
| Dec 6/75 | 144.72 MP | 588.22 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 144.47 MP | 589.0 | MP (1062.9) |
| Feb 6/76 | 144.22 MP | 589.9 | |
| Mar 6/76 | 144.01 MP | 590.5 | |
| Apr 6/76 | 143.76 MP | 591.4 | |
| May 4/76 | 143.56 MP | 592.0 | |
| June 1/76 | 143.36 MP | 592.7 | |
| June 22/76 | 143.21 MP | 593.2 | |
| July 14/76 | 143.05 MP | 593.7 | Sampled; temp. 9°C |
| Aug 10/76 | 143.42 MP | 592.5 | |
| Sept 1/76 | 143.28 MP | 593.0 | |
| Sept 28/76 | 143.09 MP | 593.6 | |
| Oct 26/76 | 142.89 MP | 594.2 | |
| Nov 23/76 | 142.70 MP | 594.8 | |
| Dec 20/76 | 142.52 MP | 595.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 142.35 MP | 596.0 | MP (1062.9) |
| Feb 15/77 | 142.12 MP | 596.7 | |
| Mar 15/77 | 141.86 MP | 597.6 | |
| Apr 13/77 | 141.72 MP | 598.1 | |
| May 10/77 | 141.53 MP | 598.7 | |
| June 7/77 | 141.35 MP | 599.3 | |
| July 5/77 | 141.06 MP | 600.2 | Sampled; temp. 7°C |
| Aug 3/77 | 140.42 MP | 602.3 | |
| Aug 30/77 | 141.13 MP | 600.0 | |
| Sept 27/77 | 140.95 MP | 600.6 | |
| Oct 25/77 | 141.59 MP | 598.5 | |
| Nov 22/77 | 140.68 MP | 601.5 | |
| Dec 19/77 | 140.42 MP | 602.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 140.24 MP | 602.9 | MP (1062.9) |
| Feb 13/78 | 140.04 MP | 603.7 | |
| Mar 14/78 | 139.96 MP | 603.8 | |
| Apr 12/78 | 139.77 MP | 604.4 | |
| May 9/78 | 139.46 MP | 605.5 | |
| June 6/78 | 139.09 MP | 606.7 | |
| July 5/78 | 138.88 MP | 607.4 | Sampled; temp. 7°C |
| Aug 1/78 | 139.19 MP | 606.4 | |
| Aug 29/78 | 139.01 MP | 606.9 | |
| Sept 26/78 | 138.83 MP | 607.5 | |
| Oct 24/78 | 138.65 MP | 608.1 | |
| Nov 21/78 | 138.82 MP | 607.6 | |
| Dec 19/78 | 138.55 MP | 608.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 138.47 MP | 608.7 | MP (1062.9) |
| Feb 13/79 | 138.20 MP | 609.6 | |
| Mar 14/79 | | | Could not measure |
| Apr 11/79 | 137.85 MP | 610.7 | |
| May 8/79 | 137.77 MP | 611.0 | |
| June 5/79 | 137.48 MP | 612.0 | |
| July 4/79 | 137.28 MP | 612.6 | Sampled; temp. 8.5°C |
| Aug 1/79 | 137.53 MP | 611.8 | |
| Aug 28/79 | 137.42 MP | 612.2 | |
| Sept 25/79 | 137.26 MP | 612.7 | |
| Oct 23/79 | 137.07 MP | 613.3 | |
| Nov 20/79 | 136.92 MP | 613.8 | |
| Dec 17/79 | 136.83 MP | 614.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 2-525

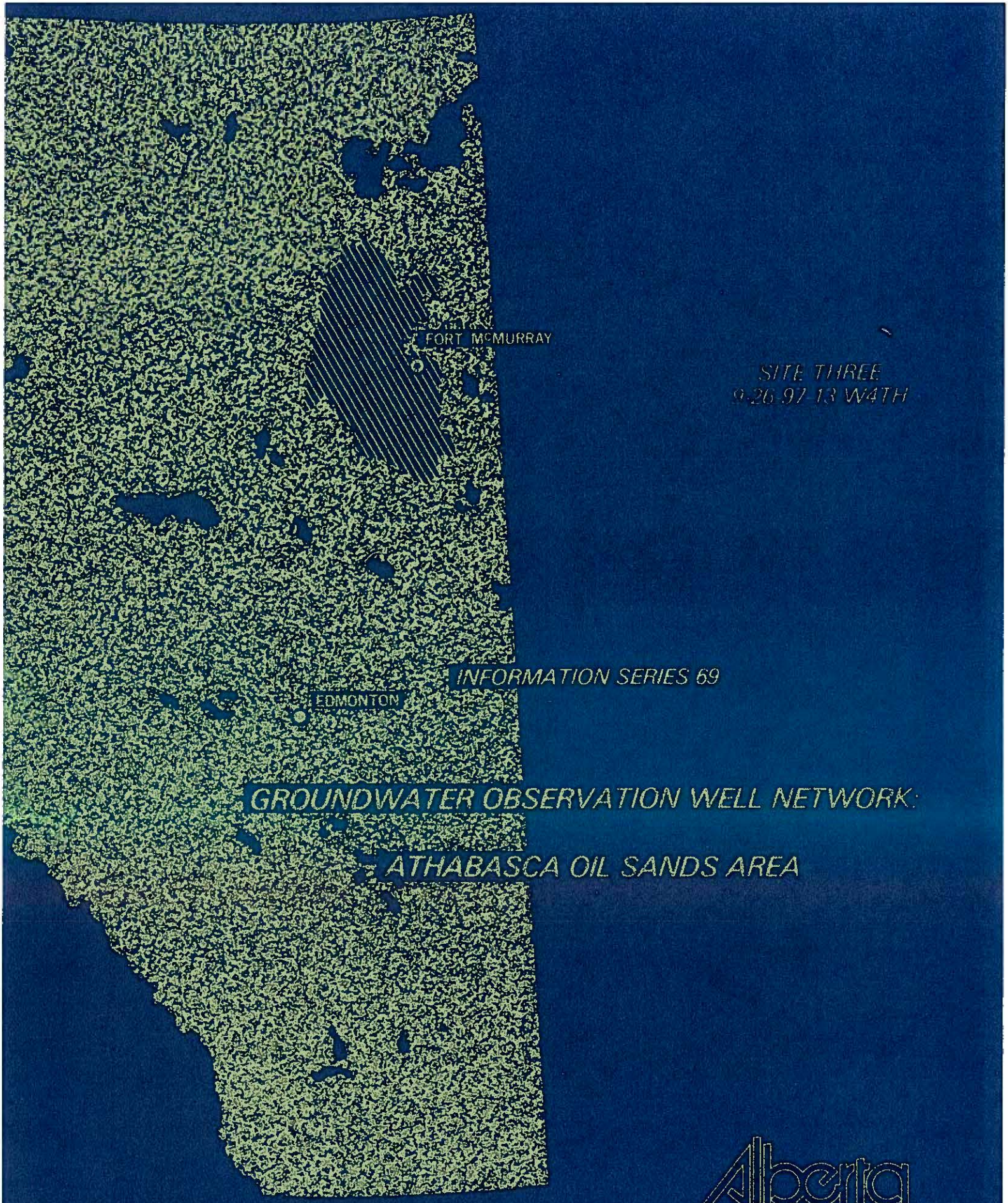
Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 136.65 MP | 614.7 | |
| Feb 12/80 | 136.50 MP | 615.2 | |
| Mar 11/80 | 136.31 MP | 615.8 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 135.97 MP | 616.9 | |
| June 3/80 | 135.79 MP | 617.5 | |
| July 1/80 | 135.56 MP | 618.3 | Temp. 7°C |
| July 28/80 | 135.91 MP | 617.1 | |
| Aug 26/80 | 135.75 MP | 617.6 | |
| Sept 24/80 | 135.60 MP | 618.1 | |
| Oct 21/80 | 135.27 MP | 619.2 | |
| Nov 18/80 | 135.27 MP | 619.2 | |
| Dec 17/80 | 134.95 MP | 620.3 | |
| Jan 15/81 | 134.80 MP | 620.8 | |
| Feb 10/81 | 134.89 MP | 620.5 | |
| Mar 10/81 | 134.50 MP | 621.7 | |
| Apr 7/81 | 134.49 MP | 621.8 | |
| May 5/81 | 134.33 MP | 622.3 | |
| June 2/81 | 134.10 MP | 623.1 | |
| June 30/81 | 133.82 MP | 624.0 | |
| July 28/81 | 133.66 MP | 624.5 | |
| Aug 25/81 | 133.69 MP | 624.4 | |
| Sept 22/81 | 133.49 MP | 625.1 | |
| Oct 20/81 | 133.32 MP | 625.6 | |
| Nov 17/81 | 133.21 MP | 626.0 | |
| Dec 15/81 | 133.04 MP | 626.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing




INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites, containing 36 individual wells, were instrumented in this manner during the winter of 1974-75.

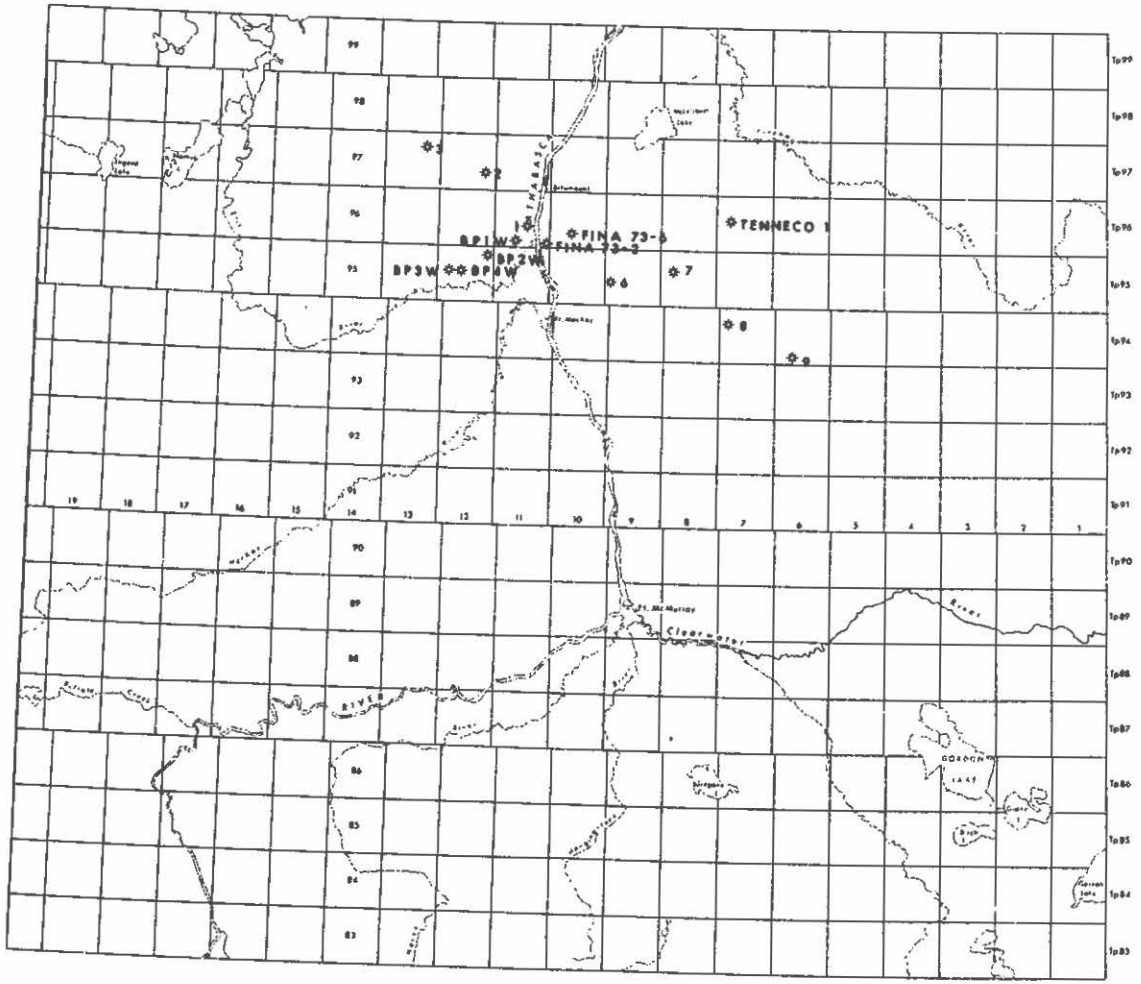
The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill-stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The loose-leaf format has been chosen to facilitate periodic updating with such information as hydrographs, water analyses and well history. The page indexing system is also consistent with the updating process. All updating packages will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this introduction and legend.

There were seven piezometer nests in the system on August 31, 1975. Four companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing. Table 1 lists the location of wells in the system as of August 31, 1975. Map 1 indicates the location of these wells. Publications available as of the date of this document include those for sites 1, 2, 3, 6, 7, 8 and 9.

Table 1
Athabasca Oil Sands Observation Wells
August 31, 1975

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |




6 0 6 12 18 MILES

**MAP 1**
**ATHABASCA OIL SANDS**
**OBSERVATION WELL NETWORK**
**August 31, 1975**

## Acknowledgments

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, C. Seibert, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1975: BOPG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., and Shell Canada Ltd.

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication
Well Number - the name used for designating the well
Subject Code - as follows:

- I - Introduction (no site number indicated)
- L - Legend (no site number indicated)
- G - General site information including geological logs, geophysical logs and site plan (no well number indicated)
- C - Well construction details
- D - Drill stem testing
- A - Aquifer testing
- E - Chemical analyses including spectral emission estimates and routine water analyses
- H - Annual hydrograph
- W - Well history

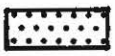
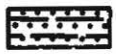
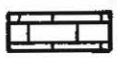
So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within the tabbed section for that particular well.

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| Mer | meridian |
| Meg/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diamter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| Sec. | section |
| ss | stainless steel |

| Symbol | Units or Parameter |
|---|---|
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) *or* time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| $\Delta t$ | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| Wt | weight |

## GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
|  | sandstone |
| | arkosic sandstone |
| | silt |
| | siltstone |
| | silt & sandstone |
| | clay |
| | sandy clay |
| | shale |
|  | sandstone & shale |
| | oilsand |
| | shaley dolomite |
| | gypsum |
| | dolomite |
|  | limestone |

| Symbol | Stratigraphic Unit |
|---|---|
| Qd | unconsolidated deposits |
| Klb | La Biche Fm. |
| Kpl | Pelican Fm. |
| Kj | Joli Fou Fm. |
| Kg | Grand Rapids Fm. |
| Kc | Clearwater Fm. |
| Km | McMurray Fm. |
| Dbl | Beaverhill Lake Gp. |
| Dw | Waterways Fm. |
| Dpe | Prairie Evaporite Fm. |
| Dmt | Methy Fm. |
| Dmr | McLean River Fm. |
| Dl | La Loche Fm. |
| P€ | Precambrian |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: complete routine analysis and a spectral emission estimate for 29 elements. Many of the samples collected during 1975 appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years.

Most water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source".

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface

3. drill through the aquifer using very light mud
4. insert a screening device (if necessary).

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

Two drilling rigs were used simultaneously during the 1974-1975 drilling season. Both were Failing 1500; one was trailer mounted and capable of 2,000-foot depths, the other was truck mounted and capable of about 1,200-foot depths.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma and uncompensated density were the logs run during the 1974-75 drilling. The geological log presented represents an interpretation based upon the sample description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells when the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, all wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the

measuring tape sticking to the wet casing. Conventional oil-field drill stem testing equipment was selected in an attempt to produce permeability and head values in the wells with deep water levels. Information from these drill stem tests is presented in the section on "Drill Stem Testing". A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day
V = volume of production into drill collars and stem
t = total flow time of test
T = transmissivity in millidarcy-feet
M = slope of final shut-in pressure plot
k = permeability in millidarcys
h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot.

Values of transmissivity are expressed in the metric units of square metres per day. Permeability is expressed as centimetres per second.

OBSERVATION WELL SITE 3

9-26-97-13 W 4th

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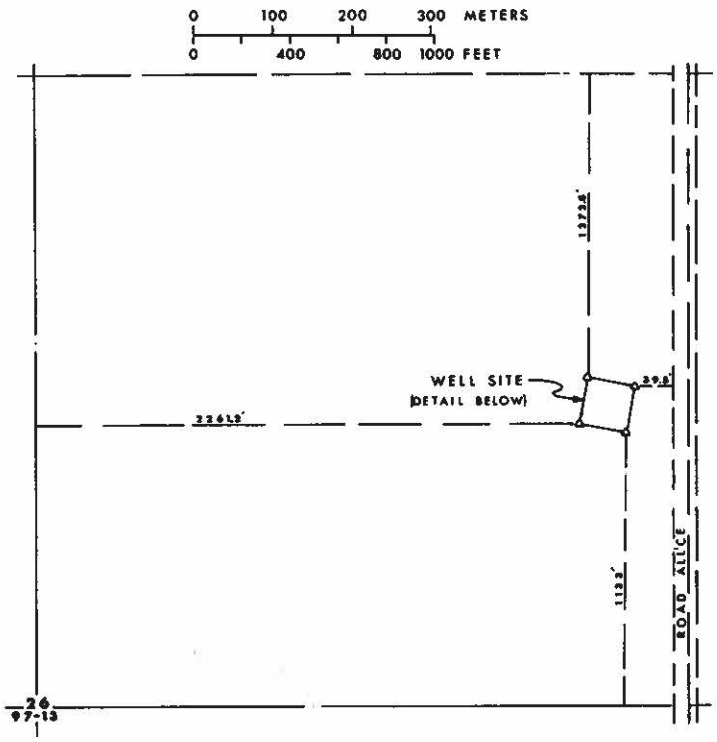
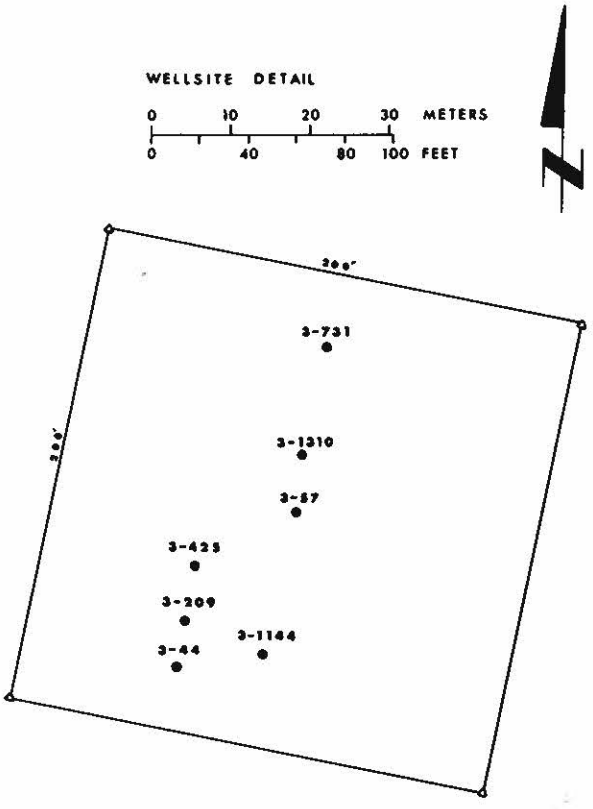


## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Three

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Ground elevation 2012 Total depth 1310

KB elevation 2017

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 10 | Clayey silty sand, poorly sorted, quartz sand rounded to sub-rounded, medium grained, some well rounded K-feldspar < 5%, fine grained, organics < 5%, overall earth brown color | Drift |
| 10 | 40 | Micaceous silt, light grey, calcareous | |
| 40 | 60 | Micaceous silty clay, light grey, calcareous | |
| 60 | 80 | Micaceous clayey silt, light grey, calcareous | |
| 80 | 100 | Micaceous silty clay, light grey, calcareous | |
| | 110 | Micaceous silty clay, light grey, calcareous with microolitic pyrite inclusion < 1% calcareous | |
| 110 | 140 | Micaceous silty clay, light grey, calcareous | |
| | 150 | As above with pyrite < 1%, calcareous | |
| | 160 | As above with pyrite, and aragonite rhombs < 1%, calcareous | |
| | 170 | As above with aragonite rhombs 1%-2%, no pyrite | |
| | 180 | As above, no inclusion | |
| | 190 | As above with pyrites 2%-3% | |
| | 200 | As above, with pyrite, pelecypod shell fragments rare | |
| | 210 | As above, no fossils, aragonite rhombs 1% | La Biche |
| | 220 | Shale, grey, mica, fissile, sand very minor | |
| | 230 | Shale as above (pyrite) | |
| 230 | 270 | Shale grey, mica, pyrite, inclusions of barren sand | |
| | 280 | Shale as above, sand minor | |

GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Three (continued)

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 290 | Clay, dark grey, sand very silty | |
| 290 | 310 | Shale, dark grey, mica, slight traces of sand | |
| 310 | 330 | Shale, clay, sand 20%, 50%, 30%, shale and clay as above sand white, very fine grained, rounded | |
| 330 | 350 | Clay and sand, 60%, 40%, clay, grey, mica silty and white very fine grained, well rounded | |
| | 360 | Sandy clay, silty quartz medium grained, sub-rounded to rounded | |
| | 370 | Sandy clay, silt | Pelican |
| 370 | 400 | Clayey sand, sand-very fine to fine grained, quartz sub-rounded to rounded, well sorted | |
| 400 | 430 | Sand, white, very fine to coarse grained, sub-rounded to rounded, poorly sorted | |
| | 440 | Sand, as above, minor clay, mica, silty | |
| | 450 | Sand, sub-rounded to rounded, micaceous, carbonaceous, silty, poorly sorted, very fine to coarse grained quartz | |
| | 460 | Sand, sub-rounded to rounded, micaceous, silty, poorly sorted, very fine to coarse grained carbonaceous quartz | |
| | 470 | Sand, sub-rounded to rounded, poorly sorted, very fine to coarse grained, micaceous, silty | |
| | 480 | Sand, sub-angular to sub-rounded, poorly sorted very fine to coarse grained, silty, micaceous | |
| | 490 | As above, carbonaceous | Joli Fou |
| | 500 | Sand, sub-angular to sub-rounded, very fine to coarse grained, silty, micaceous, quartz | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Three (continued)

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 500 | 530 | Sand, poorly sorted, very fine to coarse grained, silty, micaceous, quartz | |
| | 540 | Sand, sub-angular to sub-rounded, poorly sorted, very fine to medium grained, silty, micaceous, quartz | |
| | 550 | As above, poor bitumen | |
| 550 | 570 | Sand, sub-angular to sub-rounded, poorly sorted, very fine to medium grained, micaceous, green carbonaceous material | Grand Rapids |
| 570 | 590 | Sand, poorly sorted, very fine to medium grained, sub-angular to sub-rounded, micaceous, greenish quartz, carbonaceous | |
| | 600 | Sand, poorly sorted, very fine to medium grained, micaceous carbonaceous | |
| 600 | 620 | Sand, poorly sorted, very fine to medium grained, micaceous | |
| | 630 | Sand, sub-rounded to rounded, very fine to coarse grained, carbonaceous, micaceous | |
| 630 | 650 | As above, but sub-angular to sub-rounded | |
| | 660 | As above, some greenish material | |
| 660 | 680 | Sand, sub-rounded, to rounded, poorly sorted, very fine to medium grained, micaceous, carbonaceous | |
| | 690 | Sand, sub-rounded to sub-angular, very fine to fine grained, micaceous, carbonaceous | |
| 690 | 710 | As above, very slightly bituminous, poorly sorted | |
| 710 | 740 | Sand, white, silty, quartz medium to coarse grained, sub-angular to sub-rounded, well sorted | Clearwater |
| 740 | 760 | As above, micaceous, carbonaceous | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Three (Continued)

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 760 | 790 | Sand, silty with quartz sub-rounded to rounded, poorly sorted, micaceous, carbonaceous | |
| 790 | 820 | Shale, quartz, sub-rounded to rounded, medium to coarse grained, micaceous, carbonaceous | |
| | 830 | Silty band, micaceous, carbonaceous | |
| 830 | 890 | Sand, silt to medium grained, sub-rounded to rounded, micaceous, carbonaceous | |
| | 900 | Sand as above with some inclusions of clay | |
| | 910 | Sand as above with very thin laminations of tarsand | |
| 910 | 930 | Shale and sand, shale-grey micaceous, carbonaceous, fissile | |
| 930 | 1010 | Sand, very fine to fine grained, sub-rounded to rounded, interbedded with shale | |
| 1010 | 1040 | Shale, grey, sand - white, very fine to fine grained, well sorted | |
| 1040 | 1060 | Sand, very silty, micaceous, carbonaceous | |
| | 1070 | As above, some clay | |
| 1070 | 1090 | Sand, silty, quartz sub-rounded to rounded, well sorted | |
| 1090 | 1120 | Shale and sand, sand as above | |
| | 1130 | As above with some tarsand | |
| 1130 | 1160 | Sand, silty, quartz sub-rounded to rounded, fine to medium grained, well sorted | |
| | 1170 | Quartz, sub-rounded to rounded, fine to medium grained, well sorted | McMurray |
| | 1180 | Fine white sand, sub-rounded to rounded, pods of oil stained sand, traces of gypsum | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Three (continued)

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 1190 | Shale and sand, sand as above | |
| 1190 | 1230 | Sand, very fine to fine grained, well sorted sub-rounded to rounded | |
| | 1240 | Sand, as above, compacted very tight | |
| 1240 | 1270 | Limestone | Beaverhill Lake |
| 1270 | 1310 | Limestone, white to light tan, micritic, tight | |

## SUMMARY OF CONTENTS

SITE NUMBER THREE

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | | | |
|---|---|---|---|---|---|---|---|
| | site | 3-44 | 3-57 | 3-209 | 3-425 | 3-731 | 3-1144 | 3-1310 |
| Introduction | 4 | — | — | — | — | — | — | — |
| Legend | 8 | — | — | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — | — | — |
| Geological Sample Description | 5 | — | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Drill Stem Test | — | 0 | 0 | 2 | 1 | 1 | 2 | 2 |
| Shut-In Pressure Data | — | 0 | 0 | 2 | 0 | 0 | 2 | 2 |
| Water Analysis | — | 2 | 1 | 3 | 1 | 2 | 3 | 3 |
| Spectral Emission Estimates | — | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER THREE

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | site | 3-44 | 3-57 | 3-209 | 3-425 | 3-731 | 3-1144 | 3-1310 |
| Geological Sample Description | 3* | — | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1* | — | — | — | — | — | — | — |
| Water Analysis | — | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

*Erratum sheets replacing material distributed in 1976

### ERRATUM STATEMENT

Material Distributed in 1976

1. Corrected GEOLOGICAL SAMPLE DESCRIPTION pages have been issued. Pages indexed 3-G-77 have replaced those indexed 3-G-76.
2. A corrected GEOPHYSICAL AND GEOLOGICAL LOGS page has been issued. The page indexed 3-G-77 has replaced 3-G-76.
3. The "formation tested" on the DRILL STEM TEST for well 3-209 (page 3-209-D-76) should be changed to "Shaftesbury".
4. The "formation tested" on the DRILL STEM TEST for well 3-425 (page 3-425-D-76) should be changed to "Grand Rapids".
5. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
6. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Three

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Ground elevation 2012 Total depth 1310

KB elevation 2017

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 5 | 25 | Unsorted drift. Clay, brown, silty and sandy, brown, medium grained qtz, fld, hvy dark mineral, organics | Drift |
| 25 | 50 | Sand, light grey, fine, silty, calcareous | Dunvegan |
| 50 | 140 | Clay, light to medium grey, calcareous; mica and pyrite traces; silty clay interbeds | Shaftesbury |
| 140 | 165 | Siltstone, light grey, sandy, calcareous, pyrite traces | |
| 165 | 190 | Shale, light to medium grey, calcareous, pyrite and mica traces, minor silty stringers | |
| 190 | 205 | Sandstone, light grey, silty, calcareous, mica, pyrite, fossil (pelecypod?) traces | |
| 205 | 240 | Shale, medium grey, fissile, calcareous, mica and pyrite traces | |
| 240 | 310 | Shale as above; siltstone and minor sandstone, light grey interbedded | |
| 310 | 330 | Shale, dark grey, fissile, silty, fossiliferous | |
| 330 | 350 | Sandstone, salt and pepper, fine grained, well sorted, well rounded, qtz, fld, hvy dark mnrls, pyrite | Grand Rapids |
| 350 | 365 | Clay, medium grey, silty, calcareous, siltstone stringers | |
| 365 | 400 | Sandstone, salt and pepper, fine grained, well sorted, subrounded to rounded, calcareous; siltstone light grey, sandy, in stringers | |
| 400 | 410 | Siltstone as above; interbedded with clay, medium grey, calcareous | |
| 410 | 490 | Sandstone, light brown, fine to coarse, poorly sorted, subangular to subrounded, calcareous, carbonaceous, micaceous, qtz, fld, hvy dark minerals, pyrite | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Three (continued)

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 490 | 570 | Clay, medium grey, silty, calcareous, carbonaceous; thin beds of silty sandstone, slightly bituminous | |
| 570 | 615 | Sandstone, light brown, fine to medium grained, medium sorted, subang to subrd, micaceous, carbonaceous; clay, medium grey, calcareous, interbedded | |
| 615 | 640 | Sandstone, light brown, fine-coarse grained, poorly sorted, subang to subrd, micaceous, carbonaceous | |
| 640 | 700 | Sandstone as above interbedded with siltstone, medium grey, sandy | |
| 700 | 730 | Sandstone, light brown, fine to coarse grained, poorly sorted, subang to subrd, micaceous, carbonaceous, slightly bituminous | |
| 730 | 810 | Clay, medium grey, calcareous, carbonaceous, interbedded with siltstone, medium grey, mainly in the lower part | Clearwater |
| 810 | 830 | Sandstone, light grey, silt to medium grained, poorly sorted, subrounded to rounded, micaceous, carbonaceous, qtz, fld, hvy dark mnrls, pyrite; siltstone in thin beds | |
| 830 | 850 | Clay, medium grey, calcareous | |
| 850 | 970 | Clay, medium grey, calcareous interbedded with shale, medium to dark grey, fissile, micaceous, carbonaceous and thin beds of sandstone, silty | |
| 970 | 995 | Sandstone, light grey, very fine to fine grained, well sorted, subrounded to rounded, qtz, fld, glauc, mica, pyrite | |
| 995 | 1055 | Shale, medium grey, calcareous, carbonaceous, interbedded with siltstone, light grey, sandy | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Three (continued)

Lsd 9 Sec 26 Twp 97 R 13 W4th

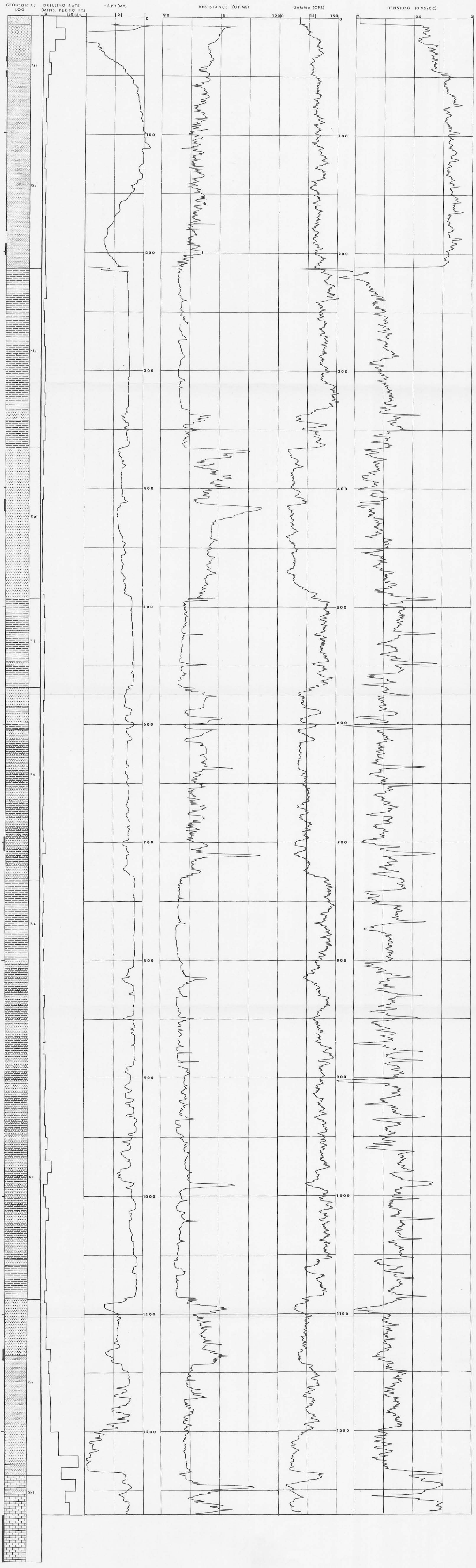
Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 1055 | 1070 | Sandstone, medium grey, silty, fine-grained, well sorted, subrounded to rounded, argillaceous, qtz, fld, glauc, mica | Wabiskaw |
| 1070 | 1085 | Shale, medium to dark grey, micaceous, carbonaceous | McMurray |
| 1085 | 1140 | Sand, light brown, fine-medium grained, well sorted, subrounded to rounded, qtz, mica, pyrite; oil impregnated between 1120-1130 | |
| 1140 | 1190 | Siltstone, medium grey, sandy, interbedded with sandstone as above, oil stained | |
| 1190 | 1230 | Sandstone, light brown, fine grained, well sorted, subrounded to rounded, qtz, pyrite, plant remains | |
| 1230 | 1240 | Shale, medium grey, silty, calcareous | Beaverhill Lake |
| 1240 | 1310 | Limestone, buff to light grey; argillaceous limestone and medium grey calcareous shale in thin beds | |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 3
### 9-26-97-13 W4th
### ALBERTA RESEARCH COUNCIL

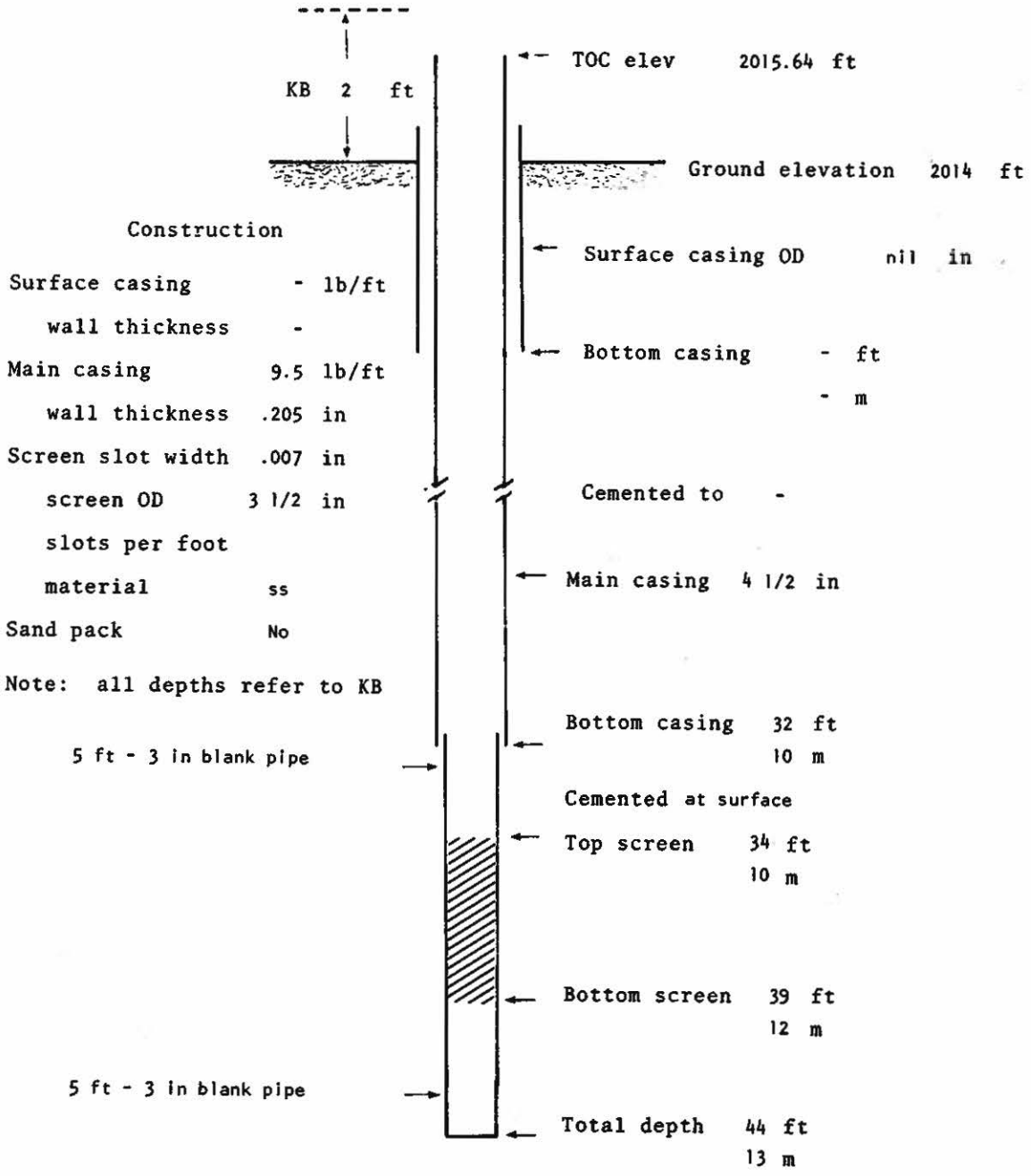


WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Tp 97 R 13 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed from 3-44

Date sampled January 22, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 77.0 | 3.84 | 32.6 |
| Magnesium ($Mg^{++}$) | 17.9 | 1.47 | 12.5 |
| Sodium ($Na^{+}$) | 146.0 | 6.35 | 53.8 |
| Potassium ($K^{+}$) | 5.4 | 0.14 | 1.2 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 124.4 | 2.04 | 16.7 |
| Sulfate ($SO_4^{=}$) | 450.0 | 9.37 | 76.7 |
| Chloride ($Cl^{-}$) | 27.0 | 0.76 | 6.2 |
| Nitrate ($NO_3^{=}$) | 2.5 | 0.04 | 0.3 |
| Silica ($SiO_2$) | 7.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 798.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.210 | Total Cations (epm) | 11.803 |

### Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1710 | Temperature (C) | 0.5 |
| pH | 7.9 | pH | 9.3 |
| Fluoride ($F^{-}$) | 0.8 ppm | Carbonate ($CO_3^{=}$) | 50.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 66.90 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | 925 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 9, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 117 | 5.84 | 14 |
| Magnesium ($Mg^{++}$) | 22.4 | 1.84 | 5 |
| Sodium ($Na^{+}$) | 750 | 32.62 | 81 |
| Potassium ($K^{+}$) | 6.7 | 0.17 | 0 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 424 | 6.95 | 18 |
| Sulfate ($SO_4^{=}$) | 1496 | 31.15 | 81 |
| Chloride ($Cl^{-}$) | 14 | 0.39 | 1 |
| Nitrate ($NO_3^{=}$) | 1.8 | 0.03 | 0 |
| Silica ($SiO_2$) | 3.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 148 | | |
| Magnesium (Acidified) | 50 | | |
| Total dissolved solids | 2596 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 38.52 | Total Cations (epm) | 40.47 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 4200 | Temperature (C) | 2.5 |
| pH | 7.7 | pH | 8.2 |
| Fluoride ($F^{-}$) | 1.4 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 451 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed from well 3-44

Date of sampling January 22, 1975

Total dissolved solids 798 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .05 | Mg | .01 |
| As | <.01 | Mn | .001 |
| B | .03 | Mo | ND |
| Ba | .001 | Ni | .002 |
| Be | ND | Pb | .005 |
| Bi | ND | Sb | ND |
| Ca | M | Si | M |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .004 | V | .005 |
| Fe | .05 | Zn | .05 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 64.0 | 3.19 | 8 |
| Magnesium ($Mg^{++}$) | 27.0 | 2.22 | 5 |
| Sodium ($Na^{+}$) | 850.0 | 36.97 | 87 |
| Potassium ($K^{+}$) | 7.5 | 0.19 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 517.0 | 8.47 | 20 |
| Sulfate ($SO_4^{=}$) | 1620.0 | 33.73 | 78 |
| Chloride ($Cl^{-}$) | 30.0 | 0.85 | 2 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 67.1 | | |
| Magnesium (Acidified) | 29.7 | | |
| Total dissolved solids | 2828 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 43.06 | Total Cations (epm) | 42.58 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 4000 | Temperature (C) | 4.0 |
| pH | 8.0 | pH | 8.3 |
| Fluoride ($F^{-}$) | 0.8 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 542 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 6, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 52.0 | 2.59 | 5.9 |
| Magnesium ($Mg^{++}$) | 19.9 | 1.64 | 3.7 |
| Sodium ($Na^{+}$) | 913.0 | 39.71 | 90.0 |
| Potassium ($K^{+}$) | 7.1 | 0.18 | 0.4 |
| Carbonate ($CO_3^{=}$) | 4.8 | 0.16 | 0.4 |
| Bicarbonate ($HCO_3^{-}$) | 517.0 | 8.47 | 18.7 |
| Sulfate ($SO_4^{=}$) | 1715.0 | 35.71 | 78.7 |
| Chloride ($Cl^{-}$) | 36.0 | 1.02 | 2.2 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 0.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 51.0 | | |
| Magnesium (Acidified) | 19.6 | | |
| Total dissolved solids | 2870.0 | | |
| Total Anions (epm) | 45.36 | Total Cations (epm) | 44.13 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 4300 |
| pH | 8.4 |
| Fluoride ($F^{-}$) | 0.8 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 4.0 |
| pH | 8.7 |
| Carbonate ($CO_3^{=}$) | 29.0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 464 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Date sampled: July 14, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .097 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 785 |
| As | <.038 | Ni | <.010 |
| B | 1.49 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 67.7 | Si | 1.43 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 1.07 |
| Cr | <.006 | Te | <.065 |
| Cu | .011 | Ti | .003 |
| Eu | <.015 | U | <.020 |
| Fe | .066 | V | .011 |
| K | 88 | W | <.078 |
| Mg | 24.9 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

3-44-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 06, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 28.0 | 1.40 | 4.4 |
| Magnesium(Mg) | 19.0 | 1.56 | 4.9 |
| Sodium(Na) | 650.0 | 28.27 | 89.1 |
| Potassium(K) | 20.0 | 0.51 | 1.6 |
| Carbonate(CO3) | 12.0 | 0.40 | 1.2 |
| Bicarbonate(HCO3) | 256.0 | 4.20 | 13.0 |
| Sulphate(SO4) | 1270.0 | 26.44 | 82.0 |
| Chloride(Cl) | 42.0 | 1.18 | 3.7 |
| Nitrate(NO3) | 1.7 | 0.03 | 0.1 |
| Silica(SiO2) | 0.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 21.0 | | |
| Magnesium(Acidified) | 16.0 | | |
| TDS(mg/l) | 2174.0 | | |
| Total Anions(epm) | 32.25 | Total Cations(epm) | 31.75 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2750 | Temperature(C) | 3.00 | |
| pH | 8.4 | pH | 8.8 | |
| Fluoride(F) | 0.5 mg/l | Carbonate(CO3) | 19 | mg/l |
| | | Bicarbonate(HCO3) | 214 | mg/l |
| | | Hydroxide(OH) | | |

3-44-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 32.0 | 1.60 | 4.1 |
| Magnesium(Mg) | 18.5 | 1.52 | 3.9 |
| Sodium(Na) | 813.0 | 35.36 | 91.5 |
| Potassium(K) | 5.8 | 0.15 | 0.4 |
| Carbonate(CO3) | 26.4 | 0.88 | 2.2 |
| Bicarbonate(HCO3) | 432.0 | 7.08 | 17.8 |
| Sulphate(SO4) | 1468.0 | 30.56 | 77.0 |
| Chloride(Cl) | 42.0 | 1.18 | 3.0 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 1.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 32.0 | | |
| Magnesium(Acidified) | 16.9 | | |
| TDS(mg/l) | 2652.0 | | |
| Total Anions(epm) | 39.71 | Total Cations(epm) | 38.63 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3410 | | Temperature(C) | 3.50 | |
| pH | 8.6 | | pH | 8.8 | |
| Fluoride(F) | 1.1 | mg/l | Carbonate(CO3) | 29 | mg/l |
| | | | Bicarbonate(HCO3) | 439 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 3-44-E-82

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 28.0 | 1.40 | 3.3 |
| Magnesium(Mg) | 22.0 | 1.83 | 4.4 |
| Sodium(Na) | 887.0 | 38.57 | 91.8 |
| Potassium(K) | 7.9 | 0.20 | 0.5 |
| Carbonate(CO3) | 12.0 | 0.40 | 0.9 |
| Bicarbonate(HCO3) | 322.0 | 5.28 | 11.8 |
| Sulphate(SO4) | 1775.0 | 36.98 | 82.9 |
| Chloride(Cl) | 70.0 | 1.97 | 4.4 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 0.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 26.5 | | |
| Magnesium(Acidified) | 19.8 | | |
| TDS(mg/l) | 2688.0 | | |
| Total Anions(epm) | 44.63 | Total Cations(epm) | 42.00 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3950 | Temperature | 3.00 | |
| pH | 8.8 | pH | 8.6 | |
| Fluoride | 0.7 mg/l | Carbonate(CO3) | 19 | mg/l |
| | | Bicarbonate(HCO3) | 341 | mg/l |
| | | Hydroxide(OH) | | |

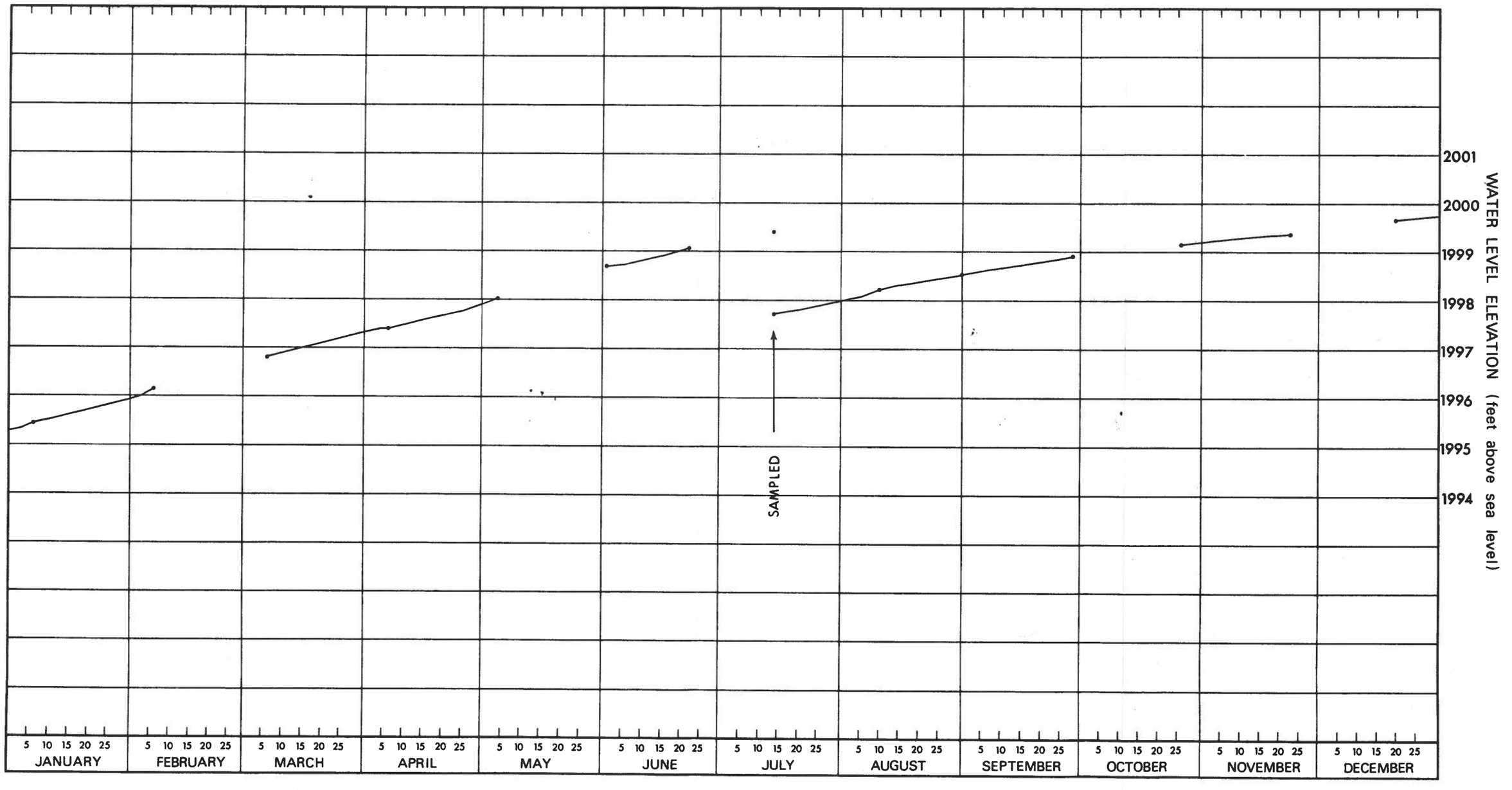
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **3-44**

Lsd **9** Sec **26** Twp **97** R **13** W4th

Alberta Research Council

**3 - 44 - H - 77**




1976

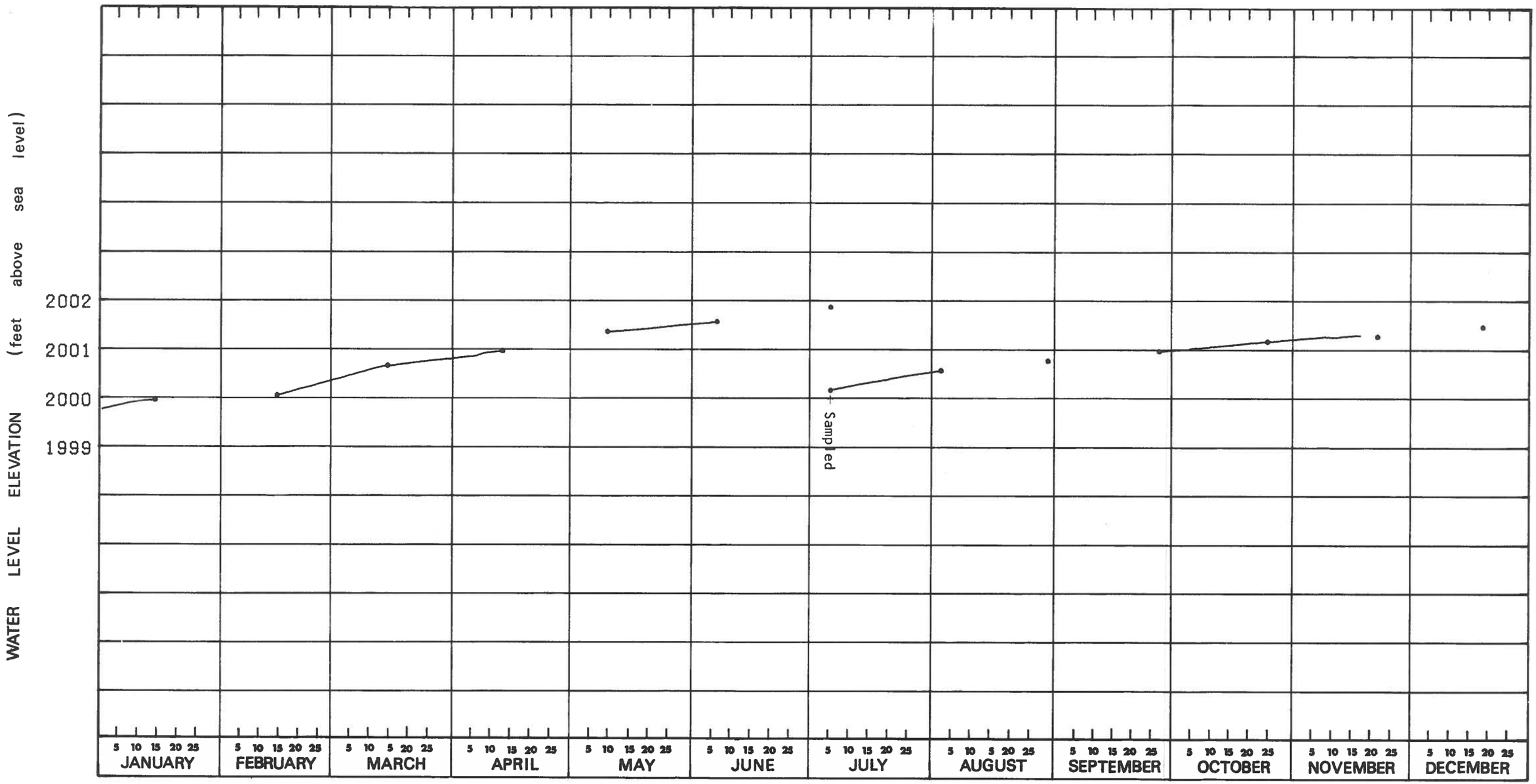
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-44-H-78




1977

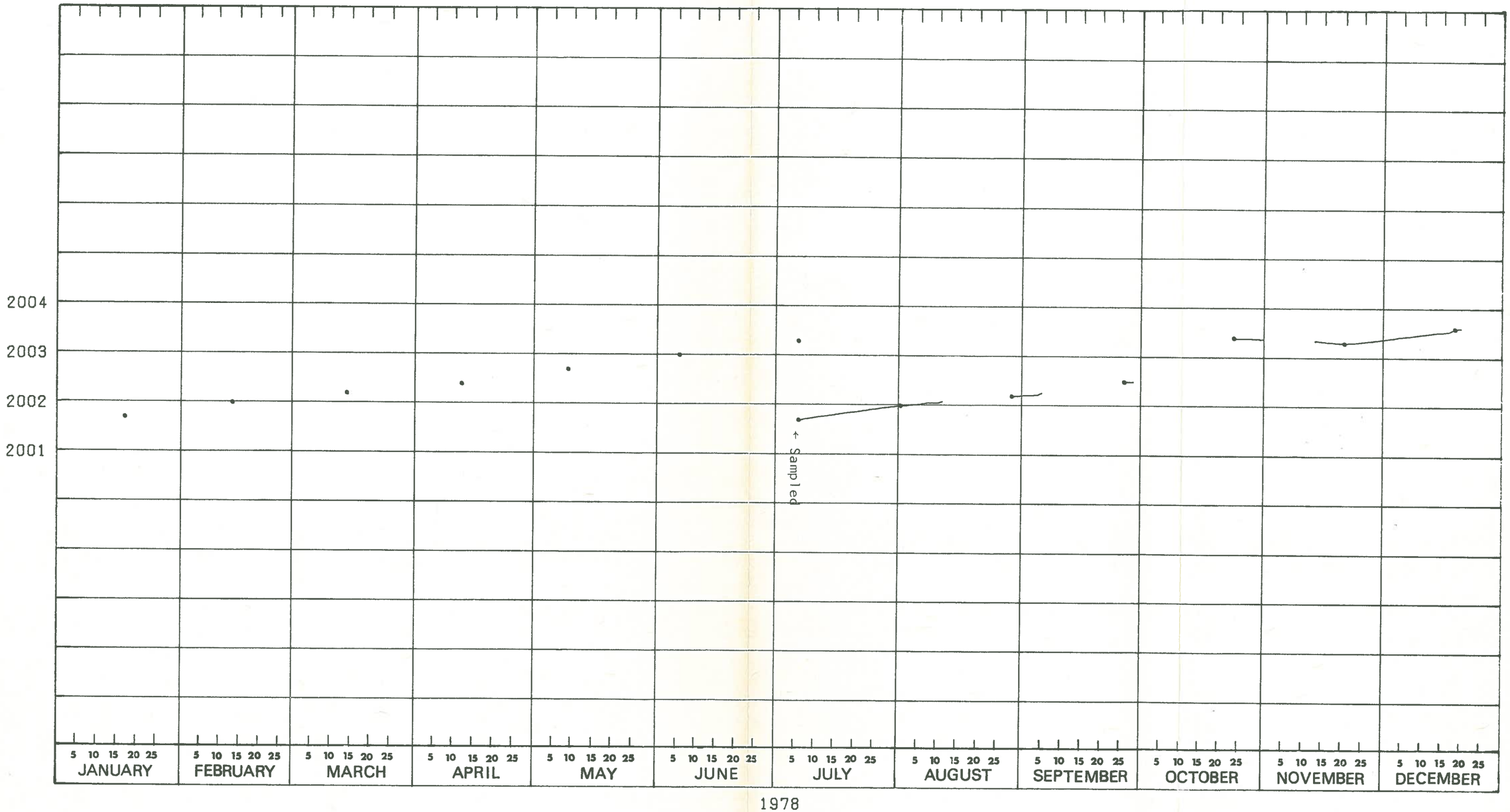
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-44

LSD 9 SEC 26 TWP 97 R 13 W4TH

3-44-H-79

Alberta Research Council




1978

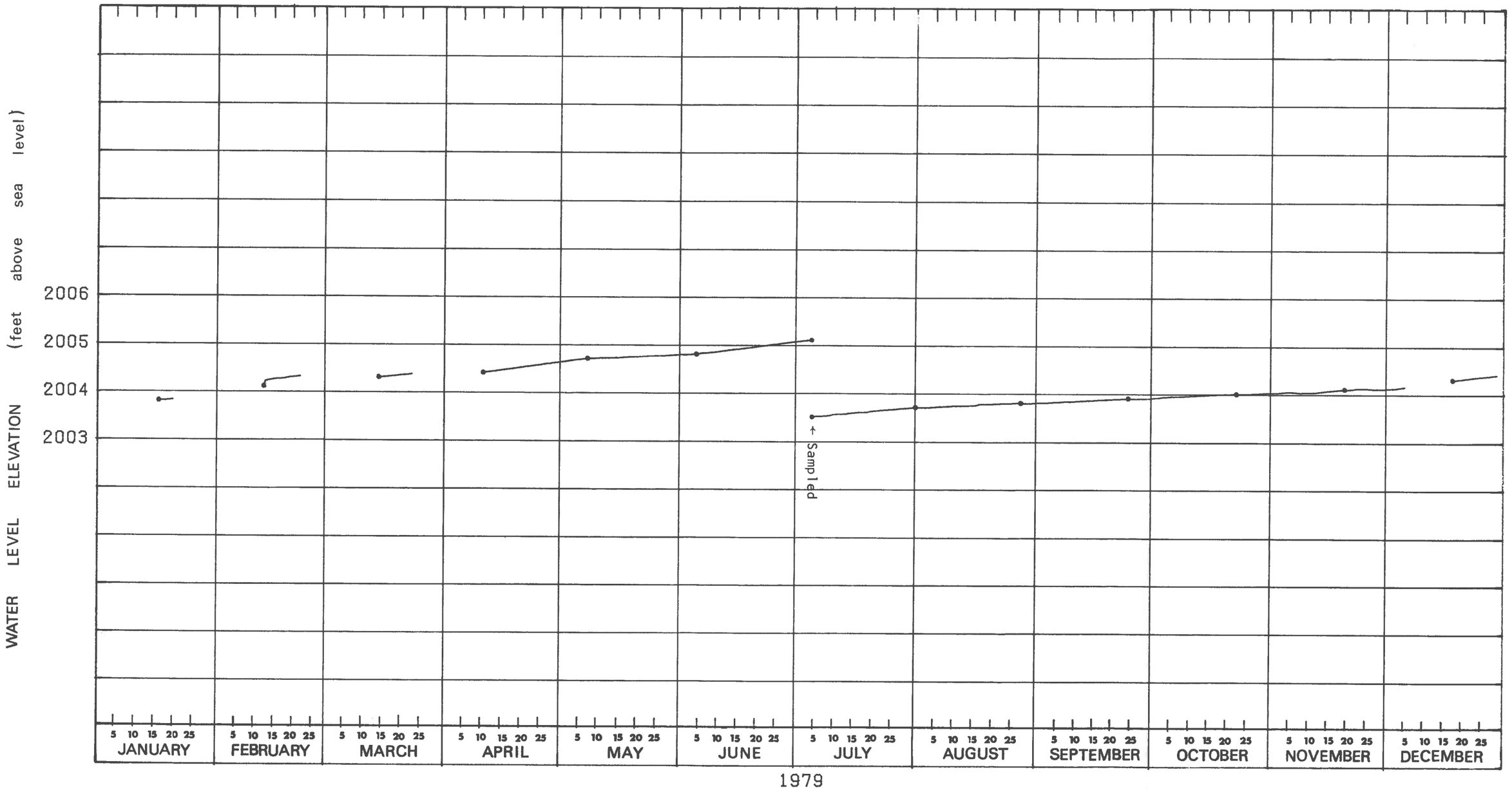
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-44-H-80



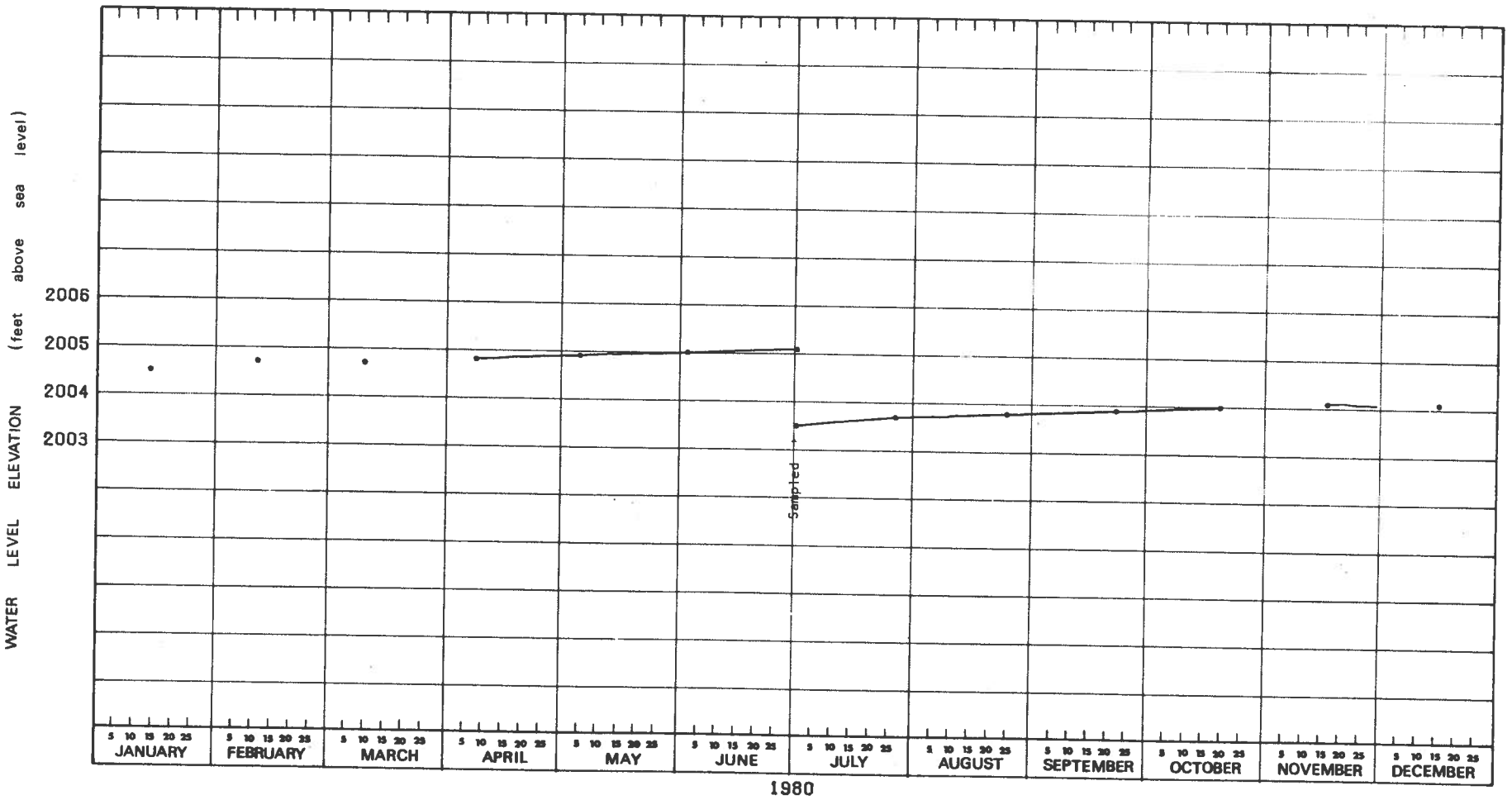
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-44-H-81



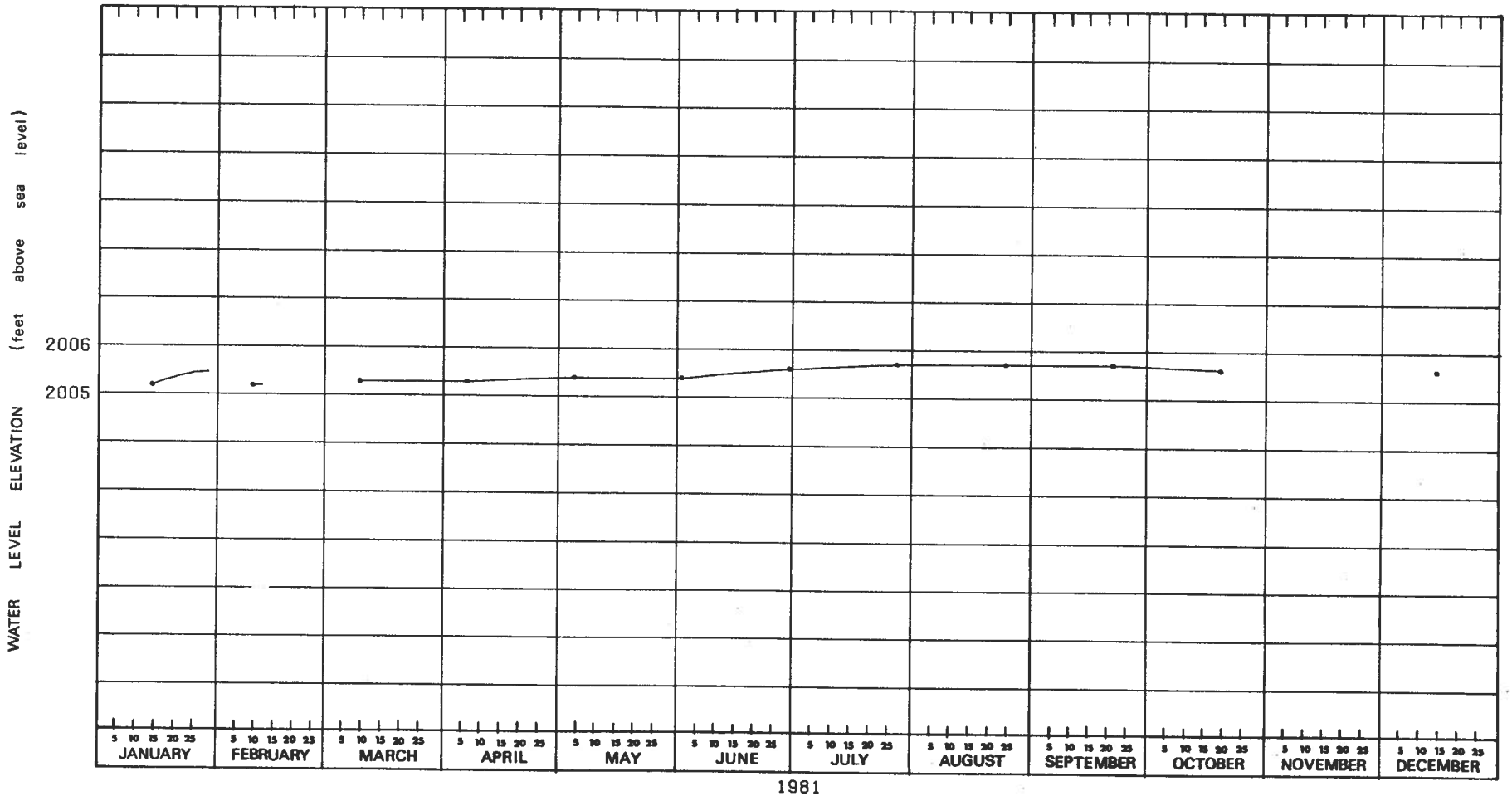
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-44-H-82



WELL HISTORY

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/75 | | | Well completed |
| Jan 19/75 | 0.75 TOC | 2013.18 | Bail 14 gallons |
| Jan 20/75 | 8.72 TOC | 1987.43 | |
| Jan 22/75 | | | Water sample |
| Jan 23/75 | 8.95 TOC | 1986.28 | |
| Jan 24/75 | 8.76 TOC | 1986.91 | |
| Jan 25/75 | 8.82 TOC | 1986.71 | |
| Feb 12/75 | 8.37 TOC | 1988.19 | |
| Feb 13/75 | 9.36 MP | 1988.19 | Install shelter and recorder; MP = 3.25' TOC, (2018.89) |
| Mar 15/75 | 9.00 MP | 1989.37 | Reinstall shelter and recorder; MP = 3.31' TOC, (2018.95) |
| Apr 17/75 | 8.63 MP | 1990.58 | |
| May 12/75 | 8.43 MP | 1991.30 | New MP = 35.75" TOC, (2018.62) |
| June 10/75 | 8.10 MP | 1992.05 | |
| July 10/75 | 7.85 MP | 1992.87 | |
| Aug 13/75 | 7.55 MP | 1993.85 | |
| Sept 9/75 | 7.35 MP | 1994.51 | Well sampled; temp. 25°C |
| | 7.86 MP | 1992.83 | after sample |
| Oct 7/75 | 7.60 MP | 1993.69 | |
| Nov 6/75 | 11.44 MP | 1981.10 | |
| Dec 6/75 | 7.28 MP | 1994.74 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 7.06 MP | 1995.4 | MP (2018.6) |
| Feb 6/76 | 6.84 MP | 1996.2 | |
| Mar 6/76 | 6.64 MP | 1996.8 | |
| Apr 6/76 | 6.46 MP | 1997.4 | |
| May 4/76 | 6.27 MP | 1998.0 | New MP = 0.70 m TOC, (2017.9) |
| June 1/76 | 5.86 MP | 1998.7 | |
| June 22/76 | 5.74 MP | 1999.1 | |
| July 14/76 | 5.63 MP | 1999.4 | |
| | 6.15 MP | 1997.7 | After sample; temp. 4°C |
| Aug 10/76 | 5.99 MP | 1998.2 | |
| Aug 31/76 | 5.90 MP | 1998.5 | |
| Sept 28/76 | 5.79 MP | 1998.9 | |
| Oct 26/76 | 5.70 MP | 1999.2 | |
| Nov 23/76 | 5.63 MP | 1999.4 | |
| Dec 20/76 | 5.55 MP | 1999.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 5.46 MP | 2000.0 | MP (2017.9) |
| Feb 15/77 | 5.44 MP | 2000.1 | |
| Mar 15/77 | 5.24 MP | 2000.7 | |
| Apr 13/77 | 5.14 MP | 2001.0 | |
| May 10/77 | 5.04 MP | 2001.4 | |
| June 7/77 | 4.97 MP | 2001.6 | |
| July 6/77 | 4.88 MP | 2001.9 | |
| | 5.38 MP | 2000.2 | After sample; temp. 4°C |
| Aug 3/77 | 5.28 MP | 2000.6 | |
| Aug 30/77 | 5.21 MP | 2000.8 | |
| Sept 27/77 | 5.14 MP | 2001.0 | |
| Oct 25/77 | 5.08 MP | 2001.2 | |
| Nov 22/77 | 5.05 MP | 2001.3 | |
| Dec 19/77 | 4.99 MP | 2001.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 4.93 MP | 2001.7 | MP (2017.9) |
| Feb 13/78 | 4.85 MP | 2002.0 | |
| Mar 14/78 | 4.78 MP | 2002.2 | |
| Apr 12/78 | 4.71 MP | 2002.4 | |
| May 9/78 | 4.62 MP | 2002.7 | |
| June 6/78 | 4.54 MP | 2003.0 | |
| July 6/78 | 4.46 MP | 2003.3 | |
| | 4.95 MP | 2001.7 | After sample; temp. 3°C |
| Aug 1/78 | 4.86 MP | 2002.0 | |
| Aug 29/78 | 4.78 MP | 2002.2 | |
| Sept 26/78 | 4.69 MP | 2002.5 | |
| Oct 24/78 | 4.43 MP | 2003.4 | |
| Nov 21/78 | 4.44 MP | 2003.3 | |
| Dec 19/78 | 4.36 MP | 2003.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 4.29 MP | 2003.8 | MP (2017.9) |
| Feb 13/79 | 4.22 MP | 2004.1 | |
| Mar 15/79 | 4.15 MP | 2004.3 | |
| Apr 11/79 | 4.10 MP | 2004.4 | |
| May 8/79 | 4.03 MP | 2004.7 | |
| June 5/79 | 3.98 MP | 2004.8 | |
| July 5/79 | 3.89 MP | 2005.1 | |
| | 4.39 MP | 2003.5 | After sample; temp. 3.5°C |
| Aug 1/79 | 4.34 MP | 2003.7 | |
| Aug 28/79 | 4.31 MP | 2003.8 | |
| Sept 25/79 | 4.27 MP | 2003.9 | |
| Oct 23/79 | 4.24 MP | 2004.0 | |
| Nov 20/79 | 4.21 MP | 2004.1 | |
| Dec 18/79 | 4.15 MP | 2004.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 3-44

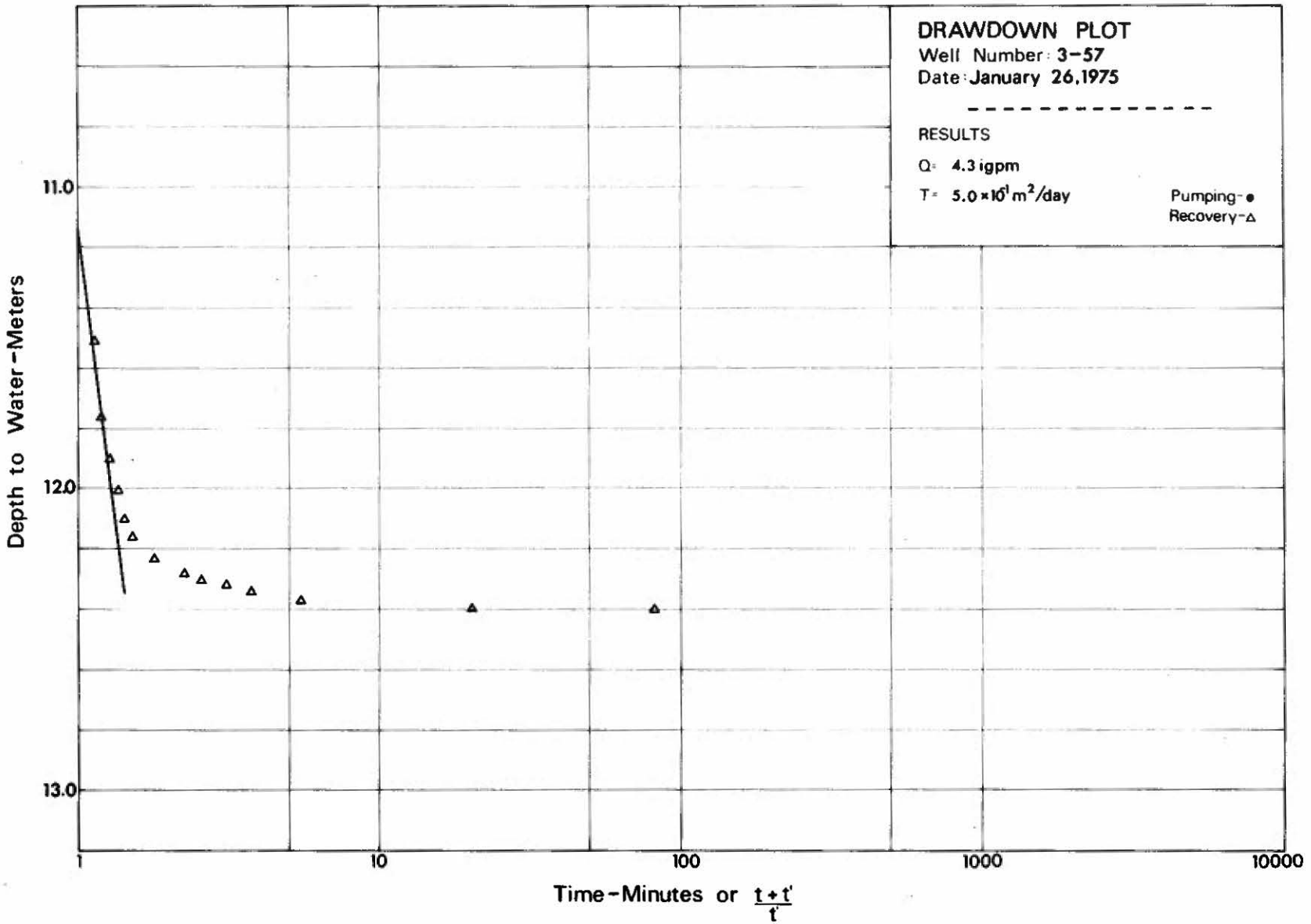
Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 4.09 MP | 2004.5 | |
| Feb 12/80 | 4.03 MP | 2004.7 | |
| Mar 11/80 | 4.01 MP | 2004.7 | |
| Apr 9/80 | 3.99 MP | 2004.8 | |
| May 6/80 | 3.96 MP | 2004.9 | |
| June 3/80 | 3.92 MP | 2005.0 | |
| July 2/80 | 3.89 MP | 2005.1 | Temp. 3°C |
| | 4.38 MP | 2003.5 | After Sample |
| July 28/80 | 4.34 MP | 2003.7 | |
| Aug 26/80 | 4.30 MP | 2003.8 | |
| Sept 24/80 | 4.27 MP | 2003.9 | |
| Oct 21/80 | 4.24 MP | 2004.0 | |
| Nov 18/80 | 4.22 MP | 2004.1 | |
| Dec 17/80 | 4.21 MP | 2004.1 | |
| Jan 15/81 | 3.86 MP | 2005.2 | |
| Feb 10/81 | 3.86 MP | 2005.2 | |
| Mar 10/81 | 3.85 MP | 2005.3 | |
| Apr 7/81 | 3.83 MP | 2005.3 | |
| May 5/81 | 3.82 MP | 2005.4 | |
| June 2/81 | 3.80 MP | 2005.4 | |
| June 30/81 | 3.75 MP | 2005.6 | |
| July 28/81 | 3.72 MP | 2005.7 | |
| Aug 25/81 | 3.73 MP | 2005.7 | |
| Sept 22/81 | 3.73 MP | 2005.7 | |
| Oct 20/81 | 3.74 MP | 2005.6 | |
| Dec 15/81 | 3.75 MP | 2005.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing


DRAWDOWN PLOT
Well Number: 3-57
Date: January 26,1975
RESULTS
Q= 4.3 igpm
T= 5.0 × 10¹ m²/day
Pumping-●
Recovery-△
11.0
12.0
13.0
Depth to Water-Meters
1
10
100
1000
10000
Time-Minutes or (t+t')/t

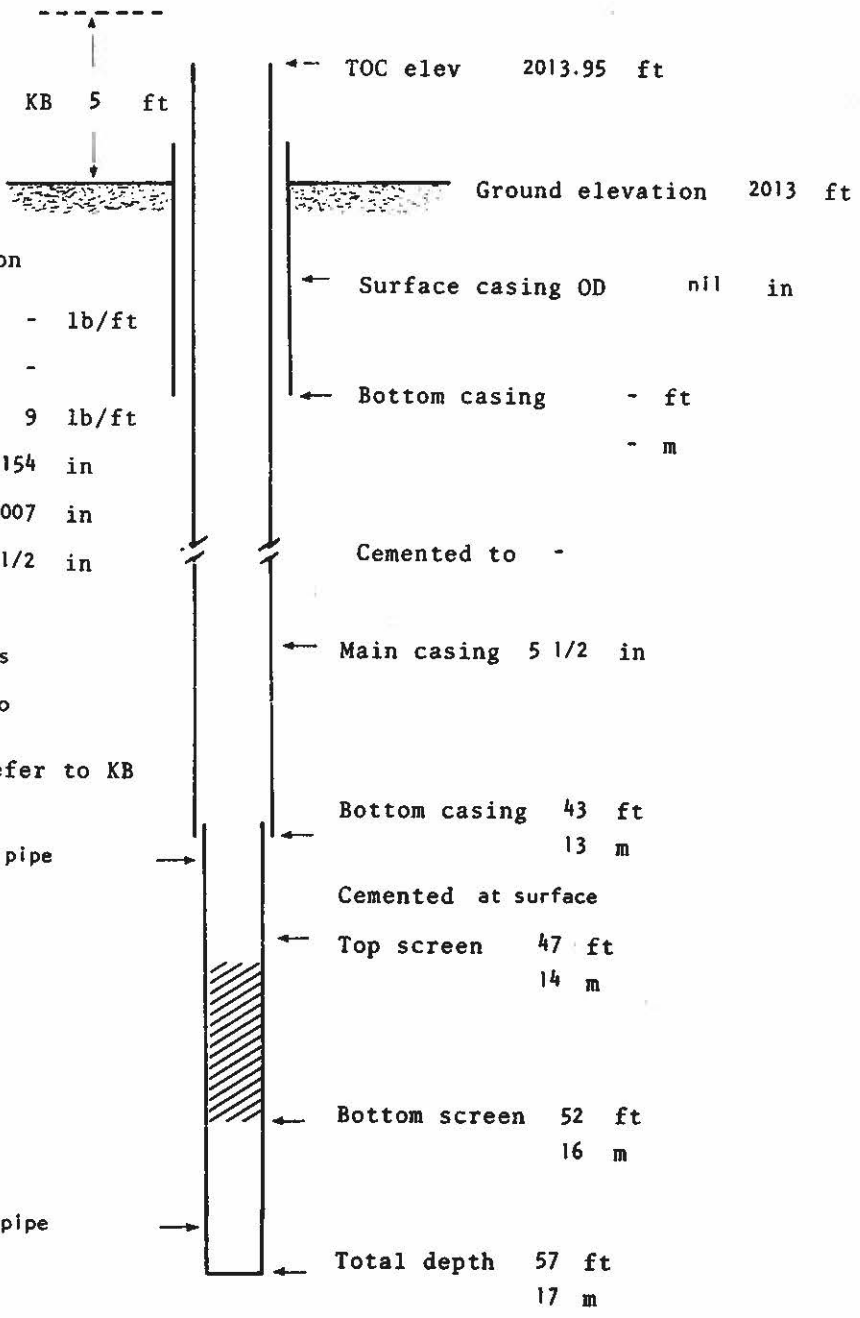
3-57-A-76

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Tp 97 R 13 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 9 | lb/ft |
| wall thickness | .154 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 9, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 43.0 | 2.15 | 33 |
| Magnesium ($Mg^{++}$) | 8.1 | 0.67 | 10 |
| Sodium ($Na^{+}$) | 76.0 | 3.31 | 52 |
| Potassium ($K^{+}$) | 11.7 | 0.31 | 5 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 73 | 1.20 | 20.5 |
| Sulfate ($SO_4^{=}$) | 200 | 4.16 | 71.4 |
| Chloride ($Cl^{-}$) | 16 | 0.45 | 7.7 |
| Nitrate ($NO_3^{=}$) | 1.1 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 43 | | |
| Magnesium (Acidified) | 7.9 | | |
| Total dissolved solids | 422 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5.83 | Total Cations (epm) | 6.44 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 620 | Temperature (C) | |
| pH | 6.7 | pH | 7.9 |
| Fluoride ($F^{-}$) | 0.3 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 73 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 151.0 | 7.53 | 18 |
| Magnesium ($Mg^{++}$) | 45.0 | 3.70 | 9 |
| Sodium ($Na^{+}$) | 700.0 | 30.45 | 72 |
| Potassium ($K^{+}$) | 14.2 | 0.36 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 124.0 | 2.03 | 5 |
| Sulfate ($SO_4^{=}$) | 1920.0 | 39.98 | 94 |
| Chloride ($Cl^{-}$) | 24.0 | 0.68 | 2 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 170.5 | | |
| Magnesium (Acidified) | 51.7 | | |
| Total dissolved solids | 2922 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 42.70 | Total Cations (epm) | 42.05 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4000 | Temperature (C) | 3.5 | |
| pH | 6.9 | pH | 6.6 | |
| Fluoride ($F^{-}$) | 0.8 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 142 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 6, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 143.0 | 7.14 | 17.4 |
| Magnesium ($Mg^{++}$) | 39.0 | 3.21 | 7.8 |
| Sodium ($Na^{+}$) | 700.0 | 30.45 | 74.1 |
| Potassium ($K^{+}$) | 12.5 | 0.32 | 0.8 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 129.0 | 2.11 | 5.3 |
| Sulfate ($SO_4^{=}$) | 1790.0 | 37.27 | 93.3 |
| Chloride ($Cl^{-}$) | 20.0 | 0.56 | 1.4 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 0.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 132.0 | | |
| Magnesium (Acidified) | 34.0 | | |
| Total dissolved solids | 2696.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 39.96 | Total Cations (epm) | 41.11 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 3900 | Temperature (C) | 4.0 |
| pH | 7.0 | pH | 7.0 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 122 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Date sampled: July 14, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | 1.04 |
| Au | <.003 | Mo | <.006 |
| Al | 0.11 | Na | 810 |
| As | <.038 | Ni | <.010 |
| B | .782 | P | 0.88 |
| Ba | <.200 | Pb | <.088 |
| Be | .002 | Se | <.060 |
| Ca | 184 | Si | .54 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 2.91 |
| Cr | <.006 | Te | <.065 |
| Cu | .040 | Ti | .004 |
| Eu | <.015 | U | <.020 |
| Fe | 4.18 | V | .013 |
| K | 121 | W | <.078 |
| Mg | 47.4 | Zn | .077 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

3-57-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 06, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 107.0 | 5.34 | 18.7 |
| Magnesium(Mg) | 28.0 | 2.30 | 8.1 |
| Sodium(Na) | 474.0 | 20.62 | 72.2 |
| Potassium(K) | 12.1 | 0.31 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 134.0 | 2.20 | 7.5 |
| Sulphate(SO4) | 1270.0 | 26.44 | 90.3 |
| Chloride(Cl) | 22.0 | 0.62 | 2.1 |
| Nitrate(NO3) | 2.1 | 0.03 | 0.1 |
| Silica(SiO2) | 1.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 62.0 | | |
| Magnesium(Acidified) | 22.0 | | |
| TDS(mg/l) | 1978.0 | | |
| Total Anions(epm) | 29.29 | Total Cations(epm) | 28.57 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2400 | Temperature(C) | 3.50 | |
| pH | 7.2 | pH | 6.5 | |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 132 | mg/l |
| | | Hydroxide(OH) | | |

3-57-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 84.0 | 4.19 | 21.1 |
| Magnesium(Mg) | 21.0 | 1.73 | 8.7 |
| Sodium(Na) | 314.0 | 13.66 | 68.9 |
| Potassium(K) | 9.6 | 0.25 | 1.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 132.0 | 2.16 | 10.7 |
| Sulphate(SO4) | 840.0 | 17.49 | 86.5 |
| Chloride(Cl) | 20.0 | 0.56 | 2.8 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 1.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 72.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 1376.0 | | |
| Total Anions(epm) | 20.22 | Total Cations(epm) | 19.82 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1700 | Temperature(C) | 3.50 | |
| pH | 7.6 | pH | 7.1 | |
| Fluoride(F) | 0.6 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 112 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 3-57-E-82

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 85.0 | 4.25 | 26.5 |
| Magnesium(Mg) | 19.0 | 1.58 | 9.9 |
| Sodium(Na) | 229.0 | 9.96 | 62.0 |
| Potassium(K) | 10.4 | 0.27 | 1.7 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 78.0 | 1.28 | 7.3 |
| Sulphate(SO4) | 770.0 | 16.04 | 91.1 |
| Chloride(Cl) | 10.0 | 0.28 | 1.6 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 0.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 70.0 | | |
| Magnesium(Acidified) | 16.6 | | |
| TDS(mg/l) | 1101.0 | | |
| Total Anions(epm) | 17.61 | Total Cations(epm) | 16.06 |

Other Constituents

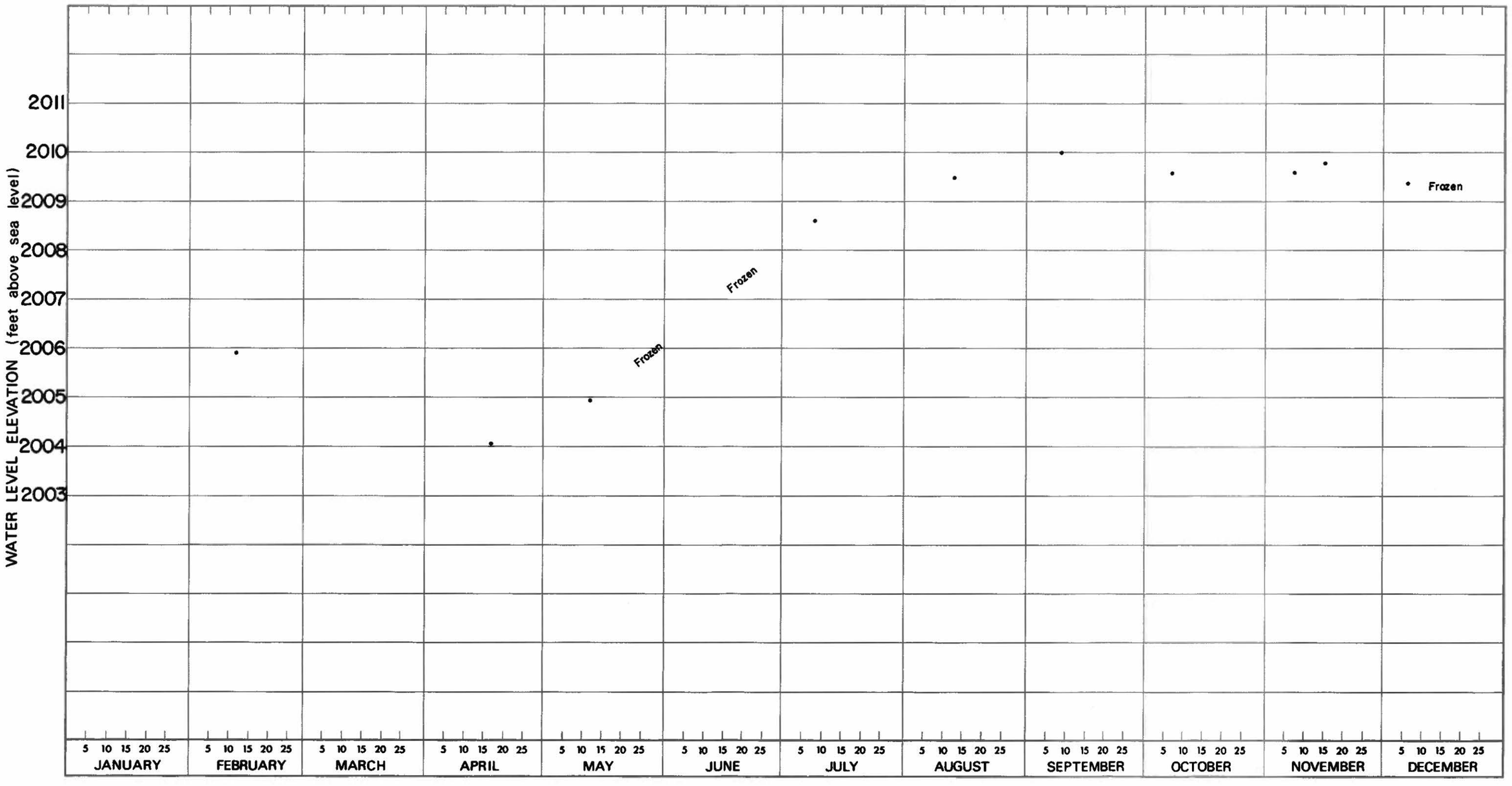
| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1750 | Temperature | 3.00 | |
| pH | 7.7 | pH | 6.8 | |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 78 | mg/l |
| | | Hydroxide(OH) | | |

## WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council



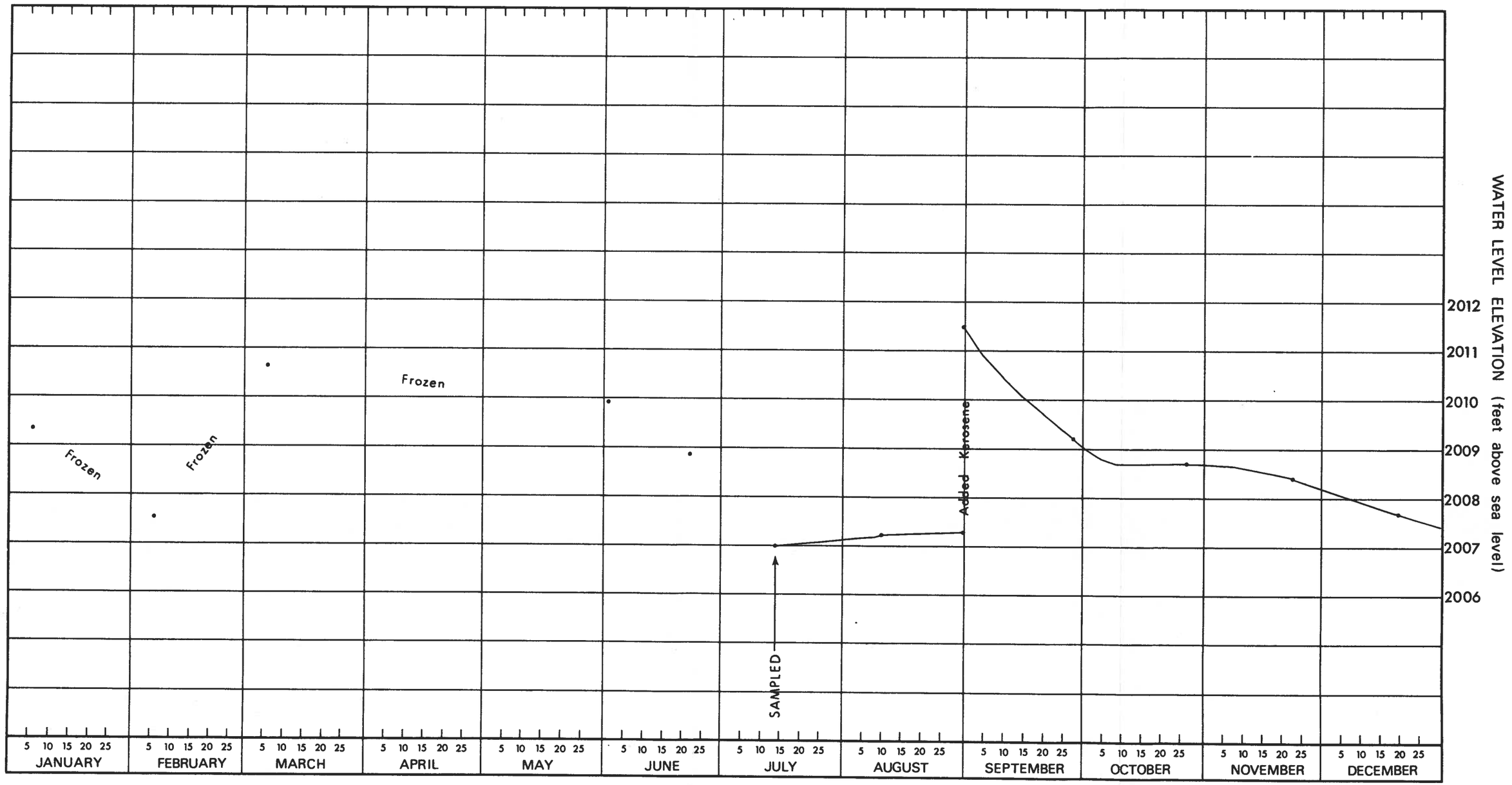
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

3 - 57 - H - 77




1976

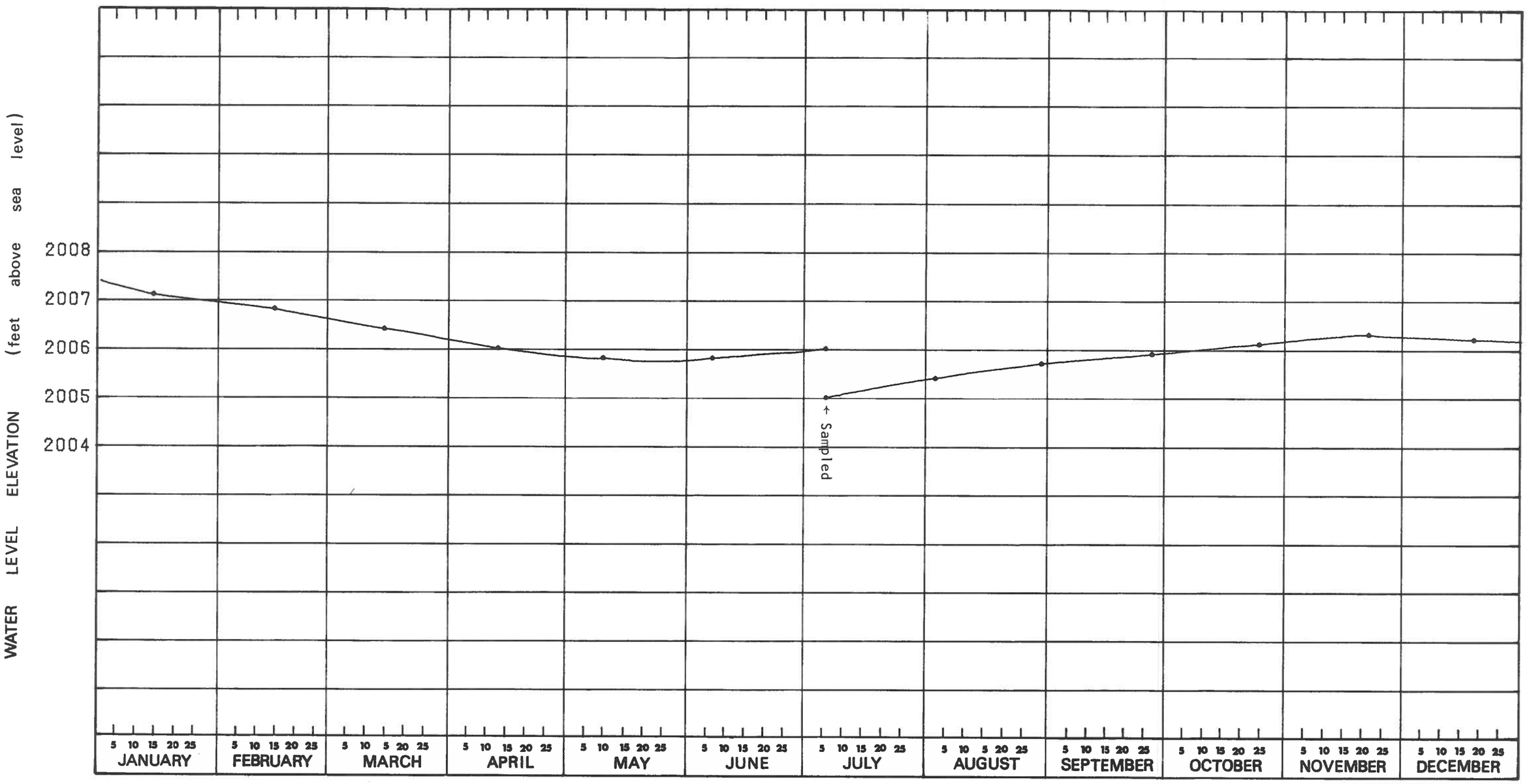
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-57-H-78



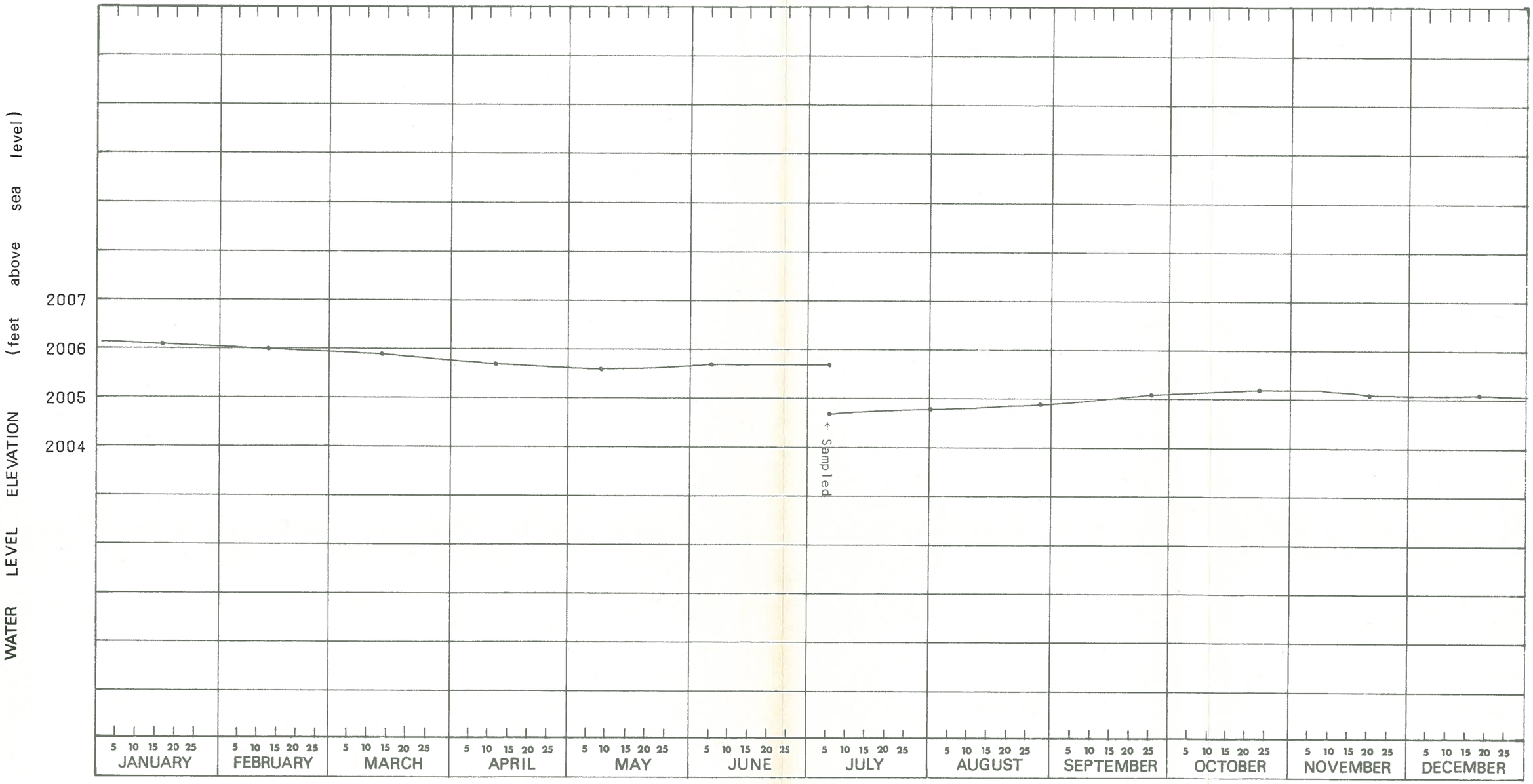
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-57

LSD 9 SEC 26 TWP 97 R 13 W4TH

Alberta Research Council

3-57-H-79




1978

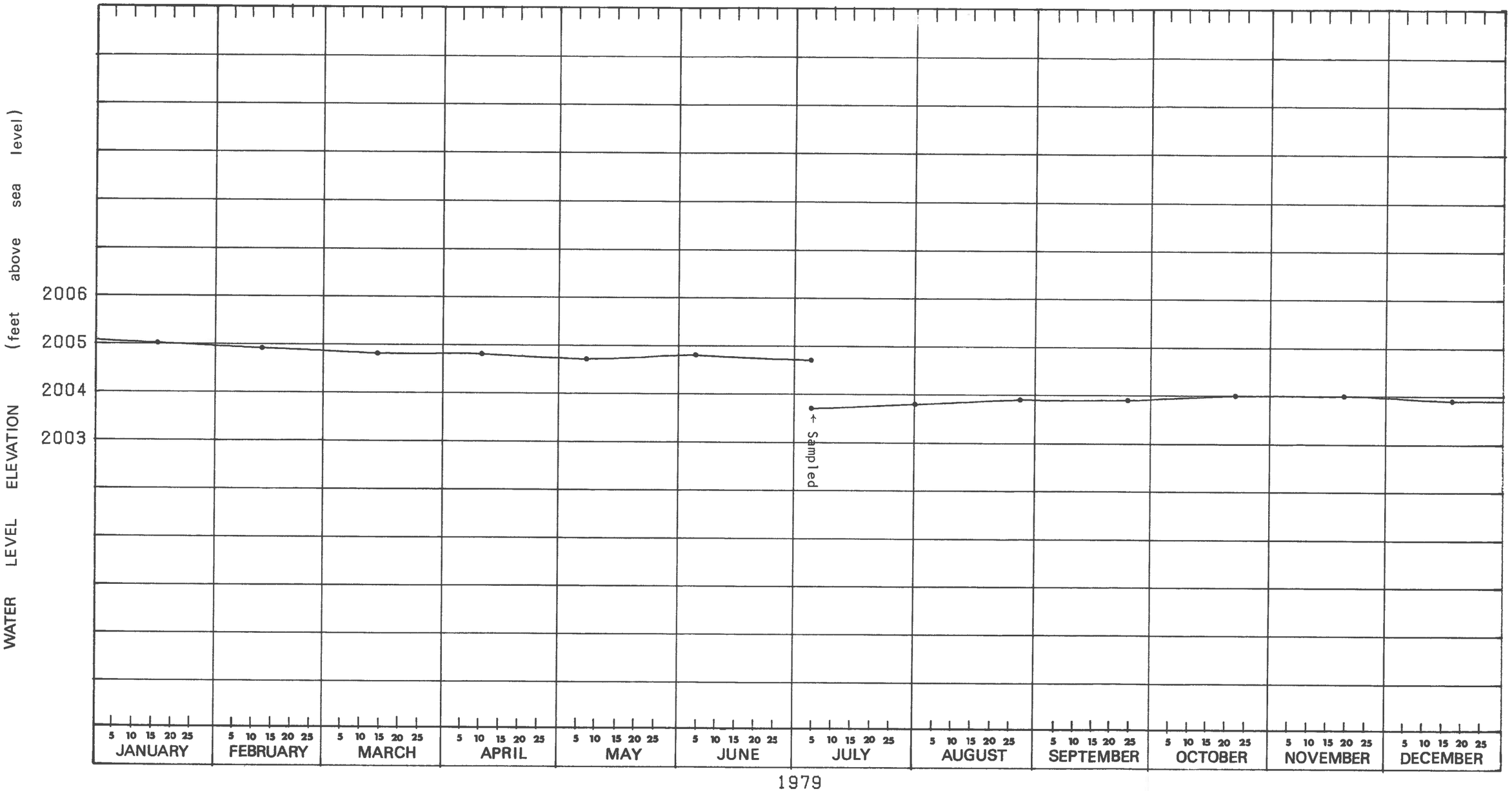
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-57-H-80



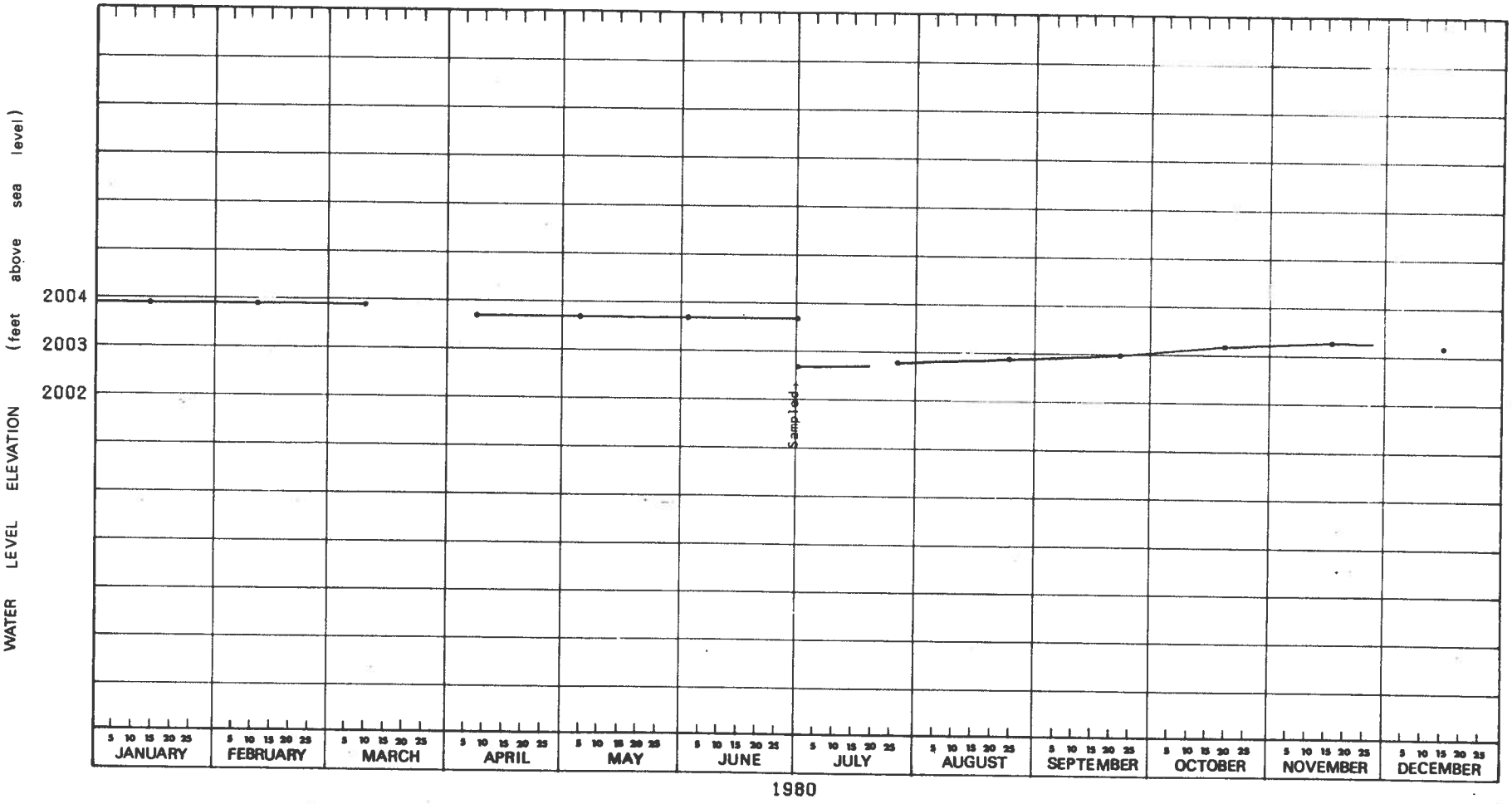
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-57-H-81



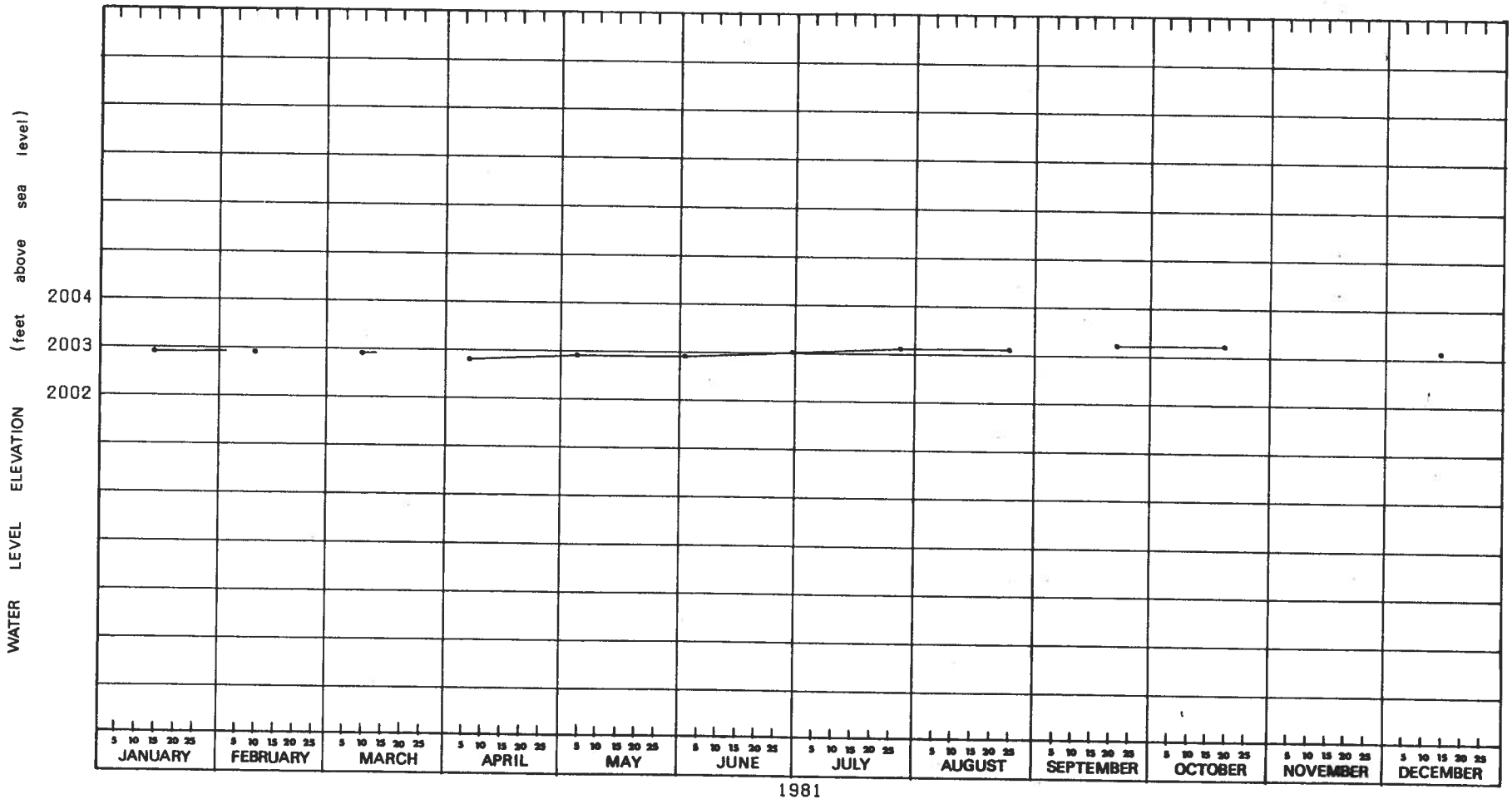
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-57-H-82



WELL HISTORY

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.87 (Until March 16/75)
2013.95 (After March 16/75)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 25/75 | | | Well completed |
| Jan 26/75 | 0.61 TOC | 2012.87 | Bail dry |
| Feb 12/75 | 2.74 TOC | 2005.88 | |
| Feb 13/75 | | | MP = 2.28 TOC, (2017.15); install shelter;bail; caked mud on bailer; flush out with clear water using rig 16 |
| Mar 16/75 | | | Cut off casing |
| Mar 17/75 | 5.95 MP | 1997.58 | Reinstall shelter; relevel TOC; MP = 3.15' TOC, (2017.10) |
| Apr 17/75 | 3.99 MP | 2004.01 | |
| May 12/75 | 3.72 MP | 2004.90 | |
| June 10/75 | Frozen | | Frost in casing at 2.65m |
| July 10/75 | 2.61 MP | 2008.54 | |
| Aug 13/75 | 2.33 MP | 2009.45 | |
| Sept 9/75 | 2.18 MP | 2009.94 | Sampled well; temp. 2.5°C |
| Oct 7/75 | 2.29 MP | 2009.58 | |
| Nov 6/75 | 2.21 MP | 2009.85 | |
| Dec 6/75 | 2.36 MP | 2009.36 | Frozen |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.95

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 2.36 MP | 2009.4 | Frozen MP (2017.1) |
| Feb 6/76 | 2.91 MP | 2007.5 | Frozen |
| Mar 6/76 | 1.96 MP | 2010.7 | Frozen |
| Apr 6/76 | | | Frozen |
| May 4/76 | | | Frozen |
| June 1/76 | 2.18 MP | 2009.9 | Frozen |
| June 22/76 | 2.41 MP | 2008.9 | New MP = 0.87 m TOC, (2016.8) |
| July 14/76 | 2.99 MP | 2007.0 | After sample; temp. 3.5°C |
| Aug 10/76 | 2.92 MP | 2007.2 | |
| Aug 31/76 | 2.90 MP | 2007.3 | |
| | 1.22 MP | 2011.5 | Added 5 gallons of kerosene; water level elevation adjusted downward by 1.25 ft after this date |
| Sept 28/76 | 1.94 MP | 2009.2 | |
| Oct 26/76 | 2.10 MP | 2008.7 | |
| Nov 23/76 | 2.20 MP | 2008.4 | |
| Dec 20/76 | 2.38 MP | 2007.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.95

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 2.58 MP | 2007.1 | MP (2016.8) water level elevation adjusted downward by 1.25 ft to compensate for kerosene |
| Feb 15/77 | 2.67 MP | 2006.8 | |
| Mar 15/77 | 2.79 MP | 2006.4 | |
| Apr 13/77 | 2.92 MP | 2006.0 | |
| May 10/77 | 3.00 MP | 2005.8 | |
| June 7/77 | 3.00 MP | 2005.8 | |
| July 6/77 | 2.92 MP | 2006.0 | |
| | 3.22 MP | 2005.0 | After sample; temp. 4°C |
| Aug 3/77 | 3.08 MP | 2005.4 | |
| Aug 30/77 | 2.99 MP | 2005.7 | |
| Sept 27/77 | 2.94 MP | 2005.9 | |
| Oct 25/77 | 2.87 MP | 2006.1 | |
| Nov 22/77 | 2.83 MP | 2006.3 | |
| Dec 19/77 | 2.84 MP | 2006.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.95

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 2.89 MP | 2006.1 | MP (2016.8) water level elevation adjusted downward by 1.25 ft to compensate for kerosene |
| Feb 13/78 | 2.92 MP | 2006.0 | |
| Mar 14/78 | 2.95 MP | 2005.9 | |
| Apr 12/78 | 3.00 MP | 2005.7 | |
| May 9/78 | 3.02 MP | 2005.6 | |
| June 6/78 | 3.01 MP | 2005.7 | |
| July 6/78 | 3.00 MP | 2005.7 | |
| | 3.30 MP | 2004.7 | After sample; temp. 3.5°C |
| Aug 1/78 | 3.27 MP | 2004.8 | |
| Aug 29/78 | 3.05 MP | 2004.9 | New MP 0.68 m TOC (2016.2) |
| Sept 26/78 | 3.01 MP | 2005.1 | |
| Oct 24/78 | 2.97 MP | 2005.2 | |
| Nov 21/78 | 2.99 MP | 2005.1 | |
| Dec 19/78 | 3.01 MP | 2005.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.95

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 3.02 MP | 2005.0 | MP (2016.2) water level elevation adjusted downward by 1.25 ft to compensate for kerosene |
| Feb 13/79 | 3.05 MP | 2004.9 | |
| Mar 15.79 | 3.09 MP | 2004.8 | |
| Apr 11/79 | 3.08 MP | 2004.8 | |
| May 8/79 | 3.12 MP | 2004.7 | |
| June 5/79 | 3.10 MP | 2004.8 | |
| July 5/79 | 3.00 MP | 2004.7 | New MP 0.58m TOC (2015.8) |
| | 3.30 MP | 2003.7 | After sample; temp. 3.5°C |
| Aug 1/79 | 3.28 MP | 2003.8 | |
| Aug 28/79 | 3.26 MP | 2003.9 | |
| Sept 25/79 | 3.24 MP | 2003.9 | |
| Oct 23/79 | 3.23 MP | 2004.0 | |
| Nov 20/79 | 3.22 MP | 2004.0 | |
| Dec 18/79 | 3.24 MP | 2003.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

3-57-W-82

WELL HISTORY

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.95

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 3.25 MP | 2003.9 | |
| Feb 12/80 | 3.26 MP | 2003.9 | |
| Mar 11/80 | 3.26 MP | 2003.9 | |
| Apr 9/80 | 3.30 MP | 2003.7 | |
| May 6/80 | 3.32 MP | 2003.7 | |
| June 3/80 | 3.32 MP | 2003.7 | |
| July 2/80 | 3.30 MP | 2003.7 | Temp. 3°C |
| | 3.60 MP | 2002.7 | After Sample |
| July 28/80 | 3.57 MP | 2002.8 | |
| Aug 26/80 | 3.55 MP | 2002.9 | |
| Sept 24/80 | 3.53 MP | 2003.0 | |
| Oct 21/80 | 3.45 MP | 2003.2 | |
| Nov 18/80 | 3.43 MP | 2003.3 | |
| Dec 17/80 | 3.45 MP | 2003.2 | |
| Jan 15/81 | 3.55 MP | 2002.9 | |
| Feb 10/81 | 3.54 MP | 2002.9 | |
| Mar 10/81 | 3.55 MP | 2002.9 | |
| Apr 7/81 | 3.57 MP | 2002.8 | |
| May 5/81 | 3.55 MP | 2002.9 | |
| June 2/81 | 3.55 MP | 2002.9 | |
| June 30/81 | 3.52 MP | 2003.0 | |
| July 28/81 | 3.50 MP | 2003.1 | |
| Aug 25/81 | 3.49 MP | 2003.1 | |
| Sept 22/81 | 3.45 MP | 2003.2 | |
| Oct 20/81 | 3.46 MP | 2003.2 | |
| Dec 15/81 | 3.50 MP | 2003.1 | |

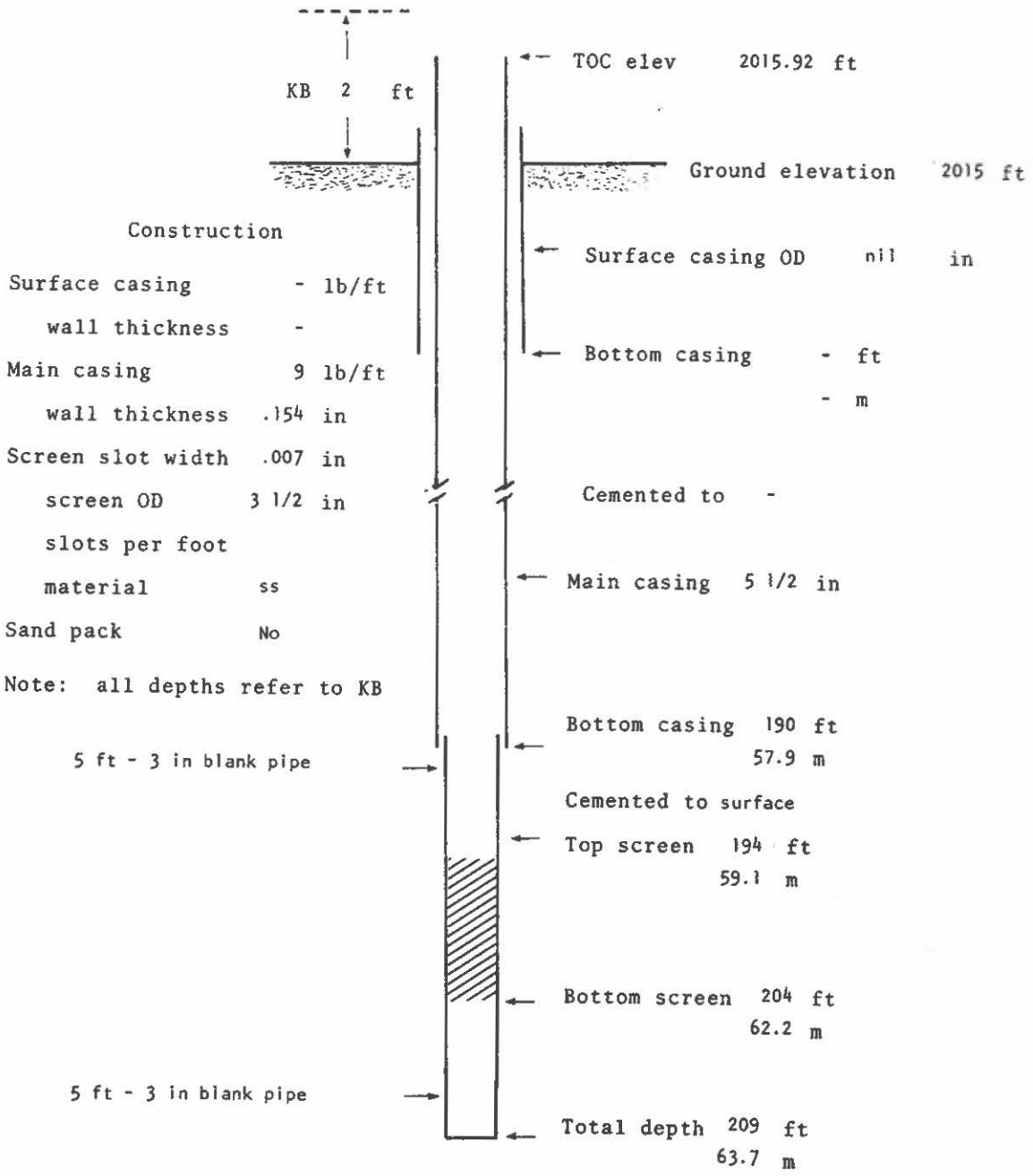
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Tp 97 R 13 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 9 | lb/ft |
| wall thickness | .154 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

# DRILL STEM TEST

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Tp 97 R 13 W4th

Alberta Research Council

Elevation: gl 2015
KB 2017

Type of test - Casing Positrieve

Date of test March 16, 1975

Testing company Johnston Testers

## TEST DATA

| | | |
|---|---|---|
| Time started | 1730 | hrs |
| Tool opened | 1805 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 720 | min |
| Pulled loose at | - | hrs |
| Out of hole at | - | hrs |
| Wt on packers | 1000 | lbs |

Description of blow Fair initial puff weak blow decreasing to nil in one minute.

Total water recovered 5 ft

Water sample No. DH 21

Gas blow No

Remarks Test satisfactory
5-1/2" RBP @ 171'

## HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 194-204

Formation tested Quaternary

## TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

## PRESSURE DATA (psi)

| Instrument No. | | RPG-89N | RPG-92N |
|---|---|---|---|
| Capacity (psig) | | 400 | 431 |
| Instrument set at (ft) | | 175 | 183 |
| Initial hydrostatic | A | 93 | 96 |
| First flow | B | 34 | 32 |
| | B1 | 34 | 33 |
| Initial shut in | C | 76 | 77 |
| Second flow | D | 7 | 9 |
| | D1 | 7 | 9 |
| Final shut in | G | 43 | 49 |
| Final hydrostatic | H | 81 | 79 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 3-209

PRESSURE INCREMENTS

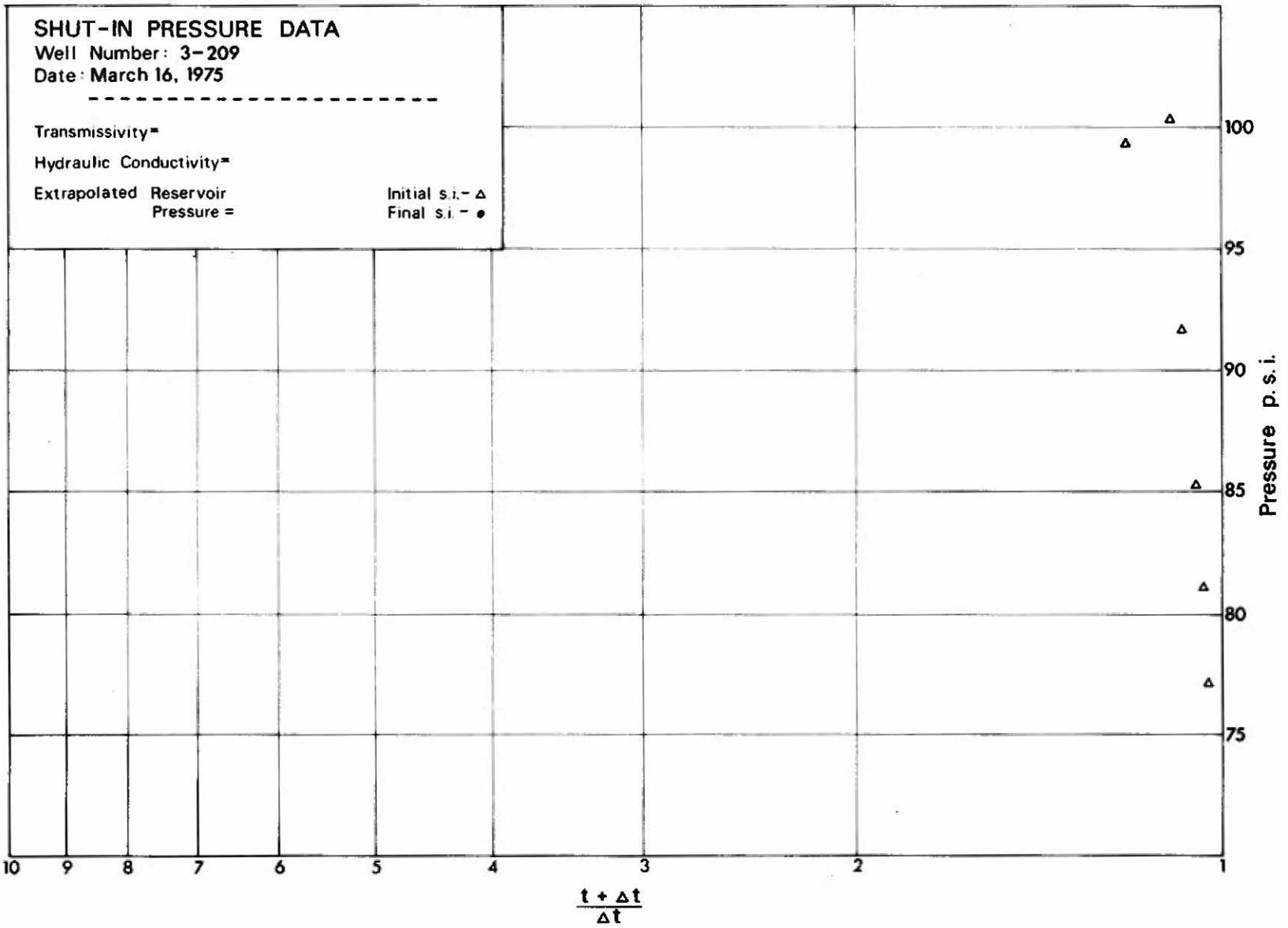
Recorder RPG 92 N

Initial Shut In

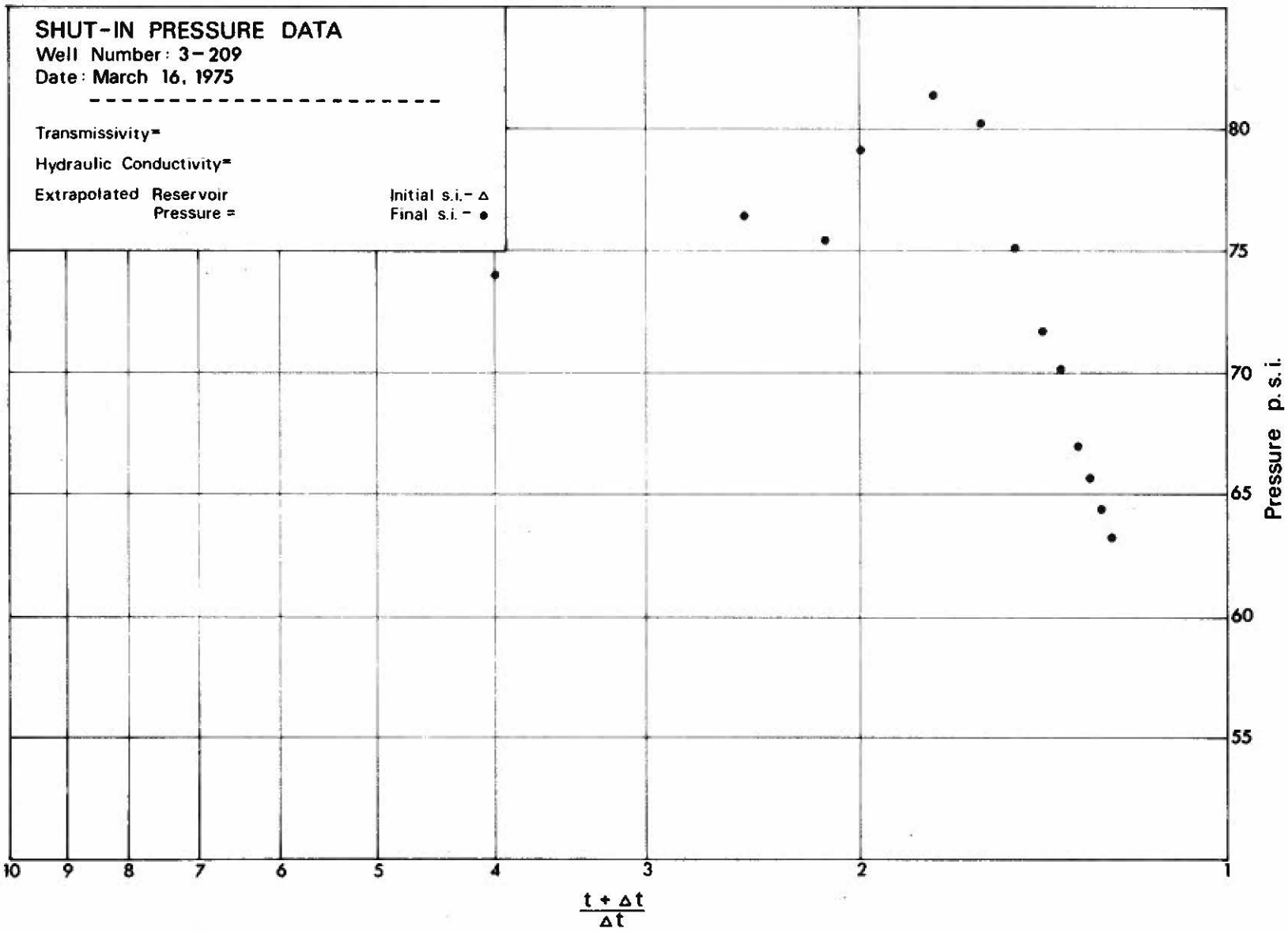
| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 99.1 | 1.20 |
| 10 | 100.2 | 1.10 |
| 15 | 91.5 | 1.07 |
| 20 | 85.2 | 1.05 |
| 25 | 80.9 | 1.04 |
| 30 | 77.0 | 1.033 |

Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 74.0 | 4.00 |
| 10 | 76.3 | 2.50 |
| 15 | 79.1 | 2.00 |
| 20 | 81.3 | 1.75 |
| 25 | 80.2 | 1.60 |
| 30 | 75.0 | 1.50 |
| 35 | 71.7 | 1.43 |
| 40 | 70.1 | 1.375 |
| 45 | 67.0 | 1.333 |
| 50 | 65.7 | 1.300 |
| 55 | 64.4 | 1.273 |
| 60 | 63.1 | 1.250 |


SHUT-IN PRESSURE DATA
Well Number: 3-209
Date: March 16, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure =
Initial s.i.- Δ
Final s.i. - •
100
95
90
85
80
75
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

3-209-D-76


SHUT-IN PRESSURE DATA
Well Number: 3-209
Date: March 16, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure =
Initial s.i.- Δ
Final s.i. - ●
80
75
70
65
60
55
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

3-209-D-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Drill stem test on 3-209

Date sampled March 18, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 33.0 | 1.65 | 35.4 |
| Magnesium ($Mg^{++}$) | 3.6 | 0.30 | 6.4 |
| Sodium ($Na^{+}$) | 57.5 | 2.50 | 53.7 |
| Potassium ($K^{+}$) | 8.3 | 0.21 | 4.6 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 124.0 | 2.03 | 38.3 |
| Sulfate ($SO_4^{=}$) | 107.0 | 2.23 | 42.0 |
| Chloride ($Cl^{-}$) | 35.0 | 0.99 | 18.6 |
| Nitrate ($NO_3^{=}$) | 3.4 | 0.05 | 1.0 |
| Silica ($SiO_2$) | 8.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 288.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5.302 | Total Cations (epm) | 4.656 |

### Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 255 | Temperature (C) | |
| pH | 8.1 | pH | 9.8 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 52.8 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 29.3 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed from 3-209

Date sampled January 22, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 16.0 | 0.80 | 5.5 |
| Magnesium ($Mg^{++}$) | 0.2 | 0.02 | 0.1 |
| Sodium ($Na^{+}$) | 311.0 | 13.53 | 92.9 |
| Potassium ($K^{+}$) | 8.8 | 0.23 | 1.5 |
| Carbonate ($CO_3^{=}$) | 43.0 | 1.43 | 9.2 |
| Bicarbonate ($HCO_3^{-}$) | 14.0 | 0.23 | 1.5 |
| Sulfate ($SO_4^{=}$) | 167.0 | 3.48 | 22.4 |
| Chloride ($Cl^{-}$) | 367.0 | 10.35 | 66.7 |
| Nitrate ($NO_3^{=}$) | 1.5 | 0.02 | 0.2 |
| Silica ($SiO_2$) | 15.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 874.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 15.514 | Total Cations (epm) | 14.568 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1670 | Temperature (C) | 3.3 | |
| pH | 10.7 | pH | 11.8 | |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | 58 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 | ppm |
| | | Hydroxide ($OH^{-}$) | 56 | ppm |
| | | Conductivity | 1700 | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 9, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 10 | 0.5 | 15 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 42.5 | 1.85 | 56 |
| Potassium ($K^{+}$) | 38.3 | 0.98 | 29 |
| Carbonate ($CO_3^{=}$) | 31.2 | 1.04 | 29 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 66 | 1.37 | 39 |
| Chloride ($Cl^{-}$) | 22 | 0.62 | 18 |
| Nitrate ($NO_3^{=}$) | 1.1 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.4 | | |
| Hydroxide ($OH^{-}$) | 8.2 | 0.48 | 14 |
| Calcium (Acidified) | 13.1 | | |
| Magnesium (Acidified) | 0.5 | | |
| Total dissolved solids | 242 | | |
| Total Anions (epm) | 3.53 | Total Cations (epm) | 3.33 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 520 |
| pH | 10.6 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 3.0 |
| pH | 11.6 |
| Carbonate ($CO_3^{=}$) | 36 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| Hydroxide ($OH^{-}$) | 13.6 ppm |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.9 | 0.19 | 4 |
| Magnesium ($Mg^{++}$) | 0.4 | 0.03 | 1 |
| Sodium ($Na^{+}$) | 83.8 | 3.65 | 74 |
| Potassium ($K^{+}$) | 41.0 | 1.05 | 21 |
| Carbonate ($CO_3^{=}$) | 50.0 | 1.67 | 36 |
| Bicarbonate ($HCO_3^{-}$) | 46.4 | 0.76 | 16 |
| Sulfate ($SO_4^{=}$) | 69.0 | 1.44 | 31 |
| Chloride ($Cl^{-}$) | 24.0 | 0.68 | 15 |
| Nitrate ($NO_3^{=}$) | 5.7 | 0.09 | 2 |
| Silica ($SiO_2$) | 2.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 5.1 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 360 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4.63 | Total Cations (epm) | 4.92 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 540 | Temperature (C) | 5.0 | |
| pH | 9.5 | pH | 11.2 | |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 62 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 15 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 6, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 4.8 | 0.24 | 3.7 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0.0 |
| Sodium ($Na^{+}$) | 120.0 | 5.22 | 79.9 |
| Potassium ($K^{+}$) | 42.1 | 1.08 | 16.5 |
| Carbonate ($CO_3^{=}$) | 62.0 | 2.07 | 33.4 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 66.2 | 1.38 | 22.3 |
| Chloride ($Cl^{-}$) | 30.0 | 0.85 | 13.7 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 0.7 | | |
| Hydroxide ($OH^{-}$) | 32.0 | 1.88 | 30.4 |
| Calcium (Acidified) | 5.1 | | |
| Magnesium (Acidified) | 0.1 | | |
| Total dissolved solids | 382.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 6.18 | Total Cations (epm) | 6.54 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 950 | Temperature (C) | 5.0 |
| pH | 11.2 | pH | 11.4 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | 53.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 37.0 ppm |
| | | Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 06, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3.6 | 0.18 | 2.6 |
| Magnesium(Mg) | 0.2 | 0.02 | 0.2 |
| Sodium(Na) | 128.0 | 5.57 | 79.2 |
| Potassium(K) | 49.6 | 1.27 | 18.0 |
| Carbonate(CO3) | 84.0 | 2.80 | 36.8 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 62.0 | 1.29 | 17.0 |
| Chloride(Cl) | 36.0 | 1.02 | 13.3 |
| Nitrate(NO3) | 1.2 | 0.02 | 0.3 |
| Silica(SiO2) | 3.8 | | |
| Hydroxide(OH) | 42.2 | 2.48 | 32.6 |
| Calcium(Acidified) | 4.8 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 406.0 | | |
| Total Anions(epm) | 7.61 | Total Cations(epm) | 7.03 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1000 | | Temperature(C) | 3.50 | |
| pH | 10.4 | | pH | 11.6 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | 57 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 58 | mg/l |

3-209-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 5.4 | 0.27 | 3.2 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.1 |
| Sodium(Na) | 158.0 | 6.87 | 80.8 |
| Potassium(K) | 53.0 | 1.36 | 15.9 |
| Carbonate(CO3) | 106.0 | 3.53 | 39.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 50.0 | 1.04 | 11.5 |
| Chloride(Cl) | 42.0 | 1.18 | 13.1 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.1 |
| Silica(SiO2) | 5.9 | | |
| Hydroxide(OH) | 56.0 | 3.29 | 36.4 |
| Calcium(Acidified) | 4.9 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 466.0 | | |
| Total Anions(epm) | 9.06 | Total Cations(epm) | 8.51 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1190 | Temperature(C) | 3.50 | |
| pH | 11.4 | pH | 11.6 | |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) | 82 | mg/l |
| | | Bicarbonate(HCO3) | | |
| | | Hydroxide(OH) | 69 | mg/l |

WATER ANALYSIS 3-209-E-82

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 4.5 | 0.22 | 2.2 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.1 |
| Sodium(Na) | 192.0 | 8.35 | 82.5 |
| Potassium(K) | 60.0 | 1.54 | 15.2 |
| Carbonate(CO3) | 32.0 | 1.07 | 11.4 |
| Bicarbonate(HCO3) | 203.0 | 3.33 | 35.4 |
| Sulphate(SO4) | 110.0 | 2.29 | 24.4 |
| Chloride(Cl) | 96.0 | 2.70 | 28.8 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 3.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 3.7 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 578.0 | | |
| Total Anions(epm) | 9.39 | Total Cations(epm) | 10.12 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1500 |
| pH | 11.2 |
| Fluoride | 0.2 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 3.50 | |
| pH | 11.7 | |
| Carbonate(CO3) | 96 | mg/l |
| Bicarbonate(HCO3) | 0 | mg/l |
| Hydroxide(OH) | 78 | mg/l |

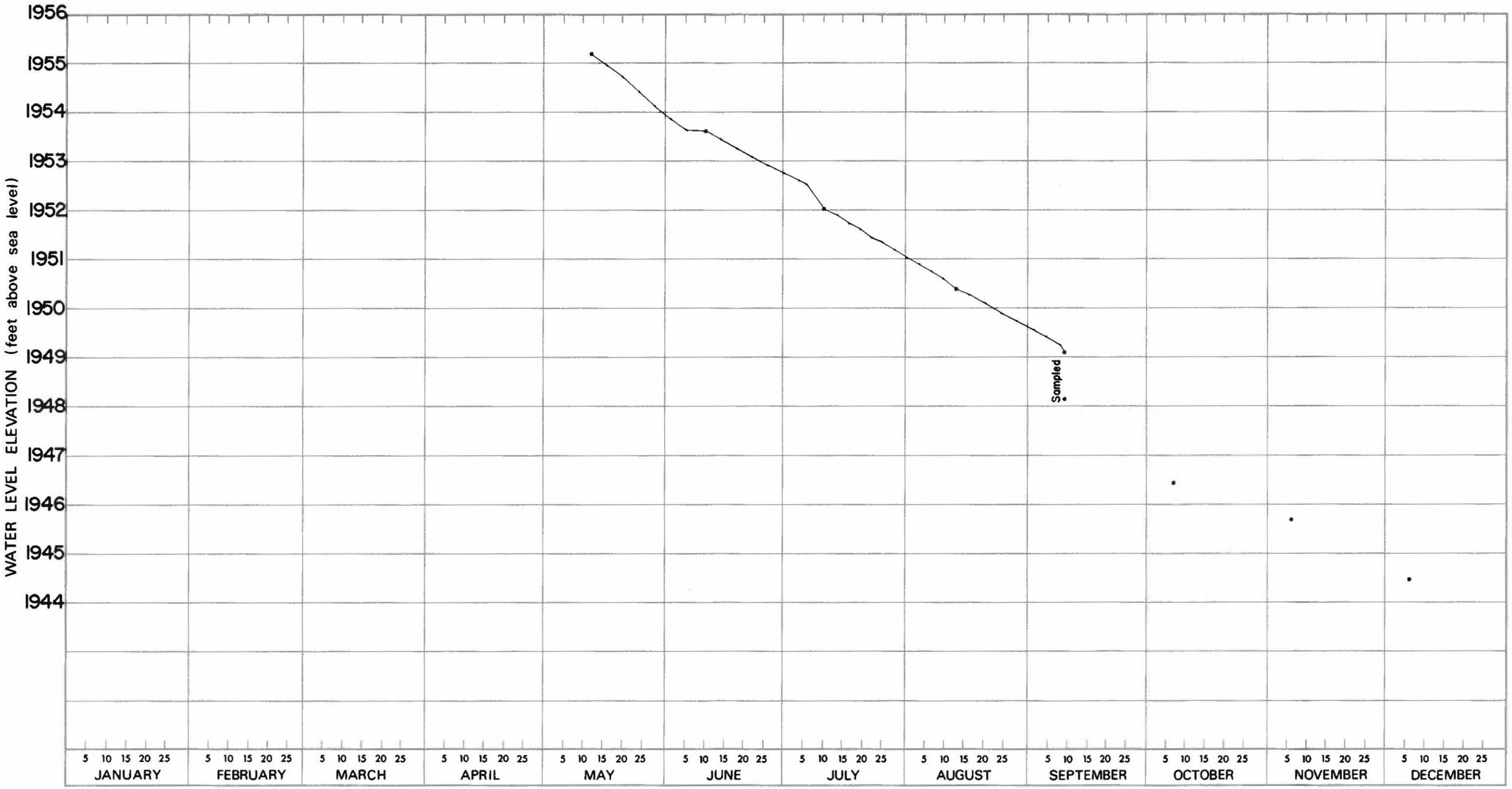
**WATER LEVEL HYDROGRAPH**

3-209-H-76

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council



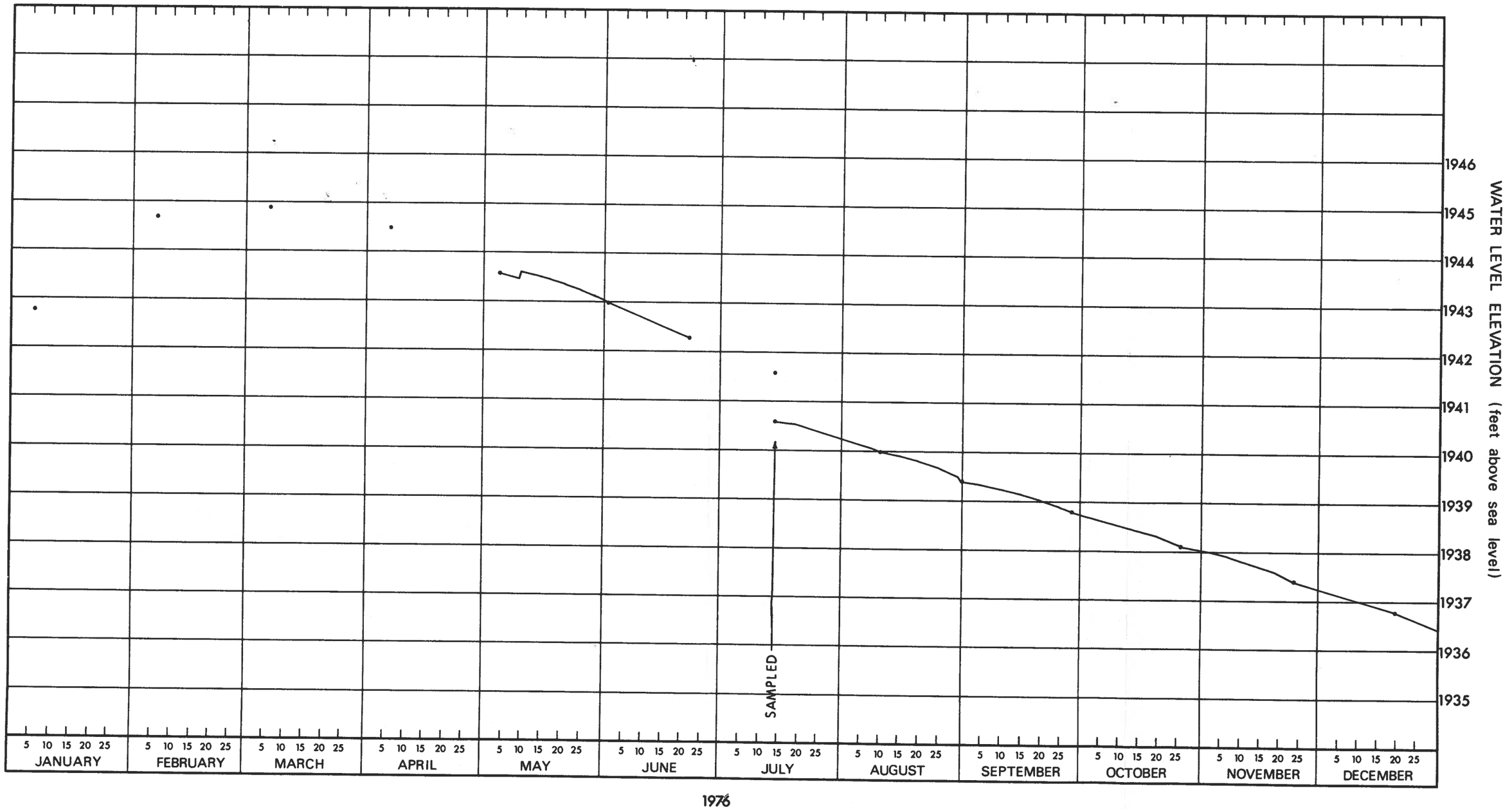
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **3-209**

Lsd **9** Sec **26** Twp **97** R **13** W4th

Alberta Research Council

**3 - 209 - H - 77**




1976

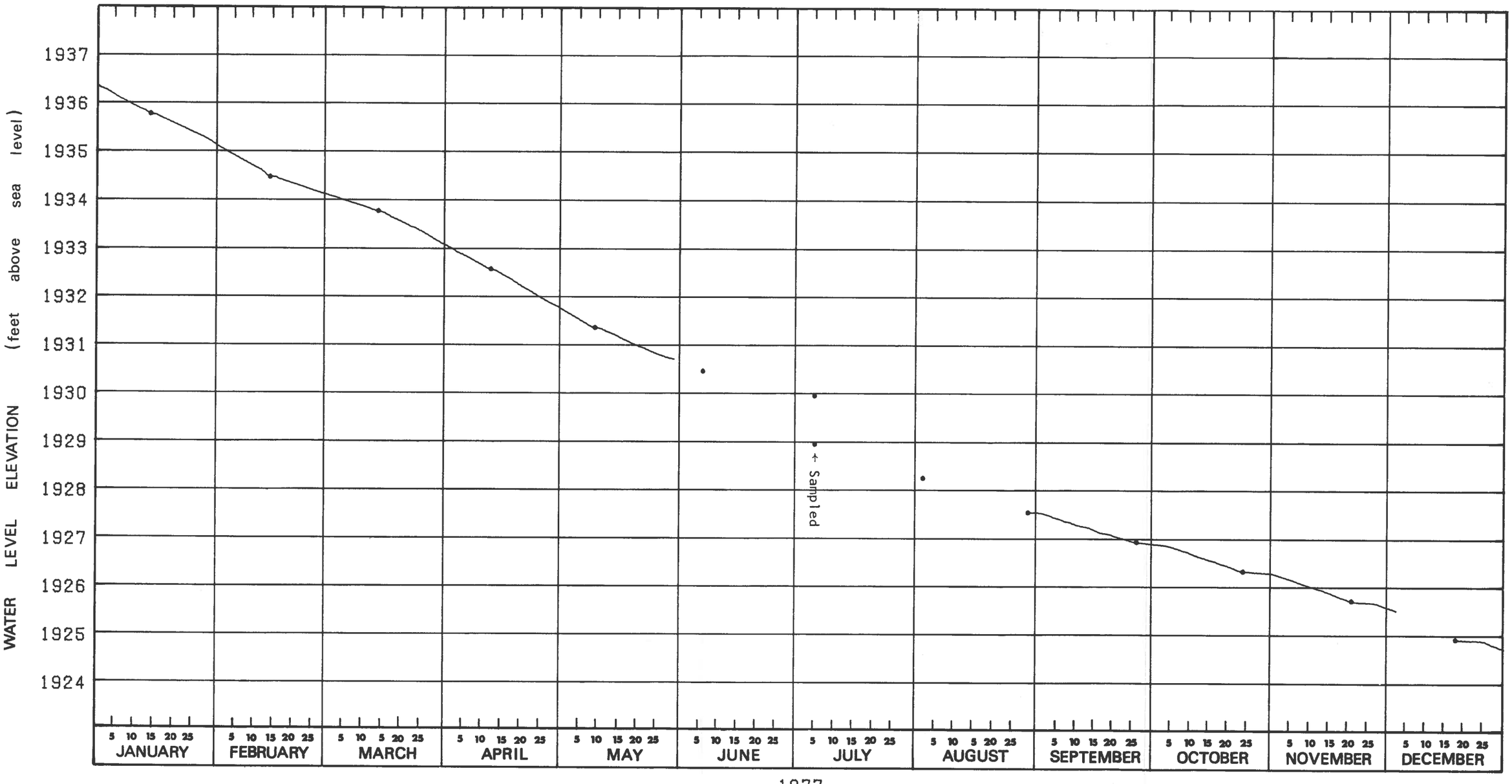
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-209-H-78



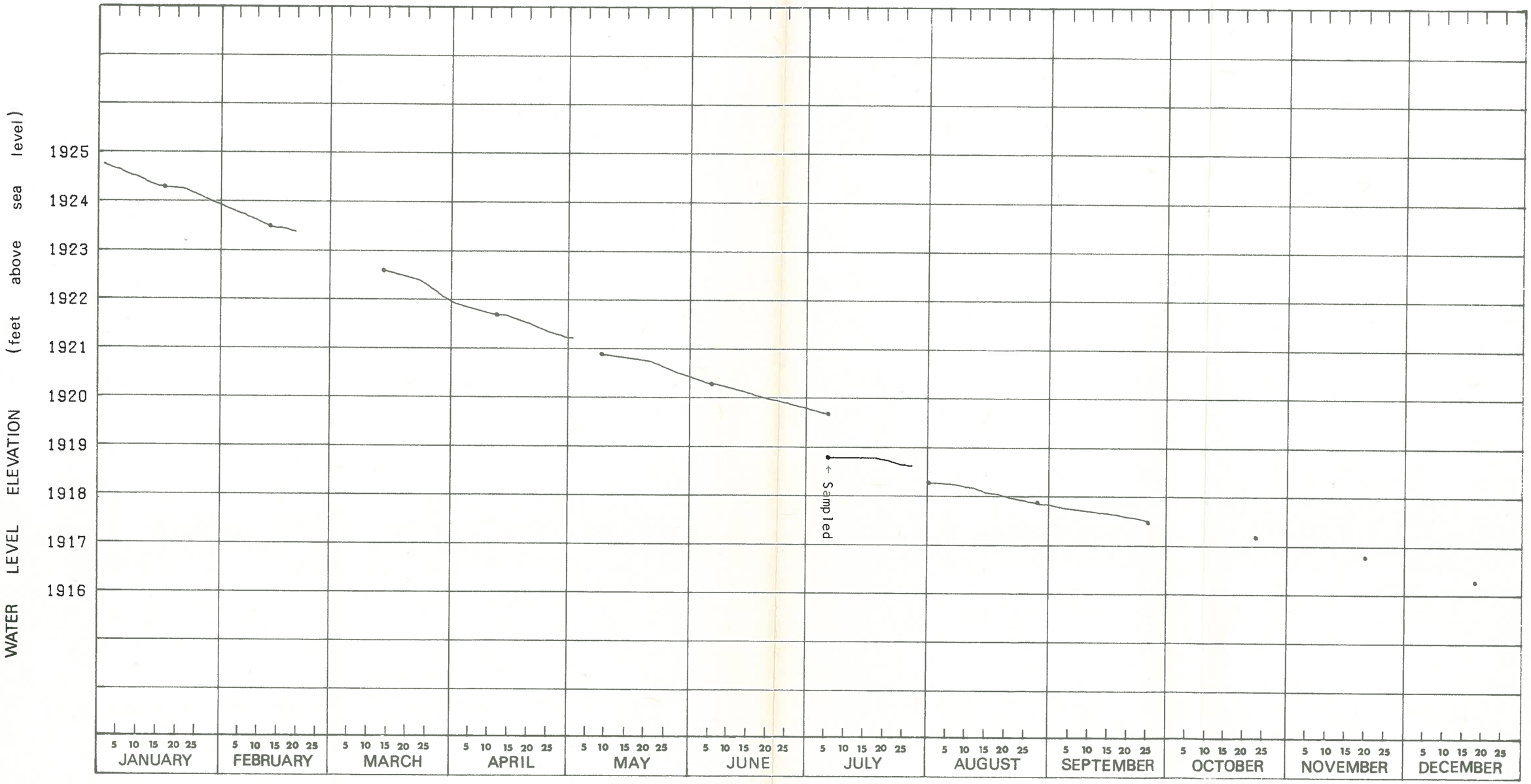
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-209

LSD 9 SEC 26 TWP 97 R 13 W4TH

Alberta Research Council

3-209-H-79




1978

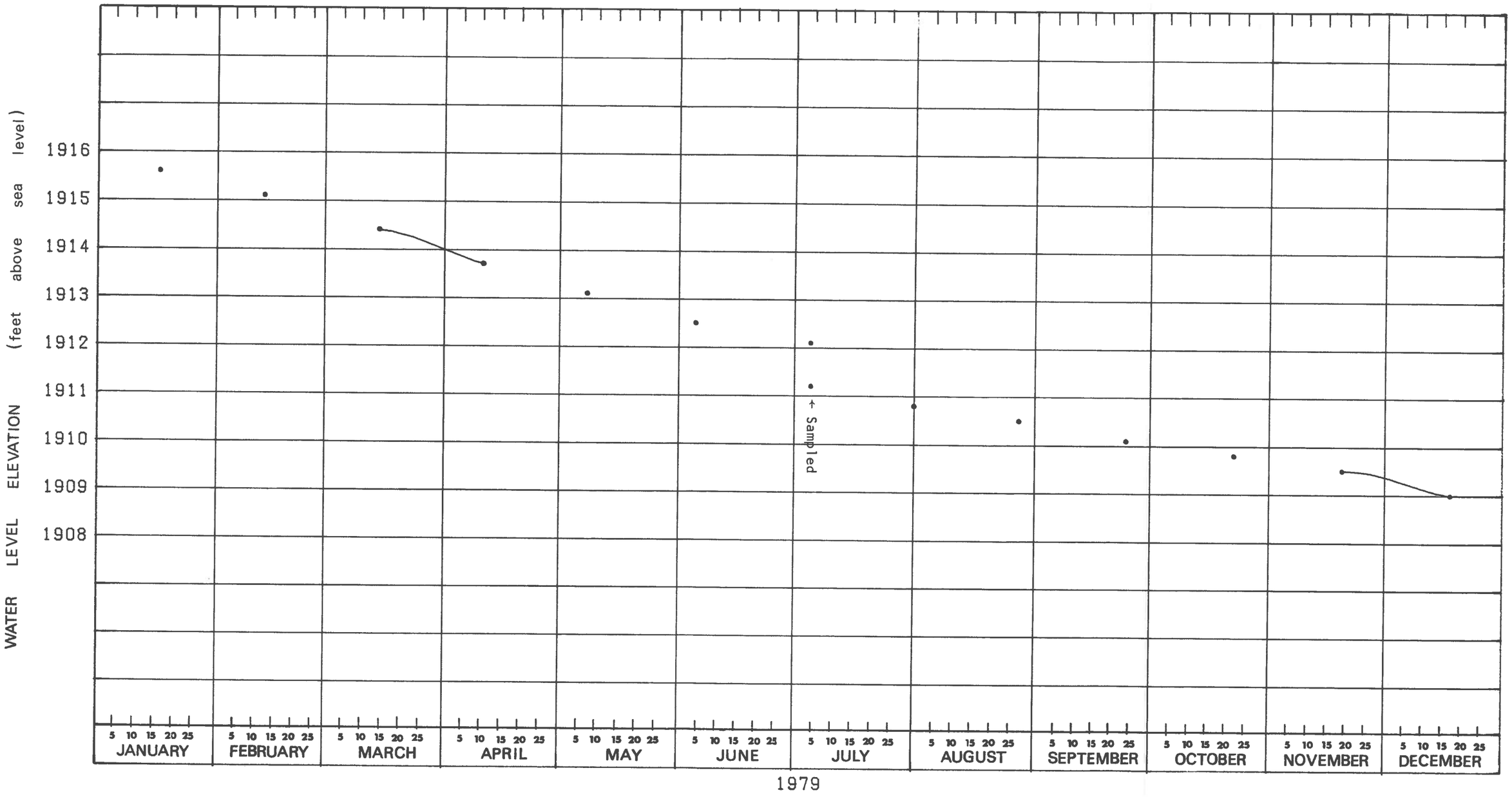
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-209-H-80



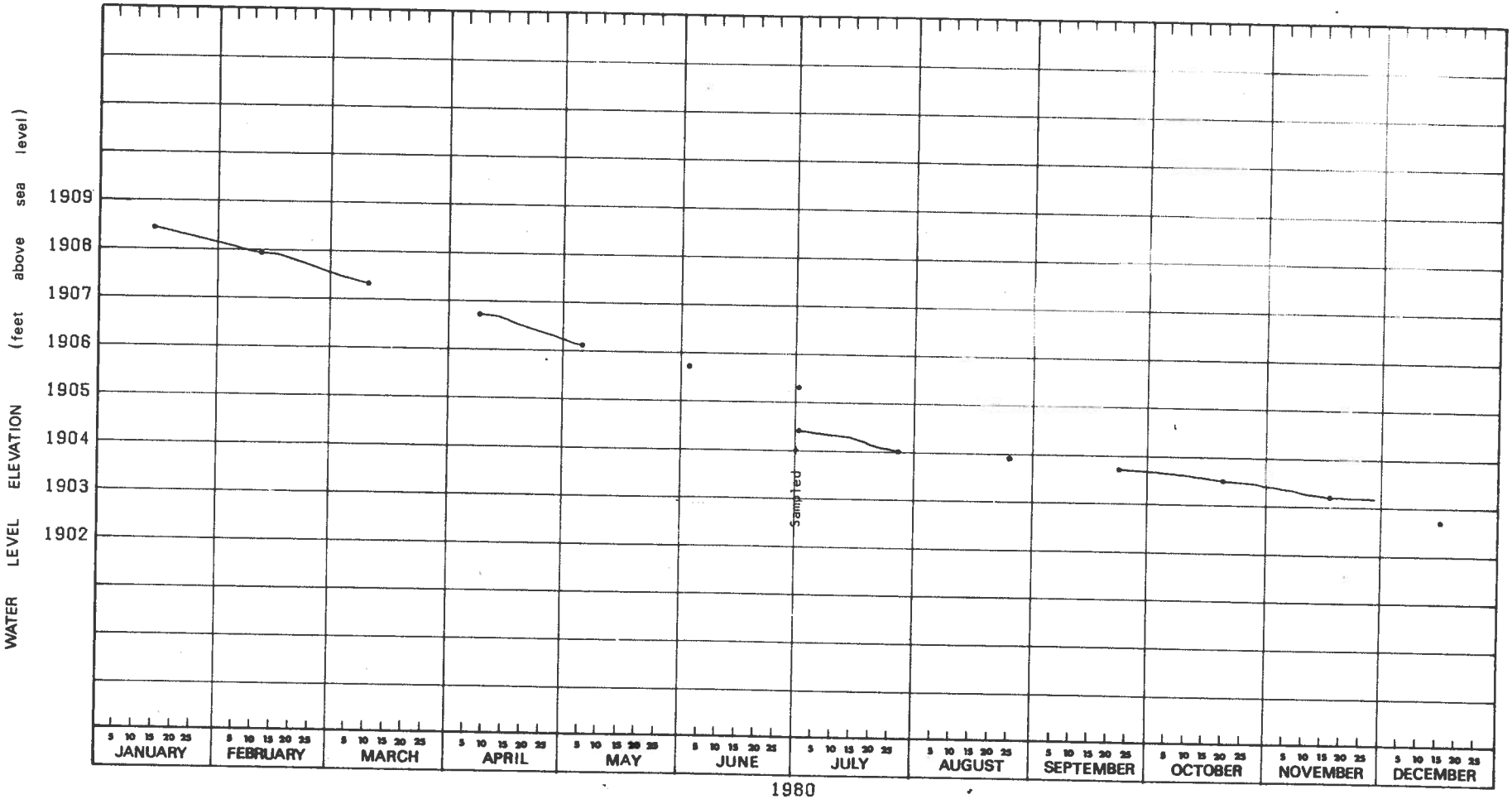
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-209-H-81



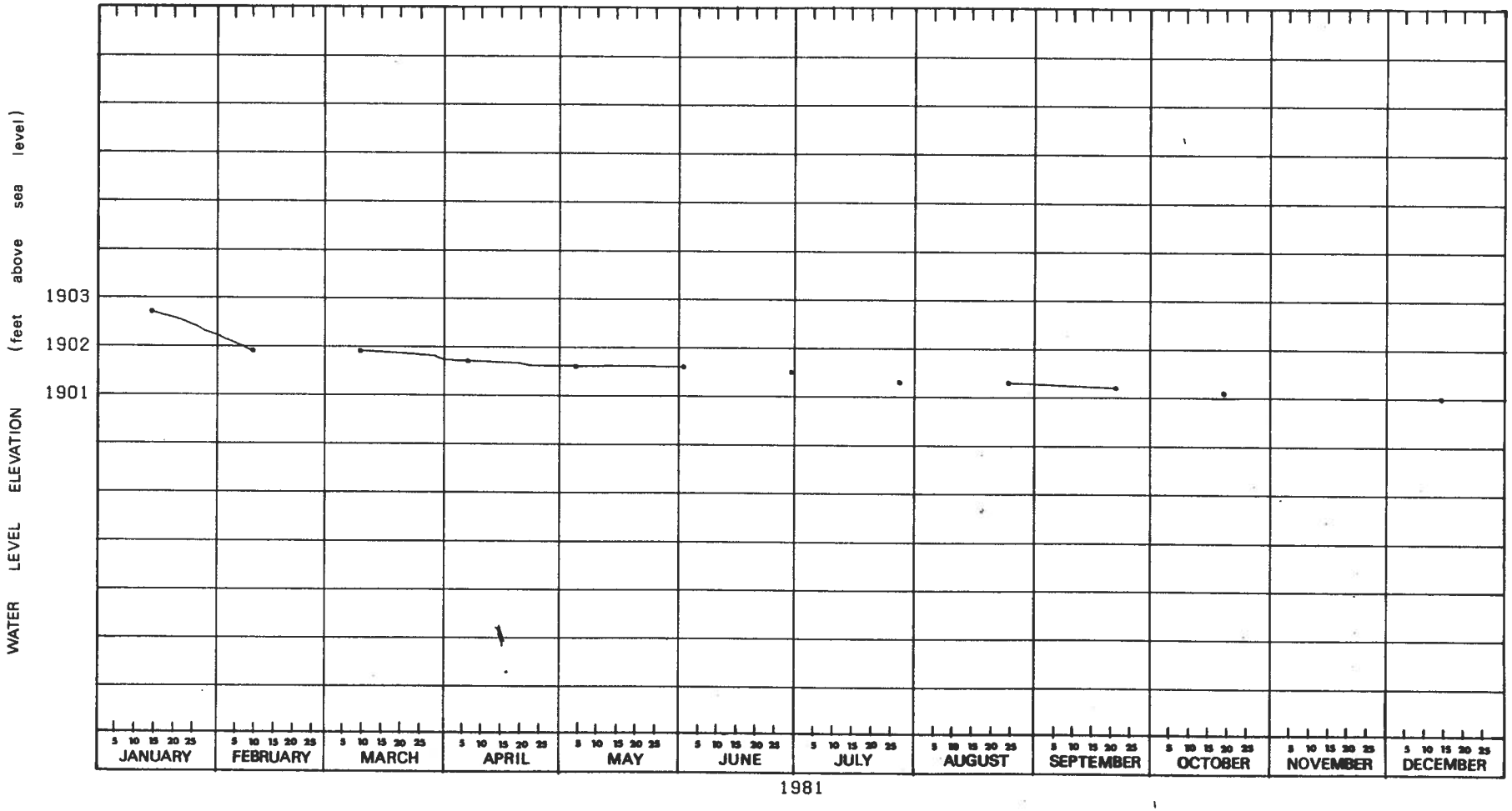
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-209-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 10/75 | 9.99 TOC | 1983.15 | Well completed; bail 100 gallons |
| Jan 20/75 | 45.36 TOC | 1867.11 | |
| Jan 22/75 | | | Water sample |
| Jan 23/75 | 50.63 TOC | 1849.79 | |
| Jan 24/75 | 50.60 TOC | 1849.92 | |
| Jan 25/75 | 50.67 TOC | 1849.69 | Attemp a slug test |
| Feb 12/75 | 8.89 TOC | 1985.76 | |
| Feb 13/75 | | | Install shelter and recorder; MP = 2.79' TOC, (2018.71) |
| Mar 16/75 | | | DST; water sample; FSI = 43# from 175' |
| Mar 17/75 | 17.96 MP | 1959.67 | Reinstall shelter MP = 2.69' TOC, (2018.61) |
| Apr 17/75 | 9.62 MP | 1987.06 | Measurement questionable |
| May 12/75 | 19.35 old MP | 1955.14 | New MP = 32.62" TOC, (2018.64) |
| June 10/75 | 19.83 MP | 1953.60 | |
| July 10/75 | 20.32 MP | 1951.99 | |
| Aug 13/75 | 20.81 MP | 1950.38 | |
| Sept 9/75 | 21.21 MP | 1949.07 | Sampled well; temp. 3°C |
| | 21.50 MP | 1948.12 | after sample |
| Oct 7/75 | 21.85 MP | 1946.47 | |
| Nov 6/75 | 22.25 MP | 1945.66 | |
| Dec 6/75 | 22.69 MP | 1944.22 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 23.12 MP | 1942.8 | MP (2018.6) |
| Feb 6/76 | 22.53 MP | 1944.7 | |
| Mar 6/76 | 22.47 MP | 1944.9 | |
| Apr 6/76 | 22.60 MP | 1944.5 | |
| May 4/76 | 22.86 MP | 1943.6 | |
| June 1/76 | 23.06 MP | 1943.0 | |
| June 22/76 | 23.26 MP | 1942.3 | |
| July 14/76 | 23.46 MP | 1941.6 | |
| | 23.78 MP | 1940.6 | After sample; temp. 5°C |
| Aug 10/76 | 23.97 MP | 1940.0 | |
| Aug 31/76 | 24.13 MP | 1939.4 | |
| Sept 28/76 | 24.33 MP | 1938.8 | |
| Oct 26/76 | 24.53 MP | 1938.1 | |
| Nov 23/76 | 24.73 MP | 1937.4 | |
| Dec 20/76 | 24.95 MP | 1936.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 25.23 MP | 1935.8 | MP (2018.6) |
| Feb 15/77 | 25.63 MP | 1934.5 | |
| Mar 15/77 | 25.85 MP | 1933.8 | |
| Apr 13/77 | 26.21 MP | 1932.6 | |
| May 10/77 | 26.57 MP | 1931.4 | |
| June 7/77 | 26.85 MP | 1930.5 | |
| July 6/77 | 27.03 MP | 1930.0 | |
| | 27.33 MP | 1929.0 | After sample; temp. 5°C |
| Aug 3/77 | 27.54 MP | 1928.3 | |
| Aug 30/77 | 27.73 MP | 1927.6 | |
| Sept 27/77 | 27.92 MP | 1927.0 | |
| Oct 25/77 | 28.10 MP | 1926.4 | |
| Nov 22/77 | 28.30 MP | 1925.8 | |
| Dec 19/77 | 28.52 MP | 1925.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 28.76 MP | 1924.3 | MP (2018.6) |
| Feb 13/78 | 29.00 MP | 1923.5 | |
| Mar 14/78 | 29.26 MP | 1922.6 | |
| Apr 12/78 | 29.55 MP | 1921.7 | |
| May 9/78 | 29.78 MP | 1920.9 | |
| June 6/78 | 29.97 MP | 1920.3 | |
| July 6/78 | 30.14 MP | 1919.7 | |
| | 30.44 MP | 1918.8 | After sample; temp. 3.5°C |
| Aug 1/78 | 30.59 MP | 1918.3 | |
| Aug 29/78 | 30.71 MP | 1917.9 | |
| Sept 26/78 | 30.81 MP | 1917.5 | |
| Oct 24/78 | 30.91 MP | 1917.2 | |
| Nov 21/78 | 31.04 MP | 1916.8 | |
| Dec 19/78 | 31.20 MP | 1916.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 31.39 MP | 1915.6 | MP (2018.6) |
| Feb 13/79 | 31.56 MP | 1915.1 | |
| Mar 15/79 | 31.77 MP | 1914.4 | |
| Apr 11/79 | 31.99 MP | 1913.7 | |
| May 8/79 | 32.17 MP | 1913.1 | |
| June 5/79 | 32.15 MP | 1912.5 | New MP 0.64m TOC (2018.0) |
| July 5/79 | 32.28 MP | 1912.1 | |
| | 32.55 MP | 1911.2 | After sample; temp. 3.5°C |
| Aug 1/79 | 32.67 MP | 1910.8 | |
| Aug 28/79 | 32.78 MP | 1910.5 | |
| Sept 25/79 | 32.88 MP | 1910.1 | |
| Oct 23/79 | 32.98 MP | 1909.8 | |
| Nov 20/79 | 33.09 MP | 1909.5 | |
| Dec 18/79 | 33.24 MP | 1909.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 33.40 MP | 1908.4 | |
| Feb 12/80 | 33.57 MP | 1907.9 | |
| Mar 11/80 | 33.74 MP | 1907.3 | |
| Apr 9/80 | 33.93 MP | 1906.7 | |
| May 6/80 | 34.10 MP | 1906.1 | |
| June 3/80 | 34.23 MP | 1905.7 | |
| July 2/80 | 34.36 MP | 1905.3 | Temp. 3.5°C |
| | 34.64 MP | 1904.4 | After Sample |
| July 28/80 | 34.74 MP | 1904.0 | |
| Aug 26/80 | 34.80 MP | 1903.9 | |
| Sept 24/80 | 34.86 MP | 1903.7 | |
| Oct 21/80 | 34.91 MP | 1903.5 | |
| Nov 18/80 | 34.99 MP | 1903.2 | |
| Dec 17/80 | 35.14 MP | 1902.7 | |
| Jan 15/81 | 35.14 MP | 1902.7 | |
| Feb 10/81 | 35.38 MP | 1901.9 | |
| Mar 10/81 | 35.39 MP | 1901.9 | |
| Apr 7/81 | 35.47 MP | 1901.7 | |
| May 5/81 | 35.49 MP | 1901.6 | |
| June 2/81 | 35.50 MP | 1901.6 | |
| June 30/81 | 35.53 MP | 1901.5 | |
| July 28/81 | 35.57 MP | 1901.3 | |
| Aug 25/81 | 35.59 MP | 1901.3 | |
| Sept 22/81 | 35.61 MP | 1901.2 | |
| Oct 20/81 | 35.63 MP | 1901.1 | |
| Dec 15/81 | 35.67 MP | 1901.0 | |

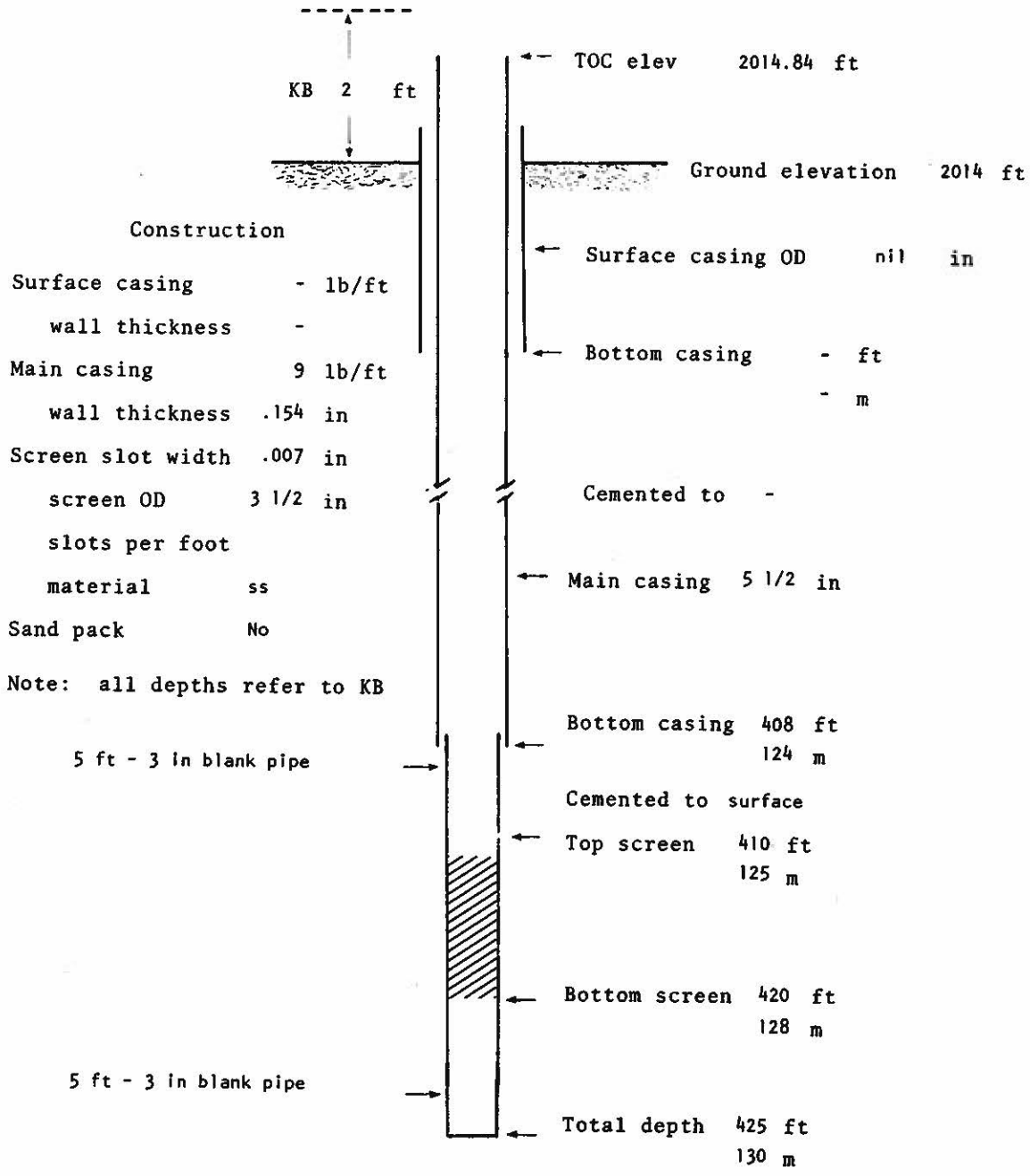
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Tp 97 R 13 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 9 | lb/ft |
| wall thickness | .154 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

## DRILL STEM TEST

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Tp 97 R 13 W4th

Alberta Research Council

Elevation: gl 2014
KB 2016

Type of test - Casing Positrieve

Date of test March 16, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1430 | hrs |
| Tool opened | 1457 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 30 | min |
| Pulled loose at | 1635 | hrs |
| Out of hole at | 1650 | hrs |
| Wt on packers | 7000 | lbs |

Description of blow Weak initial puff, weak blow decreasing to very faint.

Total water recovered Nil ft

Water sample No. -

Gas blow No

Remarks Misrun, tool set above fluid level.

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 410-420

Formation tested Pelican

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

### PRESSURE DATA (psi)

| | |
|---|---|
| Instrument No. | |
| Capacity (psig) | |
| Instrument set at (ft) | |
| Initial hydrostatic | A |
| First flow | B |
| | B1 |
| Initial shut in | C |
| Second flow | D |
| | D1 |
| Final shut in | G |
| Final hydrostatic | H |

B1, D1, etc. Initial Hyd. Pressure

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed from 3-425

Date sampled January 22, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 43.0 | 2.15 | 63.0 |
| Magnesium ($Mg^{++}$) | 8.7 | 0.72 | 21.0 |
| Sodium ($Na^{+}$) | 11.3 | 0.49 | 14.4 |
| Potassium ($K^{+}$) | 2.1 | 0.05 | 1.6 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 105.0 | 1.72 | 49.1 |
| Sulfate ($SO_4^{=}$) | 78.0 | 1.62 | 46.4 |
| Chloride ($Cl^{-}$) | 3.0 | 0.08 | 2.4 |
| Nitrate ($NO_3^{=}$) | 4.5 | 0.07 | 2.1 |
| Silica ($SiO_2$) | 3.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 232.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3.502 | Total Cations (epm) | 3.406 |

### Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 319 | Temperature (C) | 5.6 |
| pH | 7.7 | pH | 9.3 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 17.8 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 76.6 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | 325 |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed from well 3-425

Date of sampling January 22, 1975

Total dissolved solids 232 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | <.01 | Mg | .01 |
| As | .01 | Mn | .001 |
| B | .009 | Mo | ND |
| Ba | ND | Ni | .02 |
| Be | ND | Pb | .001 |
| Bi | ND | Sb | ND |
| Ca | M | Si | .02 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .004 | V | ND |
| Fe | M | Zn | <.005 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

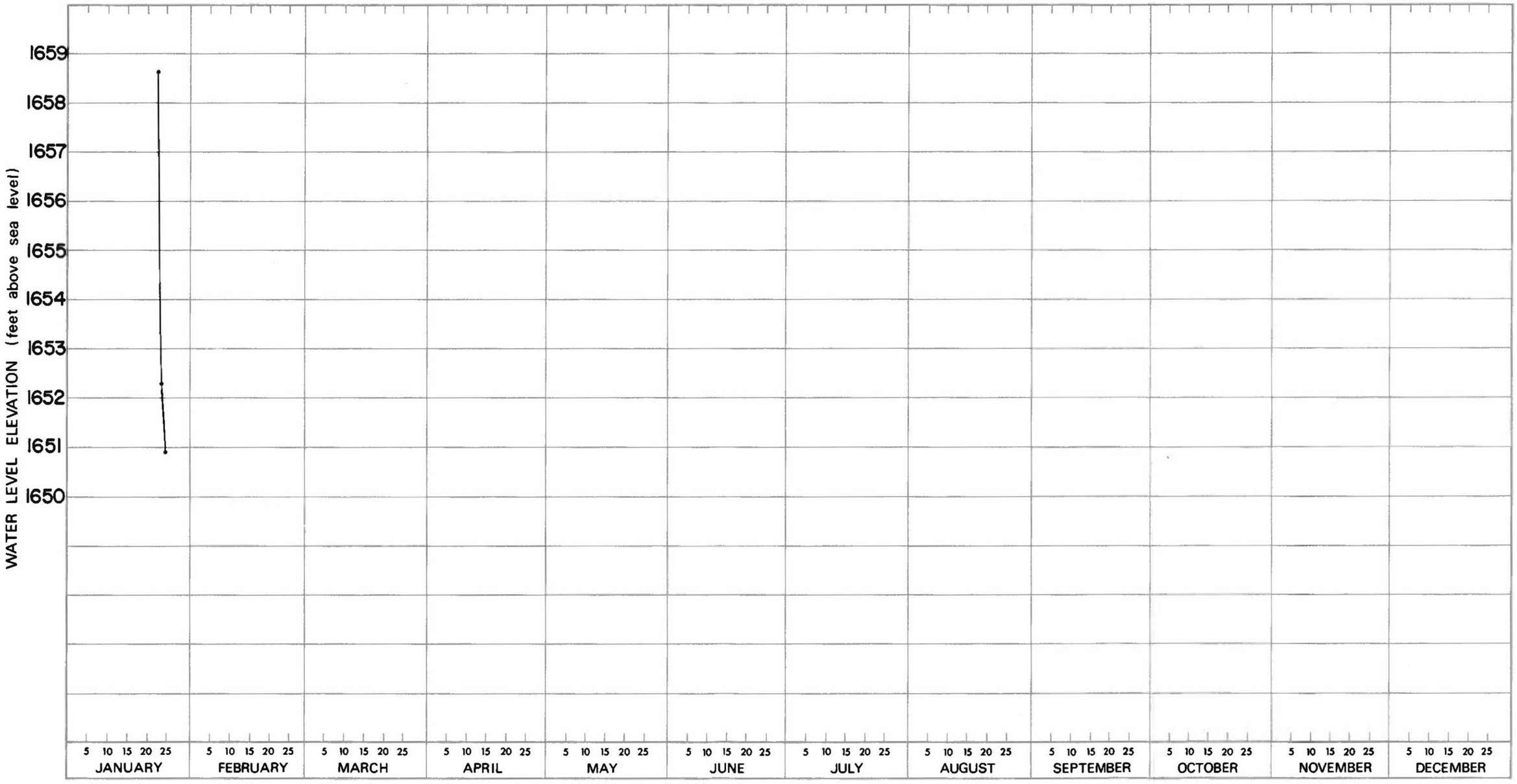
**WATER LEVEL HYDROGRAPH**

3-425-H-76

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council



WELL HISTORY

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.84

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 20/75 | | | Well completed |
| Jan 22/75 | | | Bail water sample |
| Jan 23/75 | 108.59 TOC | 1658.57 | |
| Jan 24/75 | 110.52 TOC | 1652.24 | |
| Jan 25/75 | 110.94 TOC | 1650.86 | |
| Feb 12/75 | 123.03 TOC | 1611.20 | |
| Feb 13/75 | | | Install shelter; MP = 3.70' TOC, (2018.54) |
| Mar 16/75 | | | DST; misrun; set tool above water |
| Mar 17/75 | | | Reinstall shelter |
| Apr 17/75 | Dry | | |
| May 12/75 | Dry | | New MP = 36.5" TOC, (2017.88) |
| June 10/75 | Dry | | |
| July 10/75 | Dry | | |
| Aug 13/75 | Dry | | |
| Sept 9/75 | Dry | | |
| Oct 7/75 | Dry | | |
| Nov 6/75 | Dry | | |
| Dec 6/75 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.84

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | Dry | | MP (2017.9) |
| Feb 6/76 | Dry | | |
| Mar 6/76 | Dry | | |
| Apr 6/76 | Dry | | |
| May 4/76 | Dry | | |
| June 1/76 | Dry | | |
| June 22/76 | Dry | | |
| July 14/76 | Dry | | |
| Aug 10/76 | Dry | | |
| Aug 31/76 | Dry | | |
| Sept 28/76 | Dry | | |
| Oct 26/76 | Dry | | |
| Nov 23/76 | 130.88 MP | 1588.6 | |
| Dec 20/76 | 130.90 MP | 1588.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.84

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | Dry | | MP (2017.9) |
| Feb 15/77 | 129.80 MP | 1592.2 | |
| Mar 15/77 | 125.08 MP | 1607.6 | |
| Apr 13/77 | Dry | | |
| May 10/77 | Dry | | |
| June 7/77 | Dry | | |
| July 6/77 | Dry | | |
| Aug 3/77 | Dry | | |
| Aug 30/77 | Dry | | |
| Sept 27/77 | Dry | | |
| Oct 25/77 | Dry | | |
| Nov 22/77 | Dry | | |
| Dec 19/77 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.84

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | Dry | | MP (2017.9) |
| Feb 13/78 | Dry | | |
| Mar 14/78 | Dry | | |
| Apr 12/78 | Dry | | |
| May 9/78 | 128.36 | 1596.9 | |
| June 6/78 | Dry | | |
| July 6/78 | Dry | | |
| Aug 1/78 | Dry | | |
| Aug 29/78 | Dry | | |
| Sept 26/78 | Dry | | |
| Oct 24/78 | Dry | | |
| Nov 21/78 | Dry | | |
| Dec 19/78 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.84

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | Dry | | MP (2017.9) |
| Feb 13/79 | Dry | | |
| Mar 15/79 | Dry | | |
| Apr 11/79 | Dry | | |
| May 8/79 | Dry | | |
| June 5/79 | Dry | | |
| July 5/79 | Dry | | |
| Aug 1/79 | Dry | | |
| Aug 28/79 | Dry | | |
| Sept 25/79 | Dry | | |
| Oct 23/79 | Dry | | |
| Nov 20/79 | Dry | | |
| Dec 18/79 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing

3-425-W-82

WELL HISTORY

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.84

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | DRY | | |
| Feb 12/80 | DRY | | |
| Mar 11/80 | DRY | | |
| Apr 9/80 | DRY | | |
| May 6/80 | DRY | | |
| June 3/80 | DRY | | |
| July 2/80 | DRY | | |
| July 28/80 | DRY | | |
| Aug 26/80 | DRY | | |
| Sept 24/80 | DRY | | |
| Oct 21/80 | DRY | | |
| Nov 18/80 | DRY | | |
| Dec 17/80 | DRY | | |
| Jan 15/81 | DRY | | |
| Feb 10/81 | DRY | | |
| Mar 10/81 | DRY | | |
| Apr 7/81 | DRY | | |
| May 5/81 | DRY | | |
| June 2/81 | DRY | | |
| June 30/81 | DRY | | |
| July 28/81 | DRY | | |
| Aug 25/81 | DRY | | |
| Sept 22/81 | DRY | | |
| Oct 20/81 | DRY | | |
| Dec 15/81 | DRY | | |

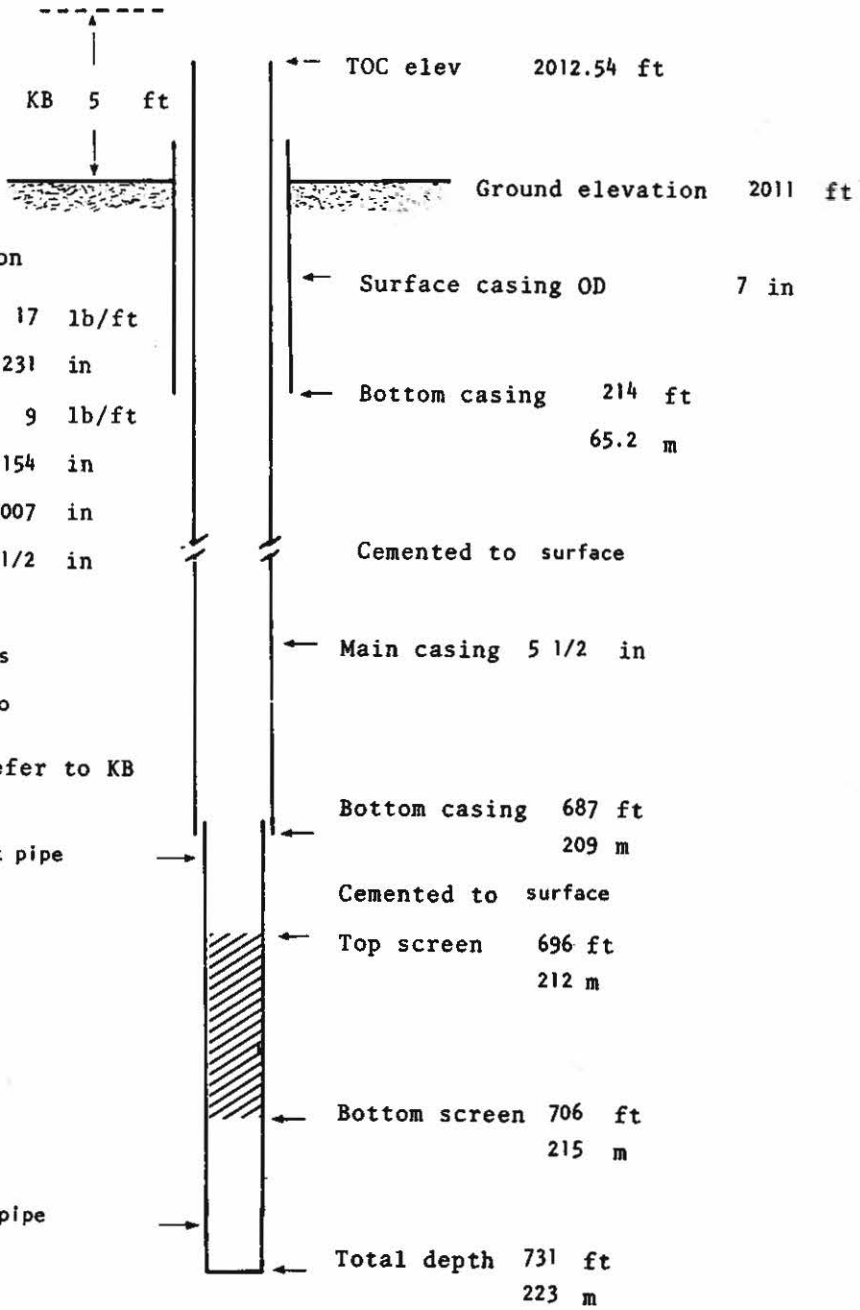
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Tp 97 R 13 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Main casing | 9 | lb/ft |
| wall thickness | .154 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

Note: well was drilled to 1270 ft and cemented back to 731

## DRILL STEM TEST

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Tp 97 R 13 W4th

Alberta Research Council

Elevation: gl 2011
KB 2013

Type of test - Casing Positrieve

Date of test March 14, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1815 | hrs |
| Tool opened | 1941 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | - | min |
| Final shut in | - | min |
| Pulled loose at | - | hrs |
| Out of hole at | - | hrs |
| Wt on packers | 5000 | lbs |

Description of blow Weak initial puff faint blow decreasing to nil in one minute.

Total water recovered nil ft

Water sample No. -

Gas blow No

Remarks Misrun, unable to set tool last stands very tight, unable to set tool lower.

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 696-706

Formation tested Grand Rapids

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Total Interval | 11.20 | |

### PRESSURE DATA (psi)

| | |
|---|---|
| Instrument No. | |
| Capacity (psig) | |
| Instrument set at (ft) | |
| Initial hydrostatic | A |
| First flow | B |
| | B1 |
| Initial shut in | C |
| Second flow | D |
| | D1 |
| Final shut in | G |
| Final hydrostatic | H |

B1, D1, etc. Initial Hyd. Pressure

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed from 3-731

Date sampled February 12, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.2 | 0.16 | 0.7 |
| Magnesium ($Mg^{++}$) | 1.3 | 0.11 | 0.5 |
| Sodium ($Na^{+}$) | 491.0 | 21.36 | 97.5 |
| Potassium ($K^{+}$) | 10.8 | 0.28 | 1.3 |
| Carbonate ($CO_3^{=}$) | 93.6 | 3.12 | 12.4 |
| Bicarbonate ($HCO_3^{-}$) | 463.6 | 7.60 | 30.3 |
| Sulfate ($SO_4^{=}$) | 134.0 | 2.79 | 11.1 |
| Chloride ($Cl^{-}$) | 407.0 | 11.48 | 45.7 |
| Nitrate ($NO_3^{=}$) | 7.5 | 0.12 | 0.5 |
| Silica ($SiO_2$) | 3.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1336.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 25.107 | Total Cations (epm) | 21.900 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2350 | Temperature (C) | 5.0 |
| pH | 9.3 | pH | 9.9 |
| Fluoride ($F^{-}$) | 2.0 ppm | Carbonate ($CO_3^{=}$) | 197 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 217 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed from well 3-731

Date of sampling February 12, 1975

Total dissolved solids 1336 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | M | Mg | .01 |
| As | <.01 | Mn | .002 |
| B | .05 | Mo | ND |
| Ba | .005 | Ni | .005 |
| Be | ND | Pb | ND |
| Bi | ND | Sb | ND |
| Ca | .1 | Si | M |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .004 | V | .03 |
| Fe | .1 | Zn | <.005 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 9, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.9 | 0.14 | 1 |
| Magnesium ($Mg^{++}$) | 0.6 | 0.05 | 0 |
| Sodium ($Na^{+}$) | 458 | 19.92 | 98 |
| Potassium ($K^{+}$) | 5.8 | 0.15 | 1 |
| Carbonate ($CO_3^{=}$) | 144 | 4.80 | 23 |
| Bicarbonate ($HCO_3^{-}$) | 405 | 6.64 | 32 |
| Sulfate ($SO_4^{=}$) | 40 | 0.83 | 4 |
| Chloride ($Cl^{-}$) | 306 | 8.63 | 41 |
| Nitrate ($NO_3^{=}$) | 12 | 0.19 | 1 |
| Silica ($SiO_2$) | 3.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1.3 | | |
| Magnesium (Acidified) | 2.7 | | |
| Total dissolved solids | 1294 | | |
| Total Anions (epm) | 21.09 | Total Cations (epm) | 20.26 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2180 |
| pH | 9.2 |
| Fluoride ($F^{-}$) | 1.5 ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | 6.0 | |
| pH | 9.8 | |
| Carbonate ($CO_3^{=}$) | 50.5 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 | ppm |
| Hydroxide ($OH^{-}$) | 46.9 | ppm |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.2 | 0.16 | 1 |
| Magnesium ($Mg^{++}$) | 0.7 | 0.06 | 0 |
| Sodium ($Na^{+}$) | 491.0 | 21.36 | 98 |
| Potassium ($K^{+}$) | 6.3 | 0.16 | 1 |
| Carbonate ($CO_3^{=}$) | 60.0 | 2.00 | 10 |
| Bicarbonate ($HCO_3^{-}$) | 698.0 | 11.44 | 55 |
| Sulfate ($SO_4^{=}$) | 13.8 | 0.29 | 1 |
| Chloride ($Cl^{-}$) | 252.0 | 7.11 | 34 |
| Nitrate ($NO_3^{=}$) | 9.8 | 0.16 | 1 |
| Silica ($SiO_2$) | 3.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 3.1 | | |
| Magnesium (Acidified) | 1.2 | | |
| Total dissolved solids | 1252 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 20.99 | Total Cations (epm) | 21.74 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2150 |
| pH | 8.8 |
| Fluoride ($F^{-}$) | 1.8 Mg/L |

Field:

| | |
|---|---|
| Temperature (C) | 9.0 |
| pH | 9.3 |
| Carbonate ($CO_3^{=}$) | 120 Mg/L |
| Bicarbonate ($HCO_3^{-}$) | 605 Mg/L |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 6, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.6 | 0.13 | 0.6 |
| Magnesium ($Mg^{++}$) | 0.9 | 0.07 | 0.3 |
| Sodium ($Na^{+}$) | 505.0 | 21.97 | 98.5 |
| Potassium ($K^{+}$) | 5.3 | 0.14 | 0.6 |
| Carbonate ($CO_3^{=}$) | 79.0 | 2.63 | 11.9 |
| Bicarbonate ($HCO_3^{-}$) | 739.0 | 12.11 | 55.0 |
| Sulfate ($SO_4^{=}$) | 5.6 | 0.12 | 0.5 |
| Chloride ($Cl^{-}$) | 248.0 | 6.99 | 31.7 |
| Nitrate ($NO_3^{=}$) | 11.2 | 0.18 | 0.8 |
| Silica ($SiO_2$) | 2.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 2.2 | | |
| Magnesium (Acidified) | 0.4 | | |
| Total dissolved solids | 1292.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 22.04 | Total Cations (epm) | 22.31 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2300 | Temperature (C) | 8.0 |
| pH | 9.1 | pH | 9.2 |
| Fluoride ($F^{-}$) | 1.6 ppm | Carbonate ($CO_3^{=}$) | 96.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 683.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 25 Twp 97 R 13 W4th

Alberta Research Council

Date sampled: July 14, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .017 |
| Au | <.003 | Mo | <.006 |
| Al | 0.22 | Na | 499 |
| As | <.038 | Ni | <.010 |
| B | 4.49 | P | 1.10 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 3.71 | Si | 2.33 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .111 |
| Cr | <.006 | Te | <.065 |
| Cu | .011 | Ti | .050 |
| Eu | <.015 | U | <.020 |
| Fe | 0.53 | V | .015 |
| K | <.150 | W | <.078 |
| Mg | 1.40 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 06, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3.0 | 0.15 | 0.7 |
| Magnesium(Mg) | 0.7 | 0.06 | 0.3 |
| Sodium(Na) | 485.0 | 21.10 | 98.4 |
| Potassium(K) | 5.4 | 0.14 | 0.6 |
| Carbonate(CO3) | 74.0 | 2.47 | 10.9 |
| Bicarbonate(HCO3) | 749.0 | 12.28 | 54.4 |
| Sulphate(SO4) | 22.3 | 0.46 | 2.1 |
| Chloride(Cl) | 246.0 | 6.94 | 30.8 |
| Nitrate(NO3) | 25.7 | 0.41 | 1.8 |
| Silica(SiO2) | 5.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 2.9 | | |
| Magnesium(Acidified) | 0.7 | | |
| TDS(mg/l) | 1204.0 | | |
| Total Anions(epm) | 22.56 | Total Cations(epm) | 21.44 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1850 | | Temperature(C) | 8.00 | |
| pH | 9.1 | | pH | 9.1 | |
| Fluoride(F) | 1.4 | mg/l | Carbonate(CO3) | 106 | mg/l |
| | | | Bicarbonate(HCO3) | 693 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.9 | 0.14 | 0.7 |
| Magnesium(Mg) | 0.9 | 0.07 | 0.3 |
| Sodium(Na) | 495.0 | 21.53 | 98.5 |
| Potassium(K) | 4.6 | 0.12 | 0.5 |
| Carbonate(CO3) | 48.0 | 1.60 | 7.1 |
| Bicarbonate(HCO3) | 793.0 | 13.00 | 57.9 |
| Sulphate(SO4) | 38.5 | 0.80 | 3.6 |
| Chloride(Cl) | 250.0 | 7.05 | 31.4 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 6.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 2.1 | | |
| Magnesium(Acidified) | 0.5 | | |
| TDS(mg/l) | 1238.0 | | |
| Total Anions(epm) | 22.45 | Total Cations(epm) | 21.87 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1780 | Temperature(C) | 8.50 | |
| pH | 8.8 | pH | 9.0 | |
| Fluoride(F) | 2.0 mg/l | Carbonate(CO3) | 91 | mg/l |
| | | Bicarbonate(HCO3) | 717 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 3-731-E-82

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.7 | 0.13 | 0.5 |
| Magnesium(Mg) | 1.0 | 0.08 | 0.3 |
| Sodium(Na) | 575.0 | 25.00 | 97.1 |
| Potassium(K) | 21.0 | 0.54 | 2.1 |
| Carbonate(CO3) | 24.0 | 0.80 | 3.7 |
| Bicarbonate(HCO3) | 830.0 | 13.61 | 63.4 |
| Sulphate(SO4) | 0.0 | 0.0 | 0.0 |
| Chloride(Cl) | 250.0 | 7.04 | 32.8 |
| Nitrate(NO3) | 0.8 | 0.01 | 0.1 |
| Silica(SiO2) | 6.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 3.4 | | |
| Magnesium(Acidified) | 0.8 | | |
| TDS(mg/l) | 1278.0 | | |
| Total Anions(epm) | 21.46 | Total Cations(epm) | 25.76 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2050 | Temperature | 8.00 | |
| pH | 8.6 | pH | 9.0 | |
| Fluoride | 1.7 mg/l | Carbonate(CO3) | 82 | mg/l |
| | | Bicarbonate(HCO3) | 737 | mg/l |
| | | Hydroxide(OH) | | |

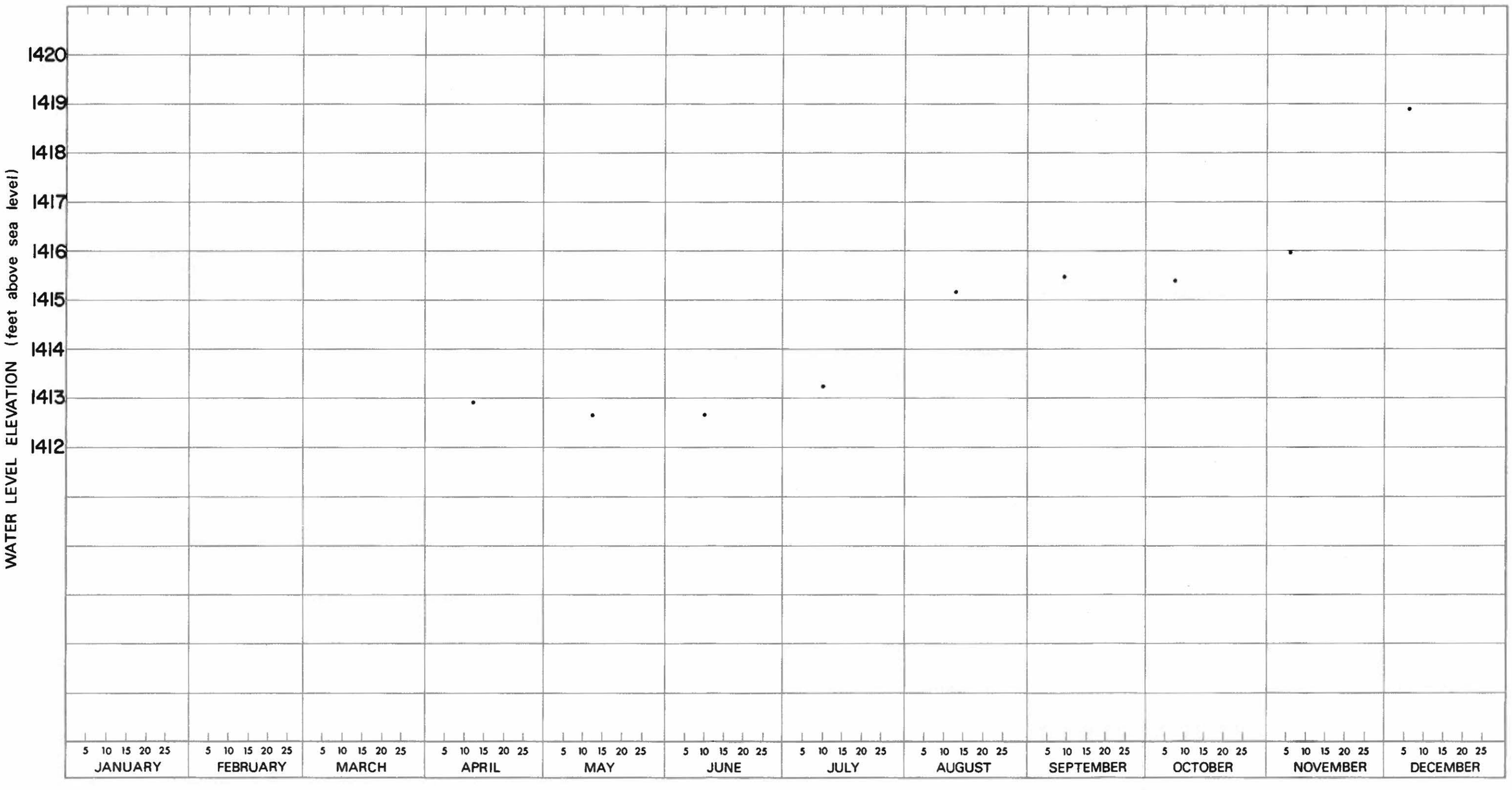
**WATER LEVEL HYDROGRAPH**

3-731-H-76

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council



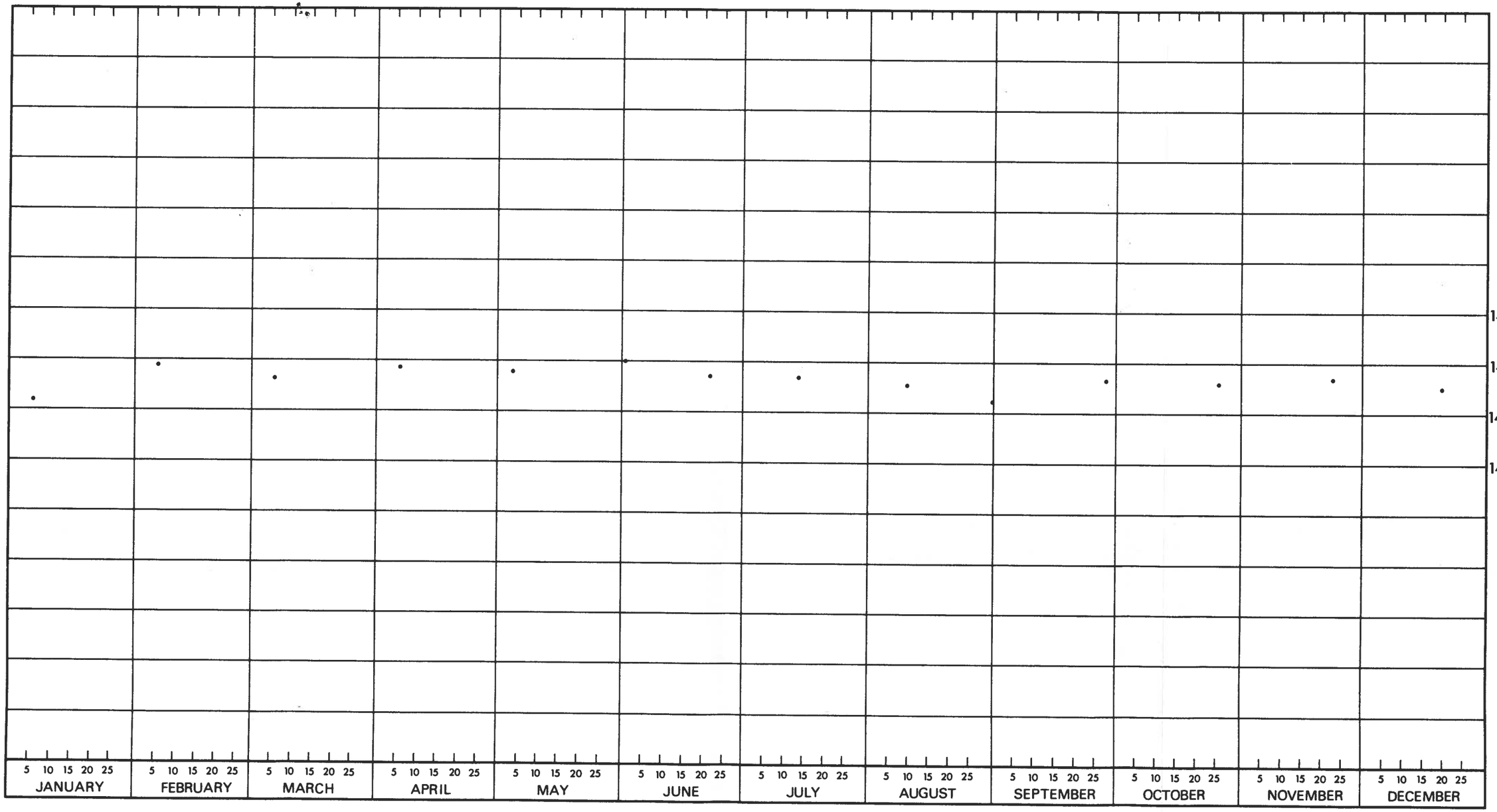
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

3 - 731 - H - 77




1976

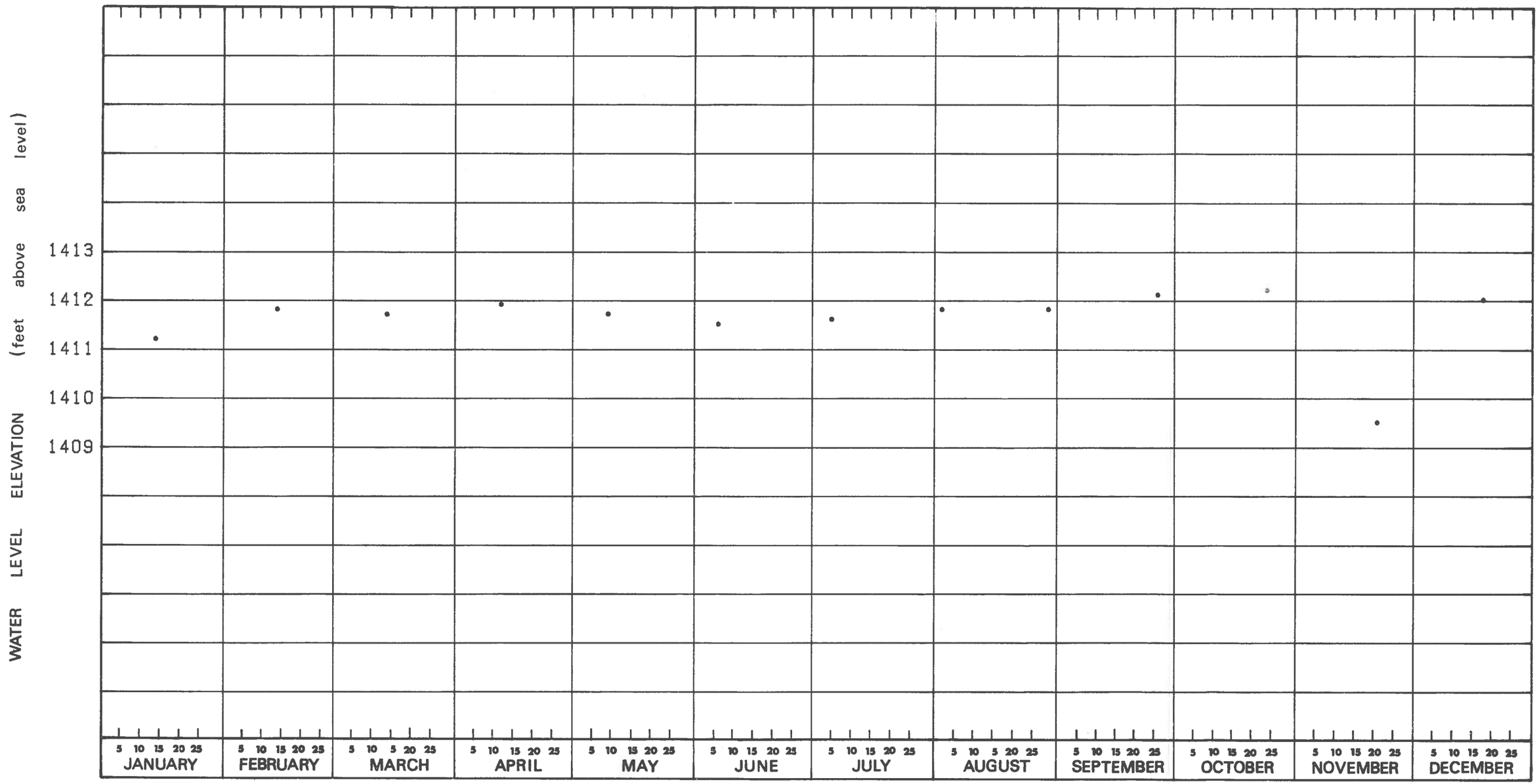
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-731

3-731-H-78

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council




1977

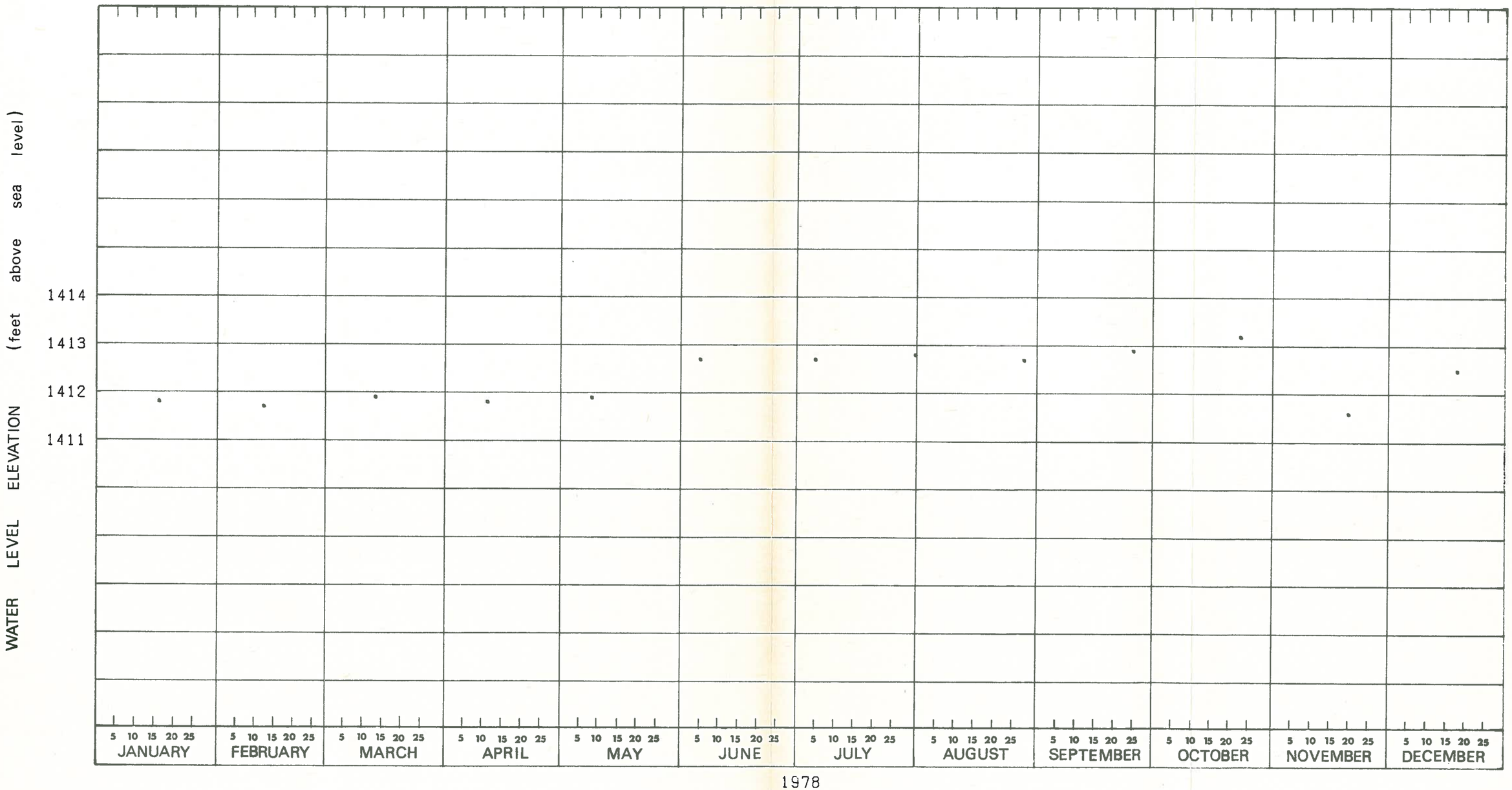
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-731

LSD 9 SEC 26 TWP 97 R 13 W4TH

Alberta Research Council

3-731-H-79




1978

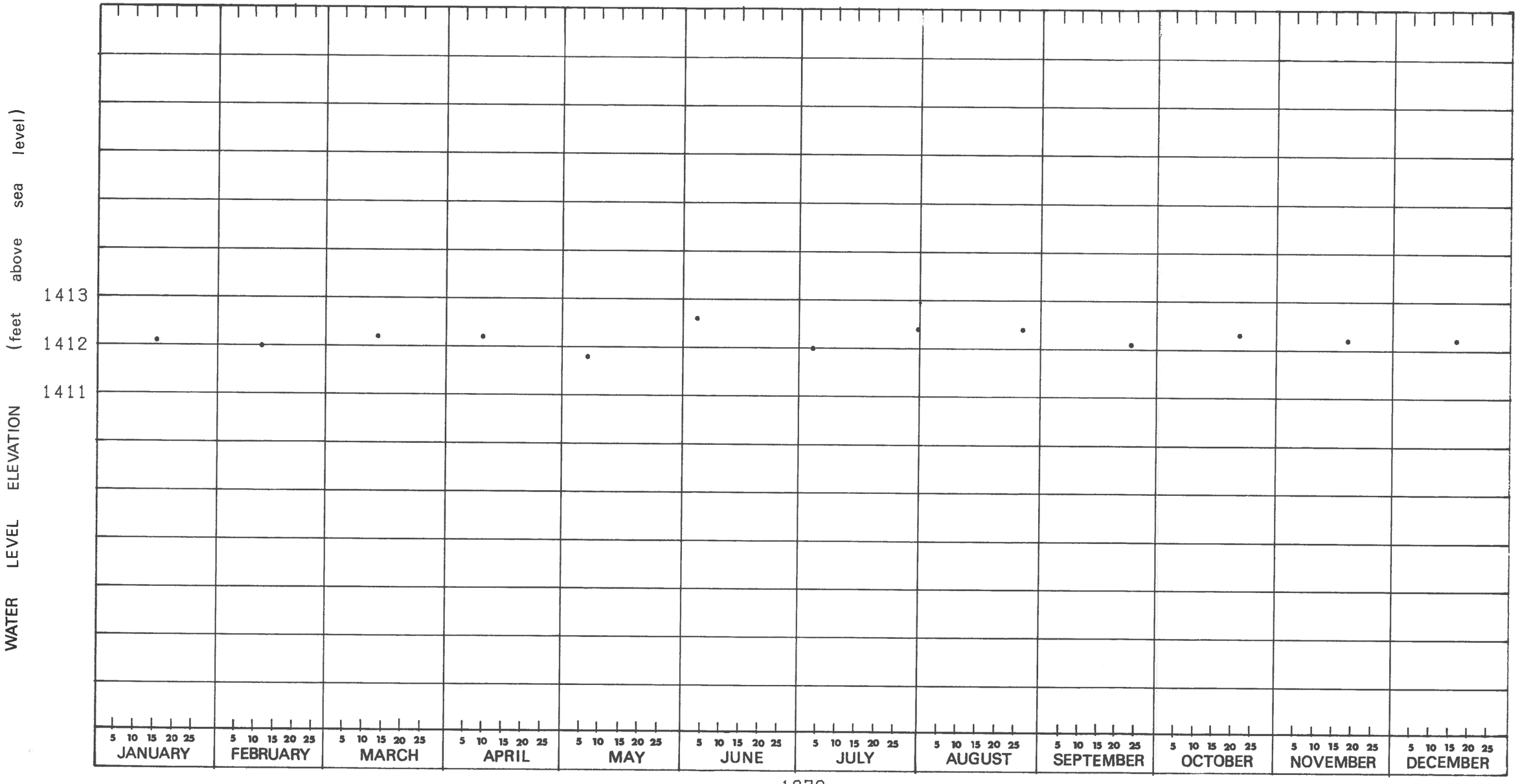
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-731-H-80



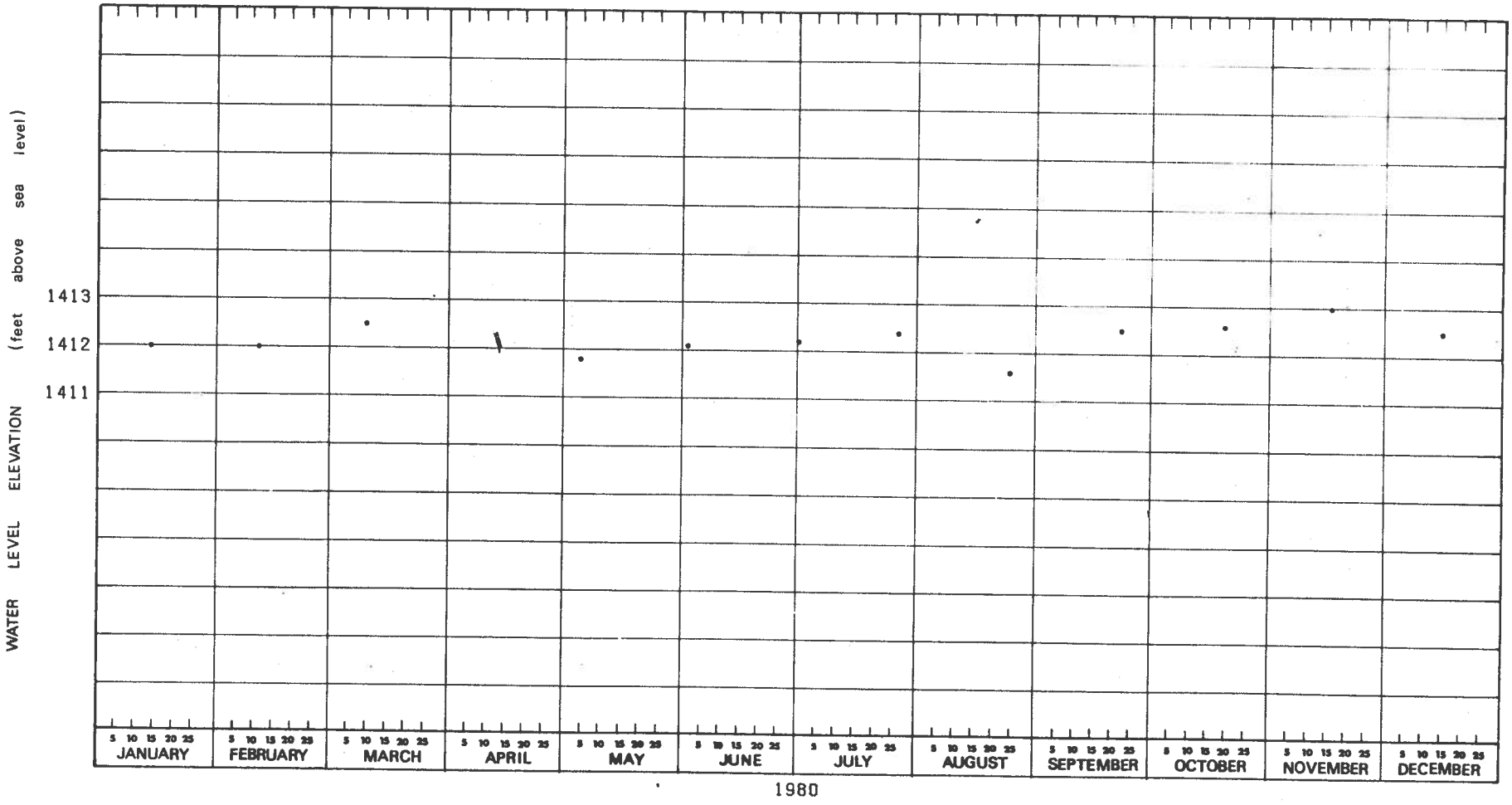
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-731-H-81



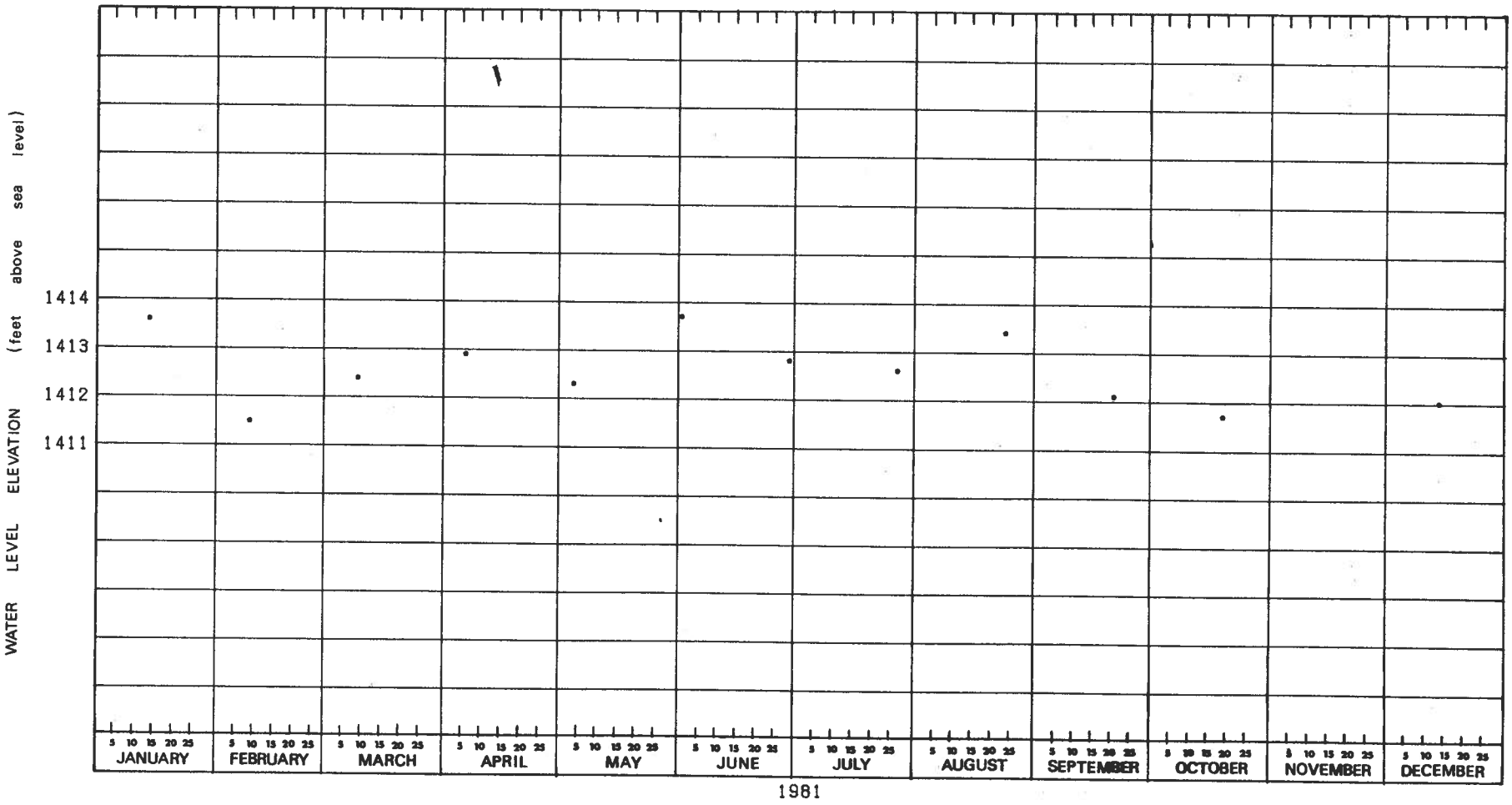
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-731-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.97 (Until March 14/75)
2012.54 (After March 14/75)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 21/75 | | | Well completed |
| Jan 22/75 | | | Bail 175 gallons |
| Jan 23/75 | 113.47 TOC | 1641.69 | |
| Jan 24/75 | 120.07 TOC | 1620.04 | |
| Jan 25/75 | 115.94 TOC | 1633.59 | |
| Feb 12/75 | 143 TOC | 1545 | Bail 190 gallons |
| Feb 13/75 | 186.08 MP | 1403.47 | Install shelter; MP = 1.44' TOC, (2013.98) |
| Mar 14/75 | | | DST; misrun, cut off casing |
| Mar 18/75 | | | Reinstall shelter and recorder |
| Apr 17/75 | 183.94 MP | 1411.92 | MP = 2.86' TOC, (2015.40) |
| May 12/75 | 184.06 MP | 1411.68 | |
| June 10/75 | 184.08 MP | 1411.64 | |
| July 10/75 | 183.60 MP | 1413.21 | |
| Aug 13/75 | 183.01 MP | 1415.12 | |
| Sept 9/75 | 182.92 MP | 1415.42 | Sampled well; temp. 6°C |
| Oct 7/75 | 182.93 MP | 1415.38 | |
| Nov 6/75 | 182.76 MP | 1415.95 | |
| Dec 6/75 | 181.87 MP | 1418.87 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2012.54

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 184.20 MP | 1411.2 | MP (2015.4) |
| Feb 6/76 | 183.99 MP | 1411.9 | |
| Mar 6/76 | 184.07 MP | 1411.6 | |
| Apr 6/76 | 184.00 MP | 1411.9 | |
| May 4/76 | 184.03 MP | 1411.8 | |
| June 1/76 | 183.96 MP | 1412.0 | |
| June 22/76 | 184.05 MP | 1411.7 | |
| July 14/76 | 184.05 MP | 1411.7 | Sampled; temp. 9°C |
| Aug 10/76 | 184.10 MP | 1411.5 | |
| Aug 31/76 | 184.20 MP | 1411.2 | |
| Sept 28/76 | 184.07 MP | 1411.6 | |
| Oct 26/76 | 184.07 MP | 1411.6 | |
| Nov 23/76 | 184.05 MP | 1411.7 | |
| Dec 20/76 | 184.10 MP | 1411.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2012.54

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 184.20 MP | 1411.2 | MP (2015.4) |
| Feb 15/77 | 184.03 MP | 1411.8 | |
| Mar 15/77 | 184.06 MP | 1411.7 | |
| Apr 13/77 | 184.00 MP | 1411.9 | |
| May 10/77 | 184.06 MP | 1411.7 | |
| June 7/77 | 184.12 MP | 1411.5 | |
| July 6/77 | 184.07 MP | 1411.6 | Sampled; temp. 8°C |
| Aug 3/77 | 184.03 MP | 1411.8 | |
| Aug 30/77 | 184.01 MP | 1411.8 | |
| Sept 27/77 | 183.93 MP | 1412.1 | |
| Oct 25/77 | 183.89 MP | 1412.2 | |
| Nov 22/77 | 184.71 MP | 1409.5 | |
| Dec 19/77 | 183.95 MP | 1412.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2012.54

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 184.03 MP | 1411.8 | MP (2015.4) |
| Feb 13/78 | 184.04 MP | 1411.7 | |
| Mar 14/78 | 184.00 MP | 1411.9 | |
| Apr 12/78 | 184.03 MP | 1411.8 | |
| May 9/78 | 184.00 MP | 1411.9 | |
| June 6/78 | 183.74 MP | 1412.7 | |
| July 6/78 | 183.75 MP | 1412.7 | Sampled; temp. 8°C |
| Aug 1/78 | 183.73 MP | 1412.8 | |
| Aug 29/78 | 183.74 MP | 1412.7 | |
| Sept 26/78 | 183.69 MP | 1412.9 | |
| Oct 24/78 | 183.60 MP | 1413.2 | |
| Nov 21/78 | 184.08 MP | 1411.6 | |
| Dec 19/78 | 183.81 MP | 1412.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2012.54

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 183.93 MP | 1412.1 | MP (2015.4) |
| Feb 13/79 | 183.97 MP | 1412.0 | |
| Mar 15/79 | 183.89 MP | 1412.2 | |
| Apr 11/79 | 183.91 MP | 1412.2 | |
| May 8/79 | 184.02 MP | 1411.8 | |
| June 5/79 | 183.79 MP | 1412.6 | |
| July 5/79 | 183.95 MP | 1412.0 | Sampled; temp. 8.5°C |
| Aug 1/79 | 183.84 MP | 1412.4 | |
| Aug 28/79 | 183.83 MP | 1412.4 | |
| Sept 25/79 | 183.92 MP | 1412.1 | |
| Oct 23/79 | 183.87 MP | 1412.3 | |
| Nov 20/79 | 183.91 MP | 1412.2 | |
| Dec 18/79 | 183.91 MP | 1412.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2012.54

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 183.95 MP | 1412.0 | |
| Feb 12/80 | 183.97 MP | 1412.0 | |
| Mar 11/80 | 183.82 MP | 1412.5 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 184.03 MP | 1411.8 | |
| June 3/80 | 183.93 MP | 1412.1 | |
| July 2/80 | 183.90 MP | 1412.2 | Temp. 8°C |
| July 28/80 | 183.83 MP | 1412.4 | |
| Aug 26/80 | 184.08 MP | 1411.6 | |
| Sept 24/80 | 183.82 MP | 1412.5 | |
| Oct 21/80 | 183.77 MP | 1412.6 | |
| Nov 18/80 | 183.65 MP | 1413.0 | |
| Dec 17/80 | 183.81 MP | 1412.5 | |
| Jan 15/81 | 183.47 MP | 1413.6 | |
| Feb 10/81 | 184.10 MP | 1411.5 | |
| Mar 10/81 | 183.84 MP | 1412.4 | |
| Apr 7/81 | 183.68 MP | 1412.9 | |
| May 5/81 | 183.87 MP | 1412.3 | |
| June 2/81 | 183.45 MP | 1413.7 | |
| June 30/81 | 183.73 MP | 1412.8 | |
| July 28/81 | 183.78 MP | 1412.6 | |
| Aug 25/81 | 183.55 MP | 1413.4 | |
| Sept 22/81 | 183.94 MP | 1412.1 | |
| Oct 20/81 | 184.04 MP | 1411.7 | |
| Dec 15/81 | 183.96 MP | 1412.0 | |

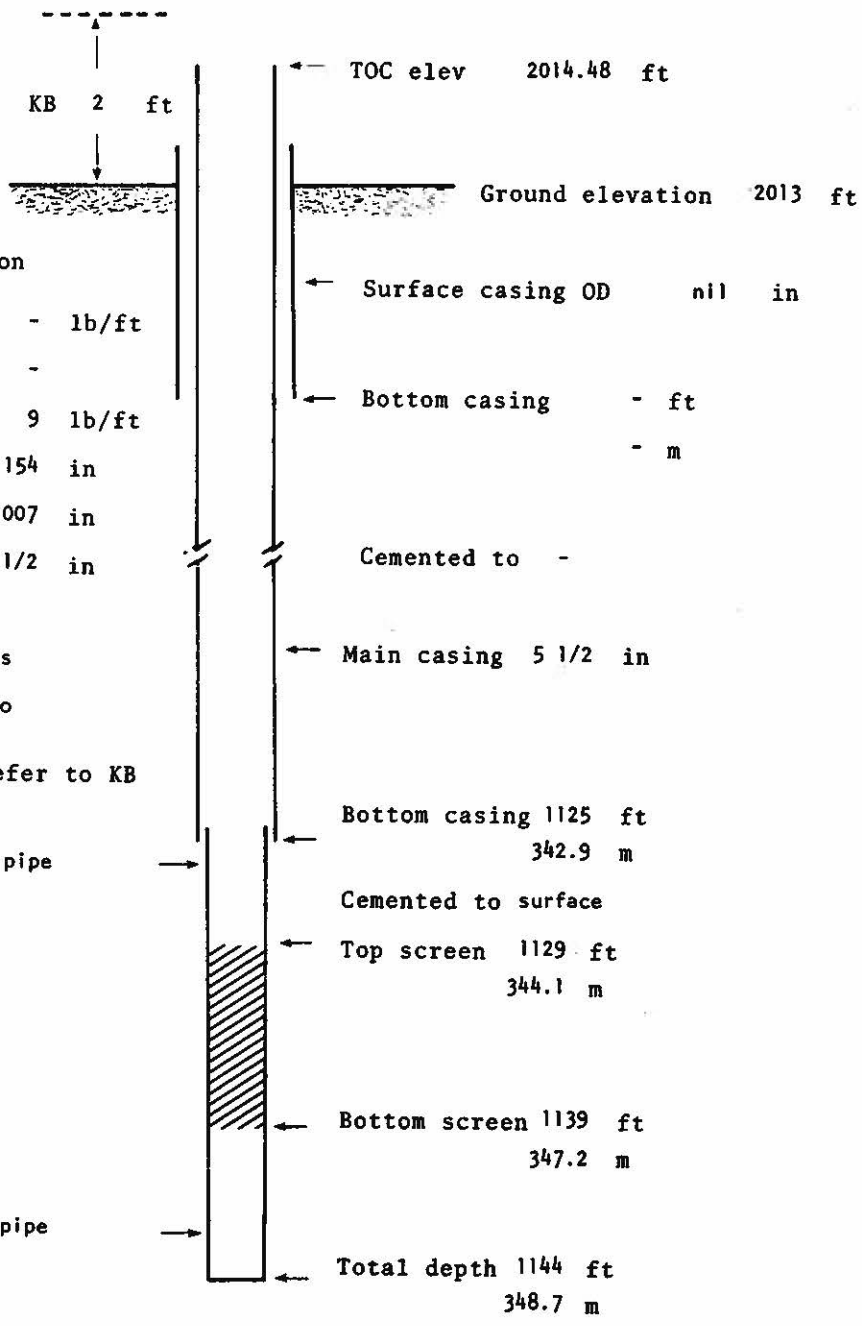
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Tp 97 R 13 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 9 | lb/ft |
| wall thickness | .154 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

## DRILL STEM TEST

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Tp 97 R 13 W4th

Alberta Research Council

Elevation: gl 2013
KB 2015

Type of test - Casing Positrieve

Date of test March 16, 1975

Testing company - Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0930 | hrs |
| Tool opened | 1048 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 30 | min |
| Pulled loose at | 1215 | hrs |
| Out of hole at | 1330 | hrs |
| Wt on packers | 5000 | lbs |
| Description of blow | Weak initial puff very weak blow decreasing to nil in 3 minutes. | |
| Total water recovered | 20 | ft |
| Water sample No. | DH 25 | |
| Gas blow | No | |
| Remarks | Test satisfactory 5-1/2"RBP @ 1095' | |

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 1129-1139

Formation tested McMurray

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

### PRESSURE DATA (psi)

| Instrument No. | | RPG-89N | RPG-92N |
|---|---|---|---|
| Capacity (psig) | | 400 | 431 |
| Instrument set at (ft) | | 1099 | 1107 |
| Initial hydrostatic | A | 143 | 145 |
| First flow | B | 9 | 7 |
| | B1 | 9 | 7 |
| Initial shut in | C | 82 | 82 |
| Second flow | D | 16 | 16 |
| | D1 | 20 | 20 |
| Final shut in | G | 56 | 56 |
| Final hydrostatic | H | 143 | 142 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

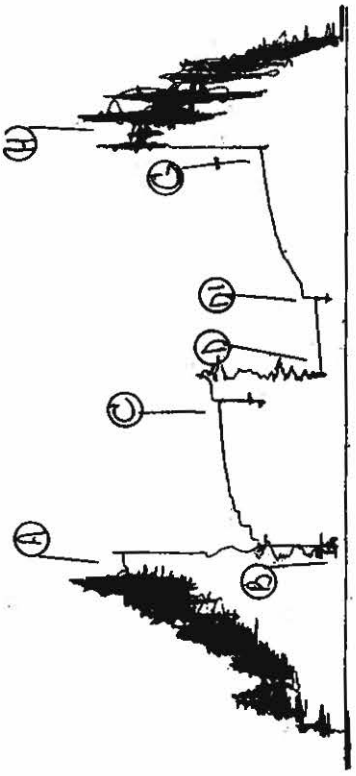
OBSERVATION WELL NUMBER 3-1144

PRESSURE INCREMENTS

Recorder RPG 92N

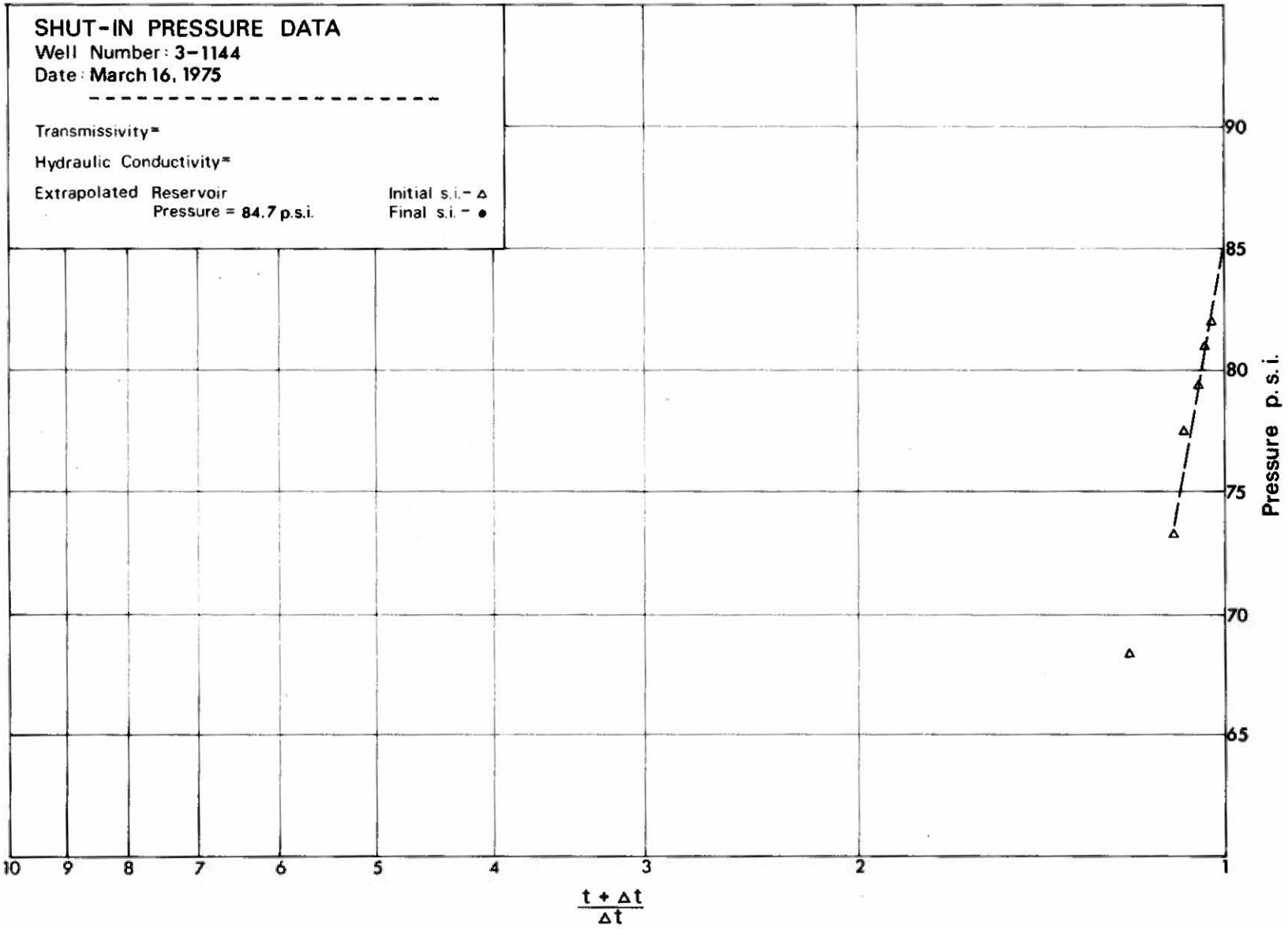
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 68.4 | 1.20 |
| 10 | 73.3 | 1.10 |
| 15 | 77.5 | 1.07 |
| 20 | 79.4 | 1.05 |
| 25 | 80.9 | 1.04 |
| 30 | 82.0 | 1.033 |

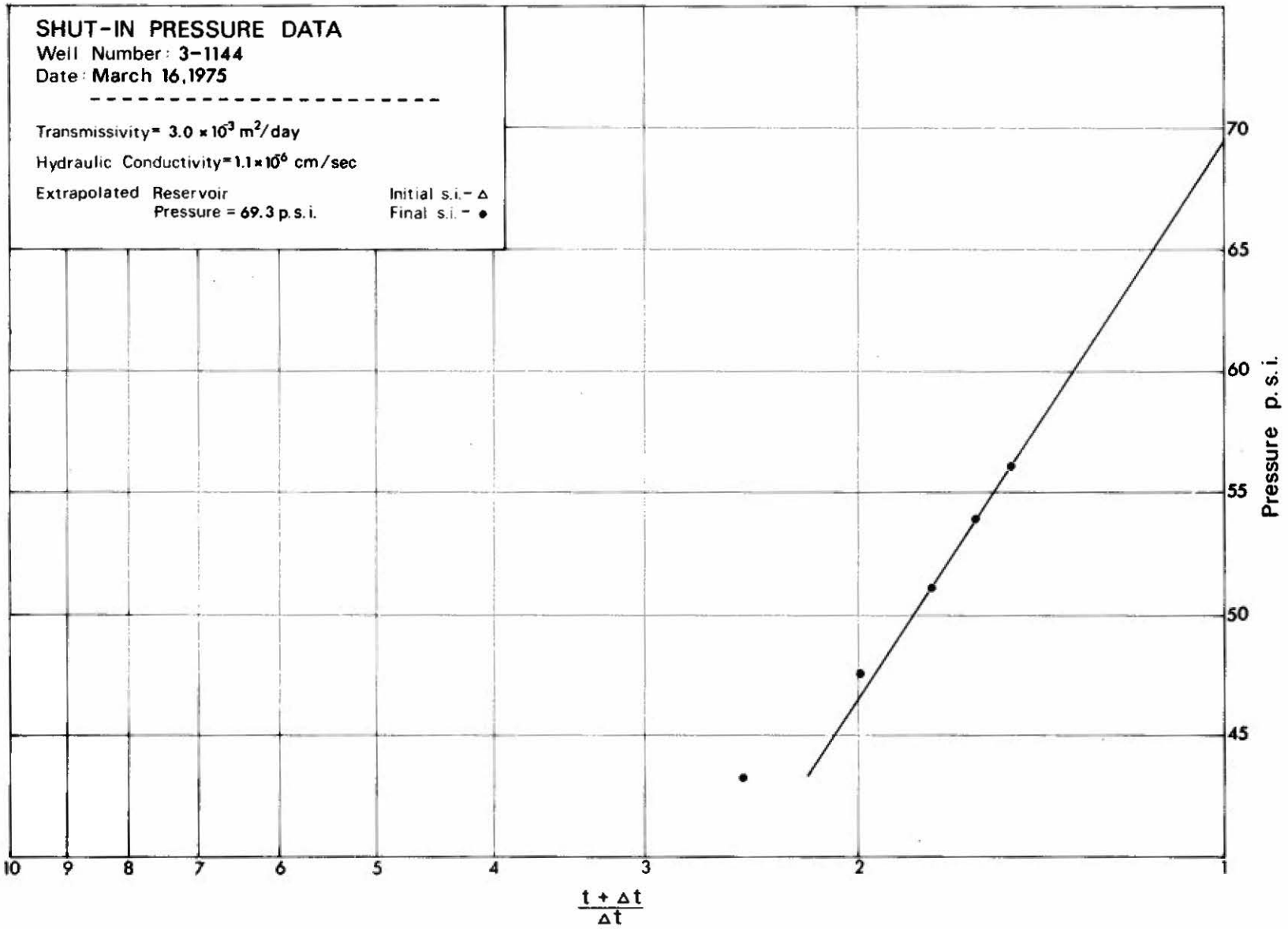


Final Shut In

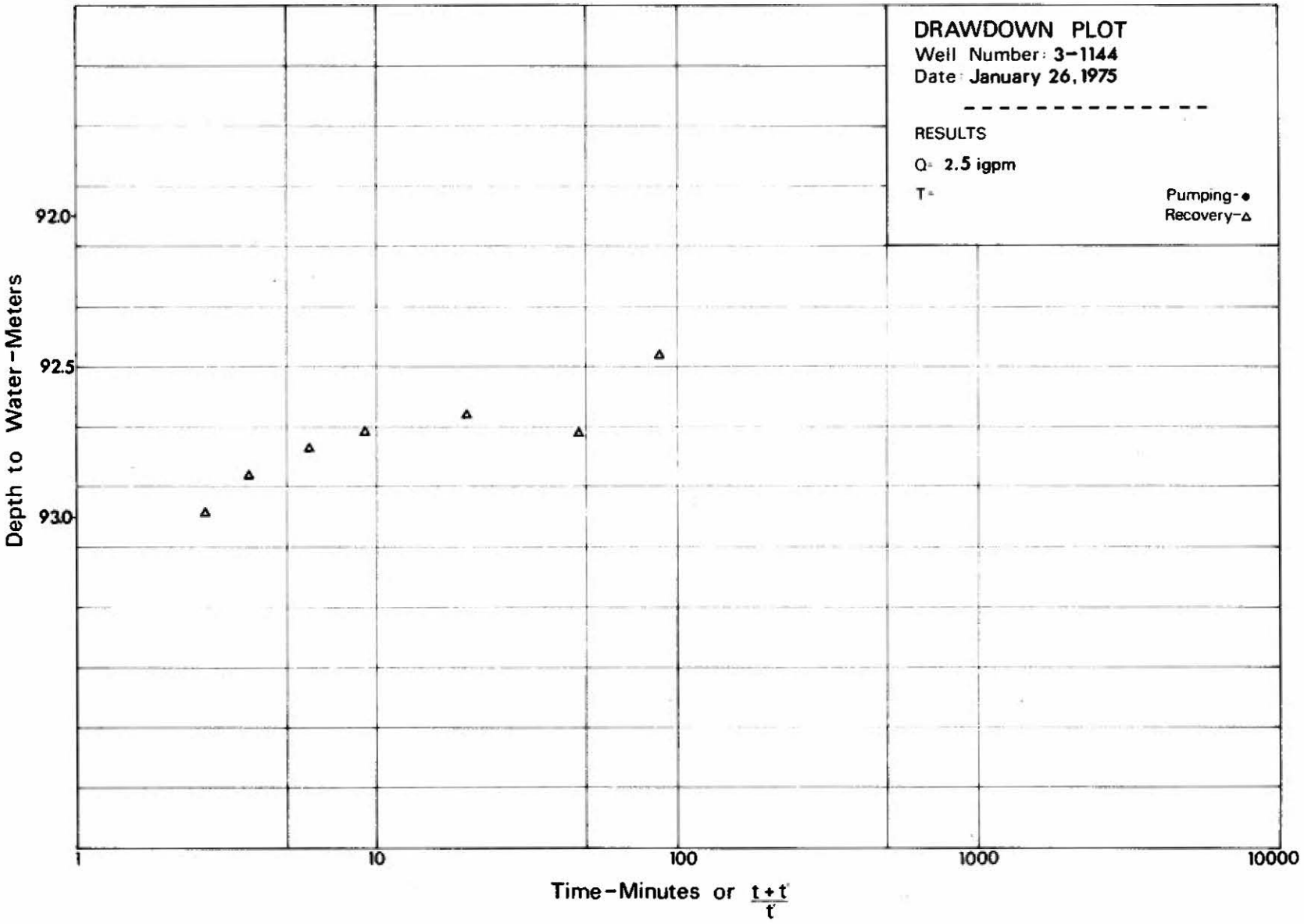
| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 34.5 | 4.00 |
| 10 | 43.2 | 2.50 |
| 15 | 47.5 | 2.00 |
| 20 | 51.0 | 1.75 |
| 25 | 53.8 | 1.60 |
| 30 | 56.0 | 1.50 |


SHUT-IN PRESSURE DATA
Well Number: 3-1144
Date: March 16, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 84.7 p.s.i.
Initial s.i.- Δ
Final s.i. - •
90
85
80
75
70
65
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

3-1144-D-76


SHUT-IN PRESSURE DATA
Well Number: 3-1144
Date: March 16,1975
Transmissivity= 3.0 × 10³ m²/day
Hydraulic Conductivity= 1.1 × 10⁶ cm/sec
Extrapolated Reservoir Pressure = 69.3 p.s.i.
Initial s.i.- △
Final s.i. - ●
70
65
60
55
50
45
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

3-1144-D-76


DRAWDOWN PLOT
Well Number: 3-1144
Date: January 26, 1975
RESULTS
Q= 2.5 igpm
T=
Pumping-●
Recovery-△
Depth to Water-Meters
92.0
92.5
93.0
1
10
100
1000
10000
Time-Minutes or $\frac{t+t'}{t'}$

3-1144-D-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed from 3-1144

Date sampled February 13, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 42.5 | 2.12 | 62.8 |
| Magnesium ($Mg^{++}$) | 8.0 | 0.66 | 19.5 |
| Sodium ($Na^{+}$) | 12.5 | 0.54 | 16.1 |
| Potassium ($K^{+}$) | 2.1 | 0.05 | 1.6 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 103.0 | 1.69 | 49.5 |
| Sulfate ($SO_4^{=}$) | 78.0 | 1.62 | 47.6 |
| Chloride ($Cl^{-}$) | 1.0 | 0.03 | 0.8 |
| Nitrate ($NO_3^{=}$) | 4.5 | 0.07 | 2.1 |
| Silica ($SiO_2$) | 3.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 220.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3.413 | Total Cations (epm) | 3.376 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 328 | Temperature (C) | 7.5 |
| pH | 8.0 | pH | 9.6 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 45.6 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 22.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | 250 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Drill Stem Test on 3-1144

Date sampled March 16, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 20.6 | 1.03 | 21.4 |
| Magnesium ($Mg^{++}$) | 2.8 | 0.23 | 4.8 |
| Sodium ($Na^{+}$) | 76.3 | 3.32 | 69.0 |
| Potassium ($K^{+}$) | 9.2 | 0.24 | 4.9 |
| Carbonate ($CO_3^{=}$) | 2.4 | 0.08 | 1.7 |
| Bicarbonate ($HCO_3^{-}$) | 93.0 | 1.52 | 32.0 |
| Sulfate ($SO_4^{=}$) | 71.0 | 1.48 | 31.0 |
| Chloride ($Cl^{-}$) | 59.0 | 1.66 | 34.9 |
| Nitrate ($NO_3^{=}$) | 1.5 | 0.02 | 0.5 |
| Silica ($SiO_2$) | 8.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 280.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4.771 | Total Cations (epm) | 4.812 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 557 | Temperature (C) | | |
| pH | 8.4 | pH | 10.3 | |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 52.8 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 | ppm |
| | | Hydroxide ($OH^{-}$) | 4.8 | ppm |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 9, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 7.9 | 0.39 | 7 |
| Magnesium ($Mg^{++}$) | 1.8 | 0.15 | 3 |
| Sodium ($Na^{+}$) | 88 | 3.83 | 70 |
| Potassium ($K^{+}$) | 44.6 | 1.14 | 21 |
| Carbonate ($CO_3^{=}$) | 12 | 0.40 | 7 |
| Bicarbonate ($HCO_3^{-}$) | 190 | 3.11 | 53 |
| Sulfate ($SO_4^{=}$) | 67 | 1.39 | 24 |
| Chloride ($Cl^{-}$) | 32 | 0.90 | 15 |
| Nitrate ($NO_3^{=}$) | 2.3 | 0.04 | 1 |
| Silica ($SiO_2$) | 1.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 13.4 | | |
| Magnesium (Acidified) | 3.5 | | |
| Total dissolved solids | 390 | | |
| Total Anions (epm) 5.84 | | Total Cations (epm) | 5.51 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 640 |
| pH | 8.6 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 9.0 |
| pH | 11.4 |
| Carbonate ($CO_3^{=}$) | 48 ppm |
| Bicarbonate ($HCO_3^{-}$) | 134 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 8.2 | 0.41 | 4 |
| Magnesium ($Mg^{++}$) | 3.8 | 0.31 | 3 |
| Sodium ($Na^{+}$) | 163.0 | 7.09 | 74 |
| Potassium ($K^{+}$) | 67.0 | 1.71 | 18 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 429.0 | 7.03 | 76 |
| Sulfate ($SO_4^{=}$) | 26.8 | 0.56 | 6 |
| Chloride ($Cl^{-}$) | 60.0 | 1.69 | 18 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 7.4 | | |
| Magnesium (Acidified) | 4.1 | | |
| Total dissolved solids | 540 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 9.30 | Total Cations (epm) | 9.53 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 950 |
| pH | 7.2 |
| Fluoride ($F^{-}$) | 0.4 Mg/L |

Field:

| | | |
|---|---|---|
| Temperature (C) | 12.0 | |
| pH | 7.3 | |
| Carbonate ($CO_3^{=}$) | 0 | Mg/L |
| Bicarbonate ($HCO_3^{-}$) | 444 | Mg/L |
| Hydroxide ($OH^{-}$) | | |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 6, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 4.4 | 0.22 | 1.9 |
| Magnesium ($Mg^{++}$) | 2.9 | 0.24 | 2.1 |
| Sodium ($Na^{+}$) | 211.0 | 9.18 | 80.3 |
| Potassium ($K^{+}$) | 70.0 | 1.79 | 15.7 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 564.0 | 9.24 | 80.2 |
| Sulfate ($SO_4^{=}$) | 6.3 | 0.13 | 1.1 |
| Chloride ($Cl^{-}$) | 76.0 | 2.14 | 18.6 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 0.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 4.2 | | |
| Magnesium (Acidified) | 2.7 | | |
| Total dissolved solids | 632.0 | | |
| Total Anions (epm) | 11.53 | Total Cations (epm) | 11.43 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1170 | Temperature (C) | 12.0 |
| pH | 7.3 | pH | 7.0 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 566.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Date sampled: July 14, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .125 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 159 |
| As | <.038 | Ni | <.010 |
| B | .227 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 9.08 | Si | 0.95 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 0.17 |
| Cr | <.006 | Te | <.065 |
| Cu | .012 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 0.53 | V | <.0008 |
| K | 66 | W | <.078 |
| Mg | 4.56 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

3-1144-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 06, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 6.3 | 0.31 | 2.5 |
| Magnesium(Mg) | 4.0 | 0.33 | 2.6 |
| Sodium(Na) | 229.0 | 9.96 | 80.0 |
| Potassium(K) | 72.0 | 1.84 | 14.8 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 644.0 | 10.56 | 76.8 |
| Sulphate(SO4) | 29.0 | 0.60 | 4.4 |
| Chloride(Cl) | 90.0 | 2.54 | 18.5 |
| Nitrate(NO3) | 2.6 | 0.04 | 0.3 |
| Silica(SiO2) | 5.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 3.1 | | |
| Magnesium(Acidified) | 3.6 | | |
| TDS(mg/l) | 752.0 | | |
| Total Anions(epm) | 13.74 | Total Cations(epm) | 12.45 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1200 | | Temperature(C) | 13.00 | |
| pH | 7.0 | | pH | 6.7 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 707 | mg/l |
| | | | Hydroxide(OH) | | |

3-1144-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3.4 | 0.17 | 1.3 |
| Magnesium(Mg) | 3.5 | 0.29 | 2.2 |
| Sodium(Na) | 255.0 | 11.09 | 83.0 |
| Potassium(K) | 71.0 | 1.82 | 13.6 |
| Carbonate(CO3) | 21.6 | 0.72 | 5.0 |
| Bicarbonate(HCO3) | 634.0 | 10.39 | 72.9 |
| Sulphate(SO4) | 7.7 | 0.16 | 1.1 |
| Chloride(Cl) | 106.0 | 2.99 | 21.0 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 5.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 2.8 | | |
| Magnesium(Acidified) | 3.3 | | |
| TDS(mg/l) | 760.0 | | |
| Total Anions(epm) | 14.26 | Total Cations(epm) | 13.37 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1190 | Temperature(C) | 12.50 | |
| pH | 8.7 | pH | 7.0 | |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 698 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 3-1144-E-82

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 4.1 | 0.20 | 1.2 |
| Magnesium(Mg) | 4.9 | 0.41 | 2.5 |
| Sodium(Na) | 326.0 | 14.17 | 85.2 |
| Potassium(K) | 72.0 | 1.85 | 11.1 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 717.0 | 11.75 | 69.3 |
| Sulphate(SO4) | 6.0 | 0.13 | 0.7 |
| Chloride(Cl) | 180.0 | 5.07 | 29.9 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 5.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 4.3 | | |
| Magnesium(Acidified) | 4.2 | | |
| TDS(mg/l) | 994.0 | | |
| Total Anions(epm) | 16.95 | Total Cations(epm) | 16.63 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1670 |
| pH | 8.2 |
| Fluoride | 0.0 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 13.00 | |
| pH | 7.0 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 756 | mg/l |
| Hydroxide(OH) | | |

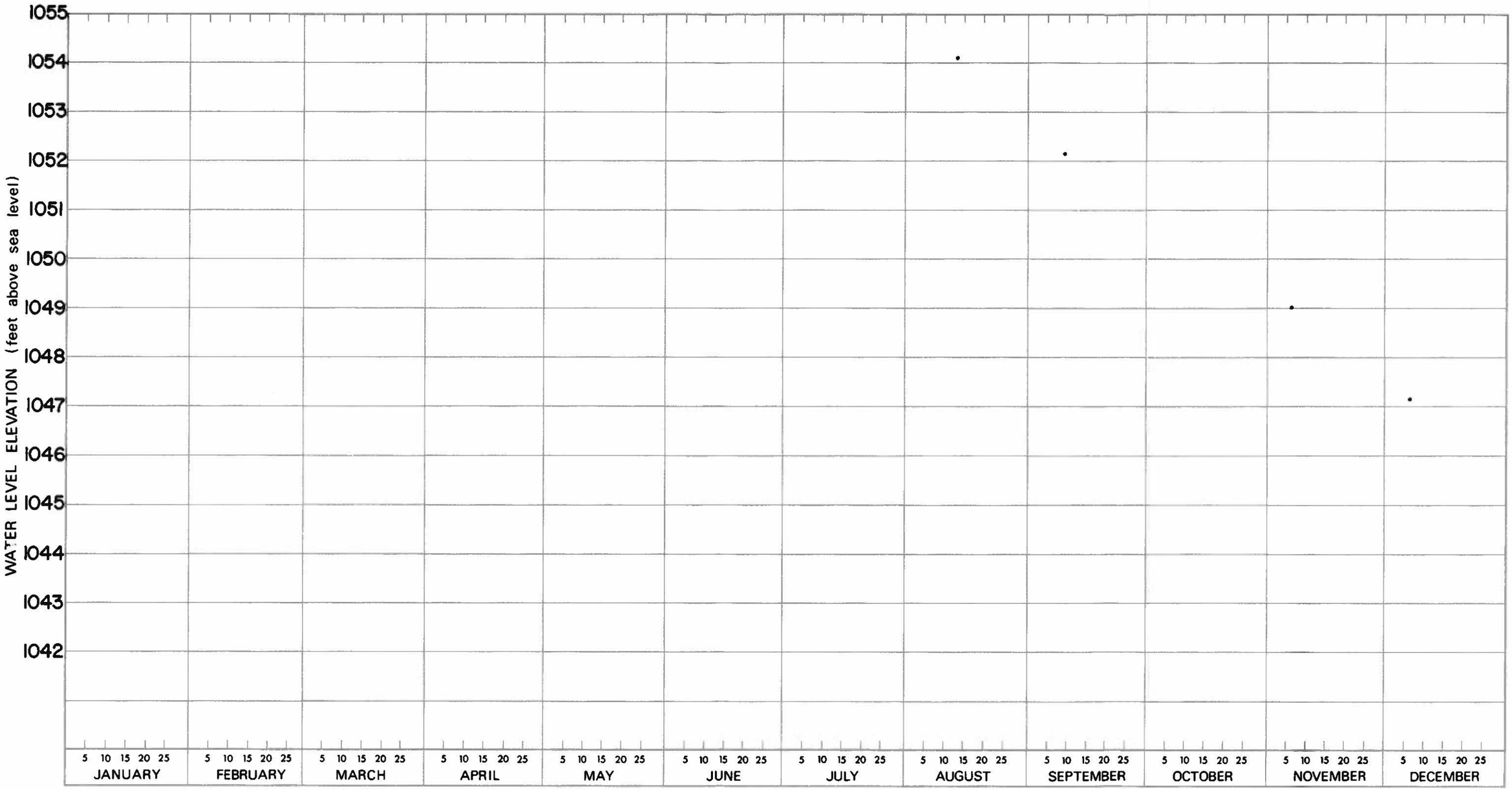
**WATER LEVEL HYDROGRAPH**

3-1144-H-76

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council



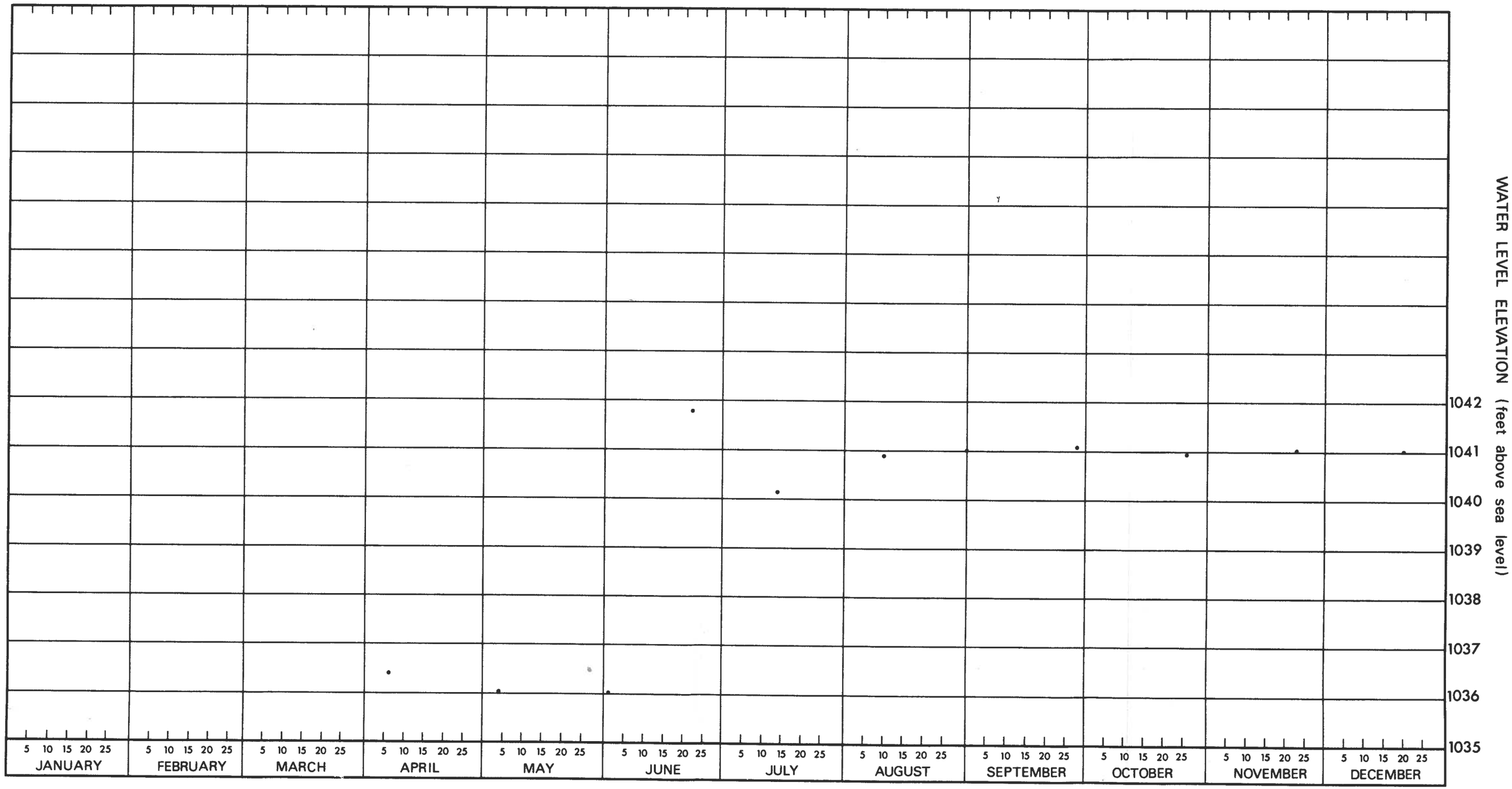
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

3 - 1144 - H - 77




1976

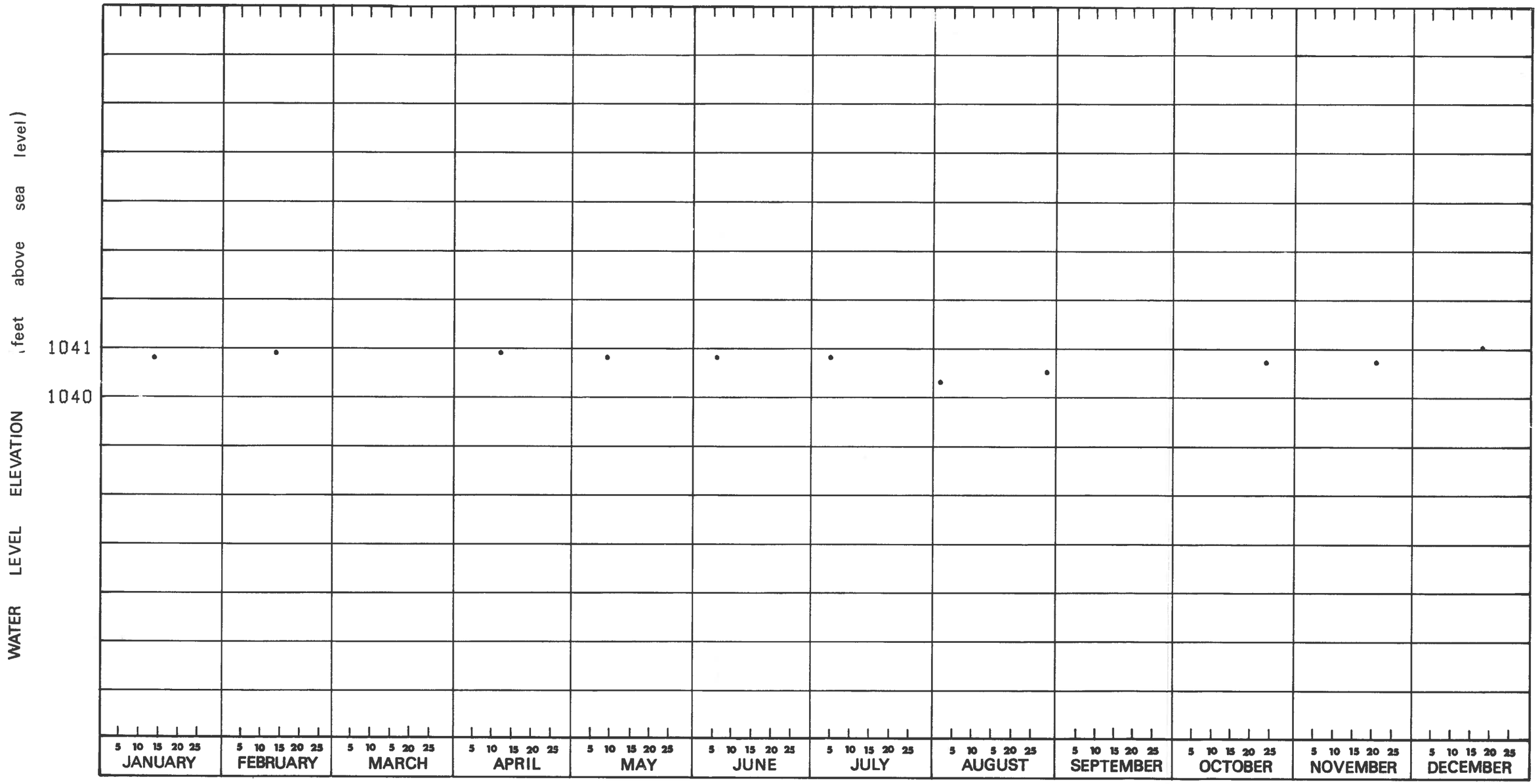
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-1144-H-78



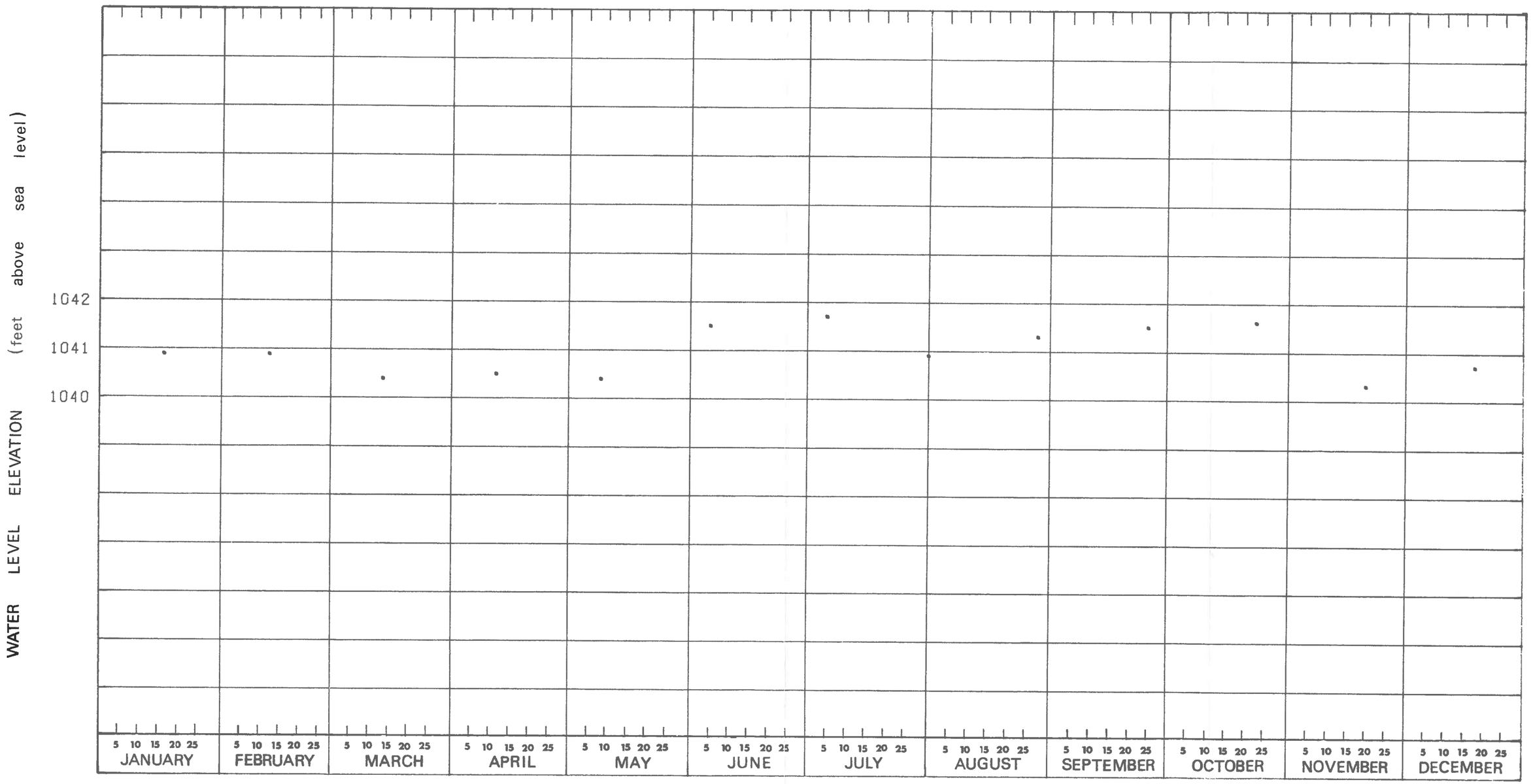
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-1144

LSD 9 SEC 26 TWP 97 R 13 W4TH

3-1144-H-79

Alberta Research Council



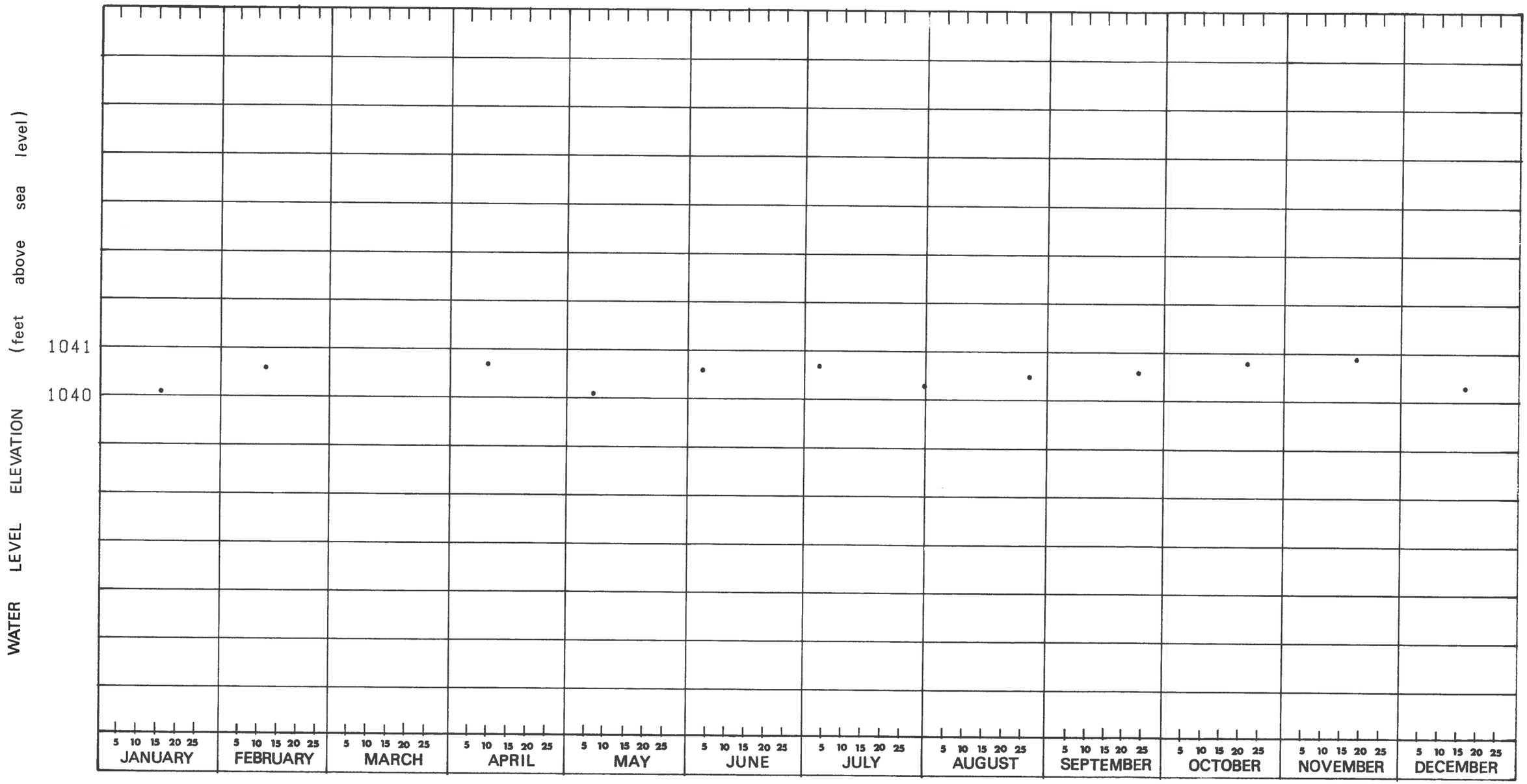
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-1144-H-80




1979

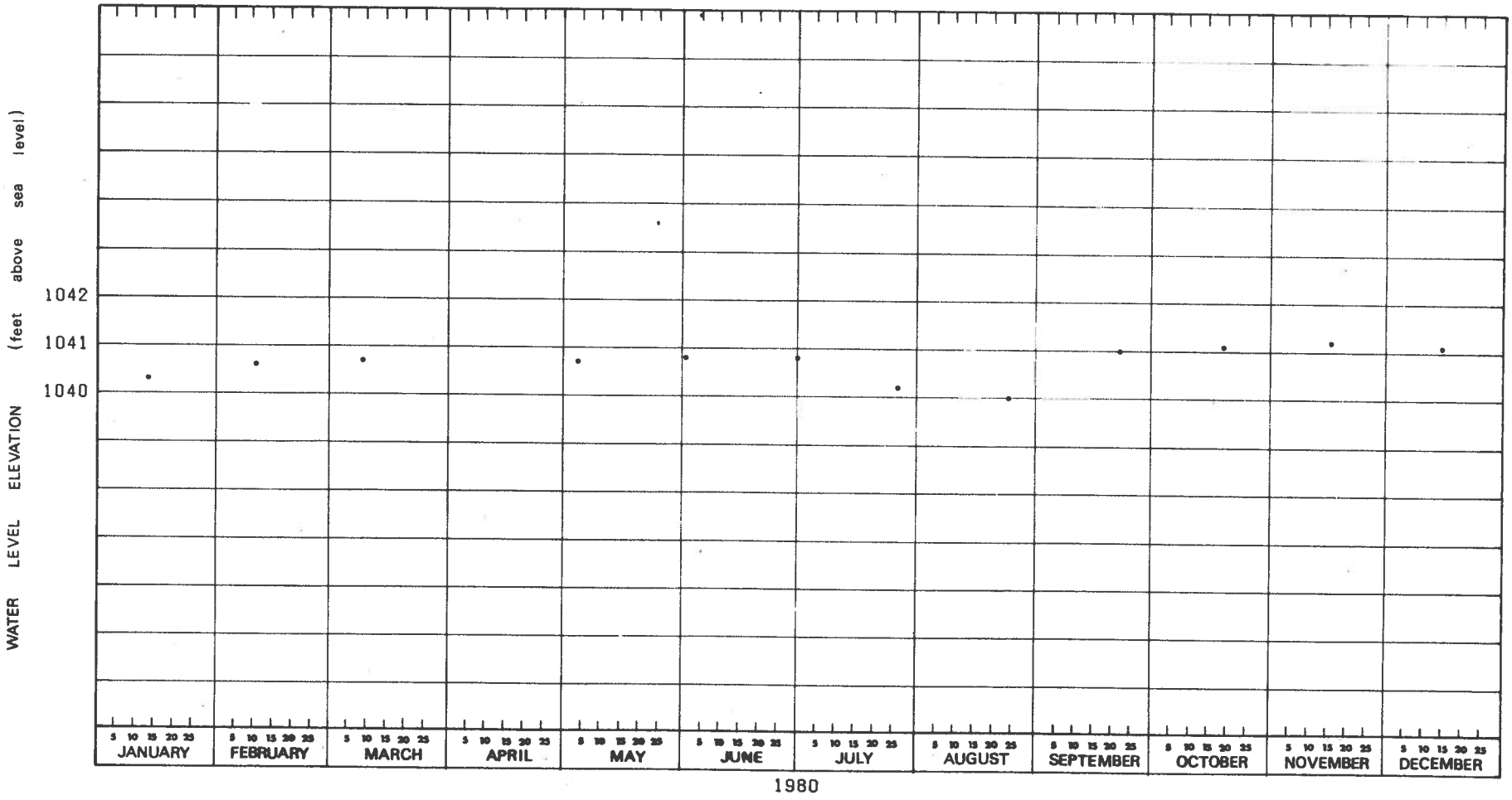
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-1144-H-81



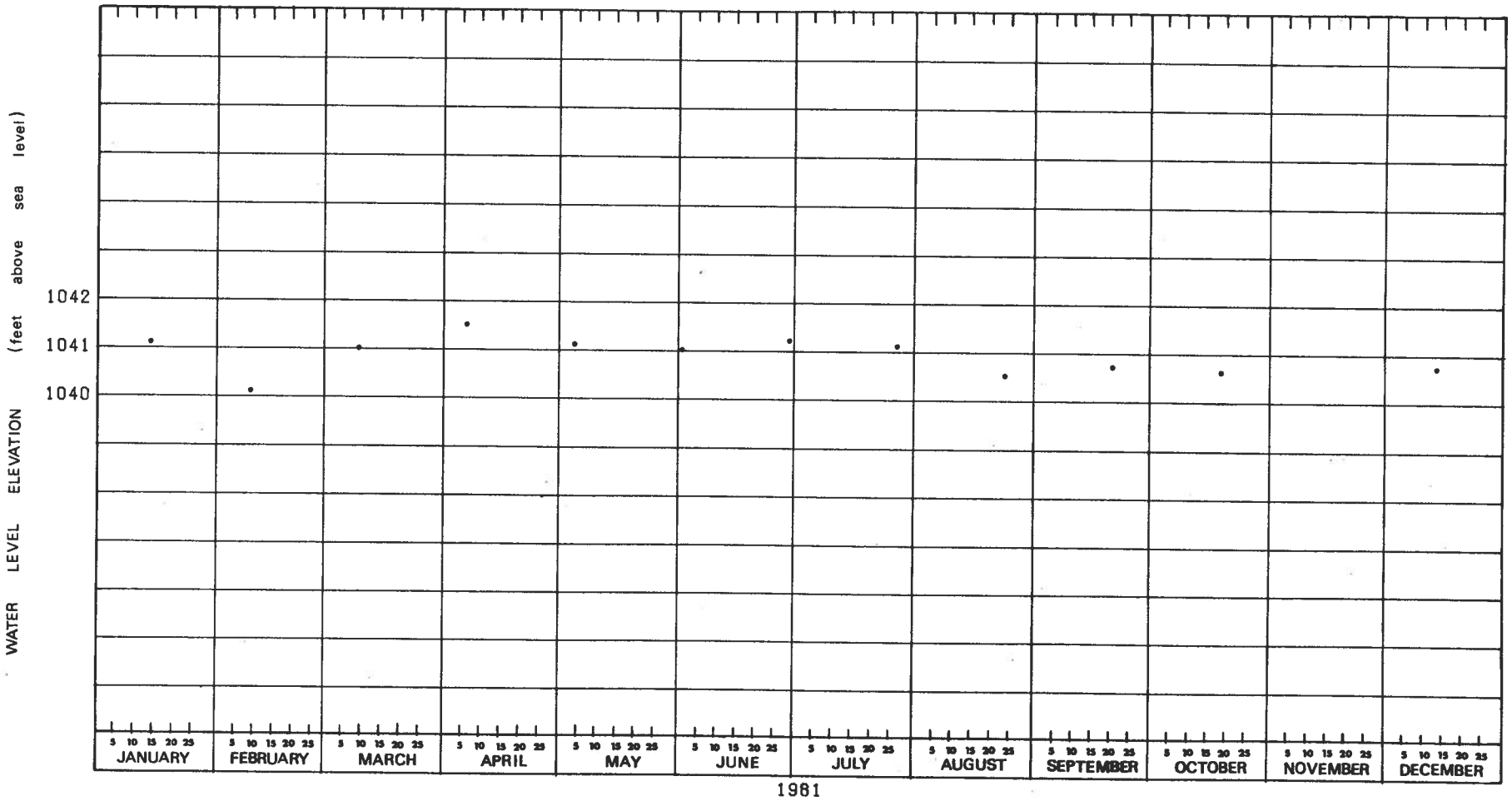
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-1144-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.48

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 25/75 | | | Well completed |
| Jan 26/75 | 40.50 TOC | 1881.61 | Bail 180 gallons |
| | 93.08 TOC | 1709.11 | |
| Feb 12/75 | 169.75 TOC | 1457.57 | Bail 98 gallons; water sample |
| Mar 16/75 | | | DST; water sample; FSI = 85# from 1099' |
| Mar 18/75 | | | Reinstall shelter |
| May 12/75 | | | Too deep to measure; New MP = 33" TOC, (2017.23) |
| June 10/75 | | | Too deep to measure |
| July 10/75 | 292.36 MP | 1058.28 | |
| Aug 13/75 | 293.64 MP | 1054.09 | |
| Sept 9/75 | 294.24 MP | 1052.12 | Sampled well; temp. 9°C |
| Oct 7/75 | 296.90 MP | 1043.39 | |
| Nov 6/75 | 295.19 MP | 1049.01 | |
| Dec 6/75 | 295.75 MP | 1047.17 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.48

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | | | MP (2017.2) Could not measure |
| Feb 6/76 | 294.96 MP | 1049.7 | |
| Mar 6/76 | 307.97 MP | 1007.1 | Questionable measurement |
| Apr 6/76 | 299.03 MP | 1036.4 | |
| May 4/76 | 299.15 MP | 1036.0 | |
| June 1/76 | 299.15 MP | 1036.0 | |
| June 22/76 | 297.39 MP | 1041.8 | |
| July 14/76 | 297.90 MP | 1040.1 | Sampled; temp. 12°C |
| Aug 10/76 | 297.67 MP | 1040.8 | |
| Aug 31/76 | 297.63 MP | 1041.0 | |
| Sept 28/76 | 297.62 MP | 1041.0 | |
| Oct 26/76 | 297.64 MP | 1040.9 | |
| Nov 23/76 | 297.63 MP | 1041.0 | |
| Dec 20/76 | 297.63 MP | 1041.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.48

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 297.67 MP | 1040.8 | MP (2017.2) |
| Feb 15/77 | 297.66 MP | 1040.9 | |
| Mar 15/77 | | | >200 m |
| Apr 13/77 | 297.65 MP | 1040.9 | |
| May 10/77 | 297.67 MP | 1040.8 | |
| June 7/77 | 297.68 MP | 1040.8 | |
| July 6/77 | 297.69 MP | 1040.8 | Sampled; temp. 12°C |
| Aug 3/77 | 297.84 MP | 1040.3 | |
| Aug 30/77 | 297.78 MP | 1040.5 | |
| Sept 27/77 | | | Could not measure |
| Oct 25/77 | 297.72 MP | 1040.7 | |
| Nov 22/77 | 297.71 MP | 1040.7 | |
| Dec 19/77 | 297.61 MP | 1041.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.48

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 297.66 MP | 1040.9 | MP (2017.2) |
| Feb 13/78 | 297.65 MP | 1040.9 | |
| Mar 14/78 | 297.81 MP | 1040.4 | |
| Apr 12/78 | 297.78 MP | 1040.5 | |
| May 9/78 | 297.80 MP | 1040.4 | |
| June 6/78 | 297.46 MP | 1041.5 | |
| July 6/78 | 297.41 MP | 1041.7 | Sampled; temp. 13°C |
| Aug 1/78 | 297.64 MP | 1040.9 | |
| Aug 29/78 | 297.53 MP | 1041.3 | |
| Sept 26/78 | 297.47 MP | 1041.5 | |
| Oct 24/78 | 297.44 MP | 1041.6 | |
| Nov 21/78 | 297.83 MP | 1040.3 | |
| Dec 19/78 | 297.70 MP | 1040.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.48

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 297.88 MP | 1040.1 | MP (2017.2) |
| Feb 13/79 | 297.75 MP | 1040.6 | |
| Mar 15/79 | | | Could not measure |
| Apr 11/79 | 297.72 MP | 1040.7 | |
| May 8/79 | 297.90 MP | 1040.1 | |
| June 5/79 | 297.74 MP | 1040.6 | |
| July 5/79 | 297.71 MP | 1040.7 | Sampled; temp. 12.5°C |
| Aug 1/79 | 297.82 MP | 1040.3 | |
| Aug 28/79 | 297.77 MP | 1040.5 | |
| Sept 25/79 | 297.73 MP | 1040.6 | |
| Oct 23/79 | 297.69 MP | 1040.8 | |
| Nov 20/79 | 297.66 MP | 1040.9 | |
| Dec 18/79 | 297.83 MP | 1040.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

3-1144-W-82

WELL HISTORY

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.48

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 297.82 MP | 1040.3 | |
| Feb 12/80 | 297.75 MP | 1040.6 | |
| Mar 11/80 | 297.70 MP | 1040.7 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 297.72 MP | 1040.7 | |
| June 3/80 | 297.69 MP | 1040.8 | |
| July 2/80 | 297.69 MP | 1040.8 | Temp. 13°C |
| July 28/80 | 297.87 MP | 1040.2 | |
| Aug 26/80 | 297.92 MP | 1040.0 | |
| Sept 24/80 | 297.62 MP | 1041.0 | |
| Oct 21/80 | 297.58 MP | 1041.1 | |
| Nov 18/80 | 297.57 MP | 1041.2 | |
| Dec 17/80 | 297.58 MP | 1041.1 | |
| Jan 15/81 | 297.60 MP | 1041.1 | |
| Feb 10/81 | 297.91 MP | 1040.1 | |
| Mar 10/81 | 297.61 MP | 1041.0 | |
| Apr 7/81 | 297.47 MP | 1041.5 | |
| May 5/81 | 297.60 MP | 1041.1 | |
| June 2/81 | 297.62 MP | 1041.0 | |
| June 30/81 | 297.57 MP | 1041.2 | |
| July 28/81 | 297.58 MP | 1041.1 | |
| Aug 25/81 | 296.95 MP | 1040.5 | |
| Sept 22/81 | 297.70 MP | 1040.7 | |
| Oct 20/81 | 297.73 MP | 1040.6 | |
| Dec 15/81 | 297.72 MP | 1040.7 | |

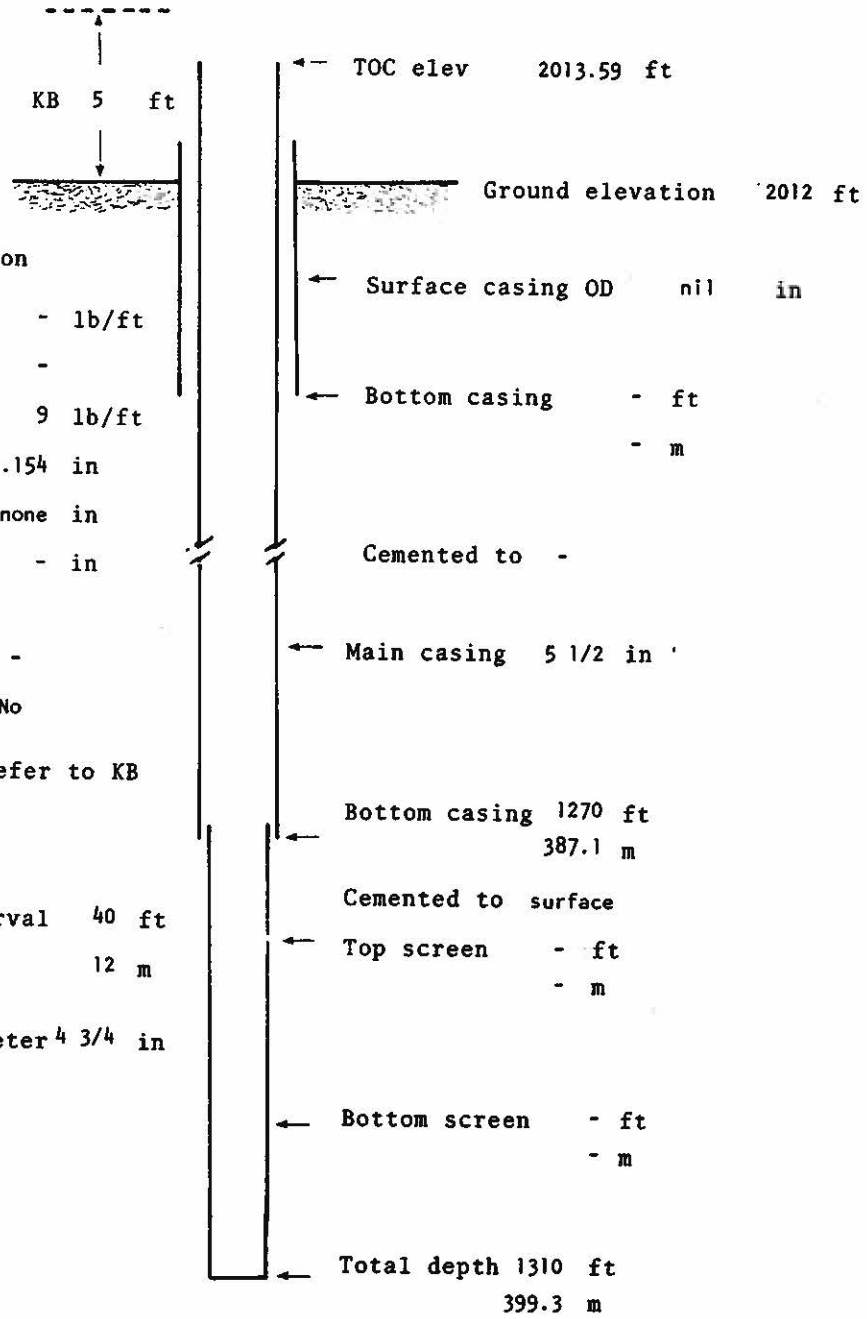
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Tp 97 R 13 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 9 | lb/ft |
| wall thickness | .154 | in |
| Screen slot width | none | in |
| screen OD | - | in |
| slots per foot | | |
| material | - | |
| Sand pack | No | |

Note: all depths refer to KB

Open hole interval 40 ft
12 m

Open hole diameter 4 3/4 in

## DRILL STEM TEST

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Tp 97 R 13 W4th

Alberta Research Council

Elevation: gl 2012
KB 2014

Type of test - Casing Positrieve

Date of test March 15, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1230 | hrs |
| Tool opened | 1437 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 30 | min |
| Pulled loose at | 1620 | hrs |
| Out of hole at | 1815 | hrs |
| Wt on packers | 5000 | lbs |

Description of blow Very weak initial puff, blow decreasing to nil in two minutes.

Total water recovered 200 ft

Water sample No. DH 27

Gas blow No

Remarks Test satisfactory
5-1/2" RBP @ 1259'

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 1270-1310

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Total Interval | 11.20 | |

### PRESSURE DATA (psi)

| | | |
|---|---|---|
| Instrument No. | | RPG-89N |
| Capacity (psig) | | 400 |
| Instrument set at (ft) | | 1263 |
| Initial hydrostatic | A | Unreadable |
| First flow | B | 66 |
| | B1 | 68 |
| Initial shut in | C | 184 |
| Second flow | D | 93 |
| | D1 | 95 |
| Final shut in | G | 112 |
| Final hydrostatic | H | 305 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

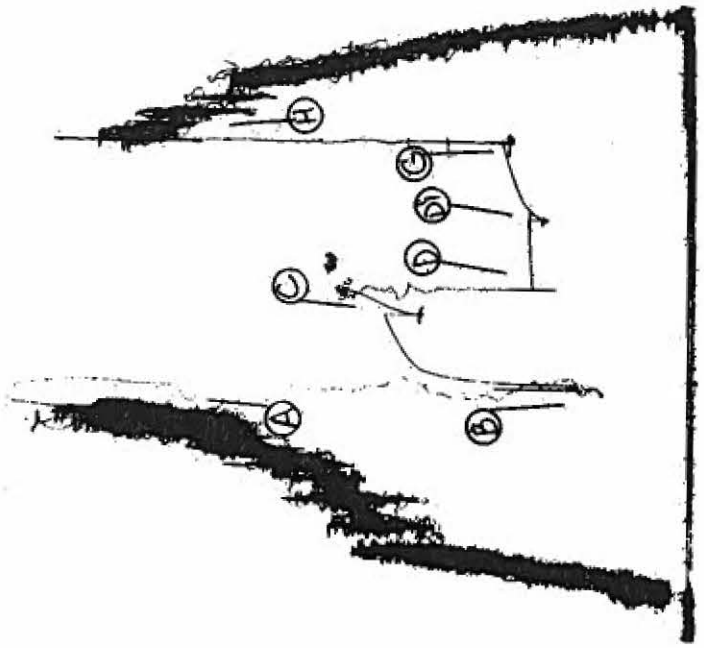
OBSERVATION WELL NUMBER 3-1310

PRESSURE INCREMENTS

Recorded RPG 89N

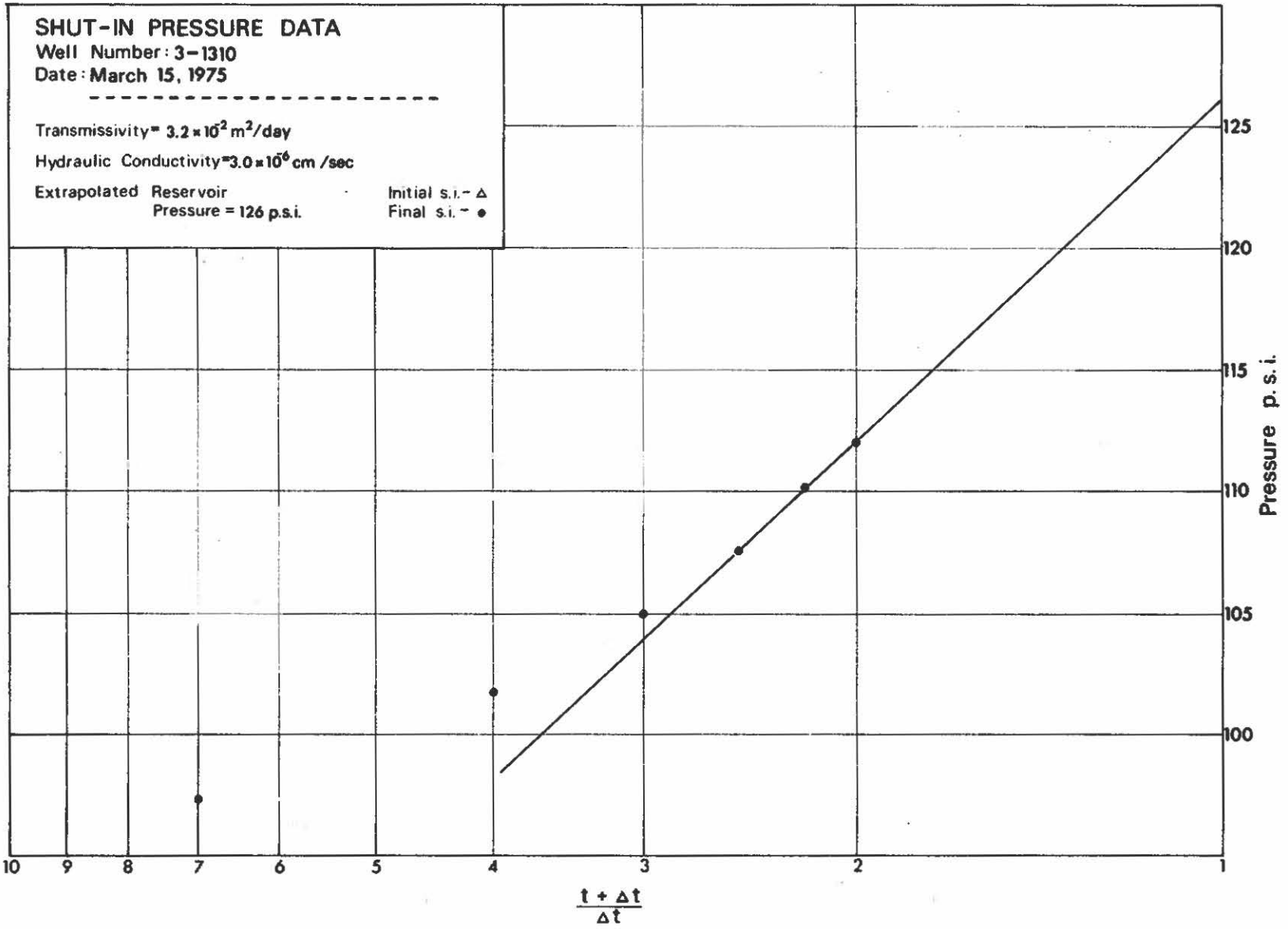
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 153.8 | 1.20 |
| 10 | 167.5 | 1.10 |
| 15 | 173.0 | 1.07 |
| 20 | 177.2 | 1.05 |
| 25 | 180.9 | 1.04 |
| 30 | 184.0 | 1.033 |

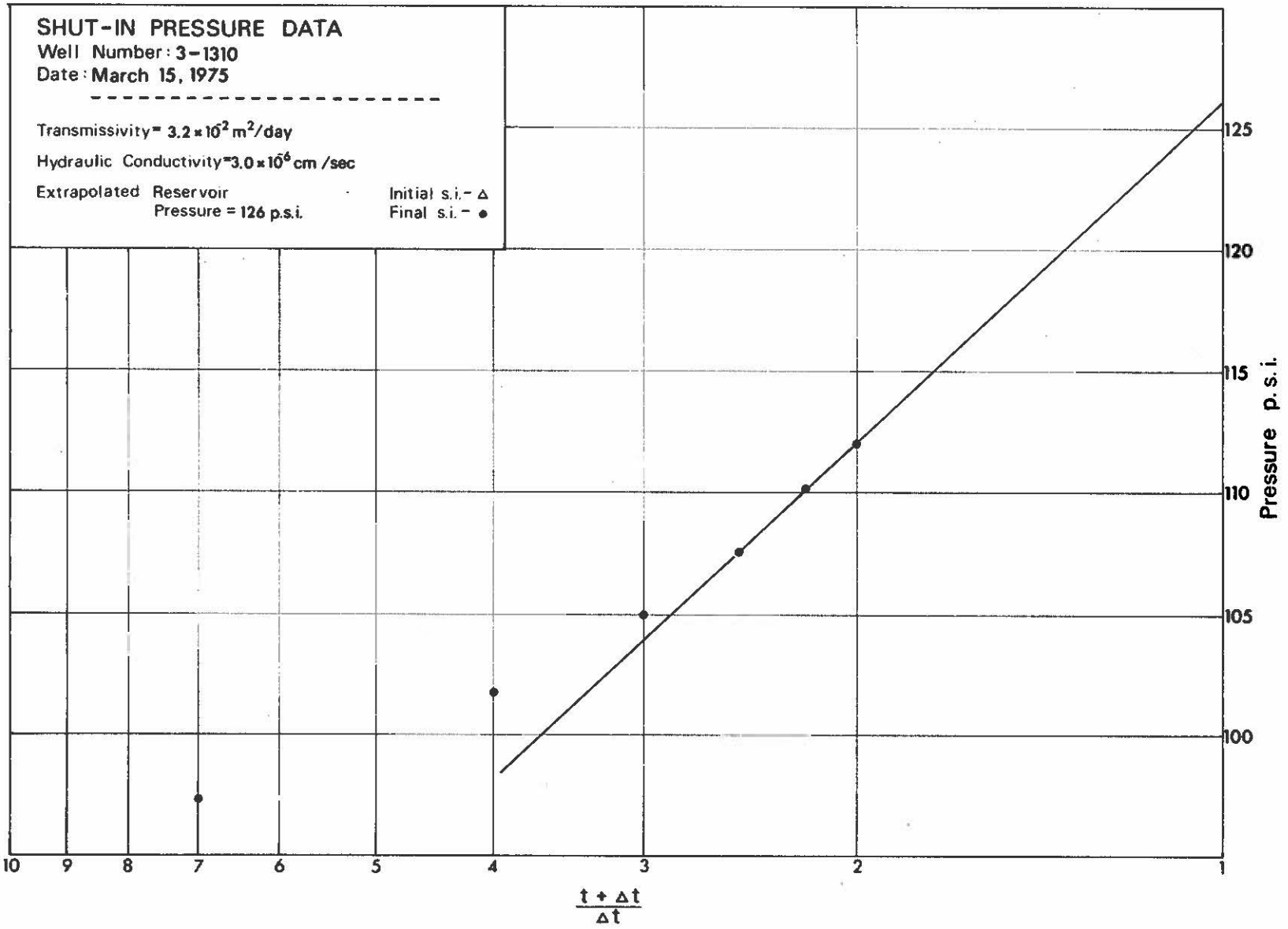


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 97.3 | 7.00 |
| 10 | 101.7 | 4.00 |
| 15 | 104.9 | 3.00 |
| 20 | 107.6 | 2.50 |
| 25 | 110.2 | 2.20 |
| 30 | 112.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 3-1310
Date: March 15, 1975
Transmissivity = 3.2 × 10⁻² m²/day
Hydraulic Conductivity = 3.0 × 10⁻⁶ cm /sec
Extrapolated Reservoir Pressure = 126 p.s.i.
Initial s.i. - Δ
Final s.i. - ●
125
120
115
110
105
100
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

3-1310-D-76


SHUT-IN PRESSURE DATA
Well Number: 3-1310
Date: March 15, 1975
Transmissivity = 3.2 × 10² m²/day
Hydraulic Conductivity = 3.0 × 10⁶ cm /sec
Extrapolated Reservoir Pressure = 126 p.s.i.
Initial s.i. - Δ
Final s.i. - ●
125
120
115
110
105
100
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

3-1310-D-76

**WATER ANALYSIS**

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed from 3-1310

Date sampled February 13, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 25.8 | 1.29 | 59.7 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.02 | 1.1 |
| Sodium ($Na^{+}$) | 17.5 | 0.76 | 35.3 |
| Potassium ($K^{+}$) | 3.3 | 0.08 | 3.9 |
| Carbonate ($CO_3^{=}$) | 28.8 | 0.96 | 32.0 |
| Bicarbonate ($HCO_3^{-}$) | 26.8 | 0.44 | 14.7 |
| Sulfate ($SO_4^{=}$) | 69.0 | 1.44 | 47.9 |
| Chloride ($Cl^{-}$) | 5.0 | 0.14 | 4.7 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0.6 |
| Silica ($SiO_2$) | 14.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 364.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 2.996 | Total Cations (epm) | 2.158 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 290 | Temperature (C) | 7.5 |
| pH | 9.9 | pH | 11.5 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | 14 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| | | Hydroxide ($OH^{-}$) | 35.4 ppm |
| | | Conductivity | 650 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Drill stem test on 3-1310

Date sampled March 15, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 4.0 | 0.20 | 1.3 |
| Magnesium ($Mg^{++}$) | 0.2 | 0.02 | 0.1 |
| Sodium ($Na^{+}$) | 340.0 | 14.79 | 96.6 |
| Potassium ($K^{+}$) | 12.1 | 0.31 | 2.0 |
| Carbonate ($CO_3^{=}$) | 144.0 | 4.80 | 5.6 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 79.0 | 1.64 | 1.9 |
| Chloride ($Cl^{-}$) | 283.0 | 7.98 | 9.3 |
| Nitrate ($NO_3^{=}$) | 2.5 | 0.04 | 0.0 |
| Silica ($SiO_2$) | 14.5 | | |
| Hydroxide ($OH^{-}$) | 1212.0 | 71.25 | 83.1 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 918.0 | | |
| Total Anions (epm) | 85.718 | Total Cations (epm) | 15.315 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1800 |
| pH | 10.9 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 10.6 |
| Carbonate ($CO_3^{=}$) | 96.0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| Hydroxide ($OH^{-}$) | 6.8 ppm |
| Conductivity | 950 |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Drill stem test on well 3-1310

Date of sampling March 15, 1975

Total dissolved solids 918 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | 0.1 | Mg | .005 |
| As | <.01 | Mn | .002 |
| B | .02 | Mo | ND |
| Ba | .005 | Ni | .03 |
| Be | ND | Pb | .04 |
| Bi | ND | Sb | ND |
| Ca | M | Si | M |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .008 | V | .01 |
| Fe | M | Zn | M |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 9, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 34 | 1.70 | 8 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 441 | 19.18 | 91 |
| Potassium ($K^{+}$) | 9.6 | 0.25 | 1 |
| Carbonate ($CO_3^{=}$) | 43.2 | 1.44 | 7 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 74 | 1.54 | 7 |
| Chloride ($Cl^{-}$) | 566 | 15.96 | 74 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 12.5 | | |
| Hydroxide ($OH^{-}$) | 44.6 | 2.60 | 12 |
| Calcium (Acidified) | 42 | | |
| Magnesium (Acidified) | 0.6 | | |
| Total dissolved solids | 1244 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 21.54 | Total Cations (epm) | 21.13 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 3000 |
| pH | 10.9 |
| Fluoride ($F^{-}$) | 2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 8.0 |
| pH | 11.4 |
| Carbonate ($CO_3^{=}$) | 72 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| Hydroxide ($OH^{-}$) | 34 ppm |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 54.0 | 2.69 | 29 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 149.0 | 6.48 | 69 |
| Potassium ($K^{+}$) | 9.6 | 0.25 | 3 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 9 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | |
| Sulfate ($SO_4^{=}$) | 74.0 | 1.54 | 16 |
| Chloride ($Cl^{-}$) | 156.0 | 4.40 | 47 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 5.7 | | |
| Hydroxide ($OH^{-}$) | 44.9 | 2.64 | 28 |
| Calcium (Acidified) | 70.4 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 568 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 9.39 | Total Cations (epm) | 9.42 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1330 | Temperature (C) | 10.0 | |
| pH | 11.0 | pH | | |
| Fluoride ($F^{-}$) | 0.4 Mg/L | Carbonate ($CO_3^{=}$) | 19 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 58 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 6, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 45.0 | 2.25 | 18.8 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0.0 |
| Sodium ($Na^{+}$) | 218.0 | 9.48 | 79.3 |
| Potassium ($K^{+}$) | 9.2 | 0.24 | 2.0 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 6.8 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 67.0 | 1.39 | 11.9 |
| Chloride ($Cl^{-}$) | 262.0 | 7.39 | 62.8 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 2.1 | | |
| Hydroxide ($OH^{-}$) | 37.0 | 2.18 | 18.5 |
| Calcium (Acidified) | 51.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 700.0 | | |
| Total Anions (epm) | 11.76 | Total Cations (epm) | 11.96 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1650 |
| pH | 11.3 |
| Fluoride ($F^{-}$) | 0.7 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 15.0 |
| pH | 11.5 |
| Carbonate ($CO_3^{=}$) | 19.0 ppm |
| Bicarbonate ($HCO_3^{-}$) | |
| Hydroxide ($OH^{-}$) | 45.0 ppm |
| Conductivity | |

3-1310-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 06, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 34.0 | 1.70 | 11.9 |
| Magnesium(Mg) | 0.0 | 0.00 | 0.0 |
| Sodium(Na) | 284.0 | 12.35 | 86.4 |
| Potassium(K) | 10.0 | 0.26 | 1.8 |
| Carbonate(CO3) | 16.8 | 0.56 | 4.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 25.5 | 0.53 | 3.8 |
| Chloride(Cl) | 378.0 | 10.66 | 76.1 |
| Nitrate(NO3) | 1.4 | 0.02 | 0.2 |
| Silica(SiO2) | 7.3 | | |
| Hydroxide(OH) | 38.1 | 2.24 | 16.0 |
| Calcium(Acidified) | 22.0 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 928.0 | | |
| Total Anions(epm) | 14.01 | Total Cations(epm) | 14.31 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1700 | | Temperature(C) | 14.50 | |
| pH | 11.2 | | pH | 11.4 | |
| Fluoride(F) | 0.6 | mg/l | Carbonate(CO3) | 34 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 37 | mg/l |

3-1310-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 28.0 | 1.40 | 12.1 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.1 |
| Sodium(Na) | 228.0 | 9.92 | 86.0 |
| Potassium(K) | 8.3 | 0.21 | 1.8 |
| Carbonate(CO3) | 21.6 | 0.72 | 5.7 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 76.0 | 1.58 | 12.5 |
| Chloride(Cl) | 300.0 | 8.46 | 66.6 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 11.0 | | |
| Hydroxide(OH) | 33.0 | 1.94 | 15.3 |
| Calcium(Acidified) | 47.0 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 674.0 | | |
| Total Anions(epm) | 12.70 | Total Cations(epm) | 11.54 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1370 | Temperature(C) | 14.50 | |
| pH | 11.2 | pH | 11.4 | |
| Fluoride(F) | 0.7 mg/l | Carbonate(CO3) | 29 | mg/l |
| | | Bicarbonate(HCO3) | | |
| | | Hydroxide(OH) | 49 | mg/l |

WATER ANALYSIS 3-1310-E-82

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Rge 13 Twp 97 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 30.3 | 1.51 | 6.7 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.0 |
| Sodium(Na) | 476.0 | 20.70 | 92.0 |
| Potassium(K) | 10.4 | 0.27 | 1.2 |
| Carbonate(CO3) | 28.8 | 0.96 | 4.5 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 66.0 | 1.38 | 6.5 |
| Chloride(Cl) | 671.0 | 18.90 | 89.0 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 26.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 29.0 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 1302.0 | | |
| Total Anions(epm) | 21.24 | Total Cations(epm) | 22.49 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2500 | Temperature | 15.00 | |
| pH | 10.6 | pH | 11.4 | |
| Fluoride | 1.0 mg/l | Carbonate(CO3) | 29 | mg/l |
| | | Bicarbonate(HCO3) | 0 | mg/l |
| | | Hydroxide(OH) | 45 | mg/l |

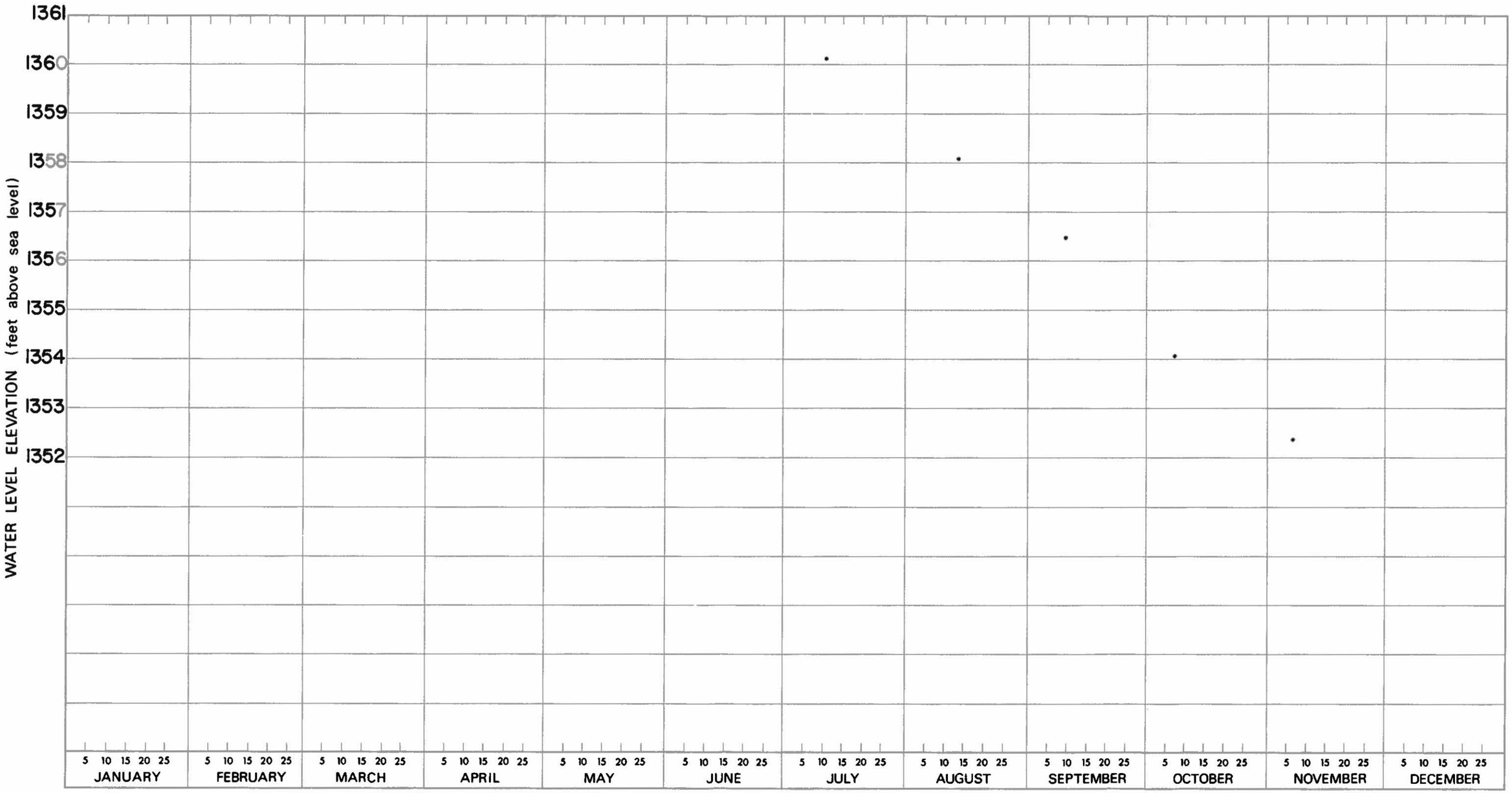
**WATER LEVEL HYDROGRAPH**

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

3-1310-H-76



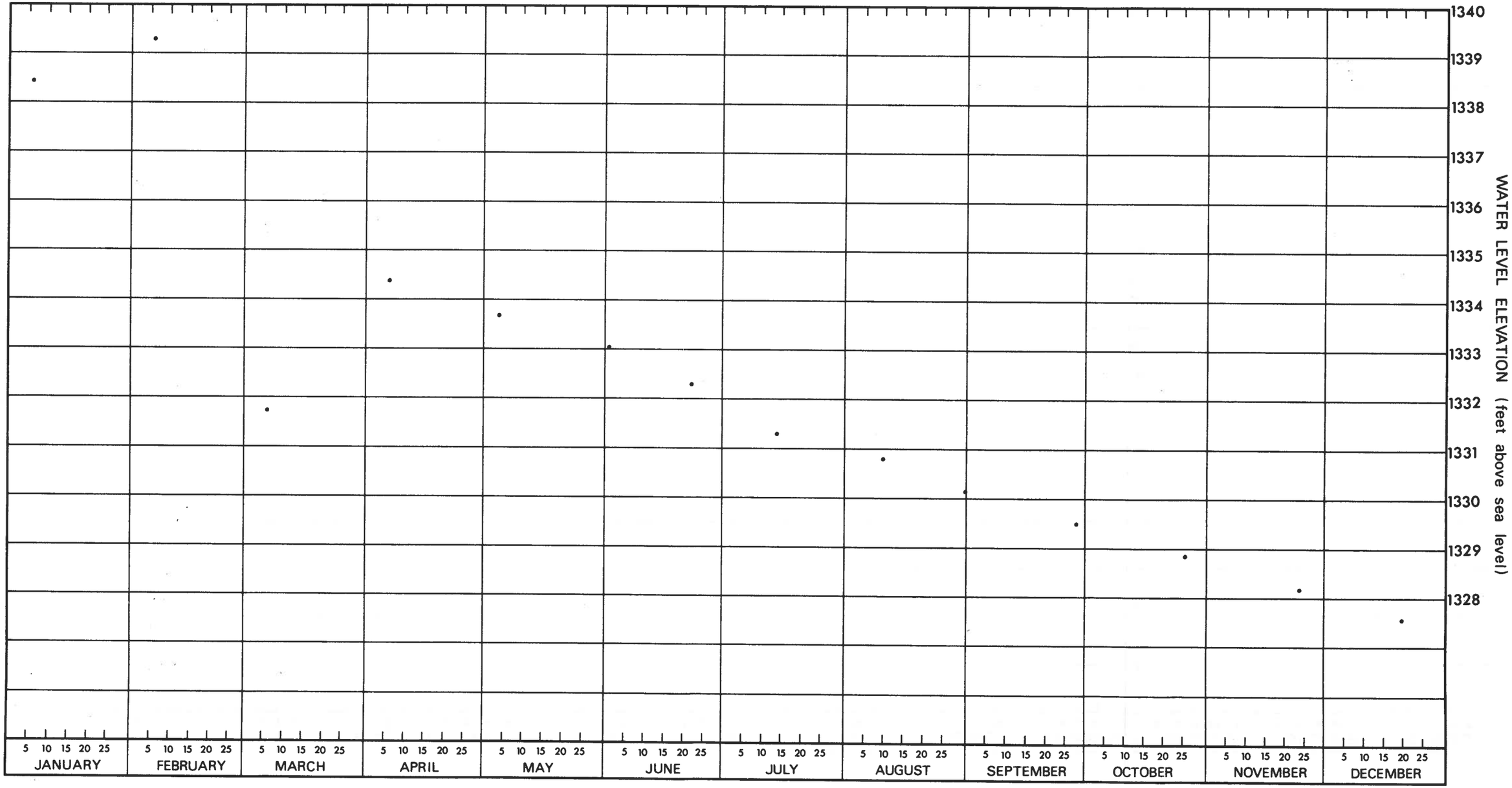
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **3-1310**

Lsd **9** Sec **26** Twp **97** R **13** W4th

Alberta Research Council

**3 - 1310 - H - 77**




**1976**

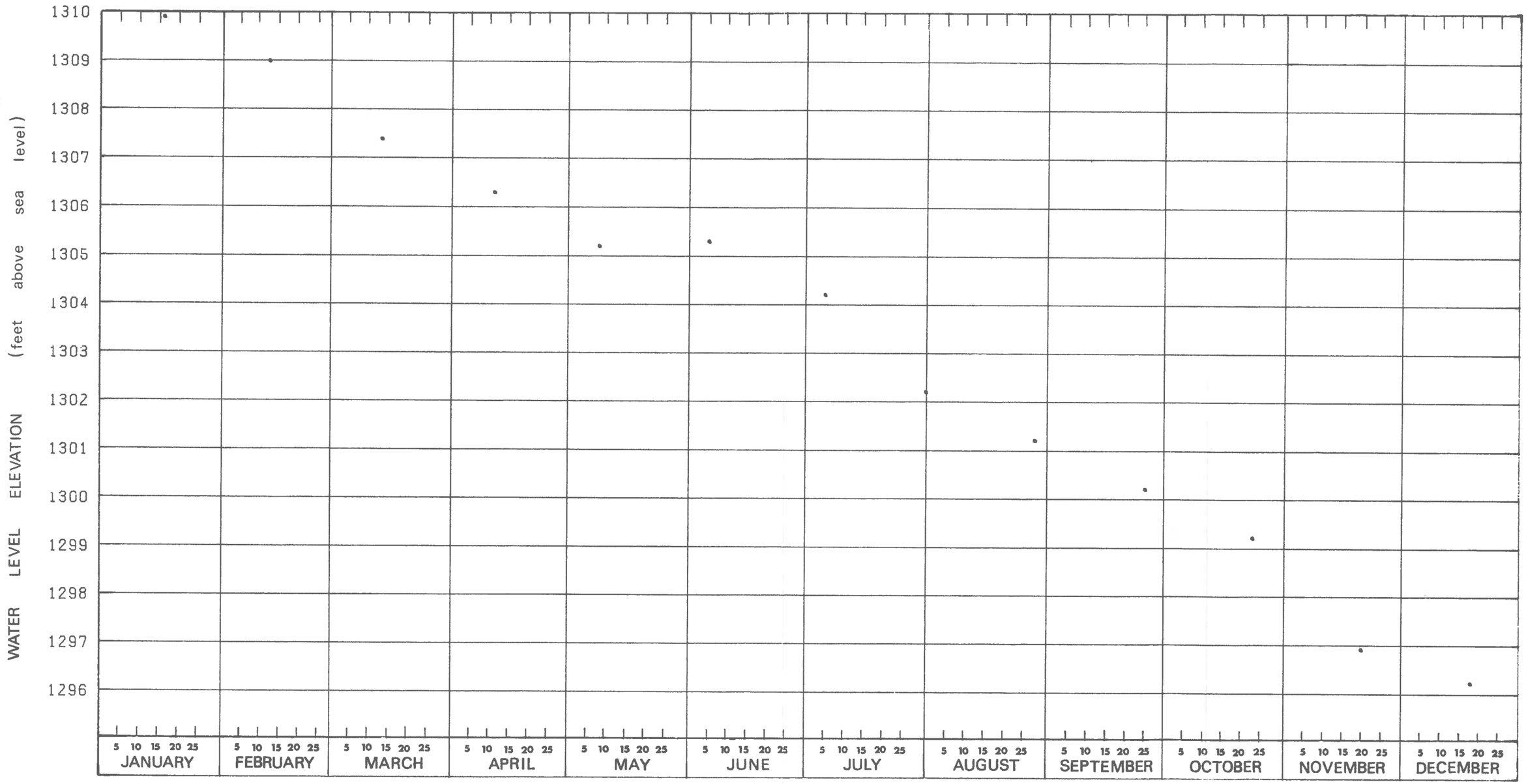
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-1310

LSD 9 SEC 26 TWP 97 R 13 W4TH

3-1310-H-79

Alberta Research Council




1978

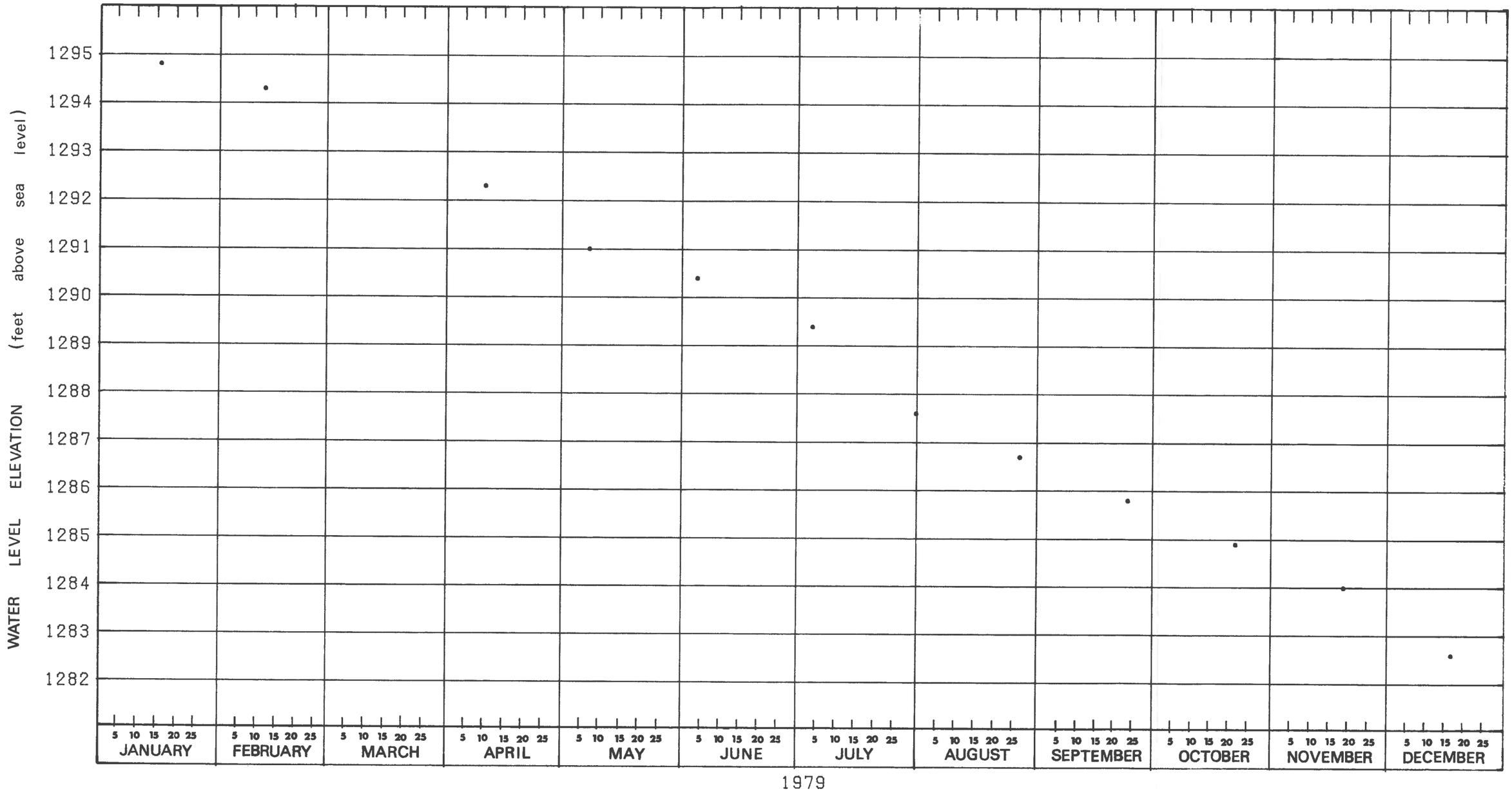
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-1310-H-80



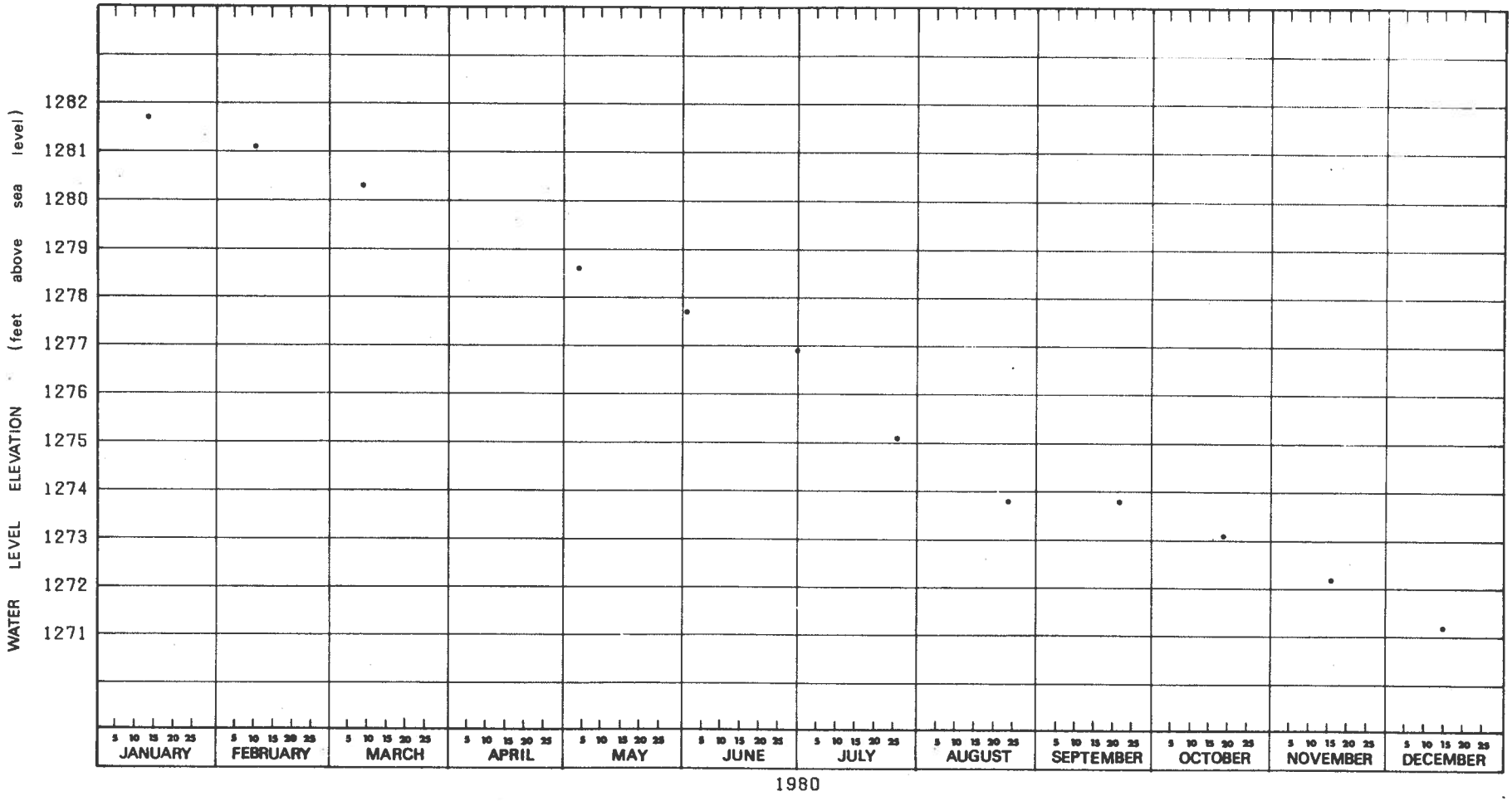
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-1310-H-81



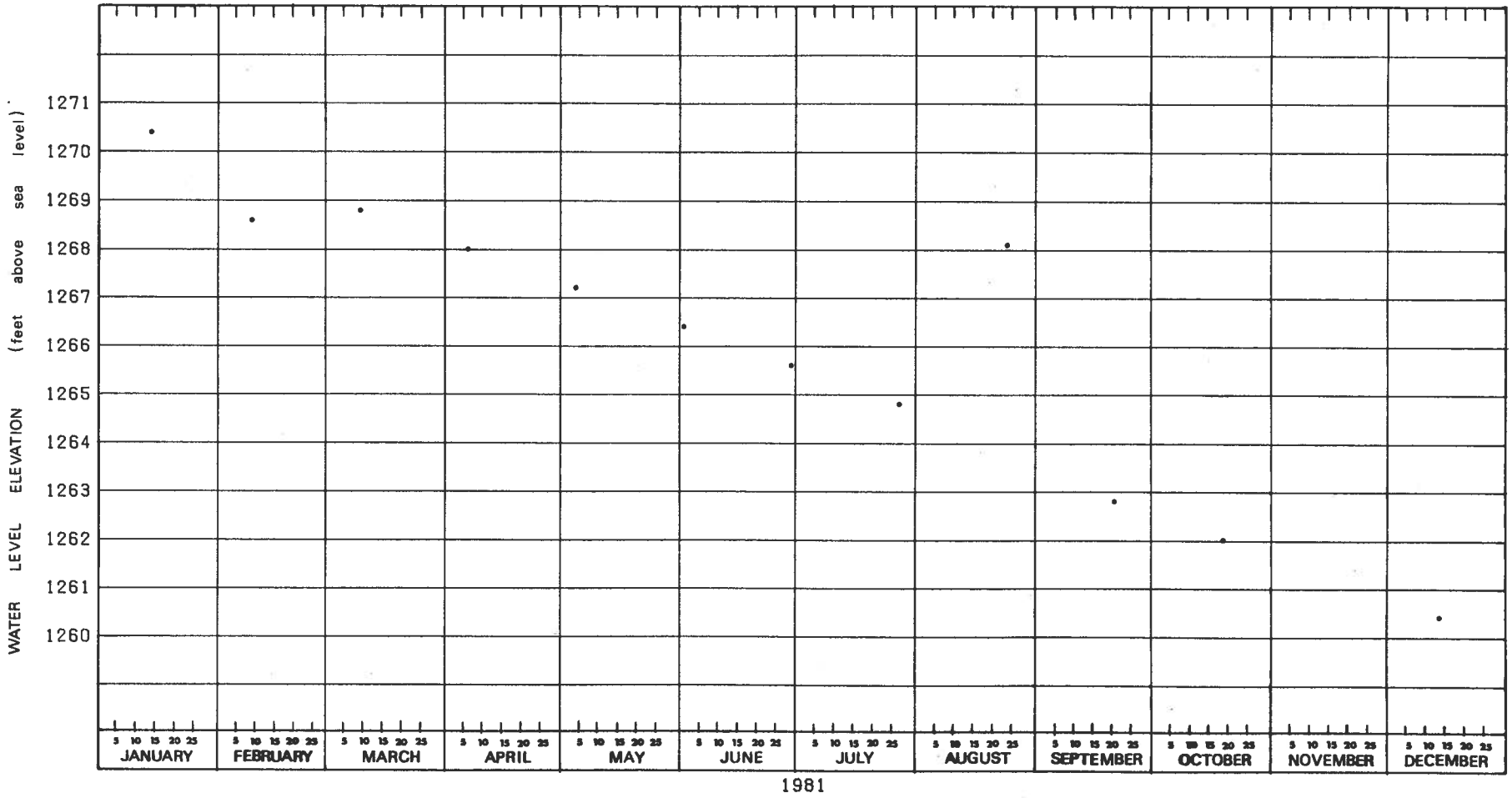
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4 th

Alberta Research Council

3-1310-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.71 (Until March 15/75)
2013.59 ( After March 15/75)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 25/75 | | | Well completed |
| | 46.05 TOC | 1863.65 | bail 150 gallons |
| Jan 26/75 | 106.93 TOC | 1663.88 | |
| Feb 12/75 | 108.88 | 1657.49 | Bail 160 gallons |
| Feb 13/75 | | | Install shelter; MP = 2.14' TOC, (2015.73) |
| Mar 15/75 | | | DST; water sample; FSI = 190# from 1263'; cut off casing |
| Mar 18/75 | | | Reinstall shelter; relevel |
| May 12/75 | 199.64 old MP | | New MP = 30" TOC, (2016.09) |
| June 10/75 | | | Too deep to measure |
| July 10/75 | 200 MP | 1360.09 | |
| Aug 13/75 | 200.63 MP | 1358.02 | Install heater |
| Sept 9/75 | 201.08 MP | 1356.57 | Sampled well; temp. 8°C |
| Oct 7/75 | 201.84 MP | 1354.05 | |
| Nov 6/75 | 202.35 MP | 1352.38 | |
| Dec 6/75 | 208.72 MP | 1331.49 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.59

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 203.41 MP | 1348.9 | MP (2016.1) |
| Feb 6/76 | 202.90 MP | 1350.6 | |
| Mar 6/76 | 207.50 MP | 1335.5 | |
| Apr 6/76 | 205.88 MP | 1340.8 | |
| May 4/76 | 206.31 MP | 1339.4 | |
| June 1/76 | 206.70 MP | 1338.1 | |
| June 22/76 | 207.16 MP | 1336.6 | |
| July 14/76 | 207.77 MP | 1334.6 | Sampled; temp. 11°C |
| Aug 10/76 | 208.17 MP | 1333.6 | |
| Aug 31/76 | 208.48 MP | 1332.3 | |
| Sept 28/76 | 208.88 MP | 1331.0 | |
| Oct 26/76 | 209.28 MP | 1329.7 | |
| Nov 23/76 | 209.67 MP | 1328.4 | |
| Dec 20/76 | 210.04 MP | 1327.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.59

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 210.40 MP | 1326.0 | MP (2016.1) |
| Feb 15/77 | 210.81 MP | 1324.6 | |
| Mar 15/77 | | | >200 m |
| Apr 13/77 | 211.58 MP | 1322.1 | |
| May 10/77 | 211.93 MP | 1321.0 | |
| June 7/77 | 212.30 MP | 1319.8 | |
| July 6/77 | 212.67 MP | 1318.5 | Sampled; temp. 15°C |
| Aug 3/77 | 213.31 MP | 1316.4 | |
| Aug 30/77 | 214.66 MP | 1312.0 | |
| Sept 27/77 | | | Could not measure |
| Oct 25/77 | 215.02 MP | 1310.8 | |
| Nov 22/77 | 215.36 MP | 1309.7 | |
| Dec 19/77 | 214.64 MP | 1312.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.59

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 219.90 MP | 1294.8 | MP (2016.1) |
| Feb 13/79 | 220.05 MP | 1294.3 | |
| Mar 15/79 | | | Could not measure |
| Apr 11/79 | 220.68 MP | 1292.3 | |
| May 8/79 | 221.08 MP | 1291.0 | |
| June 5/79 | 221.26 MP | 1290.4 | |
| July 5/79 | 221.55 MP | 1289.4 | Sampled; temp. 14.5°C |
| Aug 1/79 | 222.09 MP | 1287.6 | |
| Aug 28/79 | 222.37 MP | 1286.7 | |
| Sept 25/79 | 222.65 MP | 1285.8 | |
| Oct 23/79 | 222.92 MP | 1284.9 | |
| Nov 20/79 | 223.19 MP | 1284.0 | |
| Dec 18/79 | 223.63 MP | 1282.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.59

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 215.29 MP | 1309.9 | MP (2016.1) |
| Feb 13/78 | 215.58 MP | 1309.0 | |
| Mar 14/78 | 216.08 MP | 1307.4 | |
| Apr 12/78 | 216.41 MP | 1306.3 | |
| May 9/78 | 216.73 MP | 1305.2 | |
| June 6/78 | 216.72 MP | 1305.3 | |
| July 6/78 | 217.05 MP | 1304.2 | Sampled; temp. 14.5°C |
| Aug 1/78 | 217.65 MP | 1302.2 | |
| Aug 29/78 | 217.96 MP | 1301.2 | |
| Sept 26/78 | 218.27 MP | 1300.2 | |
| Oct 24/78 | 218.58 MP | 1299.2 | |
| Nov 21/78 | 219.26 MP | 1296.9 | |
| Dec 19/78 | 219.47 MP | 1296.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

3-1310-W-82

WELL HISTORY

OBSERVATION WELL NUMBER 3-1310

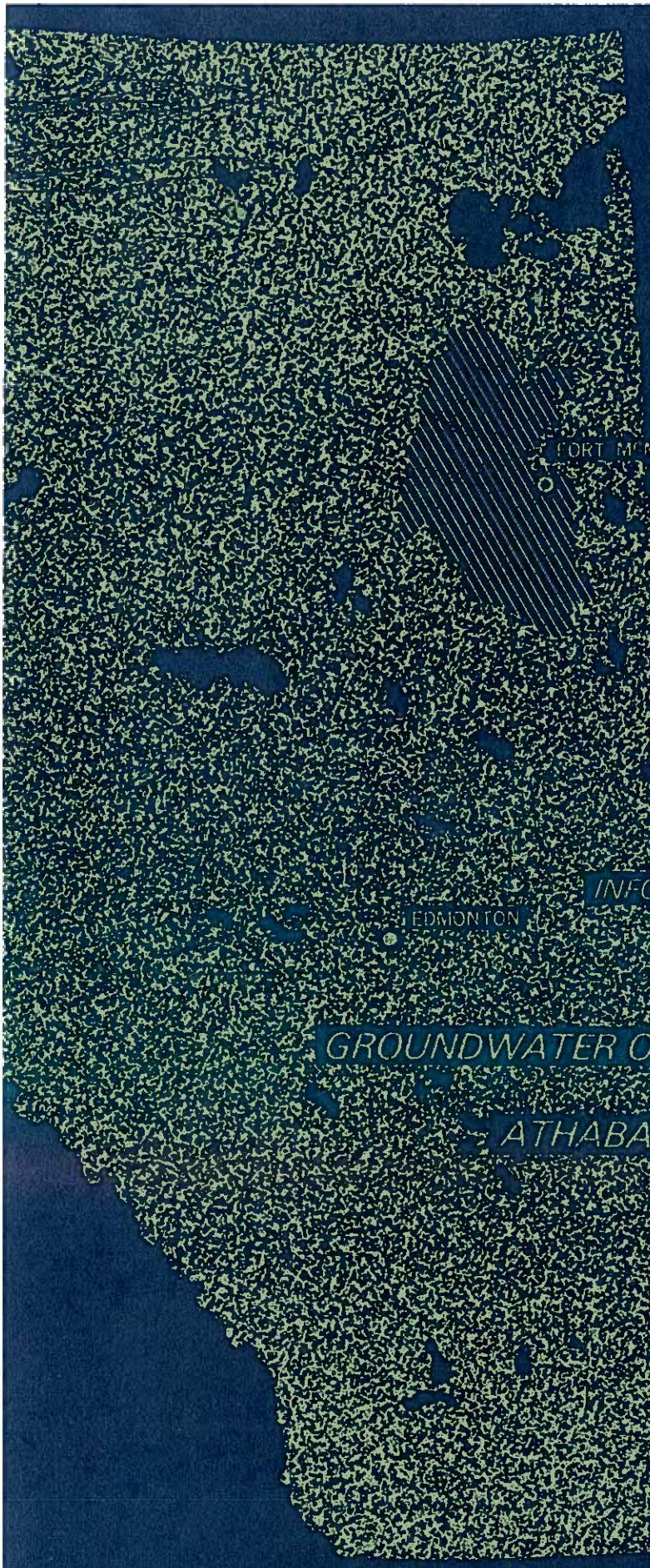
Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.59

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 223.90 MP | 1281.7 | |
| Feb 12/80 | 224.09 MP | 1281.1 | |
| Mar 11/80 | 224.33 MP | 1280.3 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 224.85 MP | 1278.6 | |
| June 3/80 | 225.11 MP | 1277.7 | |
| July 2/80 | 225.35 MP | 1276.9 | Temp. 15°C |
| July 28/80 | 225.90 MP | 1275.1 | |
| Aug 26/80 | 226.30 MP | 1273.8 | |
| Sept 24/80 | 226.32 MP | 1273.8 | |
| Oct 21/80 | 226.53 MP | 1273.1 | |
| Nov 18/80 | 226.79 MP | 1272.2 | |
| Dec 17/80 | 227.09 MP | 1271.2 | |
| Jan 15/81 | 227.34 MP | 1270.4 | |
| Feb 10/81 | 227.89 MP | 1268.6 | |
| Mar 10/81 | 227.85 MP | 1268.8 | |
| Apr 7/81 | 228.08 MP | 1268.0 | |
| May 5/81 | 228.32 MP | 1267.2 | |
| June 2/81 | 228.57 MP | 1266.4 | |
| June 30/81 | 228.81 MP | 1265.6 | |
| July 28/81 | 229.05 MP | 1264.8 | |
| Aug 25/81 | 228.05 MP | 1268.1 | |
| Sept 22/81 | 229.68 MP | 1262.8 | |
| Oct 20/81 | 229.92 MP | 1262.0 | |
| Dec 15/81 | 230.41 MP | 1260.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing




SITE SIX
2 18 95 9 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites, containing 36 individual wells, were instrumented in this manner during the winter of 1974-75.

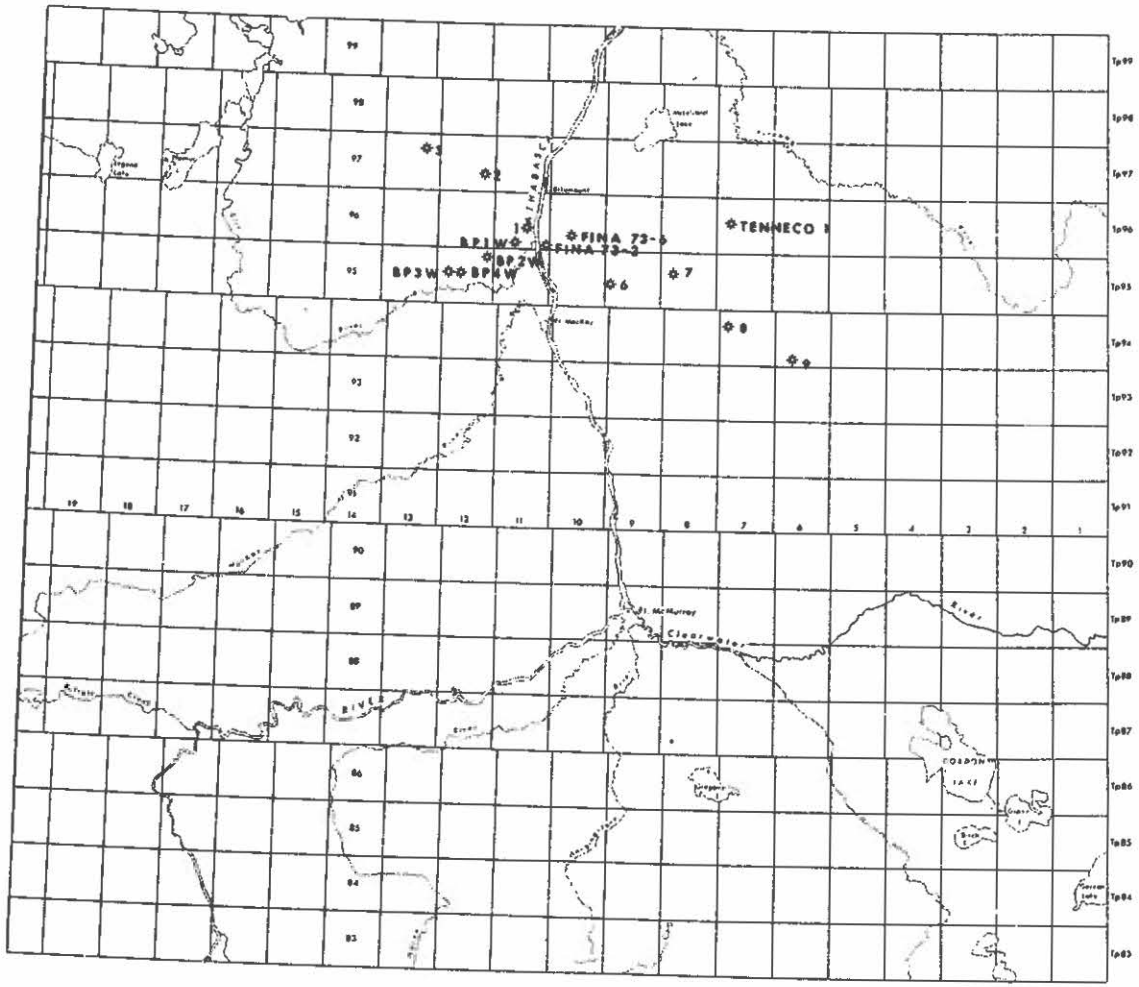
The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill-stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The loose-leaf format has been chosen to facilitate periodic updating with such information as hydrographs, water analyses and well history. The page indexing system is also consistent with the updating process. All updating packages will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this introduction and legend.

There were seven piezometer nests in the system on August 31, 1975. Four companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing. Table I lists the location of wells in the system as of August 31, 1975. Map 1 indicates the location of these wells. Publications available as of the date of this document include those for sites 1, 2, 3, 6, 7, 8 and 9.

Table I
Athabasca Oil Sands Observation Wells
August 31, 1975

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |




6 0 6 12 18 MILES

**MAP 1**
**ATHABASCA OIL SANDS**
**OBSERVATION WELL NETWORK**
**August 31, 1975**

## Acknowledgments

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, C. Seibert, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1975: BOPG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., and Shell Canada Ltd.

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication
Well Number - the name used for designating the well
Subject Code - as follows:

- I - Introduction (no site number indicated)
- L - Legend (no site number indicated)
- G - General site information including geological logs, geophysical logs and site plan (no well number indicated)
- C - Well construction details
- D - Drill stem testing
- A - Aquifer testing
- E - Chemical analyses including spectral emission estimates and routine water analyses
- H - Annual hydrograph
- W - Well history

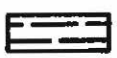
So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within the tabbed section for that particular well.

## SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| Mer | meridian |
| Meg/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diamter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| Sec. | section |
| ss | stainless steel |

| Symbol | Units or Parameter |
|---|---|
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) *or* time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| Wt | weight |

## GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
| | arkosic sandstone |
| | silt |
| | siltstone |
| | silt & sandstone |
| | clay |
| | sandy clay |
|  | shale |
| | sandstone & shale |
| | oilsand |
| | shaley dolomite |
| | gypsum |
| | dolomite |
| | limestone |

| Symbol | Stratigraphic Unit |
|---|---|
| Qd | unconsolidated deposits |
| Klb | La Biche Fm. |
| Kpl | Pelican Fm. |
| Kj | Joli Fou Fm. |
| Kg | Grand Rapids Fm. |
| Kc | Clearwater Fm. |
| Km | McMurray Fm. |
| Dbl | Beaverhill Lake Gp. |
| Dw | Waterways Fm. |
| Dpe | Prairie Evaporite Fm. |
| Dmt | Methy Fm. |
| Dmr | McLean River Fm. |
| Dl | La Loche Fm. |
| Pε | Precambrian |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: complete routine analysis and a spectral emission estimate for 29 elements. Many of the samples collected during 1975 appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years.

Most water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source".

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface

3. drill through the aquifer using very light mud
4. insert a screening device (if necessary).

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

Two drilling rigs were used simultaneously during the 1974-1975 drilling season. Both were Failing 1500; one was trailer mounted and capable of 2,000-foot depths, the other was truck mounted and capable of about 1,200-foot depths.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3. drill through the aquifer using very light mud
4. insert a screening device (if necessary).

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

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## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma and uncompensated density were the logs run during the 1974-75 drilling. The geological log presented represents an interpretation based upon the sample description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells when the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, all wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the

measuring tape sticking to the wet casing. Conventional oil-field drill stem testing equipment was selected in an attempt to produce permeability and head values in the wells with deep water levels. Information from these drill stem tests is presented in the section on "Drill Stem Testing". A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

| | | |
|---|---|---|
| $Q_b$ | = | production rate in barrels per day |
| V | = | volume of production into drill collars and stem |
| t | = | total flow time of test |
| T | = | transmissivity in millidarcy-feet |
| M | = | slope of final shut-in pressure plot |
| k | = | permeability in millidarcys |
| h | = | thickness of the aquifer - usually the length of the tested section. |

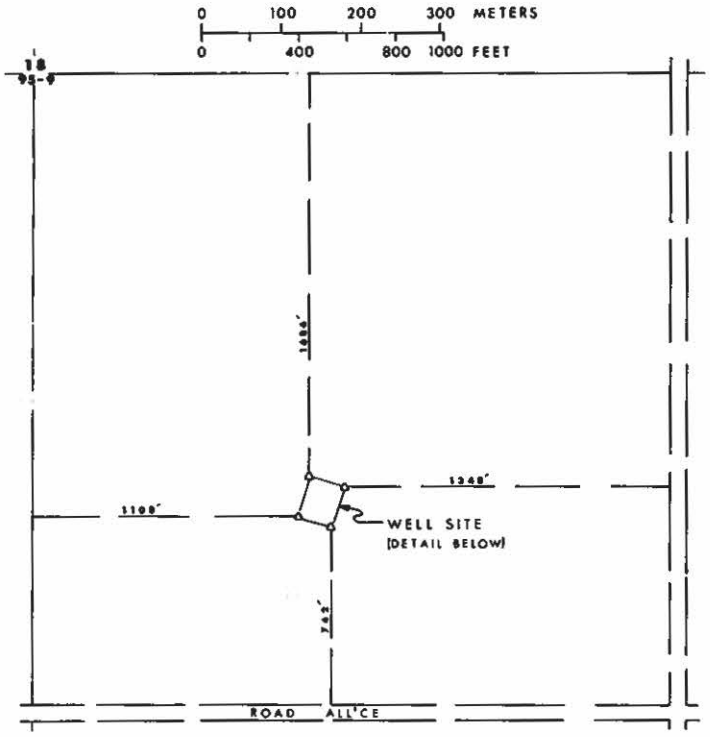
The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot.

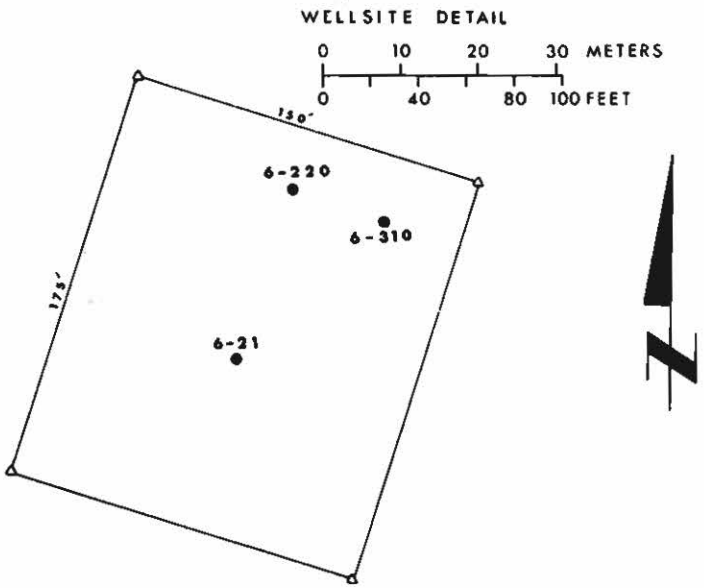
Values of transmissivity are expressed in the metric units of square metres per day. Permeability is expressed as centimetres per second.

OBSERVATION WELL SITE 6

2-18-95-9 W 4th

ALBERTA RESEARCH COUNCIL



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Six

Lsd 2 Sec 18 Twp 95 R 10 W4th

Alberta Research Council

Ground elevation 986 Total depth 310

KB elevation 981

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 10 | Tar sand, sub-angular, quartz, bituminous coarse grained medium to well sorted | McMurray |
| | 20 | Tar sand, sub-angular to sub-rounded, quartz bituminous medium to coarse grained | |
| | 30 | Sand, sub-angular to sub-rounded, quartz, coarse grained bituminous | |
| | 40 | Sand, mostly fine grained, bituminous, quartz sub-angular to sub rouded | |
| | 50 | Sand, sub-angular, quartz, slightly bituminous poorly sorted, fine to coarse grained | |
| | 60 | Sand, sub-rounded, quartz, medium grained, bituminous, well sorted | |
| | 70 | Sand, sub-rounded, quartz, fine to medium grained bituminous | |
| | 80 | Sand, well sorted,mostly fine to medium grained, bituminous sub-rounded, quartz | |
| | 90 | Sand, fine to medium grained,bituminous, sub-rounded, quartz | |
| | 100 | Sand, as above, quartz | |
| 100 | 120 | Sand medium, grained, sub-rounded bituminous | |
| | 130 | Sand, quartz, coarse grained, well sorted, sub-rounded, to sub-angular | |
| | 140 | Sand, sub-angular, some coal fragments, poorly sorted, medium to coarse grained quartz | |
| | 150 | Sand, bituminous, poorly sorted, quartz | |
| | 160 | Sand, quartz, sub-angular to sub-rounded, coarse grained,bituminous, poorly sorted | |
| | 170 | Sand, quartz, sub-rounded to sub-angular, coarse grained, well sorted, bituminous | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Six (continued)

Lsd 2 Sec 18 Twp 95 R 10 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 180 | Sand, poorly sorted, medium to coarse grained, sub-rounded to sub-angular, bituminous | |
| | 190 | Grey shale | |
| | 200 | Sand, coarse to very coarse, sub-rounded, to sub-angular, bituminous, quartz, poorly sorted | |
| | 210 | Sand, quartz, coarse to very coarse, sub-angular, bituminous | |
| | 220 | Sand, quartz, coarse to very coarse, sub-angular to sub-rounded, bituminous | |
| | 230 | Calcareous clay, fine grained, with some ( < 1%) quartz particles, well sorted | |
| 230 | 310 | Limestone, fine grained | Beaverhill Lake |

## SUMMARY OF CONTENTS

SITE NUMBER SIX

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | |
|---|---|---|---|---|
| | site | 6-21 | 6-220 | 6-310 |
| Introduction | 4 | — | — | — |
| Legend | 8 | — | — | — |
| Site Plan | 1 | — | — | — |
| Geological Sample Description | 2 | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — |
| Well Construction | — | 1 | 1 | 1 |
| Drawdown Plot | — | 0 | 1 | 2 |
| Drill Stem Test | — | 0 | 0 | 0 |
| Shut-In Pressure Data | — | 0 | 0 | 0 |
| Water Analysis | — | 2 | 2 | 3 |
| Spectral Emissions Estimates | — | 1 | 1 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER SIX

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

number of pages distributed for this site in 1977

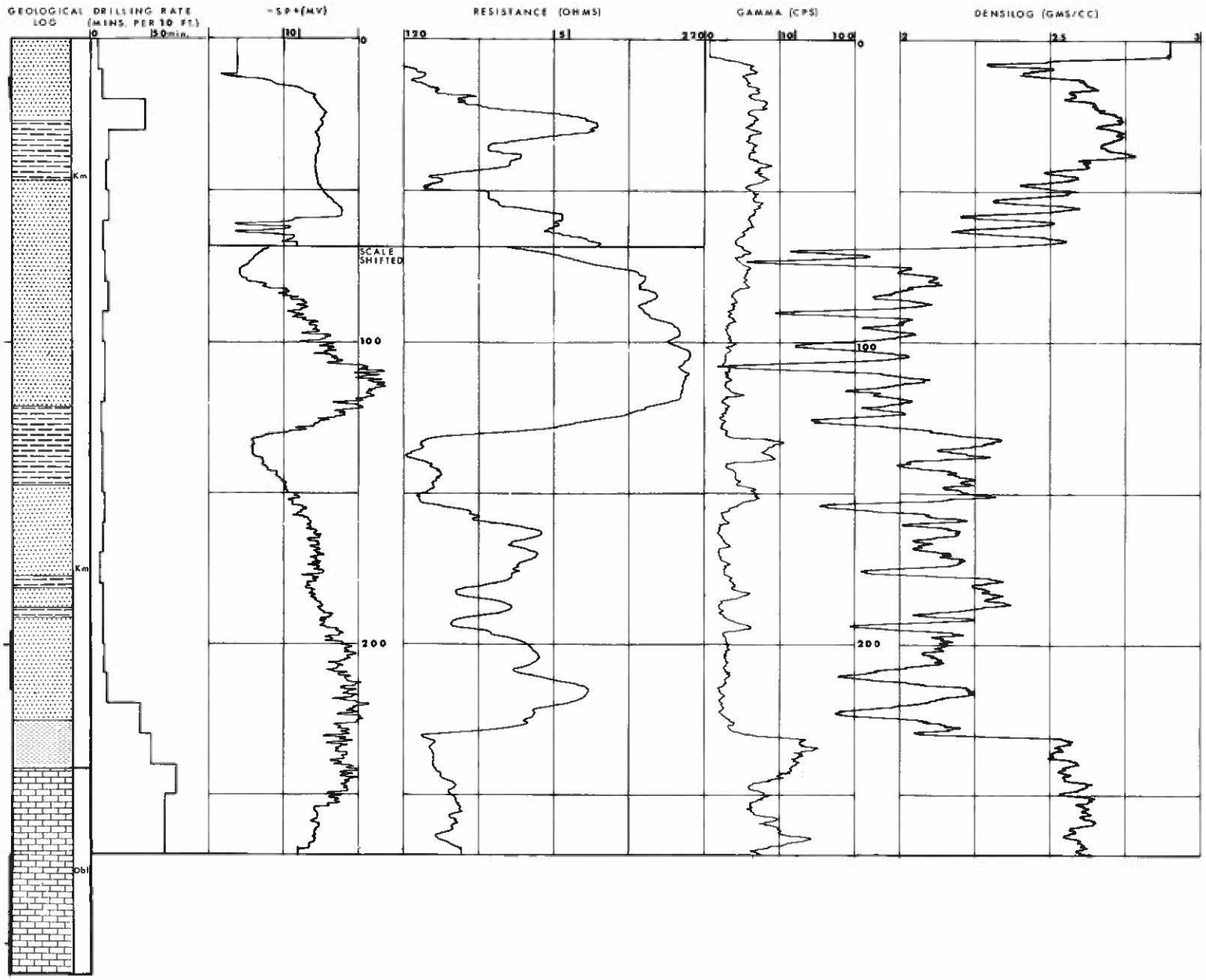
| page title | well name | | |
|---|---|---|---|
| | 6-21 | 6-220 | 6-310 |
| Water Analysis | 1 | 1 | 1 |
| Water Level Hydrograph | 1 | 1 | 1 |
| Well History | 1 | 1 | 1 |

### ERRATUM STATEMENT

Material Distributed in 1976

1. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
2. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 6
### 2-18-95-9 W4th
### ALBERTA RESEARCH COUNCIL



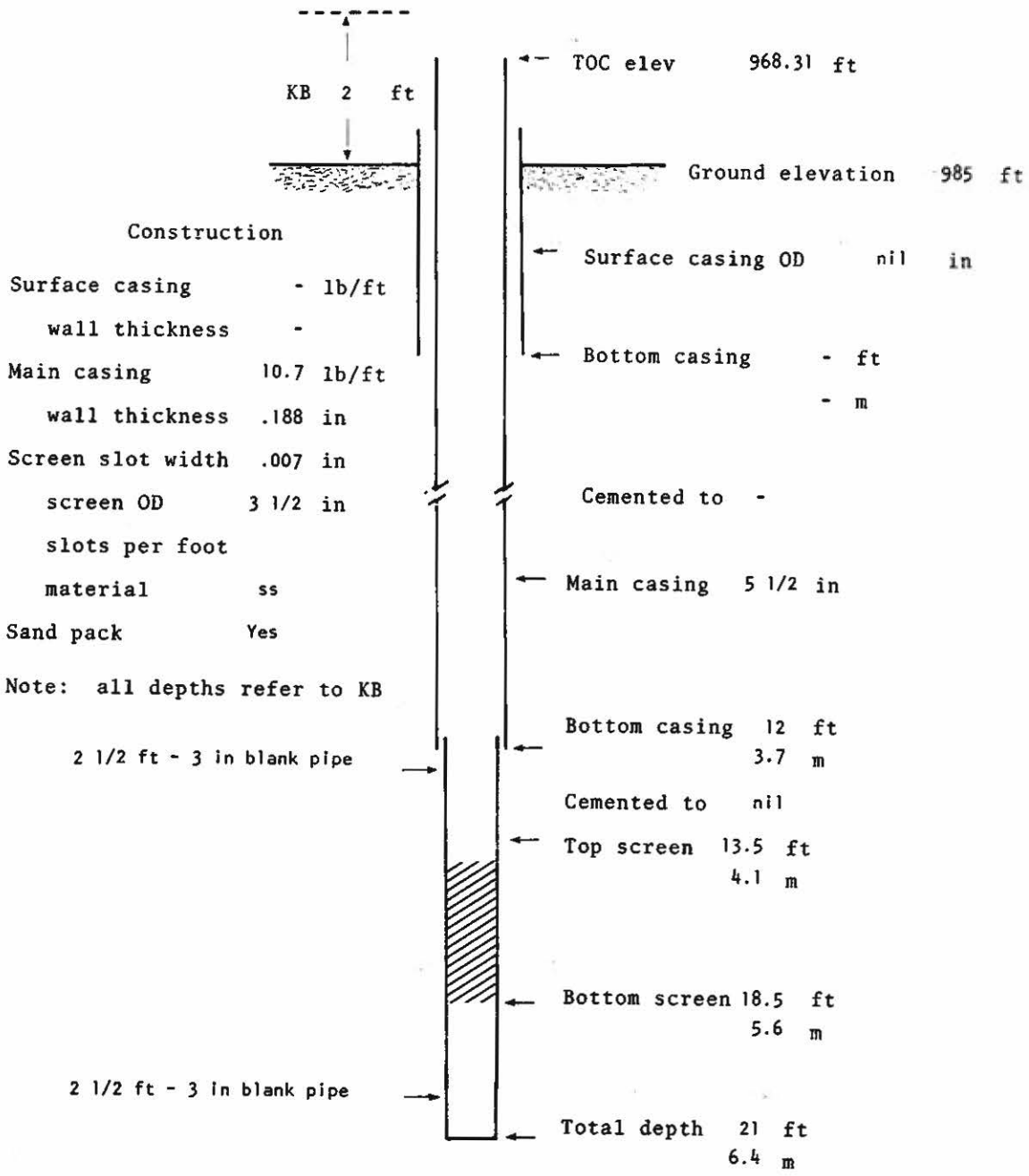
6-21-C-76

WELL CONSTRUCTION,

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Tp 95 R 9 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 10.7 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | Yes | |

Note: all depths refer to KB

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed from 6-21

Date sampled February 18, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 100.0 | 4.99 | 70.3 |
| Magnesium ($Mg^{++}$) | 22.0 | 1.81 | 25.5 |
| Sodium ($Na^{+}$) | 6.3 | 0.27 | 3.9 |
| Potassium ($K^{+}$) | 0.8 | 0.02 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 378.0 | 6.20 | 80.5 |
| Sulfate ($SO_4^{=}$) | 10.0 | 0.21 | 2.7 |
| Chloride ($Cl^{-}$) | 44.0 | 1.24 | 16.1 |
| Nitrate ($NO_3^{=}$) | 3.0 | 0.05 | 0.6 |
| Silica ($SiO_2$) | 6.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 458.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 7.693 | Total Cations (epm) | 7.094 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 640 | Temperature (C) | 1.5 |
| pH | 8.1 | pH | 7.5 |
| Fluoride ($F^{-}$) | 0.0 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 415 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | 850 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 11, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 31 | 1.55 | 56 |
| Magnesium ($Mg^{++}$) | 5.2 | 0.43 | 15 |
| Sodium ($Na^{+}$) | 17.5 | 0.76 | 27 |
| Potassium ($K^{+}$) | 1.7 | 0.04 | 2 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 137 | 2.25 | 84 |
| Sulfate ($SO_4^{=}$) | 3.3 | 0.07 | 3 |
| Chloride ($Cl^{-}$) | 12 | 0.34 | 13 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 1 |
| Silica ($SiO_2$) | 2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 31 | | |
| Magnesium (Acidified) | 6.2 | | |
| Total dissolved solids | 196 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 2.68 | Total Cations (epm) | 2.78 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 280 | Temperature (C) | 11.0 | |
| pH | 7.3 | pH | 6.4 | |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 171 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed from well 6-21

Date of sampling February 18, 1975

Total dissolved solids 458 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .02 | Mg | .1 |
| As | <.001 | Mn | .003 |
| B | .01 | Mo | ND |
| Ba | .02 | Ni | .04 |
| Be | ND | Pb | .01 |
| Bi | ND | Sb | ND |
| Ca | M | Si | M |
| Cd | ND | Sn | ND |
| Co | .001 | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .004 | V | ND |
| Fe | M | Zn | .04 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 220.0 | 10.98 | 59 |
| Magnesium ($Mg^{++}$) | 59.0 | 4.86 | 26 |
| Sodium ($Na^{+}$) | 65.0 | 2.83 | 15 |
| Potassium ($K^{+}$) | 2.1 | 0.05 | 0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 842.0 | 13.80 | 75 |
| Sulfate ($SO_4^{=}$) | 0.0 | 0.00 | 0 |
| Chloride ($Cl^{-}$) | 158.0 | 4.46 | 24 |
| Nitrate ($NO_3^{=}$) | 5.3 | 0.09 | 0 |
| Silica ($SiO_2$) | 7.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 242.0 | | |
| Magnesium (Acidified) | 60.5 | | |
| Total dissolved solids | 1138 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 18.34 | Total Cations (epm) | 18.72 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1700 | Temperature (C) | 11.0 |
| pH | 7.1 | pH | 6.4 |
| Fluoride ($F^{-}$) | 0.5 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 829 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed (U of A Geology)

Date sampled May 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 80.4 | 3.94 | 57.9 |
| Magnesium ($Mg^{++}$) | 27.3 | 2.24 | 32.9 |
| Sodium ($Na^{+}$) | 13.4 | 0.58 | 8.5 |
| Potassium ($K^{+}$) | 1.7 | 0.04 | 0.6 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 303.0 | 4.85 | 75.2 |
| Sulfate ($SO_4^{=}$) | 21.0 | 0.44 | 6.8 |
| Chloride ($Cl^{-}$) | 41.5 | 1.16 | 18.0 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 6.45 | Total Cations (epm) | 6.80 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 630 | Temperature (C) |
| pH | 7.4 | pH |
| Fluoride ($F^{-}$) | | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled June 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 145.0 | 7.24 | 57.4 |
| Magnesium ($Mg^{++}$) | 45.0 | 3.70 | 29.4 |
| Sodium ($Na^{+}$) | 37.5 | 1.63 | 12.9 |
| Potassium ($K^{+}$) | 1.7 | 0.04 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 643.0 | 10.54 | 88.9 |
| Sulfate ($SO_4^{=}$) | 24.8 | 0.52 | 4.4 |
| Chloride ($Cl^{-}$) | 28.0 | 0.79 | 6.7 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 7.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 650.0 | | |
| Total Anions (epm) 11.86 | | Total Cations (epm) | 12.61 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 7000 |
| pH | 8.6 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| |
|---|
| Temperature (C) |
| pH |
| Carbonate ($CO_3^{=}$) |
| Bicarbonate ($HCO_3^{-}$) |
| Hydroxide ($OH^{-}$) |
| Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed (U of A Geology)

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 110.0 | 5.39 | 53.6 |
| Magnesium ($Mg^{++}$) | 36.0 | 2.95 | 29.3 |
| Sodium ($Na^{+}$) | 39.0 | 1.68 | 16.7 |
| Potassium ($K^{+}$) | 1.5 | 0.04 | 0.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 502.0 | 8.03 | 81.7 |
| Sulfate ($SO_4^{=}$) | 21.9 | 0.46 | 4.7 |
| Chloride ($Cl^{-}$) | 48.0 | 1.34 | 13.6 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 9.83 | Total Cations (epm) | 10.06 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 900 | Temperature (C) | |
| pH | 7.9 | pH | |
| Fluoride ($F^{-}$) | | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 124.0 | 6.19 | 53.7 |
| Magnesium ($Mg^{++}$) | 40.0 | 3.29 | 28.6 |
| Sodium ($Na^{+}$) | 46.0 | 2.00 | 17.4 |
| Potassium ($K^{+}$) | 1.3 | 0.03 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 537.0 | 8.80 | 77.3 |
| Sulfate ($SO_4^{=}$) | 30.8 | 0.64 | 5.6 |
| Chloride ($Cl^{-}$) | 68.0 | 1.92 | 16.8 |
| Nitrate ($NO_3^{=}$) | 1.3 | 0.02 | 0.2 |
| Silica ($SiO_2$) | 6.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 111.0 | | |
| Magnesium (Acidified) | 35.0 | | |
| Total dissolved solids | 674.0 | | |
| Total Anions (epm) | 11.38 | Total Cations (epm) | 11.51 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1050 |
| pH | 7.1 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 10.0 |
| pH | 7.1 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | 586.0 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled August 3, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 148.0 | 7.39 | 58.6 |
| Magnesium ($Mg^{++}$) | 44.0 | 3.62 | 28.8 |
| Sodium ($Na^{+}$) | 35.0 | 1.52 | 12.1 |
| Potassium ($K^{+}$) | 2.5 | 0.06 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 710.0 | 11.64 | 92.1 |
| Sulfate ($SO_4^{=}$) | 0.0 | 0.00 | 0.0 |
| Chloride ($Cl^{-}$) | 32.0 | 0.90 | 7.1 |
| Nitrate ($NO_3^{=}$) | 6.2 | 0.10 | 0.8 |
| Silica ($SiO_2$) | 7.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 738.0 | | |
| Total Anions (epm) 12.64 | | Total Cations (epm) | 12.59 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 1200 | Temperature (C) |
| pH | 7.2 | pH |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed (U of A Geology)

Date sampled August 31, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 180.0 | 8.82 | 64.4 |
| Magnesium ($Mg^{++}$) | 40.0 | 3.28 | 24.0 |
| Sodium ($Na^{+}$) | 35.5 | 1.53 | 11.2 |
| Potassium ($K^{+}$) | 2.3 | 0.06 | 0.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 635.0 | 10.16 | 79.7 |
| Sulfate ($SO_4^{=}$) | 0.5 | 0.01 | 0.1 |
| Chloride ($Cl^{-}$) | 92.0 | 2.58 | 20.2 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.75 | Total Cations (epm) | 13.69 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1080 | Temperature (C) | |
| pH | 7.4 | pH | |
| Fluoride ($F^{-}$) | | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled August 31, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 136.0 | 6.79 | 57.3 |
| Magnesium ($Mg^{++}$) | 40.0 | 3.29 | 27.8 |
| Sodium ($Na^{+}$) | 40.0 | 1.74 | 14.7 |
| Potassium ($K^{+}$) | 1.2 | 0.03 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 593.0 | 9.72 | 79.8 |
| Sulfate ($SO_4^{=}$) | 14.5 | 0.30 | 2.5 |
| Chloride ($Cl^{-}$) | 76.0 | 2.14 | 17.6 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 6.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 656.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.18 | Total Cations (epm) | 11.85 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 1180 | Temperature (C) |
| pH | 7.2 | pH |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 29, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 92.0 | 4.59 | 47.5 |
| Magnesium ($Mg^{++}$) | 40.0 | 3.29 | 34.1 |
| Sodium ($Na^{+}$) | 40.0 | 1.74 | 18.0 |
| Potassium ($K^{+}$) | 1.7 | 0.04 | 0.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 490.0 | 8.03 | 79.5 |
| Sulfate ($SO_4^{=}$) | 12.0 | 0.25 | 2.5 |
| Chloride ($Cl^{-}$) | 64.0 | 1.80 | 17.9 |
| Nitrate ($NO_3^{=}$) | 1.4 | 0.02 | 0.2 |
| Silica ($SiO_2$) | 3.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 596.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 10.11 | Total Cations (epm) | 9.67 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 930 | Temperature (C) |
| pH | 8.1 | pH |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled October 25, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 142.0 | 7.09 | 56.4 |
| Magnesium ($Mg^{++}$) | 44.0 | 3.62 | 28.8 |
| Sodium ($Na^{+}$) | 42.5 | 1.85 | 14.7 |
| Potassium ($K^{+}$) | 0.4 | 0.01 | 0.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 678.0 | 11.11 | 86.8 |
| Sulfate ($SO_4^{=}$) | 11.6 | 0.24 | 1.9 |
| Chloride ($Cl^{-}$) | 50.0 | 1.41 | 11.0 |
| Nitrate ($NO_3^{=}$) | 2.6 | 0.04 | 0.3 |
| Silica ($SiO_2$) | 11.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 732.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.81 | Total Cations (epm) | 12.57 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 1140 | Temperature (C) |
| pH | 7.2 | pH |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled November 22, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 165.0 | 8.23 | 62.6 |
| Magnesium ($Mg^{++}$) | 43.0 | 3.54 | 26.9 |
| Sodium ($Na^{+}$) | 31.0 | 1.35 | 10.3 |
| Potassium ($K^{+}$) | 1.3 | 0.03 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 678.0 | 11.11 | 86.9 |
| Sulfate ($SO_4^{=}$) | 9.3 | 0.19 | 1.5 |
| Chloride ($Cl^{-}$) | 52.0 | 1.47 | 11.5 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 0.1 |
| Silica ($SiO_2$) | 8.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 658.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.79 | Total Cations (epm) | 13.15 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 1130 | Temperature (C) |
| pH | 8.2 | pH |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled November 22, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 151.0 | 7.53 | 61.2 |
| Magnesium ($Mg^{++}$) | 40.0 | 3.29 | 26.7 |
| Sodium ($Na^{+}$) | 33.8 | 1.47 | 11.9 |
| Potassium ($K^{+}$) | 0.8 | 0.02 | 0.2 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 661.0 | 10.83 | 87.3 |
| Sulfate ($SO_4^{=}$) | 8.0 | 0.17 | 1.3 |
| Chloride ($Cl^{-}$) | 50.0 | 1.41 | 11.4 |
| Nitrate ($NO_3^{=}$) | 0.1 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 8.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 654.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.41 | Total Cations (epm) | 12.32 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 1100 | Temperature (C) |
| pH | 8.0 | pH |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled December 20, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 146.0 | 7.29 | 60.6 |
| Magnesium ($Mg^{++}$) | 39.0 | 3.21 | 26.7 |
| Sodium ($Na^{+}$) | 33.8 | 1.47 | 12.2 |
| Potassium ($K^{+}$) | 2.1 | 0.05 | 0.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 632.0 | 10.36 | 85.9 |
| Sulfate ($SO_4^{=}$) | 13.5 | 0.28 | 2.3 |
| Chloride ($Cl^{-}$) | 50.0 | 1.41 | 11.7 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 6.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 670.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.06 | Total Cations (epm) | 12.02 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 1130 | Temperature (C) |
| pH | 7.2 | pH |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Date sampled: July 16, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | 8.77 |
| Au | <.003 | Mo | <.006 |
| Al | 0.11 | Na | 63.8 |
| As | <.038 | Ni | <.010 |
| B | .215 | P | 0.99 |
| Ba | <.200 | Pb | <.088 |
| Be | .003 | Se | <.060 |
| Ca | 250 | Si | 5.45 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 0.73 |
| Cr | <.006 | Te | <.065 |
| Cu | .014 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 55.9 | V | .018 |
| K | 77 | W | <.078 |
| Mg | 52.5 | Zn | .099 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

6-21-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled January 18, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 178.0 | 8.88 | 62.5 |
| Magnesium(Mg) | 41.0 | 3.37 | 23.7 |
| Sodium(Na) | 43.8 | 1.91 | 13.4 |
| Potassium(K) | 2.1 | 0.05 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 561.0 | 9.20 | 71.0 |
| Sulphate(SO4) | 9.6 | 0.20 | 1.5 |
| Chloride(Cl) | 126.0 | 3.55 | 27.4 |
| Nitrate(NO3) | 0.6 | 0.01 | 0.1 |
| Silica(SiO2) | 6.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 764.0 | | |
| Total Anions(epm) | 12.96 | Total Cations(epm) | 14.22 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 1200 | Temperature(C) |
| pH | 7.0 | pH |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

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WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled February 14, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 146.0 | 7.29 | 62.6 |
| Magnesium(Mg) | 44.0 | 3.62 | 31.1 |
| Sodium(Na) | 16.3 | 0.71 | 6.1 |
| Potassium(K) | 0.8 | 0.02 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 512.0 | 8.39 | 68.6 |
| Sulphate(SO4) | 5.2 | 0.11 | 0.9 |
| Chloride(Cl) | 132.0 | 3.72 | 30.4 |
| Nitrate(NO3) | 0.7 | 0.01 | 0.1 |
| Silica(SiO2) | 6.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 742.0 | | |
| Total Anions(epm) | 12.23 | Total Cations(epm) | 11.64 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 1090 | Temperature(C) |
| pH | 8.9 | pH |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled March 15, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 157.0 | 7.83 | 66.2 |
| Magnesium(Mg) | 39.0 | 3.21 | 27.1 |
| Sodium(Na) | 17.5 | 0.76 | 6.4 |
| Potassium(K) | 1.3 | 0.03 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 573.0 | 9.39 | 77.7 |
| Sulphate(SO4) | 0.0 | 0.00 | 0.0 |
| Chloride(Cl) | 94.0 | 2.65 | 21.9 |
| Nitrate(NO3) | 2.6 | 0.04 | 0.3 |
| Silica(SiO2) | 7.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 594.0 | | |
| Total Anions(epm) | 12.08 | Total Cations(epm) | 11.84 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 1030 | Temperature(C) |
| pH | 7.0 | pH |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

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WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled April 12, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 71.0 | 3.54 | 75.5 |
| Magnesium(Mg) | 11.7 | 0.96 | 20.5 |
| Sodium(Na) | 3.8 | 0.17 | 3.5 |
| Potassium(K) | 0.8 | 0.02 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 181.0 | 2.97 | 74.0 |
| Sulphate(SO4) | 35.0 | 0.73 | 18.2 |
| Chloride(Cl) | 10.0 | 0.28 | 7.0 |
| Nitrate(NO3) | 2.0 | 0.03 | 0.8 |
| Silica(SiO2) | 6.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 322.0 | | |
| Total Anions(epm) | 4.01 | Total Cations(epm) | 4.69 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 362 | Temperature(C) |
| pH | 7.2 | pH |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

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WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled May 10, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 38.0 | 1.90 | 64.6 |
| Magnesium(Mg) | 9.6 | 0.79 | 26.9 |
| Sodium(Na) | 5.0 | 0.22 | 7.4 |
| Potassium(K) | 1.3 | 0.03 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 105.0 | 1.72 | 60.0 |
| Sulphate(SO4) | 28.7 | 0.60 | 20.8 |
| Chloride(Cl) | 16.0 | 0.45 | 15.7 |
| Nitrate(NO3) | 6.1 | 0.10 | 3.4 |
| Silica(SiO2) | 7.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 210.0 | | |
| Total Anions(epm) | 2.87 | Total Cations(epm) | 2.94 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 282 | Temperature(C) |
| pH | 6.6 | pH |
| Fluoride(F) | 0.0 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled June 06, 1978

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 67.0 | 3.34 | 48.1 |
| Magnesium(Mg) | 26.0 | 2.14 | 30.8 |
| Sodium(Na) | 32.5 | 1.41 | 20.3 |
| Potassium(K) | 2.1 | 0.05 | 0.8 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 339.0 | 5.56 | 79.1 |
| Sulphate(SO4) | 38.0 | 0.79 | 11.3 |
| Chloride(Cl) | 24.0 | 0.68 | 9.6 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 9.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 384.0 | | |
| Total Anions(epm) | 7.02 | Total Cations(epm) | 6.95 |

## Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 590 | |
| pH | 7.7 | |
| Fluoride(F) | 0.2 mg/l | |

Field:

| | |
|---|---|
| Temperature(C) | |
| pH | |
| Carbonate(CO3) | |
| Bicarbonate(HCO3) | |
| Hydroxide(OH) | |

6-21-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 136.0 | 6.79 | 51.9 |
| Magnesium(Mg) | 43.0 | 3.54 | 27.1 |
| Sodium(Na) | 63.0 | 2.74 | 21.0 |
| Potassium(K) | 0.4 | 0.01 | 0.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 656.0 | 10.75 | 85.8 |
| Sulphate(SO4) | 14.5 | 0.30 | 2.4 |
| Chloride(Cl) | 52.0 | 1.47 | 11.7 |
| Nitrate(NO3) | 0.8 | 0.01 | 0.1 |
| Silica(SiO2) | 10.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 122.0 | | |
| Magnesium(Acidified) | 37.0 | | |
| TDS(mg/l) | 646.0 | | |
| Total Anions(epm) | 12.53 | Total Cations(epm) | 13.08 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 905 | Temperature(C) | 8.00 | |
| pH | 7.9 | pH | 6.9 | |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 678 | mg/l |
| | | Hydroxide(OH) | | |

6-21-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled August 1, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 135.0 | 6.74 | 55.7 |
| Magnesium(Mg) | 41.0 | 3.37 | 27.9 |
| Sodium(Na) | 45.0 | 1.96 | 16.2 |
| Potassium(K) | 1.3 | 0.03 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 649.0 | 10.64 | 87.3 |
| Sulphate(SO4) | 11.7 | 0.24 | 2.0 |
| Chloride(Cl) | 46.0 | 1.30 | 10.7 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 10.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 652.0 | | |
| Total Anions(epm) | 12.18 | Total Cations(epm) | 12.10 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 950 | Temperature(C) |
| pH | 7.4 | pH |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled August 29, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 95.0 | 4.74 | 52.5 |
| Magnesium(Mg) | 35.0 | 2.88 | 31.9 |
| Sodium(Na) | 32.5 | 1.41 | 15.6 |
| Potassium(K) | 0.0 | 0.00 | 0.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 466.0 | 7.64 | 86.6 |
| Sulphate(SO4) | 21.5 | 0.45 | 5.1 |
| Chloride(Cl) | 26.0 | 0.73 | 8.3 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 12.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 412.0 | | |
| Total Anions(epm) | 8.82 | Total Cations(epm) | 9.03 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 690 | Temperature(C) |
| pH | 7.7 | pH |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled September 27, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 47.0 | 2.35 | 61.2 |
| Magnesium(Mg) | 12.5 | 1.03 | 26.9 |
| Sodium(Na) | 8.8 | 0.38 | 10.0 |
| Potassium(K) | 2.9 | 0.07 | 1.9 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 210.0 | 3.44 | 85.0 |
| Sulphate(SO4) | 26.0 | 0.54 | 13.4 |
| Chloride(Cl) | 2.0 | 0.06 | 1.4 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.2 |
| Silica(SiO2) | 8.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 230.0 | | |
| Total Anions(epm) | 4.05 | Total Cations(epm) | 3.83 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 332 | Temperature(C) |
| pH | 7.0 | pH |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled October 25, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 77.0 | 3.84 | 60.6 |
| Magnesium(Mg) | 23.0 | 1.89 | 29.9 |
| Sodium(Na) | 13.8 | 0.60 | 9.5 |
| Potassium(K) | 0.0 | 0.00 | 0.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 356.0 | 5.84 | 94.5 |
| Sulphate(SO4) | 10.9 | 0.23 | 3.7 |
| Chloride(Cl) | 4.0 | 0.11 | 1.8 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 9.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 328.0 | | |
| Total Anions(epm) | 6.18 | Total Cations(epm) | 6.34 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 520 | Temperature(C) |
| pH | 6.7 | pH |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled November 22, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 134.0 | 6.69 | 59.3 |
| Magnesium(Mg) | 40.0 | 3.29 | 29.2 |
| Sodium(Na) | 30.0 | 1.30 | 11.6 |
| Potassium(K) | 0.0 | 0.00 | 0.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 603.0 | 9.88 | 94.2 |
| Sulphate(SO4) | 4.6 | 0.10 | 0.9 |
| Chloride(Cl) | 18.0 | 0.51 | 4.8 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 10.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 580.0 | | |
| Total Anions(epm) | 10.49 | Total Cations(epm) | 11.28 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 865 | Temperature(C) |
| pH | 6.7 | pH |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled December 20, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 160.0 | 7.98 | 59.9 |
| Magnesium(Mg) | 45.0 | 3.70 | 27.8 |
| Sodium(Na) | 37.5 | 1.63 | 12.2 |
| Potassium(K) | 0.8 | 0.02 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 688.0 | 11.28 | 92.5 |
| Sulphate(SO4) | 11.1 | 0.23 | 1.9 |
| Chloride(Cl) | 24.0 | 0.68 | 5.6 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 8.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 650.0 | | |
| Total Anions(epm) | 12.18 | Total Cations(epm) | 13.34 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 970 | Temperature(C) |
| pH | 7.6 | pH |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled January 16, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 116.0 | 5.79 | 53.6 |
| Magnesium(Mg) | 41.0 | 3.37 | 31.2 |
| Sodium(Na) | 36.2 | 1.57 | 14.6 |
| Potassium(K) | 2.5 | 0.06 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 595.0 | 9.75 | 89.0 |
| Sulphate(SO4) | 8.9 | 0.19 | 1.7 |
| Chloride(Cl) | 36.0 | 1.02 | 9.3 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 7.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 600.0 | | |
| Total Anions(epm) | 10.95 | Total Cations(epm) | 10.80 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 950 | Temperature(C) | |
| pH | 7.5 | pH | |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled March 14, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 124.0 | 6.19 | 60.8 |
| Magnesium(Mg) | 35.0 | 2.88 | 28.3 |
| Sodium(Na) | 25.0 | 1.09 | 10.7 |
| Potassium(K) | 0.8 | 0.02 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 493.0 | 8.08 | 83.3 |
| Sulphate(SO4) | 15.0 | 0.31 | 3.2 |
| Chloride(Cl) | 46.0 | 1.30 | 13.4 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 6.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 558.0 | | |
| Total Anions(epm) | 9.70 | Total Cations(epm) | 10.18 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 830 | Temperature(C) |
| pH | 7.8 | pH |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled April 10, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 112.0 | 5.59 | 62.4 |
| Magnesium(Mg) | 30.0 | 2.47 | 27.6 |
| Sodium(Na) | 20.0 | 0.87 | 9.7 |
| Potassium(K) | 1.2 | 0.03 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 437.0 | 7.16 | 85.3 |
| Sulphate(SO4) | 2.1 | 0.04 | 0.5 |
| Chloride(Cl) | 42.0 | 1.18 | 14.1 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.1 |
| Silica(SiO2) | 6.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 528.0 | | |
| Total Anions(epm) | 8.40 | Total Cations(epm) | 8.96 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 800 | Temperature(C) |
| pH | 7.3 | pH |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled May 09, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 105.0 | 5.24 | 79.4 |
| Magnesium(Mg) | 3.7 | 0.30 | 4.6 |
| Sodium(Na) | 22.5 | 0.98 | 14.8 |
| Potassium(K) | 2.9 | 0.07 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 490.0 | 8.03 | 91.7 |
| Sulphate(SO4) | 10.3 | 0.21 | 2.4 |
| Chloride(Cl) | 18.0 | 0.51 | 5.8 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.1 |
| Silica(SiO2) | 6.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 512.0 | | |
| Total Anions(epm) | 8.76 | Total Cations(epm) | 6.60 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 740 | Temperature(C) | |
| pH | 7.2 | pH | |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled June 07, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 54.0 | 2.69 | 62.2 |
| Magnesium(Mg) | 15.0 | 1.23 | 28.5 |
| Sodium(Na) | 8.8 | 0.38 | 8.8 |
| Potassium(K) | 0.8 | 0.02 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 256.0 | 4.20 | 92.0 |
| Sulphate(SO4) | 12.0 | 0.25 | 5.5 |
| Chloride(Cl) | 4.0 | 0.11 | 2.5 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.1 |
| Silica(SiO2) | 6.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 314.0 | | |
| Total Anions(epm) | 4.56 | Total Cations(epm) | 4.33 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 367 | Temperature(C) |
| pH | 6.8 | pH |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 6, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 73.0 | 3.64 | 44.3 |
| Magnesium(Mg) | 36.0 | 2.96 | 36.0 |
| Sodium(Na) | 36.3 | 1.58 | 19.2 |
| Potassium(K) | 1.7 | 0.04 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 449.0 | 7.36 | 87.5 |
| Sulphate(SO4) | 16.3 | 0.34 | 4.0 |
| Chloride(Cl) | 24.0 | 0.68 | 8.1 |
| Nitrate(NO3) | 1.9 | 0.03 | 0.4 |
| Silica(SiO2) | 9.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 105.0 | | |
| Magnesium(Acidified) | 37.0 | | |
| TDS(mg/l) | 472.0 | | |
| Total Anions(epm) | 8.41 | Total Cations(epm) | 8.23 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 590 | Temperature(C) | 6.00 | |
| pH | 8.0 | pH | 6.8 | |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 659 | mg/l |
| | | Hydroxide(OH) | | |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled August 3, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 124.0 | 6.19 | 57.5 |
| Magnesium(Mg) | 39.0 | 3.21 | 29.8 |
| Sodium(Na) | 30.0 | 1.30 | 12.1 |
| Potassium(K) | 2.1 | 0.05 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 608.0 | 9.97 | 90.5 |
| Sulphate(SO4) | 12.0 | 0.25 | 2.3 |
| Chloride(Cl) | 28.0 | 0.79 | 7.2 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.1 |
| Silica(SiO2) | 9.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 0.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 612.0 | | |
| Total Anions(epm) | 11.01 | Total Cations(epm) | 10.76 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 815 | Temperature(C) | |
| pH | 7.4 | pH | |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled August 29, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 121.0 | 6.04 | 57.6 |
| Magnesium(Mg) | 40.0 | 3.29 | 31.4 |
| Sodium(Na) | 26.3 | 1.14 | 10.9 |
| Potassium(K) | 0.0 | 0.00 | 0.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 583.0 | 9.56 | 91.6 |
| Sulphate(SO4) | 14.3 | 0.30 | 2.9 |
| Chloride(Cl) | 20.0 | 0.56 | 5.4 |
| Nitrate(NO3) | 0.6 | 0.01 | 0.1 |
| Silica(SiO2) | 9.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 554.0 | | |
| Total Anions(epm) | 10.43 | Total Cations(epm) | 10.47 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 770 | Temperature(C) | |
| pH | 8.1 | pH | |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled September 25, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 102.0 | 5.09 | 56.5 |
| Magnesium(Mg) | 34.0 | 2.80 | 31.1 |
| Sodium(Na) | 25.0 | 1.09 | 12.1 |
| Potassium(K) | 1.3 | 0.03 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 549.0 | 9.00 | 90.8 |
| Sulphate(SO4) | 13.8 | 0.29 | 2.9 |
| Chloride(Cl) | 22.0 | 0.62 | 6.3 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 10.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 0.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 542.0 | | |
| Total Anions(epm) | 9.91 | Total Cations(epm) | 9.01 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 745 | Temperature(C) |
| pH | 7.2 | pH |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled October 24, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 102.0 | 5.09 | 53.8 |
| Magnesium(Mg) | 39.0 | 3.21 | 33.9 |
| Sodium(Na) | 26.3 | 1.14 | 12.1 |
| Potassium(K) | 0.8 | 0.02 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 549.0 | 9.00 | 92.8 |
| Sulphate(SO4) | 14.5 | 0.30 | 3.1 |
| Chloride(Cl) | 14.0 | 0.39 | 4.1 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.1 |
| Silica(SiO2) | 10.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 522.0 | | |
| Total Anions(epm) | 9.70 | Total Cations(epm) | 9.46 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 745 | Temperature(C) |
| pH | 7.0 | pH |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled November 21, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 109.0 | 5.44 | 54.9 |
| Magnesium(Mg) | 37.0 | 3.05 | 30.8 |
| Sodium(Na) | 31.3 | 1.36 | 13.8 |
| Potassium(K) | 2.1 | 0.05 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 608.0 | 9.97 | 94.6 |
| Sulphate(SO4) | 10.4 | 0.22 | 2.1 |
| Chloride(Cl) | 12.0 | 0.34 | 3.2 |
| Nitrate(NO3) | 0.6 | 0.01 | 0.1 |
| Silica(SiO2) | 11.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 398.0 | | |
| Total Anions(epm) | 10.53 | Total Cations(epm) | 9.90 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 830 | Temperature(C) | |
| pH | 7.1 | pH | |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

6-21-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled December 19, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 106.0 | 5.29 | 54.9 |
| Magnesium(Mg) | 38.0 | 3.13 | 32.5 |
| Sodium(Na) | 27.5 | 1.20 | 12.4 |
| Potassium(K) | 0.8 | 0.02 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 559.0 | 9.16 | 94.7 |
| Sulphate(SO4) | 10.8 | 0.22 | 2.3 |
| Chloride(Cl) | 10.0 | 0.28 | 2.9 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 7.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 576.0 | | |
| Total Anions(epm) | 9.68 | Total Cations(epm) | 9.63 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 730 | Temperature(C) | |
| pH | 7.0 | pH | |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled January 17, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 117.0 | 5.85 | 60.8 |
| Magnesium(Mg) | 33.0 | 2.75 | 28.6 |
| Sodium(Na) | 22.5 | 0.98 | 10.2 |
| Potassium(K) | 1.7 | 0.04 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 544.0 | 8.92 | 93.7 |
| Sulphate(SO4) | 9.4 | 0.20 | 2.1 |
| Chloride(Cl) | 14.0 | 0.39 | 4.1 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.1 |
| Silica(SiO2) | 7.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 372.0 | | |
| Total Anions(epm) | 9.51 | Total Cations(epm) | 9.62 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 790 | Temperature | -1.00 |
| pH | 7.1 | pH | -1.0 |
| Fluoride | 0.6 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled February 13, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 86.0 | 4.30 | 54.4 |
| Magnesium(Mg) | 28.0 | 2.33 | 29.5 |
| Sodium(Na) | 28.8 | 1.25 | 15.8 |
| Potassium(K) | 0.8 | 0.02 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 525.0 | 8.61 | 89.5 |
| Sulphate(SO4) | 13.0 | 0.27 | 2.8 |
| Chloride(Cl) | 26.0 | 0.73 | 7.6 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.1 |
| Silica(SiO2) | 6.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 500.0 | | |
| Total Anions(epm) | 9.61 | Total Cations(epm) | 7.91 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 735 | Temperature | -1.00 |
| pH | 7.8 | pH | -1.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled March 11, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 100.0 | 5.00 | 63.2 |
| Magnesium(Mg) | 21.0 | 1.75 | 22.1 |
| Sodium(Na) | 26.3 | 1.14 | 14.4 |
| Potassium(K) | 0.8 | 0.02 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 612.0 | 10.03 | 91.7 |
| Sulphate(SO4) | 8.0 | 0.17 | 1.5 |
| Chloride(Cl) | 26.0 | 0.73 | 6.7 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 8.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 476.0 | | |
| Total Anions(epm) | 10.94 | Total Cations(epm) | 7.91 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 720 | Temperature | -1.00 |
| pH | 7.4 | pH | -1.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled April 9, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 103.0 | 5.15 | 64.7 |
| Magnesium(Mg) | 24.0 | 2.00 | 25.1 |
| Sodium(Na) | 17.5 | 0.76 | 9.6 |
| Potassium(K) | 2.1 | 0.05 | 0.7 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 447.0 | 7.33 | 91.2 |
| Sulphate(SO4) | 9.5 | 0.20 | 2.5 |
| Chloride(Cl) | 18.0 | 0.51 | 6.3 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.1 |
| Silica(SiO2) | 7.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 406.0 | | |
| Total Anions(epm) | 8.04 | Total Cations(epm) | 7.96 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 710 | Temperature | -1.00 |
| pH | 7.0 | pH | -1.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled May 7, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 76.0 | 3.80 | 63.5 |
| Magnesium(Mg) | 19.0 | 1.58 | 26.5 |
| Sodium(Na) | 13.8 | 0.60 | 10.0 |
| Potassium(K) | 0.0 | 0.0 | 0.0 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 320.0 | 5.25 | 86.0 |
| Sulphate(SO4) | 32.0 | 0.67 | 10.9 |
| Chloride(Cl) | 6.0 | 0.17 | 2.8 |
| Nitrate(NO3) | 1.3 | 0.02 | 0.3 |
| Silica(SiO2) | 9.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 326.0 | | |
| Total Anions(epm) | 6.10 | Total Cations(epm) | 5.98 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 493 | Temperature | -1.00 |
| pH | 7.4 | pH | -1.0 |
| Fluoride | 0.1 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled June 4, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 87.0 | 4.35 | 58.0 |
| Magnesium(Mg) | 27.0 | 2.25 | 30.0 |
| Sodium(Na) | 20.0 | 0.87 | 11.6 |
| Potassium(K) | 1.3 | 0.03 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 432.0 | 7.08 | 90.3 |
| Sulphate(SO4) | 28.0 | 0.58 | 7.4 |
| Chloride(Cl) | 6.0 | 0.17 | 2.2 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.1 |
| Silica(SiO2) | 4.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 364.0 | | |
| Total Anions(epm) | 7.84 | Total Cations(epm) | 7.50 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 640 | Temperature | -1.00 |
| pH | 7.7 | pH | -1.0 |
| Fluoride | 0.5 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 6-21-E-82

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 80.0 | 4.00 | 47.5 |
| Magnesium(Mg) | 34.9 | 2.91 | 34.6 |
| Sodium(Na) | 33.0 | 1.43 | 17.0 |
| Potassium(K) | 2.9 | 0.07 | 0.9 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 388.0 | 6.36 | 89.6 |
| Sulphate(SO4) | 12.0 | 0.25 | 3.5 |
| Chloride(Cl) | 17.0 | 0.48 | 6.7 |
| Nitrate(NO3) | 0.6 | 0.01 | 0.1 |
| Silica(SiO2) | 5.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 84.0 | | |
| Magnesium(Acidified) | 29.6 | | |
| TDS(mg/l) | 377.0 | | |
| Total Anions(epm) | 7.10 | Total Cations(epm) | 8.42 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 640 |
| pH | 8.1 |
| Fluoride | 0.2 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 7.00 | |
| pH | 7.0 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 537 | mg/l |
| Hydroxide(OH) | | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 190.0 | 9.50 | 70.8 |
| Magnesium(Mg) | 34.0 | 2.83 | 21.1 |
| Sodium(Na) | 21.3 | 0.93 | 6.9 |
| Potassium(K) | 6.3 | 0.16 | 1.2 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 547.0 | 8.97 | 93.9 |
| Sulphate(SO4) | 10.0 | 0.21 | 2.2 |
| Chloride(Cl) | 13.0 | 0.37 | 3.8 |
| Nitrate(NO3) | 0.6 | 0.01 | 0.1 |
| Silica(SiO2) | 8.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 539.0 | | |
| Total Anions(epm) | 9.55 | Total Cations(epm) | 13.42 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 910 | Temperature | 0.0 |
| pH | 8.3 | pH | 0.0 |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled August 27, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 16.0 | 0.80 | 11.3 |
| Magnesium(Mg) | 63.0 | 5.25 | 74.5 |
| Sodium(Na) | 22.5 | 0.98 | 13.9 |
| Potassium(K) | 0.8 | 0.02 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 383.0 | 6.28 | 91.8 |
| Sulphate(SO4) | 17.0 | 0.35 | 5.2 |
| Chloride(Cl) | 7.0 | 0.20 | 2.9 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 9.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 394.0 | | |
| Total Anions(epm) | 6.84 | Total Cations(epm) | 7.05 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 740 | Temperature | 0.0 |
| pH | 8.3 | pH | 0.0 |
| Fluoride | 0.1 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled September 24, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 127.0 | 6.35 | 63.1 |
| Magnesium(Mg) | 37.2 | 3.10 | 30.8 |
| Sodium(Na) | 13.8 | 0.60 | 6.0 |
| Potassium(K) | 0.8 | 0.02 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 303.0 | 4.97 | 70.2 |
| Sulphate(SO4) | 20.0 | 0.42 | 5.9 |
| Chloride(Cl) | 60.0 | 1.69 | 23.9 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 8.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 283.0 | | |
| Total Anions(epm) | 7.08 | Total Cations(epm) | 10.07 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 465 |
| pH | 8.2 |
| Fluoride | 0.1 mg/l |

Field:

| | |
|---|---|
| Temperature | 0.0 |
| pH | 0.0 |
| Carbonate(CO3) | |
| Bicarbonate(HCO3) | |
| Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled October 21, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 144.0 | 7.20 | 54.8 |
| Magnesium(Mg) | 62.0 | 5.17 | 39.3 |
| Sodium(Na) | 17.5 | 0.76 | 5.8 |
| Potassium(K) | 0.8 | 0.02 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 407.0 | 6.67 | 93.9 |
| Sulphate(SO4) | 17.0 | 0.35 | 5.0 |
| Chloride(Cl) | 2.8 | 0.08 | 1.1 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 9.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 349.0 | | |
| Total Anions(epm) | 7.11 | Total Cations(epm) | 13.15 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 680 | Temperature | 0.0 |
| pH | 8.2 | pH | 0.0 |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled November 18, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 65.0 | 3.25 | 32.5 |
| Magnesium(Mg) | 65.0 | 5.42 | 54.1 |
| Sodium(Na) | 30.0 | 1.30 | 13.0 |
| Potassium(K) | 1.7 | 0.04 | 0.4 |
| Carbonate(CO3) | 4.8 | 0.16 | 2.7 |
| Bicarbonate(HCO3) | 322.0 | 5.28 | 90.4 |
| Sulphate(SO4) | 11.0 | 0.23 | 3.9 |
| Chloride(Cl) | 6.1 | 0.17 | 2.9 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 7.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 314.0 | | |
| Total Anions(epm) | 5.84 | Total Cations(epm) | 10.01 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 625 | Temperature | 0.0 |
| pH | 8.4 | pH | 0.0 |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled January 16, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 25.4 | 1.27 | 25.9 |
| Magnesium(Mg) | 32.2 | 2.68 | 54.6 |
| Sodium(Na) | 21.3 | 0.93 | 18.9 |
| Potassium(K) | 1.3 | 0.03 | 0.7 |
| Carbonate(CO3) | 0.2 | 0.01 | 0.1 |
| Bicarbonate(HCO3) | 254.0 | 4.16 | 79.6 |
| Sulphate(SO4) | 20.5 | 0.43 | 8.2 |
| Chloride(Cl) | 22.0 | 0.62 | 11.8 |
| Nitrate(NO3) | 0.8 | 0.01 | 0.2 |
| Silica(SiO2) | 3.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 286.0 | | |
| Total Anions(epm) | 5.23 | Total Cations(epm) | 4.91 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 440 | Temperature | -1.00 |
| pH | 8.4 | pH | -1.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 95 Twp 9 W4th

Alberta Research Council

Sample Source Bailed

Date sampled March 11, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 100.0 | 5.00 | 60.1 |
| Magnesium(Mg) | 29.8 | 2.48 | 29.8 |
| Sodium(Na) | 18.8 | 0.82 | 9.8 |
| Potassium(K) | 0.8 | 0.02 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 481.0 | 7.89 | 91.5 |
| Sulphate(SO4) | 13.0 | 0.27 | 3.1 |
| Chloride(Cl) | 16.0 | 0.45 | 5.2 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 7.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 449.0 | | |
| Total Anions(epm) | 8.61 | Total Cations(epm) | 8.32 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 770 | Temperature | -1.00 |
| pH | 7.6 | pH | -1.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled May 5, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 110.0 | 5.50 | 57.0 |
| Magnesium(Mg) | 36.9 | 3.07 | 31.9 |
| Sodium(Na) | 23.8 | 1.03 | 10.7 |
| Potassium(K) | 1.7 | 0.04 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 559.0 | 9.16 | 91.0 |
| Sulphate(SO4) | 25.8 | 0.54 | 5.3 |
| Chloride(Cl) | 13.0 | 0.37 | 3.6 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.1 |
| Silica(SiO2) | 1.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 602.0 | | |
| Total Anions(epm) | 10.07 | Total Cations(epm) | 9.65 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 840 | Temperature | -1.00 |
| pH | 7.7 | pH | -1.0 |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 110.0 | 5.50 | 59.2 |
| Magnesium(Mg) | 34.8 | 2.90 | 31.2 |
| Sodium(Na) | 20.0 | 0.87 | 9.4 |
| Potassium(K) | 1.0 | 0.03 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 549.0 | 9.00 | 92.3 |
| Sulphate(SO4) | 33.0 | 0.69 | 7.1 |
| Chloride(Cl) | 2.0 | 0.06 | 0.6 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 6.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 387.0 | | |
| Total Anions(epm) | 9.75 | Total Cations(epm) | 9.30 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 795 | Temperature | 0.0 |
| pH | 7.3 | pH | 0.0 |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 29, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 102.0 | 5.10 | 58.2 |
| Magnesium(Mg) | 32.8 | 2.73 | 31.2 |
| Sodium(Na) | 20.1 | 0.87 | 10.0 |
| Potassium(K) | 1.9 | 0.05 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 554.0 | 9.08 | 94.8 |
| Sulphate(SO4) | 10.3 | 0.21 | 2.2 |
| Chloride(Cl) | 10.0 | 0.28 | 2.9 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 8.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 446.0 | | |
| Total Anions(epm) | 9.58 | Total Cations(epm) | 8.76 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 750 | Temperature | 0.0 |
| pH | 8.1 | pH | 0.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled August 26, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 27.1 | 1.35 | 14.7 |
| Magnesium(Mg) | 15.0 | 1.25 | 13.5 |
| Sodium(Na) | 150.0 | 6.52 | 70.5 |
| Potassium(K) | 4.6 | 0.12 | 1.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 476.0 | 7.80 | 92.0 |
| Sulphate(SO4) | 5.0 | 0.10 | 1.2 |
| Chloride(Cl) | 20.2 | 0.57 | 6.7 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.1 |
| Silica(SiO2) | 1.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 580.0 | | |
| Total Anions(epm) | 8.48 | Total Cations(epm) | 9.24 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 724 | Temperature | 0.0 |
| pH | 8.1 | pH | 0.0 |
| Fluoride | 0.7 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 6-21-E-82

OBSERVATION WELL NUMBER ARC 6-21

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled September 23, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 106.0 | 5.30 | 58.7 |
| Magnesium(Mg) | 33.7 | 2.81 | 31.1 |
| Sodium(Na) | 20.0 | 0.87 | 9.6 |
| Potassium(K) | 2.1 | 0.05 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 522.0 | 8.56 | 96.1 |
| Sulphate(SO4) | 7.2 | 0.15 | 1.7 |
| Chloride(Cl) | 6.6 | 0.19 | 2.1 |
| Nitrate(NO3) | 0.7 | 0.01 | 0.1 |
| Silica(SiO2) | 8.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 420.0 | | |
| Total Anions(epm) | 8.90 | Total Cations(epm) | 9.03 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 740 | Temperature | 0.0 |
| pH | 7.7 | pH | 0.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

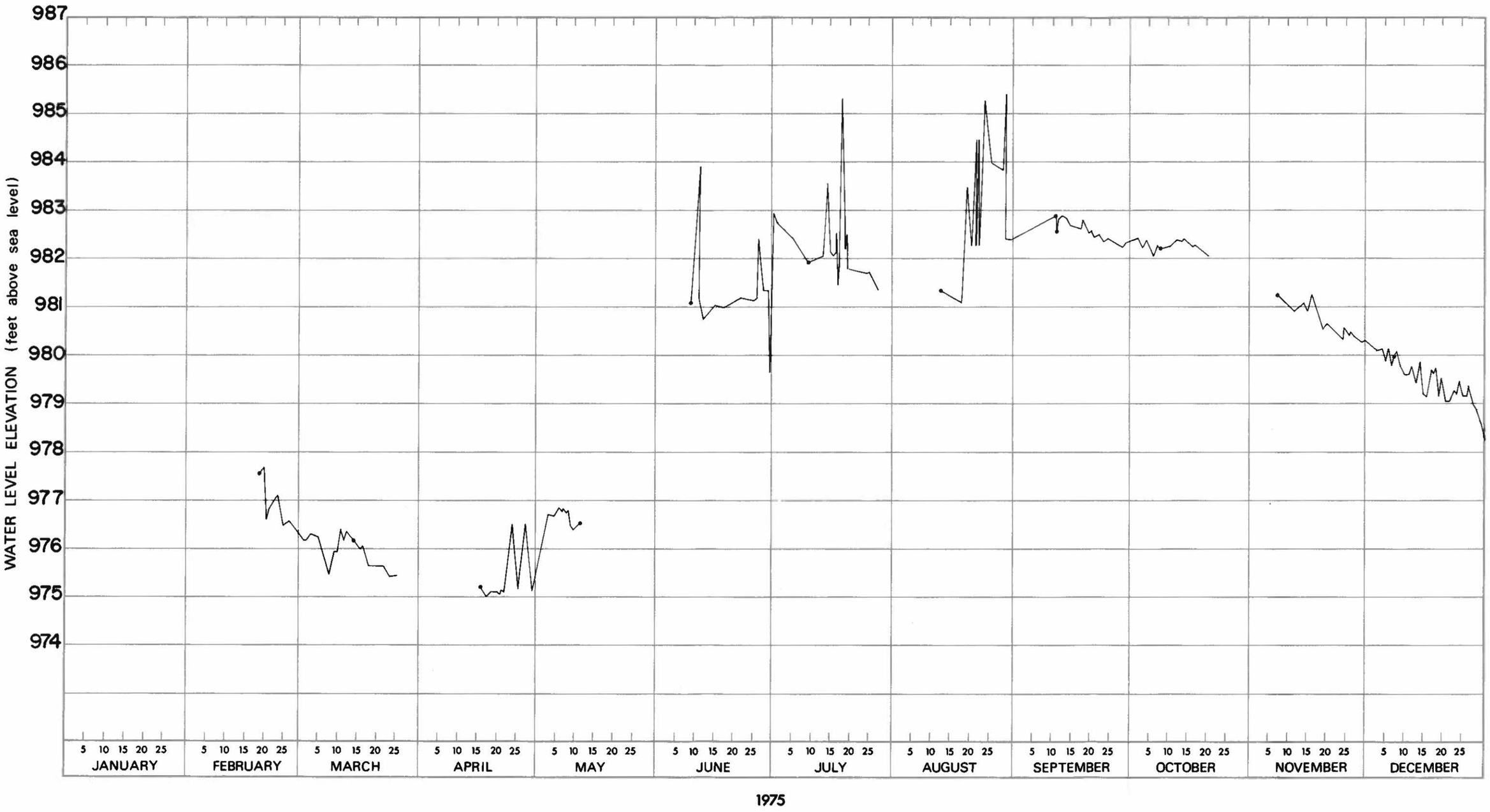
6-21-H-76

**WATER LEVEL HYDROGRAPH**

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council



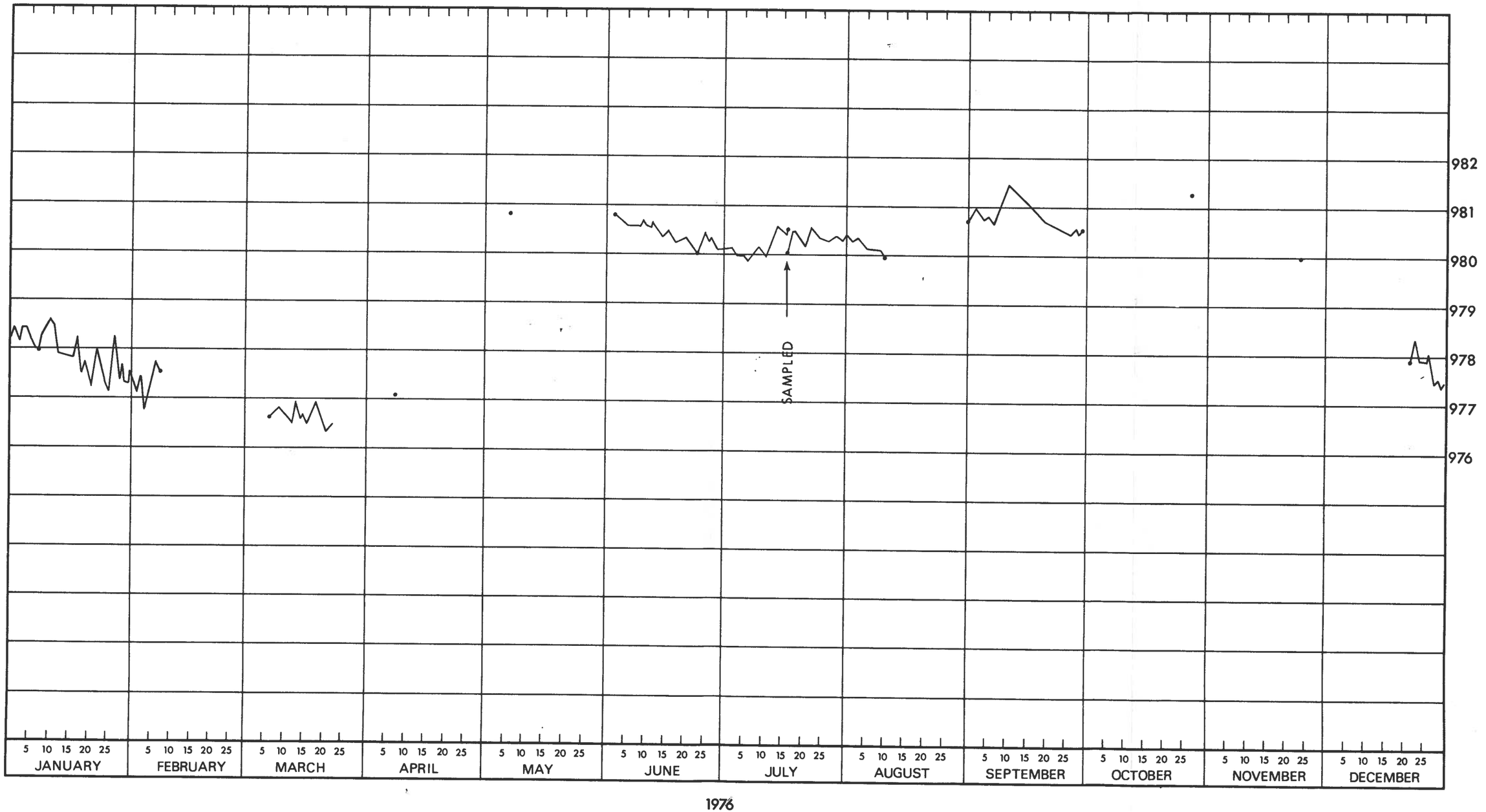
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **6-21**

Lsd **2** Sec **18** Twp **95** R **9** W4th

Alberta Research Council

**6 - 21 - H - 77**

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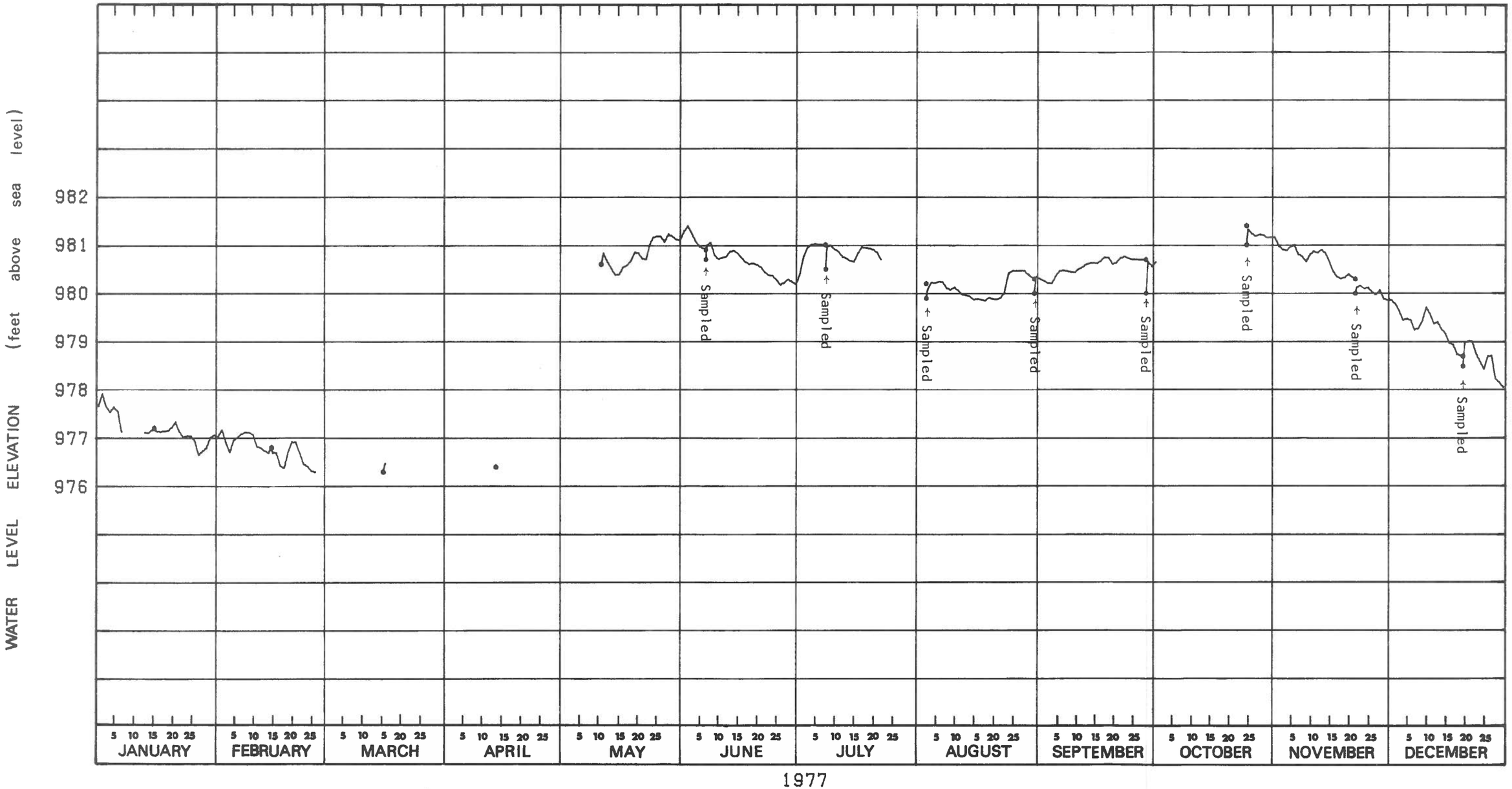
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council

6-21-H-78



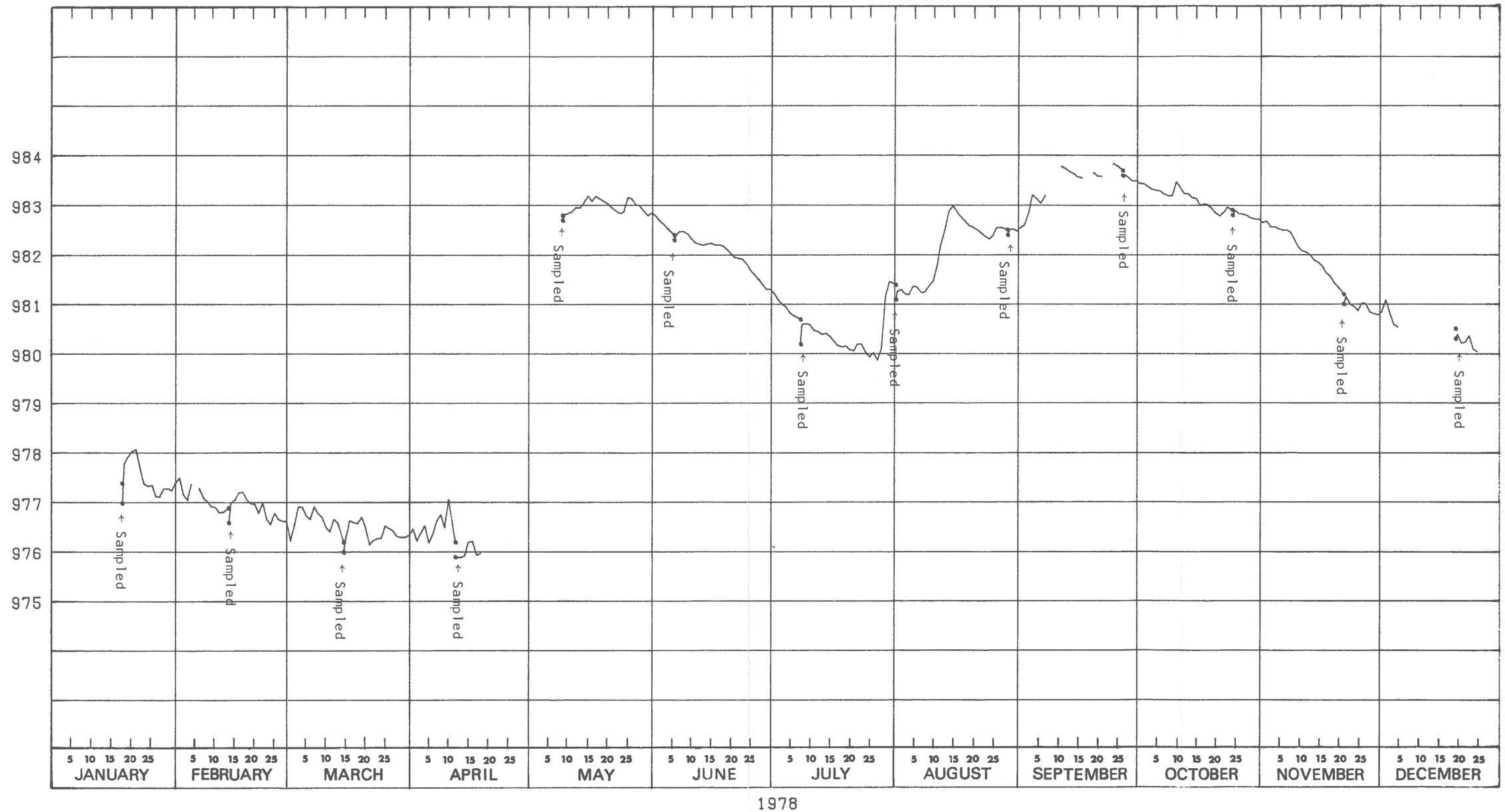
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-21

LSD 2 SEC 18 TWP 95 R 9 W4TH

6-21-H-79

Alberta Research Council



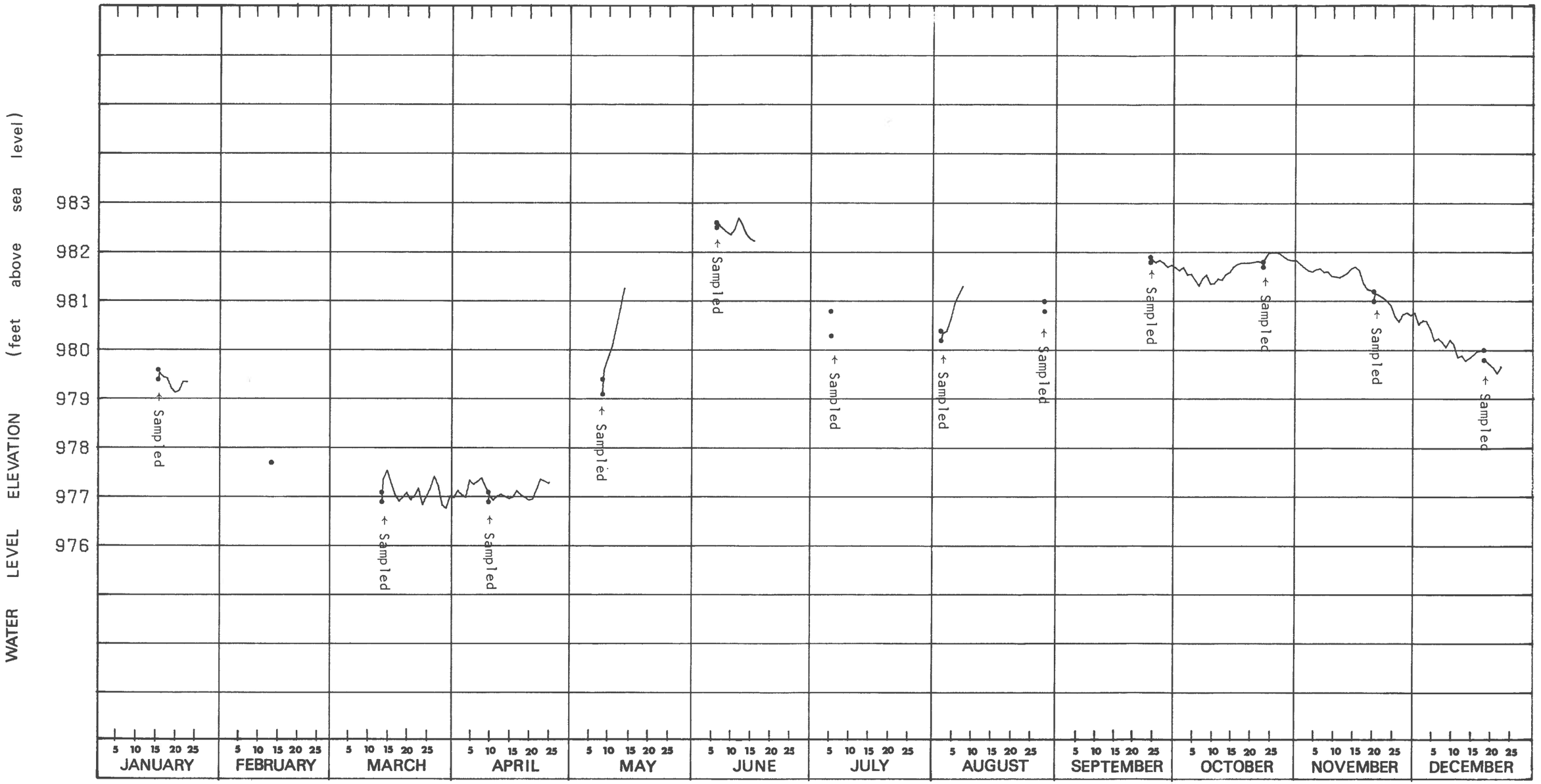
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council

6-21-H-80



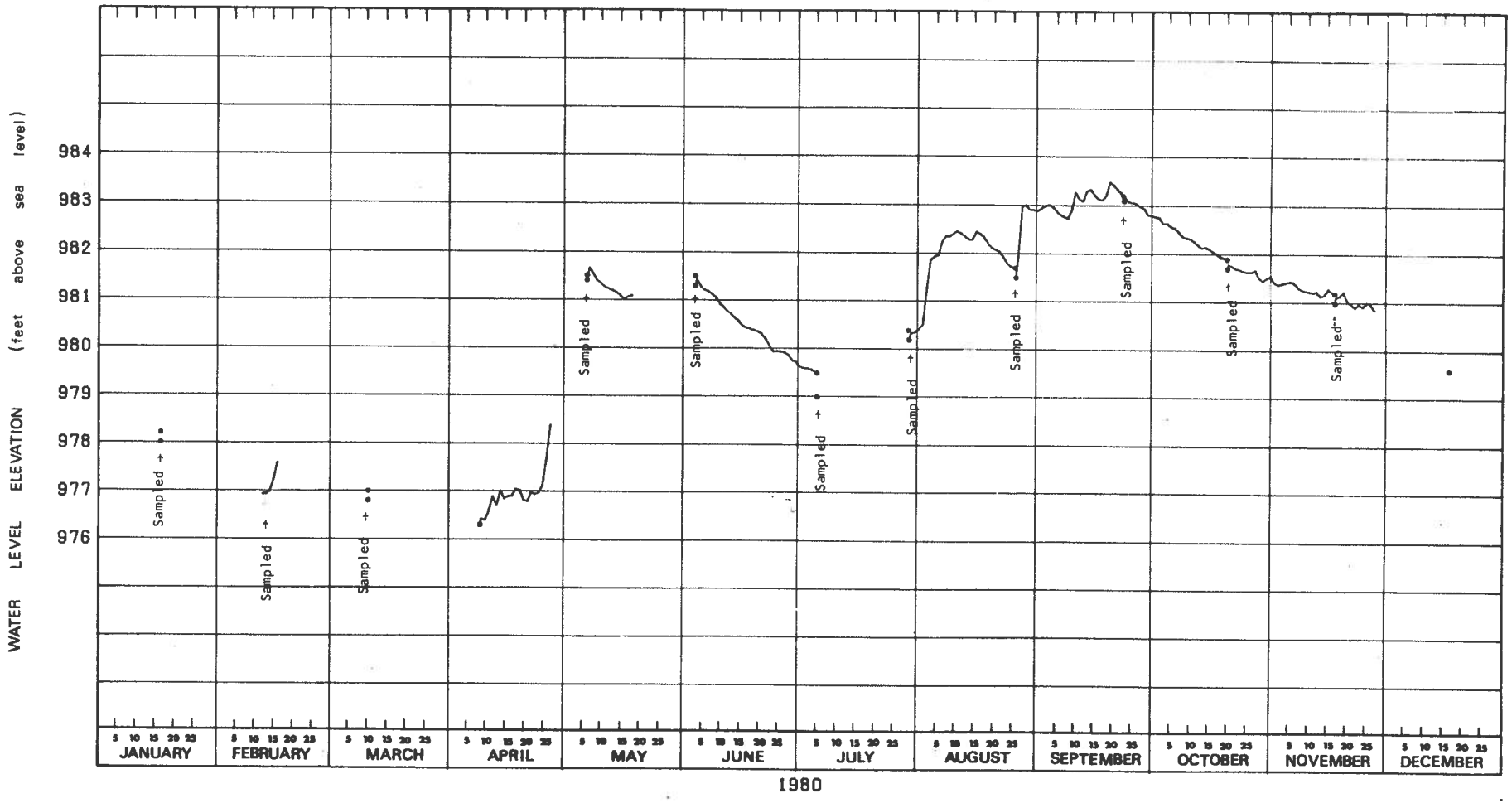
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council

6-21-H-81



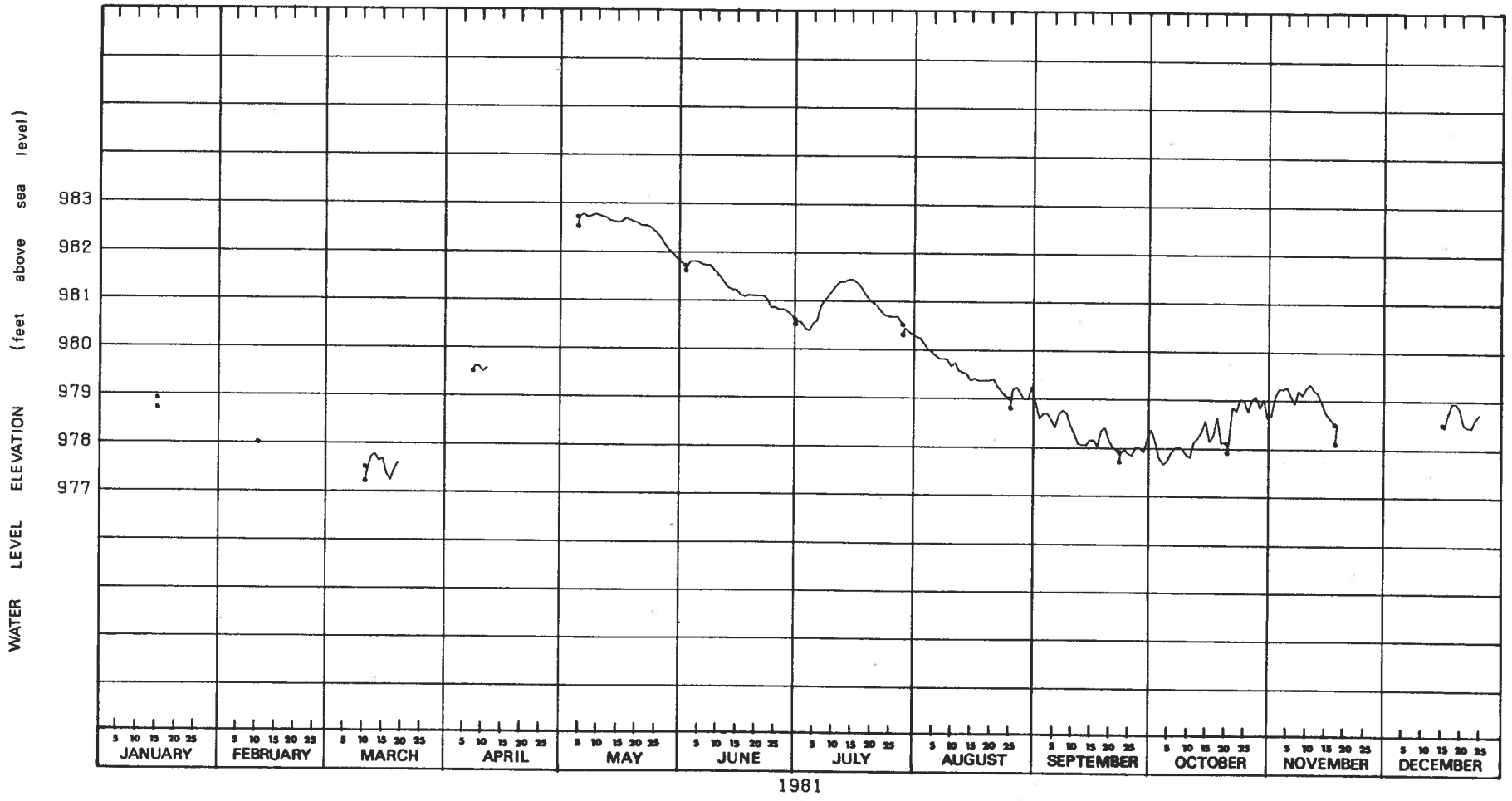
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council

6-21-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 986.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 6/75 | | | Well completed |
| Feb 9/75 | 1.89 TOC | 980.02 | |
| Feb 18/75 | 2.62 TOC | 977.95 | Water sample |
| Feb 19/75 | 3.49 MP | 978.07 | Install shelter and recorder; MP = 3.21' TOC, (989.52) |
| Mar 14/75 | 3.90 MP | 976.72 | |
| Apr 16/75 | 4.20 MP | 975.75 | |
| May 12/75 | 3.79 old MP | 977.10 | New MP = 31" TOC, (988.89) |
| June 9/75 | 2.39 MP | 981.05 | |
| July 9/75 | 2.14 MP | 981.87 | |
| Aug 13/75 | 2.30 MP | 980.97 | |
| Sept 11/75 | 1.84 MP | 982.85 | Well sampled; temp. 11°C |
| | 1.93 MP | 982.55 | after sample |
| Oct 7/75 | 2.04 MP | 981.82 | |
| Nov 7/75 | 2.34 MP | 981.21 | |
| Dec 7/75 | 2.72 MP | 979.97 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 986.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 3.32 MP | 978.0 | MP (988.9) |
| Feb 7/76 | 3.45 MP | 977.6 | |
| Mar 6/76 | 3.73 MP | 976.7 | |
| Apr 7/76 | 3.59 MP | 977.1 | |
| May 6/76 | 2.45 MP | 980.9 | |
| June 2/76 | 2.46 MP | 980.8 | |
| June 23/76 | 2.70 MP | 980.0 | |
| July 16/76 | 2.54 MP | 980.6 | |
| | 2.69 MP | 980.1 | After sample; temp. 11°C |
| Aug 10/76 | 2.72 MP | 980.0 | |
| Aug 31/76 | 2.49 MP | 980.7 | |
| Sept 29/76 | 2.54 MP | 980.6 | |
| Oct 27/76 | 2.31 MP | 981.3 | |
| Nov 24/76 | 2.72 MP | 980.0 | |
| Dec 22/76 | 3.36 MP | 977.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 986.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 3.58 MP | 977.2 | MP (988.9) |
| Feb 15/77 | 3.70 MP | 976.8 | |
| Mar 16/77 | 3.85 MP | 976.3 | |
| Apr 14/77 | 3.80 MP | 976.4 | |
| May 11/77 | 2.54 MP | 980.6 | |
| June 7/77 | 2.43 MP | 980.9 | |
| | 2.51 MP | 980.7 | After sample |
| July 8/77 | 2.42 MP | 981.0 | |
| | 2.57 MP | 980.5 | After sample; temp. 10°C |
| Aug 3/77 | 2.65 MP | 980.2 | |
| | 2.75 MP | 979.9 | After sample |
| Aug 31/77 | 2.62 MP | 980.3 | |
| | 2.72 MP | 980.0 | After sample |
| Sept 29/77 | 2.50 MP | 980.7 | |
| | 2.71 MP | 980.0 | After sample |
| Oct 25/77 | 2.30 MP | 981.4 | |
| | 2.41 MP | 981.0 | After sample |
| Nov 22/77 | 2.62 MP | 980.3 | |
| | 2.70 MP | 980.0 | After sample |
| Dec 20/77 | 3.10 MP | 978.7 | |
| | 3.16 MP | 978.5 | After sample |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 986.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 3.49 MP | 977.4 | MP (988.9) |
| | 3.63 MP | 977.0 | After sample |
| Feb 14/78 | 3.66 MP | 976.9 | |
| | 3.76 MP | 976.6 | After sample |
| Mar 15/78 | 3.86 MP | 976.2 | |
| | 3.93 MP | 976.0 | After sample; float resting on top of screen |
| Apr 12/78 | 3.86 MP | 976.2 | |
| | 3.95 MP | 975.9 | After sample |
| May 9/78 | 1.85 MP | 982.8 | |
| | 1.89 MP | 982.7 | After sample |
| June 6/78 | 1.98 MP | 982.4 | |
| | 2.02 MP | 982.3 | After sample |
| July 8/78 | 2.51 MP | 980.7 | |
| | 2.65 MP | 980.2 | After sample; temp. 8°C |
| Aug 1/78 | 2.30 MP | 981.4 | |
| | 2.37 MP | 981.1 | After sample |
| Aug 29/78 | 1.96 MP | 982.5 | |
| | 1.99 MP | 982.4 | After sample |
| Sept 27/78 | 1.59 MP | 983.7 | |
| | 1.61 MP | 983.6 | After sample |
| Oct 25/78 | 1.83 MP | 982.9 | |
| | 1.86 MP | 982.8 | After sample |
| Nov 22/78 | 2.35 MP | 981.2 | |
| | 2.40 MP | 981.0 | After sample |
| Dec 20/78 | 2.56 MP | 980.5 | |
| | 2.61 MP | 980.3 | After sample |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 986.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 2.83 MP | 979.6 | MP (988.9) |
| | 2.90 MP | 979.4 | After sample |
| Feb 14/79 | 3.41 MP | 977.7 | |
| Mar 14/79 | 3.59 MP | 977.1 | |
| | 3.65 MP | 976.9 | After sample |
| Apr 10/79 | 3.60 MP | 977.1 | |
| | 3.67 MP | 976.9 | After sample |
| May 9/79 | 2.90 MP | 979.4 | |
| | 2.98 MP | 979.1 | After sample |
| June 7/79 | 1.91 MP | 982.6 | |
| | 1.94 MP | 982.5 | After sample |
| July 6/79 | 2.47 MP | 980.8 | |
| | 2.61 MP | 980.3 | After sample; temp. 6°C |
| Aug 3/79 | 2.58 MP | 980.4 | |
| | 2.65 MP | 980.2 | After sample |
| Aug 29/79 | 2.41 MP | 981.0 | |
| | 2.46 MP | 980.8 | After sample |
| Sept 25/79 | 2.12 MP | 981.9 | |
| | 2.16 MP | 981.8 | After sample |
| Oct 24/79 | 2.16 MP | 981.8 | |
| | 2.20 MP | 981.7 | After sample |
| Nov 21/79 | 2.36 MP | 981.2 | |
| | 2.41 MP | 981.0 | After sample |
| Dec 19/79 | 2.72 MP | 980.0 | |
| | 2.78 MP | 979.8 | After sample |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 986.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 3.27 MP | 978.2 | |
| | 3.33 MP | 978.0 | After Sample |
| Feb 13/80 | 3.65 MP | 976.9 | |
| | 3.73 MP | 976.7 | After Sample |
| Mar 11/80 | 3.63 MP | 977.0 | |
| | 3.69 MP | 976.8 | After Sample |
| Apr 9/80 | 3.85 MP | 976.3 | |
| | 3.85 MP | 976.3 | After Sample |
| May 7/80 | 2.24 MP | 981.5 | |
| | 2.30 MP | 981.4 | After Sample |
| June 4/80 | 2.26 MP | 981.5 | |
| | 2.31 MP | 981.3 | After Sample |
| July 6/80 | 2.86 MP | 979.5 | Temp. 7°C |
| | 3.02 MP | 979.0 | After Sample |
| July 30/80 | 2.60 MP | 980.4 | |
| | 2.66 MP | 980.2 | After Sample |
| Aug 27/80 | 2.20 MP | 981.7 | |
| | 2.24 MP | 981.5 | After Sample |
| Sept 24/80 | 1.75 MP | 983.2 | |
| | 1.77 MP | 983.1 | After Sample |
| Oct 21/80 | 2.12 MP | 981.9 | |
| | 2.18 MP | 981.7 | After Sample |
| Nov 18/80 | 2.35 MP | 981.2 | |
| | 2.40 MP | 981.0 | After Sample |
| Dec 18/80 | 2.83 MP | 979.6 | |
| Jan 16/81 | 3.05 MP | 978.9 | |
| | 3.12 MP | 978.7 | After Sample |
| Feb 11/81 | 3.31 MP | 978.0 | |
| Mar 11/81 | 3.49 MP | 977.5 | |
| | 3.57 MP | 977.2 | After Sample |
| Apr 8/81 | 2.86 MP | 979.5 | |
| May 5/81 | 1.90 MP | 982.7 | |
| | 1.96 MP | 982.5 | After Sample |
| June 2/81 | 2.19 MP | 981.7 | |
| | 2.24 MP | 981.6 | After Sample |
| July 1/81 | 2.53 MP | 980.6 | |
| | 2.57 MP | 980.5 | After Sample |
| July 29/81 | 2.56 MP | 980.5 | |
| | 2.61 MP | 980.3 | After Sample |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 986.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Aug 26/81 | 3.01 MP | 979.0 | |
| | 3.09 MP | 978.8 | After Sample |
| Sept 23/81 | 3.36 MP | 977.9 | |
| | 3.41 MP | 977.7 | After Sample |
| Oct 21/81 | 3.30 MP | 978.1 | |
| | 3.36 MP | 977.9 | After Sample |
| Nov 18/81 | 3.16 MP | 978.5 | |
| | 3.30 MP | 978.1 | After Sample |
| Dec 16/81 | 3.17 MP | 978.5 | |

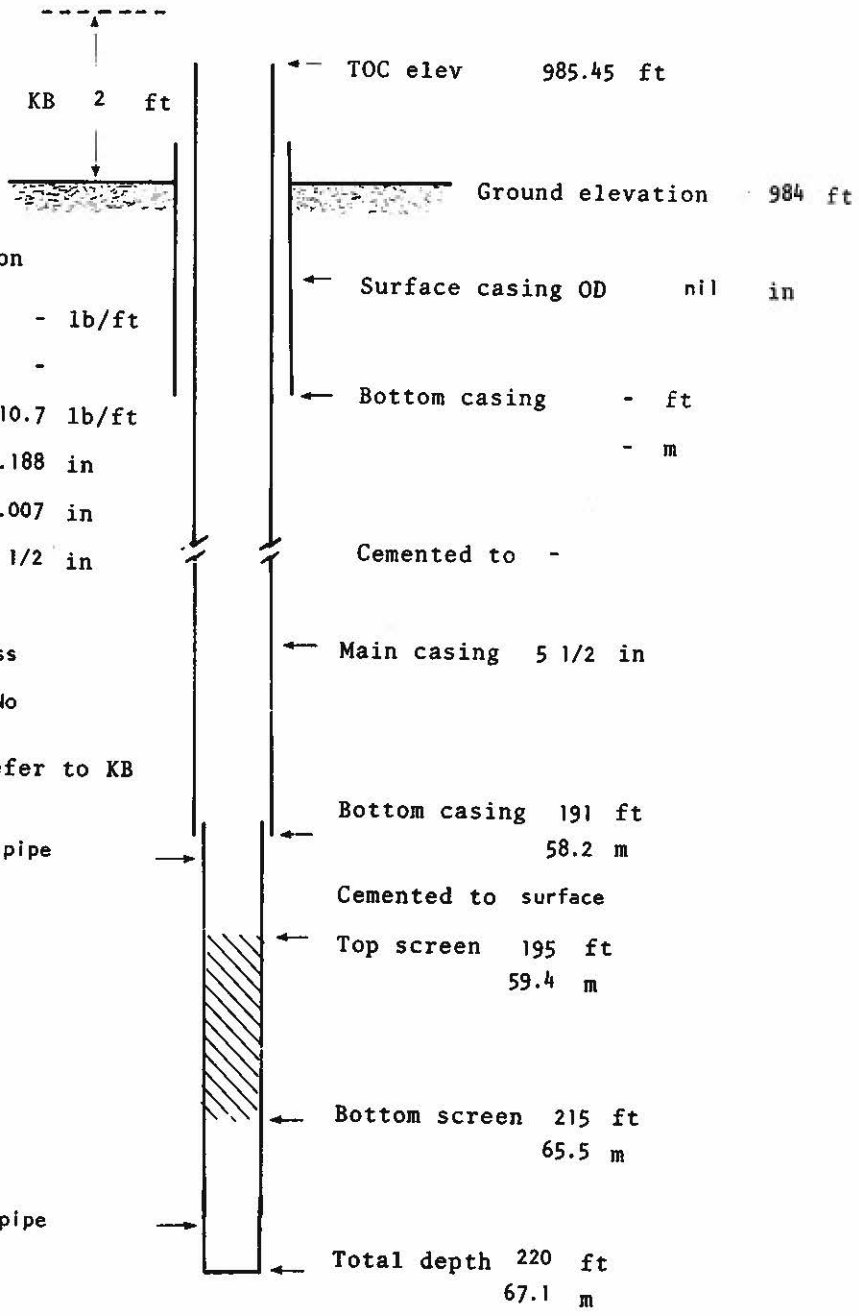
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Tp 95 R 9 W4th

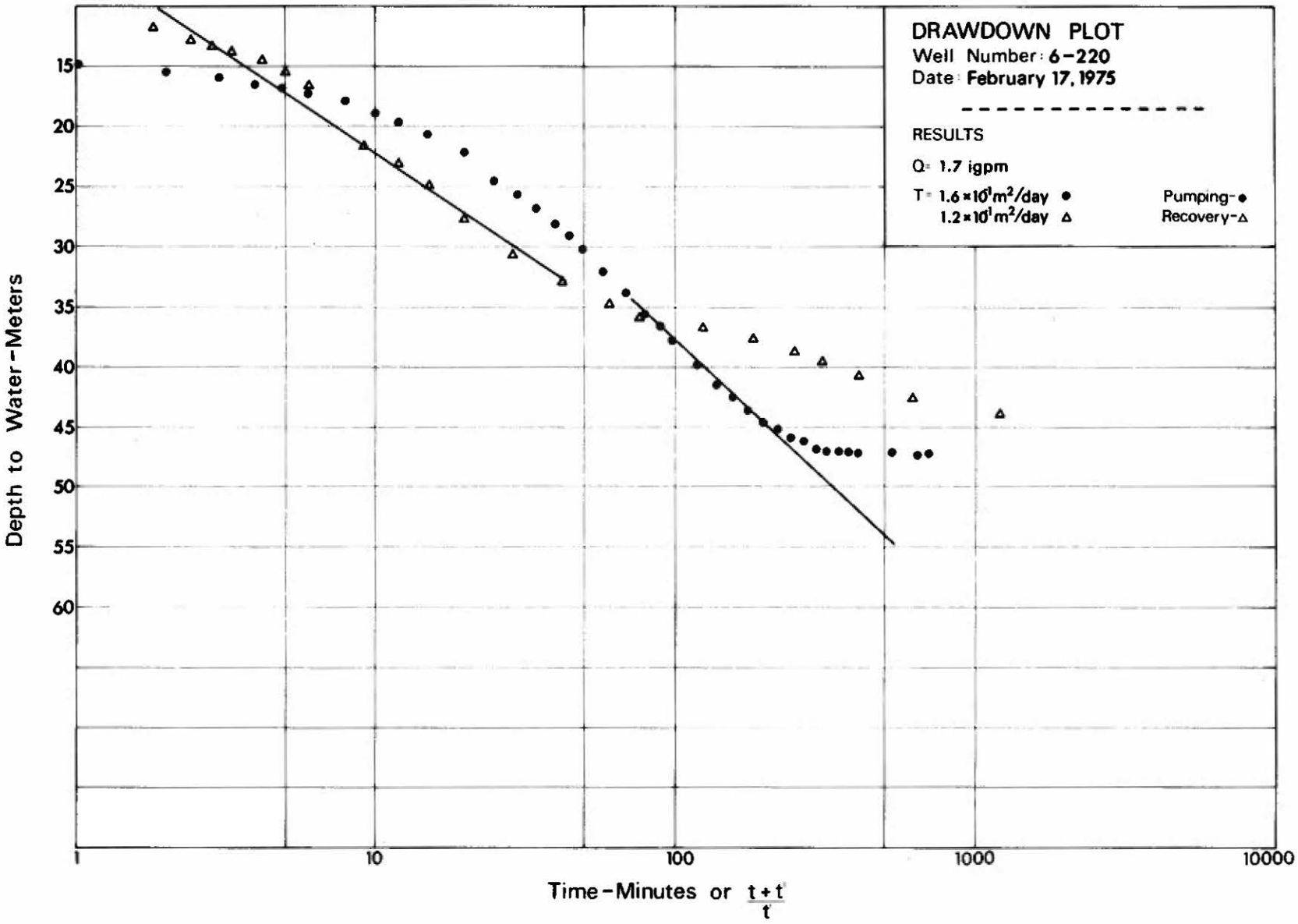
Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 10.7 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 6-220
Date: February 17, 1975
RESULTS
Q= 1.7 igpm
T= 1.6×10¹m²/day ●
1.2×10¹m²/day △
Pumping-●
Recovery-△
Depth to Water-Meters
15
20
25
30
35
40
45
50
55
60
1
10
100
1000
10000
Time-Minutes or t+t'/t

6-220-D-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Pump test on 6-220

Date sampled February 18, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 6.8 | 0.34 | 0.5 |
| Magnesium ($Mg^{++}$) | 22.8 | 1.87 | 2.9 |
| Sodium ($Na^{+}$) | 1431.0 | 62.24 | 95.8 |
| Potassium ($K^{+}$) | 18.8 | 0.48 | 0.7 |
| Carbonate ($CO_3^{=}$) | 146.0 | 4.87 | 6.8 |
| Bicarbonate ($HCO_3^{-}$) | 1715.0 | 28.11 | 39.1 |
| Sulfate ($SO_4^{=}$) | 73.5 | 1.53 | 2.1 |
| Chloride ($Cl^{-}$) | 1320.0 | 37.23 | 51.8 |
| Nitrate ($NO_3^{=}$) | 11.2 | 0.18 | 0.3 |
| Silica ($SiO_2$) | 5.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 3910.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 71.913 | Total Cations (epm) | 64.940 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 6500 | Temperature (C) | 3.5 | |
| pH | 9.0 | pH | 7.1 | |
| Fluoride ($F^{-}$) | 0.7 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 2735 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | 7000 | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 11, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 6.9 | 0.34 | 0 |
| Magnesium ($Mg^{++}$) | 21.1 | 1.74 | 3 |
| Sodium ($Na^{+}$) | 1400 | 60.90 | 92 |
| Potassium ($K^{+}$) | 125 | 3.20 | 5 |
| Carbonate ($CO_3^{=}$) | 86 | 2.87 | 5 |
| Bicarbonate ($HCO_3^{-}$) | 2079 | 34.08 | 61 |
| Sulfate ($SO_4^{=}$) | 2.5 | 0.05 | 0 |
| Chloride ($Cl^{-}$) | 658 | 18.56 | 33 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0 |
| Silica ($SiO_2$) | 4.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 15.4 | | |
| Magnesium (Acidified) | 21.7 | | |
| Total dissolved solids | 3988 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 55.57 | Total Cations (epm) | 66.18 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | 3.5 |
| pH | 8.7 | pH | 8.9 |
| Fluoride ($F^{-}$) | 1.2 ppm | Carbonate ($CO_3^{=}$) | 168 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1928 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Pump test on well 6-220

Date of sampling February 18, 1975

Total dissolved solids 3910 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .001 | Mg | .05 |
| As | <.001 | Mn | ND |
| B | .04 | Mo | ND |
| Ba | .1 | Ni | ND |
| Be | ND | Pb | ND |
| Bi | ND | Sb | ND |
| Ca | .05 | Si | .02 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | ND | V | ND |
| Fe | ND | Zn | .04 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 40.0 | 2.00 | 3 |
| Magnesium ($Mg^{++}$) | 24.0 | 1.98 | 3 |
| Sodium ($Na^{+}$) | 1450.0 | 63.07 | 90 |
| Potassium ($K^{+}$) | 133.0 | 3.40 | 5 |
| Carbonate ($CO_3^{=}$) | 86.0 | 2.87 | 4 |
| Bicarbonate ($HCO_3^{-}$) | 1969.0 | 32.27 | 47 |
| Sulfate ($SO_4^{=}$) | 11.2 | 0.23 | 0 |
| Chloride ($Cl^{-}$) | 1200.0 | 33.84 | 49 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 3.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 9.9 | | |
| Magnesium (Acidified) | 25.3 | | |
| Total dissolved solids | 3908 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 69.23 | Total Cations (epm) | 70.45 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 7000 | Temperature (C) | 5.0 | |
| pH | 8.7 | pH | 8.1 | |
| Fluoride ($F^{-}$) | 0.9 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 2220 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 7.2 | 0.36 | 0.5 |
| Magnesium ($Mg^{++}$) | 19.7 | 1.62 | 2.3 |
| Sodium ($Na^{+}$) | 1500.0 | 65.25 | 93.4 |
| Potassium ($K^{+}$) | 104.0 | 2.66 | 3.8 |
| Carbonate ($CO_3^{=}$) | 48.0 | 1.60 | 2.3 |
| Bicarbonate ($HCO_3^{-}$) | 2113.0 | 34.63 | 49.0 |
| Sulfate ($SO_4^{=}$) | 4.2 | 0.09 | 0.1 |
| Chloride ($Cl^{-}$) | 1220.0 | 34.40 | 48.6 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 3.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 7.7 | | |
| Magnesium (Acidified) | 20.7 | | |
| Total dissolved solids | 3794.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 70.74 | Total Cations (epm) | 69.89 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 7000 | Temperature (C) | 6.0 |
| pH | 8.6 | pH | 8.8 |
| Fluoride ($F^{-}$) | 1.2 ppm | Carbonate ($CO_3^{=}$) | 91.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1986 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed (U of A Geology)

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 9.1 | 0.45 | 0.7 |
| Magnesium ($Mg^{++}$) | 21.0 | 1.72 | 2.9 |
| Sodium ($Na^{+}$) | 1340.1 | 57.62 | 95.8 |
| Potassium ($K^{+}$) | 14.0 | 0.36 | 0.6 |
| Carbonate ($CO_3^{=}$) | 49.8 | 1.64 | 2.5 |
| Bicarbonate ($HCO_3^{-}$) | 2073.0 | 33.17 | 50.1 |
| Sulfate ($SO_4^{=}$) | 15.0 | 0.32 | 0.5 |
| Chloride ($Cl^{-}$) | 1112.0 | 31.14 | 47.0 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 66.27 | Total Cations (epm) | 60.15 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 6000 | Temperature (C) | |
| pH | 8.5 | pH | |
| Fluoride ($F^{-}$) | | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Date sampled: July 16, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .029 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 1452 |
| As | <.038 | Ni | <.010 |
| B | 2.25 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 10.18 | Si | 1.84 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .578 |
| Cr | <.006 | Te | <.065 |
| Cu | .018 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .088 | V | <.0008 |
| K | 132 | W | <.078 |
| Mg | 21.2 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

6-220-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 16.1 | 0.80 | 1.2 |
| Magnesium(Mg) | 26.0 | 2.14 | 3.2 |
| Sodium(Na) | 1438.0 | 62.55 | 93.7 |
| Potassium(K) | 50.0 | 1.28 | 1.9 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 2189.0 | 35.88 | 53.1 |
| Sulphate(SO4) | 3.0 | 0.06 | 0.1 |
| Chloride(Cl) | 1120.0 | 31.58 | 46.8 |
| Nitrate(NO3) | 1.1 | 0.02 | 0.0 |
| Silica(SiO2) | 4.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 14.8 | | |
| Magnesium(Acidified) | 24.0 | | |
| TDS(mg/l) | 3796.0 | | |
| Total Anions(epm) | 67.54 | Total Cations(epm) | 66.77 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 5050 | | Temperature(C) | 6.00 | |
| pH | 8.1 | | pH | 8.0 | |
| Fluoride(F) | 1.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 2172 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 6, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 4.4 | 0.22 | 0.3 |
| Magnesium(Mg) | 19.0 | 1.56 | 2.4 |
| Sodium(Na) | 1406.0 | 61.16 | 95.3 |
| Potassium(K) | 48.0 | 1.23 | 1.9 |
| Carbonate(CO3) | 101.0 | 3.37 | 4.7 |
| Bicarbonate(HCO3) | 1967.0 | 32.24 | 45.2 |
| Sulphate(SO4) | 8.6 | 0.18 | 0.3 |
| Chloride(Cl) | 1260.0 | 35.53 | 49.8 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 3.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 3.7 | | |
| Magnesium(Acidified) | 22.3 | | |
| TDS(mg/l) | 3844.0 | | |
| Total Anions(epm) | 71.33 | Total Cations(epm) | 64.17 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 5300 | Temperature(C) | 6.00 | |
| pH | 8.7 | pH | 8.9 | |
| Fluoride(F) | 1.1 mg/l | Carbonate(CO3) | 163 | mg/l |
| | | Bicarbonate(HCO3) | 1825 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 6-220-E-82

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 6.0 | 0.30 | 0.4 |
| Magnesium(Mg) | 20.8 | 1.73 | 2.3 |
| Sodium(Na) | 1625.0 | 70.65 | 94.6 |
| Potassium(K) | 79.0 | 2.03 | 2.7 |
| Carbonate(CO3) | 242.0 | 8.07 | 11.9 |
| Bicarbonate(HCO3) | 1628.0 | 26.69 | 39.4 |
| Sulphate(SO4) | 16.0 | 0.33 | 0.5 |
| Chloride(Cl) | 1162.0 | 32.73 | 48.3 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 1.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 12.4 | | |
| Magnesium(Acidified) | 19.4 | | |
| TDS(mg/l) | 3906.0 | | |
| Total Anions(epm) | 67.82 | Total Cations(epm) | 74.71 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 6400 |
| pH | 9.2 |
| Fluoride | 1.1 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 4.00 | |
| pH | 8.7 | |
| Carbonate(CO3) | 96 | mg/l |
| Bicarbonate(HCO3) | 1981 | mg/l |
| Hydroxide(OH) | | |

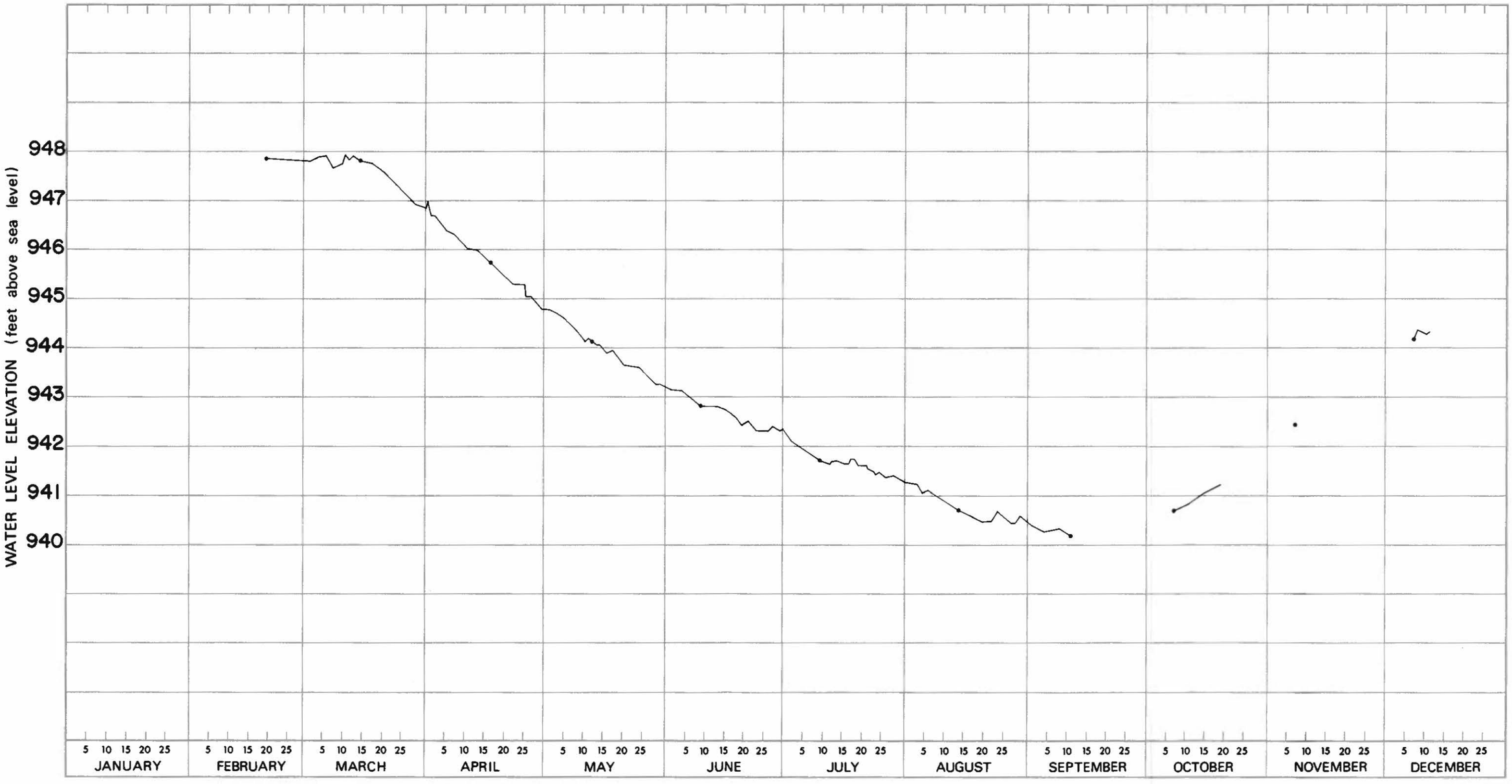
**WATER LEVEL HYDROGRAPH**

6-220-H-76

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council



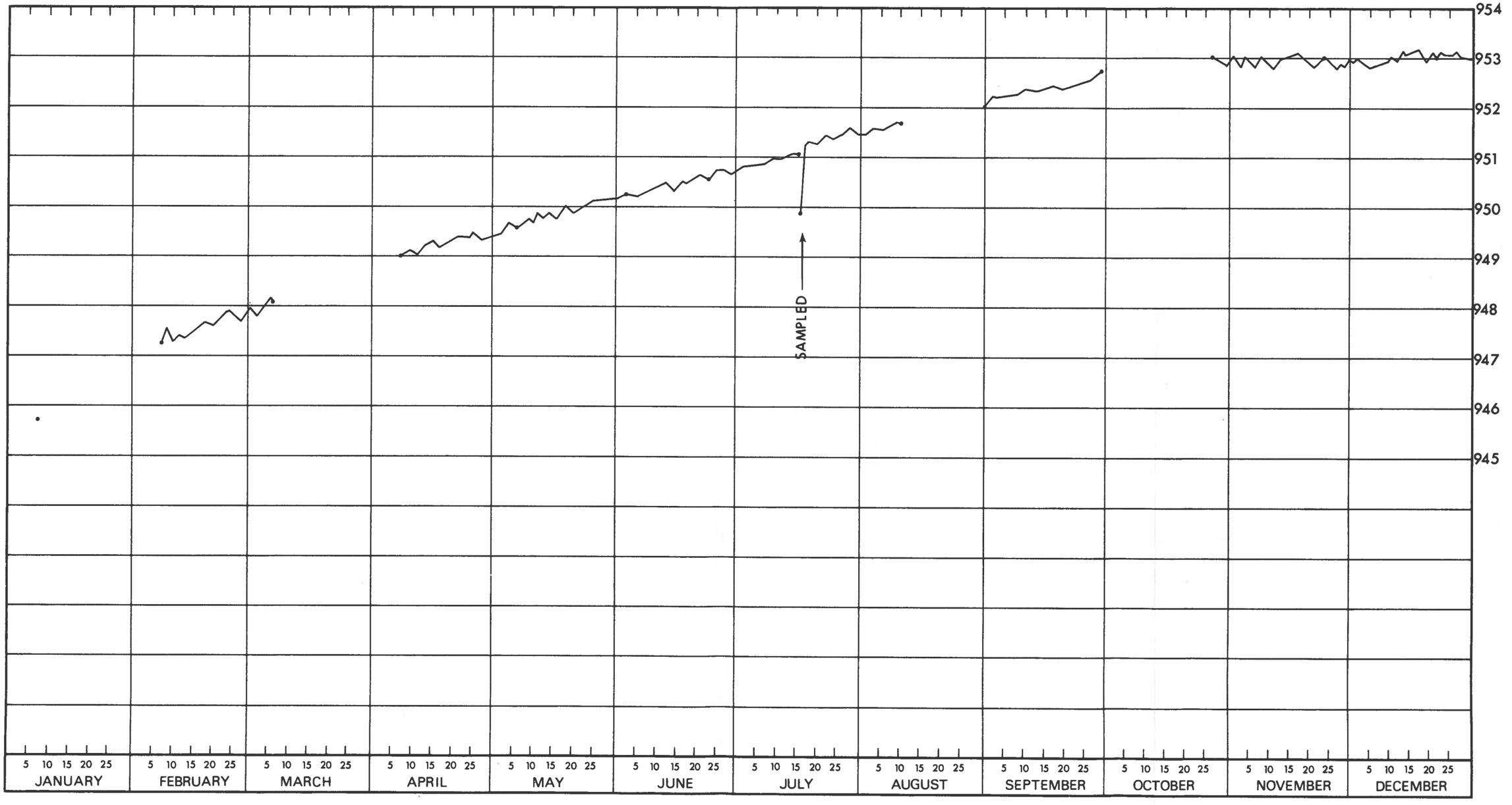
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

6 - 220 - H - 77




1976

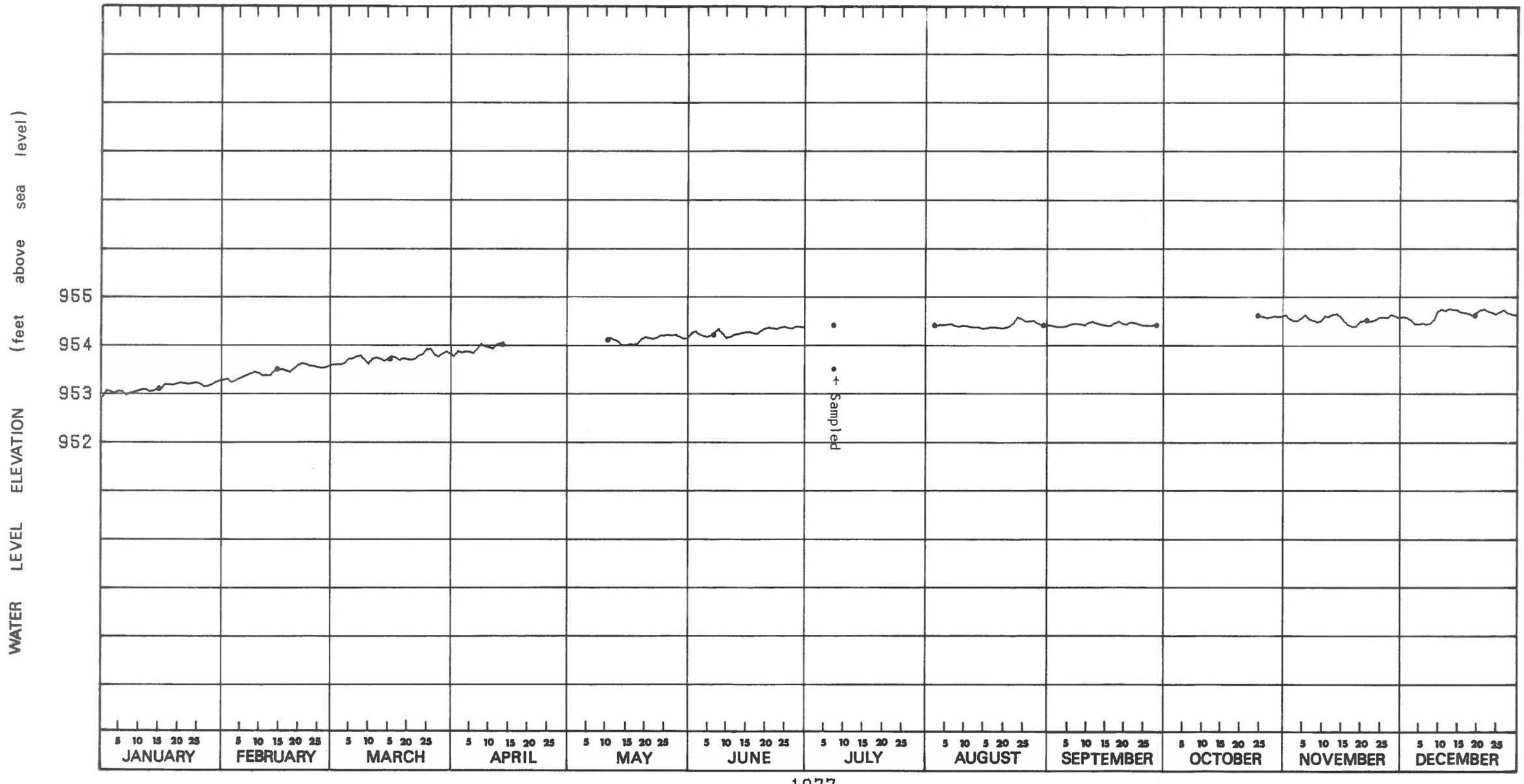
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council

6-220-H-78




1977

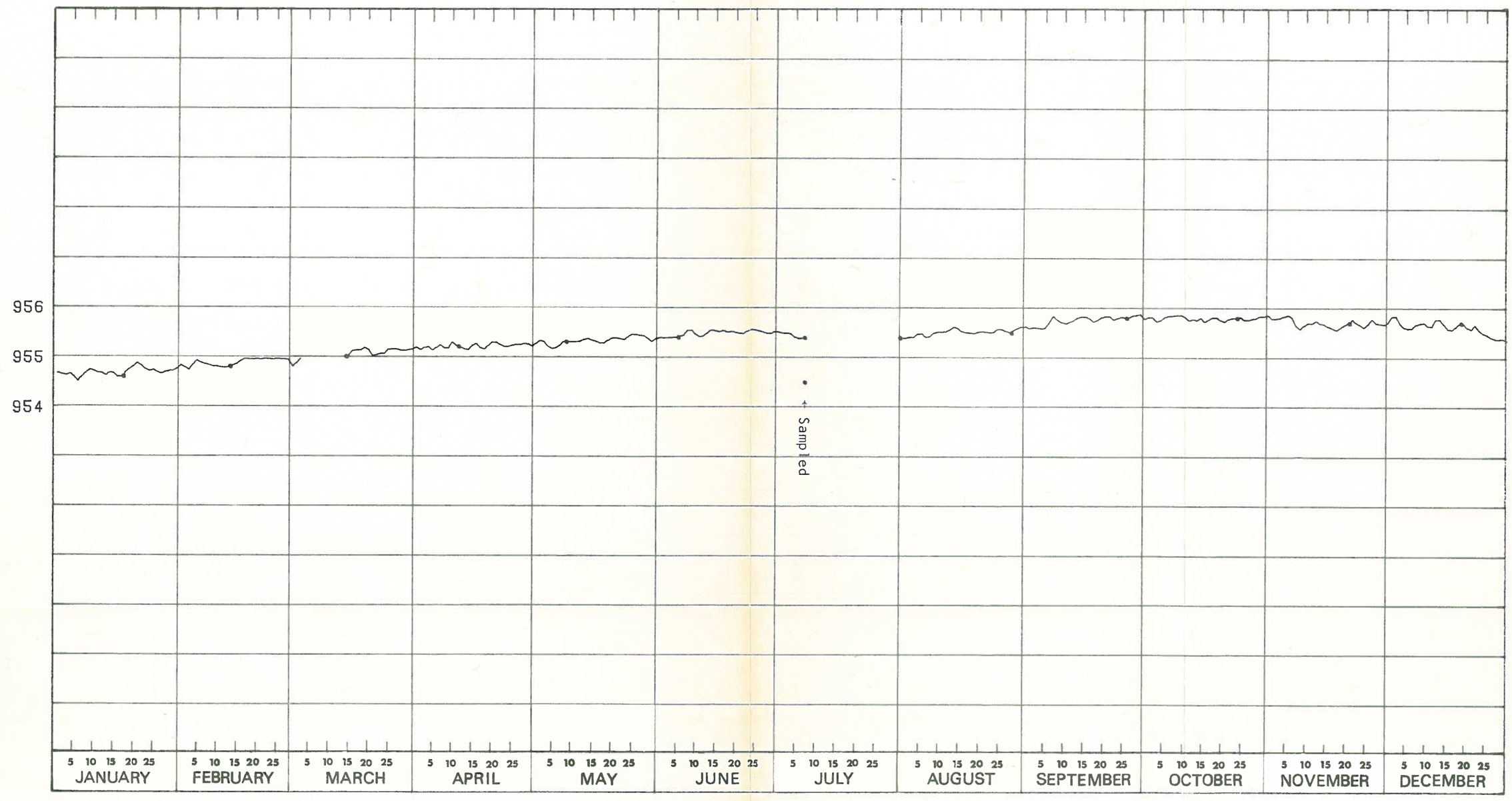
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-220

LSD 2 SEC 18 TWP 95 R 9 W4TH

Alberta Research Council

6-220-H-79



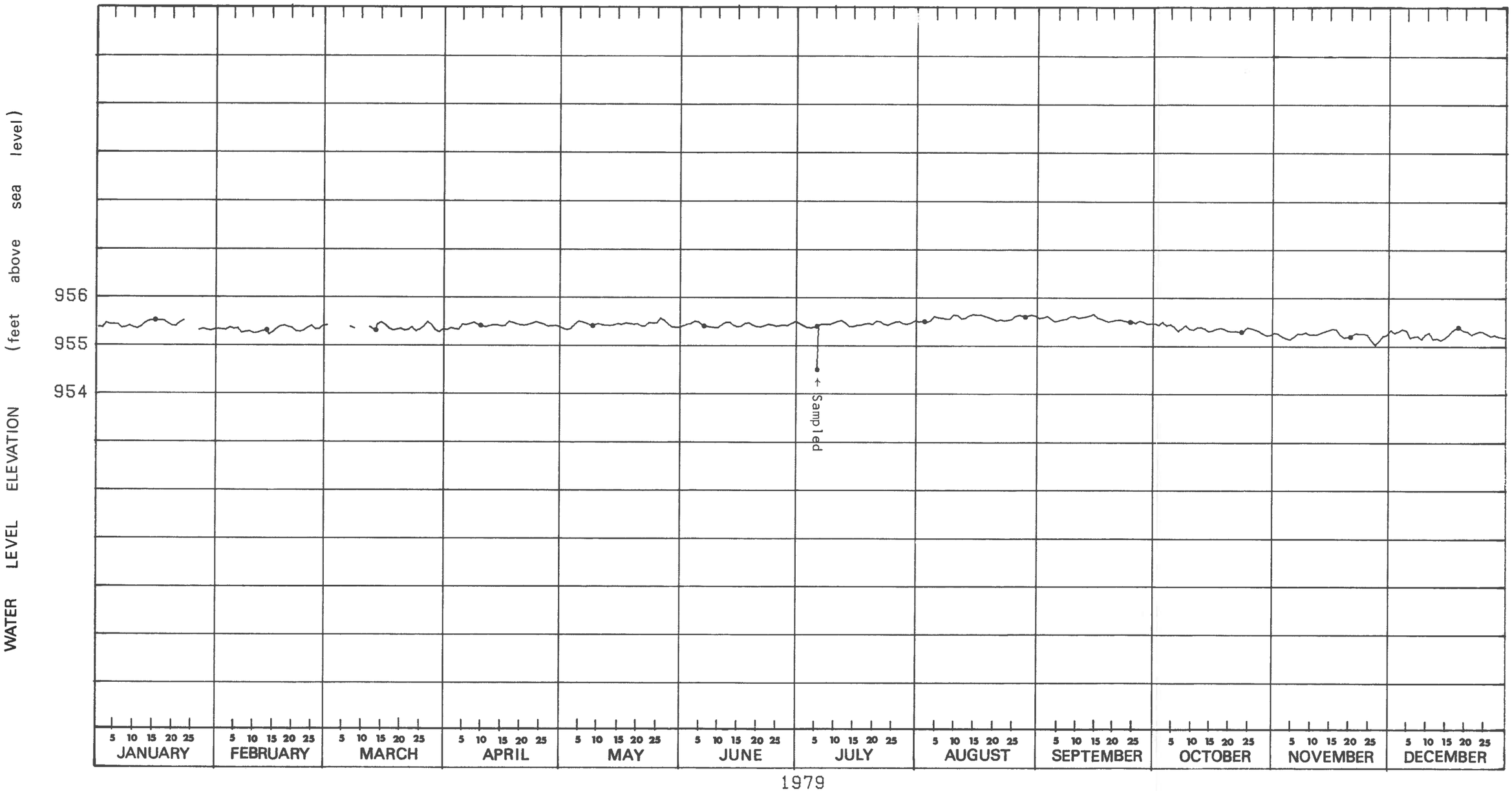
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council

6-220-H-80



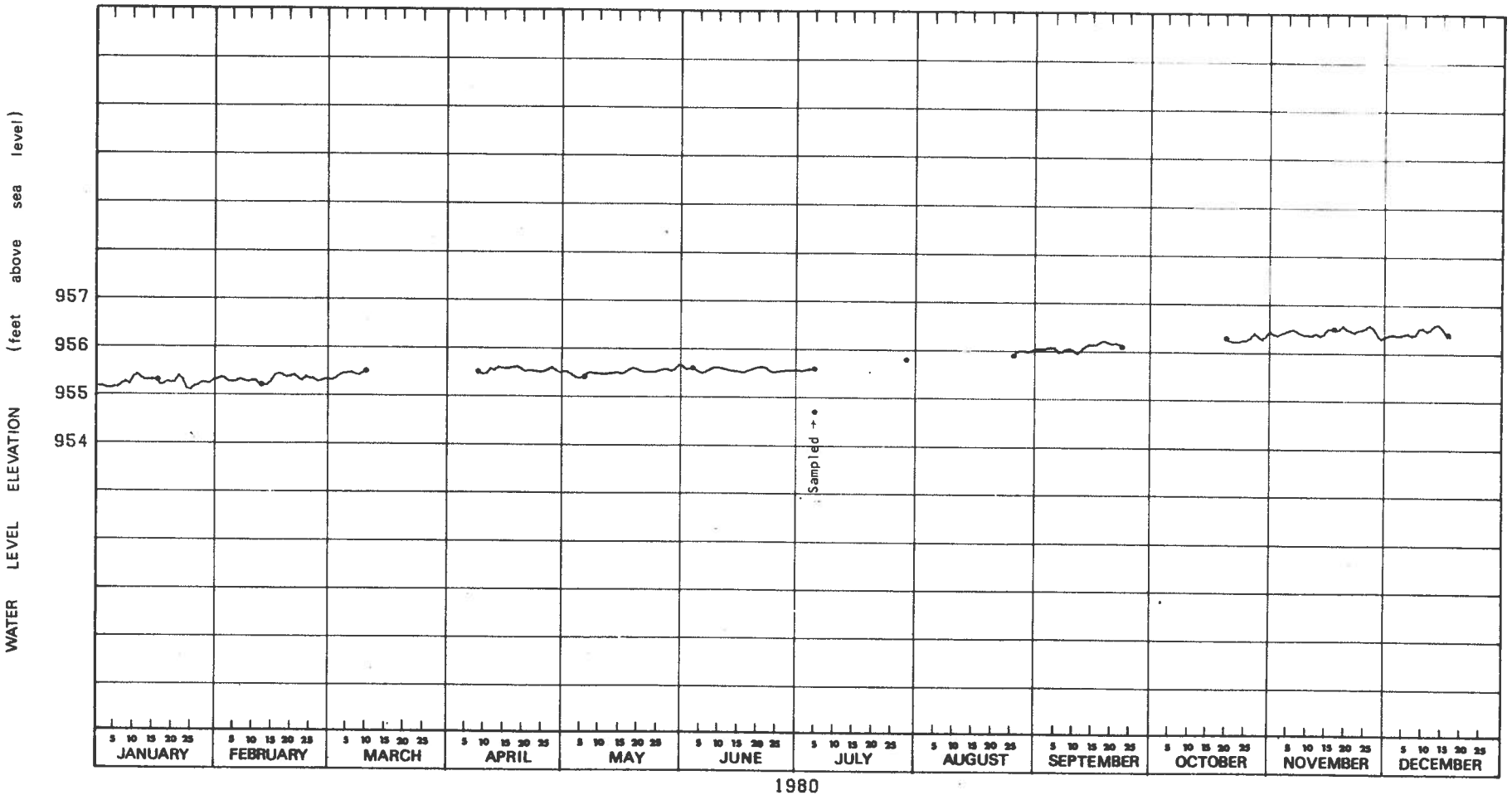
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council

6-220-H-81



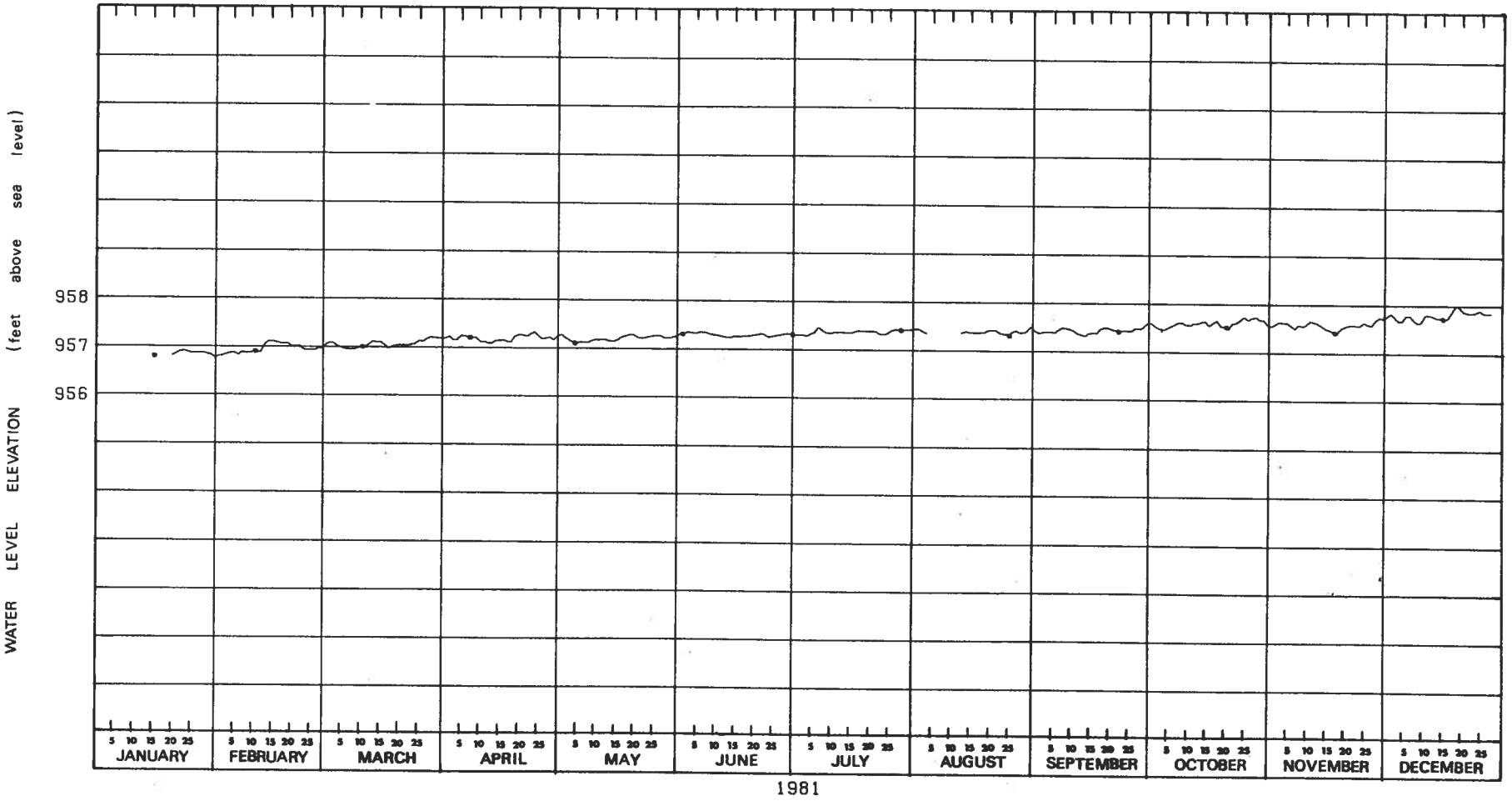
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council

6-220-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 985.45

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 8/75 | | | Well completed |
| Feb 9/75 | 10.42 TOC | 951.27 | |
| Feb 16/75 | 10.61 TOC | 950.66 | Before pump test - 10 USGPM/ 10 minutes |
| Feb 17/75 | 11.88 TOC | 946.48 | Before pump test - 2 USGPM/ 1260 min; T = 10 - 12 USGPD/Ft; water sample |
| Feb 19/75 | 11.76 TOC | 950.00 | Install shelter and recorder; MP = 3.12' TOC, (988.57) |
| Feb 25/75 | 12.41 MP | 947.87 | Counter weights malfunctioned |
| Mar 14/75 | 12.45 MP | 947.73 | |
| Apr 16/75 | 13.07 MP | 945.69 | |
| May 12/75 | 13.56 MP | 944.07 | |
| June 9/75 | 13.97 MP | 942.75 | |
| July 9/75 | 14.03 MP | 941.67 | |
| Aug 14/75 | 14.61 MP | 940.64 | |
| Sept 11/75 | 14.76 MP | 940.15 | Sampled well; temp. 3.5°C |
| | 15.05 MP | 939.20 | after sample |
| Oct 7/75 | 14.61 MP | 940.64 | |
| Nov 7/75 | 14.07 MP | 942.42 | |
| Dec 7/75 | 13.54 MP | 944.16 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 985.45

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 13.06 MP | 945.8 | MP (988.6) |
| Feb 7/76 | 12.60 MP | 947.3 | |
| Mar 6/76 | 12.35 MP | 948.1 | |
| Apr 7/76 | 12.06 MP | 949.0 | |
| May 6/76 | 11.90 MP | 949.6 | |
| June 2/76 | 11.69 MP | 950.3 | |
| June 23/76 | 11.60 MP | 950.5 | |
| July 16/76 | 11.43 MP | 951.1 | |
| | 11.80 MP | 949.9 | After sample; temp. 5°C |
| Aug 10/76 | 11.25 MP | 951.7 | |
| Aug 31/76 | 11.15 MP | 952.0 | |
| Sept 29/76 | 10.94 MP | 952.7 | |
| Oct 27/76 | 10.85 MP | 953.0 | |
| Nov 24/76 | 10.84 MP | 953.0 | |
| Dec 22/76 | 10.84 MP | 953.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 985.45

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 10.81 MP | 953.1 | MP (988.6) |
| Feb 15/77 | 10.69 MP | 953.5 | |
| Mar 16/77 | 10.64 MP | 953.7 | |
| Apr 14/77 | 10.55 MP | 954.0 | |
| May 11/77 | 10.51 MP | 954.1 | |
| June 7/77 | 10.50 MP | 954.2 | |
| July 8/77 | 10.44 MP | 954.4 | |
| | 10.68 MP | 953.5 | After sample; temp. 6°C |
| Aug 3/77 | 10.41 MP | 954.4 | |
| Aug 31/77 | 10.42 MP | 954.4 | |
| Sept 29/77 | 10.43 MP | 954.4 | |
| Oct 25/77 | 10.37 MP | 954.6 | |
| Nov 22/77 | 10.40 MP | 954.5 | |
| Dec 20/77 | 10.35 MP | 954.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 985.45

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 10.35 MP | 954.6 | MP (988.6) |
| Feb 14/78 | 10.30 MP | 954.8 | |
| Mar 15/78 | 10.25 MP | 955.0 | |
| Apr 12/78 | 10.17 MP | 955.2 | |
| May 9/78 | 10.14 MP | 955.3 | |
| June 6/78 | 10.12 MP | 955.4 | |
| July 8/78 | 10.12 MP | 955.4 | |
| | 10.40 MP | 954.5 | After sample; temp. 6°C |
| Aug 1/78 | 10.11 MP | 955.4 | |
| Aug 29/78 | 10.08 MP | 955.5 | |
| Sept 27/78 | 10.00 MP | 955.8 | |
| Oct 25/78 | 9.86 MP | 955.8 | New MP 0.81 m TOC (988.1) |
| Nov 22/78 | 9.87 MP | 955.7 | |
| Dec 20/78 | 9.88 MP | 955.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 985.45

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 9.94 MP | 955.5 | MP (988.1) |
| Feb 14/79 | 10.01 MP | 955.3 | |
| Mar 14/79 | 9.99 MP | 955.3 | |
| Apr 10/79 | 9.96 MP | 955.4 | |
| May 9/79 | 9.97 MP | 955.4 | |
| June 7/79 | 9.96 MP | 955.4 | |
| July 6/79 | 9.96 MP | 955.4 | |
| | 10.24 MP | 954.5 | After sample; temp. 6°C |
| Aug 3/79 | 9.95 MP | 955.5 | |
| Aug 29/79 | 9.92 MP | 955.6 | |
| Sept 25/79 | 9.94 MP | 955.5 | |
| Oct 24/79 | 10.00 MP | 955.3 | |
| Nov 21/79 | 10.04 MP | 955.2 | |
| Dec 19.79 | 9.97 MP | 955.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 985.45

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 10.00 MP | 955.3 | |
| Feb 13/80 | 10.03 MP | 955.2 | |
| Mar 11/80 | 9.93 MP | 955.5 | |
| Apr 9/80 | 9.94 MP | 955.5 | |
| May 7/80 | 9.97 MP | 955.4 | |
| June 4/80 | 9.90 MP | 955.6 | |
| July 6/80 | 9.91 MP | 955.6 | Temp. 4°C |
| | 10.17 MP | 954.7 | After Sample |
| July 30/80 | 9.85 MP | 955.8 | |
| Aug 27/80 | 9.81 MP | 955.9 | |
| Sept 24/80 | 9.74 MP | 956.1 | |
| Oct 21/80 | 9.68 MP | 956.3 | |
| Nov 18/80 | 9.62 MP | 956.5 | |
| Dec 18/80 | 9.65 MP | 956.4 | |
| Jan 16/81 | 9.53 MP | 956.8 | |
| Feb 11/81 | 9.52 MP | 956.9 | |
| Mar 11/81 | 9.48 MP | 957.0 | |
| Apr 8/81 | 9.43 MP | 957.2 | |
| May 5/81 | 9.44 MP | 957.1 | |
| June 2/81 | 9.40 MP | 957.3 | |
| July 1/81 | 9.39 MP | 957.3 | |
| July 29/81 | 9.37 MP | 957.4 | |
| Aug 26/81 | 9.40 MP | 957.3 | |
| Sept 23/81 | 9.37 MP | 957.4 | |
| Oct 21/81 | 9.32 MP | 957.5 | |
| Nov 18/81 | 9.35 MP | 957.4 | |
| Dec 16/81 | 9.26 MP | 957.7 | |

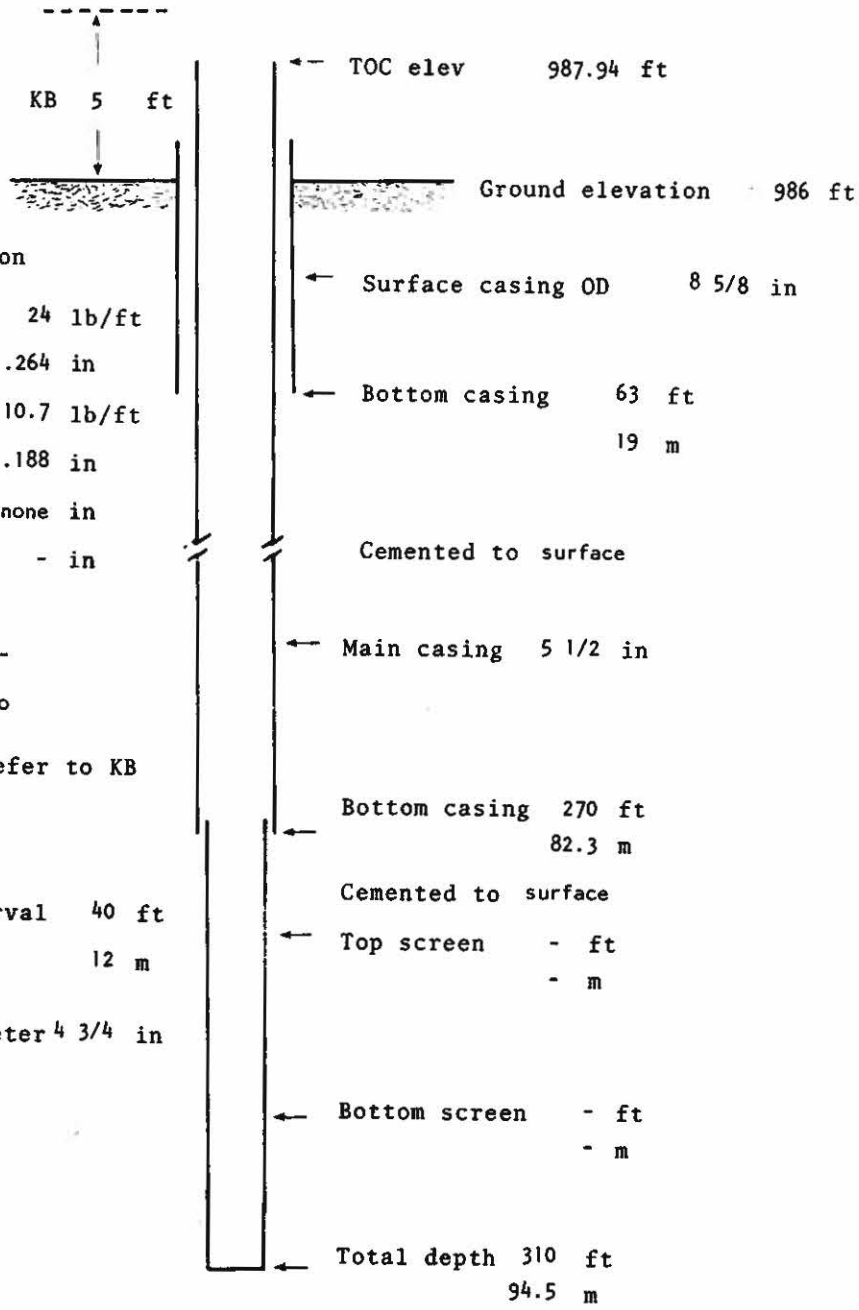
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Tp 95 R 9 W4th

Alberta Research Council



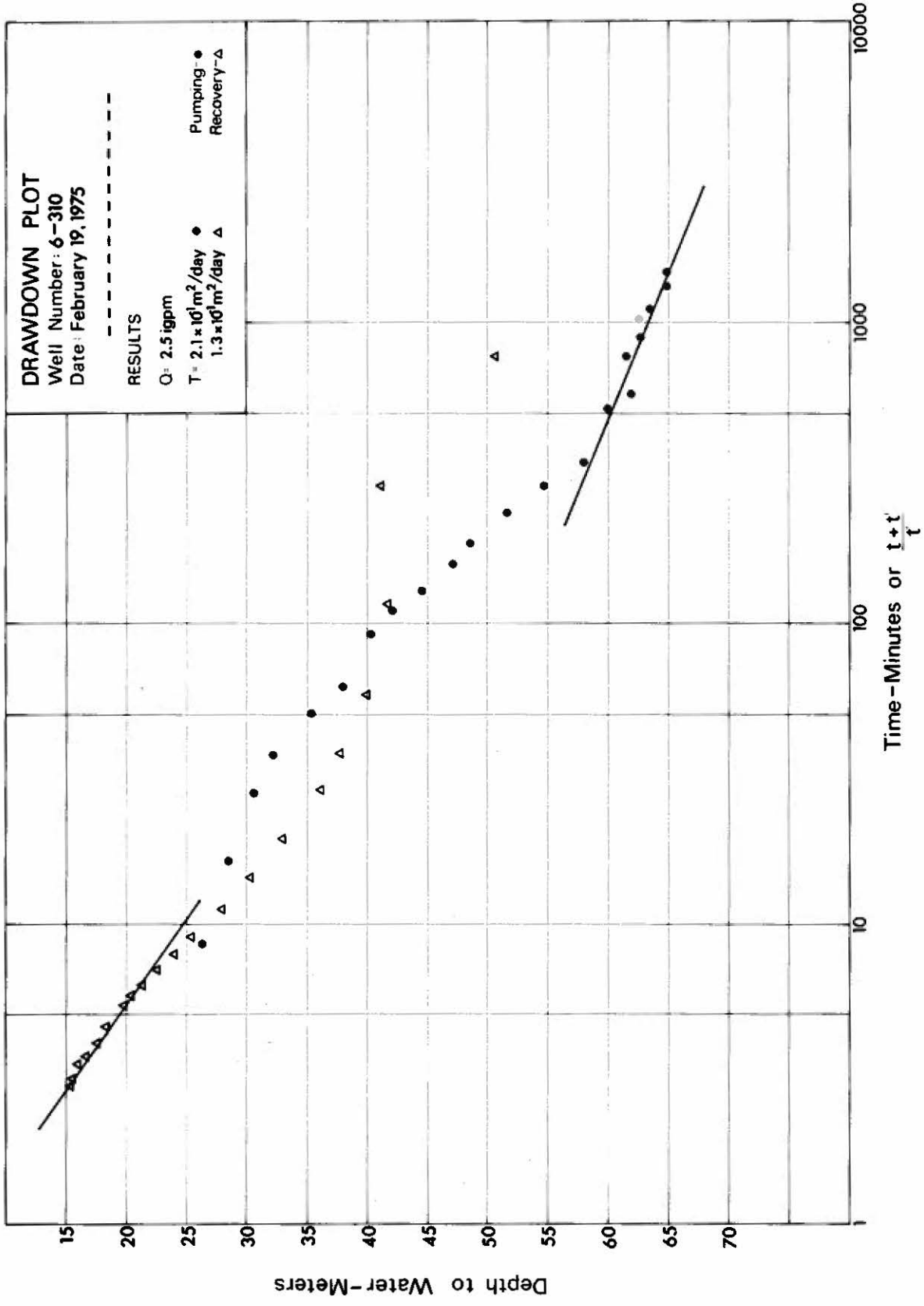

Construction

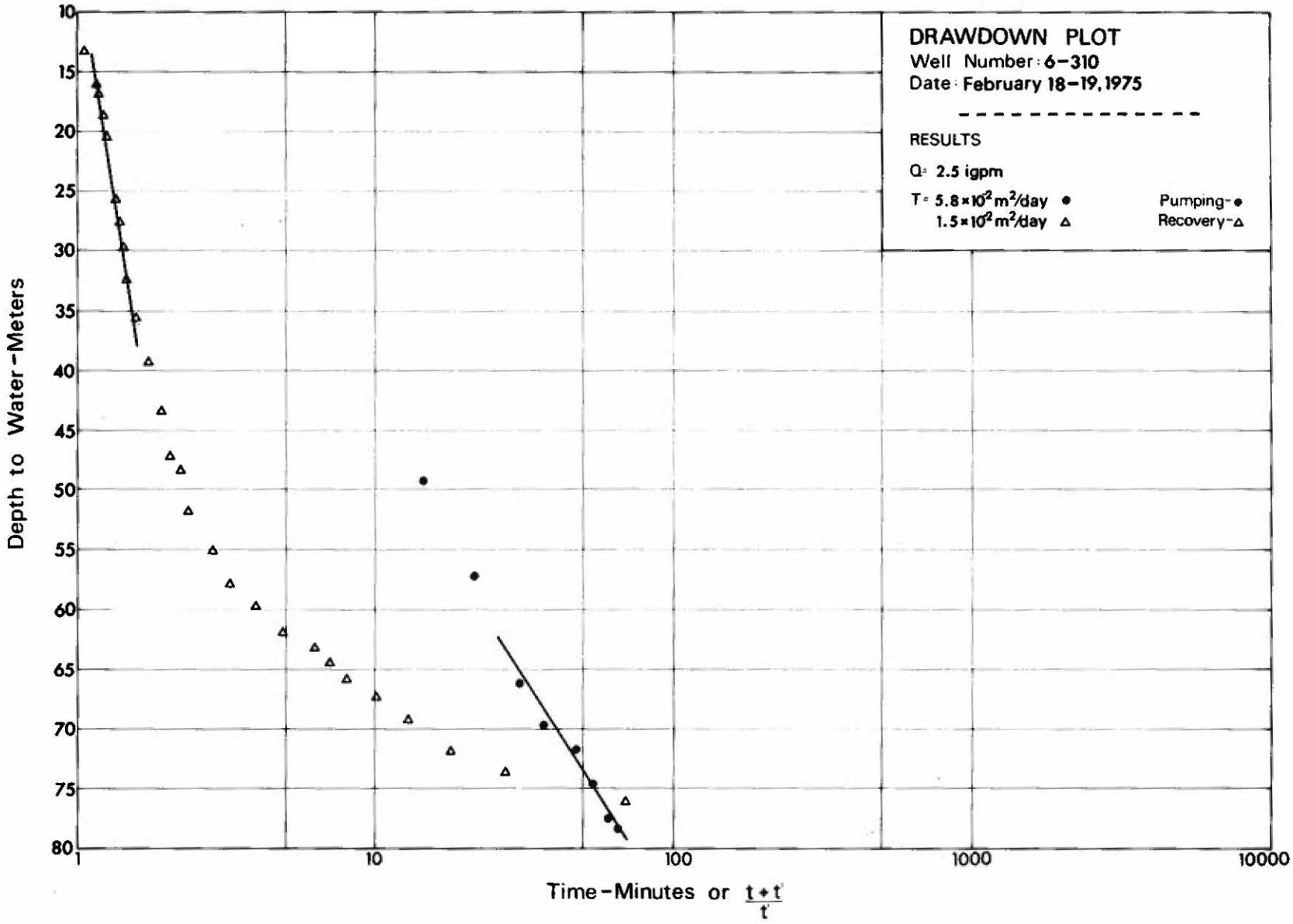
| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 10.7 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | none | in |
| screen OD | - | in |
| slots per foot | | |
| material | - | |
| Sand pack | No | |

Note: all depths refer to KB

Open hole interval 40 ft
12 m

Open hole diameter 4 3/4 in


DRAWDOWN PLOT
Well Number: 6-310
Date: February 19, 1975
RESULTS
Q= 2.5 igpm
T= 2.1×10¹m²/day ● Pumping-●
1.3×10¹m²/day △ Recovery-△
Depth to Water-Meters
15
20
25
30
35
40
45
50
55
60
65
70
1
10
100
1000
10000
Time-Minutes or t+t'/t'


DRAWDOWN PLOT
Well Number: 6-310
Date: February 18-19, 1975
RESULTS
Q= 2.5 igpm
T= 5.8×10² m²/day ● Pumping-●
1.5×10² m²/day △ Recovery-△
Depth to Water-Meters
Time-Minutes or (t+t')/t'
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
1
10
100
1000
10000

6-310-A-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed from 6-310

Date sampled February 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 9.2 | 0.46 | 0.7 |
| Magnesium ($Mg^{++}$) | 27.3 | 2.25 | 3.3 |
| Sodium ($Na^{+}$) | 1469.0 | 63.90 | 94.6 |
| Potassium ($K^{+}$) | 38.0 | 0.97 | 1.4 |
| Carbonate ($CO_3^{=}$) | 72.0 | 2.40 | 3.2 |
| Bicarbonate ($HCO_3^{-}$) | 1720.0 | 28.19 | 37.6 |
| Sulfate ($SO_4^{=}$) | 123.0 | 2.56 | 3.4 |
| Chloride ($Cl^{-}$) | 1480.0 | 41.74 | 55.7 |
| Nitrate ($NO_3^{=}$) | 2.0 | 0.03 | 0.0 |
| Silica ($SiO_2$) | 8.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 4022.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 74.922 | Total Cations (epm) | 67.574 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 6800 |
| pH | 8.5 |
| Fluoride ($F^{-}$) | 0.60 ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | 1.1 | |
| pH | 7.8 | |
| Carbonate ($CO_3^{=}$) | 0 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 2550 | ppm |
| Hydroxide ($OH^{-}$) | | |
| Conductivity | 7000 | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Pump test on 6-310

Date sampled February 19, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 5.4 | 0.27 | 0.4 |
| Magnesium ($Mg^{++}$) | 27.5 | 2.26 | 3.2 |
| Sodium ($Na^{+}$) | 1563.0 | 67.99 | 95.7 |
| Potassium ($K^{+}$) | 20.8 | 0.53 | 0.7 |
| Carbonate ($CO_3^{=}$) | 240.0 | 8.00 | 10.4 |
| Bicarbonate ($HCO_3^{-}$) | 1708.0 | 28.00 | 36.3 |
| Sulfate ($SO_4^{=}$) | 25.0 | 0.52 | 0.7 |
| Chloride ($Cl^{-}$) | 1440.0 | 40.61 | 52.6 |
| Nitrate ($NO_3^{=}$) | 1.5 | 0.02 | 0.0 |
| Silica ($SiO_2$) | 5.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 4138.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 77.149 | Total Cations (epm) | 71.049 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 7000 |
| pH | 8.9 |
| Fluoride ($F^{-}$) | 0.7 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 4.0 |
| pH | 7.3 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 2162 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

6-310-E-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-310

Lsd Sec Twp R W4th

Alberta Research Council

Sample source Bailed

Date sampled September 11, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 117 | 5.84 | 4 |
| Magnesium ($Mg^{++}$) | 144 | 11.84 | 8 |
| Sodium ($Na^{+}$) | 2850 | 123.97 | 86 |
| Potassium ($K^{+}$) | 77 | 1.97 | 1 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1996 | 32.72 | 34 |
| Sulfate ($SO_4^{=}$) | 43.7 | 0.91 | 1 |
| Chloride ($Cl^{-}$) | 2238 | 63.11 | 65 |
| Nitrate ($NO_3^{=}$) | 17 | 0.27 | 0 |
| Silica ($SiO_2$) | 6.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 114 | | |
| Magnesium (Acidified) | 146 | | |
| Total dissolved solids | 8532 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 97.01 | Total Cations (epm) | 143.62 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | | Temperature (C) | 3.5 | |
| pH | 8.0 | pH | 8.9 | |
| Fluoride ($F^{-}$) | 0.7 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 2050 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Pump test on well 6-310

Date of sampling February 19, 1975

Total dissolved solids 4138 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .02 | Mg | .05 |
| As | <.001 | Mn | ND |
| B | .02 | Mo | ND |
| Ba | .004 | Ni | ND |
| Be | ND | Pb | .008 |
| Bi | ND | Sb | ND |
| Ca | .05 | Si | .02 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .001 | V | ND |
| Fe | .001 | Zn | <.005 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 111.0 | 5.54 | 3 |
| Magnesium ($Mg^{++}$) | 233.0 | 19.18 | 11 |
| Sodium ($Na^{+}$) | 3475.0 | 151.15 | 85 |
| Potassium ($K^{+}$) | 78.0 | 2.00 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 869.0 | 14.24 | 8 |
| Sulfate ($SO_4^{=}$) | 17.7 | 0.37 | 0 |
| Chloride ($Cl^{-}$) | 5460.0 | 153.98 | 91 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0 |
| Silica ($SiO_2$) | 6.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 122.1 | | |
| Magnesium (Acidified) | 234.3 | | |
| Total dissolved solids | 10340 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 168.59 | Total Cations (epm) | 177.86 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 6.0 | |
| pH | 7.9 | pH | 6.9 | |
| Fluoride ($F^{-}$) | 0.4 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 2182 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 149.0 | 7.44 | 3.6 |
| Magnesium ($Mg^{++}$) | 254.0 | 20.91 | 10.1 |
| Sodium ($Na^{+}$) | 4050.0 | 176.16 | 85.2 |
| Potassium ($K^{+}$) | 93.0 | 2.38 | 1.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 2274.0 | 37.27 | 17.9 |
| Sulfate ($SO_4^{=}$) | 17.4 | 0.36 | 0.2 |
| Chloride ($Cl^{-}$) | 6040.0 | 170.33 | 81.9 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 6.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 133.0 | | |
| Magnesium (Acidified) | 208.0 | | |
| Total dissolved solids | 11616.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 207.97 | Total Cations (epm) | 206.88 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 6.5 |
| pH | 7.2 | pH | 7.0 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 2259.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Date sampled: July 16, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .161 |
| Au | <.003 | Mo | <.006 |
| Al | 0.55 | Na | 3740 |
| As | <.038 | Ni | <.010 |
| B | 3.61 | P | 0.99 |
| Ba | 1.43 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 116.6 | Si | 4.47 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 6.50 |
| Cr | <.006 | Te | <.065 |
| Cu | .011 | Ti | .003 |
| Eu | <.015 | U | <.020 |
| Fe | 23.98 | V | .016 |
| K | 165 | W | <.078 |
| Mg | 226 | Zn | .014 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 103.0 | 5.14 | 2.6 |
| Magnesium(Mg) | 246.0 | 20.25 | 10.3 |
| Sodium(Na) | 3913.0 | 170.20 | 86.9 |
| Potassium(K) | 6.3 | 0.16 | 0.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 2211.0 | 36.24 | 17.6 |
| Sulphate(SO4) | 9.6 | 0.20 | 0.1 |
| Chloride(Cl) | 6000.0 | 169.20 | 82.3 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.0 |
| Silica(SiO2) | 7.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 69.0 | | |
| Magnesium(Acidified) | 237.0 | | |
| TDS(mg/l) | 11250.0 | | |
| Total Anions(epm) | 205.65 | Total Cations(epm) | 195.75 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 16400 | | Temperature(C) | 5.50 | |
| pH | 7.5 | | pH | 7.2 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 2191 | mg/l |
| | | | Hydroxide(OH) | | |

6-310-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 6, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 73.0 | 3.64 | 1.9 |
| Magnesium(Mg) | 256.0 | 21.07 | 11.0 |
| Sodium(Na) | 3800.0 | 165.29 | 86.0 |
| Potassium(K) | 84.0 | 2.15 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 2137.0 | 35.03 | 17.0 |
| Sulphate(SO4) | 15.8 | 0.33 | 0.2 |
| Chloride(Cl) | 6040.0 | 170.33 | 82.8 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 7.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 78.0 | | |
| Magnesium(Acidified) | 227.0 | | |
| TDS(mg/l) | 11124.0 | | |
| Total Anions(epm) | 205.69 | Total Cations(epm) | 192.15 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 15400 | | Temperature(C) | 6.00 | |
| pH | 8.0 | | pH | 7.4 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 2172 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 6-310-E-82

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 105.0 | 5.25 | 2.2 |
| Magnesium(Mg) | 236.0 | 19.67 | 8.3 |
| Sodium(Na) | 4813.0 | 209.26 | 88.5 |
| Potassium(K) | 86.0 | 2.21 | 0.9 |
| Carbonate(CO3) | 45.6 | 1.52 | 0.8 |
| Bicarbonate(HCO3) | 1435.0 | 23.52 | 11.7 |
| Sulphate(SO4) | 11.0 | 0.23 | 0.1 |
| Chloride(Cl) | 6243.0 | 175.86 | 87.4 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 4.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 97.0 | | |
| Magnesium(Acidified) | 204.0 | | |
| TDS(mg/l) | 11773.0 | | |
| Total Anions(epm) | 201.13 | Total Cations(epm) | 236.38 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 19399 | Temperature | 5.00 | |
| pH | 8.4 | pH | 7.1 | |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 2152 | mg/l |
| | | Hydroxide(OH) | | |

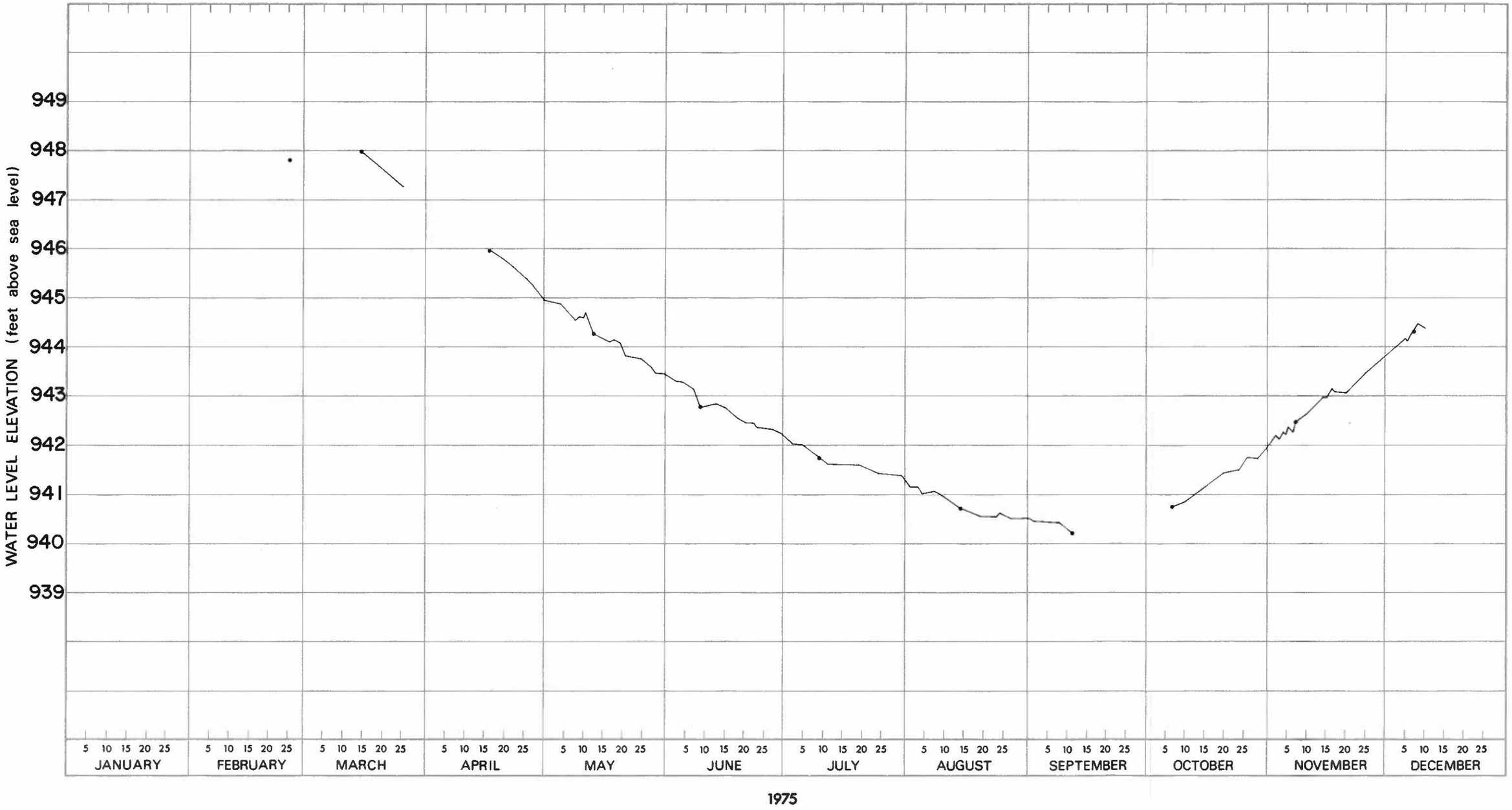
## WATER LEVEL HYDROGRAPH

6-310-H-76

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council



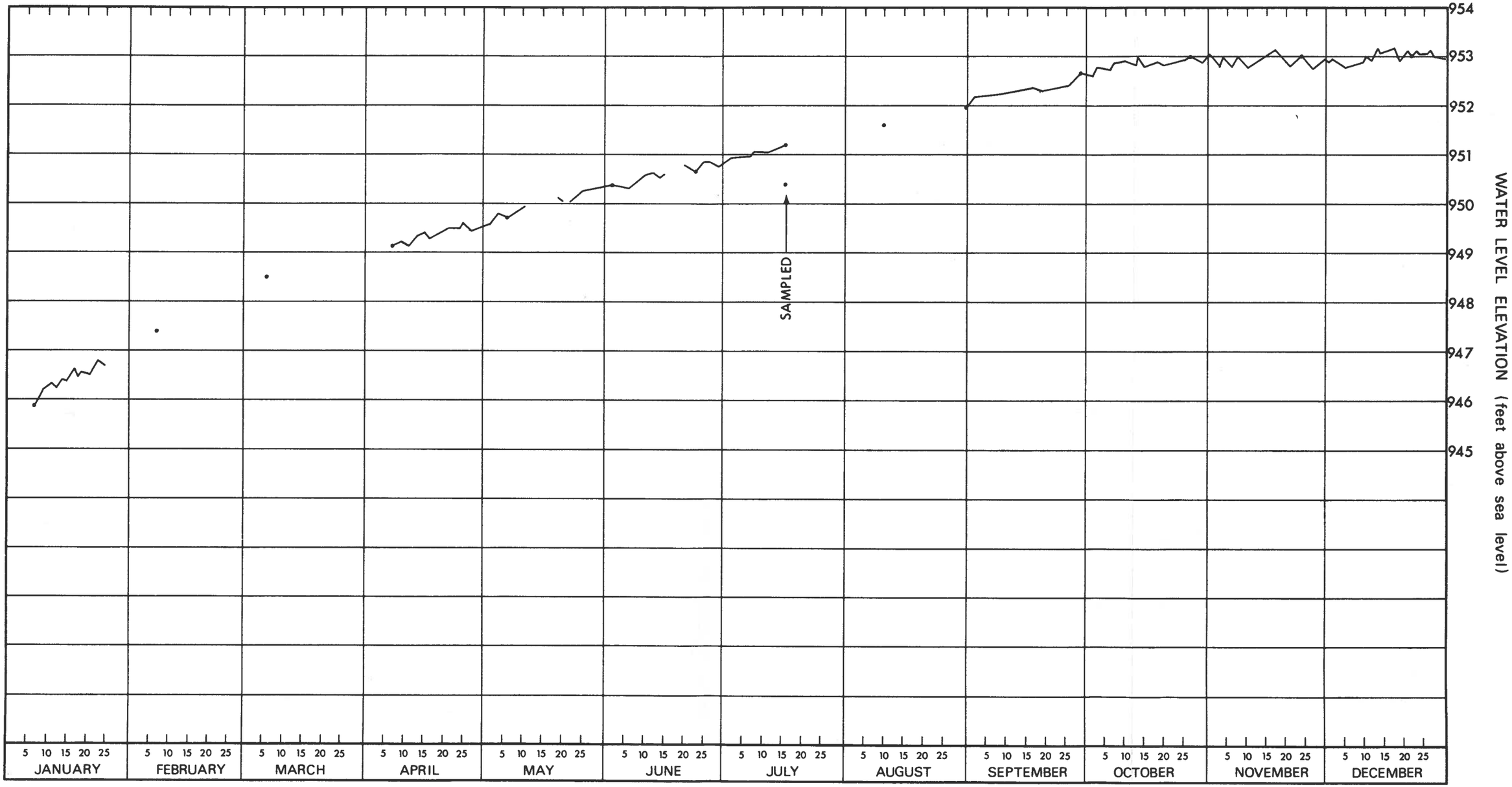
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **6-310**

Lsd **2** Sec **18** Twp **95** R **9** W4th

Alberta Research Council

6 - 310 - H - 77




1976

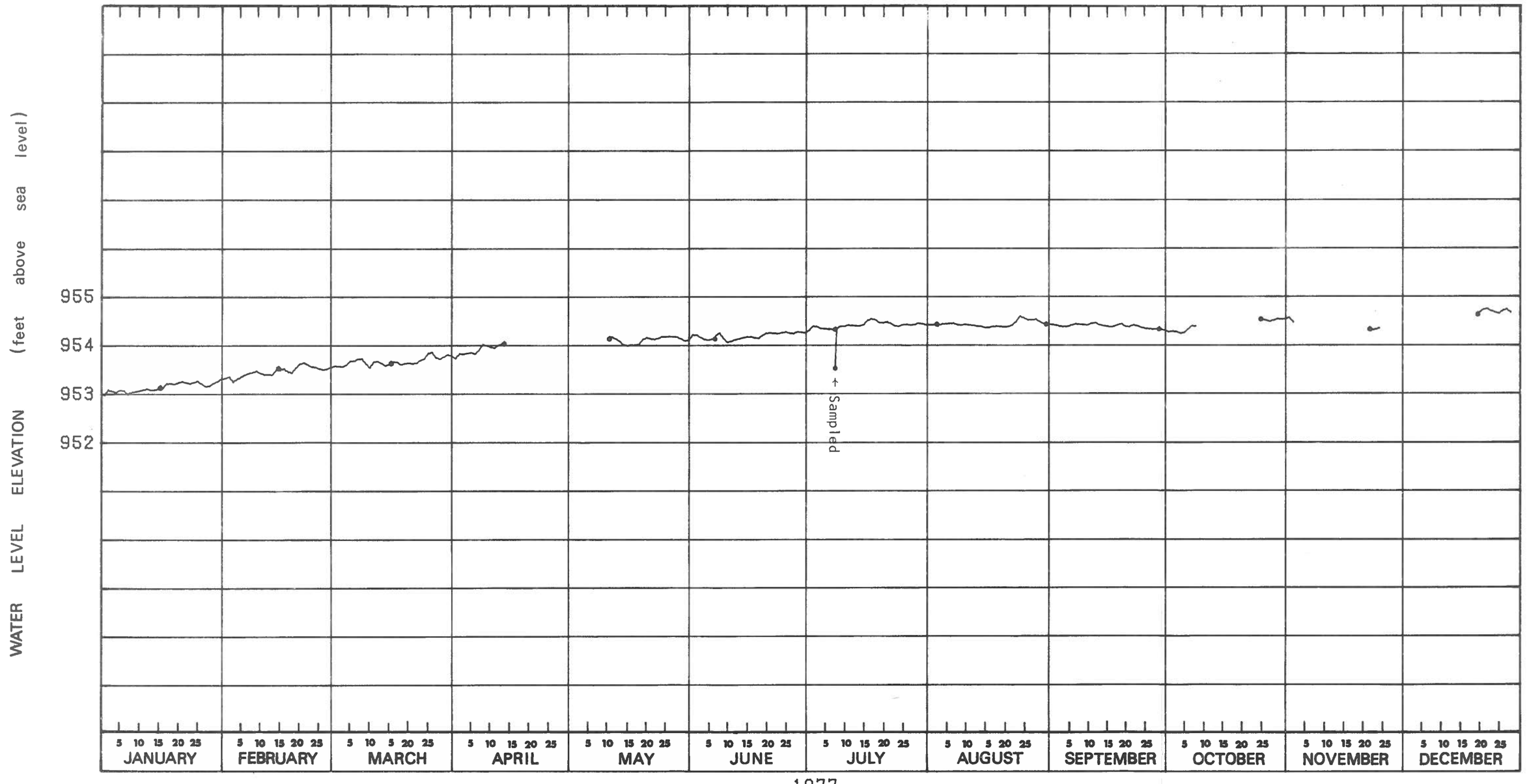
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council

6-310-H-78



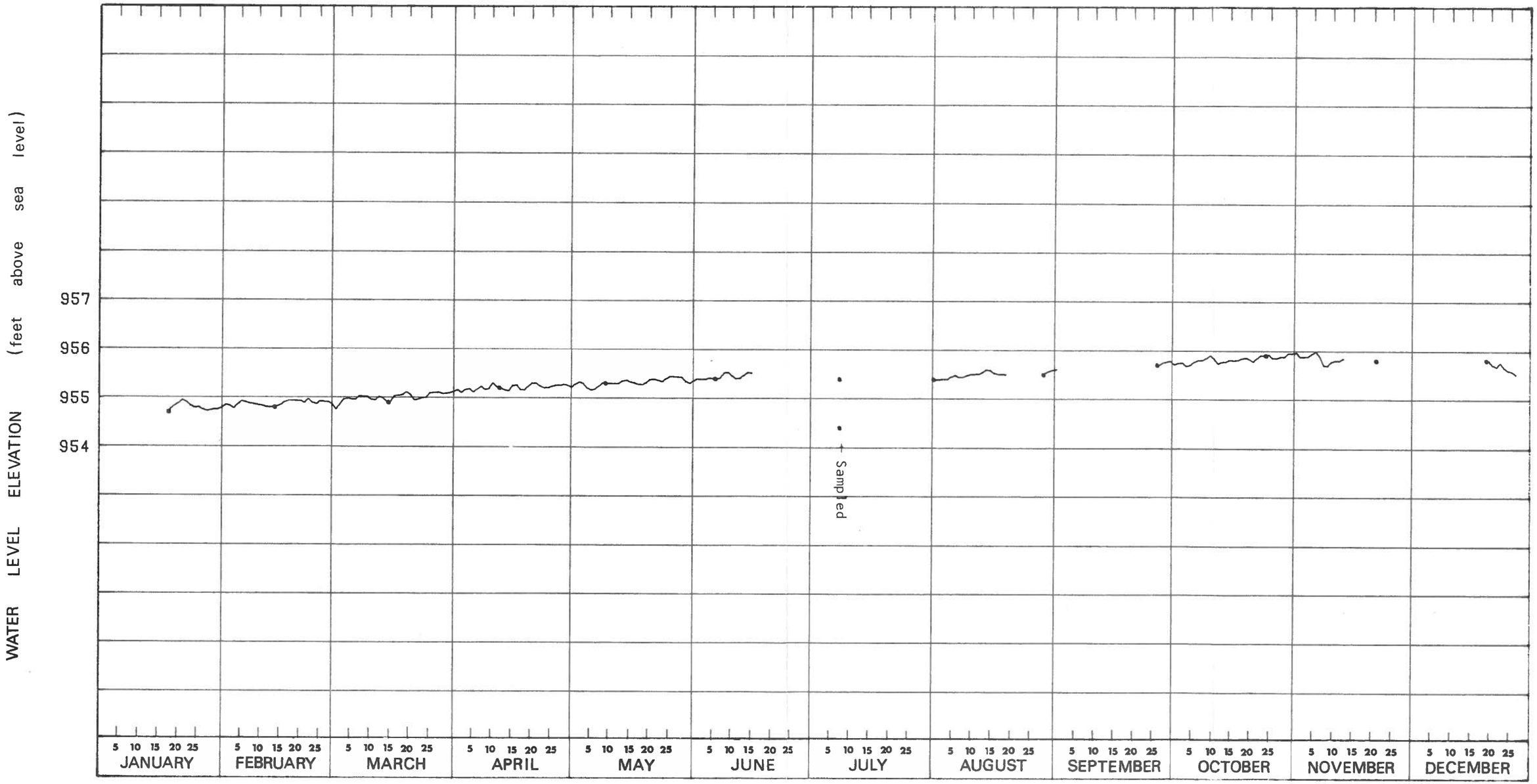
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-310

LSD 2 SEC 18 TWP 95 R 9 W4TH

6-310-H-79

Alberta Research Council



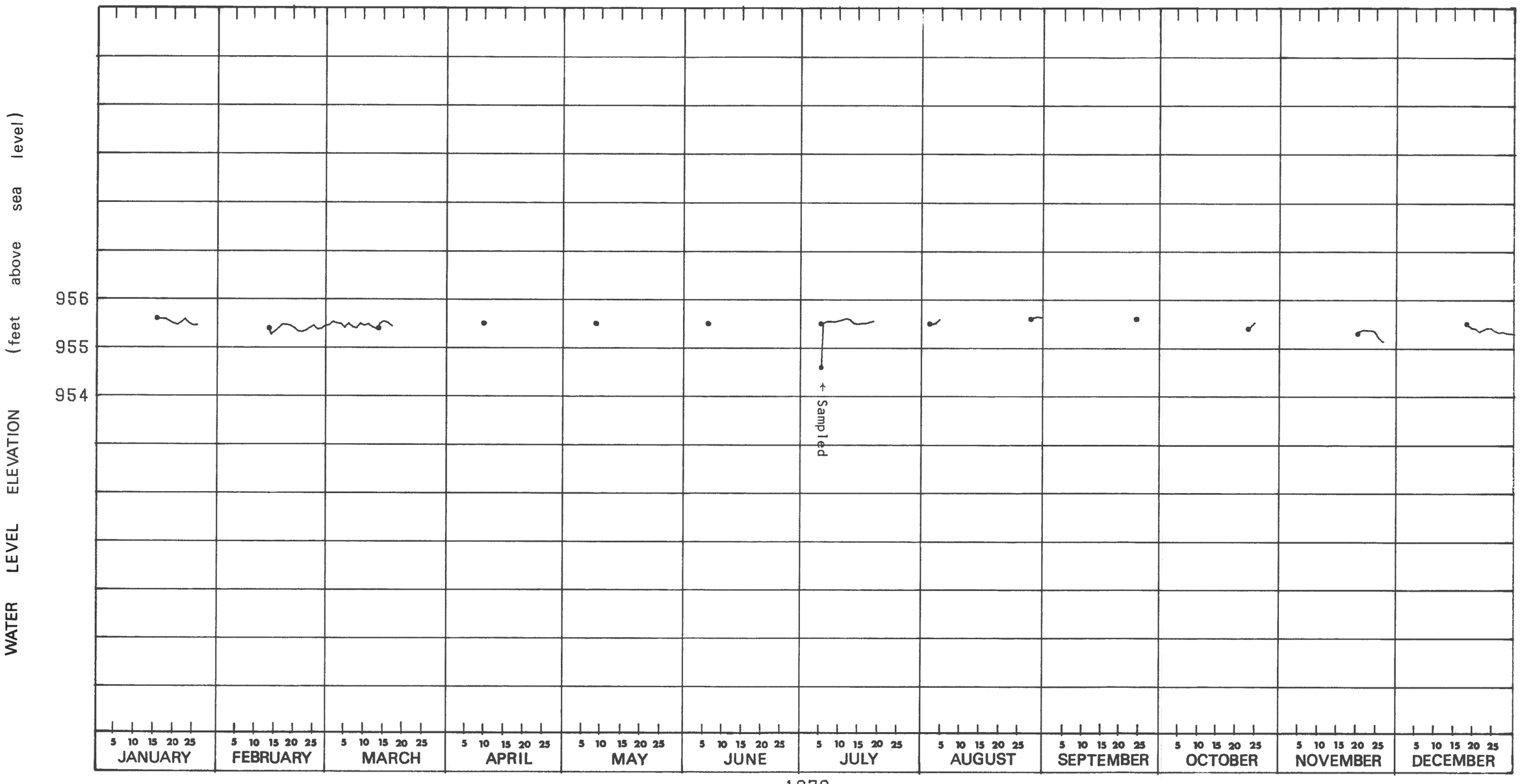
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council

6-310-H-80



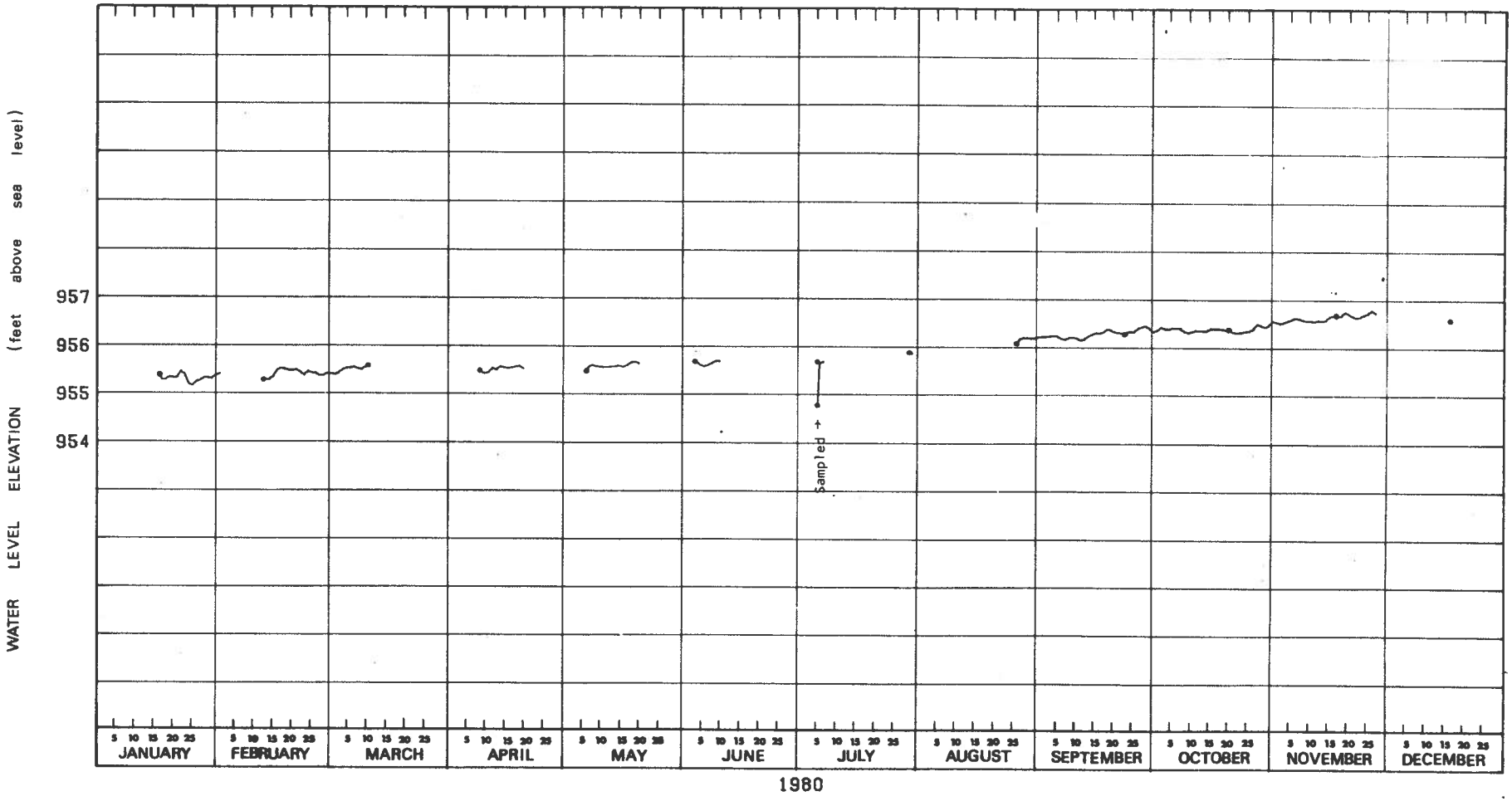
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council

6-310-H-81



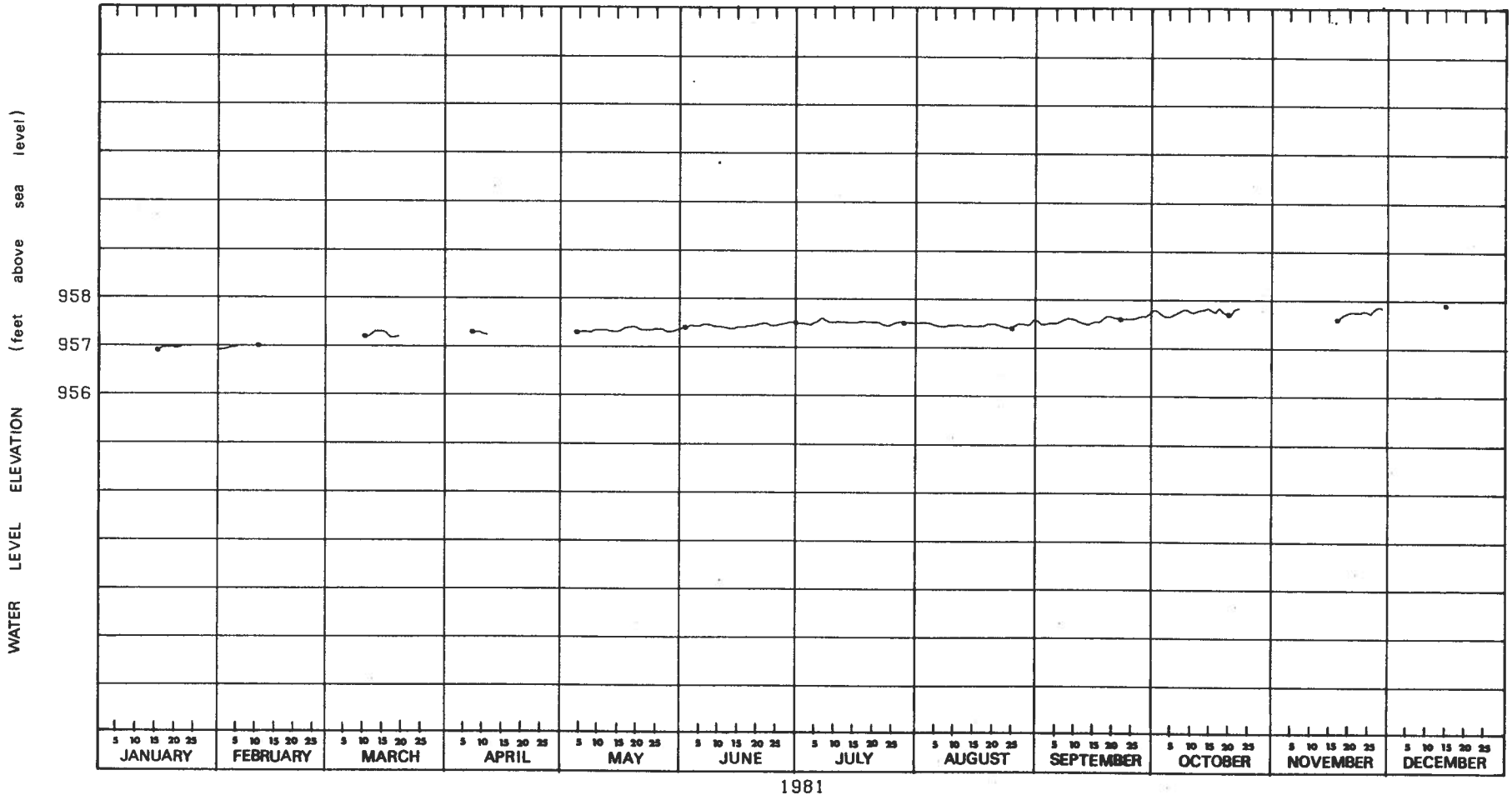
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-310

6-310-H-82

Lsd 2 Sec 18 Twp 95 R 9 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 987.94

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 8/75 | | | Well completed |
| Feb 9/75 | 2.68 TOC | 949.14 | |
| Feb 10/75 | | | Bail water sample |
| Feb 15/75 | 13.45 TOC | 943.82 | |
| Feb 16/75 | 12.20 TOC | 947.92 | |
| Feb 18/75 | 11.47 TOC | 950.32 | Pump test @ 3 USGPM/35 min; pump test @ 4 USGPM/8 min; pump test @ 2 USGPM/50 min; pump test @ 10 USGPM/23 min |
| Feb 19/75 | | | Pump test @ 2.5 IGPM/240 min; water sample |
| Feb 25/75 | 12.74 MP | 947.79 | |
| Mar 14/75 | 12.72 MP | 947.86 | |
| Apr 16/75 | 13.34 MP | 945.83 | |
| May 12/75 | 13.84 old MP | 944.18 | New MP = 20.75" TOC, (989.67) |
| June 9/75 | 14.31 MP | 942.77 | |
| July 9/75 | 14.62 MP | 941.71 | |
| Aug 14/75 | 14.93 MP | 939.69 | |
| Sept 11/75 | 15.09 MP | 939.17 | Sampled well; temp. 4°C |
| | 15.36 MP | 938.28 | after sample |
| Oct 7/75 | 14.92 MP | 940.73 | |
| Nov 7/75 | 14.38 MP | 942.50 | |
| Dec 7/75 | 13.83 MP | 944.31 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 987.94

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 13.36 MP | 945.9 | MP (989.7) |
| Feb 7/76 | 12.90 MP | 947.4 | |
| Mar 6/76 | 12.66 MP | 948.2 | |
| Apr 7/76 | 12.36 MP | 949.2 | |
| May 6/76 | 12.19 MP | 949.7 | |
| June 2/76 | 11.99 MP | 950.4 | |
| June 23/76 | 11.90 MP | 950.7 | |
| July 16/76 | 11.73 MP | 951.2 | |
| | 11.98 MP | 950.4 | After sample; temp. 6°C |
| Aug 10/76 | 11.61 MP | 951.6 | |
| Aug 31/76 | 11.50 MP | 952.0 | |
| Sept 29/76 | 11.29 MP | 952.7 | |
| Oct 27/76 | 11.19 MP | 953.0 | |
| Nov 24/76 | 11.19 MP | 953.0 | |
| Dec 22/76 | 11.18 MP | 953.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 987.94

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 11.15 MP | 953.1 | MP (989.7) |
| Feb 15/77 | 11.03 MP | 953.5 | |
| Mar 16/77 | 11.00 MP | 953.6 | |
| Apr 14/77 | 10.89 MP | 954.0 | |
| May 11/77 | 10.86 MP | 954.1 | |
| June 7/77 | 10.84 MP | 954.1 | |
| July 8/77 | 10.78 MP | 954.3 | |
| | 11.03 MP | 953.5 | After sample; temp. 6.5°C |
| Aug 3/77 | 10.77 MP | 954.4 | |
| Aug 31/77 | 10.77 MP | 954.4 | |
| Sept 29/77 | 10.78 MP | 954.3 | |
| Oct 25/77 | 10.74 MP | 954.5 | |
| Nov 22/77 | 10.78 MP | 954.3 | |
| Dec 20/77 | 10.71 MP | 954.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 987.94

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 10.68 MP | 954.7 | MP (989.7) |
| Feb 14/78 | 10.65 MP | 954.8 | |
| Mar 15/78 | 10.60 MP | 954.9 | |
| Apr 12/78 | 10.52 MP | 955.2 | |
| May 9/78 | 10.48 MP | 955.3 | |
| June 6/78 | 10.46 MP | 955.4 | |
| July 8/78 | 10.47 MP | 955.4 | |
| | 10.75 MP | 954.4 | After sample; temp. 5.5°C |
| Aug 1/78 | 10.47 MP | 955.4 | |
| Aug 29/78 | 10.43 MP | 955.5 | |
| Sept 27/78 | 10.35 MP | 955.7 | |
| Oct 25/78 | 10.31 MP | 955.9 | |
| Nov 22/78 | 10.32 MP | 955.8 | |
| Dec 20/78 | 10.33 MP | 955.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 987.94

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 10.39 MP | 955.6 | MP (989.7) |
| Feb 14/79 | 10.47 MP | 955.4 | |
| Mar 14/79 | 10.45 MP | 955.4 | |
| Apr 10/79 | 10.42 MP | 955.5 | |
| May 9/79 | 10.43 MP | 955.5 | |
| June 7/79 | 10.41 MP | 955.5 | |
| July 6/79 | 10.41 MP | 955.5 | |
| | 10.70 MP | 954.6 | After sample; temp. 6°C |
| Aug 3/79 | 10.41 MP | 955.5 | |
| Aug 29/79 | 10.38 MP | 955.6 | |
| Sept 25/79 | 10.40 MP | 955.6 | |
| Oct 24/79 | 10.46 MP | 955.4 | |
| Nov 21/79 | 10.50 MP | 955.3 | |
| Dec 19/79 | 10.43 MP | 955.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

6-310-W-82

## WELL HISTORY

OBSERVATION WELL NUMBER 6-310

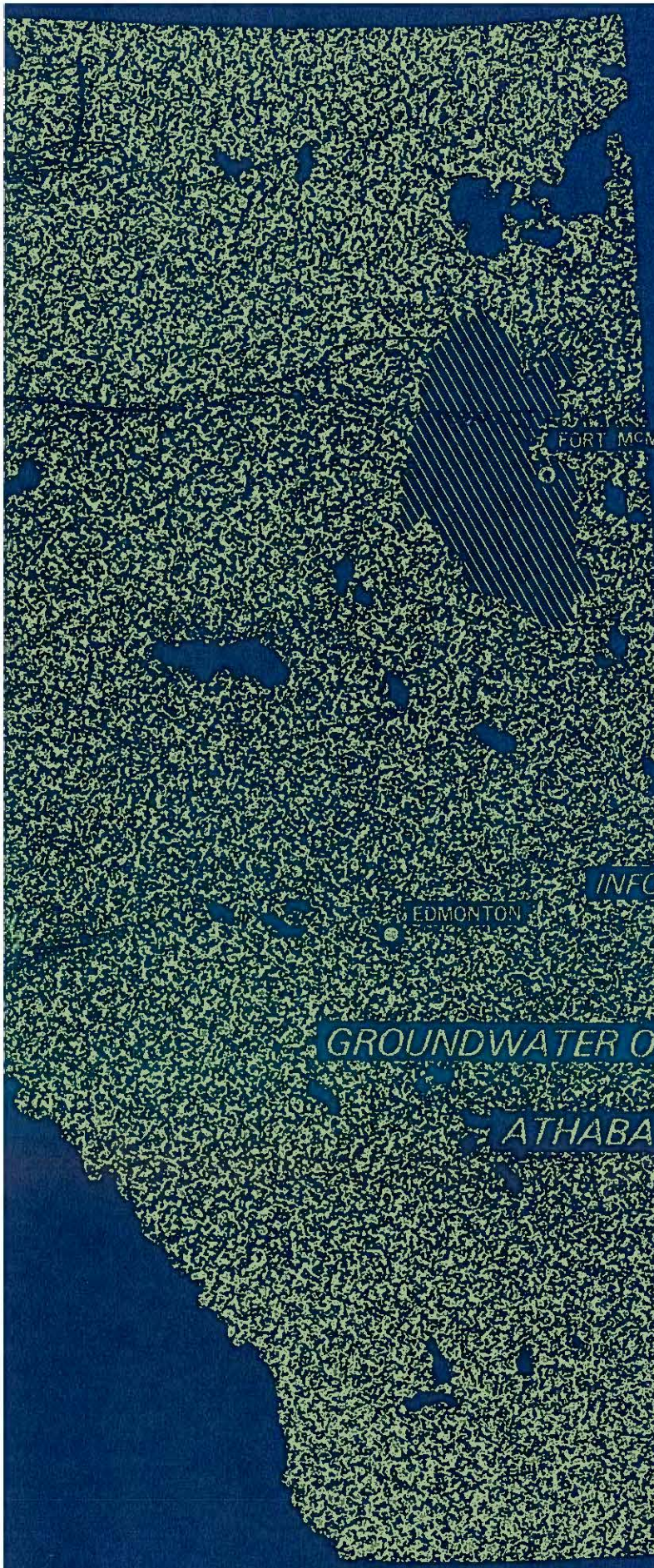
Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 987.94

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 10.45 MP | 955.4 | |
| Feb 13/80 | 10.49 MP | 955.3 | |
| Mar 11/80 | 10.40 MP | 955.6 | |
| Apr 9/80 | 10.41 MP | 955.5 | |
| May 7/80 | 10.42 MP | 955.5 | |
| June 4/80 | 10.35 MP | 955.7 | |
| July 6/80 | 10.35 MP | 955.7 | Temp. 5°C |
| | 10.63 MP | 954.8 | After Sample |
| July 30/80 | 10.29 MP | 955.9 | |
| Aug 27/80 | 10.24 MP | 956.1 | |
| Sept 24/80 | 10.18 MP | 956.3 | |
| Oct 21/80 | 10.13 MP | 956.4 | |
| Nov 18/80 | 10.06 MP | 956.7 | |
| Dec 18/80 | 10.08 MP | 956.6 | |
| Jan 16/81 | 9.99 MP | 956.9 | |
| Feb 11/81 | 9.96 MP | 957.0 | |
| Mar 11/81 | 9.92 MP | 957.2 | |
| Apr 8/81 | 9.87 MP | 957.3 | |
| May 5/81 | 9.89 MP | 957.3 | |
| June 2/81 | 9.84 MP | 957.4 | |
| July 1/81 | 9.83 MP | 957.5 | |
| July 29/81 | 9.81 MP | 957.5 | |
| Aug 26/81 | 9.84 MP | 957.4 | |
| Sept 23/81 | 9.80 MP | 957.6 | |
| Oct 21/81 | 9.77 MP | 957.7 | |
| Nov 18/81 | 9.79 MP | 957.6 | |
| Dec 16/81 | 9.70 MP | 957.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing




SITE SEVEN
13 20 95 8 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites, containing 36 individual wells, were instrumented in this manner during the winter of 1974-75.

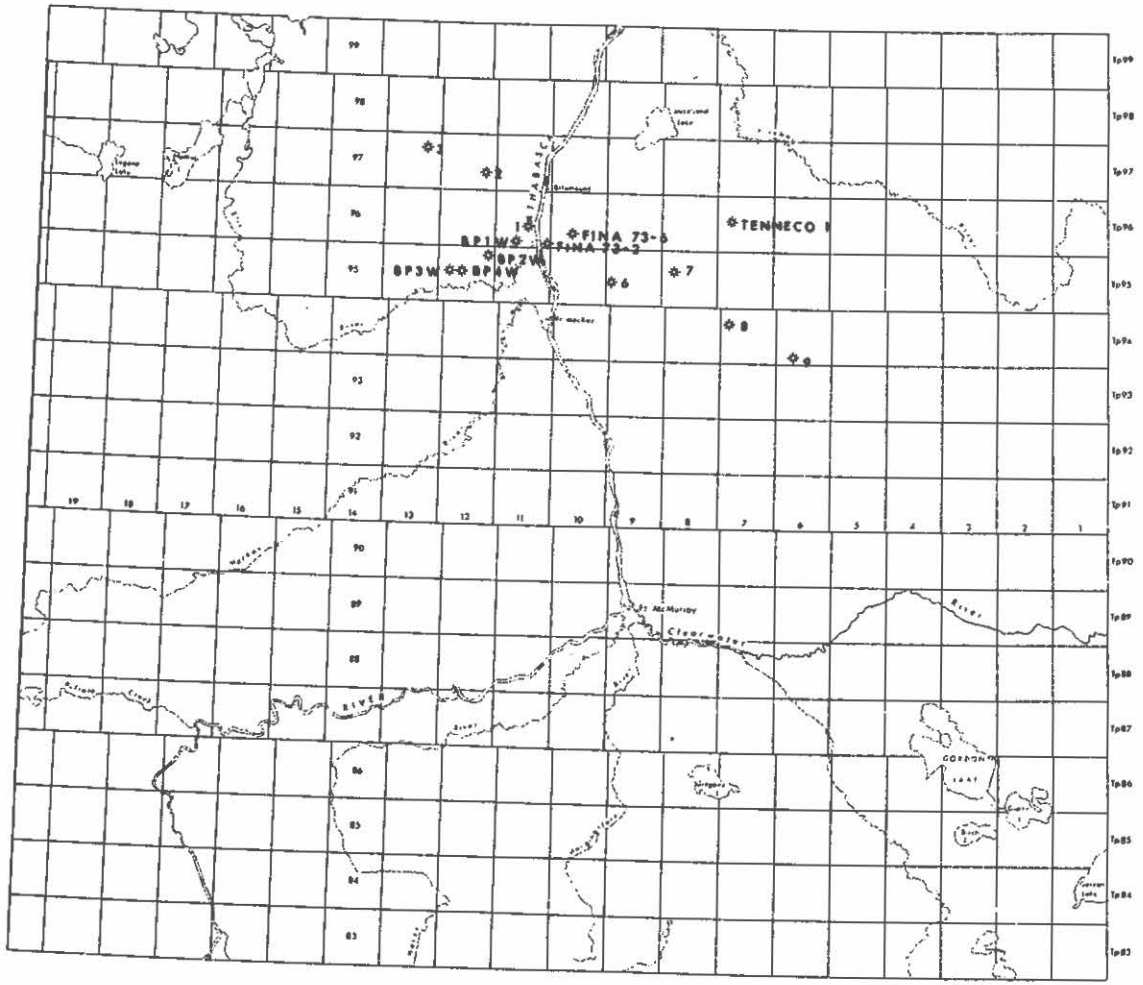
The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill-stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The loose-leaf format has been chosen to facilitate periodic updating with such information as hydrographs, water analyses and well history. The page indexing system is also consistent with the updating process. All updating packages will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this introduction and legend.

There were seven piezometer nests in the system on August 31, 1975. Four companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing. Table 1 lists the location of wells in the system as of August 31, 1975. Map 1 indicates the location of these wells. Publications available as of the date of this document include those for sites 1, 2, 3, 6, 7, 8 and 9.

Table 1
Athabasca Oil Sands Observation Wells
August 31, 1975

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |




6 0 6 12 18 MILES

**MAP 1**
**ATHABASCA OIL SANDS**
**OBSERVATION WELL NETWORK**
**August 31, 1975**

Acknowledgments

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, C. Seibert, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1975: BOPG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., and Shell Canada Ltd.

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

Well Number - the name used for designating the well

Subject Code - as follows:

- I - Introduction (no site number indicated)
- L - Legend (no site number indicated)
- G - General site information including geological logs, geophysical logs and site plan (no well number indicated)
- C - Well construction details
- D - Drill stem testing
- A - Aquifer testing
- E - Chemical analyses including spectral emission estimates and routine water analyses
- H - Annual hydrograph
- W - Well history

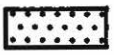
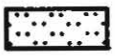
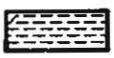
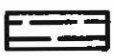
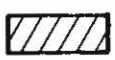
So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within the tabbed section for that particular well.

## SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| Mer | meridian |
| Meg/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diamter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| Sec. | section |
| ss | stainless steel |

| Symbol | Units or Parameter |
|---|---|
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) *or* time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| Wt | weight |

## GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
|  | sandstone |
| | arkosic sandstone |
| | silt |
|  | siltstone |
| | silt & sandstone |
|  | clay |
| | sandy clay |
|  | shale |
| | sandstone & shale |
| | oilsand |
| | shaley dolomite |
|  | gypsum |
| | dolomite |
| | limestone |

| Symbol | Stratigraphic Unit |
|---|---|
| Qd | unconsolidated deposits |
| Klb | La Biche Fm. |
| Kpl | Pelican Fm. |
| Kj | Joli Fou Fm. |
| Kg | Grand Rapids Fm. |
| Kc | Clearwater Fm. |
| Km | McMurray Fm. |
| Dbl | Beaverhill Lake Gp. |
| Dw | Waterways Fm. |
| Dpe | Prairie Evaporite Fm. |
| Dmt | Methy Fm. |
| Dmr | McLean River Fm. |
| Dl | La Loche Fm. |
| P$\epsilon$ | Precambrian |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: complete routine analysis and a spectral emission estimate for 29 elements. Many of the samples collected during 1975 appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years.

Most water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source".

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface

3. drill through the aquifer using very light mud
4. insert a screening device (if necessary).

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

Two drilling rigs were used simultaneously during the 1974-1975 drilling season. Both were Failing 1500; one was trailer mounted and capable of 2,000-foot depths, the other was truck mounted and capable of about 1,200-foot depths.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma and uncompensated density were the logs run during the 1974-75 drilling. The geological log presented represents an interpretation based upon the sample description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells when the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, all wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the

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measuring tape sticking to the wet casing. Conventional oil-field drill stem testing equipment was selected in an attempt to produce permeability and head values in the wells with deep water levels. Information from these drill stem tests is presented in the section on "Drill Stem Testing". A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day
V = volume of production into drill collars and stem
t = total flow time of test
T = transmissivity in millidarcy-feet
M = slope of final shut-in pressure plot
k = permeability in millidarcys
h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot.

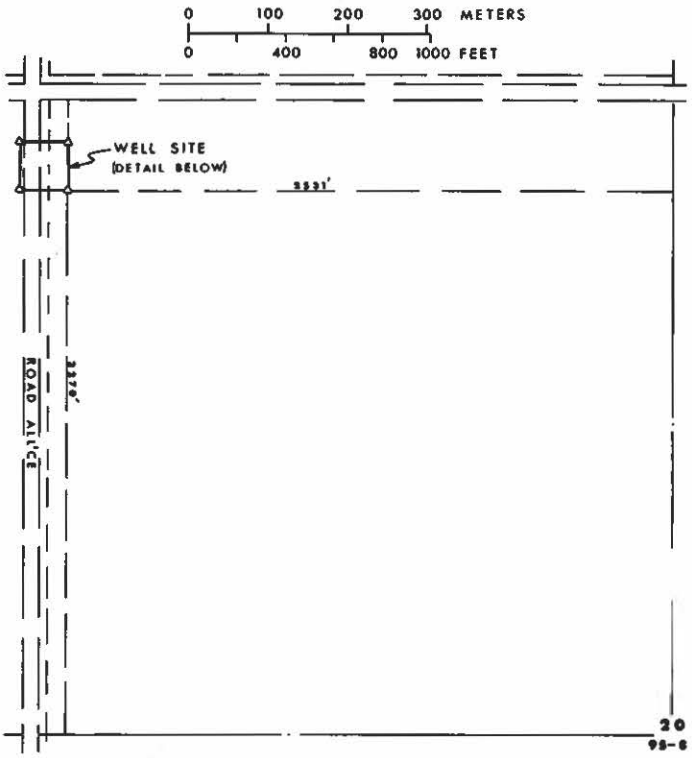
Values of transmissivity are expressed in the metric units of square metres per day. Permeability is expressed as centimetres per second.

OBSERVATION WELL SITE 7

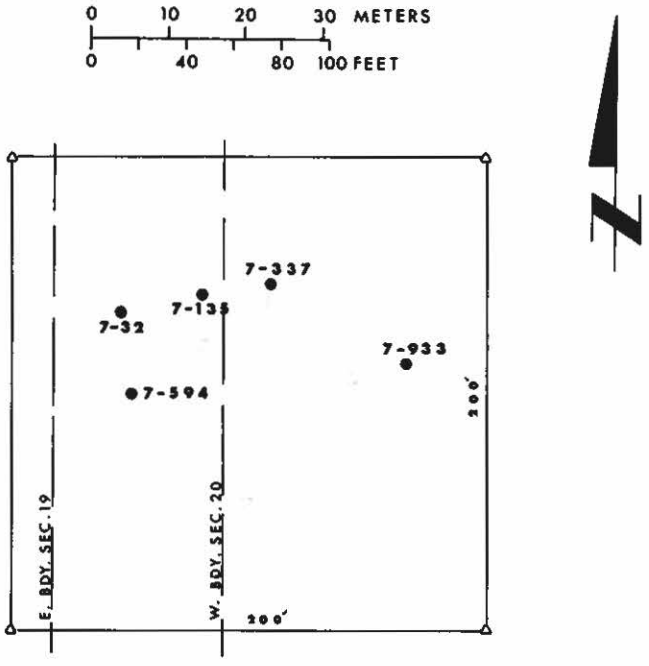
13-20-95-8 W 4th

16-19-95-9 W 4th

ALBERTA RESEARCH COUNCIL




WELLSITE DETAIL



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Seven

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Ground elevation 1071 Total depth 933

KB elevation 1076

| Interval from (feet below KB) to | Description | Formation |
|---|---|---|
| 10 | Unconsolidated sand and silt, very poor sorting, angular (quartz 80%, rock fragments 20%, clay 20%) | Drift |
| 20 | Unconsolidated sand + silt 50%, poor sorting, angular, (quartz 90%) clay 50% | |
| 30 | Unconsolidated, poorly sorted, clayey fine sand 85%, quartzite boulder chips 10%, coarse well rounded quartz 5% | |
| 40 | Tar sand, very fine - fine grained, poor sorting, sub-rounded quartz | McMurray |
| 50 | Tar sand, very fine - fine grained, poor sorted, sub-angular - sub-rounded, sub-spherical quartz | |
| 60 | Tar sand, fine grained, well sorted, sub-angular - sub-rounded, sub-spherical quartz | |
| 70 | Tar sand, very fine - fine grained, moderately well sorted, sub-angular - sub-spherical quartz | |
| 80 | Tar sand - A. very poorly sorted, coarse quartz and rock fragments 80%<br>B. very fine + fine quartz + rock fragments 10%<br>C. white quartzite boulder chips 10% rock fragments - granite 20%, quartzite 80%, coarse quartz well-rounded, clear-white coarse rock fragments - angular to sub-angular | |
| 90 | Tar sand - moderately well sorted, fine - very fine sand, sub-angular to sub-rounded<br>sub-spherical quartz 90%<br>coarser, clear, well rounded quartz 10% | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Seven (continued)

Lsd16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 100 | Tar sand - well sorted, very fine quartz sand, angular to sub-angular 70% - poor overall sorting | |
| | | - medium grained lithic (granite) quartz sand, angular 20% | |
| | 110 | Tar sand - fine grained, sub-spherical quartz 60% poor overall sorting | |
| | | - medium grained, sub-angular - sub-rounded quartz 40% | |
| 110 | 130 | Tar sand - very fine, angular sub-spherical quartz 20% - overall sorting, poor | |
| | | - fine - fine med. sub-rounded quartz 30% | |
| 130 | 140 | Silt (quartz) 95%, sand very fine - medium 5%, coarser material well rounded | |
| | 170 | Sandy siltstone, sand - fine - med. 5%, silt (quartz) 95% barren of tar | |
| | 180 | Silty very fine sand, angular - sub-angular, moderately well sorted, tar < 1% inclusion | |
| | 190 | Micaceous sandy siltstone, poorly consolidated, poor sorting, tar < 2% inclusions | |
| | 200 | Marginal tar sand, very fine silty sand, tar 2-3% distributed through sample | |
| 200 | 230 | Tar silt - silt 80%, very fine - fine sand 15%, tar 5% | |
| | 240 | Well consolidated sandy siltstone, silt 95%, sand (fine - medium well-rounded) 5% | |
| | 250 | Tar sand - well sorted, spherical, fine quartz sand | |
| | 260 | Tar sand - well sorted, spherical, fine - medium quartz sand | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Seven (continued)

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 270 | Tar sand - moderately well sorted, fine to medium, sub-angular to rounded quartz sand | |
| | 280 | Tar sand - moderately sorted, very fine - medium, angular to sub-rounded quartz sand clay and rock fragments 5 - 10% | |
| | 290 | Silty clay, grey, some tar but less than 1%, silt 20% | |
| | 300 | Silty clay, grey, tar inclusions < 1%, silt 10-15% | |
| | 310 | Silty clay, silt 5%, grey, 98%, tar inclusions < 1%, medium - coarse well-rounded quartz sand grains 1 - 2 % | |
| | 320 | Silty clay, silt 5%, grey,tar inclusions < 1% | |
| 320 | 340 | Clayey silty - very fine sand, poor sorting, quartz 95%, clay 5% | |
| | 350 | Shale, black crumbly, 95%, well-rounded medium-coarse quartz 5% | |
| | 360 | Shale, dark grey to black | |
| | 370 | Medium - light grey, silty clay, silt 10% | |
| | 380 | White - light grey silt | |
| | 390 | Dark grey - black shale, accessory well-rounded spherical, fine - medium quartz | |
| | 400 | Light grey, clayey silt, clay 10 - 15% | |
| 400 | 440 | Marl, clay, light grey, greenish waxy, highly calcareous | |
| 440 | 500 | Limestone, fissile lime mudstone, light grey to white | Beaverhill Lake |
| | 510 | Marl, clay light grey, greenish waxy, highly calcareous 98%, lime mudstone chips 2% | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Seven (continued)

Lsd 16 Sec 4 Twp94 R 6 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 520 | Limestone, fissile lime mudstone, light grey to white 90%, clay 10% | |
| | 550 | Marl, clay, light grey greenish waxy, highly calcareous | |
| | 570 | Limestone, light grey to tan, pelletal grainstone (Durham), pellets 90%, unidentifiable fossil fragments 10% | |
| | 580 | Grey, very fine grained clastic limestone 40%, very porous, wackestone - white microcrystaline limestone - 30%, fissile grey argillaceous limestone - 30% | |
| | 590 | Grey to green very fine grained clastic limestone, porous limestone, porous wackestone 60%, gypsum as vugs or veins 40% - fibrous 1-2% coarse crystaline, pyrite, trace inclusions | Prairie Evaporite |
| | 600 | Gypsum 90% - white grey green very fine grained clastic limestone 10%, oil staining | |
| | 610 | White grey green very fine grained clastic limestone 10%, gypsum 10%, fissile light green argillaceous limestone 15% | |
| | 620 | White to grey-green very fine grained clastic limestone 80%, gypsum 5%, fissile light green argillaceous limestone 15% | |
| | 630 | White to grey-green very fine grained clastic limestone 35%, gypsum 20%, fissile light green argillaceous limestone 10%, fine grained brownish dolomite mosaic intercrystalized with gypsum 35% | |
| | 640 | Gypsum 80%, fine grained dolomite 10%, fissile light green argillaceous limestone 10% | |
| 640 | 730 | Gypsum | |
| | 740 | Limestone, mottled brown and white, fine grained autoclastic | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Seven (continued)

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

| Interval from (feet below KB) to | Description | Formation |
|---|---|---|
| 750 | Gypsum | |
| 760 | Calcareous black shale | |
| 770 | Brown very fine grained dolomite mosaic | |
| 780 | Brown, very fine to fine grained dolomite mosaic | |
| 790 | Medium grey tan, very fine to fine grained dolomite mosaic | |
| 800 | Brown dolomite as above | |
| 810 | White dolomite as above | |
| 820 | Gypsum 10%, grey green fine crystaline limestone, pyrite inclusions 30% | |
| 830 | Gypsum 50%, white dolomite 50% | |
| 840 | Dark grey microcrystaline dolomite | |
| 850 | Calcareous claystone 70%, white very fine grained pelletal limestone 25%, gypsum 5% | |
| 860 | Brown sucrosic dolomite 30%, gypsum 70% | |
| 870 | Grey green dolomitic claystone 60%, gypsum 40% | |
| 880 | Dolomite claystone 90%, gypsum, 10% | |
| 890 | Red dolomitic claystone 85%, grey dolomitic claystone 10%, gypsum 5% | |
| 900 | Arkose 95% very fine to fine medium, moderately well sorted, sub-angular quartz, k-spar granite wash and amphibole - mod. porosity in coarser material, gypsum fibrous elongate and crystaline 5%, dolomitic claystone trace | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Seven (continued)

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 910 | Arkose, fine to medium coarse moderately well sorted, angular - sub-angular quartz 90% K-spar 10% and accessories | |
| | 920 | Coarse to very coarse granite wash, very poor sorting, angular particles | |
| | 930 | Granite | Precambrian |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Seven

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Ground elevation 1071 Total depth 933

KB elevation 1076

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 8 | 20 | Unconsolidated drift: sand, fine-coarse grained, angular, quartz, feldspar, hvy mnrls; silt up to 50%; some boulderchips | Drift |
| 20 | 40 | Clay, grey with thin silty beds | Clearwater |
| 40 | 50 | Sandstone, medium grey, fine-medium grained, silty, subrounded, heavily oil impregnated, qtz, lt cht, fld | McMurray |
| 50 | 70 | Sandstone as above, slightly oil impregnated; medium grey clay interbedded | |
| 70 | 90 | Sandstone, light brown, fine grained, subangular-subrounded, well sorted, heavily oil impregnated; qtz, light cht, pyrite, fld | |
| 90 | 100 | Sandstone as above, coarse-grained | |
| 100 | 110 | Sandstone, light brown, fine-medium grained, some pebbles, subangular-subrounded, poorly sorted, light oil impregnation | |
| 110 | 150 | Shale, medium-dark grey, interbedded with sandstone, light brown, fine grained, subrounded; minor siltstone | |
| 150 | 190 | Sandstone, light brown, fine-medium grained, subrounded, medium sorted, heavily to moderately oil impregnated, qtz, lt cht, pyrite, mica; siltstone interbedded in the bottom | |
| 190 | 250 | Siltstone, medium grey, sandy, slightly oil impregnated. Clay, medium grey, interbedded | |
| 250 | 270 | Sandstone, light brown, oil cemented, fine to medium grained, well sorted, well rounded, qtz, lt cht, pyrite | |
| 270 | 330 | Clay, medium-dark grey, silty interbedded with siltstone, grey sandy, slightly oil impregnation | |
| 330 | 360 | Shale, dark grey, carbonaceous | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Seven (continued)

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 360 | 390 | Siltstone, medium grey; sandstone, light brown, fine-grained, interbedded | |
| 390 | 400 | Shale, dark grey, carbonaceous | |
| 400 | 440 | Siltstone, medium grey, calcareous, carbonaceous, sandstone, light grey, interbedded | |
| 440 | 510 | Limestone, light-medium grey; argillaceous limestone and calcareous shale in thin beds | Beaverhill Lake |
| 510 | 520 | Limestone, light grey, dolomitic; dolomite, light brown, calcareous, fossiliferous (pelletal), thin anhydrite beds | Slave Point and Fort Vermilion |
| 520 | 555 | Shale, light to medium grey, calcareous; minor anhydrite interbedded | Watt Mountain |
| 555 | 600 | Dolomite, buff to light grey, fine grained, vuggy porosity, interbedded with light brown anhydritic dolomite and white, green mottled anhydrite. Oil stained in the upper part to oil saturated in the lower part | Muskeg |
| 600 | 640 | Shale, grey, dolomitic, fissile, with rock salt and thin light green anhydrite beds. Oil impregnated in the upper part | Prairie Evaporite |
| 640 | 680 | Anhydrite, white, green and red mottling; white gypsum and smoky grey rock salt | |
| 680 | 695 | Rock salt, smoky grey, argillaceous, interbedded with medium grey shale | |
| 695 | 735 | Anhydrite, white to medium grey, red mottling, partly crystalline, interbedded with white, leached gypsum and minor dolomitic shale | |
| 735 | 750 | Shale, medium grey, dolomitic, fissile with smoky grey rock salt and minor white anhydrite beds | |
| 750 | 770 | Anhydrite, grey, red mottling, powdery, partly argillaceous; thin beds of grey shale | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Seven (continued)

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 770 | 800 | Dolomite, light brown to brownish grey, fine grained, fossiliferous, vuggy porosity; limestone, buff, dolomitic and thin beds of grey calcareous shale | Methy |
| 800 | 850 | Dolomite, light grey, microcrystalline, fossiliferous; argillaceous and silty dolomite and minor calcareous shale | |
| 850 | 860 | Shale, grey, calcareous with thin beds of light brown, fine grained dolomite and white gypsum | McLean River (Chinchaga) |
| 860 | 870 | Gypsum, white, crystalline with brown sucrosic dolomite | |
| 870 | 880 | Shale, grey to green, dolomitic with thin beds of gypsum | |
| 880 | 900 | Shale, light brownish and grey, dolomitic with gypsum, white, in thick beds | |
| 900 | 920 | Sandstone, arkosic, reddish, fine to medium grained with angular to subangular quartz and feldspar | La Loche |
| 920 | 930 | Coarse to very coarse grained granite wash, very poor sorting, angular | |
| 930 | | Granite, reddish | Precambrian |

## SUMMARY OF CONTENTS

SITE NUMBER SEVEN

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | site | 7-32 | 7-135 | 7-337 | 7-594 | 7-933 |
| Introduction | 4 | — | — | — | — | — |
| Legend | 8 | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — |
| Geological Sample Description | 6 | — | — | — | — | — |
| Geophysical and Geological Logs | 2 | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 1 | 4 | 3 | 1 | 0 |
| Drill Stem Test | — | 0 | 0 | 0 | 2 | 2 |
| Shut-In Pressure Data | — | 0 | 0 | 0 | 2 | 1 |
| Water Analysis | — | 3 | 3 | 5 | 4 | 4 |
| Spectral Emissions Estimates | — | 1 | 1 | 1 | 0 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER SEVEN

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | site | 7-32 | 7-135 | 7-337 | 7-594 | 7-933 |
| Geological Sample Description | 3* | — | — | — | — | — |
| Geophysical and Geological Logs | 1* | — | — | — | — | — |
| Shut-In Pressure Data | — | 0 | 0 | 0 | 0 | 1* |
| Water Analysis | — | 1 | 1 | 1 | 1 | 1 |
| Water Level Hydrograph | — | 2** | 1 | 1 | 1 | 1 |
| Well History | — | 1* | 1 | 1 | 1 | 1 |

*Erratum sheets replacing material distributed in 1976.
**Includes 1976 hydrograph and corrected 1975 hydrograph.

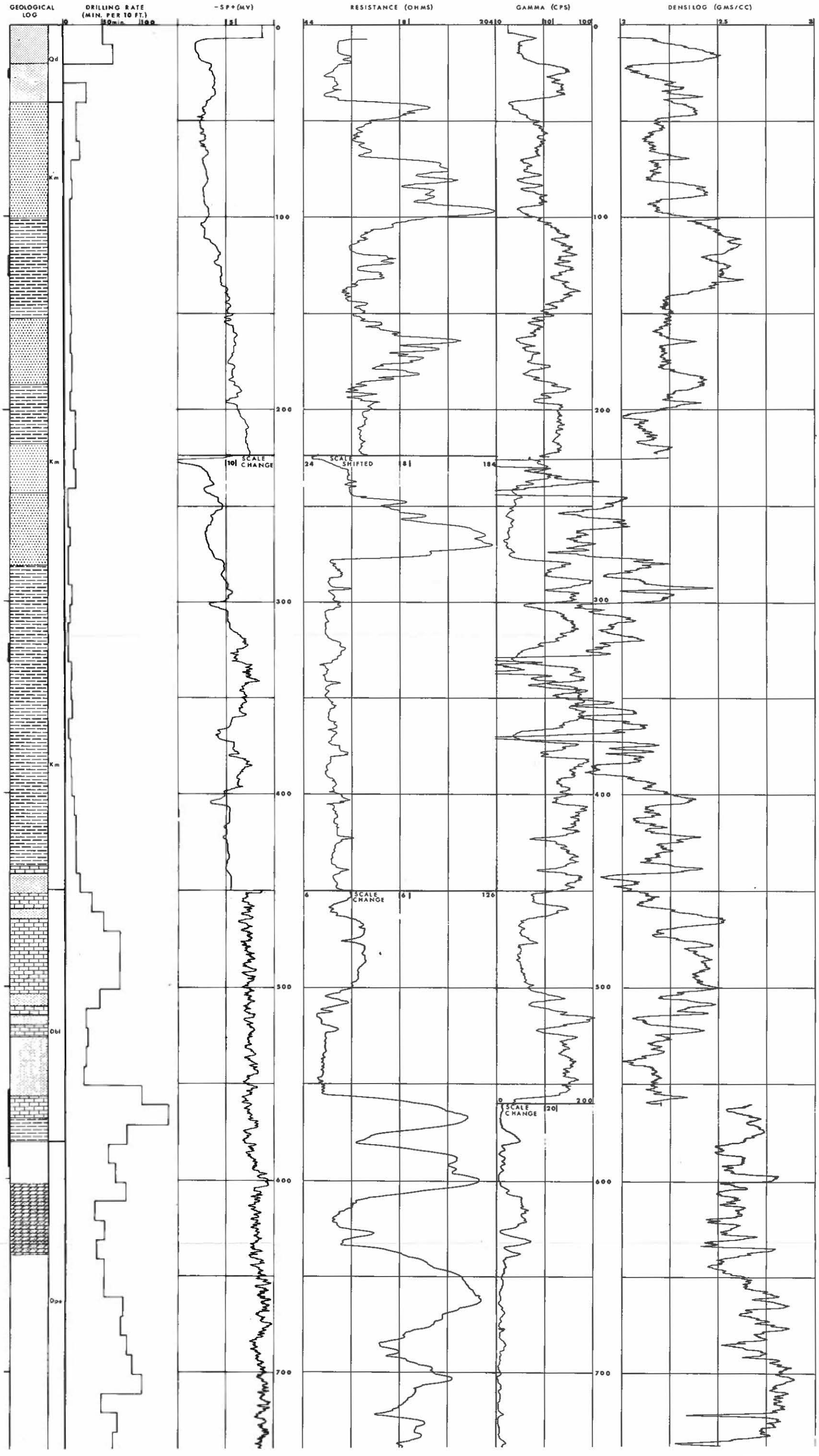
# SITE 7

## ERRATUM STATEMENT

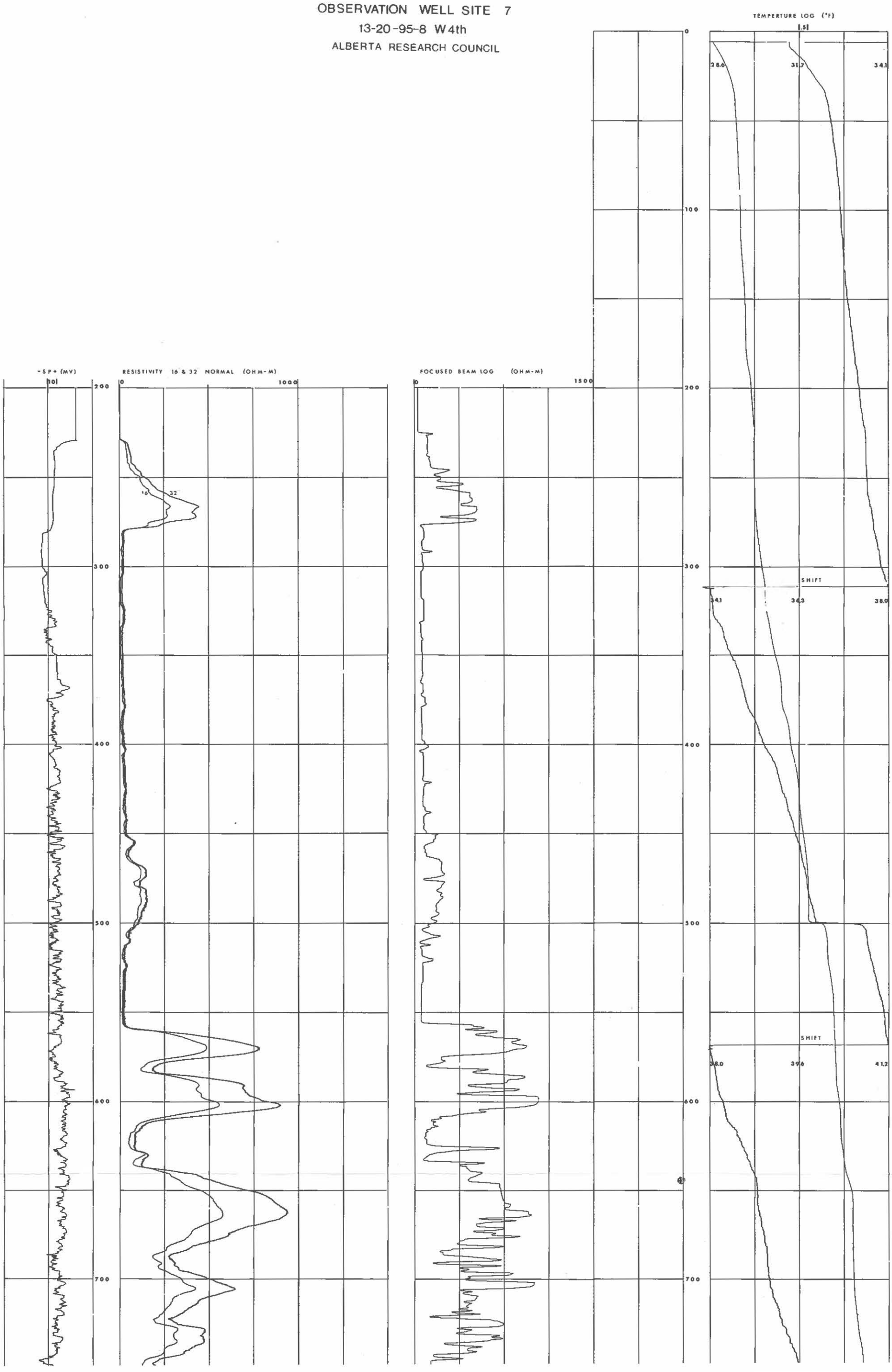
### Material Distributed in 1976

1. Corrected GEOLOGICAL SAMPLE DESCRIPTION pages have been issued. Pages indexed 7-G-77 have replaced those indexed 7-G-76.
2. A corrected GEOPHYSICAL AND GEOLOGICAL LOGS page has been issued. The page indexed 7-G-77 has replaced 7-G-76.
3. The "formation tested" on the DRILL STEM TEST page for well 7-594 should be changed to Prairie Evaporite.
4. The "formation tested" on the DRILL STEM TEST page for well 7-933 should be changed to McLean River/La Loche.
5. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
6. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.
7. A new WATER LEVEL HYDROGRAPH has been issued for well 7-32 covering 1975. The page index is 7-32-H-77 and replaces 7-32-H-76.
8. A new WELL HISTORY has been issued for well 7-32 covering 1975 and 1976. The page index is 7-32-W-77 and replaces 7-32-W-76.
9. The top of casing elevation (TOC elev) shown on the WELL CONSTRUCTION page for well 7-32 should be 1073.42 not 1972.42.
10. A new SHUT-IN PRESSURE DATA page has been issued for well 7-933. The page indexed 7-973-D-77 has replaced 7-973-D-76.

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 7
### 13-20-95-8 W4th
### ALBERTA RESEARCH COUNCIL



GEOPHYSICAL LOGS
OBSERVATION WELL SITE 7
13-20-95-8 W4th
ALBERTA RESEARCH COUNCIL



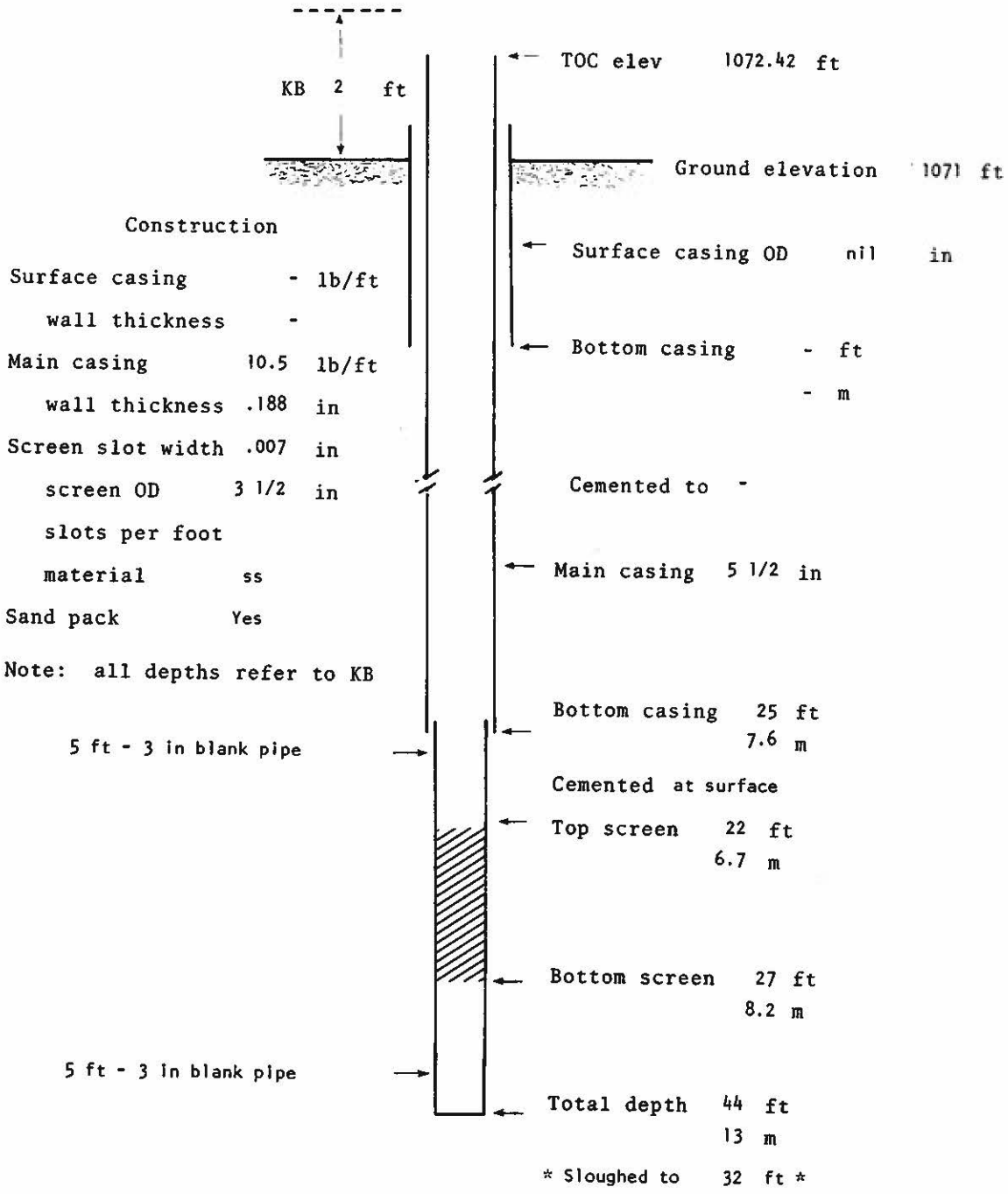
7-32-C-76

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Tp 95 R 8 W4th

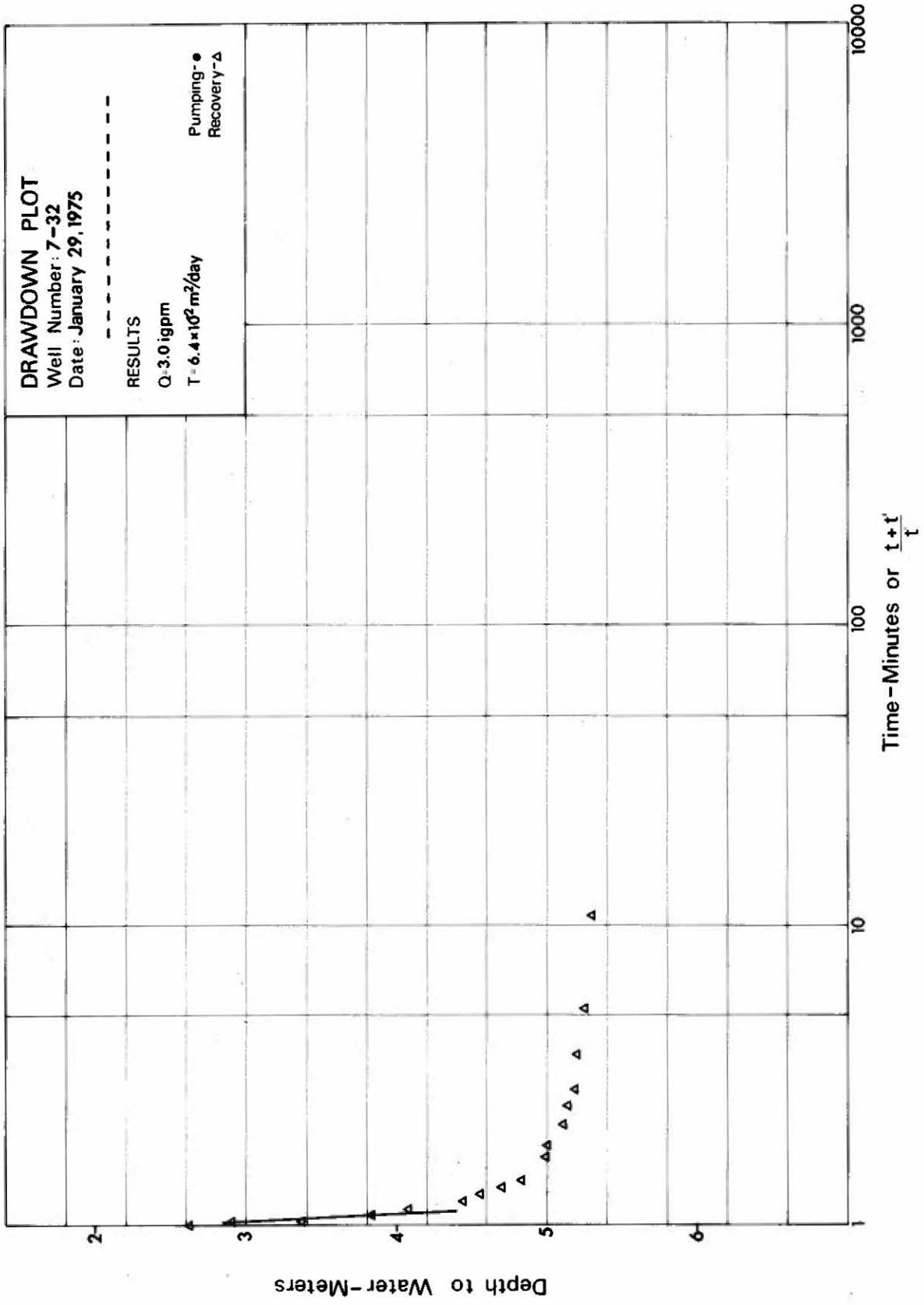
Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 10.5 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | Yes | |

Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 7-32
Date: January 29, 1975
RESULTS
Q=3.0 igpm
T=6.4×10² m²/day
Pumping-●
Recovery-△
Depth to Water-Meters
Time-Minutes or (t+t')/t
2
3
4
5
6
1
10
100
1000
10000

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed from 7-32

Date sampled January 31, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 41.5 | 2.07 | 26.6 |
| Magnesium ($Mg^{++}$) | 15.3 | 1.26 | 16.2 |
| Sodium ($Na^{+}$) | 101.0 | 4.39 | 56.5 |
| Potassium ($K^{+}$) | 2.1 | 0.05 | 0.7 |
| Carbonate ($CO_3^{=}$) | 16.8 | 0.56 | 6.8 |
| Bicarbonate ($HCO_3^{-}$) | 408.0 | 6.69 | 81.8 |
| Sulfate ($SO_4^{=}$) | 35.2 | 0.73 | 9.0 |
| Chloride ($Cl^{-}$) | 5.0 | 0.14 | 1.7 |
| Nitrate ($NO_3^{=}$) | 3.5 | 0.06 | 0.7 |
| Silica ($SiO_2$) | 11.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 402.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 8.178 | Total Cations (epm) | 7.776 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 660 | Temperature (C) | 1.1 |
| pH | 8.5 | pH | 8.6 |
| Fluoride ($F^{-}$) | 0.9 ppm | Carbonate ($CO_3^{=}$) | 17.3 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 389.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

7-32-E-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 6.3 | 0.31 | 5 |
| Magnesium ($Mg^{++}$) | 10.9 | 0.90 | 14 |
| Sodium ($Na^{+}$) | 108 | 4.70 | 76 |
| Potassium ($K^{+}$) | 11.3 | 0.29 | 5 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 322 | 5.28 | 85 |
| Sulfate ($SO_4^{=}$) | 26.3 | 0.55 | 9 |
| Chloride ($Cl^{-}$) | 14 | 0.39 | 6 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0 |
| Silica ($SiO_2$) | 0.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 15.1 | | |
| Magnesium (Acidified) | 10 | | |
| Total dissolved solids | 348 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 6.23 | Total Cations (epm) | 6.20 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 610 |
| pH | 8.3 |
| Fluoride ($F^{-}$) | 0.8 ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | 7.5 | |
| pH | | |
| Carbonate ($CO_3^{=}$) | 72 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 220 | ppm |
| Hydroxide ($OH^{-}$) | | |
| Conductivity | | |

7-32-E-76

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed from well 7-32

Date of sampling January 31, 1975

Total dissolved solids 402 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .04 | Mg | .05 |
| As | <.01 | Mn | .002 |
| B | .02 | Mo | ND |
| Ba | .004 | Ni | .03 |
| Be | ND | Pb | .005 |
| Bi | ND | Sb | ND |
| Ca | M | Si | M |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .004 | V | ND |
| Fe | .04 | Zn | .01 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 6.3 | 0.31 | 5 |
| Magnesium ($Mg^{++}$) | 10.9 | 0.90 | 14 |
| Sodium ($Na^{+}$) | 108 | 4.70 | 76 |
| Potassium ($K^{+}$) | 11.3 | 0.29 | 5 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 322 | 5.28 | 85 |
| Sulfate ($SO_4^{=}$) | 26.3 | 0.55 | 9 |
| Chloride ($Cl^{-}$) | 14.0 | 0.39 | 6 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0 |
| Silica ($SiO_2$) | 0.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 15.1 | | |
| Magnesium (Acidified) | 10.0 | | |
| Total dissolved solids | 348 | | |

Total Anions (epm) 6.23 Total Cations (epm) 6.20

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 610 |
| pH | 8.3 |
| Fluoride ($F^{-}$) | 0.8 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 7.5 |
| pH | 9.5 |
| Carbonate ($CO_3^{=}$) | 72 ppm |
| Bicarbonate ($HCO_3^{-}$) | 220 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 90.0 | 4.49 | 51 |
| Magnesium ($Mg^{++}$) | 32.0 | 2.63 | 30 |
| Sodium ($Na^{+}$) | 35.0 | 1.52 | 17 |
| Potassium ($K^{+}$) | 5.0 | 0.13 | 2 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 478.0 | 7.83 | 95 |
| Sulfate ($SO_4^{=}$) | 6.6 | 0.14 | 2 |
| Chloride ($Cl^{-}$) | 4.0 | 0.11 | 1 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 9.9 | | |
| Hydroxide ($OH^{-}$) | 2.3 | 0.14 | 2 |
| Calcium (Acidified) | 84.7 | | |
| Magnesium (Acidified) | 28.6 | | |
| Total dissolved solids | 426 | | |
| Total Anions (epm) | 8.23 | Total Cations (epm) | 8.78 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 720 | Temperature (C) | 7.0 |
| pH | 7.6 | pH | 6.9 |
| Fluoride ($F^{-}$) | 0.6 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 522 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed (U of A Geology)

Date sampled May 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 60.7 | 2.97 | 43.9 |
| Magnesium ($Mg^{++}$) | 21.5 | 1.76 | 26.0 |
| Sodium ($Na^{+}$) | 44.8 | 1.93 | 28.5 |
| Potassium ($K^{+}$) | 4.2 | 0.11 | 1.6 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 356.0 | 5.70 | 95.6 |
| Sulfate ($SO_4^{=}$) | 2.3 | 0.05 | 0.8 |
| Chloride ($Cl^{-}$) | 7.5 | 0.21 | 3.5 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5.96 | Total Cations (epm) | 6.77 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 515 | Temperature (C) | |
| pH | 7.9 | pH | |
| Fluoride ($F^{-}$) | | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed (U of A Geology)

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 38.6 | 1.89 | 32.2 |
| Magnesium ($Mg^{++}$) | 18.6 | 1.53 | 26.1 |
| Sodium ($Na^{+}$) | 53.3 | 2.29 | 39.0 |
| Potassium ($K^{+}$) | 2.9 | 0.08 | 1.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 356.0 | 5.70 | 95.6 |
| Sulfate ($SO_4^{=}$) | 0.5 | 0.01 | 0.2 |
| Chloride ($Cl^{-}$) | 9.0 | 0.25 | 4.2 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5.96 | Total Cations (epm) | 5.87 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 525 | Temperature (C) | |
| pH | 7.8 | pH | |
| Fluoride ($F^{-}$) | | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 10, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 40.0 | 2.00 | 33.0 |
| Magnesium ($Mg^{++}$) | 18.3 | 1.51 | 24.9 |
| Sodium ($Na^{+}$) | 56.0 | 2.44 | 40.3 |
| Potassium ($K^{+}$) | 4.2 | 0.11 | 1.8 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 359.0 | 5.88 | 94.2 |
| Sulfate ($SO_4^{=}$) | 3.8 | 0.08 | 1.3 |
| Chloride ($Cl^{-}$) | 10.0 | 0.28 | 4.5 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 5.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 36.0 | | |
| Magnesium (Acidified) | 18.1 | | |
| Total dissolved solids | 330.1 | | |
| Total Anions (epm) | 6.25 | Total Cations (epm) | 6.05 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 580 | Temperature (C) | 8.0 |
| pH | 7.8 | pH | 7.1 |
| Fluoride ($F^{-}$) | 0.6 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 356.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed (U of A Geology)

Date sampled August 31, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 53.0 | 2.60 | 42.1 |
| Magnesium ($Mg^{++}$) | 20.0 | 1.64 | 26.5 |
| Sodium ($Na^{+}$) | 42.0 | 1.81 | 29.3 |
| Potassium ($K^{+}$) | 4.9 | 0.13 | 2.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 350.0 | 5.60 | 96.9 |
| Sulfate ($SO_4^{=}$) | 0.5 | 0.01 | 0.2 |
| Chloride ($Cl^{-}$) | 6.0 | 0.17 | 2.9 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | | | |
| Total Anions (epm) | 5.78 | Total Cations (epm) | 6.18 |

Other Constituents

Lab:

- Conductivity 498
- pH 8.2
- Fluoride ($F^{-}$)

Field:

- Temperature (C)
- pH
- Carbonate ($CO_3^{=}$)
- Bicarbonate ($HCO_3^{-}$)
- Hydroxide ($OH^{-}$)
- Conductivity

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled November 23, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 42.0 | 2.10 | 34.6 |
| Magnesium ($Mg^{++}$) | 22.0 | 1.81 | 29.9 |
| Sodium ($Na^{+}$) | 48.8 | 2.12 | 35.0 |
| Potassium ($K^{+}$) | 1.3 | 0.03 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 359.0 | 5.88 | 92.3 |
| Sulfate ($SO_4^{=}$) | 7.0 | 0.15 | 2.3 |
| Chloride ($Cl^{-}$) | 12.0 | 0.34 | 5.3 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 4.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 324.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 6.38 | Total Cations (epm) | 6.06 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 580 | Temperature (C) |
| pH | 8.3 | pH |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Date sampled: July 18, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .488 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 41.8 |
| As | <.038 | Ni | <.010 |
| B | .227 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 89.8 | Si | 6.83 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .590 |
| Cr | <.006 | Te | <.065 |
| Cu | .021 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 2.31 | V | .006 |
| K | 44 | W | <.078 |
| Mg | 29.9 | Zn | .066 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

7-32-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled January 18, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 44.0 | 2.20 | 36.3 |
| Magnesium(Mg) | 19.0 | 1.56 | 25.8 |
| Sodium(Na) | 50.0 | 2.17 | 35.9 |
| Potassium(K) | 4.6 | 0.12 | 1.9 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 320.0 | 5.25 | 91.8 |
| Sulphate(SO4) | 3.4 | 0.07 | 1.2 |
| Chloride(Cl) | 14.0 | 0.39 | 6.9 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.1 |
| Silica(SiO2) | 2.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 292.0 | | |
| Total Anions(epm) | 5.72 | Total Cations(epm) | 6.05 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 510 | Temperature(C) |
| pH | 7.4 | pH |
| Fluoride(F) | 0.5 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled March 15, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 32.0 | 1.60 | 28.5 |
| Magnesium(Mg) | 23.0 | 1.89 | 33.7 |
| Sodium(Na) | 46.3 | 2.01 | 35.9 |
| Potassium(K) | 4.2 | 0.11 | 1.9 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 300.0 | 4.92 | 82.3 |
| Sulphate(SO4) | 9.5 | 0.20 | 3.3 |
| Chloride(Cl) | 30.0 | 0.85 | 14.2 |
| Nitrate(NO3) | 0.8 | 0.01 | 0.2 |
| Silica(SiO2) | 2.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 236.0 | | |
| Total Anions(epm) | 5.97 | Total Cations(epm) | 5.61 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 452 | Temperature(C) |
| pH | 7.3 | pH |
| Fluoride(F) | 0.5 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

7-32-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled May 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 35.0 | 1.75 | 33.6 |
| Magnesium(Mg) | 18.0 | 1.48 | 28.5 |
| Sodium(Na) | 43.8 | 1.91 | 36.7 |
| Potassium(K) | 2.5 | 0.06 | 1.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 307.0 | 5.03 | 89.1 |
| Sulphate(SO4) | 8.0 | 0.17 | 2.9 |
| Chloride(Cl) | 16.0 | 0.45 | 8.0 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 3.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 274.0 | | |
| Total Anions(epm) | 5.65 | Total Cations(epm) | 5.20 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 470 | Temperature(C) |
| pH | 7.5 | pH |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 103.0 | 5.14 | 55.7 |
| Magnesium(Mg) | 41.0 | 3.37 | 36.6 |
| Sodium(Na) | 15.0 | 0.65 | 7.1 |
| Potassium(K) | 2.5 | 0.06 | 0.7 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 527.0 | 8.64 | 91.1 |
| Sulphate(SO4) | 6.3 | 0.13 | 1.4 |
| Chloride(Cl) | 24.0 | 0.68 | 7.1 |
| Nitrate(NO3) | 2.0 | 0.03 | 0.3 |
| Silica(SiO2) | 14.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 93.0 | | |
| Magnesium(Acidified) | 36.0 | | |
| TDS(mg/l) | 468.0 | | |
| Total Anions(epm) | 9.48 | Total Cations(epm) | 9.23 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 715 | | Temperature(C) | 5.00 | |
| pH | 7.3 | | pH | 7.0 | |
| Fluoride(F) | 0.5 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 551 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS

OBSERVATION WELL NUMBER ARC 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled August 29, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 57.0 | 2.84 | 43.2 |
| Magnesium(Mg) | 26.0 | 2.14 | 32.5 |
| Sodium(Na) | 35.0 | 1.52 | 23.1 |
| Potassium(K) | 2.9 | 0.07 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 366.0 | 6.00 | 91.3 |
| Sulphate(SO4) | 3.0 | 0.06 | 1.0 |
| Chloride(Cl) | 18.0 | 0.51 | 7.7 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.1 |
| Silica(SiO2) | 7.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 274.0 | | |
| Total Anions(epm) | 6.57 | Total Cations(epm) | 6.58 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 540 | Temperature(C) |
| pH | 7.6 | pH |
| Fluoride(F) | 0.6 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

7-32-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled October 25, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 84.0 | 4.19 | 53.8 |
| Magnesium(Mg) | 31.0 | 2.55 | 32.7 |
| Sodium(Na) | 22.5 | 0.98 | 12.6 |
| Potassium(K) | 2.9 | 0.07 | 1.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 412.0 | 6.75 | 90.2 |
| Sulphate(SO4) | 2.3 | 0.05 | 0.6 |
| Chloride(Cl) | 22.0 | 0.62 | 8.3 |
| Nitrate(NO3) | 3.8 | 0.06 | 0.8 |
| Silica(SiO2) | 10.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 366.0 | | |
| Total Anions(epm) | 7.48 | Total Cations(epm) | 7.80 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 640 | Temperature(C) |
| pH | 7.1 | pH |
| Fluoride(F) | 0.6 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

7-32-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled November 22, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 47.0 | 2.35 | 38.3 |
| Magnesium(Mg) | 29.0 | 2.39 | 39.0 |
| Sodium(Na) | 30.0 | 1.30 | 21.3 |
| Potassium(K) | 3.3 | 0.08 | 1.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 327.0 | 5.36 | 90.4 |
| Sulphate(SO4) | 3.1 | 0.06 | 1.1 |
| Chloride(Cl) | 18.0 | 0.51 | 8.6 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 4.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 294.0 | | |
| Total Anions(epm) | 5.93 | Total Cations(epm) | 6.12 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 515 | Temperature(C) |
| pH | 7.4 | pH |
| Fluoride(F) | 0.5 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

7-32-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled January 16, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 34.0 | 1.70 | 30.2 |
| Magnesium(Mg) | 28.0 | 2.30 | 41.0 |
| Sodium(Na) | 33.8 | 1.47 | 26.2 |
| Potassium(K) | 5.8 | 0.15 | 2.6 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 281.0 | 4.61 | 87.2 |
| Sulphate(SO4) | 2.7 | 0.06 | 1.1 |
| Chloride(Cl) | 22.0 | 0.62 | 11.7 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 2.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 236.0 | | |
| Total Anions(epm) | 5.28 | Total Cations(epm) | 5.62 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 482 | Temperature(C) | |
| pH | 7.5 | pH | |
| Fluoride(F) | 0.5 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

7-32-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled March 14, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 28.0 | 1.40 | 27.3 |
| Magnesium(Mg) | 27.0 | 2.22 | 43.4 |
| Sodium(Na) | 32.5 | 1.41 | 27.6 |
| Potassium(K) | 3.3 | 0.08 | 1.6 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 275.0 | 4.51 | 84.1 |
| Sulphate(SO4) | 10.1 | 0.21 | 3.9 |
| Chloride(Cl) | 22.0 | 0.62 | 11.6 |
| Nitrate(NO3) | 1.2 | 0.02 | 0.4 |
| Silica(SiO2) | 2.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 304.0 | | |
| Total Anions(epm) | 5.36 | Total Cations(epm) | 5.12 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 446 | Temperature(C) |
| pH | 8.2 | pH |
| Fluoride(F) | 0.5 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

7-32-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled May 09, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 20.0 | 1.00 | 22.8 |
| Magnesium(Mg) | 24.0 | 1.98 | 45.0 |
| Sodium(Na) | 30.0 | 1.30 | 29.8 |
| Potassium(K) | 4.2 | 0.11 | 2.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 222.0 | 3.64 | 84.5 |
| Sulphate(SO4) | 1.1 | 0.02 | 0.5 |
| Chloride(Cl) | 20.0 | 0.56 | 13.1 |
| Nitrate(NO3) | 5.0 | 0.08 | 1.9 |
| Silica(SiO2) | 1.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 198.0 | | |
| Total Anions(epm) | 4.31 | Total Cations(epm) | 4.38 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 426 | Temperature(C) |
| pH | 8.3 | pH |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

7-32-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 8, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 21.0 | 1.05 | 22.3 |
| Magnesium(Mg) | 22.0 | 1.81 | 38.5 |
| Sodium(Na) | 41.3 | 1.80 | 38.2 |
| Potassium(K) | 1.7 | 0.04 | 0.9 |
| Carbonate(CO3) | 7.2 | 0.24 | 4.9 |
| Bicarbonate(HCO3) | 242.0 | 3.97 | 80.3 |
| Sulphate(SO4) | 5.0 | 0.10 | 2.1 |
| Chloride(Cl) | 22.0 | 0.62 | 12.6 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.2 |
| Silica(SiO2) | 1.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 31.0 | | |
| Magnesium(Acidified) | 22.0 | | |
| TDS(mg/l) | 254.0 | | |
| Total Anions(epm) | 4.94 | Total Cations(epm) | 4.70 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 391 | | Temperature(C) | 7.00 | |
| pH | 8.6 | | pH | 8.1 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 283 | mg/l |
| | | | Hydroxide(OH) | | |

7-32-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled August 29, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 35.0 | 1.75 | 32.9 |
| Magnesium(Mg) | 30.0 | 2.47 | 46.5 |
| Sodium(Na) | 23.8 | 1.04 | 19.5 |
| Potassium(K) | 2.5 | 0.06 | 1.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 288.0 | 4.72 | 85.7 |
| Sulphate(SO4) | 5.0 | 0.10 | 1.9 |
| Chloride(Cl) | 24.0 | 0.68 | 12.3 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.1 |
| Silica(SiO2) | 4.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 260.0 | | |
| Total Anions(epm) | 5.51 | Total Cations(epm) | 5.31 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 431 | Temperature(C) |
| pH | 8.0 | pH |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

7-32-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled October 24, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 16.7 | 0.83 | 18.9 |
| Magnesium(Mg) | 28.0 | 2.30 | 52.4 |
| Sodium(Na) | 26.3 | 1.14 | 26.0 |
| Potassium(K) | 4.6 | 0.12 | 2.7 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 239.0 | 3.92 | 82.3 |
| Sulphate(SO4) | 5.0 | 0.10 | 2.2 |
| Chloride(Cl) | 26.0 | 0.73 | 15.4 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.1 |
| Silica(SiO2) | 2.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 260.0 | | |
| Total Anions(epm) | 4.76 | Total Cations(epm) | 4.40 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 373 | Temperature(C) |
| pH | 8.3 | pH |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

7-32-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled November 21, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 14.9 | 0.74 | 17.2 |
| Magnesium(Mg) | 28.0 | 2.30 | 53.3 |
| Sodium(Na) | 26.3 | 1.14 | 26.5 |
| Potassium(K) | 5.0 | 0.13 | 3.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 232.0 | 3.80 | 84.2 |
| Sulphate(SO4) | 1.7 | 0.04 | 0.8 |
| Chloride(Cl) | 24.0 | 0.68 | 15.0 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.1 |
| Silica(SiO2) | 1.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 214.0 | | |
| Total Anions(epm) | 4.52 | Total Cations(epm) | 4.32 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 1290 | Temperature(C) |
| pH | 8.0 | pH |
| Fluoride(F) | 0.5 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

WATER ANALYSIS

ARC 7-32-E-82

OBSERVATION WELL NUMBER ARC 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled January 17, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 13.5 | 0.67 | 18.8 |
| Magnesium(Mg) | 23.0 | 1.92 | 53.4 |
| Sodium(Na) | 21.3 | 0.93 | 25.8 |
| Potassium(K) | 2.9 | 0.07 | 2.1 |
| Carbonate(CO3) | 9.6 | 0.32 | 8.0 |
| Bicarbonate(HCO3) | 198.0 | 3.25 | 81.4 |
| Sulphate(SO4) | 4.1 | 0.09 | 2.1 |
| Chloride(Cl) | 12.0 | 0.34 | 8.5 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 1.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 234.0 | | |
| Total Anions(epm) | 3.99 | Total Cations(epm) | 3.59 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 359 |
| pH | 8.7 |
| Fluoride | 0.5 mg/l |

Field:

| | |
|---|---|
| Temperature | -1.00 |
| pH | -1.0 |
| Carbonate(CO3) | |
| Bicarbonate(HCO3) | |
| Hydroxide(OH) | |

WATER ANALYSIS

ARC 7-32-E-82

OBSERVATION WELL NUMBER ARC 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled March 11, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 10.6 | 0.53 | 12.8 |
| Magnesium(Mg) | 25.0 | 2.08 | 50.4 |
| Sodium(Na) | 31.3 | 1.36 | 32.9 |
| Potassium(K) | 6.2 | 0.16 | 3.8 |
| Carbonate(CO3) | 43.2 | 1.44 | 35.9 |
| Bicarbonate(HCO3) | 115.0 | 1.89 | 47.0 |
| Sulphate(SO4) | 3.0 | 0.06 | 1.6 |
| Chloride(Cl) | 22.0 | 0.62 | 15.5 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.1 |
| Silica(SiO2) | 0.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 186.0 | | |
| Total Anions(epm) | 4.01 | Total Cations(epm) | 4.13 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 325 | Temperature | -1.00 |
| pH | 8.7 | pH | -1.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 7-32-E-82

OBSERVATION WELL NUMBER ARC 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled May 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 14.0 | 0.70 | 17.9 |
| Magnesium(Mg) | 23.0 | 1.92 | 48.9 |
| Sodium(Na) | 27.5 | 1.20 | 30.5 |
| Potassium(K) | 4.2 | 0.11 | 2.7 |
| Carbonate(CO3) | 19.2 | 0.64 | 15.6 |
| Bicarbonate(HCO3) | 159.0 | 2.61 | 63.4 |
| Sulphate(SO4) | 3.5 | 0.07 | 1.8 |
| Chloride(Cl) | 28.0 | 0.79 | 19.2 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 0.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 206.0 | | |
| Total Anions(epm) | 4.11 | Total Cations(epm) | 3.92 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 333 | Temperature | -1.00 |
| pH | 8.6 | pH | -1.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 7-32-E-82

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 18.5 | 0.92 | 15.3 |
| Magnesium(Mg) | 30.8 | 2.57 | 42.5 |
| Sodium(Na) | 54.0 | 2.35 | 38.9 |
| Potassium(K) | 7.9 | 0.20 | 3.4 |
| Carbonate(CO3) | 4.8 | 0.16 | 3.2 |
| Bicarbonate(HCO3) | 173.0 | 2.84 | 57.3 |
| Sulphate(SO4) | 22.0 | 0.46 | 9.3 |
| Chloride(Cl) | 53.0 | 1.49 | 30.2 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 1.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 11.6 | | |
| Magnesium(Acidified) | 26.3 | | |
| TDS(mg/l) | 296.0 | | |
| Total Anions(epm) | 4.95 | Total Cations(epm) | 6.04 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 510 |
| pH | 8.4 |
| Fluoride | 0.0 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 7.00 | |
| pH | 8.6 | |
| Carbonate(CO3) | 14 | mg/l |
| Bicarbonate(HCO3) | 171 | mg/l |
| Hydroxide(OH) | | |

WATER ANALYSIS

ARC 7-32-E-82

OBSERVATION WELL NUMBER ARC 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled August 27, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 16.0 | 0.80 | 18.7 |
| Magnesium(Mg) | 26.5 | 2.21 | 51.7 |
| Sodium(Na) | 26.3 | 1.14 | 26.8 |
| Potassium(K) | 4.6 | 0.12 | 2.8 |
| Carbonate(CO3) | 7.2 | 0.24 | 5.8 |
| Bicarbonate(HCO3) | 198.0 | 3.25 | 78.1 |
| Sulphate(SO4) | 5.0 | 0.10 | 2.5 |
| Chloride(Cl) | 20.0 | 0.56 | 13.6 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 2.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 219.0 | | |
| Total Anions(epm) | 4.15 | Total Cations(epm) | 4.27 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 407 | Temperature | 0.0 |
| pH | 8.6 | pH | 0.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 7-32-E-82

OBSERVATION WELL NUMBER ARC 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled October 22, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 10.8 | 0.54 | 14.0 |
| Magnesium(Mg) | 26.1 | 2.18 | 56.4 |
| Sodium(Na) | 23.8 | 1.03 | 26.8 |
| Potassium(K) | 4.2 | 0.11 | 2.8 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 207.0 | 3.39 | 83.0 |
| Sulphate(SO4) | 5.0 | 0.10 | 2.5 |
| Chloride(Cl) | 21.0 | 0.59 | 14.5 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 1.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 217.0 | | |
| Total Anions(epm) | 4.09 | Total Cations(epm) | 3.86 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 415 | Temperature | 0.0 |
| pH | 8.3 | pH | 0.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 7-32-E-82

OBSERVATION WELL NUMBER ARC 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled January 16, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 12.2 | 0.61 | 16.0 |
| Magnesium(Mg) | 25.3 | 2.11 | 55.4 |
| Sodium(Na) | 22.5 | 0.98 | 25.7 |
| Potassium(K) | 4.2 | 0.11 | 2.8 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 203.0 | 3.33 | 80.9 |
| Sulphate(SO4) | 7.8 | 0.16 | 3.9 |
| Chloride(Cl) | 22.0 | 0.62 | 15.1 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.1 |
| Silica(SiO2) | 1.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 184.0 | | |
| Total Anions(epm) | 4.11 | Total Cations(epm) | 3.80 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 376 | Temperature | -1.00 |
| pH | 8.3 | pH | -1.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 7-32-E-82

OBSERVATION WELL NUMBER ARC 7-32

Lsd 13 Sec 20 Rge 95 Twp 8 W4th

Alberta Research Council

Sample Source Bailed

Date sampled March 11, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 9.5 | 0.47 | 13.0 |
| Magnesium(Mg) | 23.7 | 1.97 | 54.0 |
| Sodium(Na) | 25.0 | 1.09 | 29.7 |
| Potassium(K) | 4.6 | 0.12 | 3.2 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 193.0 | 3.16 | 80.5 |
| Sulphate(SO4) | 7.0 | 0.15 | 3.7 |
| Chloride(Cl) | 22.0 | 0.62 | 15.8 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.1 |
| Silica(SiO2) | 1.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 175.0 | | |
| Total Anions(epm) | 3.93 | Total Cations(epm) | 3.65 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 358 | Temperature | -1.00 |
| pH | 8.3 | pH | -1.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 7-32-E-82

OBSERVATION WELL NUMBER ARC 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled May 5, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 11.7 | 0.58 | 15.6 |
| Magnesium(Mg) | 26.3 | 2.19 | 58.4 |
| Sodium(Na) | 20.0 | 0.87 | 23.2 |
| Potassium(K) | 4.2 | 0.11 | 2.9 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 194.0 | 3.18 | 76.2 |
| Sulphate(SO4) | 17.8 | 0.37 | 8.9 |
| Chloride(Cl) | 22.0 | 0.62 | 14.9 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 0.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 212.0 | | |
| Total Anions(epm) | 4.17 | Total Cations(epm) | 3.75 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 354 | Temperature | -1.00 |
| pH | 8.3 | pH | -1.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS ARC 7-32-E-82

OBSERVATION WELL NUMBER ARC 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 15.0 | 0.75 | 18.5 |
| Magnesium(Mg) | 27.1 | 2.26 | 55.8 |
| Sodium(Na) | 21.0 | 0.91 | 22.5 |
| Potassium(K) | 5.0 | 0.13 | 3.2 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 203.0 | 3.33 | 77.5 |
| Sulphate(SO4) | 22.0 | 0.46 | 10.7 |
| Chloride(Cl) | 18.0 | 0.51 | 11.8 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 0.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 183.0 | | |
| Total Anions(epm) | 4.29 | Total Cations(epm) | 4.05 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 356 |
| pH | 8.3 |
| Fluoride | 0.3 mg/l |

Field:

| | |
|---|---|
| Temperature | 0.0 |
| pH | 0.0 |
| Carbonate(CO3) | |
| Bicarbonate(HCO3) | |
| Hydroxide(OH) | |

WATER ANALYSIS

ARC 7-32-E-82

OBSERVATION WELL NUMBER ARC 7-32

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled August 26, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 13.1 | 0.65 | 16.7 |
| Magnesium(Mg) | 27.4 | 2.28 | 58.2 |
| Sodium(Na) | 20.0 | 0.87 | 22.1 |
| Potassium(K) | 4.6 | 0.12 | 3.0 |
| Carbonate(CO3) | 7.0 | 0.23 | 6.0 |
| Bicarbonate(HCO3) | 188.0 | 3.08 | 79.5 |
| Sulphate(SO4) | 0.0 | 0.0 | 0.0 |
| Chloride(Cl) | 19.8 | 0.56 | 14.4 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.1 |
| Silica(SiO2) | 1.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 214.0 | | |
| Total Anions(epm) | 3.88 | Total Cations(epm) | 3.93 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 331 | Temperature | 0.0 |
| pH | 8.6 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

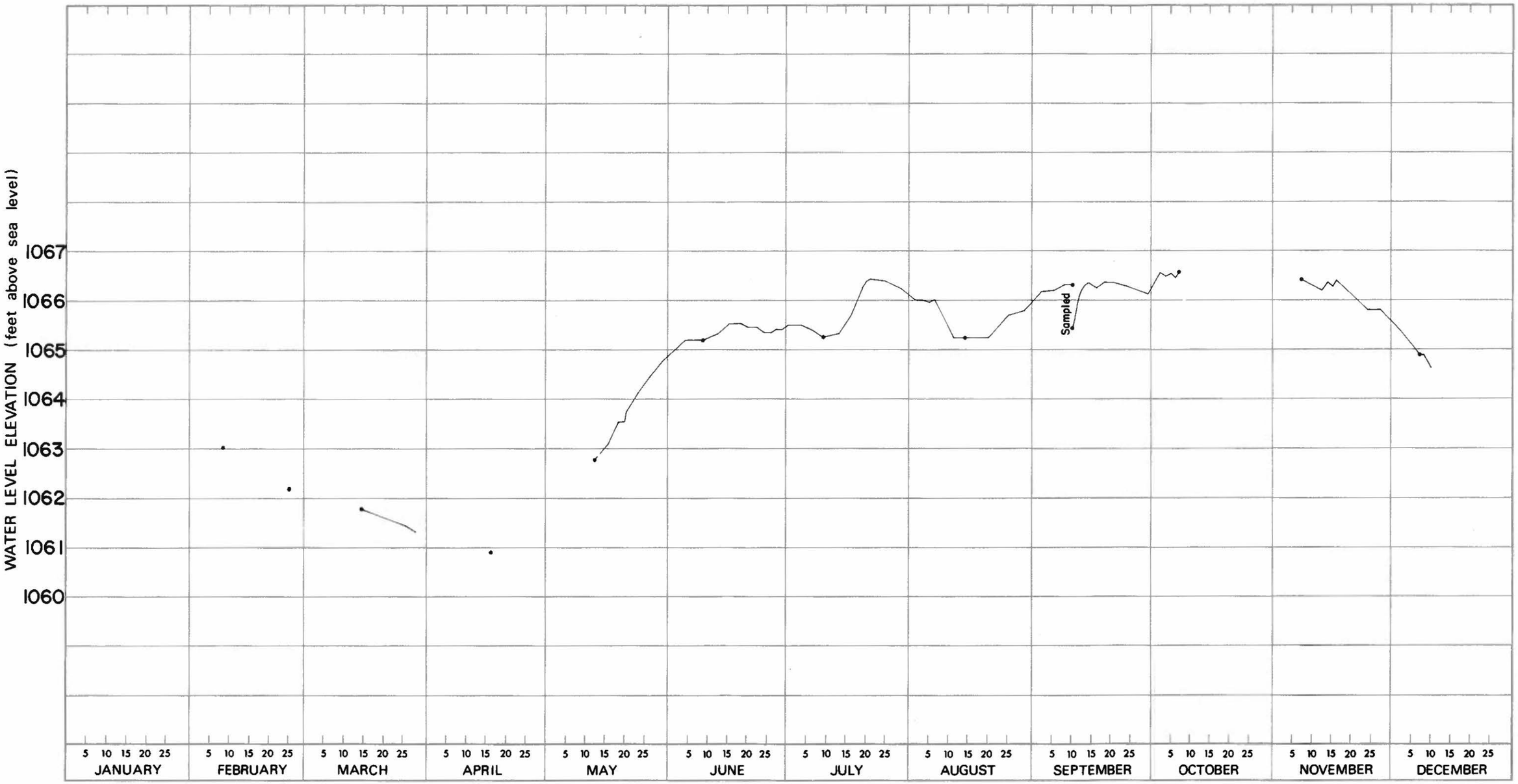
**WATER LEVEL HYDROGRAPH**

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

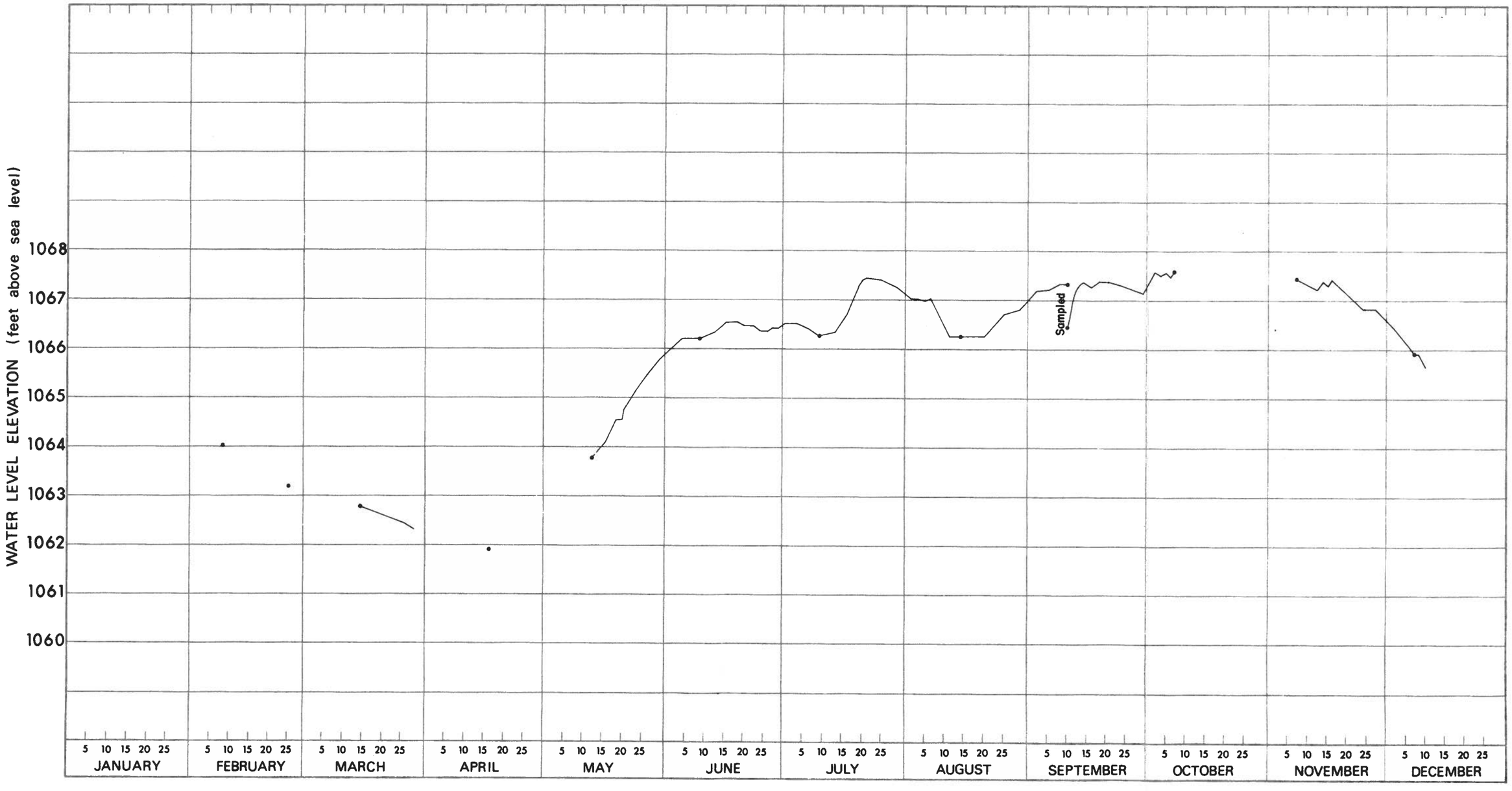
7-32-H-76



## WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-32
Lsd 13 Sec 20 Twp 95 R 8 W4th
Alberta Research Council

7-32-H-77



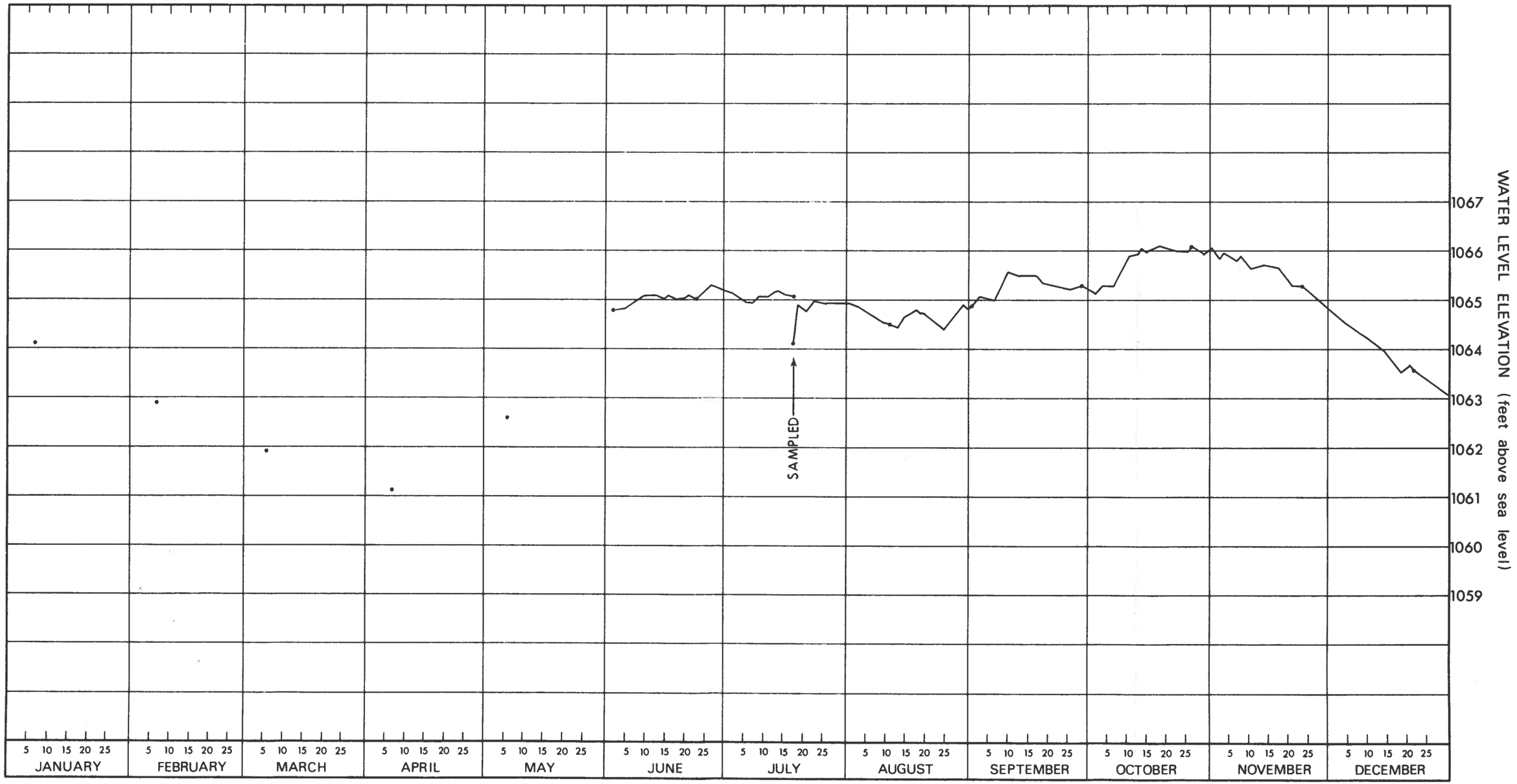
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-32

7 - 32 - H - 77

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council




1976

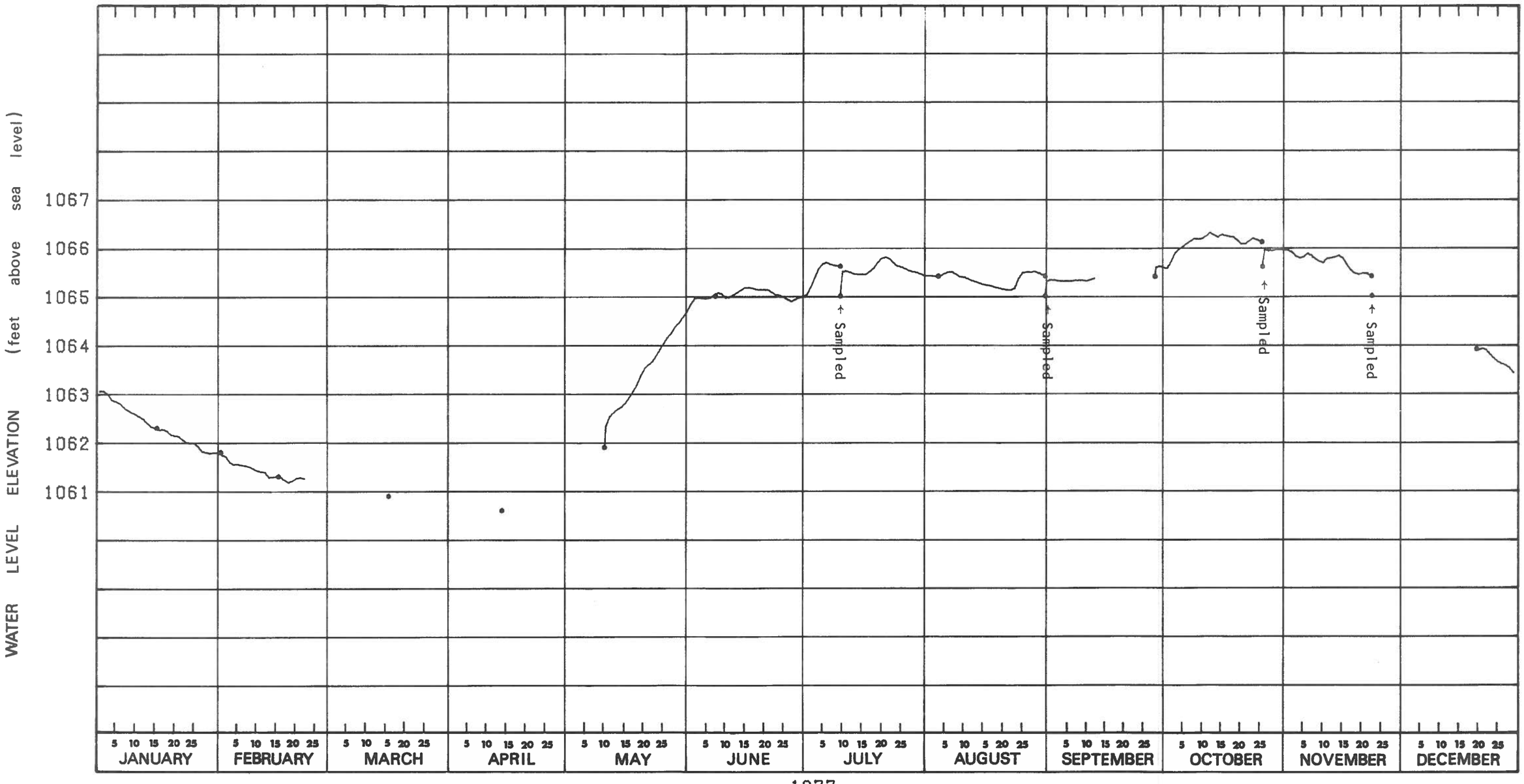
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-32-H-78



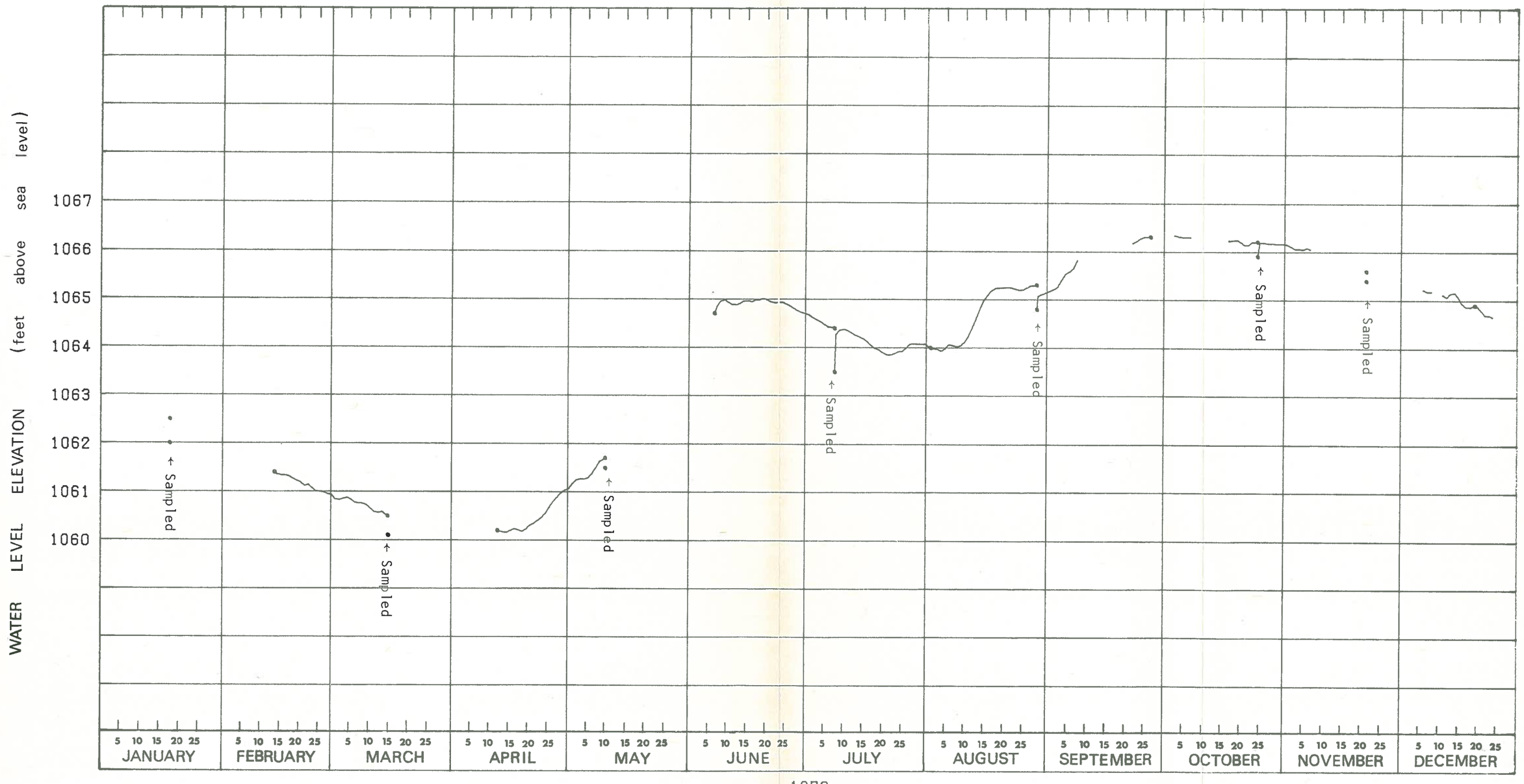
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-32

LSD 13 SEC 20 TWP 95 R 8 W4TH

Alberta Research Council

7-32-H-79



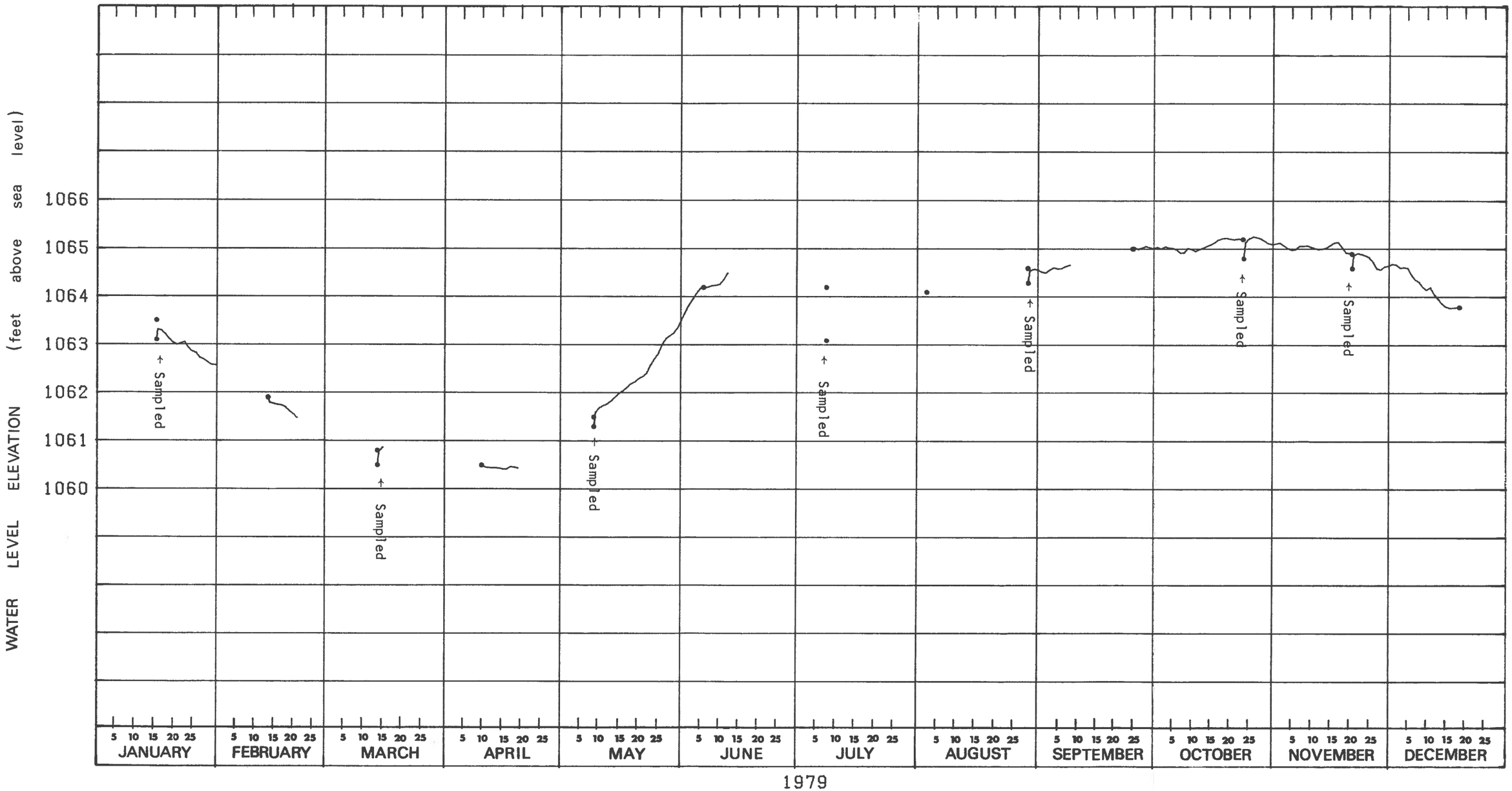
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-32-H-80



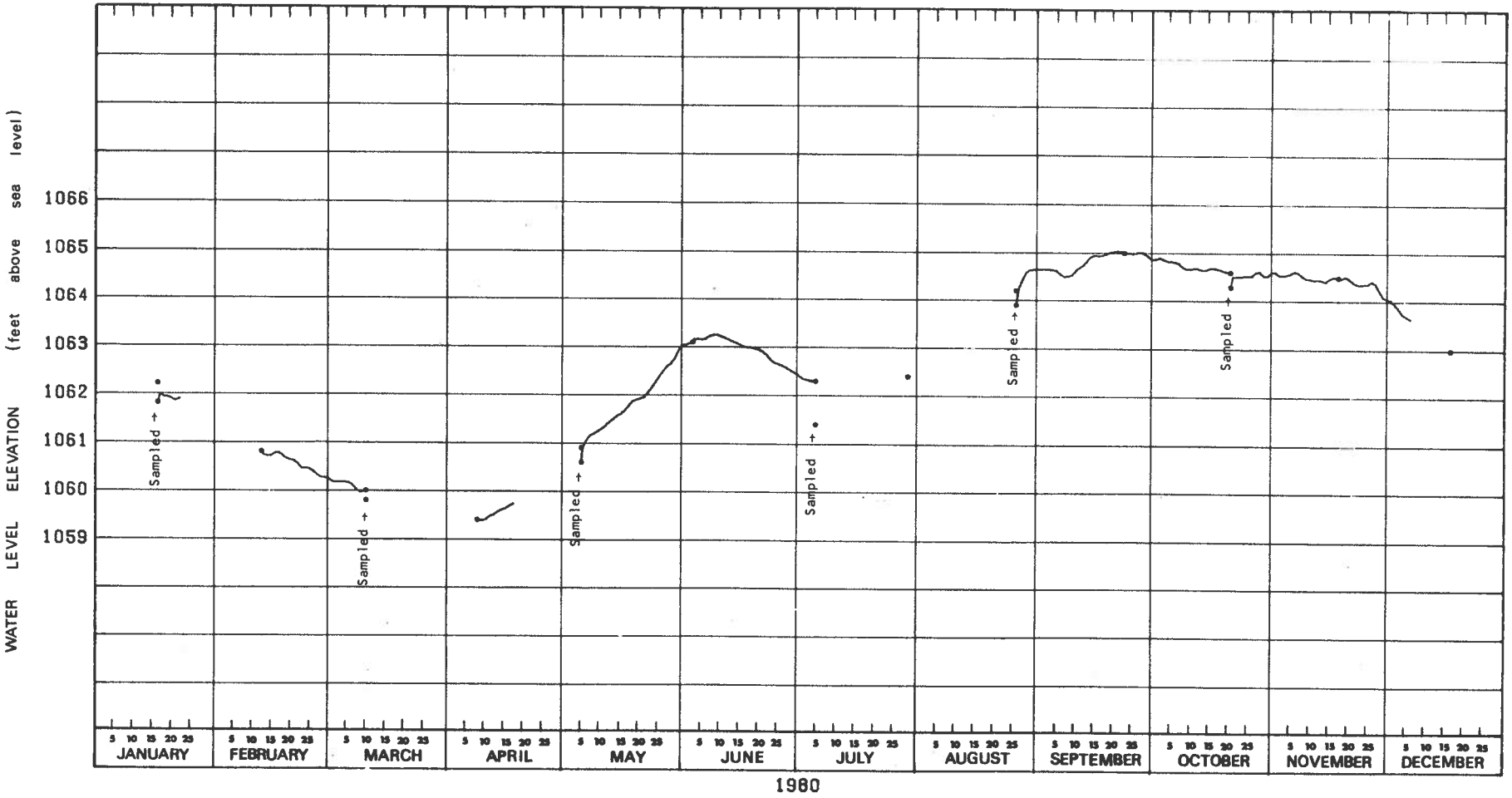
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-32-H-81



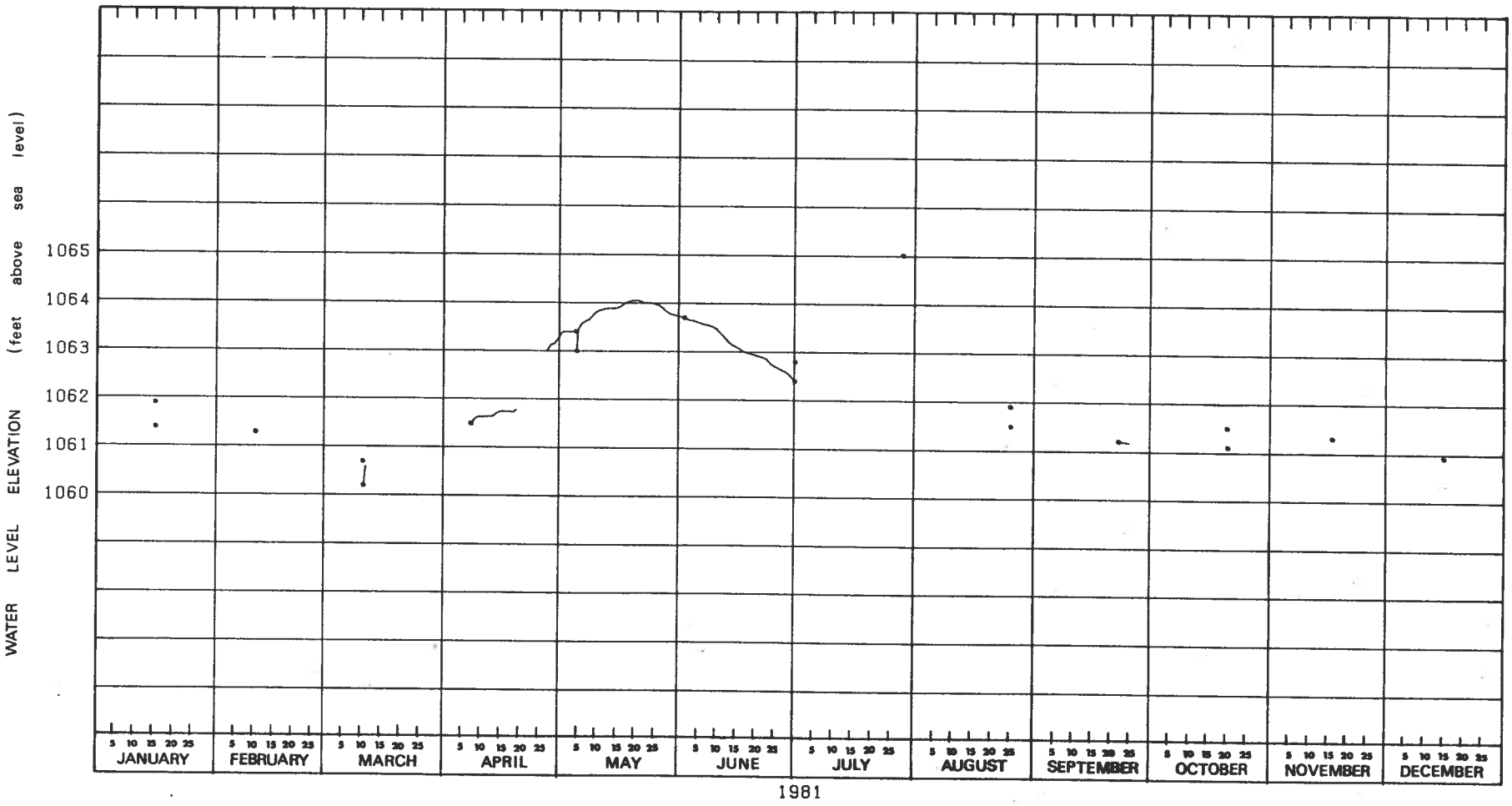
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-32-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.42

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 29/75 | | | Well completed; water sample; bail 15 gallons; recovery T = 4 IGPD/Ft |
| Feb 8/75 | 3.67 MP | 1063.03 | Install shelter and recorder; MP = 2.65' TOC, (1075.07) |
| Feb 25/75 | 3.93 MP | 1062.18 | |
| Mar 14/75 | 4.04 MP | 1061.82 | |
| Apr 16/75 | 4.30 MP | 1060.95 | |
| May 13/75 | 4.28 MP | 1061.07 | |
| June 10/75 | 2.99 MP | 1065.26 | |
| July 9/75 | 2.98 MP | 1065.29 | |
| Aug 14/75 | 2.95 MP | 1065.39 | |
| Sept 10/75 | 2.67 MP | 1066.31 | Sampled well; temp. 7.5°C |
| | 2.94 MP | 1065.42 | after sample |
| Oct 7/75 | 2.60 MP | 1066.54 | |
| Nov 7/75 | 2.64 MP | 1066.41 | |
| Dec 7/75 | 3.10 MP | 1064.90 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1073.42

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 29/75 | | | Well completed; water sample, bail 15 gallons recovery T = 4 IGPD/FT MP = 2.65 TOC, (1076.1) |
| Feb 8/75 | 3.67 MP | 1064.1 | |
| Feb 25/75 | 3.93 MP | 1063.2 | |
| Mar 14/75 | 4.04 MP | 1062.8 | |
| Apr 16/75 | 4.30 MP | 1062.0 | |
| May 13/75 | 4.28 MP | 1062.1 | |
| June 10/75 | 2.99 MP | 1066.3 | |
| July 9/75 | 2.98 MP | 1066.3 | |
| Aug 14/75 | 2.95 MP | 1066.4 | |
| Sept 10/75 | 2.67 MP | 1067.3 | |
| | 2.94 MP | 1066.5 | Sampled well; temp. 7.5°C After sample |
| Oct 7/75 | 2.60 MP | 1067.6 | |
| Nov 7/75 | 2.64 MP | 1067.4 | |
| Dec 7/75 | 3.10 MP | 1065.9 | |
| Jan 7/76 | 3.65 MP | 1064.1 | |
| Feb 7/76 | 4.02 MP | 1062.9 | |
| Mar 6/76 | 4.32 MP | 1061.9 | |
| Apr 7/76 | 4.56 MP | 1061.1 | |
| May 6/76 | 4.11 MP | 1062.6 | |
| June 2/76 | 3.23 MP | 1064.8 | |
| June 23/76 | 3.17 MP | 1065.0 | |
| July 18/76 | 3.15 MP | 1065.1 | |
| | 3.44 MP | 1064.1 | After sample; temp. 7°C |
| Aug 10/76 | 3.32 MP | 1064.5 | |
| Sept 1/76 | 3.20 MP | 1064.9 | |
| Sept 29/76 | 3.08 MP | 1065.4 | |
| Oct 27/76 | 2.85 MP | 1066.1 | |
| Nov 24/76 | 3.07 MP | 1065.1 | |
| Dec 22/76 | 3.61 MP | 1063.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1073.42

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 29/75 | | | Well completed; water sample, bail 15 gallons recovery T = 4 IGPD/FT |
| Feb 8/75 | 3.67 MP | 1064.1 | MP = 2.65 TOC, (1076.1) |
| Feb 25/75 | 3.93 MP | 1063.2 | |
| Mar 14/75 | 4.04 MP | 1062.8 | |
| Apr 16/75 | 4.30 MP | 1062.0 | |
| May 13/75 | 4.28 MP | 1062.1 | |
| June 10/75 | 2.99 MP | 1066.3 | |
| July 9/75 | 2.98 MP | 1066.3 | |
| Aug 14/75 | 2.95 MP | 1066.4 | |
| Sept 10/75 | 2.67 MP | 1067.3 | Sampled well; temp. 7.5°C |
| | 2.94 MP | 1066.5 | After sample |
| Oct 7/75 | 2.60 MP | 1067.6 | |
| Nov 7/75 | 2.64 MP | 1067.4 | |
| Dec 7/75 | 3.10 MP | 1065.9 | |
| Jan 7/76 | 3.65 MP | 1064.1 | |
| Feb 7/76 | 4.02 MP | 1062.9 | |
| Mar 6/76 | 4.32 MP | 1061.9 | |
| Apr 7/76 | 4.56 MP | 1061.1 | |
| May 6/76 | 4.11 MP | 1062.6 | |
| June 2/76 | 3.23 MP | 1064.8 | |
| June 23/76 | 3.17 MP | 1065.0 | |
| July 18/76 | 3.15 MP | 1065.1 | |
| | 3.44 MP | 1064.1 | After sample; temp. 7°C |
| Aug 10/76 | 3.32 MP | 1064.5 | |
| Sept 1/76 | 3.20 MP | 1064.9 | |
| Sept 29/76 | 3.08 MP | 1065.4 | |
| Oct 27/76 | 2.85 MP | 1066.1 | |
| Nov 24/76 | 3.07 MP | 1065.1 | |
| Dec 22/76 | 3.61 MP | 1063.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1073.42 before Feb 1/77
1071.40 after Feb 1/77

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 3.98 MP | 1062.3 | MP (1076.1) |
| Feb 1/77 | 4.13 MP | 1061.8 | Cut casing |
| | 3.76 MP | 1061.8 | New MP = 0.84 m TOC, (1074.1) |
| Feb 16/77 | 3.91 MP | 1061.3 | |
| Mar 16/77 | 4.01 MP | 1060.9 | |
| Apr 14/77 | 4.10 MP | 1060.6 | |
| May 10/77 | 3.64 MP | 1061.9 | New MP = 0.72 m TOC, (1073.8) |
| June 8/77 | 2.68 MP | 1065.0 | |
| July 10/77 | 2.51 MP | 1065.6 | |
| | 2.69 MP | 1065.0 | After sample; temp. 8°C |
| Aug 4/77 | 2.57 MP | 1065.4 | |
| Aug 31/77 | 2.56 MP | 1065.4 | |
| | 2.69 MP | 1065.0 | After sample |
| Sept 28/77 | 2.55 MP | 1065.4 | |
| Oct 26/77 | 2.36 MP | 1066.1 | Temp. 7°C |
| | 2.49 MP | 1065.6 | After sample |
| Nov 23/77 | 2.55 MP | 1065.4 | |
| | 2.68 MP | 1065.0 | After sample |
| Dec 20/77 | 3.03 MP | 1063.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.40

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 3.44 MP | 1062.5 | MP (1073.8) |
| | 3.60 MP | 1062.0 | After sample |
| Feb 14/78 | 3.78 MP | 1061.4 | |
| Mar 15/78 | 4.04 MP | 1060.5 | |
| | 4.16 MP | 1060.1 | After sample |
| Apr 12/78 | 4.14 MP | 1060.2 | |
| May 10/78 | 3.68 MP | 1061.7 | |
| | 3.76 MP | 1061.5 | After sample |
| June 7/78 | 2.76 MP | 1064.7 | |
| July 8/78 | 2.85 MP | 1064.4 | |
| | 3.14 MP | 1063.5 | After sample; temp. 5°C |
| Aug 2/78 | 2.99 MP | 1064.0 | |
| Aug 29/78 | 2.60 MP | 1065.3 | |
| | 2.73 MP | 1064.8 | After sample |
| Sept 27/78 | 2.30 MP | 1066.3 | |
| Oct 25/78 | 2.31 MP | 1066.2 | |
| | 2.40 MP | 1065.9 | After sample |
| Nov 22/78 | 2.49 MP | 1065.6 | |
| | 2.57 MP | 1065.4 | After sample |
| Dec 20/78 | 2.71 MP | 1064.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.40

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 3.15 MP | 1063.5 | MP (1073.8) |
| | 3.25 MP | 1063.1 | After sample |
| Feb 14/79 | 3.62 MP | 1061.9 | |
| Mar 14/79 | 3.96 MP | 1060.8 | |
| | 4.04 MP | 1060.5 | After sample |
| Apr 10/79 | 4.05 MP | 1060.5 | |
| May 9/79 | 3.74 MP | 1061.5 | |
| | 3.82 MP | 1061.3 | After sample |
| June 6/79 | 2.92 MP | 1064.2 | |
| July 8/79 | 2.92 MP | 1064.2 | |
| | 3.27 MP | 1063.1 | After sample; temp. 7°C |
| Aug 3/79 | 2.97 MP | 1064.1 | |
| Aug 29/79 | 2.79 MP | 1064.6 | |
| | 2.88 MP | 1064.3 | After sample |
| Sept 25/79 | 2.67 MP | 1065.0 | |
| Oct 24/79 | 2.63 MP | 1065.2 | |
| | 2.73 MP | 1064.8 | After sample |
| Nov 21/79 | 2.70 MP | 1064.9 | |
| | 2.79 MP | 1064.6 | After sample |
| Dec 19/79 | 3.05 MP | 1063.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7 - 32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.40

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 3.55 MP | 1062.2 | |
| | 3.65 MP | 1061.8 | After Sample |
| Feb 13/80 | 3.95 MP | 1060.8 | |
| Mar 11/80 | 4.20 MP | 1060.0 | |
| | 4.28 MP | 1059.8 | After Sample |
| Apr 9/80 | 4.38 MP | 1059.4 | |
| May 6/80 | 3.93 MP | 1060.9 | |
| | 4.02 MP | 1060.6 | After Sample |
| June 4/80 | 3.27 MP | 1063.1 | |
| July 6/80 | 3.49 MP | 1062.3 | Temp. 7°C |
| | 3.78 MP | 1061.4 | |
| July 30/80 | 3.47 MP | 1062.4 | |
| Aug 27/80 | 2.92 MP | 1064.2 | |
| | 3.01 MP | 1063.9 | After Sample |
| Sept 24/80 | 2.69 MP | 1065.0 | |
| Oct 22/80 | 2.80 MP | 1064.6 | |
| | 2.89 MP | 1064.3 | After Sample |
| Nov 19/80 | 2.84 MP | 1064.5 | |
| Dec 18/80 | 3.30 MP | 1063.0 | |
| Jan 16/81 | 3.64 MP | 1061.9 | |
| | 3.78 MP | 1061.4 | After Sample |
| Feb 11/81 | 3.80 MP | 1061.3 | |
| Mar 11/81 | 3.99 MP | 1060.7 | |
| | 4.13 MP | 1060.2 | After Sample |
| Apr 8/81 | 3.76 MP | 1061.5 | |
| May 5/81 | 3.16 MP | 1063.4 | |
| | 3.30 MP | 1063.0 | After Sample |
| June 2/81 | 3.08 MP | 1063.7 | |
| July 1/81 | 3.23 MP | 1062.4 | |
| | 3.36 MP | 1062.8 | After Sample |
| July 29/81 | 3.18 MP | 1065.0 | |
| Aug 26/81 | 3.63 MP | 1061.9 | |
| | 3.74 MP | 1061.5 | After Sample |
| Sept 23/81 | 3.84 MP | 1061.2 | |
| Oct 21/81 | 3.75 MP | 1061.5 | |
| | 3.87 MP | 1061.1 | After Sample |
| Nov 17/81 | 3.81 MP | 1061.3 | |
| Dec 16/81 | 3.93 MP | 1060.9 | |

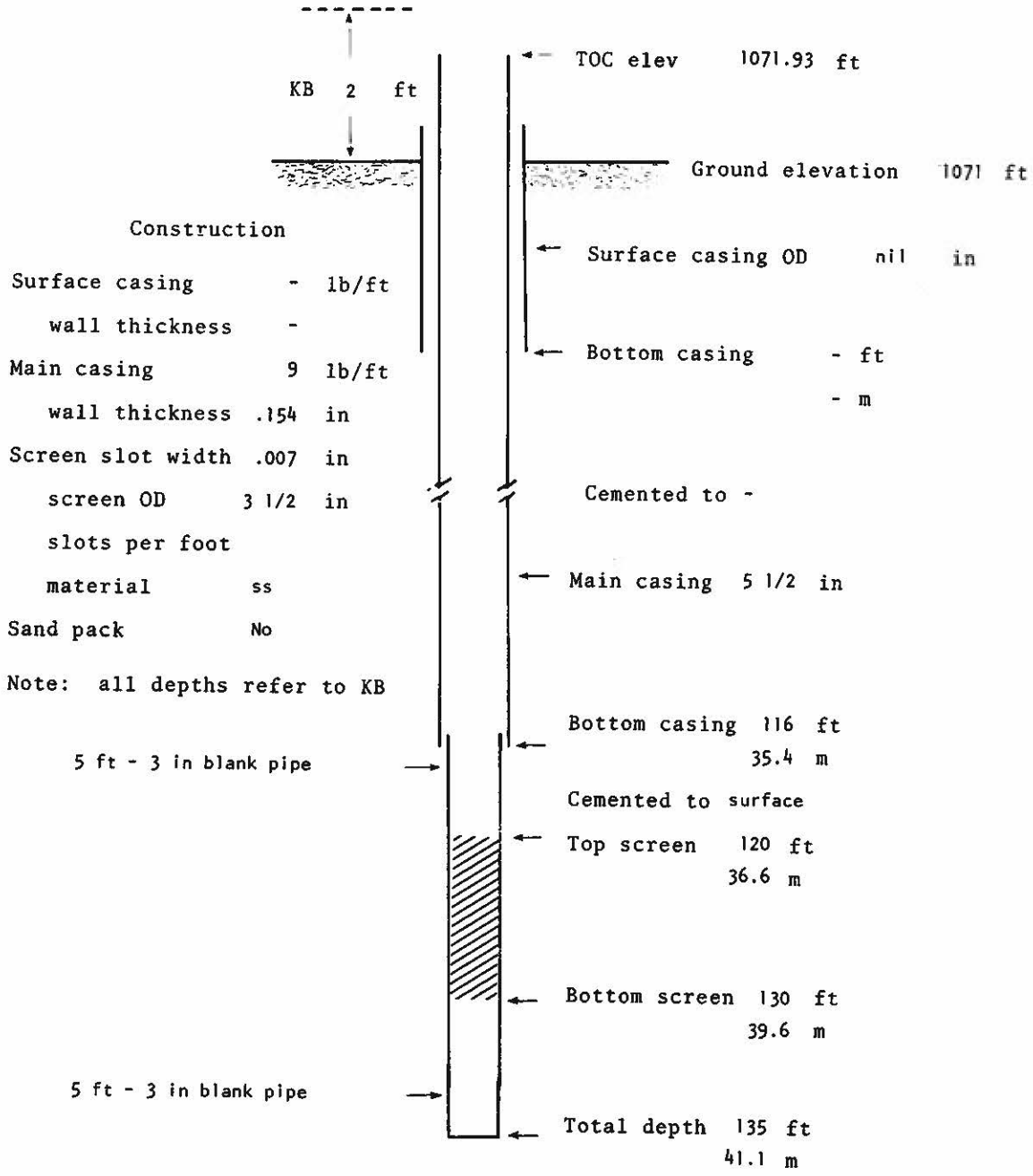
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Tp 95 R 8 W4th

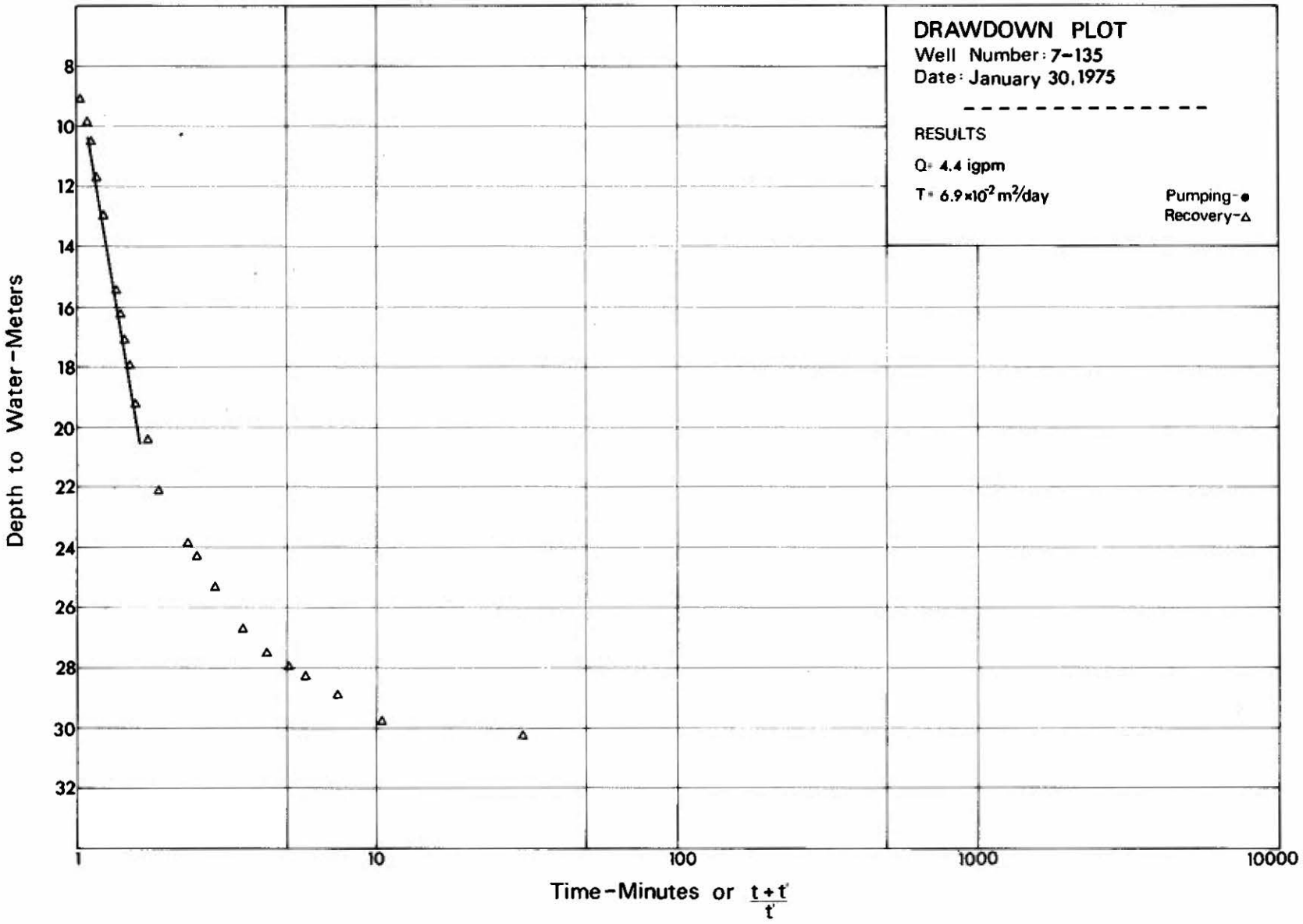
Alberta Research Council



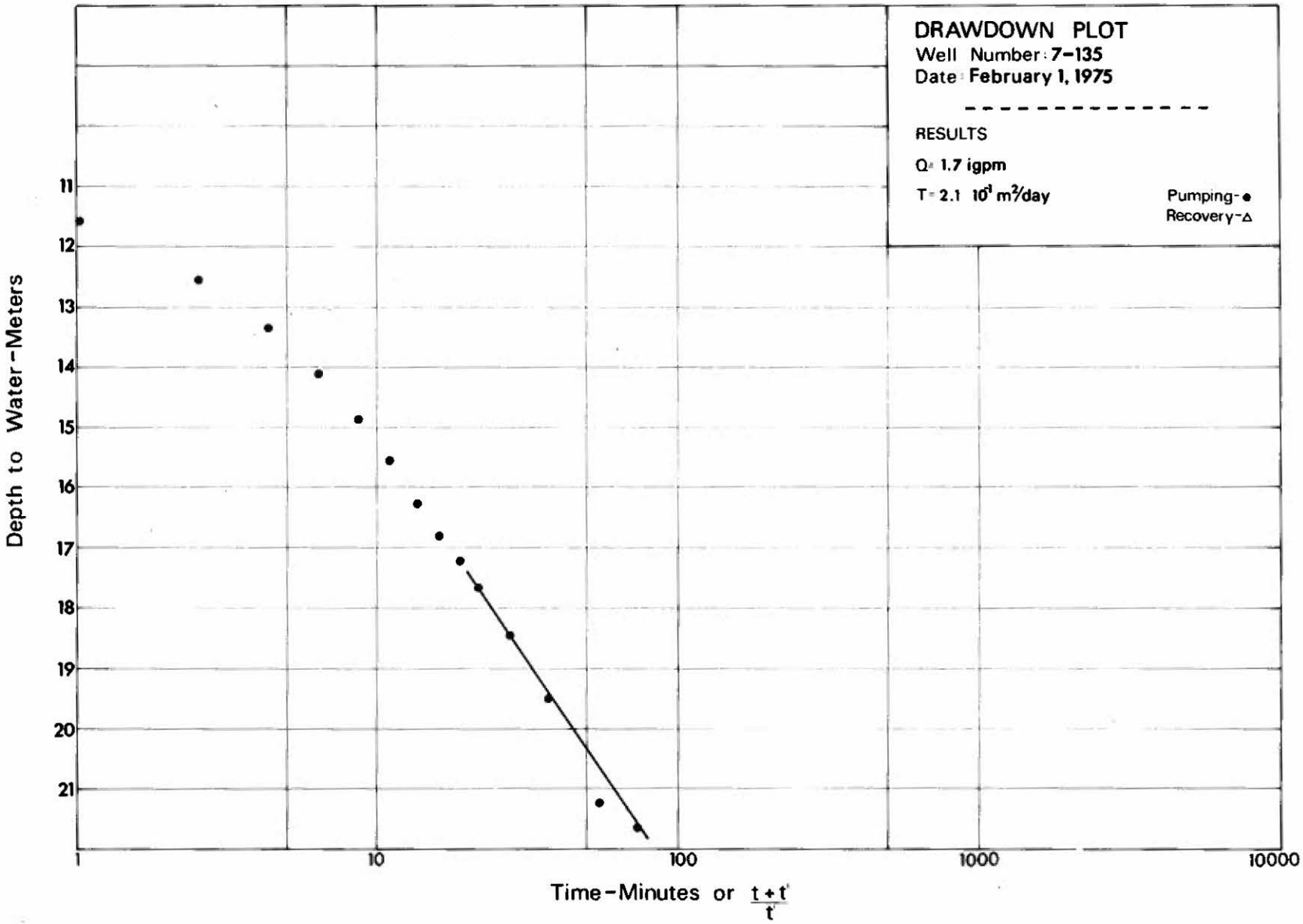

Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 9 | lb/ft |
| wall thickness | .154 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

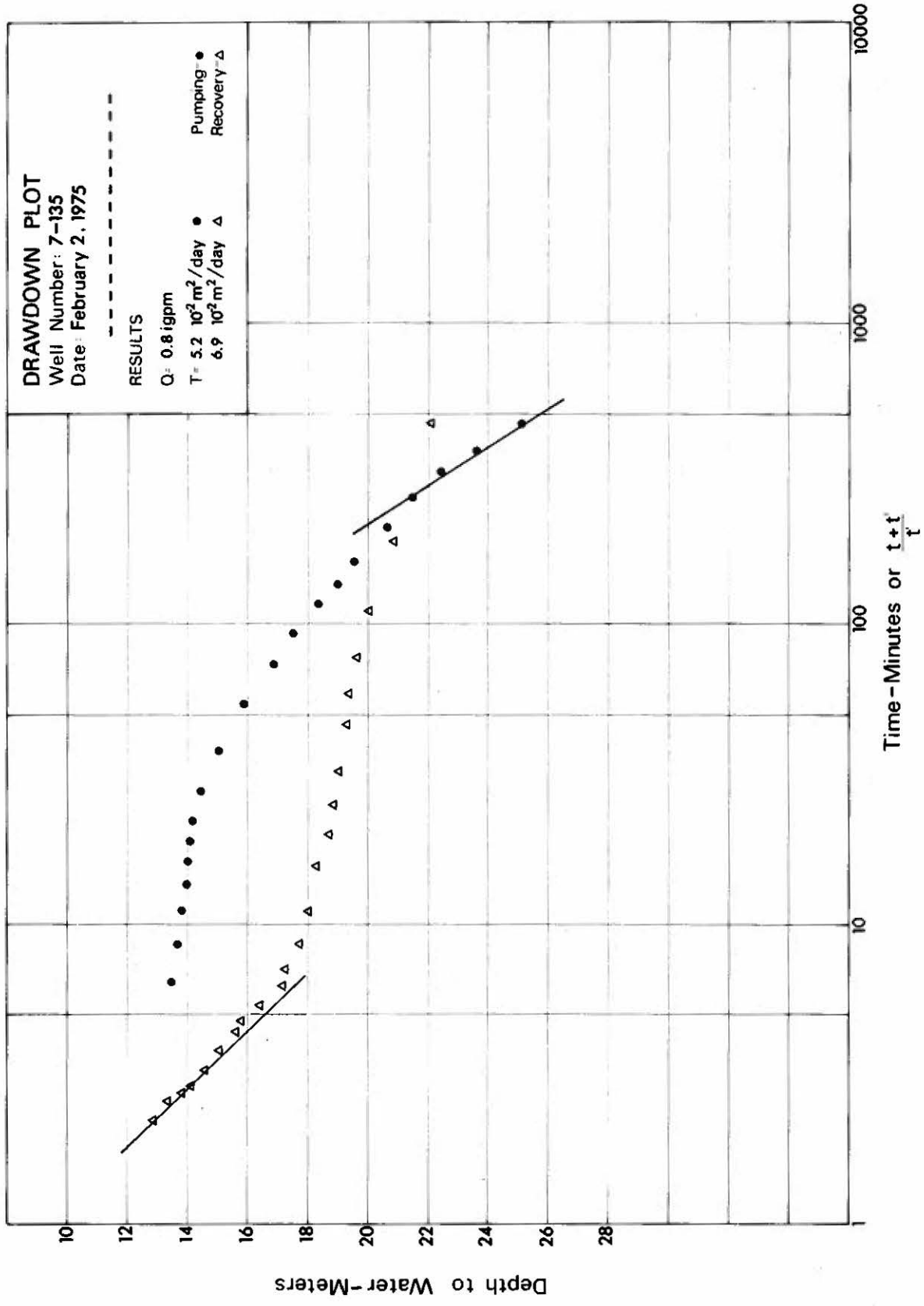
Note: all depths refer to KB

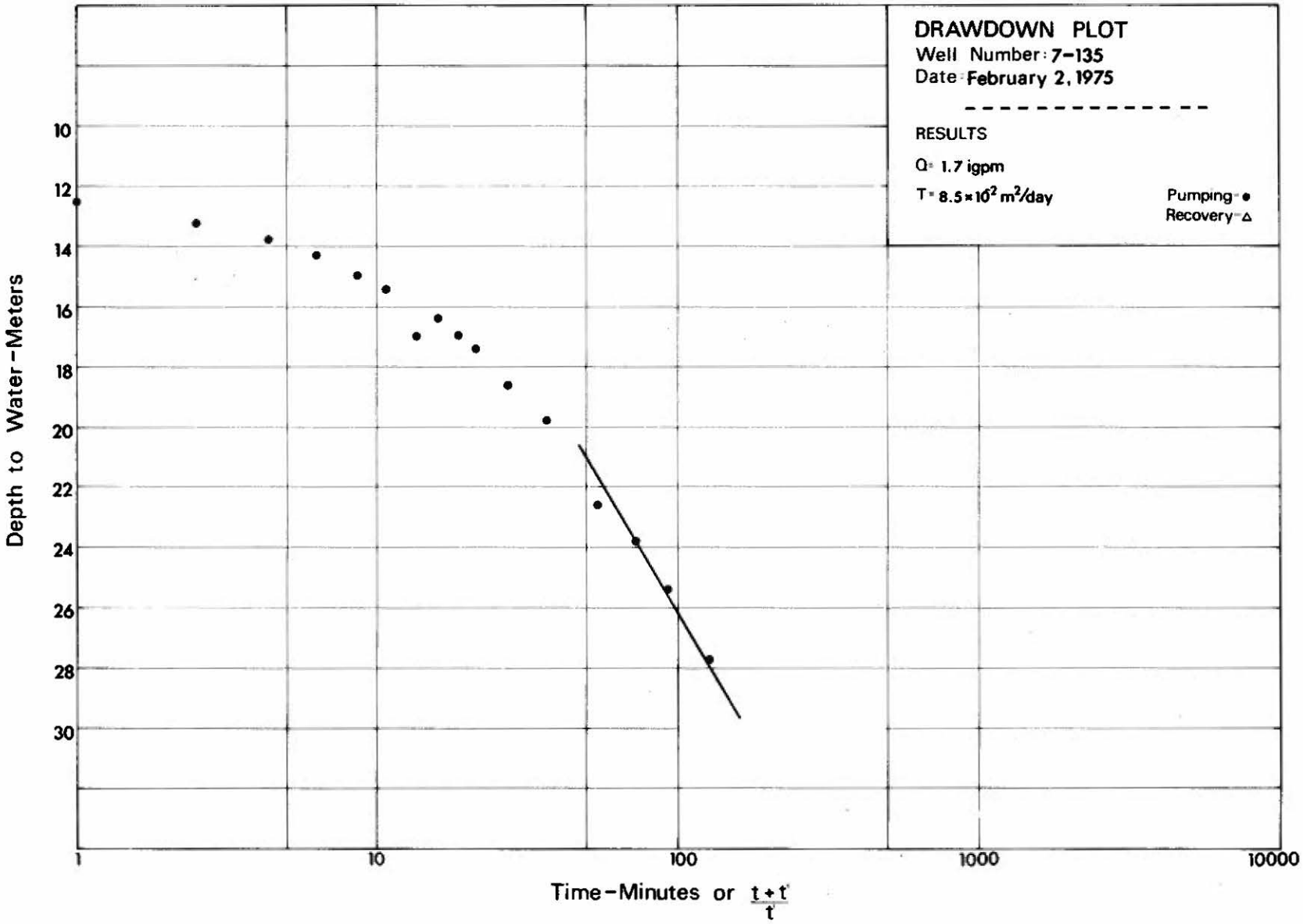

DRAWDOWN PLOT
Well Number: 7-135
Date: January 30, 1975
RESULTS
Q = 4.4 igpm
T = 6.9×10⁻² m²/day
Pumping-●
Recovery-△
Depth to Water-Meters
8
10
12
14
16
18
20
22
24
26
28
30
32
1
10
100
1000
10000
Time-Minutes or (t+t')/t'

7-135-A-76


DRAWDOWN PLOT
Well Number: 7-135
Date: February 1, 1975
RESULTS
Q= 1.7 igpm
T= 2.1 10³ m²/day
Pumping-●
Recovery-△
Depth to Water-Meters
11
12
13
14
15
16
17
18
19
20
21
1
10
100
1000
10000
Time-Minutes or (t+t')/t

7-135-A-76


DRAWDOWN PLOT
Well Number: 7-135
Date: February 2, 1975
RESULTS
Q= 0.8 igpm
T= 5.2 $10^{-2}$ $m^2$/day ●
6.9 $10^{-2}$ $m^2$/day △
Pumping = ●
Recovery = △
Depth to Water - Meters
10
12
14
16
18
20
22
24
26
28
1
10
100
1000
10000
Time - Minutes or $\frac{t+t'}{t'}$


DRAWDOWN PLOT
Well Number: 7-135
Date: February 2, 1975
RESULTS
Q= 1.7 igpm
T= 8.5×10² m²/day
Pumping = ●
Recovery = △
Depth to Water-Meters
10
12
14
16
18
20
22
24
26
28
30
1
10
100
1000
10000
Time-Minutes or (t+t')/t

7-135-A-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Pump test on 7-135

Date sampled February 2, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 9.4 | 0.47 | 2.6 |
| Magnesium ($Mg^{++}$) | 17.4 | 1.43 | 8.0 |
| Sodium ($Na^{+}$) | 355.0 | 15.44 | 86.5 |
| Potassium ($K^{+}$) | 19.6 | 0.50 | 2.8 |
| Carbonate ($CO_3^{=}$) | 53.0 | 1.77 | 9.4 |
| Bicarbonate ($HCO_3^{-}$) | 947.0 | 15.52 | 82.9 |
| Sulfate ($SO_4^{=}$) | 18.5 | 0.39 | 2.1 |
| Chloride ($Cl^{-}$) | 31.0 | 0.87 | 4.7 |
| Nitrate ($NO_3^{=}$) | 10.5 | 0.17 | 0.9 |
| Silica ($SiO_2$) | 4.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 968.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 18.717 | Total Cations (epm) | 17.843 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1550 |
| pH | 8.7 |
| Fluoride ($F^{-}$) | 1.8 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 5.0 |
| pH | 7.6 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 1164 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | 3700 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 9.6 | 0.48 | 3 |
| Magnesium ($Mg^{++}$) | 15 | 1.23 | 7 |
| Sodium ($Na^{+}$) | 345 | 15.01 | 87 |
| Potassium ($K^{+}$) | 20.8 | 0.53 | 3 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1017 | 16.67 | 97 |
| Sulfate ($SO_4^{=}$) | 4.6 | 0.10 | 1 |
| Chloride ($Cl^{-}$) | 14 | 0.39 | 2 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0 |
| Silica ($SiO_2$) | 3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 13.7 | | |
| Magnesium (Acidified) | 15.6 | | |
| Total dissolved solids | 938 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 17.17 | Total Cations (epm) | 17.25 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1600 |
| pH | 8.2 |
| Fluoride ($F^{-}$) | 1.5 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 3.5 |
| pH | 8.8 |
| Carbonate ($CO_3^{=}$) | 72 ppm |
| Bicarbonate ($HCO_3^{-}$) | 903 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Pump test on well 7-135

Date of sampling February 2, 1975

Total dissolved solids 968 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .05 | Mg | .05 |
| As | <.01 | Mn | .004 |
| B | .05 | Mo | ND |
| Ba | .005 | Ni | .02 |
| Be | ND | Pb | .005 |
| Bi | ND | Sb | ND |
| Ca | .1 | Si | M |
| Cd | ND | Sn | ND |
| Co | .005 | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .009 | V | .02 |
| Fe | M | Zn | M |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 9.6 | 0.48 | 3 |
| Magnesium ($Mg^{++}$) | 15.0 | 1.23 | 7 |
| Sodium ($Na^{+}$) | 345 | 15.01 | 87 |
| Potassium ($K^{+}$) | 20.8 | 0.53 | 3 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1017 | 16.67 | 97 |
| Sulfate ($SO_4^{=}$) | 4.6 | 0.10 | 1 |
| Chloride ($Cl^{-}$) | 14.0 | 0.39 | 2 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0 |
| Silica ($SiO_2$) | 3.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 13.7 | | |
| Magnesium (Acidified) | 15.6 | | |
| Total dissolved solids | 938 | | |

Total Anions (epm) 17.17 Total Cations (epm) 17.25

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1600 |
| pH | 8.2 |
| Fluoride ($F^{-}$) | 1.5 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 3.5 |
| pH | 8.8 |
| Carbonate ($CO_3^{=}$) | 72 ppm |
| Bicarbonate ($HCO_3^{-}$) | 903 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.6 | 0.18 | 1 |
| Magnesium ($Mg^{++}$) | 12.5 | 1.03 | 6 |
| Sodium ($Na^{+}$) | 341.0 | 14.83 | 85 |
| Potassium ($K^{+}$) | 53.0 | 1.36 | 8 |
| Carbonate ($CO_3^{=}$) | 82.0 | 2.73 | 16 |
| Bicarbonate ($HCO_3^{-}$) | 800.0 | 13.11 | 78 |
| Sulfate ($SO_4^{=}$) | 4.0 | 0.08 | 1 |
| Chloride ($Cl^{-}$) | 28.0 | 0.79 | 5 |
| Nitrate ($NO_3^{=}$) | 1.5 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 7.4 | | |
| Magnesium (Acidified) | 12.7 | | |
| Total dissolved solids | 984 | | |
| Total Anions (epm) | 16.74 | Total Cations (epm) | 17.40 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1520 | Temperature (C) | 4.0 |
| pH | 8.9 | pH | 9.4 |
| Fluoride ($F^{-}$) | 1.4 Mg/L | Carbonate ($CO_3^{=}$) | 154 Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 683 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 10, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 60.0 | 2.99 | 8.5 |
| Magnesium ($Mg^{++}$) | 45.0 | 3.70 | 10.5 |
| Sodium ($Na^{+}$) | 635.0 | 27.62 | 78.2 |
| Potassium ($K^{+}$) | 40.0 | 1.02 | 2.9 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 632.0 | 10.36 | 43.6 |
| Sulfate ($SO_4^{=}$) | 9.6 | 0.20 | 0.8 |
| Chloride ($Cl^{-}$) | 468.0 | 13.20 | 55.5 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 1.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 53.0 | | |
| Magnesium (Acidified) | 47.0 | | |
| Total dissolved solids | 2782.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 23.77 | Total Cations (epm) | 35.34 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 3600 | Temperature (C) | 4.0 |
| pH | 6.8 | pH | 6.7 |
| Fluoride ($F^{-}$) | 1.4 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 810.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed (U of A Geology)

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 54.3 | 2.66 | 11.6 |
| Magnesium ($Mg^{++}$) | 42.6 | 3.49 | 15.2 |
| Sodium ($Na^{+}$) | 364.9 | 15.69 | 68.4 |
| Potassium ($K^{+}$) | 42.6 | 1.11 | 4.8 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 610.0 | 9.76 | 43.5 |
| Sulfate ($SO_4^{=}$) | 0.5 | 0.01 | 0.1 |
| Chloride ($Cl^{-}$) | 452.0 | 12.66 | 56.4 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | | | |

Total Anions (epm) 22.43 Total Cations (epm) 22.95

Other Constituents

Lab:

- Conductivity 3090
- pH 7.4
- Fluoride ($F^{-}$)

Field:

- Temperature (C)
- pH
- Carbonate ($CO_3^{=}$)
- Bicarbonate ($HCO_3^{-}$)
- Hydroxide ($OH^{-}$)
- Conductivity

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Date sampled: July 18, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .005 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 333 |
| As | <.038 | Ni | <.010 |
| B | 1.68 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 8.97 | Si | .825 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .257 |
| Cr | <.006 | Te | <.065 |
| Cu | <.0004 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .022 | V | <.0008 |
| K | 44 | W | <.078 |
| Mg | 14.6 | Zn | <.002 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

7-135-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 9.2 | 0.46 | 2.2 |
| Magnesium(Mg) | 22.0 | 1.81 | 8.5 |
| Sodium(Na) | 408.0 | 17.75 | 83.6 |
| Potassium(K) | 47.5 | 1.22 | 5.7 |
| Carbonate(CO3) | 60.0 | 2.00 | 9.7 |
| Bicarbonate(HCO3) | 854.0 | 14.00 | 67.8 |
| Sulphate(SO4) | 5.2 | 0.11 | 0.5 |
| Chloride(Cl) | 160.0 | 4.51 | 21.9 |
| Nitrate(NO3) | 1.6 | 0.03 | 0.1 |
| Silica(SiO2) | 4.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 13.6 | | |
| Magnesium(Acidified) | 22.0 | | |
| TDS(mg/l) | 1350.0 | | |
| Total Anions(epm) | 20.64 | Total Cations(epm) | 21.23 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1740 | | Temperature(C) | 4.00 | |
| pH | 8.4 | | pH | 8.7 | |
| Fluoride(F) | 1.2 | mg/l | Carbonate(CO3) | 53 | mg/l |
| | | | Bicarbonate(HCO3) | 756 | mg/l |
| | | | Hydroxide(OH) | | |

7-135-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 8, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 5.1 | 0.25 | 1.4 |
| Magnesium(Mg) | 0.8 | 0.07 | 0.4 |
| Sodium(Na) | 370.0 | 16.09 | 91.0 |
| Potassium(K) | 49.6 | 1.27 | 7.2 |
| Carbonate(CO3) | 70.0 | 2.33 | 13.7 |
| Bicarbonate(HCO3) | 754.0 | 12.36 | 72.5 |
| Sulphate(SO4) | 6.7 | 0.14 | 0.8 |
| Chloride(Cl) | 78.0 | 2.20 | 12.9 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.0 |
| Silica(SiO2) | 2.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 7.1 | | |
| Magnesium(Acidified) | 0.8 | | |
| TDS(mg/l) | 1110.0 | | |
| Total Anions(epm) | 17.04 | Total Cations(epm) | 17.68 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1455 | | Temperature(C) | 5.50 | |
| pH | 9.0 | | pH | 9.3 | |
| Fluoride(F) | 1.3 | mg/l | Carbonate(CO3) | 134 | mg/l |
| | | | Bicarbonate(HCO3) | 634 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 7-135-E-82

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.7 | 0.08 | 0.5 |
| Magnesium(Mg) | 9.7 | 0.81 | 4.7 |
| Sodium(Na) | 331.0 | 14.39 | 84.3 |
| Potassium(K) | 70.0 | 1.79 | 10.5 |
| Carbonate(CO3) | 82.0 | 2.73 | 16.6 |
| Bicarbonate(HCO3) | 727.0 | 11.92 | 72.4 |
| Sulphate(SO4) | 16.0 | 0.33 | 2.0 |
| Chloride(Cl) | 52.0 | 1.46 | 8.9 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 2.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 5.8 | | |
| Magnesium(Acidified) | 9.3 | | |
| TDS(mg/l) | 1046.0 | | |
| Total Anions(epm) | 16.45 | Total Cations(epm) | 17.08 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1570 | Temperature | 5.00 | |
| pH | 9.2 | pH | 9.5 | |
| Fluoride | 1.1 mg/l | Carbonate(CO3) | 187 | mg/l |
| | | Bicarbonate(HCO3) | 547 | mg/l |
| | | Hydroxide(OH) | | |

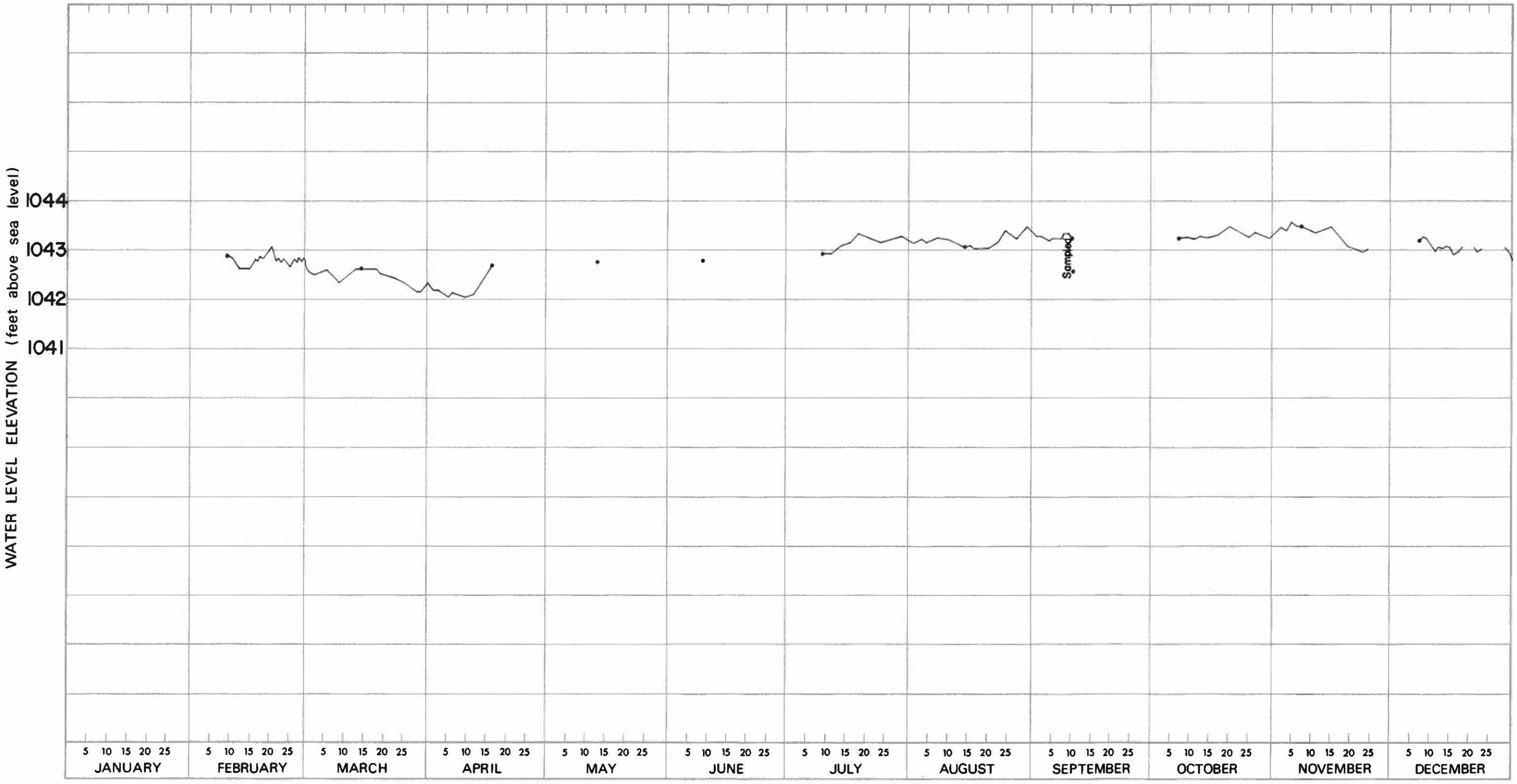
**WATER LEVEL HYDROGRAPH**

7-135-H-76

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council



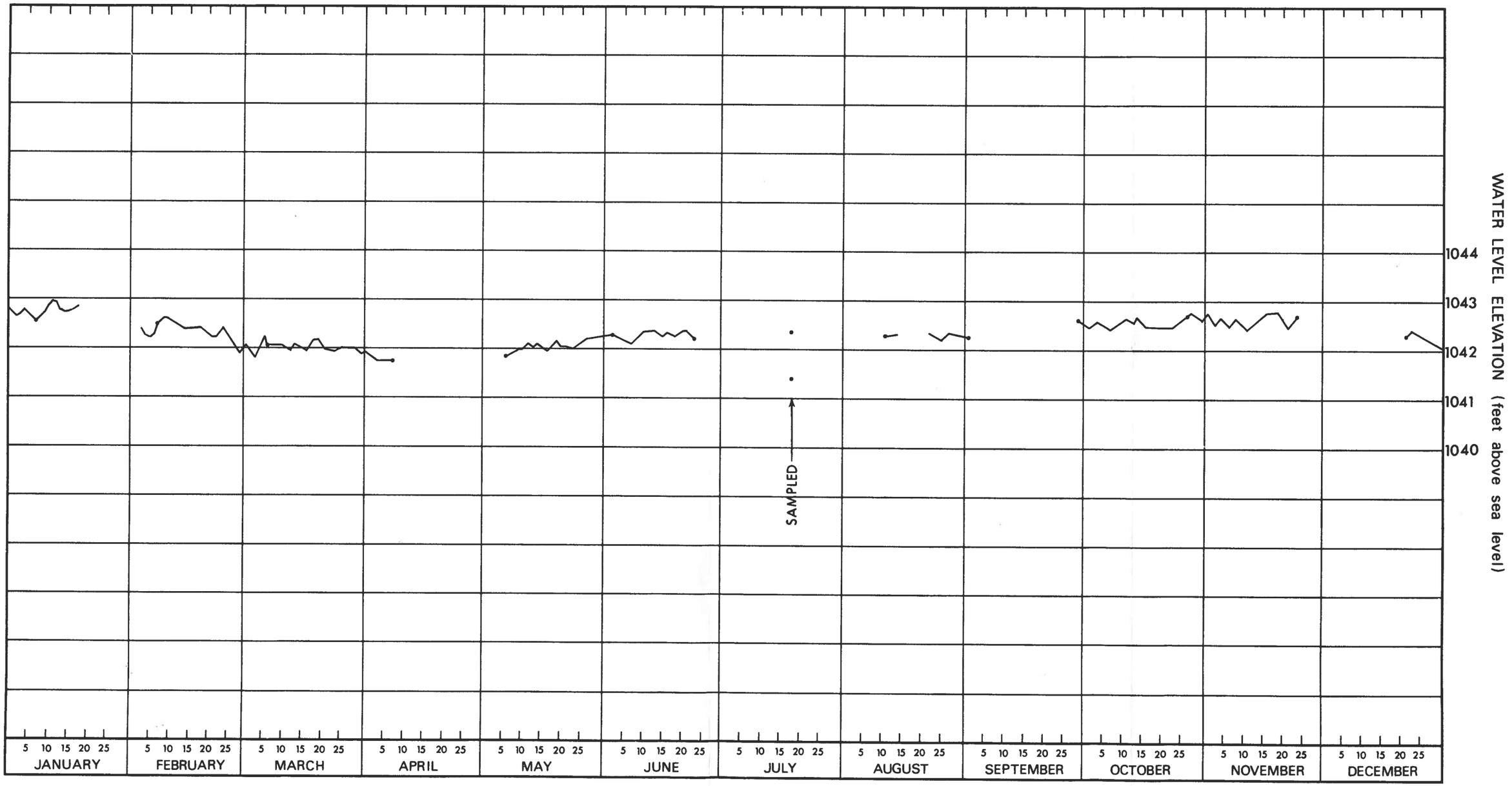
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

7 - 135 - H - 77




1976

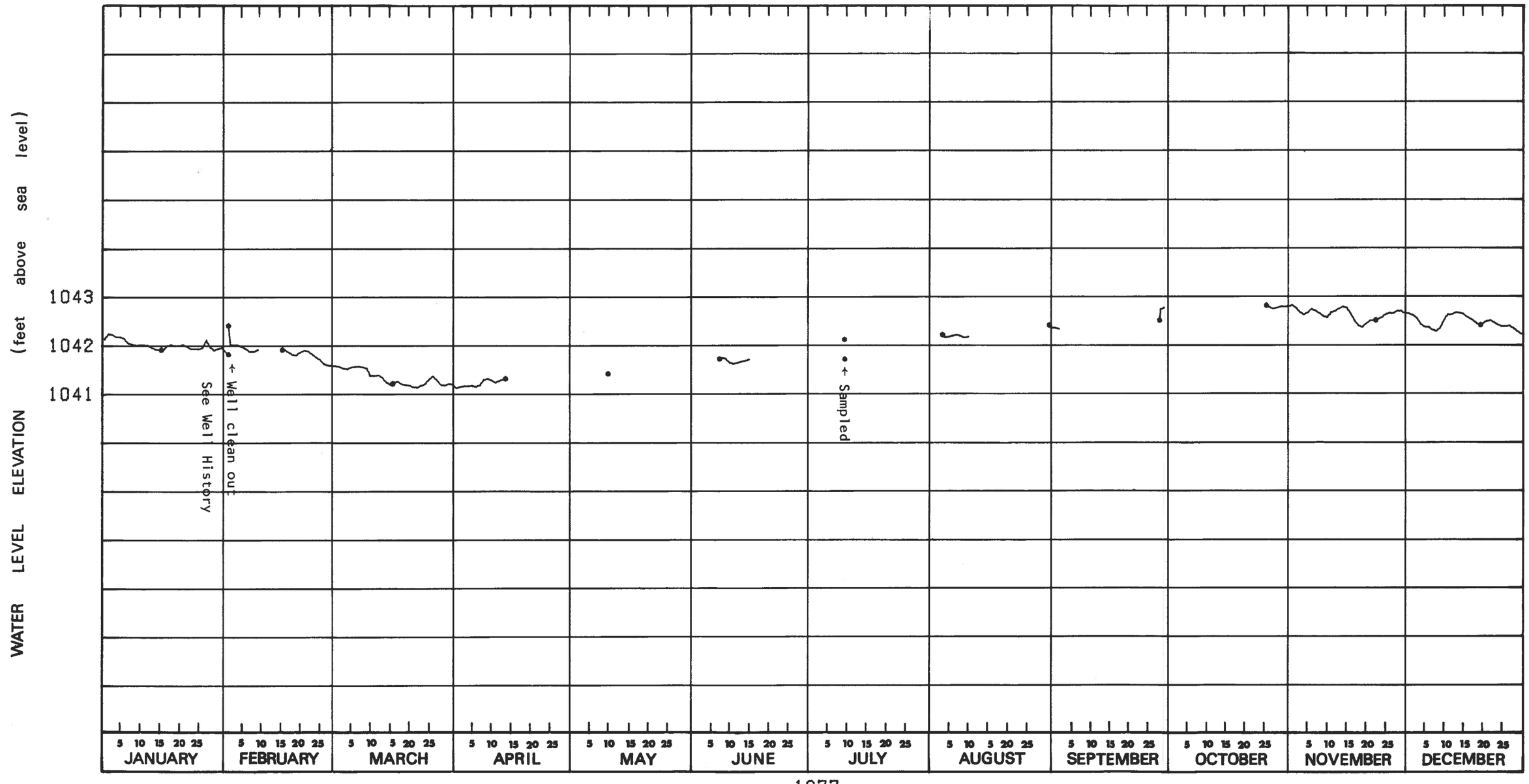
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-135-H-78




1977

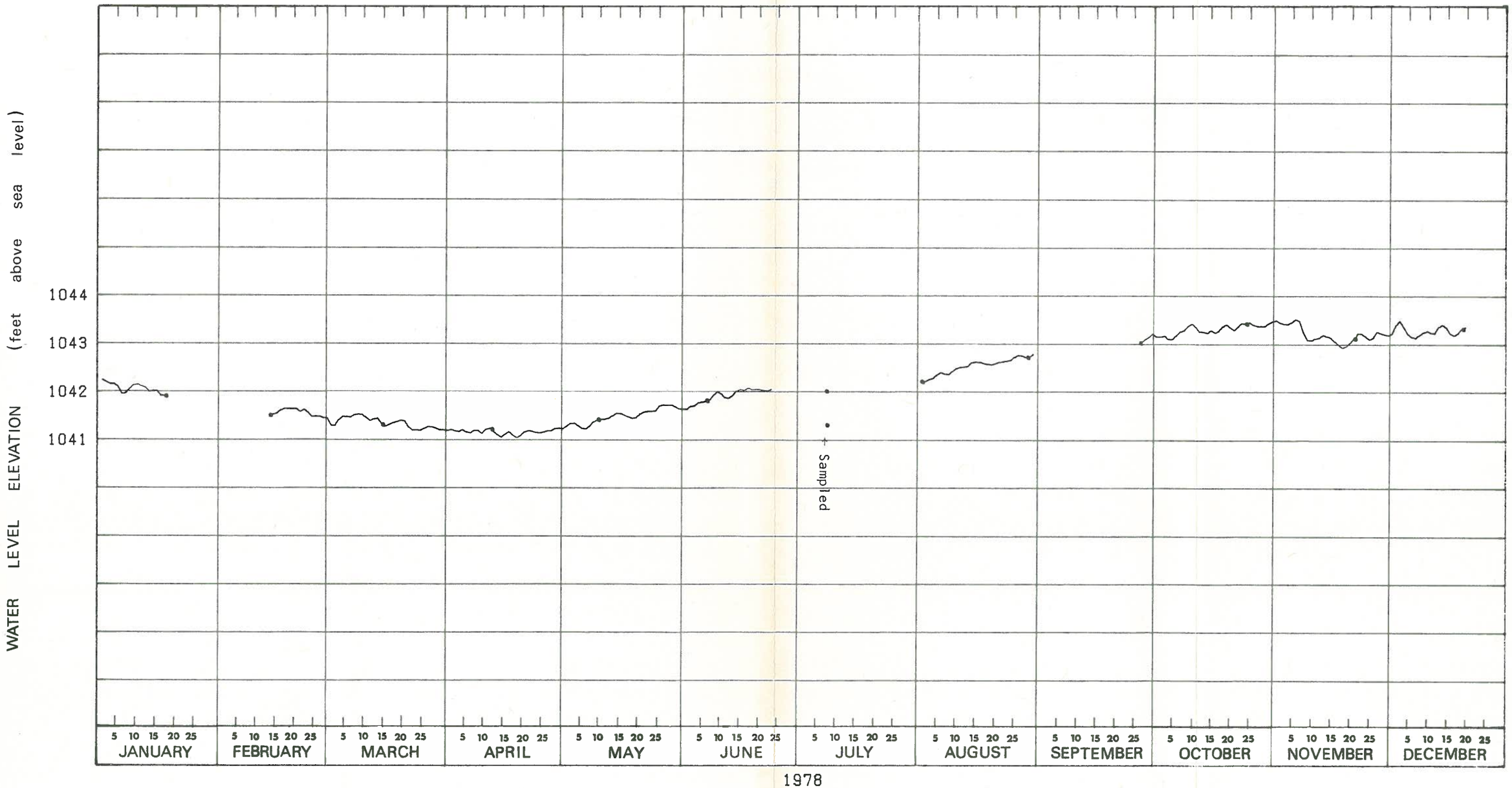
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-135

LSD 13 SEC 20 TWP 95 R 8 W4TH

7-135-H-79

Alberta Research Council



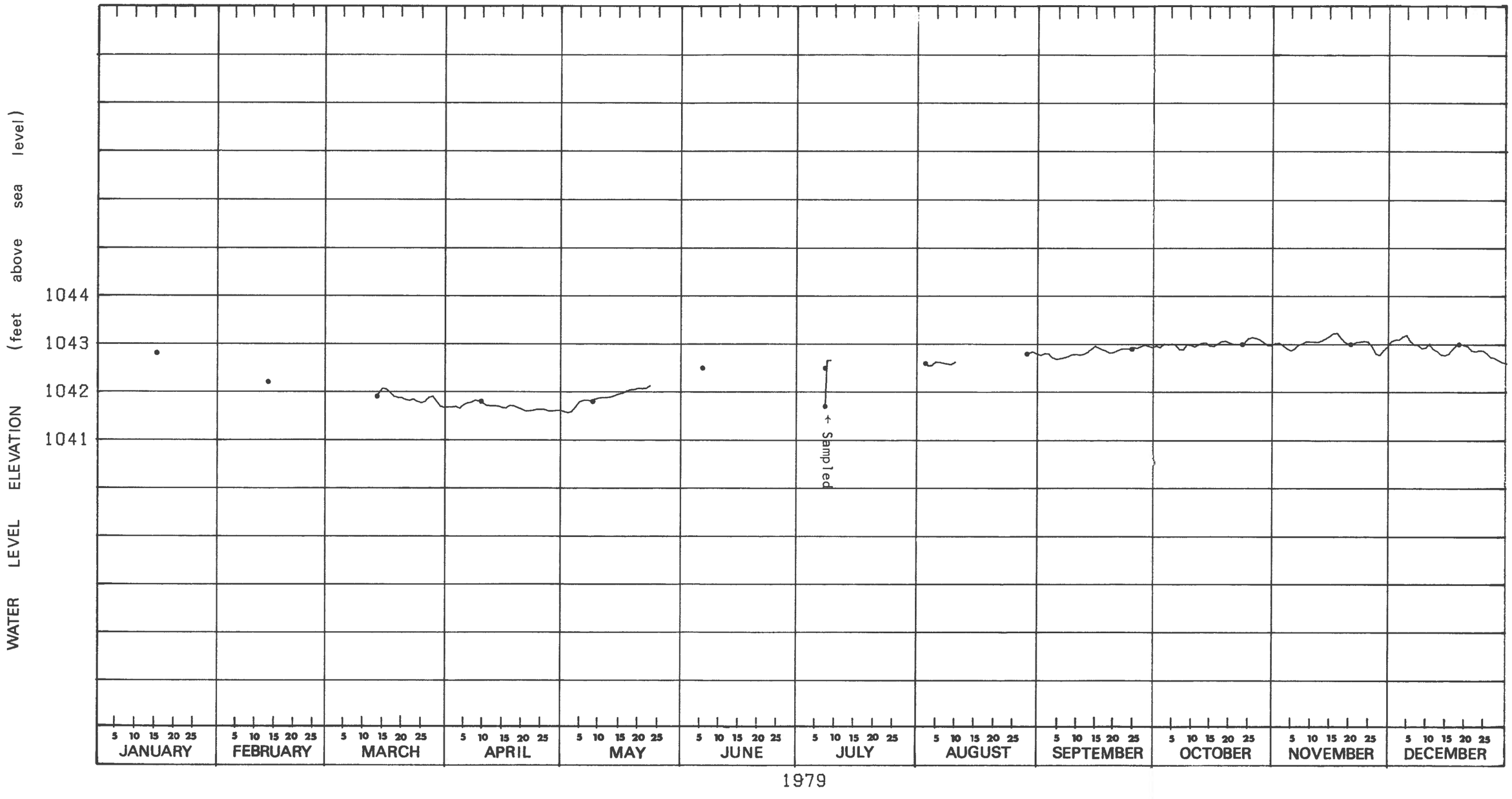
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-135-H-80



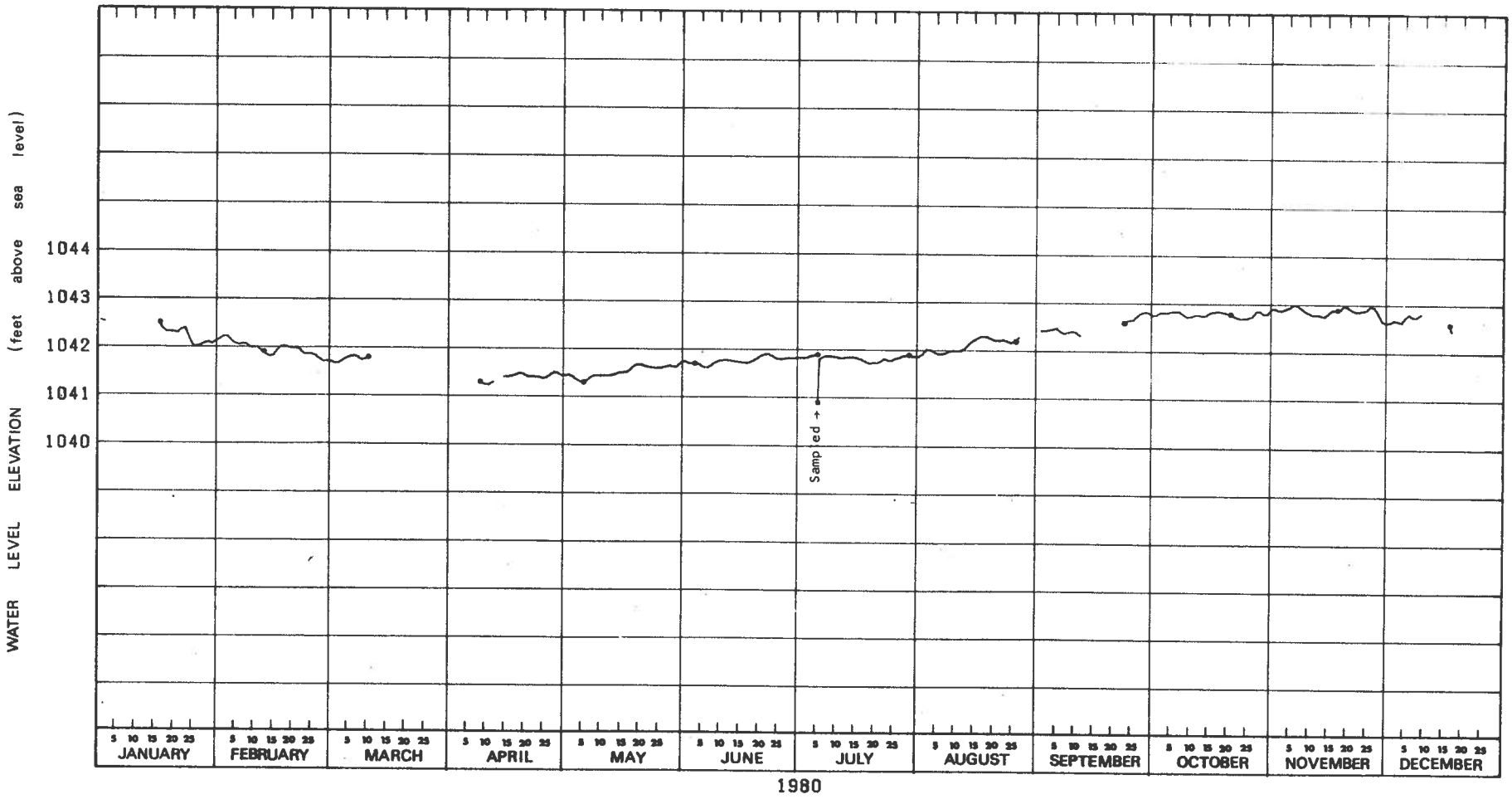
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-135-H-81



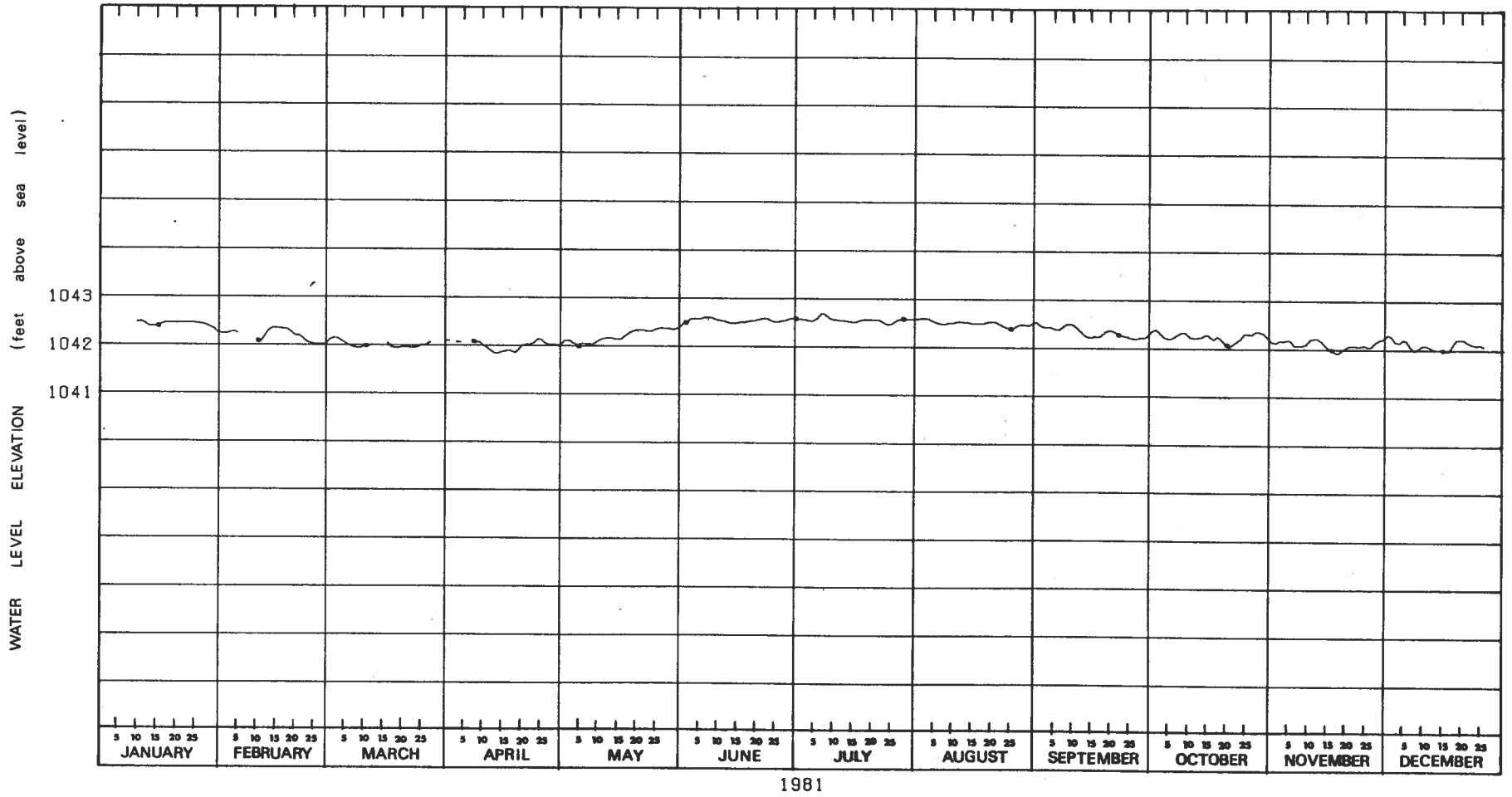
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-135

7-135-H-82

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.93

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 30/75 | | | Well completed |
| | 7.09 TOC | 1048.67 | bail test; 100 gallons/24 min. T = 5 IGPD/Ft |
| Feb 2/75 | 9.02 TOC | 1042.35 | 38 minute pump test @ 2 USGPM: 100 min; pump test @ 1 USGPM; water sample; 30 minutes pump test @ 2 USGPM |
| Feb 5/75 | | | Pump dry 4 times |
| Feb 8/75 | 9.85 MP | 1042.55 | Install shelter; MP = 2.94' TOC, (1074.87) |
| Feb 9/75 | 9.81 MP | 1042.69 | Install recorder |
| Feb 25/75 | 9.87 MP | 1042.50 | |
| Mar 14/75 | 9.89 MP | 1042.42 | |
| Apr 16/75 | 9.95 | 1042.24 | Weight frozen to casing |
| May 13/75 | 10.45 MP | 1040.57 | |
| June 9/75 | 9.88 MP | 1042.46 | |
| July 10/75 | 9.81 MP | 1042.69 | Recorder stuck |
| Aug 14/75 | 9.76 MP | 1042.85 | |
| Sept 10/75 | 9.71 MP | 1043.02 | Sampled well; temp. 3.5°C |
| | 9.86 MP | 1042.52 | after sample |
| Oct 7/75 | 9.65 MP | 1043.21 | |
| Nov 7/75 | 9.58 MP | 1043.45 | |
| Dec 7/75 | 9.66 MP | 1043.18 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.93

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 9.85 MP | 1042.6 | MP (1074.9) |
| Feb 7/76 | 9.87 MP | 1042.5 | |
| Mar 6/76 | 10.01 MP | 1042.1 | |
| Apr 7/76 | 10.11 MP | 1041.7 | |
| May 6/76 | 10.07 MP | 1041.9 | |
| June 2/76 | 9.84 MP | 1042.2 | New MP = 0.80 m TOC, (1074.5) |
| June 23/76 | 9.86 MP | 1042.2 | |
| July 18/76 | 9.82 MP | 1042.3 | |
| | 10.11 MP | 1041.3 | After sample; temp. 4°C |
| Aug 11/76 | 9.84 MP | 1042.2 | |
| Sept 1/76 | 9.85 MP | 1042.2 | |
| Sept 29/76 | 9.74 MP | 1042.6 | |
| Oct 27/76 | 9.69 MP | 1042.7 | |
| Nov 24/76 | 9.69 MP | 1042.7 | |
| Dec 22/76 | 9.81 MP | 1042.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.93

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 9.93 MP | 1041.9 | MP (1074.5) |
| Jan 27/77 | | | Treated with 70 lb NU-WELL acid well conditioner |
| Feb 1/77 | | | Blown with air |
| Feb 16/77 | 10.05 MP | 1041.9 | New MP = 0.90 m TOC, (1074.9) |
| Mar 16/77 | 10.26 MP | 1041.2 | |
| Apr 14/77 | 10.23 MP | 1041.3 | |
| May 10/77 | 10.12 MP | 1041.4 | New MP = 0.81 m TOC, (1074.6) |
| June 8/77 | 10.02 MP | 1041.7 | |
| July 10/77 | 9.92 MP | 1042.1 | |
| | 10.04 MP | 1041.7 | After sample; temp. 4°C |
| Aug 4/77 | 9.87 MP | 1042.2 | |
| Aug 31/77 | 9.82 MP | 1042.4 | |
| Sept 28/77 | 9.80 MP | 1042.5 | |
| Oct 26/77 | 9.69 MP | 1042.8 | Temp. 3.9°C |
| Nov 23/77 | 9.79 MP | 1042.5 | |
| Dec 20/77 | 9.82 MP | 1042.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.93

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 9.98 MP | 1041.9 | MP (1074.6) |
| Feb 14/78 | 10.09 MP | 1041.5 | |
| Mar 15/78 | 10.14 MP | 1041.3 | |
| Apr 12/78 | 10.18 MP | 1041.2 | |
| May 10/78 | 10.12 MP | 1041.4 | |
| June 7/78 | 10.00 MP | 1041.8 | |
| July 8/78 | 9.93 MP | 1042.0 | |
| | 10.10 MP | 1041.3 | After sample; temp. 4°C<br>New MP 0.74 m TOC (1074.4) |
| Aug 2/78 | 9.81 MP | 1042.2 | |
| Aug 29/78 | 9.72 MP | 1042.7 | |
| Sept 27/78 | 9.57 MP | 1043.0 | |
| Oct 25/78 | 9.45 MP | 1043.4 | |
| Nov 22/78 | 9.53 MP | 1043.1 | |
| Dec 20/78 | 9.49 MP | 1043.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.93

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 9.62 MP | 1042.8 | MP (1074.4) |
| Feb 14/79 | 9.82 MP | 1042.2 | |
| Mar 14/79 | 9.92 MP | 1041.9 | |
| Apr 10/79 | 9.95 MP | 1041.8 | |
| May 9/79 | 9.95 MP | 1041.8 | |
| June 6/79 | 9.73 MP | 1042.5 | |
| July 8/79 | 9.71 MP | 1042.5 | |
| | 9.97 MP | 1041.7 | After sample; temp. 5.5°C |
| Aug 3/79 | 9.60 MP | 1042.6 | New MP 0.66m TOC (1074.1) |
| Aug 29/79 | 9.53 MP | 1042.8 | |
| Sept 25/79 | 9.50 MP | 1042.9 | |
| Oct 24/79 | 9.49 MP | 1043.0 | |
| Nov 21/79 | 9.49 MP | 1043.0 | |
| Dec 19/79 | 9.48 MP | 1043.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.93

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 9.62 MP | 1042.5 | |
| Feb 13/80 | 9.83 MP | 1041.9 | |
| Mar 11/80 | 9.86 MP | 1041.8 | |
| Apr 9/80 | 10.00 MP | 1041.3 | |
| May 6/80 | 10.01 MP | 1041.3 | |
| June 4/80 | 9.87 MP | 1041.7 | |
| July 6/80 | 9.83 MP | 1041.9 | Temp. 5°C |
| | 10.13 MP | 1040.9 | After Sample |
| July 30/80 | 9.82 MP | 1041.9 | |
| Aug 27/80 | 9.73 MP | 1042.2 | |
| Sept 24/80 | 9.61 MP | 1042.6 | |
| Oct 22/80 | 9.55 MP | 1042.8 | |
| Nov 19/80 | 9.52 MP | 1042.9 | |
| Dec 18/80 | 9.59 MP | 1042.6 | |
| Jan 16/81 | 9.67 MP | 1042.4 | |
| Feb 11/81 | 9.74 MP | 1042.1 | |
| Mar 11/81 | 9.78 MP | 1042.0 | |
| Apr 8/81 | 9.75 MP | 1042.1 | |
| May 5/81 | 9.78 MP | 1042.0 | |
| June 2/81 | 9.63 MP | 1042.5 | |
| July 1/81 | 9.60 MP | 1042.6 | |
| July 29/81 | 9.59 MP | 1042.6 | |
| Aug 26/81 | 9.66 MP | 1042.4 | |
| Sept 23/81 | 9.69 MP | 1042.3 | |
| Oct 21/81 | 9.75 MP | 1042.1 | |
| Nov 17/81 | 9.78 MP | 1042.0 | |
| Dec 16/81 | 9.79 MP | 1042.0 | |

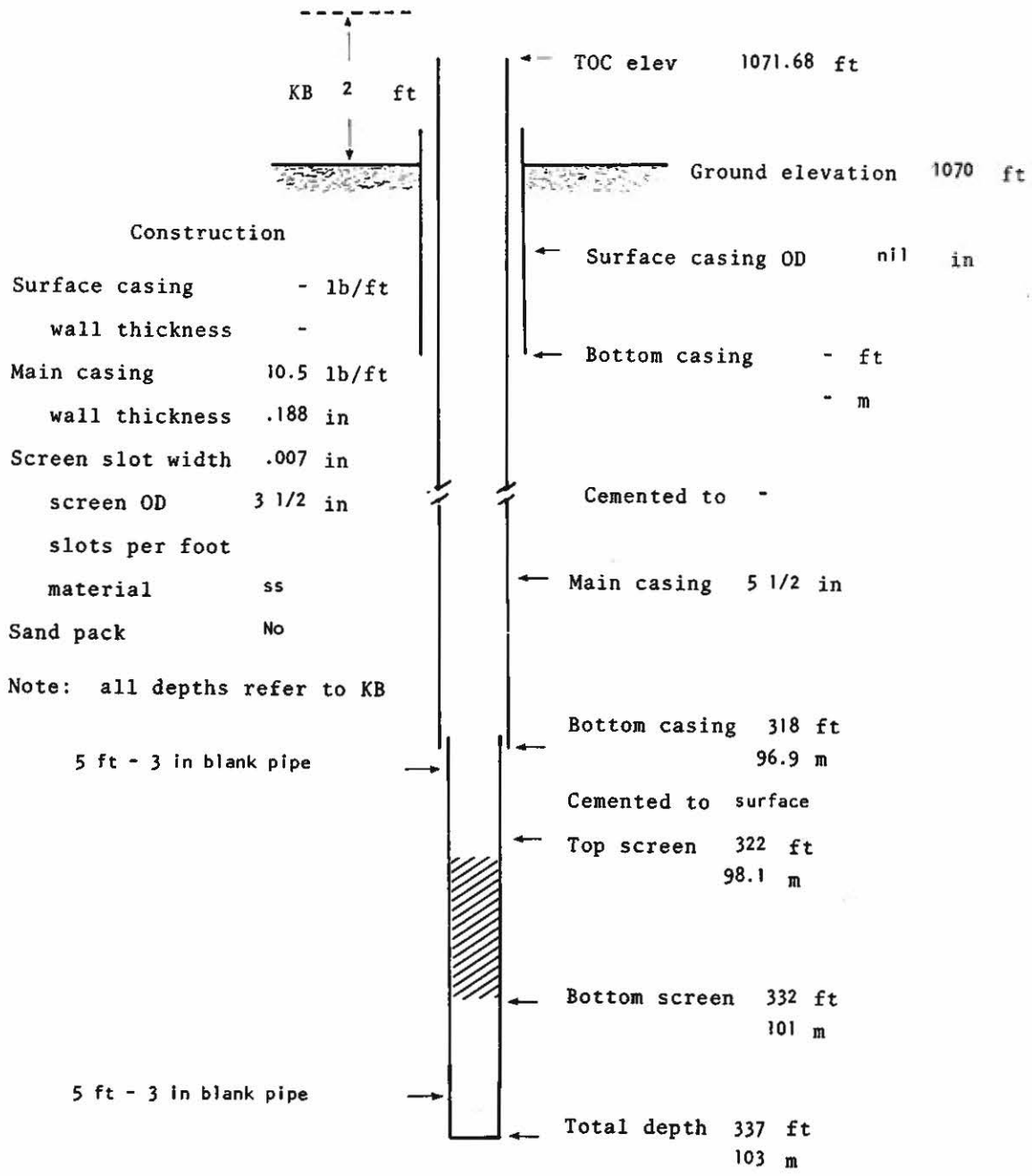
MP - Depth from measuring point
TOC - Depth from top of casing

**WELL CONSTRUCTION.**

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Tp 95 R 8 W4th

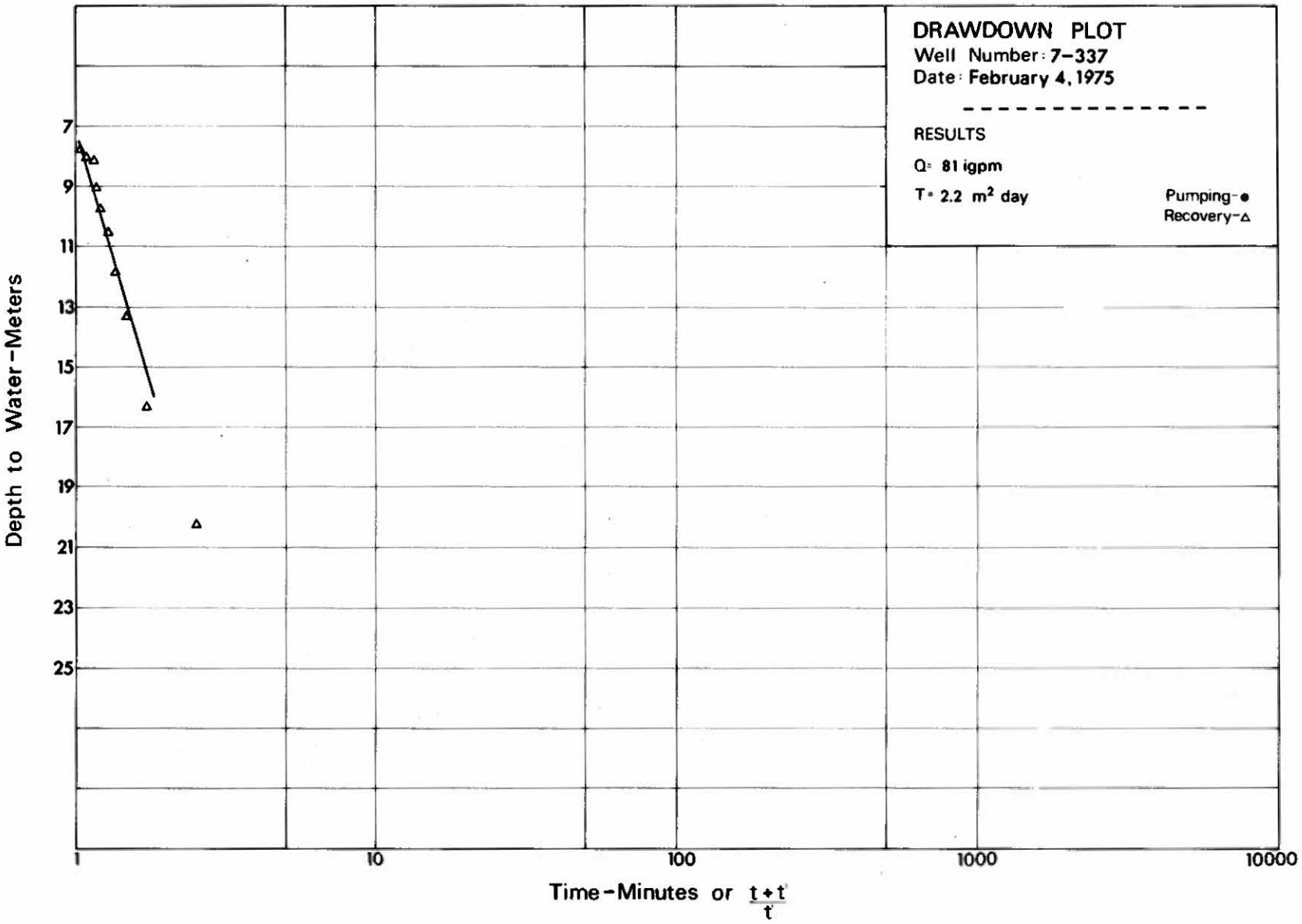
Alberta Research Council



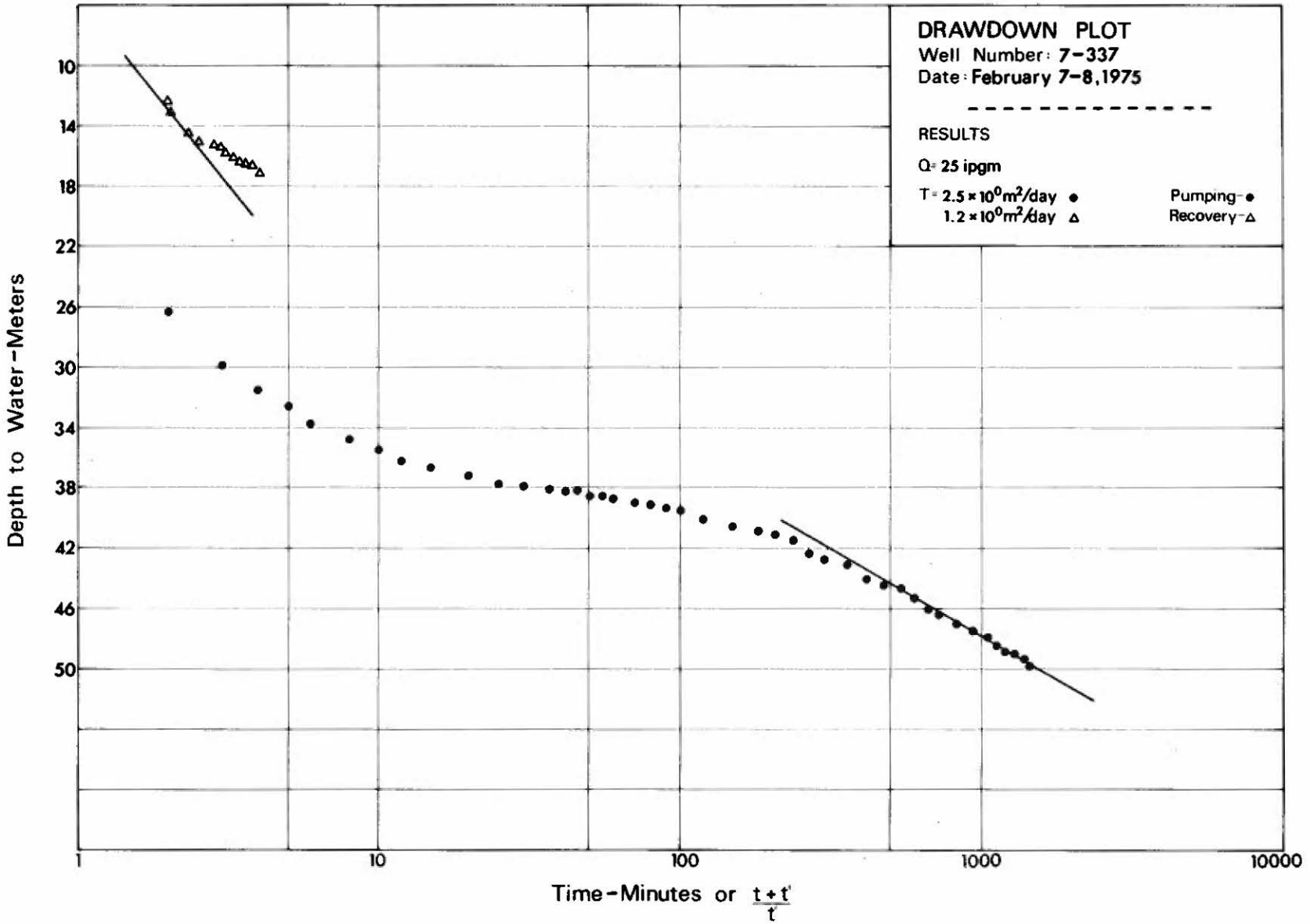

Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 10.5 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

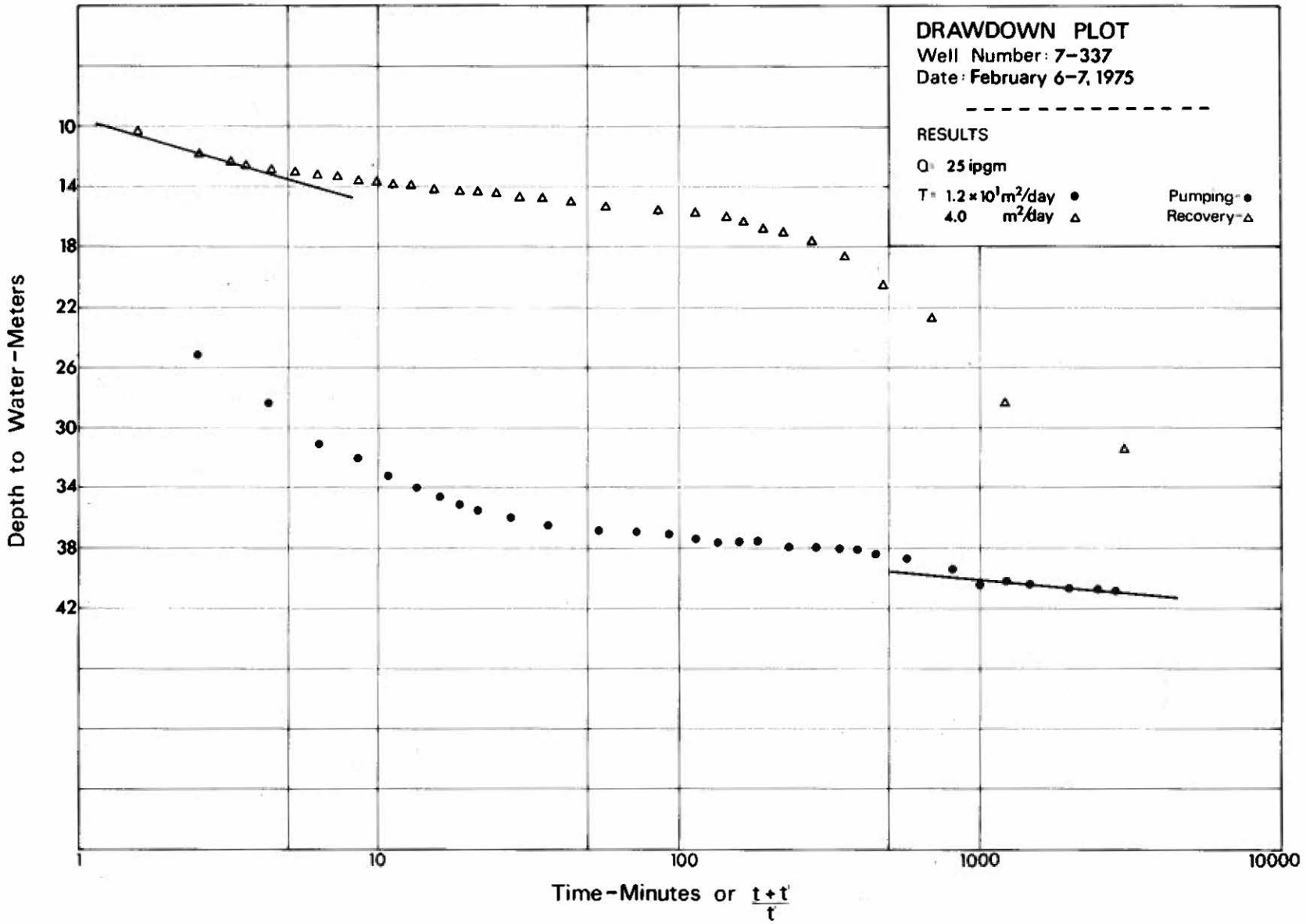
Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 7-337
Date: February 4, 1975
RESULTS
Q= 81 igpm
T= 2.2 m² day
Pumping-●
Recovery-△
Depth to Water-Meters
7
9
11
13
15
17
19
21
23
25
1
10
100
1000
10000
Time-Minutes or t+t'/t'

7-337-A-76


DRAWDOWN PLOT
Well Number: 7-337
Date: February 7-8, 1975
RESULTS
Q= 25 ipgm
T= 2.5 × 10⁰ m²/day ●
1.2 × 10⁰ m²/day △
Pumping-●
Recovery-△
Depth to Water-Meters
10
14
18
22
26
30
34
38
42
46
50
1
10
100
1000
10000
Time-Minutes or (t+t')/t

7-337-A-76


DRAWDOWN PLOT
Well Number: 7-337
Date: February 6-7, 1975
RESULTS
Q = 25 ipgm
T = 1.2 × 10¹ m²/day ● Pumping = ●
4.0 m²/day △ Recovery = △
Depth to Water-Meters
10
14
18
22
26
30
34
38
42
1
10
100
1000
10000
Time-Minutes or (t+t')/t

7-337-A-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Pump test on 7-337

Date sampled February 8, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 7.0 | 0.35 | 1.2 |
| Magnesium ($Mg^{++}$) | 28.0 | 2.30 | 8.0 |
| Sodium ($Na^{+}$) | 585.0 | 25.45 | 88.8 |
| Potassium ($K^{+}$) | 22.1 | 0.57 | 2.0 |
| Carbonate ($CO_3^{=}$) | 79.0 | 2.63 | 8.4 |
| Bicarbonate ($HCO_3^{-}$) | 1171.0 | 19.19 | 61.5 |
| Sulfate ($SO_4^{=}$) | 12.2 | 0.25 | 0.8 |
| Chloride ($Cl^{-}$) | 323.0 | 9.11 | 29.2 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 5.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1556.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 31.195 | Total Cations (epm) | 28.663 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2780 | Temperature (C) | 3.9 | |
| pH | 8.9 | pH | 7.4 | |
| Fluoride ($F^{-}$) | 1.4 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1358 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | 2700 | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Pump test on 7-337

Date sampled February 6, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 9.2 | 0.46 | 1.6 |
| Magnesium ($Mg^{++}$) | 28.7 | 2.36 | 8.2 |
| Sodium ($Na^{+}$) | 583.0 | 25.36 | 88.2 |
| Potassium ($K^{+}$) | 22.1 | 0.57 | 2.0 |
| Carbonate ($CO_3^{=}$) | 31.0 | 1.03 | 3.4 |
| Bicarbonate ($HCO_3^{-}$) | 1235.0 | 20.24 | 66.1 |
| Sulfate ($SO_4^{=}$) | 12.7 | 0.26 | 0.9 |
| Chloride ($Cl^{-}$) | 321.0 | 9.05 | 29.6 |
| Nitrate ($NO_3^{=}$) | 2.0 | 0.03 | 0.1 |
| Silica ($SiO_2$) | 6.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1572.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 30.625 | Total Cations (epm) | 28.743 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2780 | Temperature (C) | 5.0 | |
| pH | 8.5 | pH | 7.4 | |
| Fluoride ($F^{-}$) | 1.4 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1370 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | 3000 | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Pump test on 7-337

Date sampled February 7, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 42.5 | 2.12 | 6.9 |
| Magnesium ($Mg^{++}$) | 29.0 | 2.38 | 7.8 |
| Sodium ($Na^{+}$) | 586.0 | 25.49 | 83.4 |
| Potassium ($K^{+}$) | 22.1 | 0.57 | 1.8 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.0 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1369.0 | 22.44 | 71.1 |
| Sulfate ($SO_4^{=}$) | 10.5 | 0.22 | 0.7 |
| Chloride ($Cl^{-}$) | 315.0 | 8.88 | 28.2 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 5.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1648.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3148.0 | Total Cations (epm) | 30.560 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2900 |
| pH | 8.2 |
| Fluoride ($F^{-}$) | 1.4 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 2.8 |
| pH | 7.3 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 1360 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | 2400 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 9, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 14.7 | 0.73 | 3 |
| Magnesium ($Mg^{++}$) | 28 | 2.30 | 8 |
| Sodium ($Na^{+}$) | 575 | 25.01 | 87 |
| Potassium ($K^{+}$) | 22.1 | 0.57 | 2 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1239 | 20.31 | 76 |
| Sulfate ($SO_4^{=}$) | 2.7 | 0.06 | 0 |
| Chloride ($Cl^{-}$) | 218 | 6.15 | 23 |
| Nitrate ($NO_3^{=}$) | 16.5 | 0.27 | 1 |
| Silica ($SiO_2$) | 4.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 14.6 | | |
| Magnesium (Acidified) | 27 | | |
| Total dissolved solids | 1584 | | |
| Total Anions (epm) 26.79 | | Total Cations (epm) | 28.61 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 3200 |
| pH | 8.2 |
| Fluoride ($F^{-}$) | 1.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 4.0 |
| pH | 8.3 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 1269 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Pump test on well 7-337

Date of sampling February 8, 1975

Total dissolved solids 1556 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | .01 |
| Al | .002 | Mg | .05 |
| As | <.01 | Mn | ND |
| B | .04 | Mo | ND |
| Ba | .005 | Ni | ND |
| Be | ND | Pb | ND |
| Bi | ND | Sb | ND |
| Ca | M | Si | .04 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .002 | V | ND |
| Fe | .001 | Zn | <.005 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

7-337-E-76

**WATER ANALYSIS**

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 14.7 | 0.73 | 3 |
| Magnesium ($Mg^{++}$) | 28.0 | 2.30 | 8 |
| Sodium ($Na^{+}$) | 575 | 25.01 | 87 |
| Potassium ($K^{+}$) | 22.1 | 0.57 | 2 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1239 | 20.31 | 76 |
| Sulfate ($SO_4^{=}$) | 2.7 | 0.06 | 0 |
| Chloride ($Cl^{-}$) | 218 | 6.15 | 23 |
| Nitrate ($NO_3^{=}$) | 16.5 | 0.27 | 1 |
| Silica ($SiO_2$) | 4.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 14.6 | | |
| Magnesium (Acidified) | 27.0 | | |
| Total dissolved solids | 1581 | | |
| Total Anions (epm) 26.78 | | Total Cations (epm) | 28.61 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 3200 |
| pH | 8.2 |
| Fluoride ($F^{-}$) | 1.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 3.5 |
| pH | 8.3 |
| Carbonate ($CO_3^{=}$) | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1269 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 6.6 | 0.33 | 1 |
| Magnesium ($Mg^{++}$) | 25.0 | 2.06 | 7 |
| Sodium ($Na^{+}$) | 599.0 | 26.05 | 90 |
| Potassium ($K^{+}$) | 23.3 | 0.60 | 2 |
| Carbonate ($CO_3^{=}$) | 31.2 | 1.04 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 1154.0 | 18.91 | 61 |
| Sulfate ($SO_4^{=}$) | 3.7 | 0.08 | 0 |
| Chloride ($Cl^{-}$) | 398.0 | 11.22 | 36 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 6.2 | | |
| Magnesium (Acidified) | 25.3 | | |
| Total dissolved solids | 1618 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 31.26 | Total Cations (epm) | 29.04 |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2700 |
| pH | 8.5 |
| Fluoride ($F^{-}$) | 1.2 Mg/L |

Field:

| | |
|---|---|
| Temperature (C) | 5.0 |
| pH | 8.6 |
| Carbonate ($CO_3^{=}$) | 62 Mg/L |
| Bicarbonate ($HCO_3^{-}$) | 1069 Mg/L |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 10, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 28.0 | 1.40 | 4.6 |
| Magnesium ($Mg^{++}$) | 26.0 | 2.14 | 7.1 |
| Sodium ($Na^{+}$) | 601.0 | 26.14 | 86.4 |
| Potassium ($K^{+}$) | 22.9 | 0.59 | 1.9 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1325.0 | 21.72 | 70.2 |
| Sulfate ($SO_4^{=}$) | 3.8 | 0.08 | 0.3 |
| Chloride ($Cl^{-}$) | 324.0 | 9.14 | 29.5 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 2.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 24.0 | | |
| Magnesium (Acidified) | 34.0 | | |
| Total dissolved solids | 1636.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 30.94 | Total Cations (epm) | 30.27 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 3000 | Temperature (C) | 6.0 |
| pH | 7.8 | pH | 7.8 |
| Fluoride ($F^{-}$) | 1.3 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 1298.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Date sampled: July 18, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .006 |
| Au | <.003 | Mo | <.006 |
| Al | 0.11 | Na | 604 |
| As | <.038 | Ni | <.010 |
| B | 1.32 | P | 0.66 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 7.88 | Si | 1.79 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .611 |
| Cr | <.006 | Te | <.065 |
| Cu | <.0004 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .066 | V | <.0008 |
| K | 33 | W | <.078 |
| Mg | 29.8 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

7-337-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 8.7 | 0.43 | 1.5 |
| Magnesium(Mg) | 23.0 | 1.89 | 6.6 |
| Sodium(Na) | 596.0 | 25.92 | 90.0 |
| Potassium(K) | 22.0 | 0.56 | 2.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1247.0 | 20.44 | 67.9 |
| Sulphate(SO4) | 2.0 | 0.04 | 0.1 |
| Chloride(Cl) | 340.0 | 9.59 | 31.9 |
| Nitrate(NO3) | 1.7 | 0.03 | 0.1 |
| Silica(SiO2) | 5.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 8.8 | | |
| Magnesium(Acidified) | 27.0 | | |
| TDS(mg/l) | 1582.0 | | |
| Total Anions(epm) | 30.10 | Total Cations(epm) | 28.81 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2510 | | Temperature(C) | 5.00 | |
| pH | 8.2 | | pH | 8.6 | |
| Fluoride(F) | 1.1 | mg/l | Carbonate(CO3) | 48 | mg/l |
| | | | Bicarbonate(HCO3) | 1152 | mg/l |
| | | | Hydroxide(OH) | | |

7-337-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 8, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 8.1 | 0.40 | 1.4 |
| Magnesium(Mg) | 25.0 | 2.06 | 7.2 |
| Sodium(Na) | 588.0 | 25.58 | 89.6 |
| Potassium(K) | 20.0 | 0.51 | 1.8 |
| Carbonate(CO3) | 58.0 | 1.93 | 6.5 |
| Bicarbonate(HCO3) | 1127.0 | 18.47 | 62.3 |
| Sulphate(SO4) | 8.1 | 0.17 | 0.6 |
| Chloride(Cl) | 322.0 | 9.08 | 30.6 |
| Nitrate(NO3) | 1.0 | 0.02 | 0.1 |
| Silica(SiO2) | 3.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 7.0 | | |
| Magnesium(Acidified) | 23.0 | | |
| TDS(mg/l) | 1638.0 | | |
| Total Anions(epm) | 29.67 | Total Cations(epm) | 28.55 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2420 | | Temperature(C) | 5.50 | |
| pH | 8.7 | | pH | 8.9 | |
| Fluoride(F) | 1.1 | mg/l | Carbonate(CO3) | 86 | mg/l |
| | | | Bicarbonate(HCO3) | 1098 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 7-337-E-82

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.2 | 0.11 | 0.4 |
| Magnesium(Mg) | 29.5 | 2.46 | 8.6 |
| Sodium(Na) | 581.0 | 25.26 | 88.7 |
| Potassium(K) | 25.0 | 0.64 | 2.3 |
| Carbonate(CO3) | 115.0 | 3.83 | 13.6 |
| Bicarbonate(HCO3) | 959.0 | 15.72 | 55.8 |
| Sulphate(SO4) | 7.0 | 0.15 | 0.5 |
| Chloride(Cl) | 300.0 | 8.45 | 30.0 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 2.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 4.5 | | |
| Magnesium(Acidified) | 24.2 | | |
| TDS(mg/l) | 1596.0 | | |
| Total Anions(epm) | 28.16 | Total Cations(epm) | 28.47 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2650 | Temperature | 5.50 | |
| pH | 9.2 | pH | 8.8 | |
| Fluoride | 1.1 mg/l | Carbonate(CO3) | 82 | mg/l |
| | | Bicarbonate(HCO3) | 1064 | mg/l |
| | | Hydroxide(OH) | | |

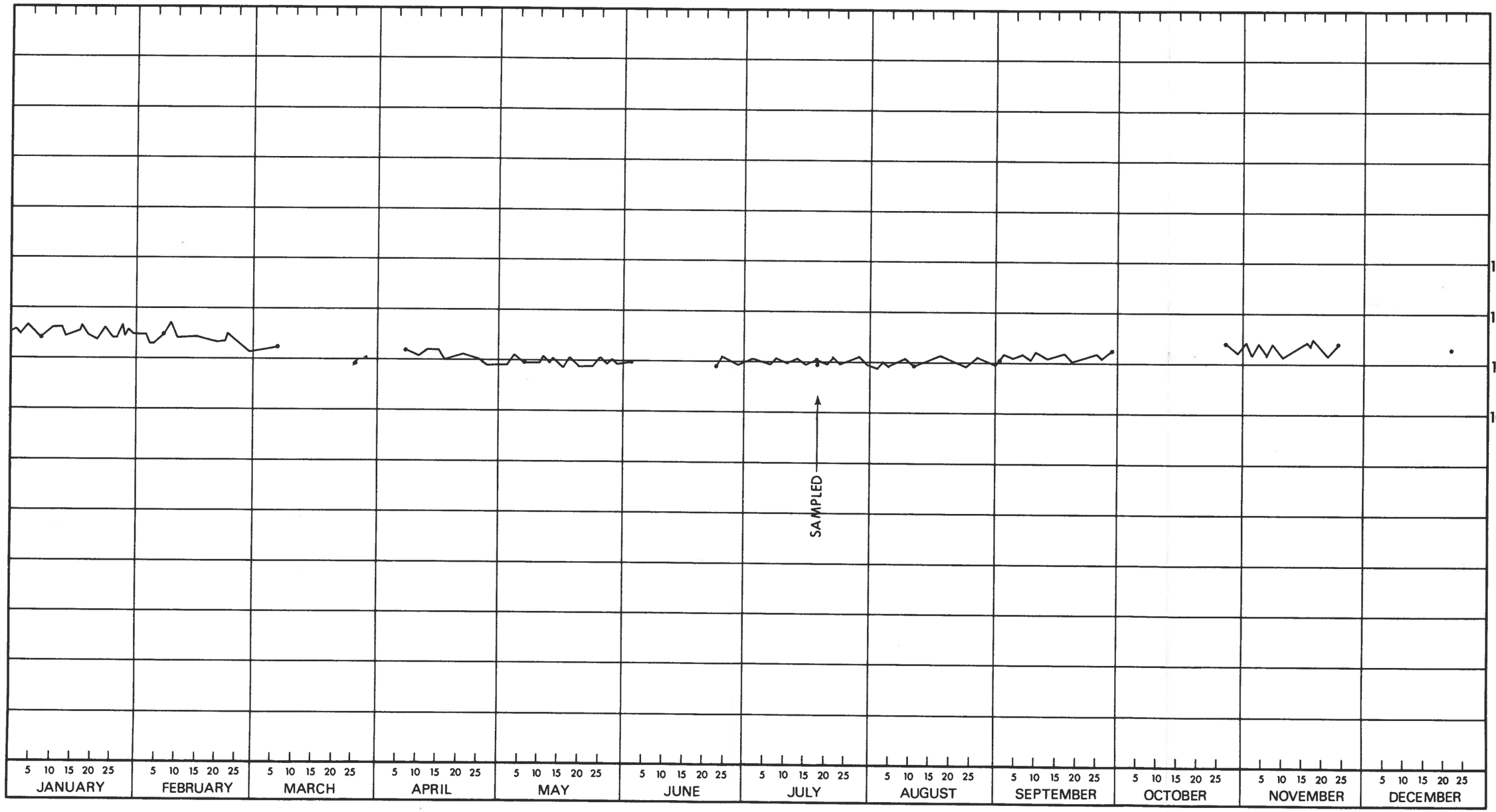
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **7-337**

Lsd **13** Sec **20** Twp **95** R **8** W4th

Alberta Research Council

**7 - 337 - H - 77**




1976

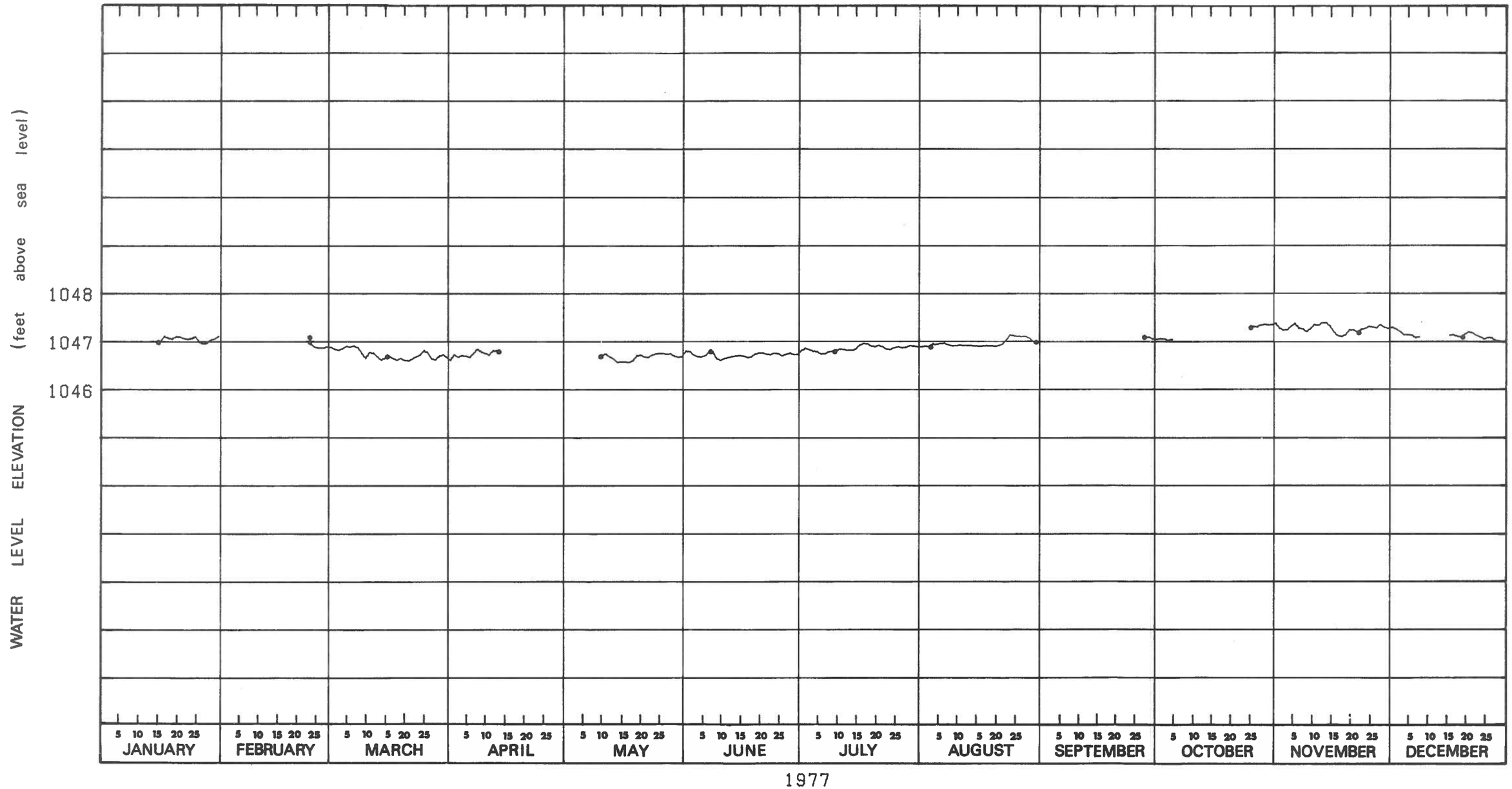
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-337-H-78



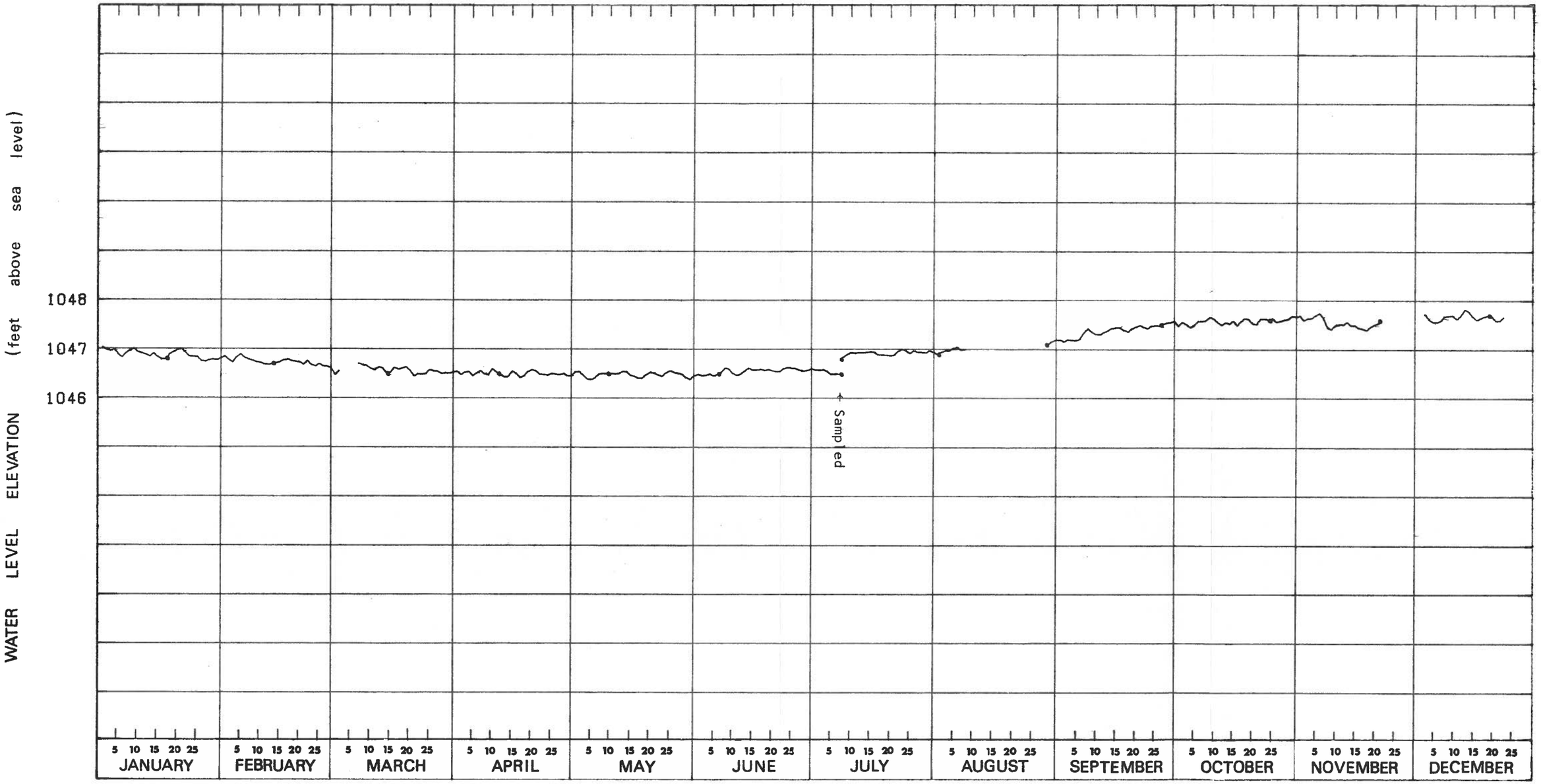
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-337

LSD 13 SEC 20 TWP 95 R 8 W4TH

Alberta Research Council

7-337-H-79



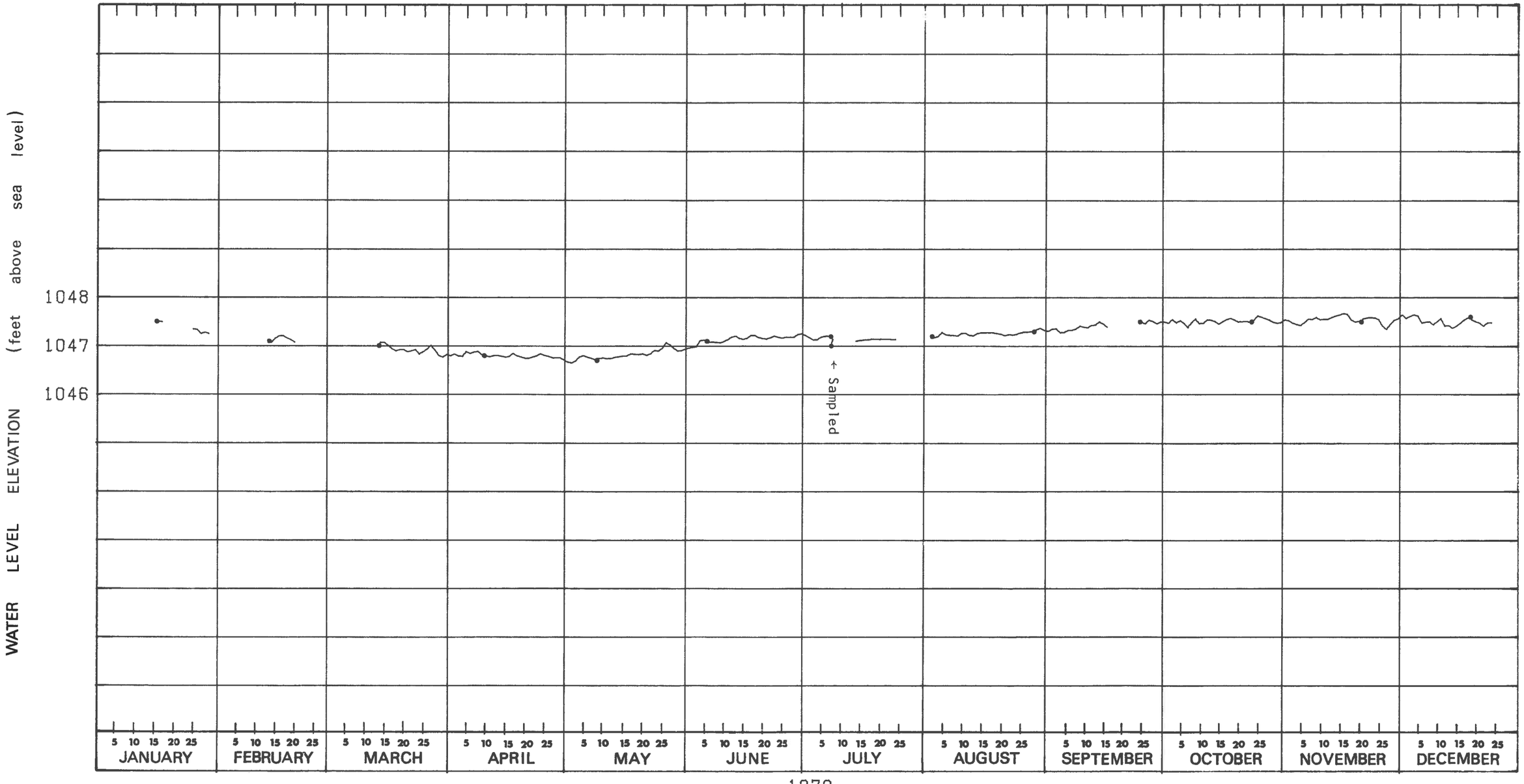
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-337-H-80



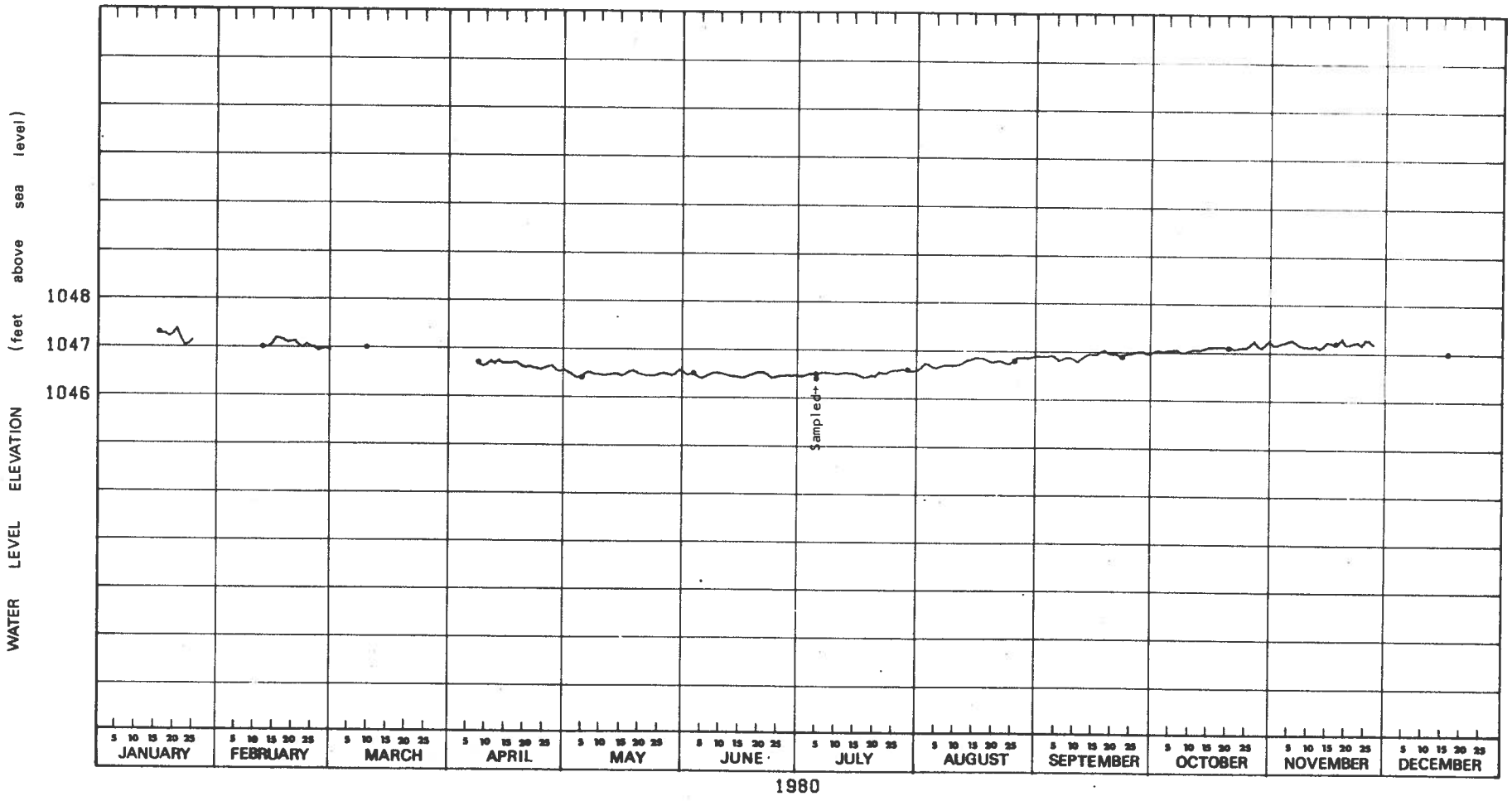
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-337-H-81



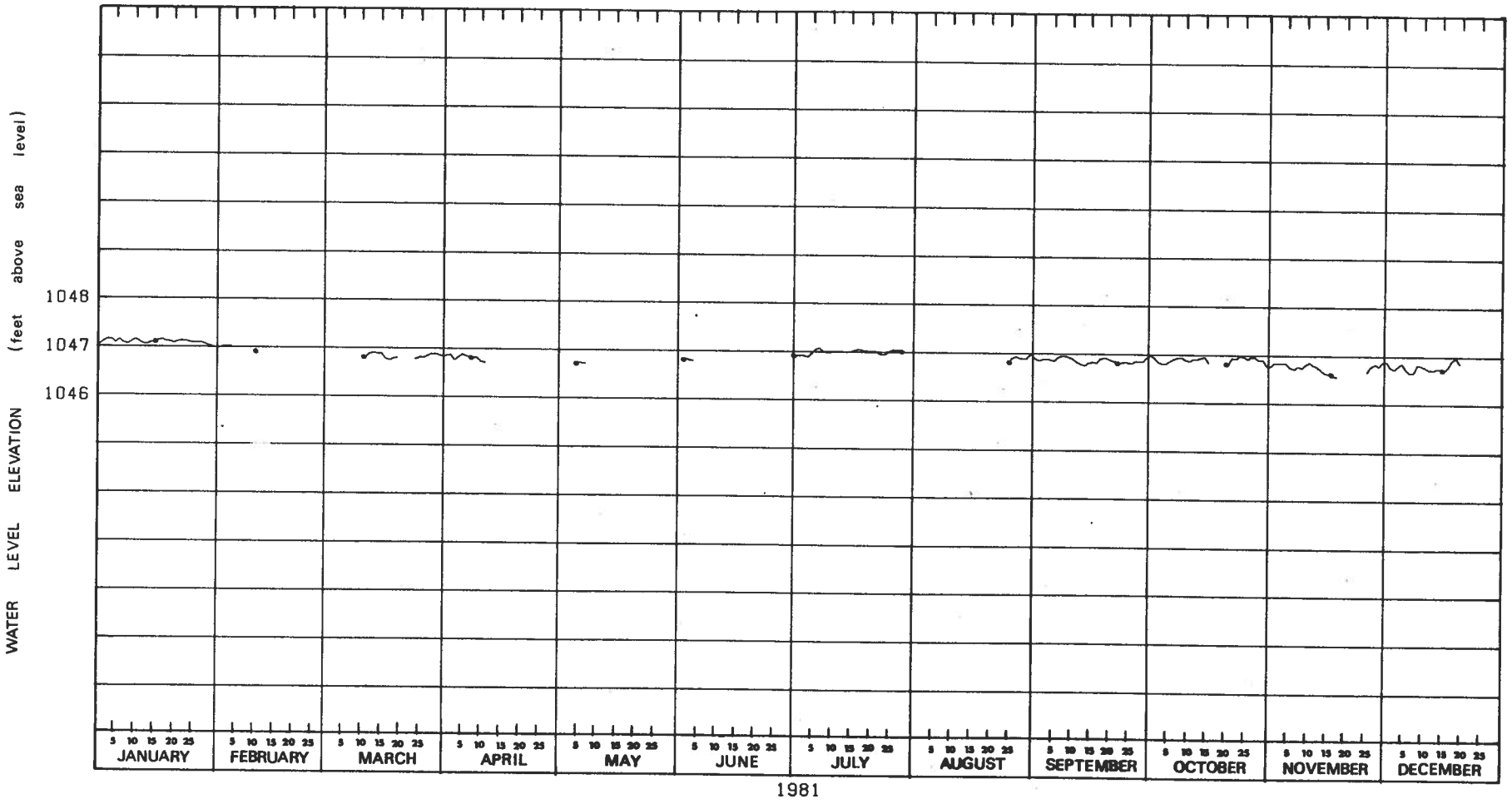
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-337-H-82



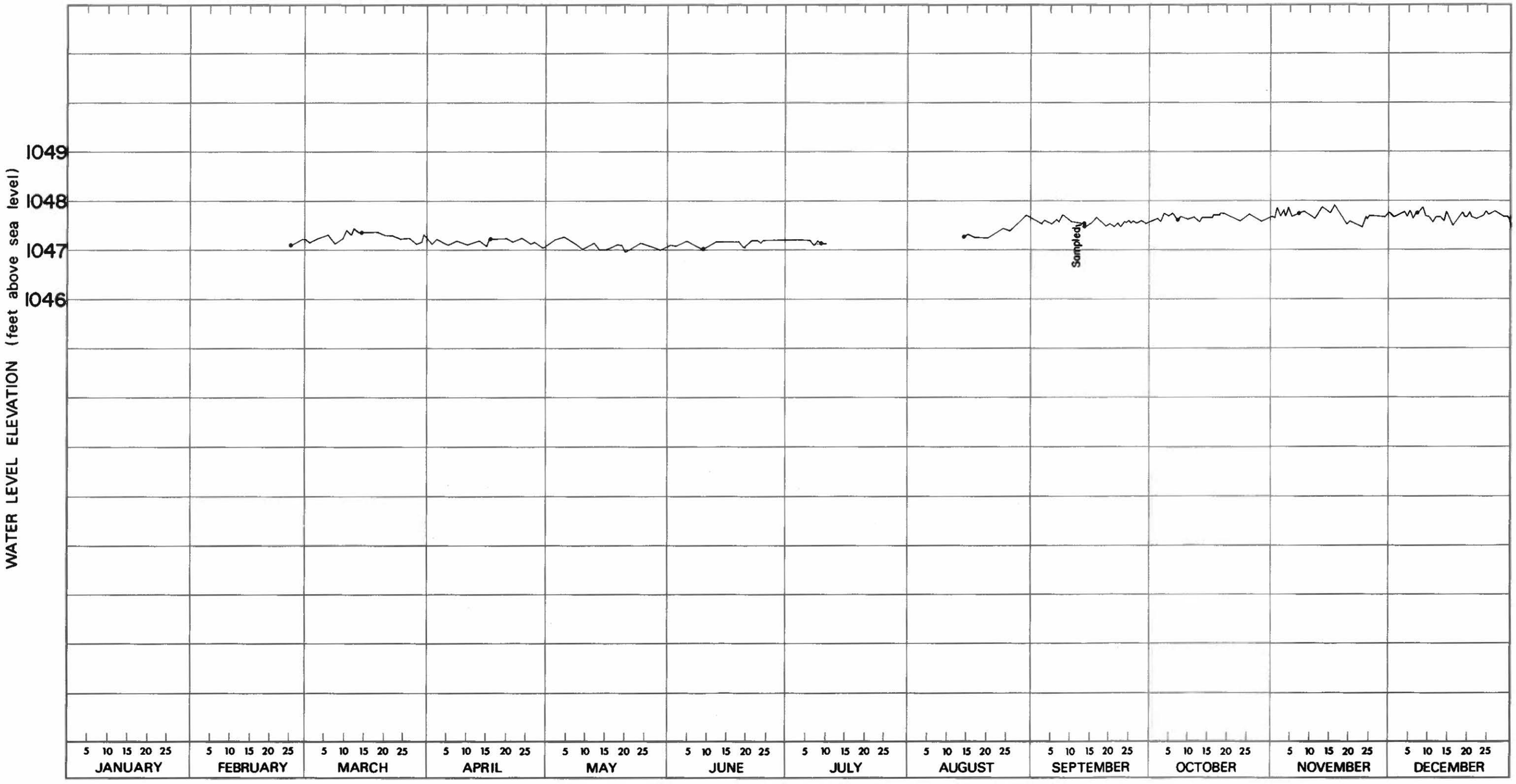
WATER LEVEL HYDROGRAPH

7-337-H-76

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 7-337

Lsd 12 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 1/75 | | | Well completed |
| | 7.16 TOC | 1048.20 | bail 140 gallons |
| Feb 2/75 | 7.45 TOC | 1047.24 | |
| Feb 6/75 | 8.26 TOC | 1044.55 | Water sample; pump test @ 30 USGPM/405 min.; T = 1000 USGPD/Ft |
| Feb 7/75 | 10.23 TOC | 1038.13 | Pump test @ 30 USGPM/1440 min.; T = 215 USGPD/Ft; no response in other wells |
| Feb 9/75 | 13.21 MP | 1031.22 | Install shelter and recorder; MP = 2.87 TOC, (1047.55) |
| Feb 25/75 | 8.90 MP | 1045.36 | |
| Mar 14/75 | 8.30 MP | 1047.33 | |
| Apr 16/75 | 8.23 MP | 1047.16 | MP = 3.00 TOC, (1074.68) |
| May 13/75 | 9.02 MP | 1044.82 | |
| June 9/75 | 8.41 MP | 1047.10 | |
| July 10/75 | 8.38 MP | 1047.19 | |
| Aug 14/75 | 8.34 MP | 1047.32 | |
| Sept 10/75 | 8.28 MP | 1047.52 | Sampled well; temp. 3.5°C |
| | 8.29 MP | 1047.48 | after sample |
| Oct 7/75 | 8.26 MP | 1047.58 | |
| Nov 7/75 | 8.21 MP | 1047.75 | |
| Dec 7/75 | 8.21 MP | 1047.75 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 8.31 MP | 1047.4 | MP (1074.7) |
| Feb 7/76 | 8.29 MP | 1047.5 | |
| Mar 6/76 | 8.37 MP | 1047.2 | |
| Apr 7/76 | 8.38 MP | 1047.2 | |
| May 6/76 | 8.45 MP | 1047.0 | |
| June 2/76 | 8.42 MP | 1047.0 | New MP = 0.89 m TOC, (1074.6) |
| June 23/76 | 8.44 MP | 1046.9 | |
| July 18/76 | 8.41 MP | 1047.0 | |
| | 8.43 MP | 1046.9 | After sample; temp. 5°C |
| Aug 11/76 | 8.43 MP | 1046.9 | |
| Sept 1/76 | 8.40 MP | 1047.0 | |
| Sept 29/76 | 8.34 MP | 1047.2 | |
| Oct 27/76 | 8.30 MP | 1047.4 | |
| Nov 24/76 | 8.30 MP | 1047.4 | |
| Dec 22/76 | 8.35 MP | 1047.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 8.45 MP | 1047.0 | MP (1074.6) |
| Feb 1/77 | 8.41 MP | 1047.1 | |
| Feb 16/77 | 7.53 TOC | 1047.0 | |
| Feb 24/77 | 8.49 MP | 1047.0 | New MP = 0.98 m TOC, (1074.9) |
| Mar 16/77 | 8.60 MP | 1046.7 | |
| Apr 14/77 | 8.56 MP | 1046.8 | |
| May 10/77 | 8.48 MP | 1046.7 | New MP = 0.87 m TOC, (1074.5) |
| June 8/77 | 8.45 MP | 1046.8 | |
| July 10/77 | 8.43 MP | 1046.8 | |
| | 8.45 MP | 1046.8 | After sample; temp. 6°C |
| Aug 4/77 | 8.42 MP | 1046.9 | |
| Aug 31/77 | 8.39 MP | 1047.0 | |
| Sept 28/77 | 8.35 MP | 1047.1 | |
| Oct 26/77 | 8.28 MP | 1047.3 | Temp. 6.3°C |
| Nov 23/77 | 8.33 MP | 1047.2 | |
| Dec 20/77 | 8.34 MP | 1047.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 8.44 MP | 1046.8 | MP (1074.5) |
| Feb 14/78 | 8.48 MP | 1046.7 | |
| Mar 15/78 | 8.52 MP | 1046.5 | |
| Apr 12/78 | 8.54 MP | 1046.5 | |
| May 10/78 | 8.55 MP | 1046.5 | |
| June 7/78 | 8.54 MP | 1046.5 | |
| July 8/78 | 8.55 MP | 1046.5 | |
| | 8.42 MP | 1046.8 | After sample; temp. 5°C<br>New MP 0.82 m TOC (1074.4) |
| Aug 2/78 | 8.39 MP | 1046.9 | |
| Aug 29/78 | 8.30 MP | 1047.1 | |
| Sept 27/78 | 8.21 MP | 1047.5 | |
| Oct 25/78 | 8.16 MP | 1047.6 | |
| Nov 22/78 | 8.17 MP | 1047.6 | |
| Dec 20/78 | 8.14 MP | 1047.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 8.21 MP | 1047.5 | MP (1074.4) |
| Feb 14/79 | 8.33 MP | 1047.1 | |
| Mar 14/79 | 8.34 MP | 1047.0 | |
| Apr 10/79 | 8.40 MP | 1046.8 | |
| May 9/79 | 8.44 MP | 1046.7 | |
| June 6/79 | 8.31 MP | 1047.1 | |
| July 8/79 | 8.29 MP | 1047.2 | |
| | 8.34 MP | 1047.0 | After sample; temp. 5.5°C |
| Aug 3/79 | 8.05 MP | 1047.2 | New MP 0.59m TOC (1073.6) |
| Aug 29/79 | 8.02 MP | 1047.3 | |
| Sept 25/79 | 7.96 MP | 1047.5 | |
| Oct 24/79 | 7.95 MP | 1047.5 | |
| Nov 21/79 | 7.95 MP | 1047.5 | |
| Dec 19/79 | 7.92 MP | 1047.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

7-337-W-82

WELL HISTORY

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 8.01 MP | 1047.3 | |
| Feb 13/80 | 8.12 MP | 1047.0 | |
| Mar 11/80 | 8.11 MP | 1047.0 | |
| Apr 9/80 | 8.19 MP | 1046.7 | |
| May 6/80 | 8.28 MP | 1046.4 | |
| June 4/80 | 8.25 MP | 1046.5 | |
| July 6/80 | 8.26 MP | 1046.5 | Temp. 5.5°C |
| | 8.29 MP | 1046.4 | After Sample |
| July 30/80 | 8.24 MP | 1046.6 | |
| Aug 27/80 | 8.16 MP | 1046.8 | |
| Sept 24/80 | 8.13 MP | 1046.9 | |
| Oct 22/80 | 8.09 MP | 1047.1 | |
| Nov 19/80 | 8.04 MP | 1047.2 | |
| Dec 20/80 | 8.12 MP | 1047.0 | |
| Jan 16/81 | 8.09 MP | 1047.1 | |
| Feb 11/81 | 8.13 MP | 1046.9 | |
| Mar 11/81 | 8.16 MP | 1046.8 | |
| Apr 8/81 | 8.16 MP | 1046.8 | |
| May 5/81 | 8.20 MP | 1046.7 | |
| June 2/81 | 8.16 MP | 1046.8 | |
| July 1/81 | 8.14 MP | 1046.9 | |
| July 29/81 | 8.12 MP | 1047.0 | |
| Aug 26/81 | 8.17 MP | 1046.8 | |
| Sept 23/81 | 8.17 MP | 1046.8 | |
| Oct 21/81 | 8.16 MP | 1046.8 | |
| Nov 17/81 | 8.23 MP | 1046.6 | |
| Dec 16/81 | 8.21 MP | 1046.7 | |

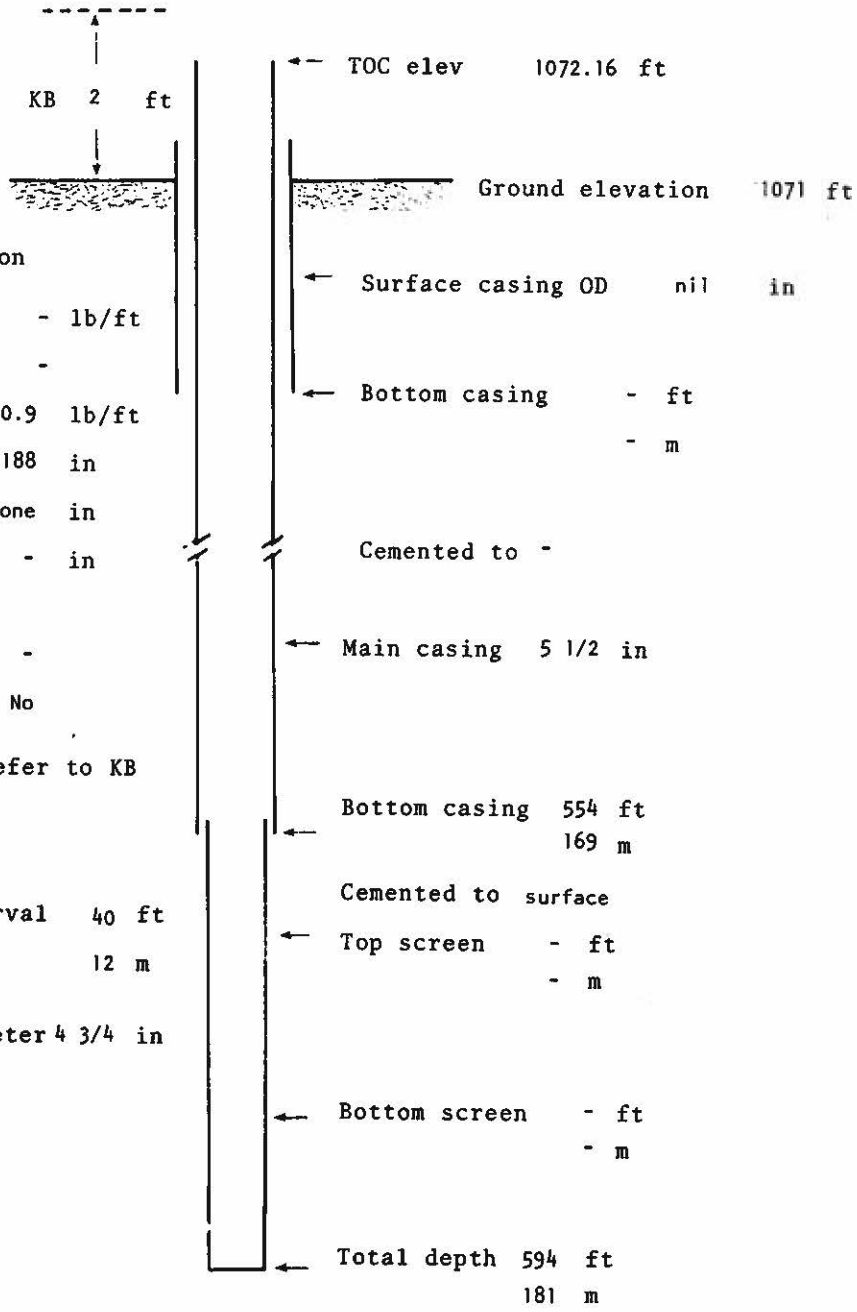
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Tp 95 R 8 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 10.9 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | none | in |
| screen OD | - | in |
| slots per foot | | |
| material | - | |
| Sand pack | No | |

Note: all depths refer to KB

# DRILL STEM TEST

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Tp 95 R 8 W4th

Alberta Research Council

Elevation: gl 1071
KB 1073

Type of test - Casing Positrieve

Date of test March 11, 1975

Testing company Johnston Testers

## TEST DATA

| | | |
|---|---|---|
| Time started | 1530 | hrs |
| Tool opened | 1612 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 45 | min |
| Pulled loose at | 1815 | hrs |
| Out of hole at | 1845 | hrs |
| Wt on packers | 3000 | lbs |
| Description of blow | Weak initial puff, weak blow decreasing to nil in four minutes | |
| Total water recovered | 20 | ft |

Water sample No. DH 38

Gas blow No

Remarks Test satisfactory
5-1/2" RBP @ 543'

## HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 554-594

Formation tested Beaverhill Lake/Prairie Evaporite

## TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Total Interval | 11.20 | |

## PRESSURE DATA (psi)

| | | |
|---|---|---|
| Instrument No. | | RPG-92N |
| Capacity (psig) | | 431 |
| Instrument set at (ft) | | 547 |
| Initial hydrostatic | A | 228 |
| First flow | B | 3 |
| | B1 | 167 |
| Initial shut in | C | 8 |
| Second flow | D | 13 |
| | D1 | |
| Final shut in | G | 154 |
| Final hydrostatic | H | 223 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

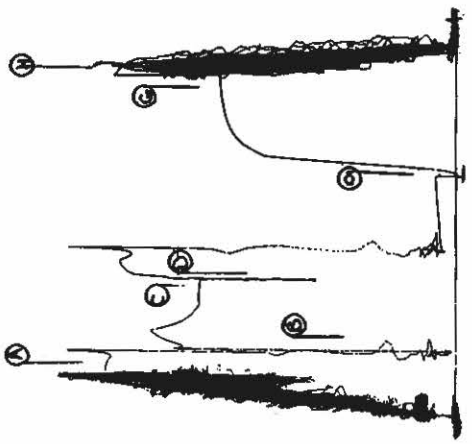
OBSERVATION WELL NUMBER 7-594

PRESSURE INCREMENTS

Recorder RPG-92N

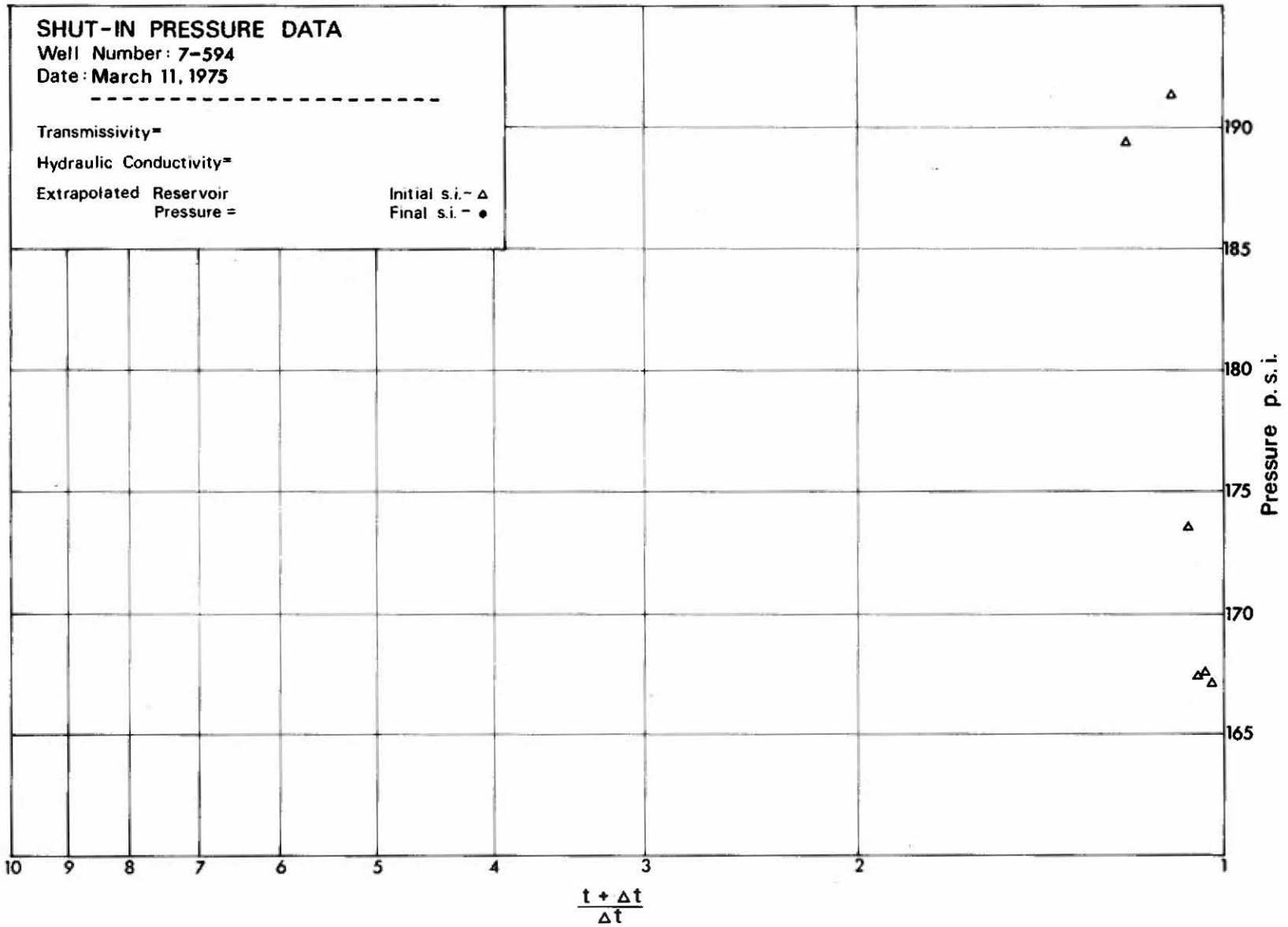
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 189.4 | 1.20 |
| 10 | 191.3 | 1.10 |
| 15 | 173.5 | 1.07 |
| 20 | 167.4 | 1.05 |
| 25 | 167.6 | 1.04 |
| 30 | 167.0 | 1.033 |

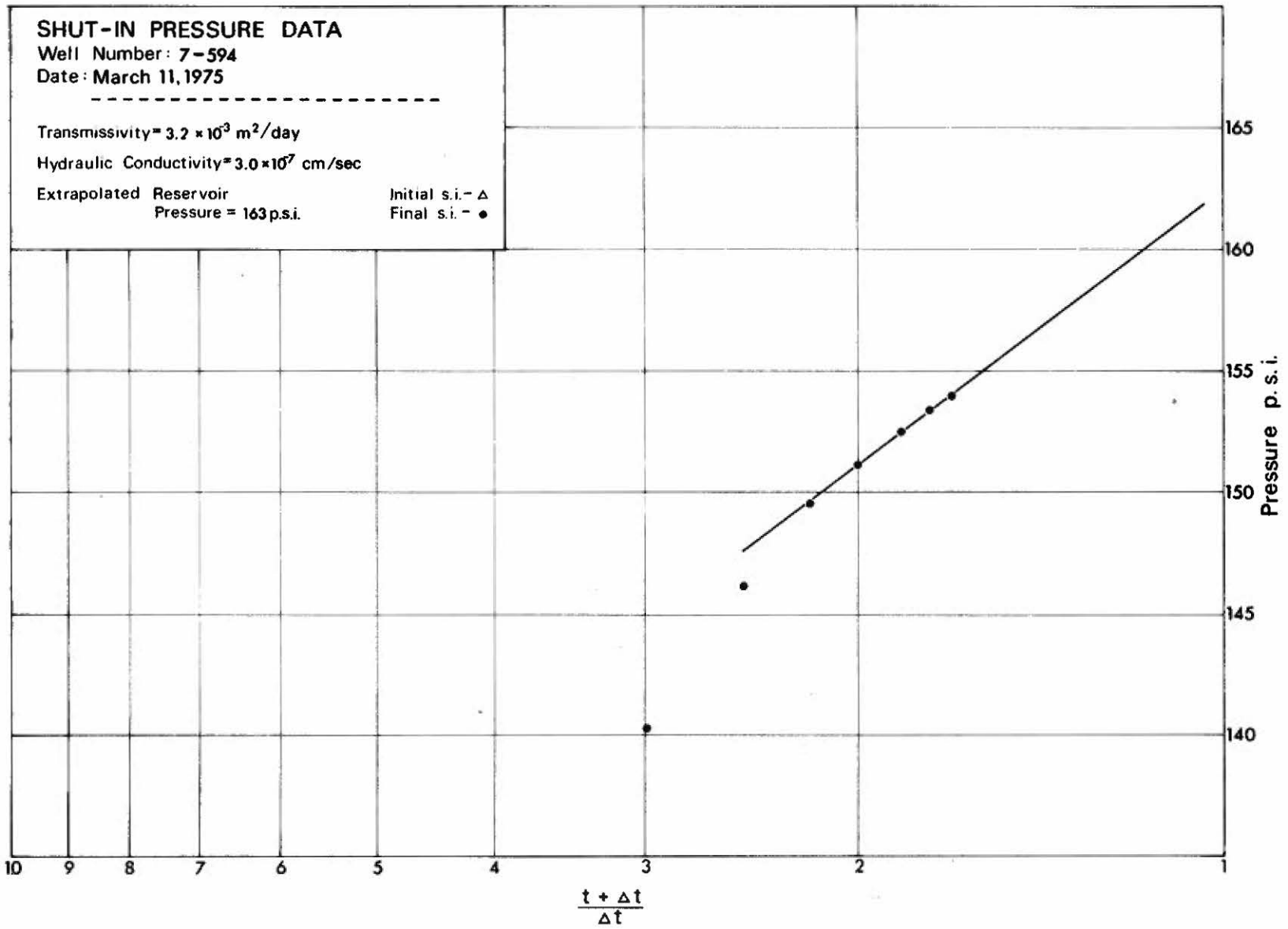


Final Shut In

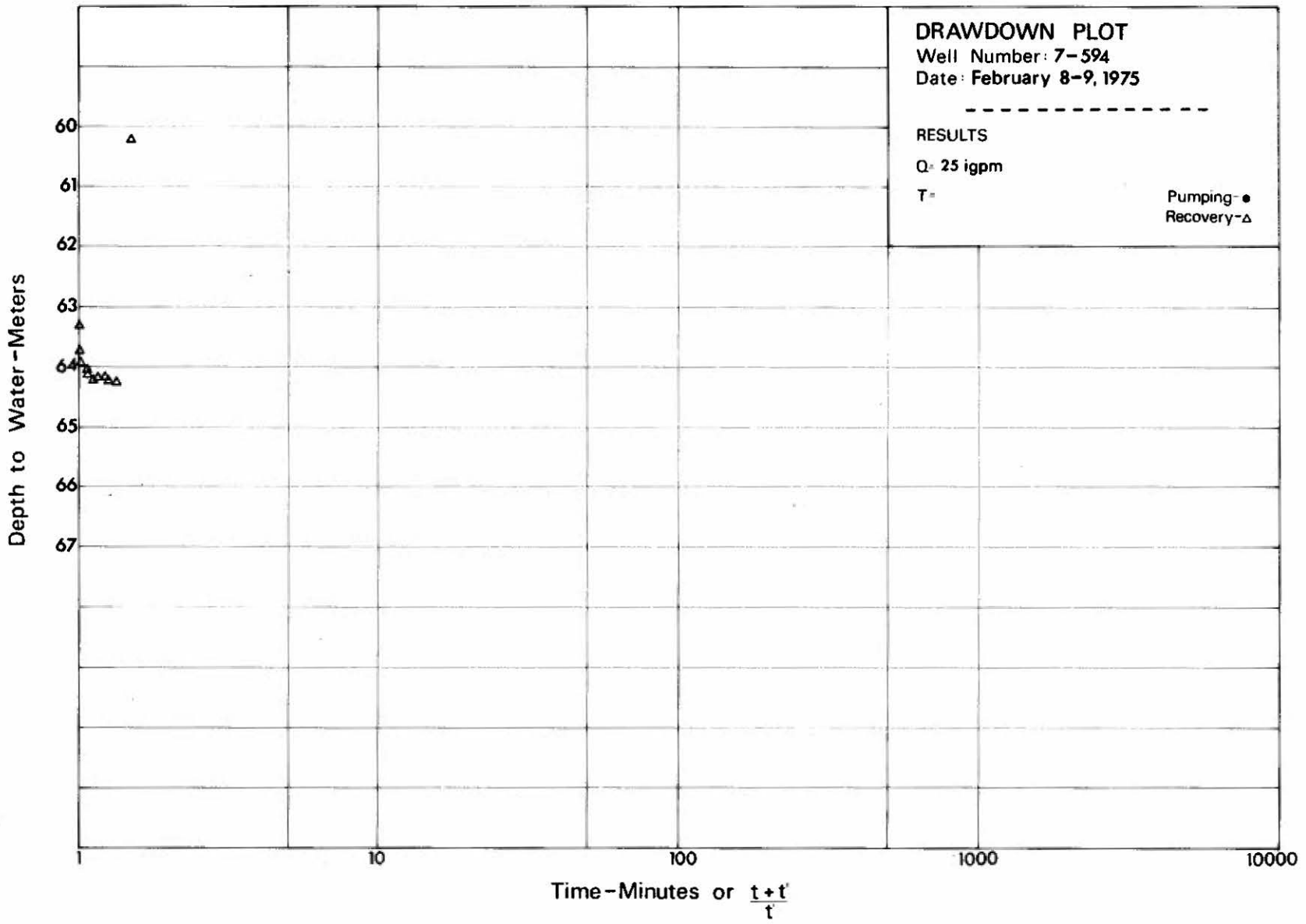
| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 53.3 | 7.00 |
| 10 | 128.0 | 4.00 |
| 15 | 140.4 | 3.00 |
| 20 | 146.2 | 2.50 |
| 25 | 149.5 | 2.20 |
| 30 | 151.2 | 2.00 |
| 35 | 152.5 | 1.86 |
| 40 | 153.4 | 1.75 |
| 45 | 154.0 | 1.76 |


SHUT-IN PRESSURE DATA
Well Number: 7-594
Date: March 11, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure =
Initial s.i.- Δ
Final s.i. - •
190
185
180
175
170
165
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

7-594-D-76


SHUT-IN PRESSURE DATA
Well Number: 7-594
Date: March 11, 1975
Transmissivity = 3.2 × 10³ m²/day
Hydraulic Conductivity = 3.0 × 10⁻⁷ cm/sec
Extrapolated Reservoir Pressure = 163 p.s.i.
Initial s.i. - △
Final s.i. - ●
165
160
155
150
145
140
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

7-594-D-76


DRAWDOWN PLOT
Well Number: 7-594
Date: February 8-9, 1975
RESULTS
Q= 25 igpm
T=
Pumping-●
Recovery-△
Depth to Water-Meters
60
61
62
63
64
65
66
67
1
10
100
1000
10000
Time-Minutes or $\frac{t+t'}{t'}$

7-594-A-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Drill stem test on 7-594

Date sampled March 12, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.4 | 0.17 | 0.7 |
| Magnesium ($Mg^{++}$) | 0.4 | 0.03 | 0.1 |
| Sodium ($Na^{+}$) | 309.0 | 13.44 | 56.3 |
| Potassium ($K^{+}$) | 400.0 | 10.23 | 42.9 |
| Carbonate ($CO_3^{=}$) | 257.0 | 8.57 | 35.2 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 117.0 | 2.44 | 10.0 |
| Chloride ($Cl^{-}$) | 364.0 | 10.27 | 42.2 |
| Nitrate ($NO_3^{=}$) | 1.5 | 0.02 | 0.1 |
| Silica ($SiO_2$) | 17.0 | | |
| Hydroxide ($OH^{-}$) | 52.0 | 3.06 | 12.6 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1418.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 24.349 | Total Cations (epm) | 23.876 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2850 |
| pH | 11.4 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | | |
| pH | 11.6 | |
| Carbonate ($CO_3^{=}$) | 159 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 | ppm |
| Hydroxide ($OH^{-}$) | 152 | ppm |
| Conductivity | | |

**WATER ANALYSIS**

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed from 7-594

Date sampled February 19, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 380.0 | 18.96 | 15.5 |
| Magnesium ($Mg^{++}$) | 346.0 | 28.45 | 23.2 |
| Sodium ($Na^{+}$) | 1688.0 | 73.42 | 59.9 |
| Potassium ($K^{+}$) | 67.0 | 1.71 | 1.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 422.0 | 6.92 | 4.9 |
| Sulfate ($SO_4^{=}$) | 2500.0 | 52.05 | 37.2 |
| Chloride ($Cl^{-}$) | 2875.0 | 81.08 | 57.09 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 0.0 |
| Silica ($SiO_2$) | 6.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 7634.0 | | |
| Total Anions (epm) 140.061 | | Total Cations (epm) | 122.553 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 8000 + | Temperature (C) | |
| pH | 7.8 | pH | 9.1 |
| Fluoride ($F^{-}$) | 0.7 ppm | Carbonate ($CO_3^{=}$) | 57.6 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 127.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 80 | 3.99 | 8 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 590 | 25.66 | 51 |
| Potassium ($K^{+}$) | 804 | 20.57 | 41 |
| Carbonate ($CO_3^{=}$) | 288 | 9.60 | 5 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 148 | 3.08 | 2 |
| Chloride ($Cl^{-}$) | 506 | 14.27 | 8 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 8.1 | | |
| Hydroxide ($OH^{-}$) | 2795 | 164.32 | 86 |
| Calcium (Acidified) | 112 | | |
| Magnesium (Acidified) | 25.9 | | |
| Total dissolved solids | 3196 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 191.27 | Total Cations (epm) | 50.22 |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | |
| pH | 12.2 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 4.0 |
| pH | 12.3 |
| Carbonate ($CO_3^{=}$) | 193 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| Hydroxide ($OH^{-}$) | 544 ppm |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 80 | 3.99 | 8 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 590 | 25.66 | 51 |
| Potassium ($K^{+}$) | 804 | 20.57 | 41 |
| Carbonate ($CO_3^{=}$) | 288 | 9.60 | 5 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 148 | 3.08 | 2 |
| Chloride ($Cl^{-}$) | 506 | 14.27 | 8 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 8.1 | | |
| Hydroxide ($OH^{-}$) | 2795 | 164.32 | 86 |
| Calcium (Acidified) | 112 | | |
| Magnesium (Acidified) | 25.9 | | |
| Total dissolved solids | 3196 | | |
| Total Anions (epm) | 191.27 | Total Cations (epm) | 50.22 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 8000+ |
| pH | 12.2 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 4.0 |
| pH | 12.6 |
| Carbonate ($CO_3^{=}$) | 193 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 |
| Hydroxide ($OH^{-}$) | 544 ppm |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 107.0 | 5.34 | 9 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 750.0 | 32.62 | 56 |
| Potassium ($K^{+}$) | 779.0 | 19.93 | 34 |
| Carbonate ($CO_3^{=}$) | 67.0 | 2.23 | 4 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 201.0 | 4.18 | 7 |
| Chloride ($Cl^{-}$) | 640.0 | 18.05 | 30 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.1 | | |
| Hydroxide ($OH^{-}$) | 602.0 | 35.39 | 59 |
| Calcium (Acidified) | 121.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 3574 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 59.88 | Total Cations (epm) | 57.89 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 7.0 | |
| pH | 12.5 | pH | 12.4 | |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 74 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 646 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 10, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 505.0 | 25.20 | 16.0 |
| Magnesium ($Mg^{++}$) | 420.0 | 34.57 | 22.0 |
| Sodium ($Na^{+}$) | 2125.0 | 92.43 | 58.8 |
| Potassium ($K^{+}$) | 200.0 | 5.12 | 3.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 473.0 | 7.75 | 5.4 |
| Sulfate ($SO_4^{=}$) | 1980.0 | 41.22 | 28.6 |
| Chloride ($Cl^{-}$) | 3380.0 | 95.32 | 66.1 |
| Nitrate ($NO_3^{=}$) | 0.1 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 2.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 475.0 | | |
| Magnesium (Acidified) | 370.0 | | |
| Total dissolved solids | 10150.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 144.30 | Total Cations (epm) | 157.32 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 7.0 |
| pH | 6.9 | pH | 7.0 |
| Fluoride ($F^{-}$) | 0.7 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 595.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 360.0 | 17.96 | 12.9 |
| Magnesium(Mg) | 342.0 | 28.15 | 20.3 |
| Sodium(Na) | 2013.0 | 87.56 | 63.0 |
| Potassium(K) | 204.0 | 5.22 | 3.8 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 324.0 | 5.31 | 3.7 |
| Sulphate(SO4) | 1885.0 | 39.25 | 27.7 |
| Chloride(Cl) | 3450.0 | 97.29 | 68.6 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 1.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 332.0 | | |
| Magnesium(Acidified) | 320.0 | | |
| TDS(mg/l) | 9818.0 | | |
| Total Anions(epm) | 141.85 | Total Cations(epm) | 138.89 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 11700 | | Temperature(C) | 7.00 | |
| pH | 7.3 | | pH | 7.5 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 326 | mg/l |
| | | | Hydroxide(OH) | | |

7-594-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 306.0 | 15.27 | 11.8 |
| Magnesium(Mg) | 290.0 | 23.87 | 18.5 |
| Sodium(Na) | 1950.0 | 84.82 | 65.6 |
| Potassium(K) | 208.0 | 5.32 | 4.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 185.0 | 3.03 | 2.3 |
| Sulphate(SO4) | 1605.0 | 33.42 | 25.8 |
| Chloride(Cl) | 3300.0 | 93.06 | 71.9 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 0.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 336.0 | | |
| Magnesium(Acidified) | 272.0 | | |
| TDS(mg/l) | 9700.0 | | |
| Total Anions(epm) | 129.51 | Total Cations(epm) | 129.28 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 11300 | | Temperature(C) | 7.00 | |
| pH | 7.6 | | pH | 8.4 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | 10 | mg/l |
| | | | Bicarbonate(HCO3) | 215 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 7-594-E-82

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 6, 1980

## Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 620.0 | 31.00 | 19.6 |
| Magnesium(Mg) | 342.0 | 28.50 | 18.1 |
| Sodium(Na) | 2125.0 | 92.39 | 58.5 |
| Potassium(K) | 233.0 | 5.97 | 3.8 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 129.0 | 2.11 | 1.6 |
| Sulphate(SO4) | 1800.0 | 37.50 | 28.9 |
| Chloride(Cl) | 3200.0 | 90.14 | 69.5 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 1.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 266.0 | | |
| Magnesium(Acidified) | 277.0 | | |
| TDS(mg/l) | 9770.0 | | |
| Total Anions(epm) | 129.76 | Total Cations(epm) | 157.87 |

## Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 12700 |
| pH | 7.9 |
| Fluoride | 0.3 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 7.50 | |
| pH | 8.5 | |
| Carbonate(CO3) | 24 | mg/l |
| Bicarbonate(HCO3) | 117 | mg/l |
| Hydroxide(OH) | | |

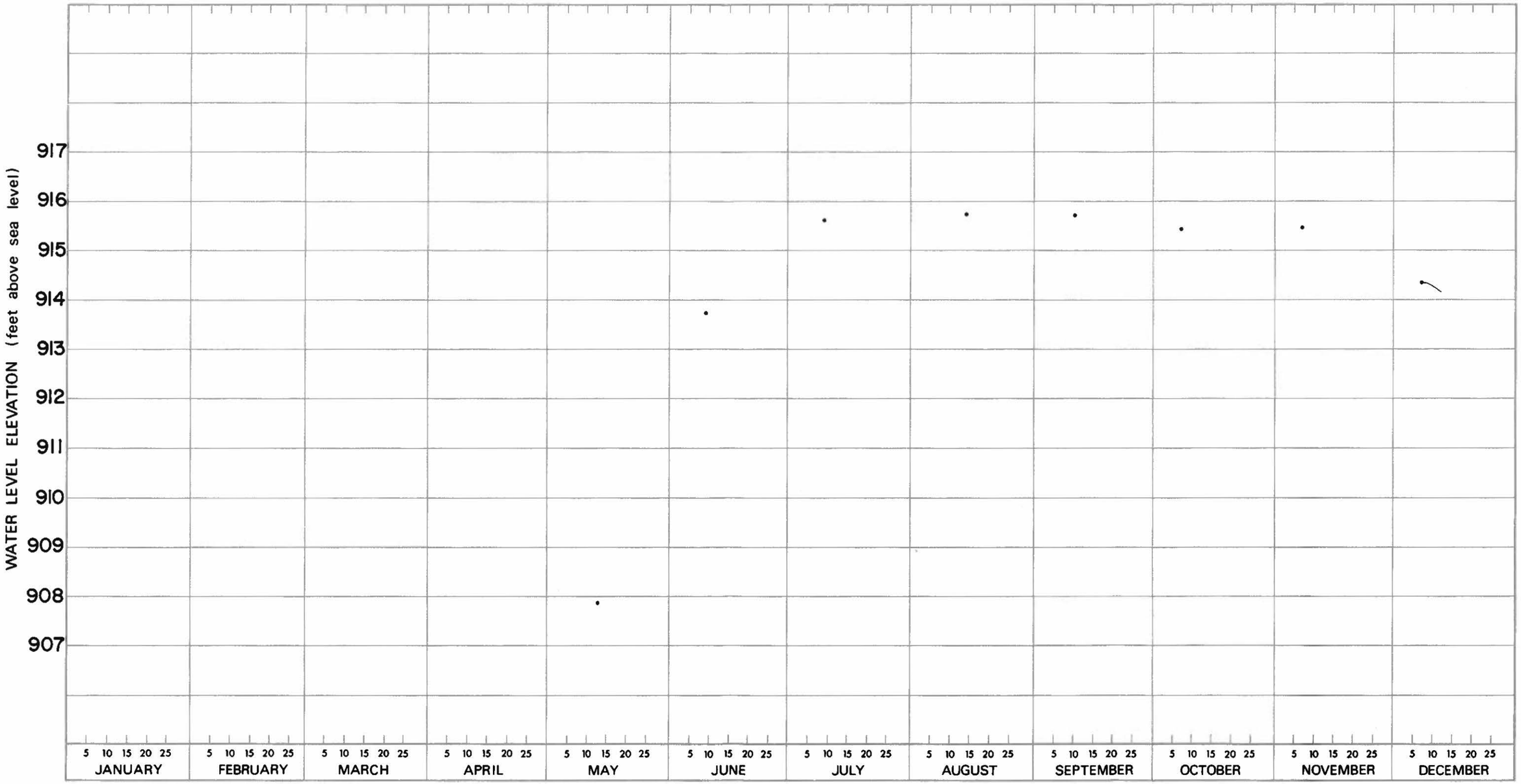
**WATER LEVEL HYDROGRAPH**

7-594-H-76

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council



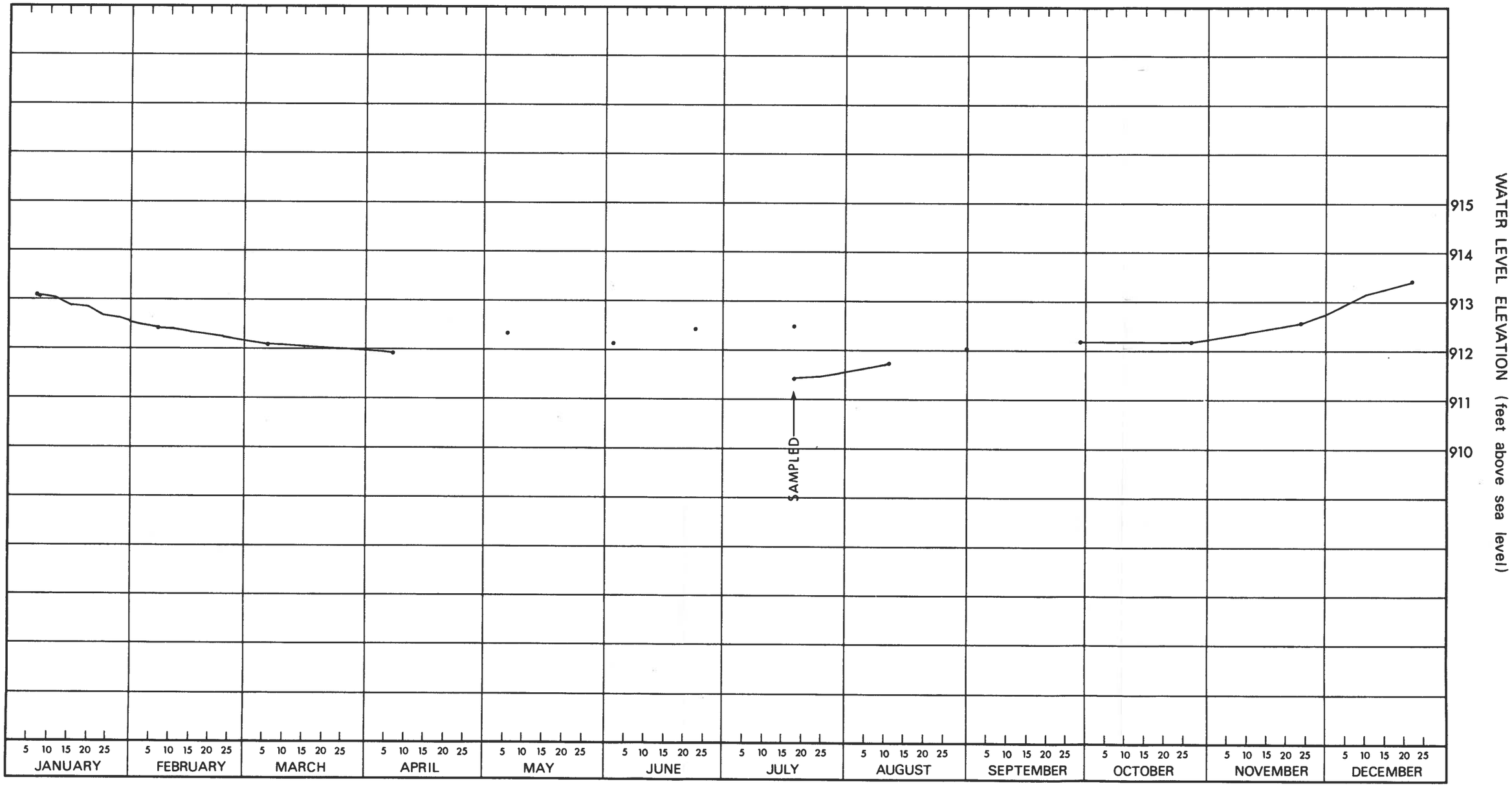
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **7-594**

Lsd **13** Sec **20** Twp **95** R **8** W4th

Alberta Research Council

7 - 594 - H - 77




1976

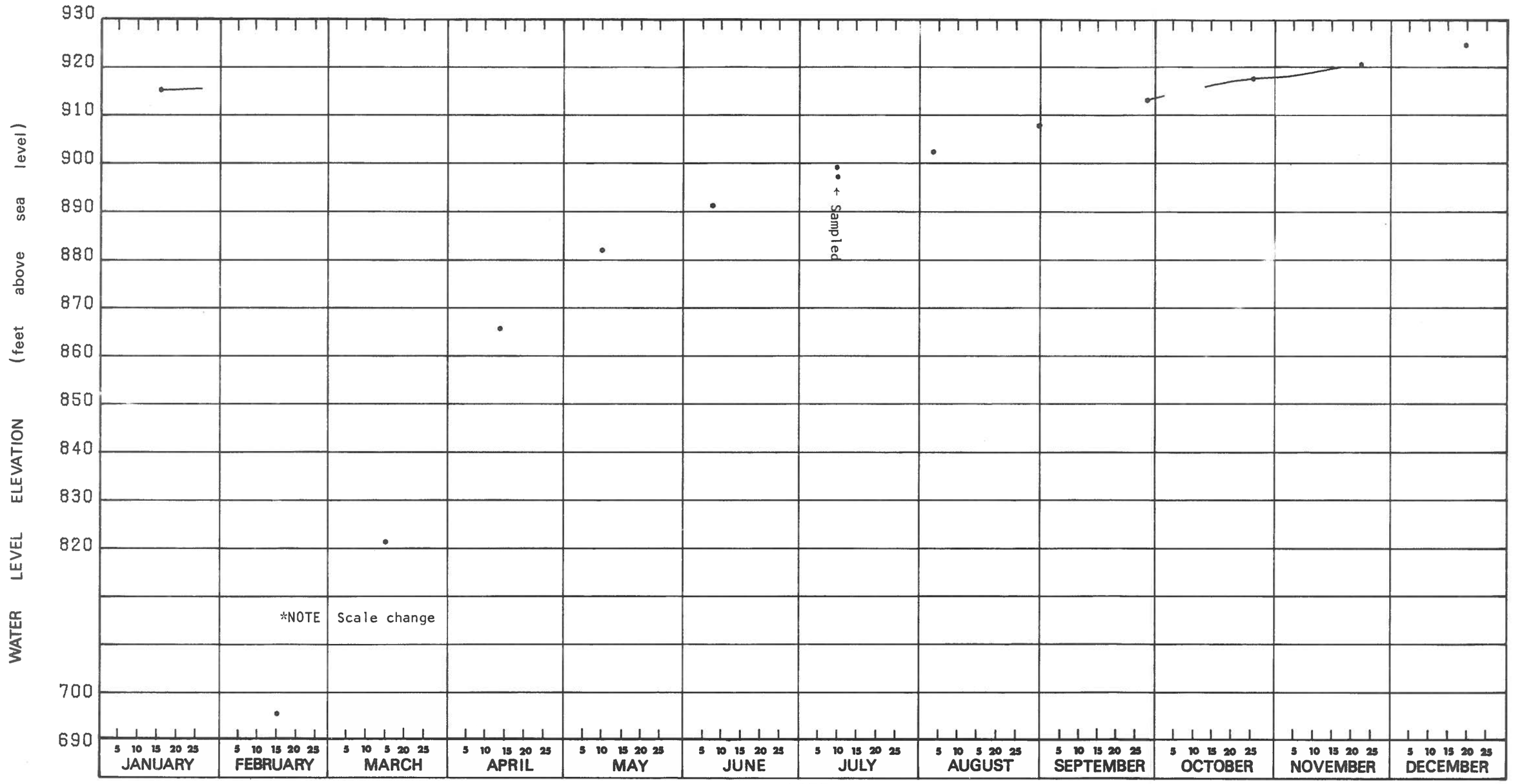
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-594-H-78




1977

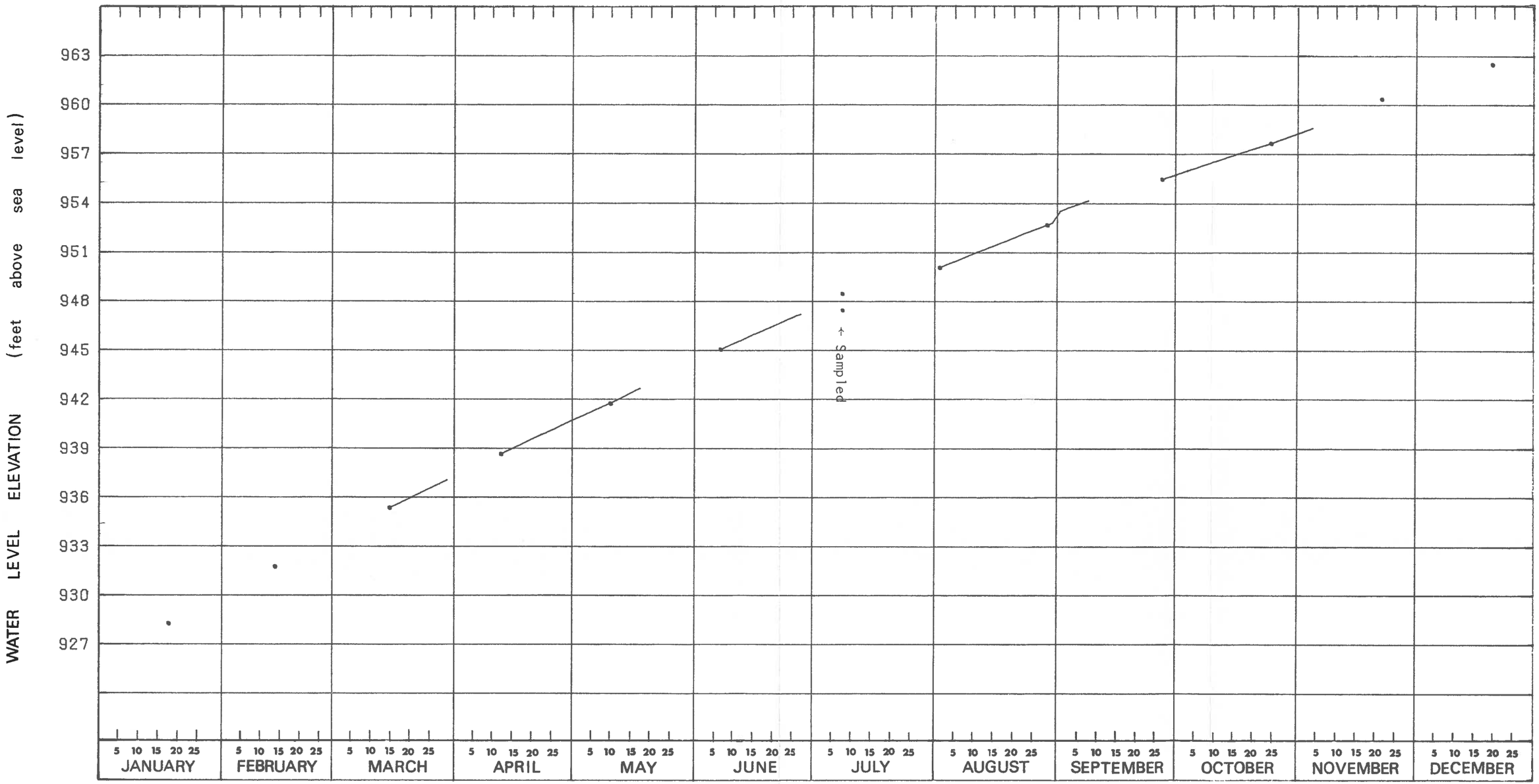
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-594

LSD 13 SEC 20 TWP 95 R 8 W4TH

7-594-H-79

Alberta Research Council




1978

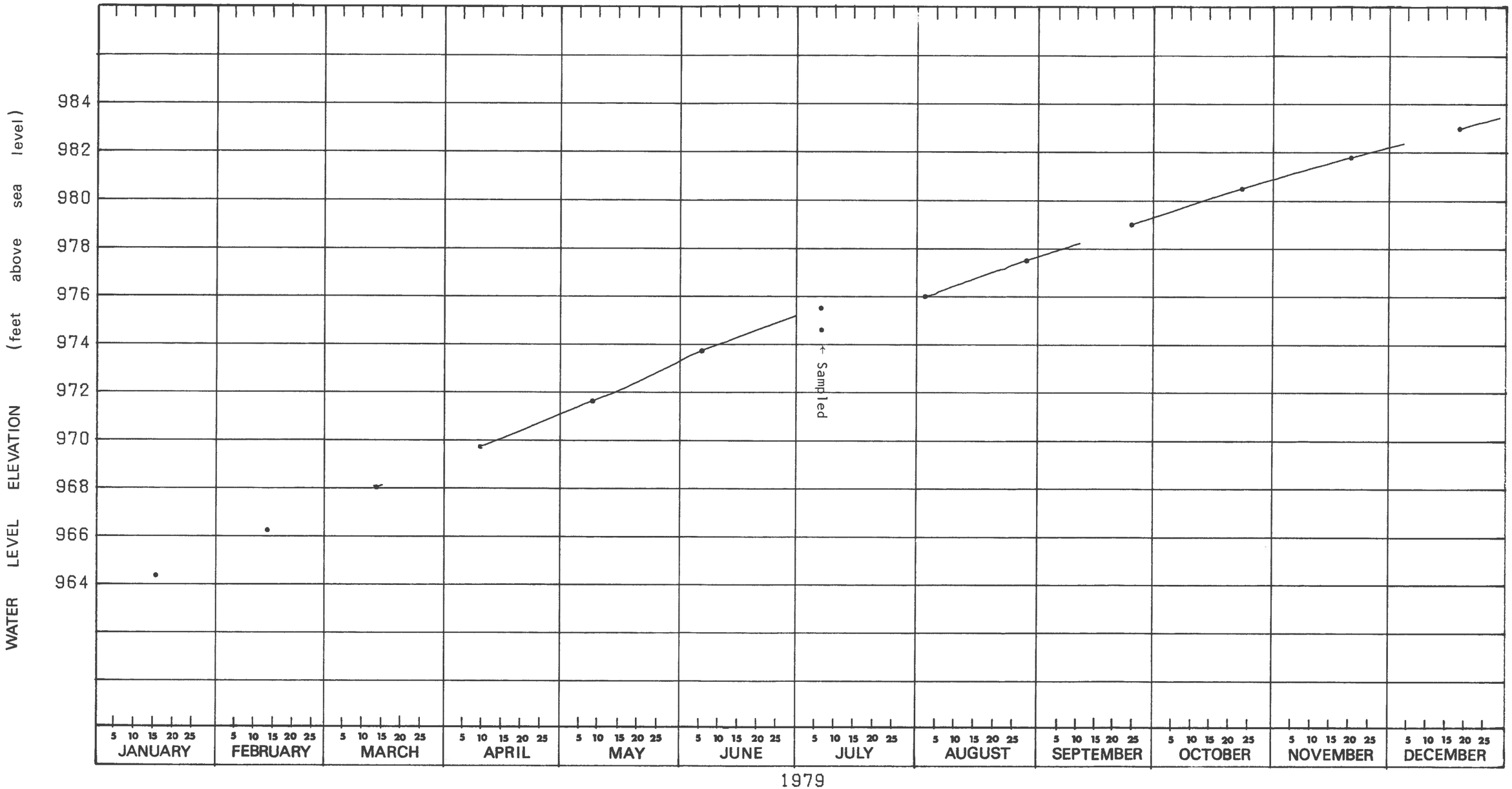
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-594-H-80



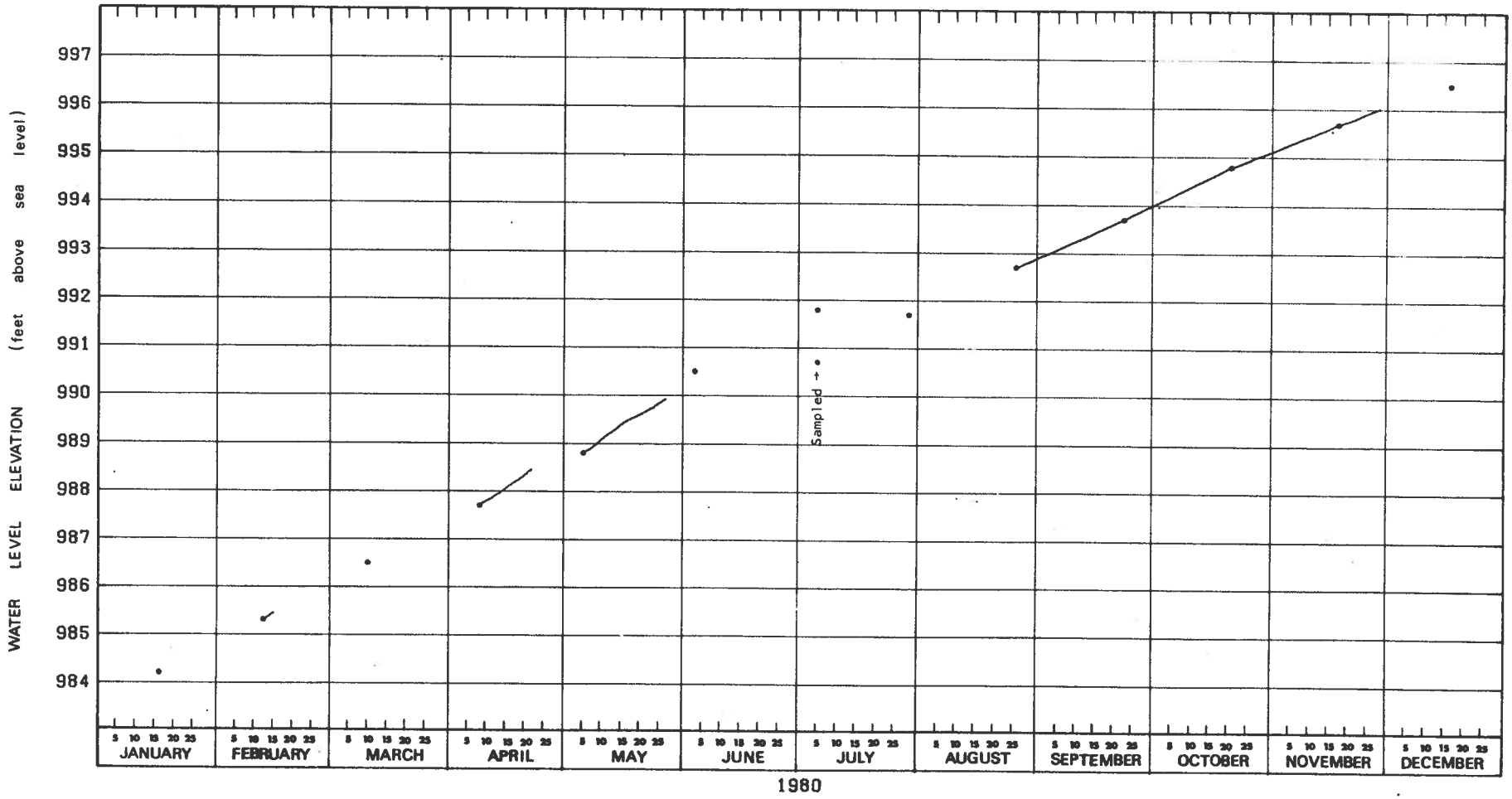
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-594-H-81



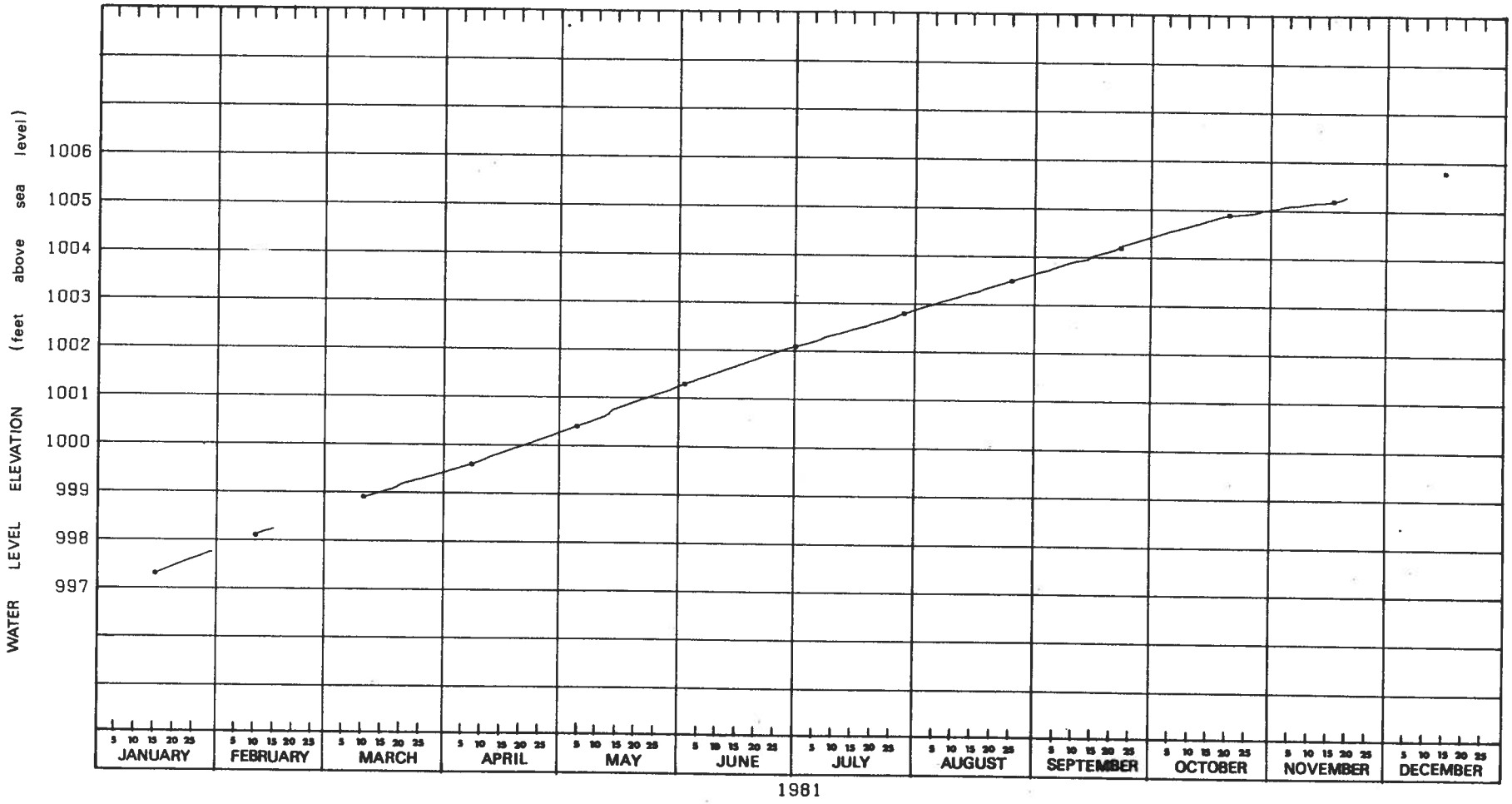
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-594-H-82



WELL HISTORY

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 6/75 | | | Well completed |
| Feb 8/75 | 24.99 TOC | 990.16 | Pump test @ 30 USGPM/5 minutes; bail 70 gallons; water sample |
| Mar 12/75 | | | DST; water sample; FSI = 162.5# from 547' |
| Mar 14/75 | | | Reinstall shelter; MP = 3.05' TOC, (1075.21) |
| Apr 16/75 | 54.25 MP | 897.21 | |
| May 13/75 | 50.75 new MP | 908.71 | MP = 26" TOC, (1074.33) |
| June 9/75 | 48.97 MP | 913.71 | |
| July 9/75 | 48.40 MP | 915.58 | Recorder stuck |
| Aug 14/75 | 48.36 MP | 915.70 | |
| Sept 10/75 | 48.36 MP | 915.70 | Sampled well; temp. 4°C |
| | 48.70 MP | 914.59 | after sample |
| Oct 7/75 | 48.45 MP | 915.41 | |
| Nov 7/75 | 48.43 MP | 915.48 | |
| Dec 7/75 | 48.78 MP | 914.33 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 49.15 MP | 913.1 | MP (1074.3) |
| Feb 7/76 | 49.36 MP | 912.4 | |
| Mar 6/76 | 49.46 MP | 912.1 | |
| Apr 7/76 | 49.51 MP | 911.9 | |
| May 6/76 | 49.50 MP | 912.3 | New MP = 0.78 m TOC, (1074.7) |
| June 2/76 | 49.56 MP | 912.1 | |
| June 23/76 | 49.47 MP | 912.4 | |
| July 18/76 | 49.46 MP | 912.5 | |
| | 49.78 MP | 911.4 | After sample; temp. 7°C |
| Aug 11/76 | 49.68 MP | 911.7 | |
| Sept 1/76 | 49.59 MP | 912.0 | |
| Sept 29/76 | 49.55 MP | 912.2 | |
| Oct 27/76 | 49.55 MP | 912.2 | |
| Nov 24/76 | 49.41 MP | 912.6 | |
| Dec 22/76 | 49.19 MP | 913.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 48.98 MP | 914.0 | MP (1074.7) |
| Jan 27/77 | | | Treated with 70 lb NU-WELL acid well conditioner |
| Feb 2/77 | | | Blown with air |
| Feb 16/77 | 114.90 TOC | 695.3 | |
| Mar 16/77 | 77.48 MP | 820.6 | |
| Apr 14/77 | 64.00 MP | 864.8 | |
| May 10/77 | 58.97 MP | 881.1 | New MP = 0.73 m TOC, (1074.5) |
| June 8/77 | 56.14 MP | 890.4 | |
| July 10/77 | 53.69 MP | 898.4 | |
| | 54.31 MP | 896.4 | After sample; temp. 7°C |
| Aug 4/77 | 52.68 MP | 901.7 | |
| Aug 31/77 | 51.01 MP | 907.2 | |
| Sept 28/77 | 49.39 MP | 912.5 | |
| Oct 26/77 | 48.02 MP | 917.0 | Temp. 7°C |
| Nov 23/77 | 47.11 MP | 920.0 | |
| Dec 20/77 | 45.84 MP | 924.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 44.59 MP | 928.2 | MP (1074.5) |
| Feb 14/78 | 43.52 MP | 931.7 | |
| Mar 15/78 | 42.43 MP | 935.3 | |
| Apr 12/78 | 41.44 MP | 938.6 | |
| May 10/78 | 40.49 MP | 941.7 | |
| June 7/78 | 39.47 MP | 945.0 | |
| July 8/78 | 38.40 MP | 948.4 | New MP 0.67 m TOC (1074.4) |
| | 38.71 MP | 947.4 | After sample; temp. 7°C |
| Aug 2/78 | 37.94 MP | 950.0 | |
| Aug 29/78 | 37.12 MP | 952.6 | |
| Sept 27/78 | 36.28 MP | 955.4 | |
| Oct 25/78 | 35.52 MP | 957.6 | |
| Nov 22/78 | 34.78 MP | 960.3 | |
| Dec 20/78 | 34.14 MP | 962.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 33.56 MP | 964.3 | MP (1074.4) |
| Feb 14/79 | 32.98 MP | 966.2 | |
| Mar 14/79 | 32.43 MP | 968.0 | |
| Apr 10/79 | 31.93 MP | 969.7 | |
| May 9/79 | 31.35 MP | 971.6 | |
| June 6/79 | 30.71 MP | 973.7 | |
| July 7/79 | 30.14 MP | 975.5 | |
| | 30.44 MP | 974.6 | After sample; temp. 7°C |
| Aug 3/79 | 30.01 MP | 976.0 | |
| Aug 29/79 | 29.54 MP | 977.5 | |
| Sept 25/79 | 29.08 MP | 979.0 | |
| Oct 24/79 | 28.63 MP | 980.5 | |
| Nov 21/79 | 28.23 MP | 981.8 | |
| Dec 19/79 | 27.87 MP | 983.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

7-594-W-82

WELL HISTORY

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 27.50 MP | 984.2 | |
| Feb 13/80 | 27.17 MP | 985.3 | |
| Mar 11/80 | 26.80 MP | 986.5 | |
| Apr 9/80 | 26.43 MP | 987.7 | |
| May 6/80 | 26.09 MP | 988.8 | |
| June 4/80 | 25.51 MP | 990.5 | New MP 0.63 m TOC (1074.2) |
| July 6/80 | 25.13 MP | 991.8 | Temp. 7.5°C |
| | 25.46 MP | 990.7 | After Sample |
| July 30/80 | 25.16 MP | 991.7 | |
| Aug 27/80 | 24.85 MP | 992.7 | |
| Sept 24/80 | 24.55 MP | 993.7 | |
| Oct 22/80 | 24.22 MP | 994.8 | |
| Nov 19/80 | 23.93 MP | 995.7 | |
| Dec 18/80 | 23.68 MP | 996.5 | |
| Jan 16/81 | 23.43 MP | 997.3 | |
| Feb 11/81 | 23.20 MP | 998.1 | |
| Mar 11/81 | 22.97 MP | 998.9 | |
| Apr 8/81 | 22.73 MP | 999.6 | |
| May 5/81 | 22.49 MP | 1000.4 | |
| June 2/81 | 22.23 MP | 1001.3 | |
| July 1/81 | 21.99 MP | 1002.1 | |
| July 29/81 | 21.77 MP | 1002.8 | |
| Aug 26/81 | 21.55 MP | 1003.5 | |
| Sept 23/81 | 21.34 MP | 1004.2 | |
| Oct 21/81 | 21.14 MP | 1004.9 | |
| Nov 17/81 | 21.04 MP | 1005.2 | |
| Dec 16/81 | 20.84 MP | 1005.8 | |

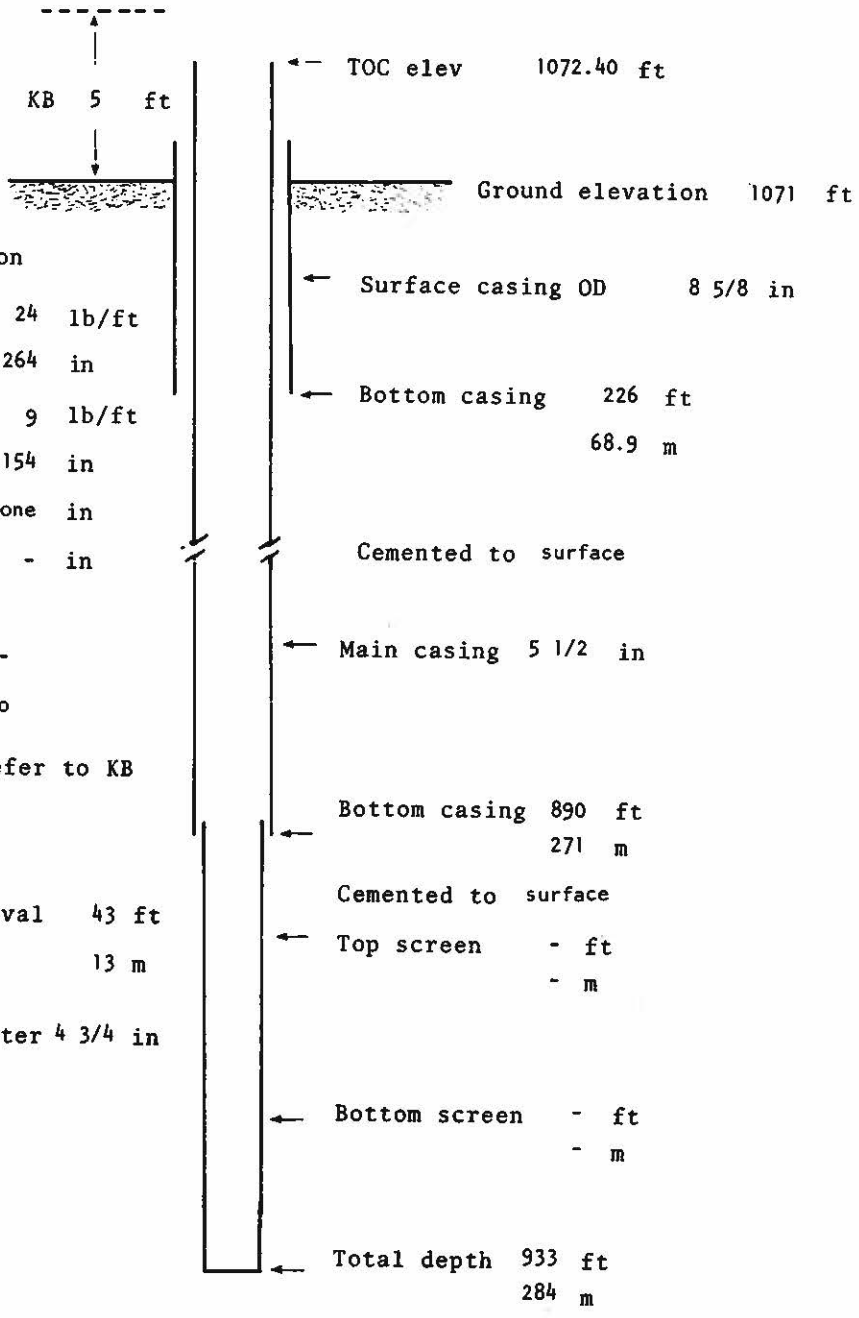
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Tp 95 R 8 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 9 | lb/ft |
| wall thickness | .154 | in |
| Screen slot width | none | in |
| screen OD | - | in |
| slots per foot | | |
| material | - | |
| Sand pack | No | |

Note: all depths refer to KB

Open hole interval 43 ft
13 m

Open hole diameter 4 3/4 in

## DRILL STEM TEST

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Tp 95 R 8 W4th

Alberta Research Council

Elevation: gl 1071
KB 1073

Type of test - Casing Positrieve

Date of test March 11, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1045 | hrs |
| Tool opened | 1153 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 30 | min |
| Pulled loose at | 1330 | hrs |
| Out of hole at | 1430 | hrs |
| Wt on packers | 5000 | lbs |
| Description of blow | Weak initial puff, weak blow decreasing to nil in 25 minutes | |
| Total water recovered | 20 | ft |
| Water sample No. | DH 40 | |
| Gas blow | No | |
| Remarks | Test satisfactory 5-1/2" RBP @ 879' | |

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 890-933

Formation tested La Loche

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Total Interval | 11.20 | |

### PRESSURE DATA (psi)

| | | |
|---|---|---|
| Instrument No. | | RPG-92N |
| Capacity (psig) | | 431 |
| Instrument set at (ft) | | 883 |
| Initial hydrostatic | A | 204 |
| First flow | B | 3 |
| | B1 | 3 |
| Initial shut in | C | 41 |
| Second flow | D | 11 |
| | D1 | 13 |
| Final shut in | G | 23 |
| Final hydrostatic | H | 204 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 7-933

PRESSURE INCREMENTS

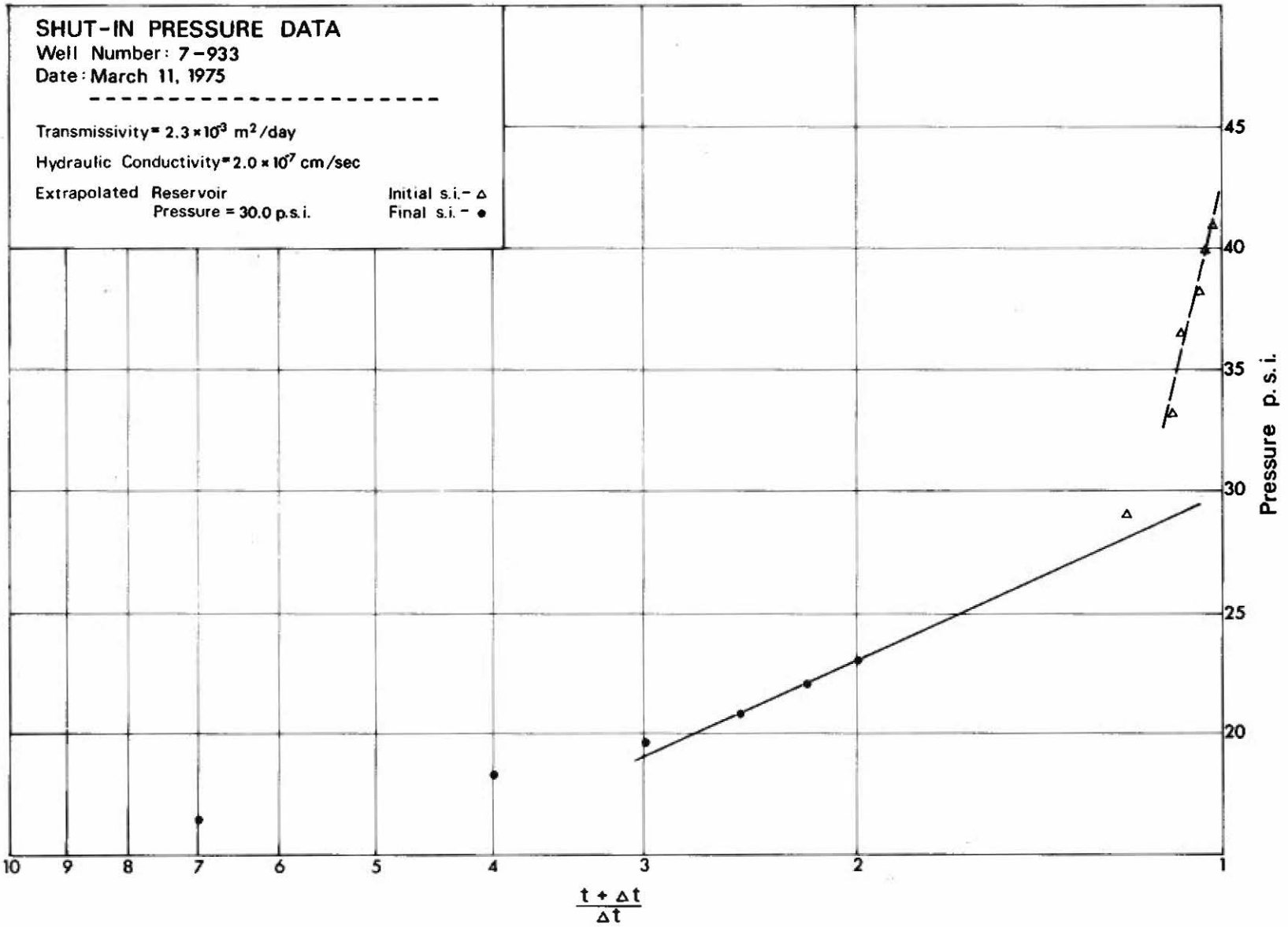
Recorder RPG-92N

Initial Shut In

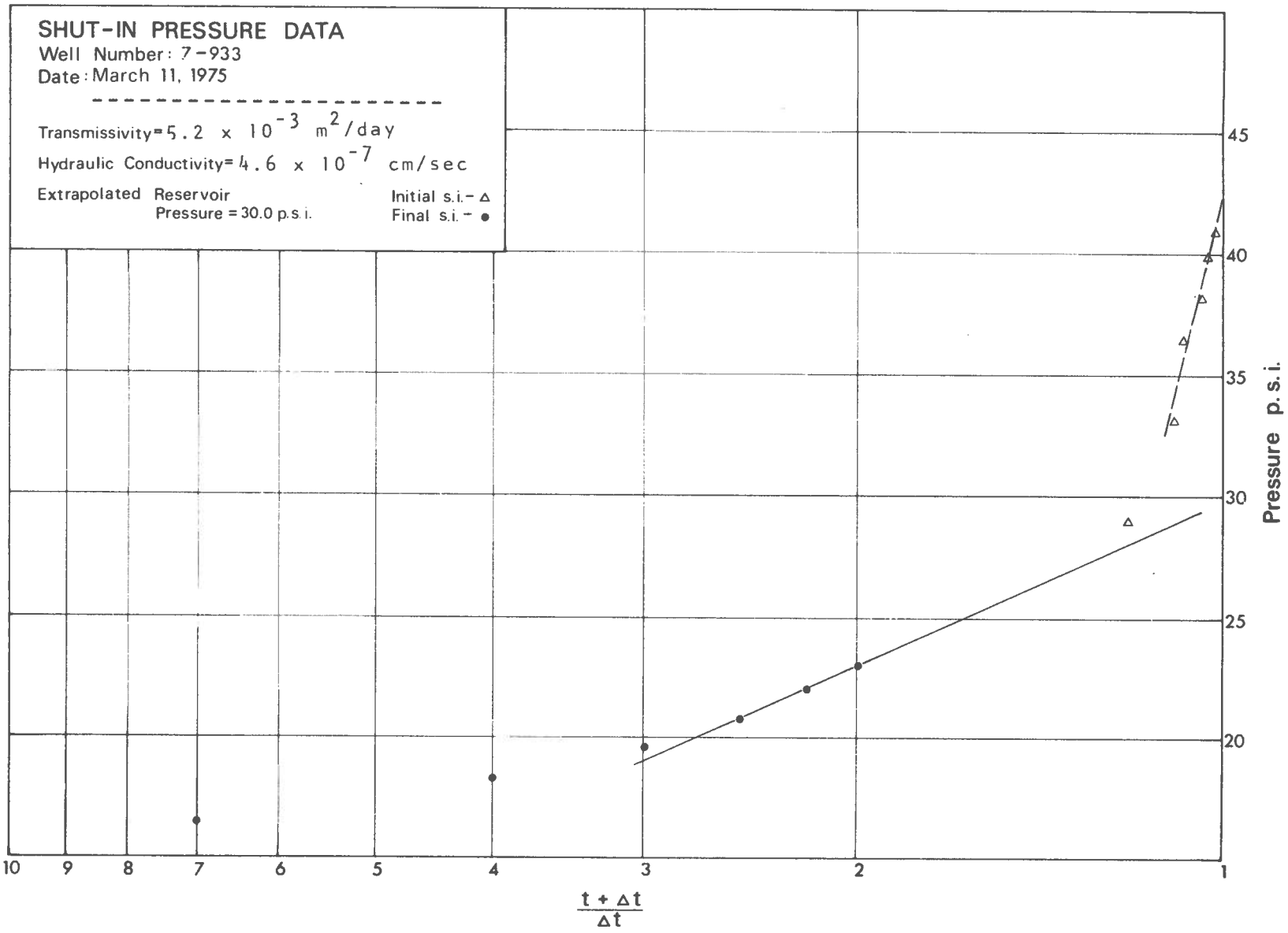
| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 29.1 | 1.20 |
| 10 | 33.2 | 1.10 |
| 15 | 36.5 | 1.07 |
| 20 | 38.3 | 1.05 |
| 35 | 40.0 | 1.04 |
| 30 | 41.0 | 1.033 |

Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 16.5 | 7.00 |
| 10 | 18.3 | 4.00 |
| 15 | 19.7 | 3.00 |
| 20 | 20.8 | 2.50 |
| 25 | 22.0 | 2.20 |
| 30 | 23.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 7-933
Date: March 11, 1975
Transmissivity = 2.3 × 10³ m²/day
Hydraulic Conductivity = 2.0 × 10⁷ cm/sec
Extrapolated Reservoir Pressure = 30.0 p.s.i.
Initial s.i. - △
Final s.i. - ●
45
40
35
30
25
20
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

7-933-D-76


SHUT-IN PRESSURE DATA
Well Number: 7-933
Date: March 11, 1975
Transmissivity = 5.2 x 10^-3 m^2/day
Hydraulic Conductivity = 4.6 x 10^-7 cm/sec
Extrapolated Reservoir Pressure = 30.0 p.s.i.
Initial s.i. - △
Final s.i. - ●
45
40
35
30
25
20
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

7-933-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed from 7-933

Date sampled February 19, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 438.0 | 21.86 | 60.2 |
| Magnesium ($Mg^{++}$) | 0.4 | 0.03 | 0.1 |
| Sodium ($Na^{+}$) | 306.0 | 13.31 | 36.6 |
| Potassium ($K^{+}$) | 43.8 | 1.12 | 3.1 |
| Carbonate ($CO_3^{=}$) | 19.0 | 0.63 | 1.5 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 866.0 | 18.03 | 43.8 |
| Chloride ($Cl^{-}$) | 482.0 | 13.59 | 33.0 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0.0 |
| Silica ($SiO_2$) | 4.9 | | |
| Hydroxide ($OH^{-}$) | 152.0 | 8.94 | 21.7 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 2340.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 41.212 | Total Cations (epm) | 36.320 |

Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 4100 | |
| pH | 11.8 | |
| Fluoride ($F^{-}$) | 0.2 | ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | | |
| pH | 12.3 | |
| Carbonate ($CO_3^{=}$) | 20 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 | ppm |
| Hydroxide ($OH^{-}$) | 241 | ppm |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Drill stem test on 7-933

Date sampled March 11, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 25.4 | 1.27 | 8.9 |
| Magnesium ($Mg^{++}$) | 1.5 | 0.12 | 0.9 |
| Sodium ($Na^{+}$) | 251.0 | 10.92 | 76.6 |
| Potassium ($K^{+}$) | 76.0 | 1.94 | 13.6 |
| Carbonate ($CO_3^{=}$) | 12.0 | 0.40 | 2.8 |
| Bicarbonate ($HCO_3^{-}$) | 146.0 | 2.39 | 17.0 |
| Sulfate ($SO_4^{=}$) | 134.0 | 2.79 | 19.8 |
| Chloride ($Cl^{-}$) | 300.0 | 8.46 | 60.0 |
| Nitrate ($NO_3^{=}$) | 3.4 | 0.05 | 0.4 |
| Silica ($SiO_2$) | 28.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 904.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 14.098 | Total Cations (epm) | 14.253 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1480 | Temperature (C) | 15.0 |
| pH | 9.0 | pH | 11.3 |
| Fluoride ($F^{-}$) | 0.3 ppm | Carbonate ($CO_3^{=}$) | 91.2 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 15.0 ppm |
| | | Conductivity | 0 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1440 | 71.86 | 29 |
| Magnesium ($Mg^{++}$) | 0.4 | 0.03 | 0 |
| Sodium ($Na^{+}$) | 4050 | 176.16 | 70 |
| Potassium ($K^{+}$) | 117 | 2.99 | 1 |
| Carbonate ($CO_3^{=}$) | 33.6 | 1.12 | 1 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 1850 | 38.52 | 22 |
| Chloride ($Cl^{-}$) | 4278 | 120.64 | 69 |
| Nitrate ($NO_3^{=}$) | 40 | 0.65 | 0 |
| Silica ($SiO_2$) | 6.1 | | |
| Hydroxide ($OH^{-}$) | 246 | 14.46 | 8 |
| Calcium (Acidified) | 1420 | | |
| Magnesium (Acidified) | 0.8 | | |
| Total dissolved solids | 16100 | | |

Total Anions (epm) 175.39 Total Cations (epm) 251.04

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | |
| pH | 12 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 7.0 |
| pH | 12.3 |
| Carbonate ($CO_3^{=}$) | 73 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| Hydroxide ($OH^{-}$) | 238 ppm |
| Conductivity | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Drill stem test on well 7-933

Date of sampling March 11,1975

Total dissolved solids 904 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | .01 |
| Al | .1 | Mg | .01 |
| As | <.01 | Mn | .002 |
| B | .02 | Mo | ND |
| Ba | .005 | Ni | .03 |
| Be | ND | Pb | M |
| Bi | ND | Sb | ND |
| Ca | M | Si | M |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | .02 |
| Cu | .005 | V | ND |
| Fe | M | Zn | M |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1440 | 71.86 | 29 |
| Magnesium ($Mg^{++}$) | 0.4 | 0.03 | 0 |
| Sodium ($Na^{+}$) | 4050 | 176.16 | 70 |
| Potassium ($K^{+}$) | 117 | 2.99 | 1 |
| Carbonate ($CO_3^{=}$) | 33.6 | 1.12 | 1 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 1850 | 38.52 | 22 |
| Chloride ($Cl^{-}$) | 4278 | 120.64 | 69 |
| Nitrate ($NO_3^{=}$) | 40 | 0.65 | 0 |
| Silica ($SiO_2$) | 6.1 | | |
| Hydroxide ($OH^{-}$) | 246 | 14.46 | 8 |
| Calcium (Acidified) | 1420 | | |
| Magnesium (Acidified) | 0.8 | | |
| Total dissolved solids | 16100 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 175.39 | Total Cations (epm) | 251.05 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | |
| pH | 12 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 7.0 |
| pH | 12.3 |
| Carbonate ($CO_3^{=}$) | 73 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 |
| Hydroxide ($OH^{-}$) | 238 ppm |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 390.0 | 19.46 | 36 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 750.0 | 32.62 | 60 |
| Potassium ($K^{+}$) | 108.0 | 2.76 | 5 |
| Carbonate ($CO_3^{=}$) | 33.6 | 1.12 | 2 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 747.0 | 15.55 | 27 |
| Chloride ($Cl^{-}$) | 1138.0 | 32.09 | 55 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 5.0 | | |
| Hydroxide ($OH^{-}$) | 159.0 | 9.35 | 16 |
| Calcium (Acidified) | 387.2 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 3388 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 58.13 | Total Cations (epm) | 54.85 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 7000 |
| pH | 12.0 |
| Fluoride ($F^{-}$) | 0.3 Mg/L |

Field:

| | |
|---|---|
| Temperature (C) | 6.0 |
| pH | 12.2 |
| Carbonate ($CO_3^{=}$) | 48 Mg/L |
| Bicarbonate ($HCO_3^{-}$) | |
| Hydroxide ($OH^{-}$) | 170 Mg/L |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 10, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2480.0 | 123.75 | 23.9 |
| Magnesium ($Mg^{++}$) | 67.0 | 5.51 | 1.1 |
| Sodium ($Na^{+}$) | 8875.0 | 386.04 | 74.6 |
| Potassium ($K^{+}$) | 94.0 | 2.40 | 0.5 |
| Carbonate ($CO_3^{=}$) | 26.4 | 0.88 | 0.2 |
| Bicarbonate ($HCO_3^{-}$) | 9.8 | 0.16 | 0.0 |
| Sulfate ($SO_4^{=}$) | 1815.0 | 37.79 | 7.5 |
| Chloride ($Cl^{-}$) | 16400.0 | 462.49 | 92.3 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 7.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 2080.0 | | |
| Magnesium (Acidified) | 76.0 | | |
| Total dissolved solids | 34430.0 | | |
| Total Anions (epm) | 501.33 | Total Cations (epm) | 517.71 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 11.0 |
| pH | 9.1 | pH | 9.4 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 24.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

7-933-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 326.0 | 16.27 | 39.7 |
| Magnesium(Mg) | 17.8 | 1.47 | 3.6 |
| Sodium(Na) | 516.0 | 22.44 | 54.7 |
| Potassium(K) | 33.0 | 0.84 | 2.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 78.0 | 1.28 | 3.2 |
| Sulphate(SO4) | 908.0 | 18.90 | 47.3 |
| Chloride(Cl) | 700.0 | 19.74 | 49.4 |
| Nitrate(NO3) | 0.9 | 0.01 | 0.0 |
| Silica(SiO2) | 3.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 304.0 | | |
| Magnesium(Acidified) | 16.1 | | |
| TDS(mg/l) | 3032.0 | | |
| Total Anions(epm) | 39.94 | Total Cations(epm) | 41.02 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3630 | | Temperature(C) | 11.00 | |
| pH | 6.4 | | pH | 8.3 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 59 | mg/l |
| | | | Hydroxide(OH) | | |

7-933-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 128.0 | 6.39 | 41.7 |
| Magnesium(Mg) | 1.0 | 0.08 | 0.5 |
| Sodium(Na) | 195.0 | 8.48 | 55.4 |
| Potassium(K) | 14.2 | 0.36 | 2.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 58.0 | 0.95 | 6.6 |
| Sulphate(SO4) | 307.0 | 6.39 | 44.6 |
| Chloride(Cl) | 248.0 | 6.99 | 48.8 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 0.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 115.0 | | |
| Magnesium(Acidified) | 1.0 | | |
| TDS(mg/l) | 1122.0 | | |
| Total Anions(epm) | 14.34 | Total Cations(epm) | 15.31 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1450 | | Temperature(C) | 10.50 | |
| pH | 7.8 | | pH | 8.6 | |
| Fluoride(F) | 0.3 | mg/l | Carbonate(CO3) | 14 | mg/l |
| | | | Bicarbonate(HCO3) | 19 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 7-933-E-82

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Rge 8 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 51.0 | 2.55 | 27.8 |
| Magnesium(Mg) | 3.1 | 0.26 | 2.8 |
| Sodium(Na) | 129.0 | 5.61 | 61.1 |
| Potassium(K) | 30.0 | 0.77 | 8.4 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 54.0 | 0.89 | 10.5 |
| Sulphate(SO4) | 250.0 | 5.21 | 61.6 |
| Chloride(Cl) | 84.0 | 2.37 | 28.0 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 0.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 42.0 | | |
| Magnesium(Acidified) | 4.0 | | |
| TDS(mg/l) | 671.0 | | |
| Total Anions(epm) | 8.46 | Total Cations(epm) | 9.19 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1030 |
| pH | 7.7 |
| Fluoride | 0.3 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 11.00 | |
| pH | 10.0 | |
| Carbonate(CO3) | 14 | mg/l |
| Bicarbonate(HCO3) | 0 | mg/l |
| Hydroxide(OH) | 1 | mg/l |

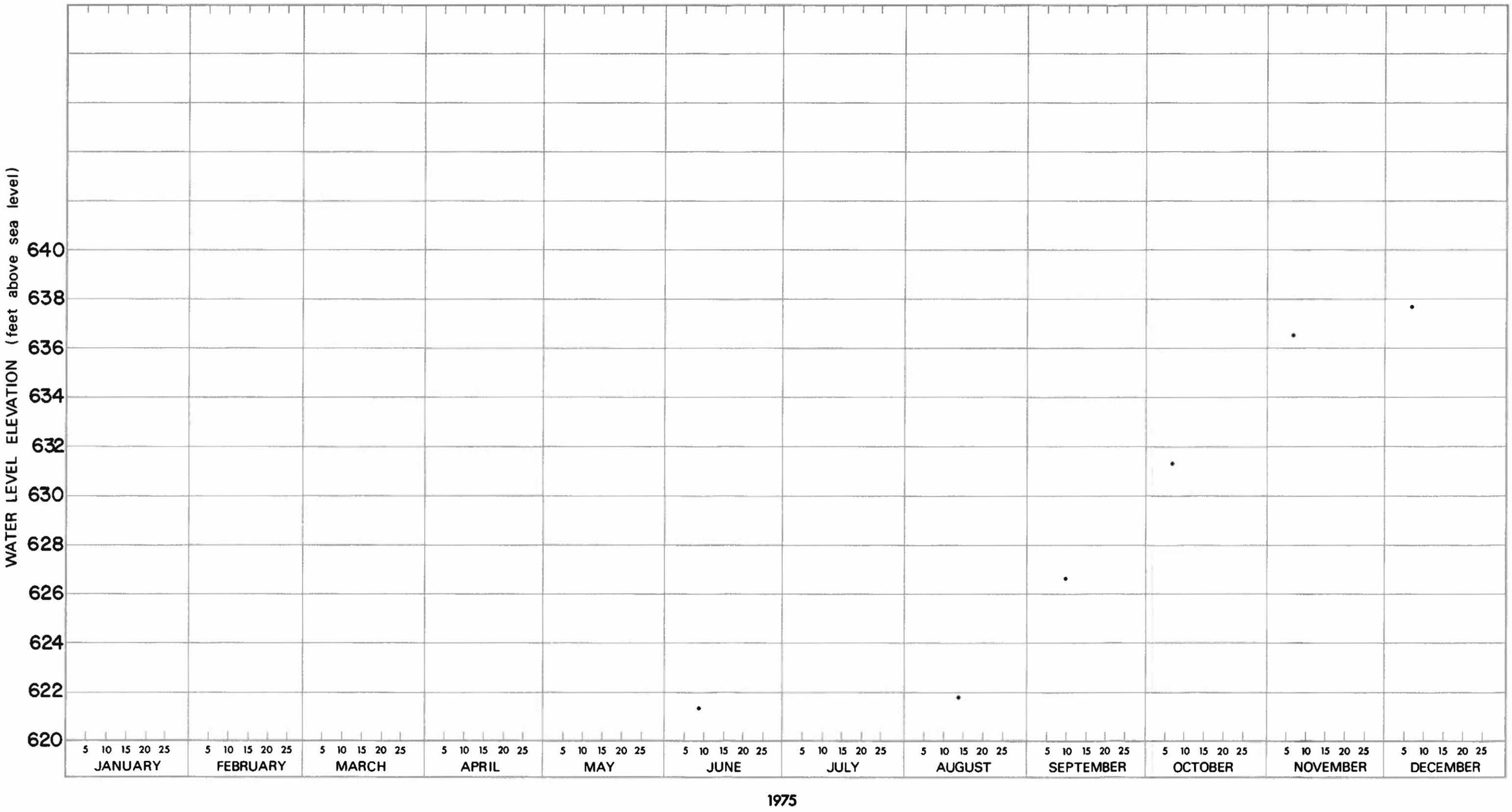
**WATER LEVEL HYDROGRAPH**

7-933-H-76

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council



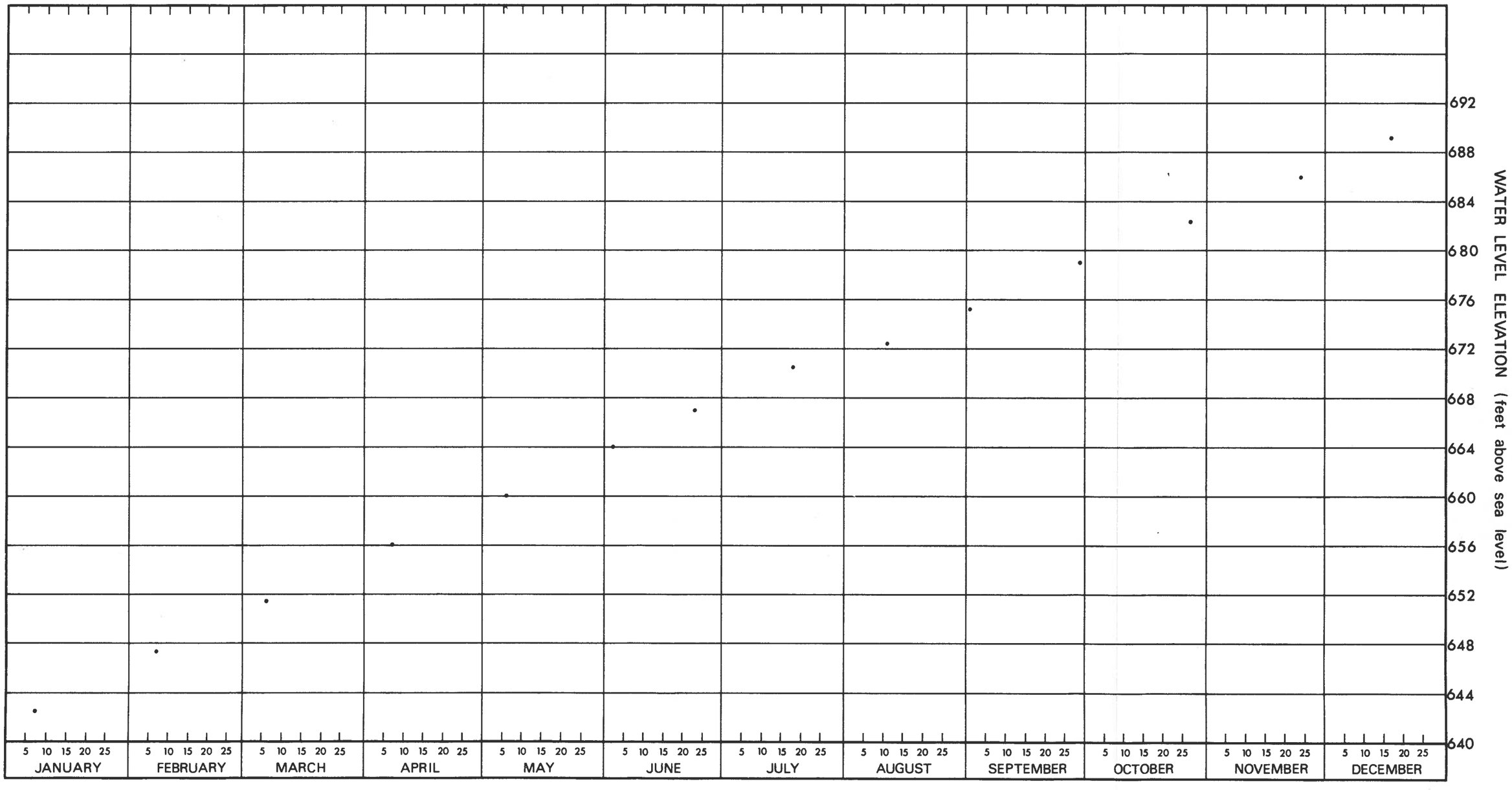
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **7-933**

7 - 933 - H - 77

Lsd **13** Sec **20** Twp **95** R **8** W4th

Alberta Research Council




1976

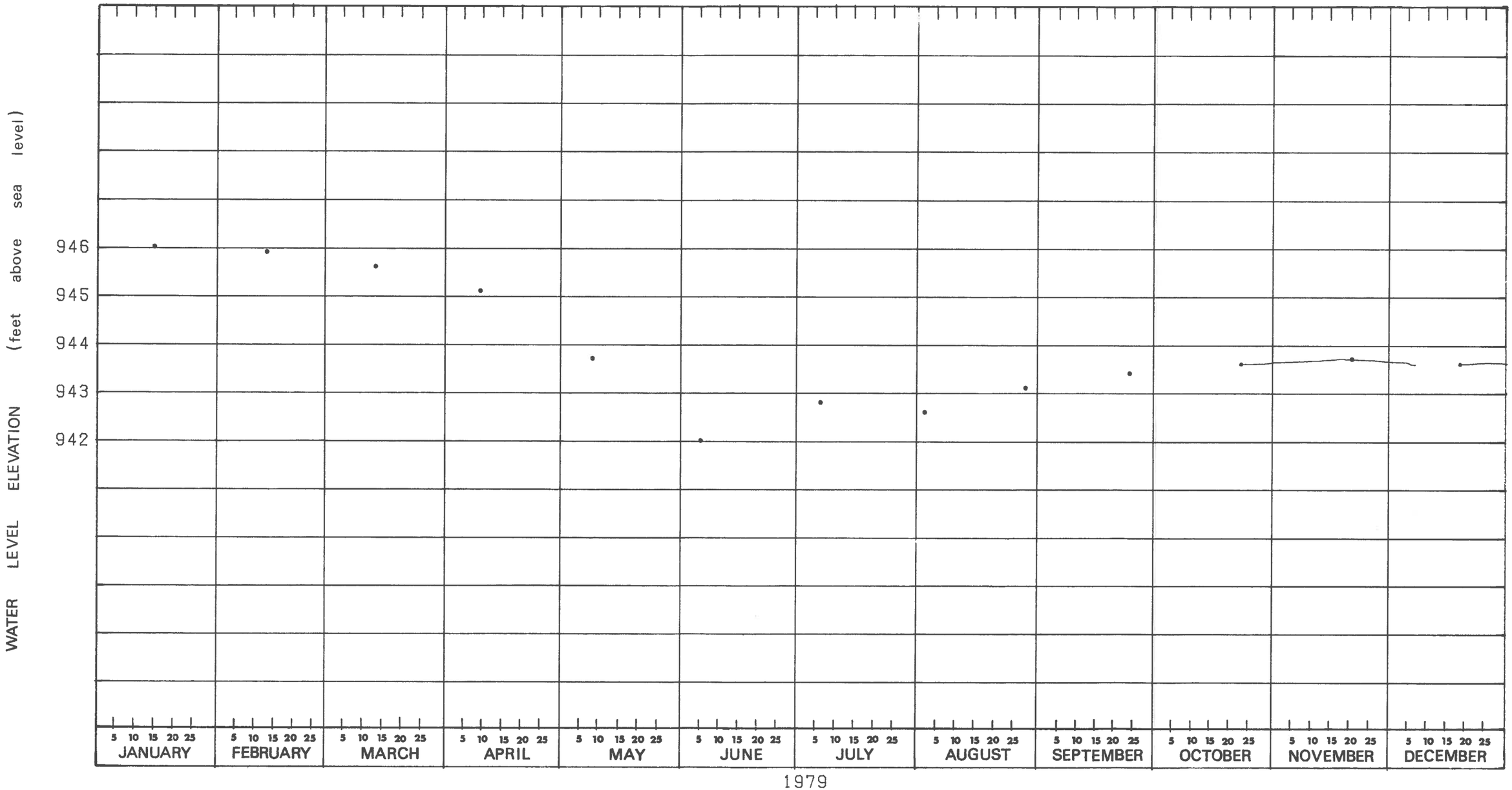
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-933-H-80




1979

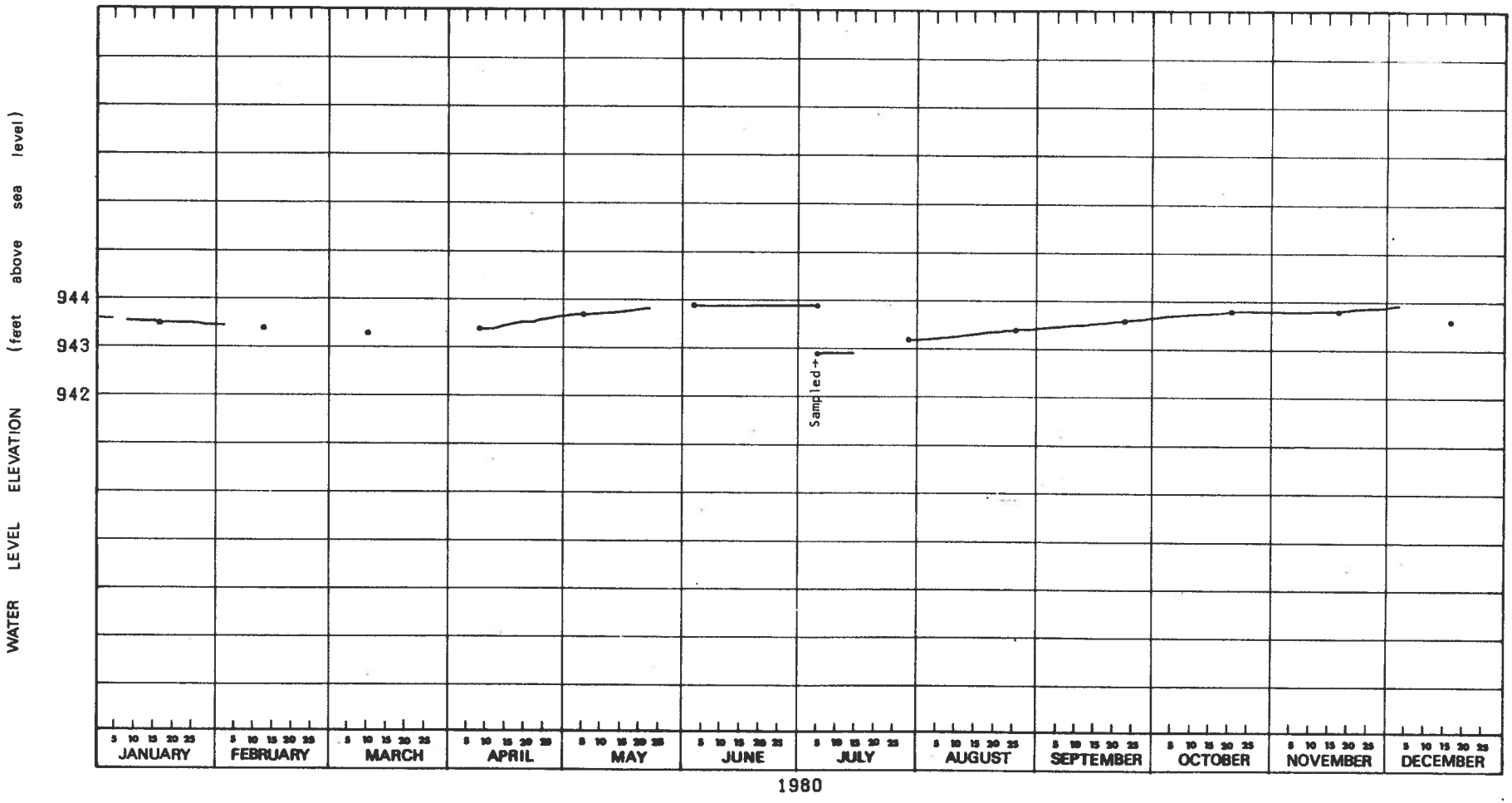
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-933-H-81



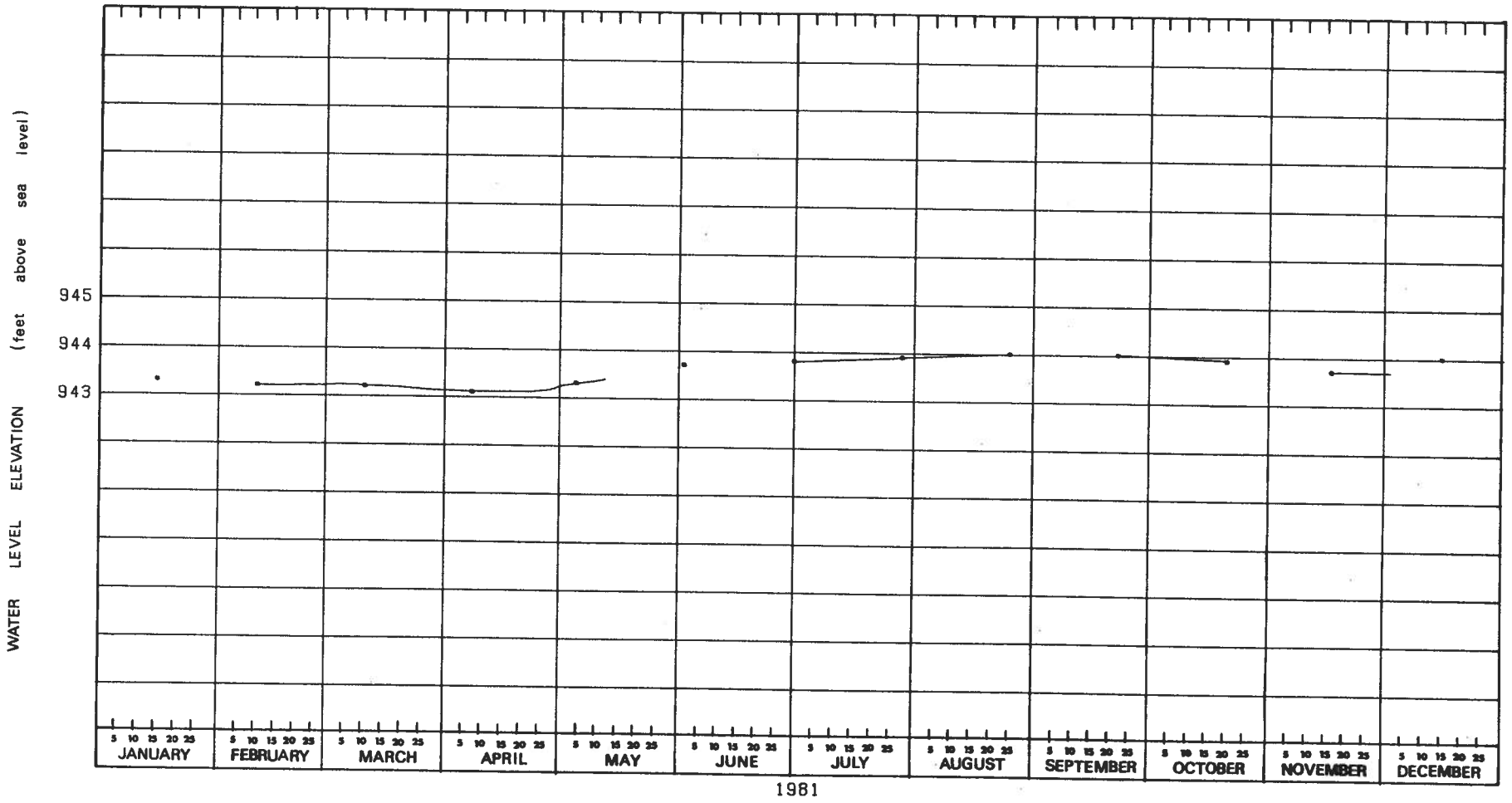
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4 th

Alberta Research Council

7-933-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1073.71 (Until March 11/75)
1072.40 (After March 11/75)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 5/75 | | | Well completed |
| Feb 9/75 | 56.94 TOC | 886.91 | Bail 160 gallons; starts to recover |
| Feb 19/75 | | | Bail 140 gallons; water sample |
| Mar 11/75 | | | Cut off casing; DST; water sample; FSI = 42.5# from 883' |
| Mar 14/75 | | | Reinstall shelter; relevel |
| May 13/75 | 144.93 new MP | 598.5 | MP = 19" (1073.98) |
| June 9/75 | 138 MP | 621.34 | |
| July 9/75 | 125.48 MP | 622.41 | |
| Aug 14/75 | 137.85 MP | 623.83 | |
| Sept 10/75 | 136.38 MP | 626.65 | Sampled well; temp. 7°C |
| Oct 7/75 | 134.96 MP | 631.31 | |
| Nov 7/75 | 133.38 MP | 636.49 | |
| Dec 7/75 | 133.02 MP | 637.67 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.40

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 131.53 MP | 642.6 | MP (1074.0) |
| Feb 7/76 | 130.08 MP | 647.3 | |
| Mar 6/76 | 128.82 MP | 651.5 | |
| Apr 7/76 | 127.45 MP | 656.0 | |
| May 6/76 | 126.19 MP | 660.1 | |
| June 2/76 | 125.00 MP | 664.0 | |
| June 23/76 | 124.08 MP | 667.0 | |
| July 18/76 | 123.02 MP | 670.5 | Sampled; temp. 6°C |
| Aug 11/76 | 122.40 MP | 672.5 | |
| Sept 1/76 | 121.56 MP | 675.3 | |
| Sept 29/76 | 120.44 MP | 679.0 | |
| Oct 27/76 | 119.35 MP | 682.5 | |
| Nov 24/76 | 118.32 MP | 685.9 | |
| Dec 22/76 | 117.36 MP | 689.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.40

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 116.45 MP | 692.0 | |
| Jan 27/77 | | | Treated with 70 lb NU-WELL acid well conditioner |
| Feb 3/77 | | | Blown with air |
| Feb 16/77 | 261.41 MP | 218.0 | New MP = 0.93 m TOC, (1075.4) |
| Mar 16/77 | | | >200 m |
| Apr 14/77 | 250.83 MP | 252.7 | |
| May 10/77 | 247.95 MP | 261.1 | New MP = 0.60 m TOC, (1074.4) hole in casing at ground level; water running in; filling casing and rendering water levels meaningless |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.40

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 39.09 MP | 946.0 | MP (1074.2) |
| Feb 14/79 | 39.10 MP | 945.9 | |
| Mar 14/79 | 39.22 MP | 945.6 | |
| Apr 10/79 | 39.37 MP | 945.1 | Installed recorder; bailed out water |
| | 39.90 MP | 943.3 | After bailed |
| May 9/79 | 39.79 MP | 943.7 | Bailed out water |
| | 40.78 MP | 940.4 | After bailed |
| June 6/79 | 40.30 MP | 942.0 | |
| July 7/79 | 40.05 MP | 942.8 | |
| | 40.31 MP | 942.0 | After sample; temp. 10.5°C |
| Aug 3/79 | 40.12 MP | 942.6 | |
| Aug 29/79 | 39.96 MP | 943.1 | |
| Sept 25/79 | 39.87 MP | 943.4 | |
| Oct 24/79 | 39.81 MP | 943.6 | |
| Nov 21/79 | 39.79 MP | 943.7 | |
| Dec 19/79 | 39.83 MP | 943.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

7-933-W-82

WELL HISTORY

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.40

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 39.85 MP | 943.5 | |
| Feb 13/80 | 39.88 MP | 943.4 | |
| Mar 11/80 | 39.90 MP | 943.3 | |
| Apr 9/80 | 39.89 MP | 943.4 | |
| May 6/80 | 39.77 MP | 943.7 | |
| June 4/80 | 39.72 MP | 943.9 | |
| July 6/80 | 39.72 MP | 943.9 | Temp. 11°C |
| | 40.02 MP | 942.9 | After Sample |
| July 30/80 | 39.94 MP | 943.2 | |
| Aug 27/80 | 39.88 MP | 943.4 | |
| Sept 24/80 | 39.83 MP | 943.6 | |
| Oct 22/80 | 39.76 MP | 943.8 | |
| Nov 19/80 | 39.76 MP | 943.8 | |
| Dec 18/80 | 39.83 MP | 943.6 | |
| Jan 16/81 | 39.90 MP | 943.3 | |
| Feb 11/81 | 39.94 MP | 943.2 | |
| Mar 11/81 | 39.95 MP | 943.2 | |
| Apr 8/81 | 39.97 MP | 943.1 | |
| May 5/81 | 39.92 MP | 943.3 | |
| June 2/81 | 39.79 MP | 943.7 | |
| July 1/81 | 39.76 MP | 943.8 | |
| July 29/81 | 39.73 MP | 943.9 | |
| Aug 26/81 | 39.71 MP | 944.0 | |
| Sept 23/81 | 39.71 MP | 944.0 | |
| Oct 21/81 | 39.72 MP | 943.9 | |
| Nov 17/81 | 39.79 MP | 943.7 | |
| Dec 16/81 | 39.71 MP | 944.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

SITE EIGHT

6 30 94-7 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK: ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites, containing 36 individual wells, were instrumented in this manner during the winter of 1974-75.

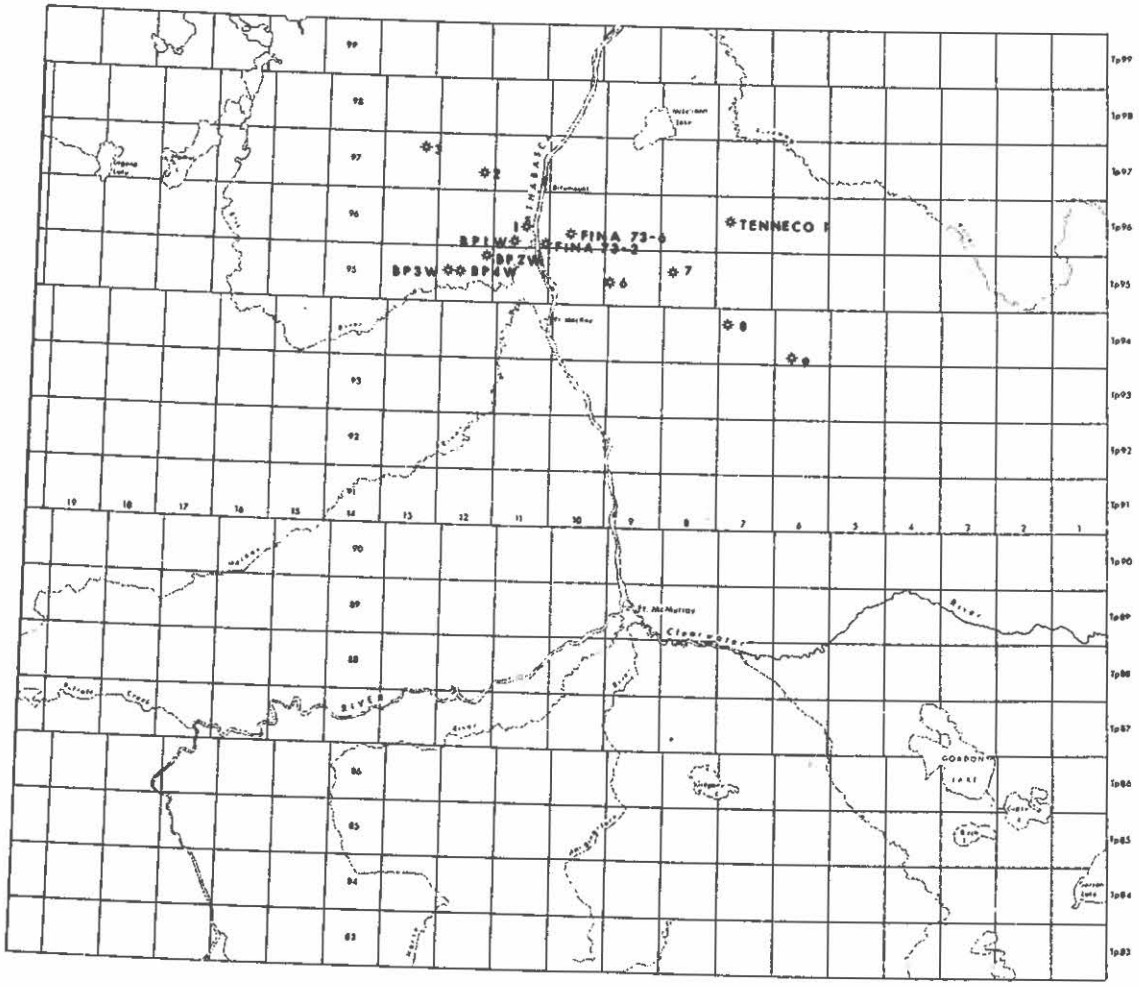
The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill-stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The loose-leaf format has been chosen to facilitate periodic updating with such information as hydrographs, water analyses and well history. The page indexing system is also consistent with the updating process. All updating packages will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this introduction and legend.

There were seven piezometer nests in the system on August 31, 1975. Four companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing. Table 1 lists the location of wells in the system as of August 31, 1975. Map 1 indicates the location of these wells. Publications available as of the date of this document include those for sites 1, 2, 3, 6, 7, 8 and 9.

Table 1
Athabasca Oil Sands Observation Wells
August 31, 1975

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |




6 0 6 12 18 MILES

**MAP 1**
**ATHABASCA OIL SANDS**
**OBSERVATION WELL NETWORK**
**August 31, 1975**

GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Eight

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Ground elevation 1414 Total depth 710

KB elevation 1419

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 0 | 10 | Till, quartz sand, sub-rounded to sub angular, fine to coarse | Drift |
| | 20 | Quartz sand, sub-rounded to sub-angular, fine to coarse grained; 1% biotite in quartz fragments | |
| | 30 | Quartz sand, fine grained, sub-rounded to sub-angular, well sorted | |
| 30 | 60 | Quartz sand, fine to coarse grained, sub-rounded to sub-angular, poorly sorted; 40% clay | |
| | 70 | Gravels and quartz sand, fine to coarse, sub-rounded to sub-angular, well sorted gravels from 2 to 10 mm. | |
| 70 | 90 | Quartz sand, very fine to coarse, poorly sorted, sub-rounded to sub-angular; 30% clay particles and very fine silt | |
| | 100 | Quartz sand, fine to medium grained, sub-rounded to sub-angular, poorly sorted; 20% mudstone chips 10% fine grained sandstone chips | |
| | 110 | Assorted gravel chips and quartz sand, fine to medium grained, sub-rounded to sub-angular | |
| | 120 | Clay, grey, with 5% quartz chips | Clearwater |
| 120 | 150 | Clay, grey | |
| | 160 | Clay, shaly, grey | |
| 160 | 180 | Clay, shaly, grey brown | |
| 180 | 250 | Clay, grey | |
| | 260 | Clay, grey, and some wood < 1% | |
| | 270 | Clay, grey and some limestone fragments < 1% | |
| 270 | 290 | Grey clay | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Eight (continued)

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 300 | Clay, grey, shaly | |
| | 310 | Clay, shaly, grey, with some limestone fragments < 1% | |
| 310 | 330 | Clay, grey, and some coal fragments (sub-bituminous) < 1% | |
| 330 | 350 | Clay, grey, coal fragments < 1%, sub-rounded quartz < 1%, fine to medium grained | |
| | 360 | Clay, grey, coal fragments < 1%, sub-rounded quartz < 1% medium grained | |
| 360 | 380 | Clay, grey brown, coal fragments < 1%, limestone fragments <1% | |
| 380 | 460 | Clay, grey brown | |
| | 460 | Clay, brown | |
| 470 | 490 | Clay, sandy, brown, fine grained quartz sand, sub-rounded | |
| | 500 | Oil sand, quartz sand, very fine grained with clay, brown quartz, sub-rounded, well sorted | |
| | 510 | Clay, brown, sandy | Beaverhill Lake |
| | 520 | Clay, grey, calcareous, (pyritiferous, micaceous < 1%) or very weather limestone | |
| | 530 | Clay, grey, calcareous (weathered limestone) | |
| | 540 | Clay, grey, calcareous (weathered limestone) | |
| 540 | 560 | Limestone, weathered | |
| | 570 | Limestone, grey, fine grained | |
| 570 | 600 | Limestone, grey, fine grained, slightly pyritiferous < 1% | |

## GEOLOGICAL SAMPLE DESCRIPTION

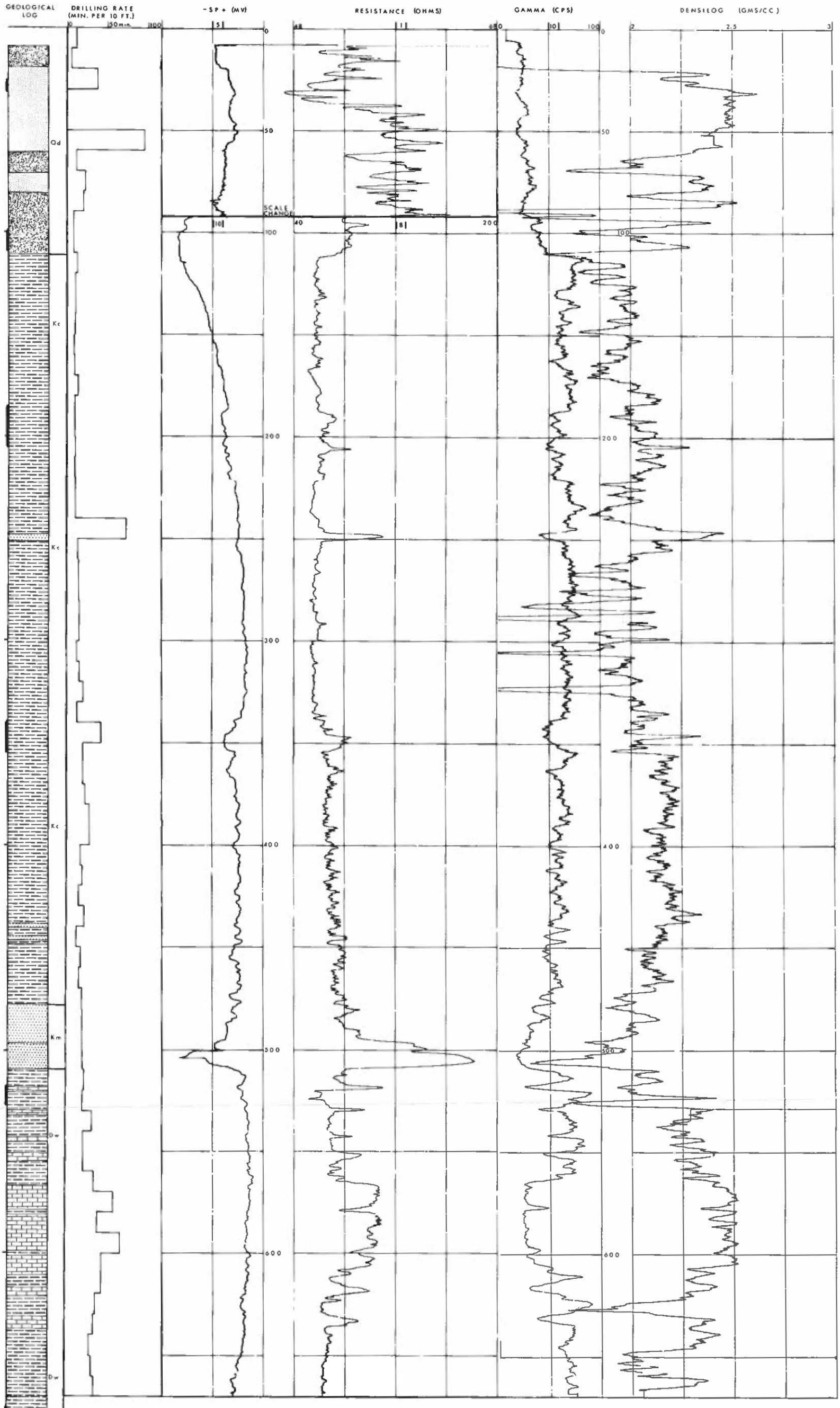
SITE NUMBER Eight (continued)

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 600 | 660 | Limestone, weathered | |
| 660 | 680 | Limestone, fine grained, slightly pyritiferous < 1% | |
| 680 | 710 | Limestone, grey, fine grained | |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 8
## 5-30-94-7 W4th
### ALBERTA RESEARCH COUNCIL



## SUMMARY OF CONTENTS

SITE NUMBER EIGHT

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | | | |
|---|---|---|---|---|---|---|---|
| | site | 8-34 | 8-114 | 8-220 | 8-370 | 8-532 | 8-716 |
| Introduction | 4 | — | — | — | — | — | — |
| Legend | 8 | — | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — | — |
| Geological Sample Description | 3 | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 0 | 3 | 0 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 2 | 1 | 2 | 2 |
| Shut-In Pressure Data | — | 0 | 0 | 1 | 0 | 1 | 1 |
| Water Analysis | — | 2 | 3 | 2 | 1 | 3 | 3 |
| Spectral Emissions Estimates | — | 1 | 1 | 1 | 1 | 1 | 0 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 0 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER EIGHT

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | 8-34 | 8-114 | 8-220 | 8-370 | 8-532 | 8-716 |
| Shut-In Pressure Data | 0 | 0 | 0 | 0 | 0 | 1* |
| Water Analysis | 1 | 1 | 1 | 1 | 1 | 1 |
| Water Level Hydrograph | 1 | 1 | 1 | 1 | 1 | 1 |
| Well History | 1 | 1 | 1* | 1 | 1* | 1 |

*Supersedes page issued in 1976

### ERRATUM STATEMENT

Material Distributed in 1976

1. Well 8-532 - A different WELL HISTORY page has been issued covering 1975. The page index is 8-532-W-77 and replaces 8-532-W-76.
2. Well 8-220 - A different WELL HISTORY page has been issued covering 1975. The page index is 8-220-W-77 and replaces 8-220-W-76.
3. The Grand Rapids Formation should be listed on the GEOLOGICAL SAMPLE DESCRIPTION at the interval 60 to 70 and from depths of 62 to 112 feet on the GEOPHYSICAL AND GEOLOGICAL LOGS.
4. The McMurray Formation should be listed on the GEOLOGICAL SAMPLE DESCRIPTION at the interval 330 to 350 and from depths of 336 to 510 on the GEOPHYSICAL AND GEOLOGICAL LOGS.
5. The "formation tested" on the DRILL STEM TEST page for well 8-370 (page 8-370-D-76) should be changed to "McMurray".
6. The stratigraphic symbol Dw on the GEOPHYSICAL AND GEOLOGICAL LOGS page should be changed to Dbl.
7. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
8. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.
9. A new SHUT-IN PRESSURE DATA page has been issued for Well 8-716. The page indexed 8-716-D-77 has replaced 8-716-D-76.

## Acknowledgments

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, C. Seibert, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1975: BOPG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., and Shell Canada Ltd.

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication
Well Number - the name used for designating the well
Subject Code - as follows:

- I - Introduction (no site number indicated)
- L - Legend (no site number indicated)
- G - General site information including geological logs, geophysical logs and site plan (no well number indicated)
- C - Well construction details
- D - Drill stem testing
- A - Aquifer testing
- E - Chemical analyses including spectral emission estimates and routine water analyses
- H - Annual hydrograph
- W - Well history

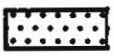
So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within the tabbed section for that particular well.

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| Mer | meridian |
| Meg/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diamter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| Sec. | section |
| ss | stainless steel |

| Symbol | Units or Parameter |
|---|---|
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) *or* time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| $\Delta t$ | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| Wt | weight |

## GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
|  | sandstone |
| | arkosic sandstone |
| | silt |
| | siltstone |
| | silt & sandstone |
| | clay |
| | sandy clay |
| | shale |
| | sandstone & shale |
| | oilsand |
| | shaley dolomite |
| | gypsum |
| | dolomite |
| | limestone |

| Symbol | Stratigraphic Unit |
|---|---|
| Qd | unconsolidated deposits |
| Klb | La Biche Fm. |
| Kpl | Pelican Fm. |
| Kj | Joli Fou Fm. |
| Kg | Grand Rapids Fm. |
| Kc | Clearwater Fm. |
| Km | McMurray Fm. |
| Dbl | Beaverhill Lake Gp. |
| Dw | Waterways Fm. |
| Dpe | Prairie Evaporite Fm. |
| Dmt | Methy Fm. |
| Dmr | McLean River Fm. |
| Dl | La Loche Fm. |
| P€ | Precambrian |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: complete routine analysis and a spectral emission estimate for 29 elements. Many of the samples collected during 1975 appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years.

Most water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source".

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface

3. drill through the aquifer using very light mud
4. insert a screening device (if necessary).

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

Two drilling rigs were used simultaneously during the 1974-1975 drilling season. Both were Failing 1500; one was trailer mounted and capable of 2,000-foot depths, the other was truck mounted and capable of about 1,200-foot depths.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma and uncompensated density were the logs run during the 1974-75 drilling. The geological log presented represents an interpretation based upon the sample description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells when the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, all wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the

measuring tape sticking to the wet casing. Conventional oil-field drill stem testing equipment was selected in an attempt to produce permeability and head values in the wells with deep water levels. Information from these drill stem tests is presented in the section on "Drill Stem Testing". A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day
V = volume of production into drill collars and stem
t = total flow time of test
T = transmissivity in millidarcy-feet
M = slope of final shut-in pressure plot
k = permeability in millidarcys
h = thickness of the aquifer - usually the length of the tested section.

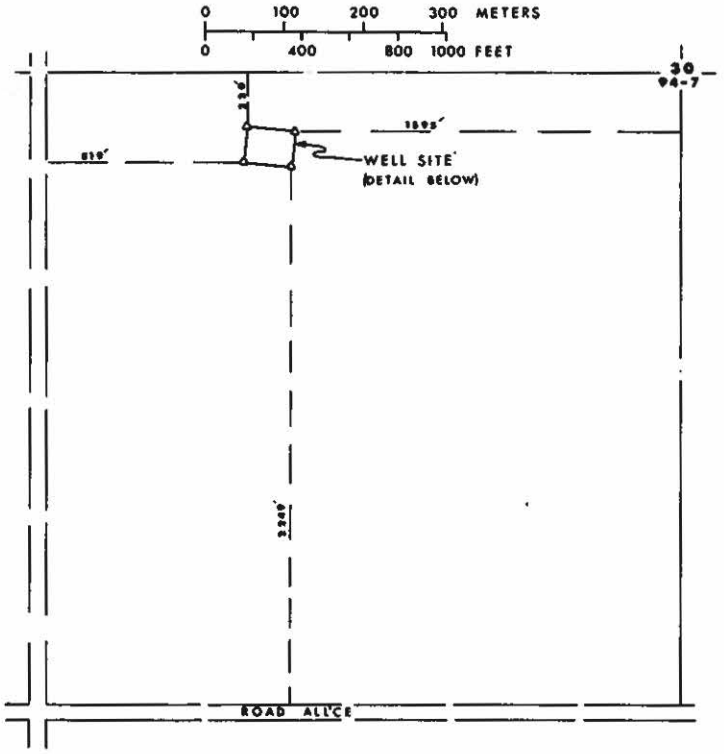
The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot.

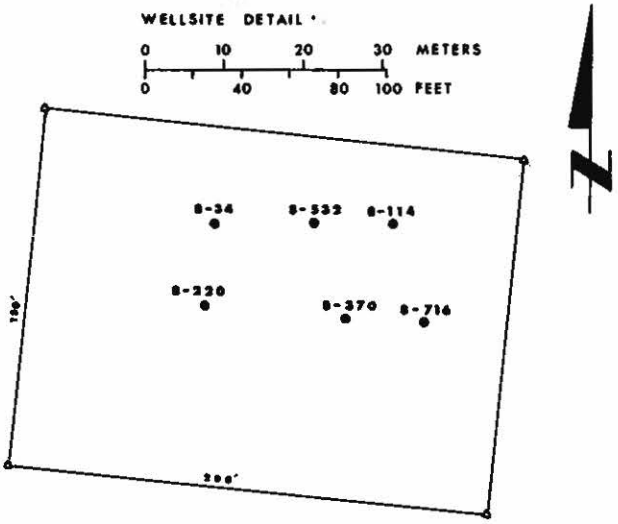
Values of transmissivity are expressed in the metric units of square metres per day. Permeability is expressed as centimetres per second.

OBSERVATION WELL SITE 8

5-30-94-7 W4th

ALBERTA RESEARCH COUNCIL



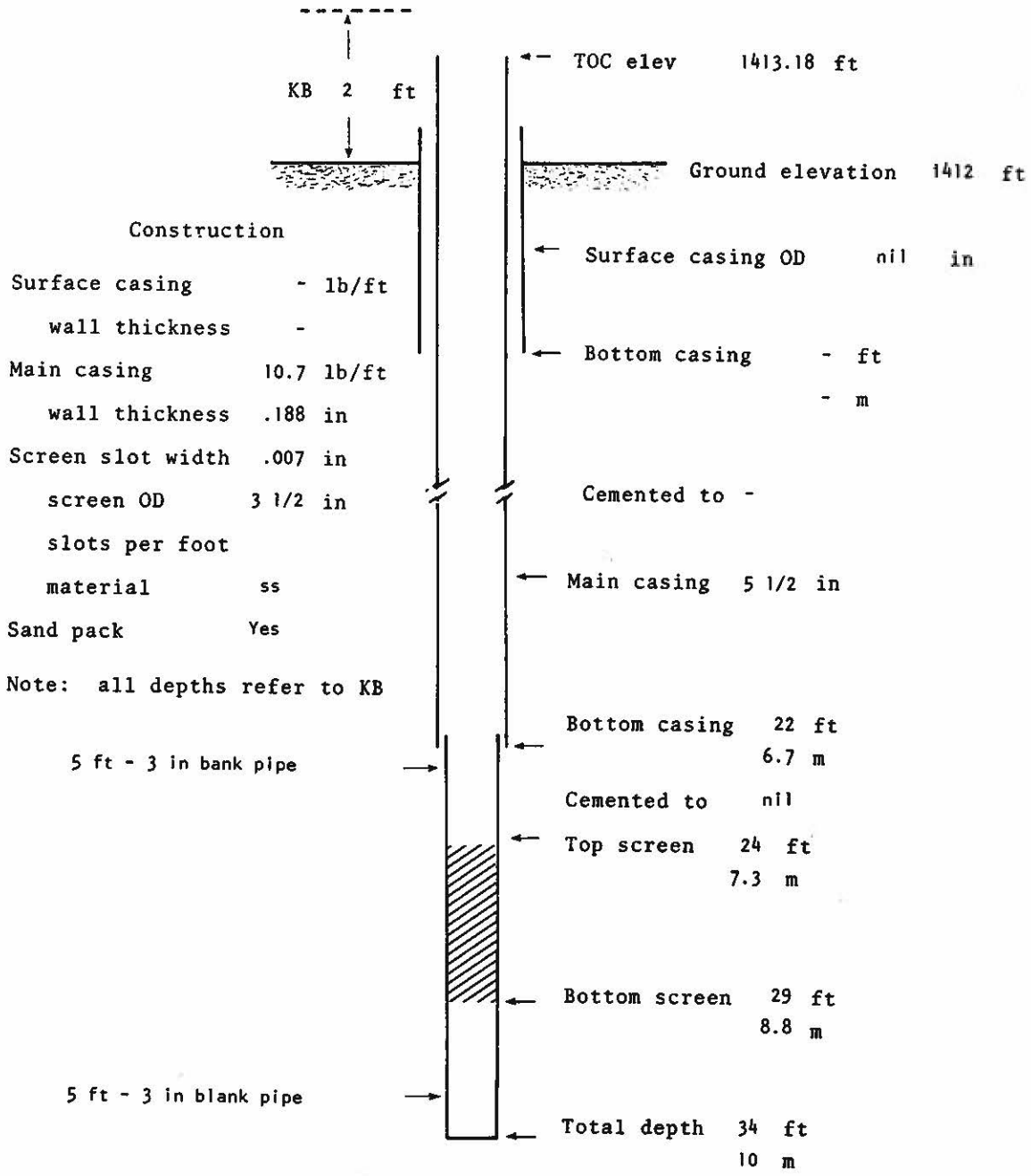
8-34-C-76

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Tp 94 R 7 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 10.7 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | Yes | |

Note: all depths refer to KB

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 23 | 1.15 | 14 |
| Magnesium ($Mg^{++}$) | 14.2 | 1.17 | 14 |
| Sodium ($Na^{+}$) | 133 | 5.79 | 70 |
| Potassium ($K^{+}$) | 6.3 | 0.16 | 2 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 444 | 7.28 | 92 |
| Sulfate ($SO_4^{=}$) | 0 | 0 | 0 |
| Chloride ($Cl^{-}$) | 22 | 0.62 | 8 |
| Nitrate ($NO_3^{=}$) | 1 | 0.02 | 0 |
| Silica ($SiO_2$) | 0.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 29 | | |
| Magnesium (Acidified) | 14.8 | | |
| Total dissolved solids | 474 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 7.92 | Total Cations (epm) | 8.27 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 820 |
| pH | 7.1 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 6.5 |
| pH | 8.7 |
| Carbonate ($CO_3^{=}$) | 24 ppm |
| Bicarbonate ($HCO_3^{-}$) | 415 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed from 8-34

Date sampled February 22, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 49.4 | 2.47 | 23.0 |
| Magnesium ($Mg^{++}$) | 22.1 | 1.82 | 17.0 |
| Sodium ($Na^{+}$) | 146.3 | 6.36 | 59.4 |
| Potassium ($K^{+}$) | 2.9 | 0.07 | 0.7 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 517.0 | 8.47 | 85.6 |
| Sulfate ($SO_4^{=}$) | 7.3 | 0.15 | 1.5 |
| Chloride ($Cl^{-}$) | 44.0 | 1.24 | 12.5 |
| Nitrate ($NO_3^{=}$) | 1.7 | 0.03 | 0.3 |
| Silica ($SiO_2$) | 19.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 444.0 | | |
| Total Anions (epm) | 9.894 | Total Cations (epm) | 10.720 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 860 | Temperature (C) | 3.0 | |
| pH | 7.7 | pH | 7.3 | |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 530 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | 900 | |

SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed from well 8-34

Date of sampling February 22, 1975

Total dissolved solids 444 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | M | Mg | .05 |
| As | <.01 | Mn | .003 |
| B | .04 | Mo | ND |
| Ba | .006 | Ni | .04 |
| Be | ND | Pb | .01 |
| Bi | ND | Sb | ND |
| Ca | M | Si | M |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | .001 |
| Cu | .005 | V | .03 |
| Fe | .1 | Zn | .03 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 30.0 | 1.50 | 16 |
| Magnesium ($Mg^{++}$) | 16.8 | 1.38 | 14 |
| Sodium ($Na^{+}$) | 152.0 | 6.61 | 69 |
| Potassium ($K^{+}$) | 5.4 | 0.14 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 466.0 | 7.64 | 84 |
| Sulfate ($SO_4^{=}$) | 18.2 | 0.38 | 4 |
| Chloride ($Cl^{-}$) | 36.0 | 1.02 | 11 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 25.3 | | |
| Magnesium (Acidified) | 17.9 | | |
| Total dissolved solids | 500 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 9.05 | Total Cations (epm) | 9.63 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 850 | Temperature (C) | 6.0 |
| pH | 7.9 | pH | 7.9 |
| Fluoride ($F^{-}$) | 0.4 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 478 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed (U of A Geology)

Date sampled May 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 65.6 | 3.21 | 28.3 |
| Magnesium ($Mg^{++}$) | 22.4 | 1.84 | 16.2 |
| Sodium ($Na^{+}$) | 141.0 | 6.06 | 53.5 |
| Potassium ($K^{+}$) | 5.0 | 0.22 | 1.9 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 459.0 | 7.34 | 79.4 |
| Sulfate ($SO_4^{=}$) | 0.5 | 0.01 | 0.1 |
| Chloride ($Cl^{-}$) | 67.5 | 1.89 | 20.5 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 9.24 | Total Cations (epm) | 11.33 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 980 | Temperature (C) |
| pH | 8.1 | pH |
| Fluoride ($F^{-}$) | | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed (U of A Geology)

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 35.7 | 1.75 | 19.7 |
| Magnesium ($Mg^{++}$) | 15.8 | 1.30 | 14.6 |
| Sodium ($Na^{+}$) | 132.4 | 5.69 | 64.1 |
| Potassium ($K^{+}$) | 5.5 | 0.14 | 1.6 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 396.0 | 6.34 | 81.2 |
| Sulfate ($SO_4^{=}$) | 0.5 | 0.01 | 0.1 |
| Chloride ($Cl^{-}$) | 52.0 | 1.46 | 18.7 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 7.81 | Total Cations (epm) | 8.88 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 815 | Temperature (C) | |
| pH | 8.2 | pH | |
| Fluoride ($F^{-}$) | | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 42.0 | 2.10 | 21.4 |
| Magnesium ($Mg^{++}$) | 15.2 | 1.25 | 12.8 |
| Sodium ($Na^{+}$) | 145.0 | 6.31 | 64.5 |
| Potassium ($K^{+}$) | 5.0 | 0.13 | 1.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 425.0 | 6.97 | 78.5 |
| Sulfate ($SO_4^{=}$) | 15.3 | 0.32 | 3.6 |
| Chloride ($Cl^{-}$) | 56.0 | 1.58 | 17.8 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 2.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 38.0 | | |
| Magnesium (Acidified) | 15.9 | | |
| Total dissolved solids | 526.0 | | |
| Total Anions (epm) | 8.88 | Total Cations (epm) | 9.78 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 910 | Temperature (C) | 4.0 |
| pH | 7.9 | pH | 8.1 |
| Fluoride ($F^{-}$) | 0.6 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 400.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed (U of A Geology)

Date sampled August 31, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 53.7 | 2.63 | 25.5 |
| Magnesium ($Mg^{++}$) | 19.3 | 1.58 | 15.3 |
| Sodium ($Na^{+}$) | 136.0 | 5.85 | 56.8 |
| Potassium ($K^{+}$) | 9.4 | 0.24 | 2.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 439.0 | 7.02 | 81.0 |
| Sulfate ($SO_4^{=}$) | 0.5 | 0.01 | 0.1 |
| Chloride ($Cl^{-}$) | 58.5 | 1.64 | 18.9 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 8.67 | Total Cations (epm) | 10.30 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 915 | Temperature (C) | |
| pH | 8.2 | pH | |
| Fluoride ($F^{-}$) | | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 8 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Date sampled: July 17, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .040 |
| Au | <.003 | Mo | <.006 |
| Al | 0.55 | Na | 153 |
| As | <.038 | Ni | <.010 |
| B | .692 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 33.4 | Si | 1.33 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .195 |
| Cr | <.006 | Te | <.065 |
| Cu | .039 | Ti | .005 |
| Eu | <.015 | U | <.020 |
| Fe | .825 | V | <.0008 |
| K | <.150 | W | <.078 |
| Mg | 20.9 | Zn | .066 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled November 23, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 69.0 | 3.44 | 30.2 |
| Magnesium ($Mg^{++}$) | 18.7 | 1.54 | 13.5 |
| Sodium ($Na^{+}$) | 146.0 | 6.35 | 55.7 |
| Potassium ($K^{+}$) | 2.9 | 0.07 | 0.7 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 542.0 | 8.88 | 84.7 |
| Sulfate ($SO_4^{=}$) | 17.0 | 0.35 | 3.4 |
| Chloride ($Cl^{-}$) | 44.0 | 1.24 | 11.8 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 0.2 |
| Silica ($SiO_2$) | 7.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 632.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 10.50 | Total Cations (epm) | 11.41 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 1100 | Temperature (C) |
| pH | 7.8 | pH |
| Fluoride ($F^{-}$) | 0.7 ppm | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

8-34-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled January 18, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 55.0 | 2.74 | 26.7 |
| Magnesium(Mg) | 11.0 | 0.91 | 8.8 |
| Sodium(Na) | 150.0 | 6.52 | 63.4 |
| Potassium(K) | 4.6 | 0.12 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 488.0 | 8.00 | 82.1 |
| Sulphate(SO4) | 18.0 | 0.37 | 3.8 |
| Chloride(Cl) | 48.0 | 1.35 | 13.9 |
| Nitrate(NO3) | 0.9 | 0.01 | 0.1 |
| Silica(SiO2) | 3.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 644.0 | | |
| Total Anions(epm) | 9.74 | Total Cations(epm) | 10.29 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 940 | Temperature(C) |
| pH | 7.4 | pH |
| Fluoride(F) | 0.8 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

8-34-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled March 15, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 45.0 | 2.25 | 23.0 |
| Magnesium(Mg) | 16.6 | 1.37 | 14.0 |
| Sodium(Na) | 139.0 | 6.05 | 61.8 |
| Potassium(K) | 4.6 | 0.12 | 1.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 434.0 | 7.11 | 77.5 |
| Sulphate(SO4) | 38.3 | 0.80 | 8.7 |
| Chloride(Cl) | 44.0 | 1.24 | 13.5 |
| Nitrate(NO3) | 1.4 | 0.02 | 0.2 |
| Silica(SiO2) | 2.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 530.0 | | |
| Total Anions(epm) | 9.17 | Total Cations(epm) | 9.78 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 825 | Temperature(C) |
| pH | 7.4 | pH |
| Fluoride(F) | 0.8 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

8-34-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled May 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 46.0 | 2.30 | 21.1 |
| Magnesium(Mg) | 18.3 | 1.51 | 13.8 |
| Sodium(Na) | 160.0 | 6.96 | 64.0 |
| Potassium(K) | 4.6 | 0.12 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 547.0 | 8.97 | 85.8 |
| Sulphate(SO4) | 17.2 | 0.36 | 3.4 |
| Chloride(Cl) | 40.0 | 1.13 | 10.8 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 4.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 642.0 | | |
| Total Anions(epm) | 10.45 | Total Cations(epm) | 10.88 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 910 | Temperature(C) |
| pH | 7.7 | pH |
| Fluoride(F) | 0.8 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

8-34-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 54.0 | 2.69 | 31.1 |
| Magnesium(Mg) | 0.0 | 0.00 | 0.0 |
| Sodium(Na) | 135.0 | 5.87 | 67.8 |
| Potassium(K) | 3.8 | 0.10 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 508.0 | 8.33 | 81.1 |
| Sulphate(SO4) | 3.9 | 0.08 | 0.8 |
| Chloride(Cl) | 65.0 | 1.83 | 17.8 |
| Nitrate(NO3) | 1.8 | 0.03 | 0.3 |
| Silica(SiO2) | 3.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 46.0 | | |
| Magnesium(Acidified) | 0.3 | | |
| TDS(mg/l) | 618.0 | | |
| Total Anions(epm) | 10.27 | Total Cations(epm) | 8.66 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 870 | | Temperature(C) | 4.50 | |
| pH | 7.3 | | pH | 7.0 | |
| Fluoride(F) | 0.8 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 522 | mg/l |
| | | | Hydroxide(OH) | | |

8-34-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER ARC 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled August 29, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 46.0 | 2.30 | 23.1 |
| Magnesium(Mg) | 16.0 | 1.32 | 13.2 |
| Sodium(Na) | 144.0 | 6.26 | 63.0 |
| Potassium(K) | 2.5 | 0.06 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 464.0 | 7.61 | 83.5 |
| Sulphate(SO4) | 15.5 | 0.32 | 3.5 |
| Chloride(Cl) | 42.0 | 1.18 | 13.0 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 2.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 566.0 | | |
| Total Anions(epm) | 9.11 | Total Cations(epm) | 9.94 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 790 | Temperature(C) |
| pH | 7.5 | pH |
| Fluoride(F) | 0.8 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

8-34-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled October 25, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 39.0 | 1.95 | 23.1 |
| Magnesium(Mg) | -1.0 | -0.08 | -1.0 |
| Sodium(Na) | 148.0 | 6.44 | 76.6 |
| Potassium(K) | 4.2 | 0.11 | 1.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 446.0 | 7.31 | 85.0 |
| Sulphate(SO4) | 13.3 | 0.28 | 3.2 |
| Chloride(Cl) | 36.0 | 1.02 | 11.8 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 2.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | 17.4 | | |
| TDS(mg/l) | 548.0 | | |
| Total Anions(epm) | 8.60 | Total Cations(epm) | 8.41 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 815 | Temperature(C) |
| pH | 7.0 | pH |
| Fluoride(F) | 0.8 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

8-34-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled November 22, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 39.0 | 1.95 | 20.1 |
| Magnesium(Mg) | 17.6 | 1.45 | 15.0 |
| Sodium(Na) | 143.0 | 6.22 | 64.3 |
| Potassium(K) | 2.5 | 0.06 | 0.7 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 451.0 | 7.39 | 90.5 |
| Sulphate(SO4) | 12.7 | 0.26 | 3.2 |
| Chloride(Cl) | 18.0 | 0.51 | 6.2 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 2.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 542.0 | | |
| Total Anions(epm) | 8.16 | Total Cations(epm) | 9.68 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 790 | Temperature(C) |
| pH | 7.5 | pH |
| Fluoride(F) | 0.7 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

8-34-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled January 16, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 29.0 | 1.45 | 16.2 |
| Magnesium(Mg) | 17.0 | 1.40 | 15.7 |
| Sodium(Na) | 136.0 | 5.92 | 66.4 |
| Potassium(K) | 5.8 | 0.15 | 1.7 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 407.0 | 6.67 | 81.2 |
| Sulphate(SO4) | 19.8 | 0.41 | 5.0 |
| Chloride(Cl) | 40.0 | 1.13 | 13.7 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 1.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 516.0 | | |
| Total Anions(epm) | 8.21 | Total Cations(epm) | 8.91 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 620 | Temperature(C) |
| pH | 7.6 | pH |
| Fluoride(F) | 0.8 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

8-34-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled March 14, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 43.0 | 2.15 | 21.5 |
| Magnesium(Mg) | 15.2 | 1.25 | 12.6 |
| Sodium(Na) | 149.0 | 6.48 | 65.1 |
| Potassium(K) | 3.3 | 0.08 | 0.8 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 488.0 | 8.00 | 87.3 |
| Sulphate(SO4) | 12.5 | 0.26 | 2.8 |
| Chloride(Cl) | 32.0 | 0.90 | 9.9 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 4.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 610.0 | | |
| Total Anions(epm) | 9.16 | Total Cations(epm) | 9.96 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 840 | Temperature(C) |
| pH | 7.8 | pH |
| Fluoride(F) | 0.9 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

8-34-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled May 09, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 25.0 | 1.25 | 14.5 |
| Magnesium(Mg) | 14.0 | 1.15 | 13.4 |
| Sodium(Na) | 140.0 | 6.09 | 70.9 |
| Potassium(K) | 3.8 | 0.10 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 417.0 | 6.83 | 82.3 |
| Sulphate(SO4) | 13.4 | 0.28 | 3.4 |
| Chloride(Cl) | 42.0 | 1.18 | 14.3 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 1.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 530.0 | | |
| Total Anions(epm) | 8.30 | Total Cations(epm) | 8.59 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 770 | Temperature(C) |
| pH | 7.6 | pH |
| Fluoride(F) | 0.6 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

8-34-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 27.0 | 1.35 | 15.2 |
| Magnesium(Mg) | 16.4 | 1.35 | 15.2 |
| Sodium(Na) | 140.0 | 6.09 | 68.5 |
| Potassium(K) | 3.8 | 0.10 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 420.0 | 6.88 | 85.2 |
| Sulphate(SO4) | 6.0 | 0.12 | 1.5 |
| Chloride(Cl) | 38.0 | 1.07 | 13.3 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 1.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 26.0 | | |
| Magnesium(Acidified) | 17.4 | | |
| TDS(mg/l) | 520.0 | | |
| Total Anions(epm) | 8.08 | Total Cations(epm) | 8.88 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 680 | Temperature(C) | 3.00 | |
| pH | 7.9 | pH | 7.6 | |
| Fluoride(F) | 0.7 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 420 | mg/l |
| | | Hydroxide(OH) | | |

8-34-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled August 29, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 41.0 | 2.05 | 20.9 |
| Magnesium(Mg) | 16.4 | 1.35 | 13.8 |
| Sodium(Na) | 146.0 | 6.35 | 64.8 |
| Potassium(K) | 2.1 | 0.05 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 483.0 | 7.92 | 87.0 |
| Sulphate(SO4) | 15.8 | 0.33 | 3.6 |
| Chloride(Cl) | 30.0 | 0.85 | 9.3 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 3.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 534.0 | | |
| Total Anions(epm) | 9.10 | Total Cations(epm) | 9.80 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 760 | Temperature(C) |
| pH | 7.3 | pH |
| Fluoride(F) | 0.7 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

8-34-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled October 24, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 47.0 | 2.35 | 23.6 |
| Magnesium(Mg) | 15.3 | 1.26 | 12.7 |
| Sodium(Na) | 143.0 | 6.22 | 62.6 |
| Potassium(K) | 4.2 | 0.11 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 537.0 | 8.80 | 91.4 |
| Sulphate(SO4) | 12.2 | 0.25 | 2.6 |
| Chloride(Cl) | 20.0 | 0.56 | 5.9 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 4.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 636.0 | | |
| Total Anions(epm) | 9.63 | Total Cations(epm) | 9.93 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 790 | Temperature(C) |
| pH | 7.2 | pH |
| Fluoride(F) | 0.7 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

8-34-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled November 21, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 37.0 | 1.85 | 19.9 |
| Magnesium(Mg) | 14.3 | 1.18 | 12.7 |
| Sodium(Na) | 141.0 | 6.13 | 66.1 |
| Potassium(K) | 5.0 | 0.13 | 1.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 490.0 | 8.03 | 89.1 |
| Sulphate(SO4) | 11.5 | 0.24 | 2.7 |
| Chloride(Cl) | 26.0 | 0.73 | 8.1 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 3.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 492.0 | | |
| Total Anions(epm) | 9.01 | Total Cations(epm) | 9.28 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 770 | Temperature(C) | |
| pH | 7.3 | pH | |
| Fluoride(F) | 1.1 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS ARC 8-34-E-82

OBSERVATION WELL NUMBER ARC 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled January 16, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 26.0 | 1.30 | 16.7 |
| Magnesium(Mg) | 11.4 | 0.95 | 12.2 |
| Sodium(Na) | 125.0 | 5.43 | 69.8 |
| Potassium(K) | 3.8 | 0.10 | 1.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 439.0 | 7.20 | 85.3 |
| Sulphate(SO4) | 21.5 | 0.45 | 5.3 |
| Chloride(Cl) | 28.0 | 0.79 | 9.3 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 2.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 602.0 | | |
| Total Anions(epm) | 8.44 | Total Cations(epm) | 7.78 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 700 | Temperature | -1.00 |
| pH | 7.7 | pH | -1.0 |
| Fluoride | 0.9 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 8-34-E-82

OBSERVATION WELL NUMBER ARC 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled March 11, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 28.0 | 1.40 | 15.8 |
| Magnesium(Mg) | 7.6 | 0.63 | 7.2 |
| Sodium(Na) | 155.0 | 6.74 | 76.1 |
| Potassium(K) | 3.3 | 0.08 | 1.0 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 493.0 | 8.08 | 85.8 |
| Sulphate(SO4) | 26.0 | 0.54 | 5.8 |
| Chloride(Cl) | 28.0 | 0.79 | 8.4 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.1 |
| Silica(SiO2) | 1.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 514.0 | | |
| Total Anions(epm) | 9.42 | Total Cations(epm) | 8.86 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 720 | Temperature | -1.00 |
| pH | 7.8 | pH | -1.0 |
| Fluoride | 0.8 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 8-34-E-82

OBSERVATION WELL NUMBER ARC 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled May 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 47.0 | 2.35 | 22.6 |
| Magnesium(Mg) | 15.2 | 1.27 | 12.2 |
| Sodium(Na) | 154.0 | 6.70 | 64.3 |
| Potassium(K) | 4.2 | 0.11 | 1.0 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 529.0 | 8.67 | 90.0 |
| Sulphate(SO4) | 21.5 | 0.45 | 4.6 |
| Chloride(Cl) | 18.0 | 0.51 | 5.3 |
| Nitrate(NO3) | 0.7 | 0.01 | 0.1 |
| Silica(SiO2) | 3.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 750.0 | | |
| Total Anions(epm) | 9.64 | Total Cations(epm) | 10.42 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 780 | Temperature | -1.00 |
| pH | 7.8 | pH | -1.0 |
| Fluoride | 0.7 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 8-34-E-82

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 70.0 | 3.50 | 30.5 |
| Magnesium(Mg) | 15.0 | 1.25 | 10.9 |
| Sodium(Na) | 150.0 | 6.52 | 56.8 |
| Potassium(K) | 8.3 | 0.21 | 1.9 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 425.0 | 6.97 | 88.6 |
| Sulphate(SO4) | 5.0 | 0.10 | 1.3 |
| Chloride(Cl) | 28.0 | 0.79 | 10.0 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 1.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 18.8 | | |
| Magnesium(Acidified) | 12.9 | | |
| TDS(mg/l) | 563.0 | | |
| Total Anions(epm) | 7.86 | Total Cations(epm) | 11.48 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 850 | Temperature | 4.00 | |
| pH | 8.0 | pH | 7.8 | |
| Fluoride | 0.7 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 429 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS

ARC 8-34-E-82

OBSERVATION WELL NUMBER ARC 8-34

Lsd 5 Sec 70 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled August 27, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 50.0 | 2.50 | 12.0 |
| Magnesium(Mg) | 141.0 | 11.75 | 56.2 |
| Sodium(Na) | 151.0 | 6.57 | 31.4 |
| Potassium(K) | 3.8 | 0.10 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 442.0 | 7.25 | 42.3 |
| Sulphate(SO4) | 440.0 | 9.17 | 53.6 |
| Chloride(Cl) | 25.0 | 0.70 | 4.1 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 1.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 494.0 | | |
| Total Anions(epm) | 17.12 | Total Cations(epm) | 20.91 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 830 | Temperature | 0.0 |
| pH | 8.1 | pH | 0.0 |
| Fluoride | 0.7 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 8-34-E-82

OBSERVATION WELL NUMBER ARC 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled October 22, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 10.6 | 0.53 | 6.3 |
| Magnesium(Mg) | 13.8 | 1.15 | 13.6 |
| Sodium(Na) | 153.0 | 6.65 | 78.8 |
| Potassium(K) | 4.2 | 0.11 | 1.3 |
| Carbonate(CO3) | 7.2 | 0.24 | 2.9 |
| Bicarbonate(HCO3) | 393.0 | 6.44 | 78.6 |
| Sulphate(SO4) | 5.0 | 0.10 | 1.3 |
| Chloride(Cl) | 50.0 | 1.41 | 17.2 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 1.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 492.0 | | |
| Total Anions(epm) | 8.20 | Total Cations(epm) | 8.44 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 790 | Temperature | 0.0 |
| pH | 8.4 | pH | 0.0 |
| Fluoride | 0.8 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 8-34-E-82

OBSERVATION WELL NUMBER ARC 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled January 16, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 12.5 | 0.63 | 7.2 |
| Magnesium(Mg) | 14.0 | 1.17 | 13.5 |
| Sodium(Na) | 154.0 | 6.70 | 77.6 |
| Potassium(K) | 5.4 | 0.14 | 1.6 |
| Carbonate(CO3) | 0.2 | 0.01 | 0.1 |
| Bicarbonate(HCO3) | 393.0 | 6.44 | 86.6 |
| Sulphate(SO4) | 9.1 | 0.19 | 2.5 |
| Chloride(Cl) | 28.0 | 0.79 | 10.6 |
| Nitrate(NO3) | 0.7 | 0.01 | 0.2 |
| Silica(SiO2) | 1.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 495.0 | | |
| Total Anions(epm) | 7.44 | Total Cations(epm) | 8.63 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 765 | Temperature | -1.00 |
| pH | 8.4 | pH | -1.0 |
| Fluoride | 1.1 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS ARC 8-34-E-82

OBSERVATION WELL NUMBER ARC 8-34

Lsd 5 Sec 30 Rge 94 Twp 7 W4th

Alberta Research Council

Sample Source Bailed

Date sampled March 11, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 15.4 | 0.77 | 8.9 |
| Magnesium(Mg) | 14.2 | 1.18 | 13.7 |
| Sodium(Na) | 151.0 | 6.57 | 75.9 |
| Potassium(K) | 5.0 | 0.13 | 1.5 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 417.0 | 6.84 | 87.8 |
| Sulphate(SO4) | 10.0 | 0.21 | 2.7 |
| Chloride(Cl) | 26.0 | 0.73 | 9.4 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 1.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 504.0 | | |
| Total Anions(epm) | 7.78 | Total Cations(epm) | 8.65 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 770 | Temperature | -1.00 |
| pH | 8.2 | pH | -1.0 |
| Fluoride | 0.7 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 8-34-E-82

OBSERVATION WELL NUMBER . ARC 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled May 6, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 19.3 | 0.97 | 11.1 |
| Magnesium(Mg) | 13.8 | 1.15 | 13.2 |
| Sodium(Na) | 149.0 | 6.48 | 74.5 |
| Potassium(K) | 3.8 | 0.10 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 435.0 | 7.13 | 83.6 |
| Sulphate(SO4) | 32.0 | 0.67 | 7.8 |
| Chloride(Cl) | 26.0 | 0.73 | 8.6 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 0.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 508.0 | | |
| Total Anions(epm) | 8.53 | Total Cations(epm) | 8.69 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 750 | Temperature | -1.00 |
| pH | 7.8 | pH | -1.0 |
| Fluoride | 0.6 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

ARC 8-34-E-82

OBSERVATION WELL NUMBER ARC 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 34.1 | 1.70 | 18.4 |
| Magnesium(Mg) | 14.8 | 1.23 | 13.3 |
| Sodium(Na) | 143.0 | 6.22 | 67.2 |
| Potassium(K) | 3.8 | 0.10 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 486.0 | 7.97 | 89.3 |
| Sulphate(SO4) | 24.0 | 0.50 | 5.6 |
| Chloride(Cl) | 16.0 | 0.45 | 5.1 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 1.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 585.0 | | |
| Total Anions(epm) | 8.92 | Total Cations(epm) | 9.25 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 790 | Temperature | 0.0 |
| pH | 7.8 | pH | 0.0 |
| Fluoride | 0.7 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS ARC 8-34-E-82

OBSERVATION WELL NUMBER ARC 8-34

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled August 26, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 88.0 | 4.40 | 53.1 |
| Magnesium(Mg) | 35.6 | 2.97 | 35.8 |
| Sodium(Na) | 20.0 | 0.87 | 10.5 |
| Potassium(K) | 2.1 | 0.05 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 541.0 | 8.87 | 97.4 |
| Sulphate(SO4) | 4.5 | 0.09 | 1.0 |
| Chloride(Cl) | 5.0 | 0.14 | 1.5 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.1 |
| Silica(SiO2) | 8.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 442.0 | | |
| Total Anions(epm) | 9.11 | Total Cations(epm) | 8.29 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 718 | Temperature | 0.0 |
| pH | 7.8 | pH | 0.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

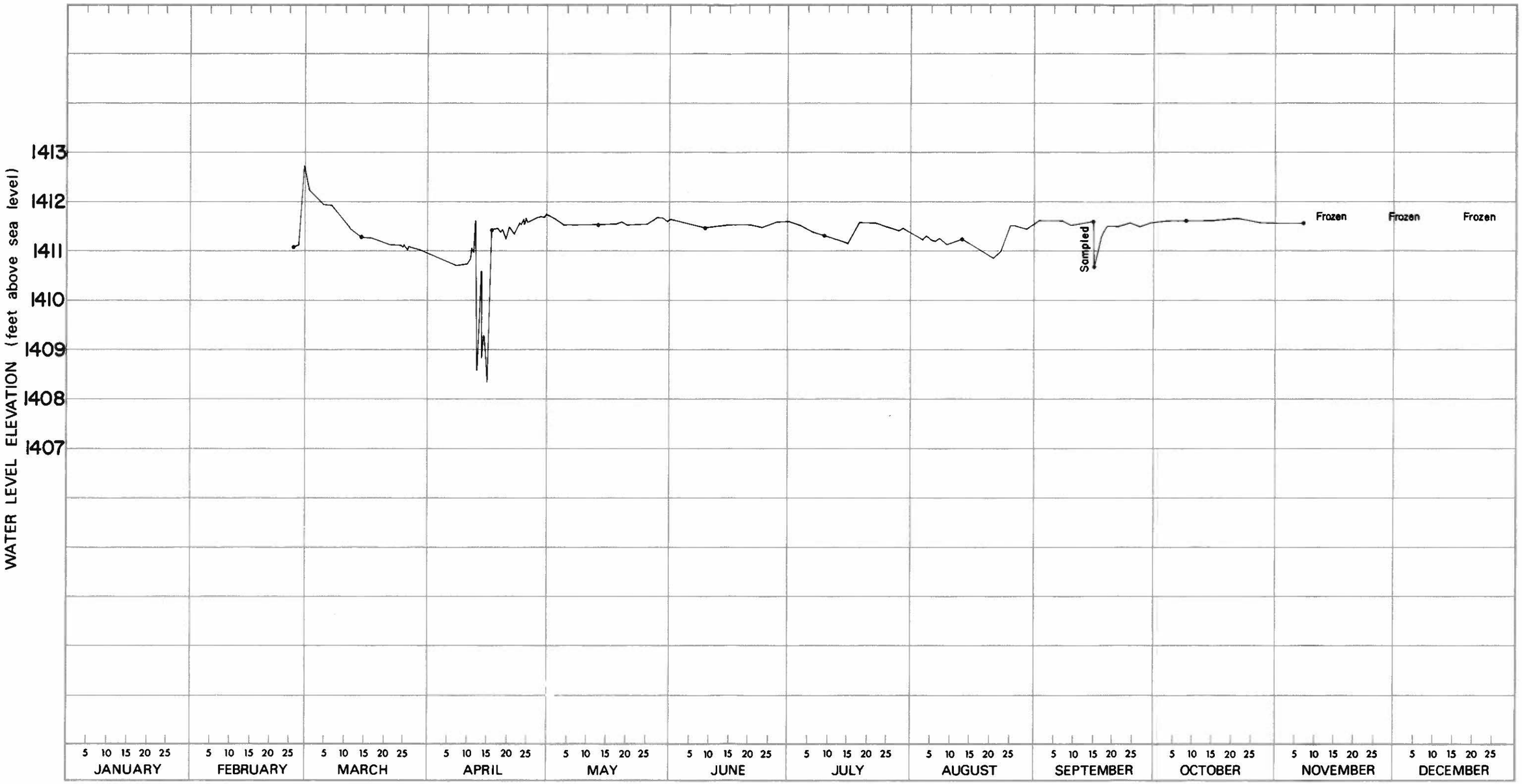
**WATER LEVEL HYDROGRAPH**

8-34-H-76

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council



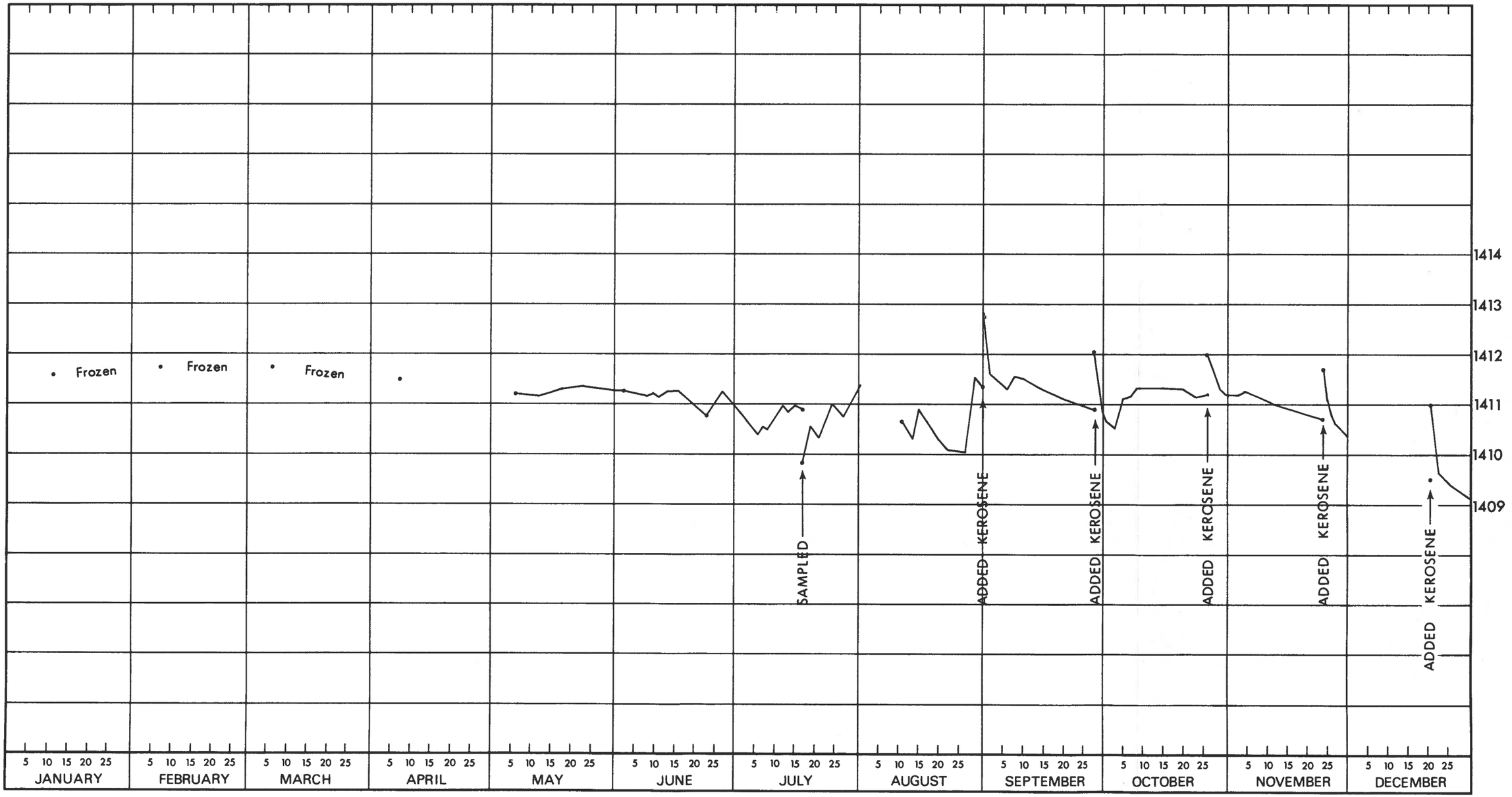
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **8-34**

Lsd **5** Sec **30** Twp **94** R **7** W4th

Alberta Research Council

8 - 34 - H - 77




1976

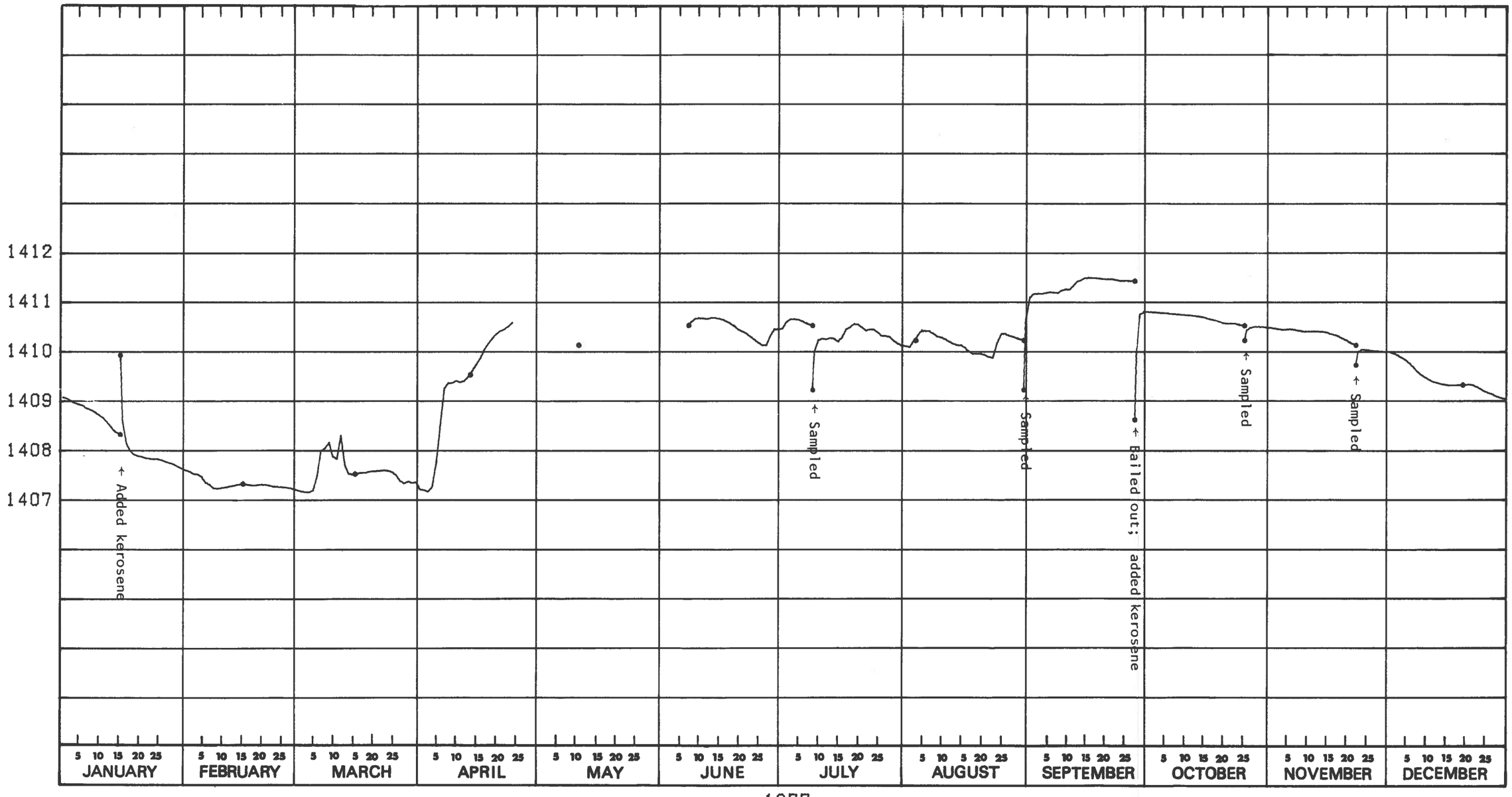
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-34

8-34-H-78

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council




1977

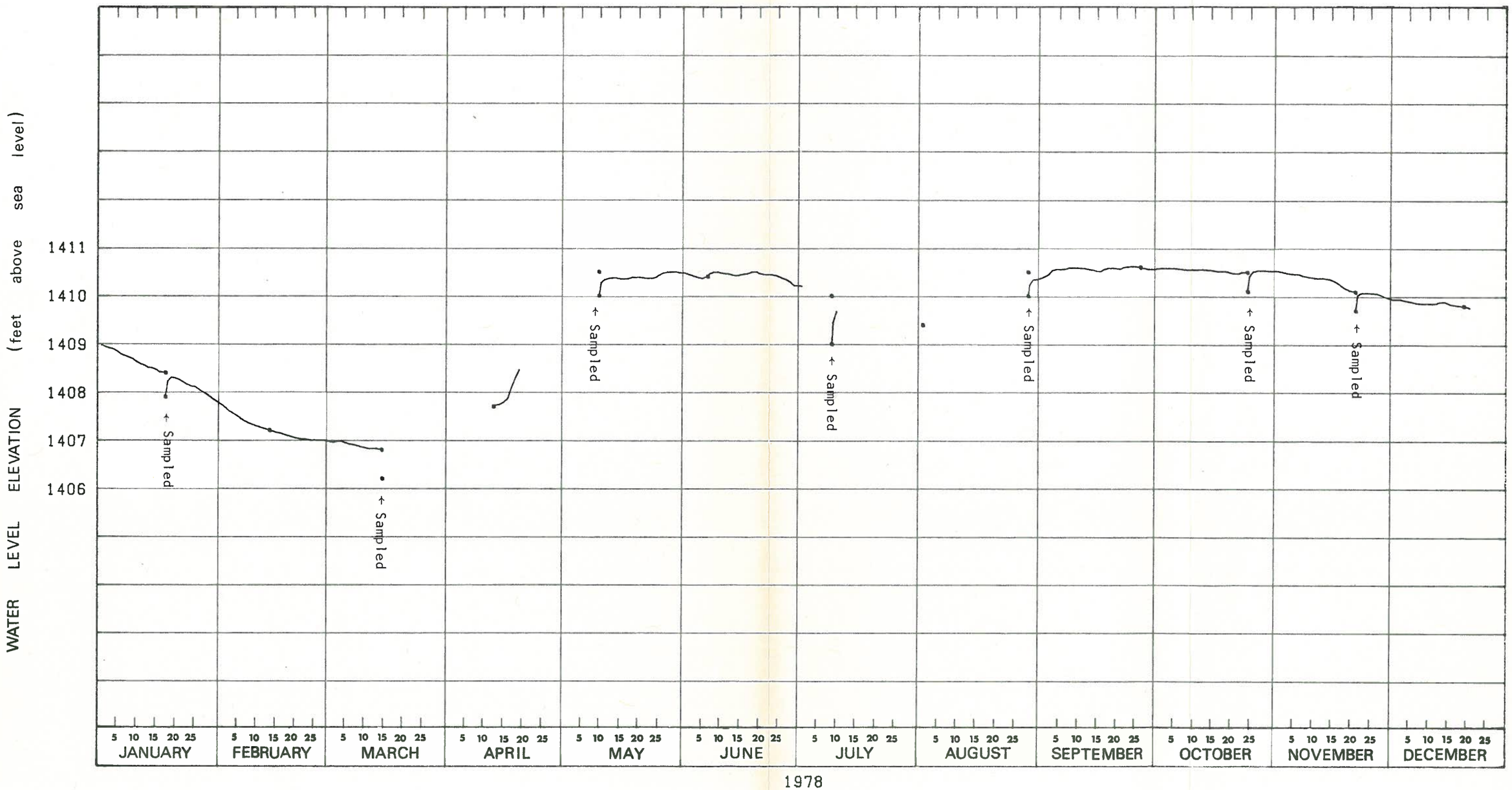
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-34

LSD 5 SEC 30 TWP 94 R 7 W4TH

8-34-H-79

Alberta Research Council



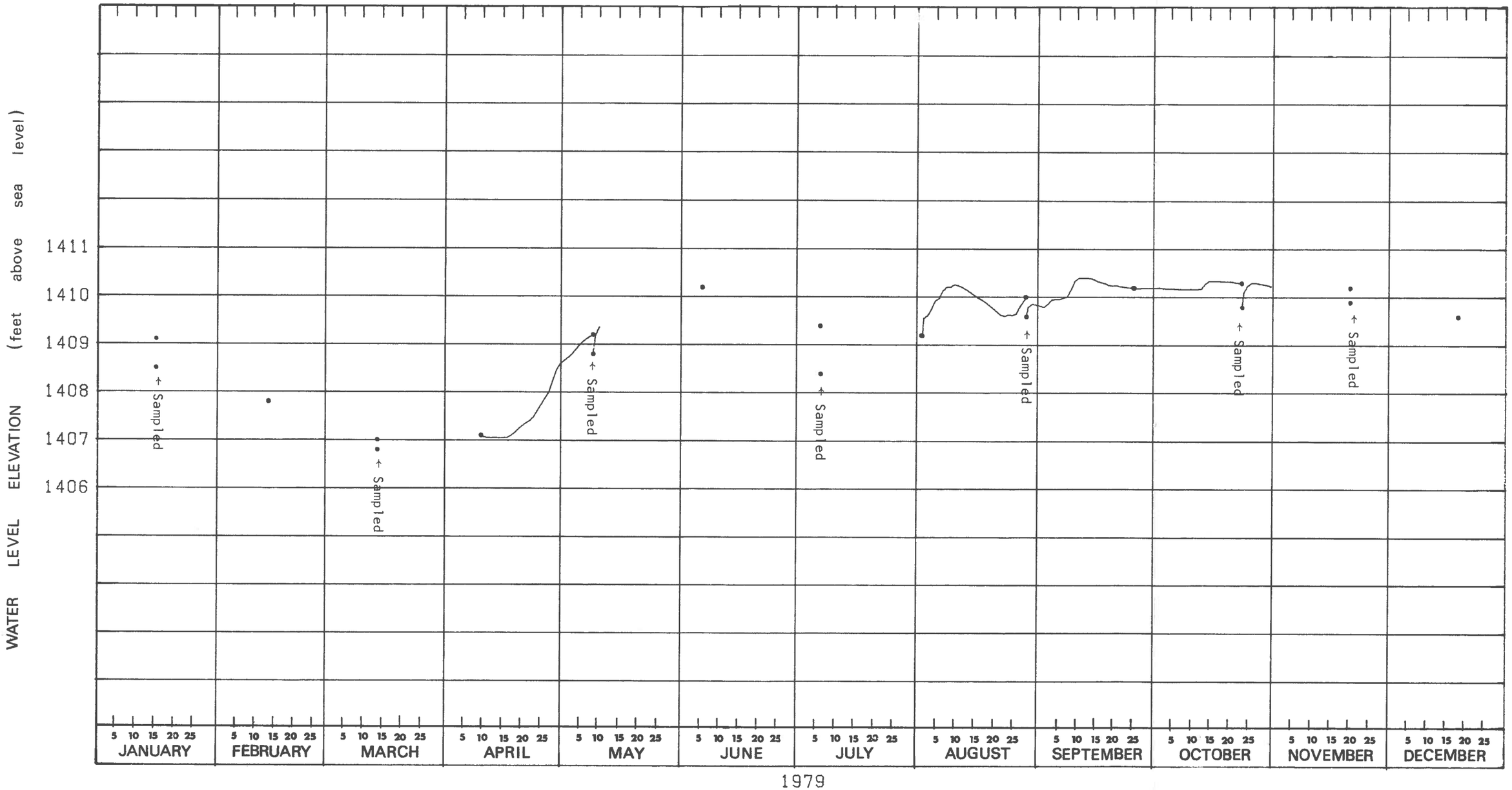
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-34-H-80



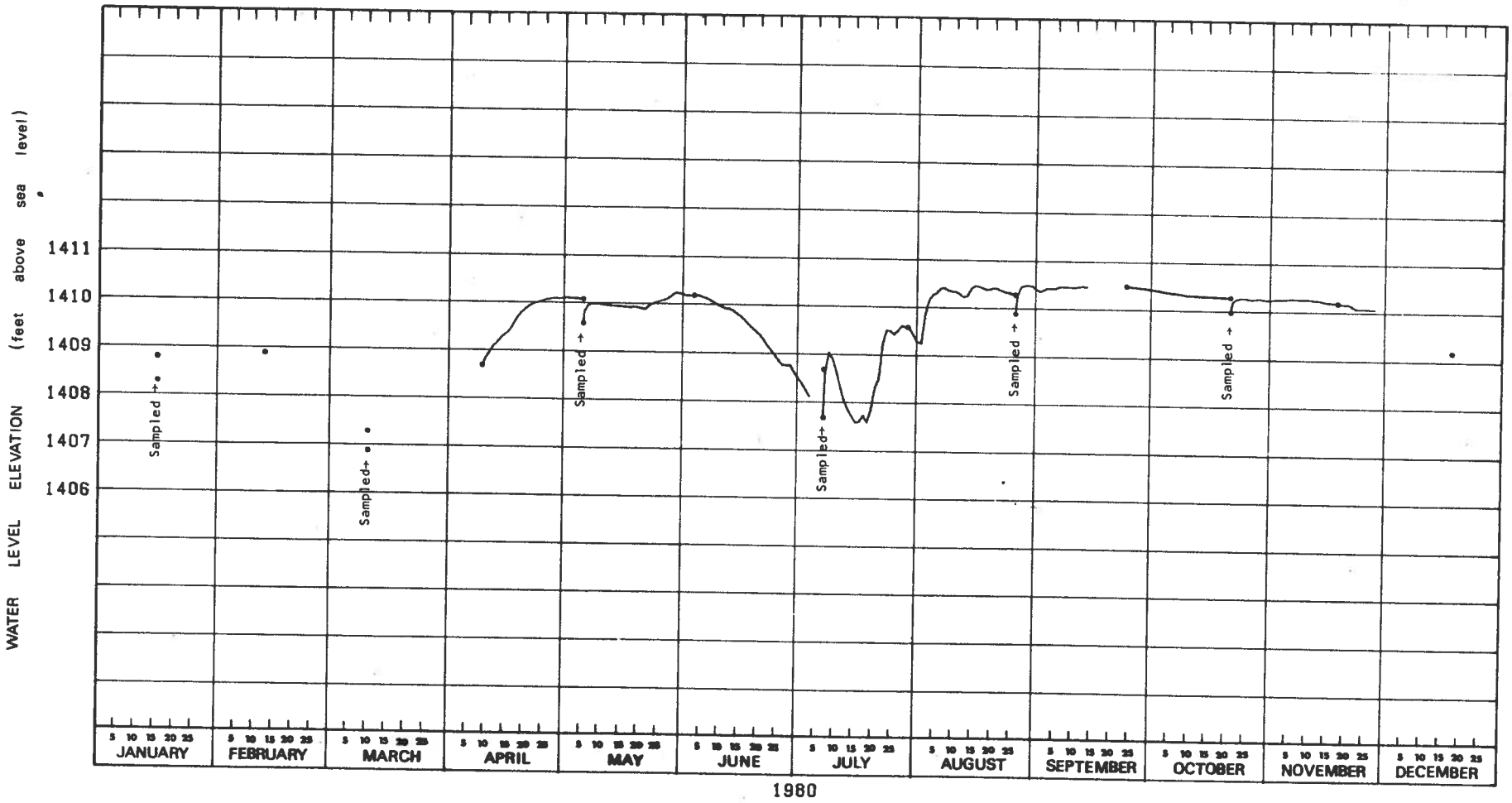
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-34-H-81



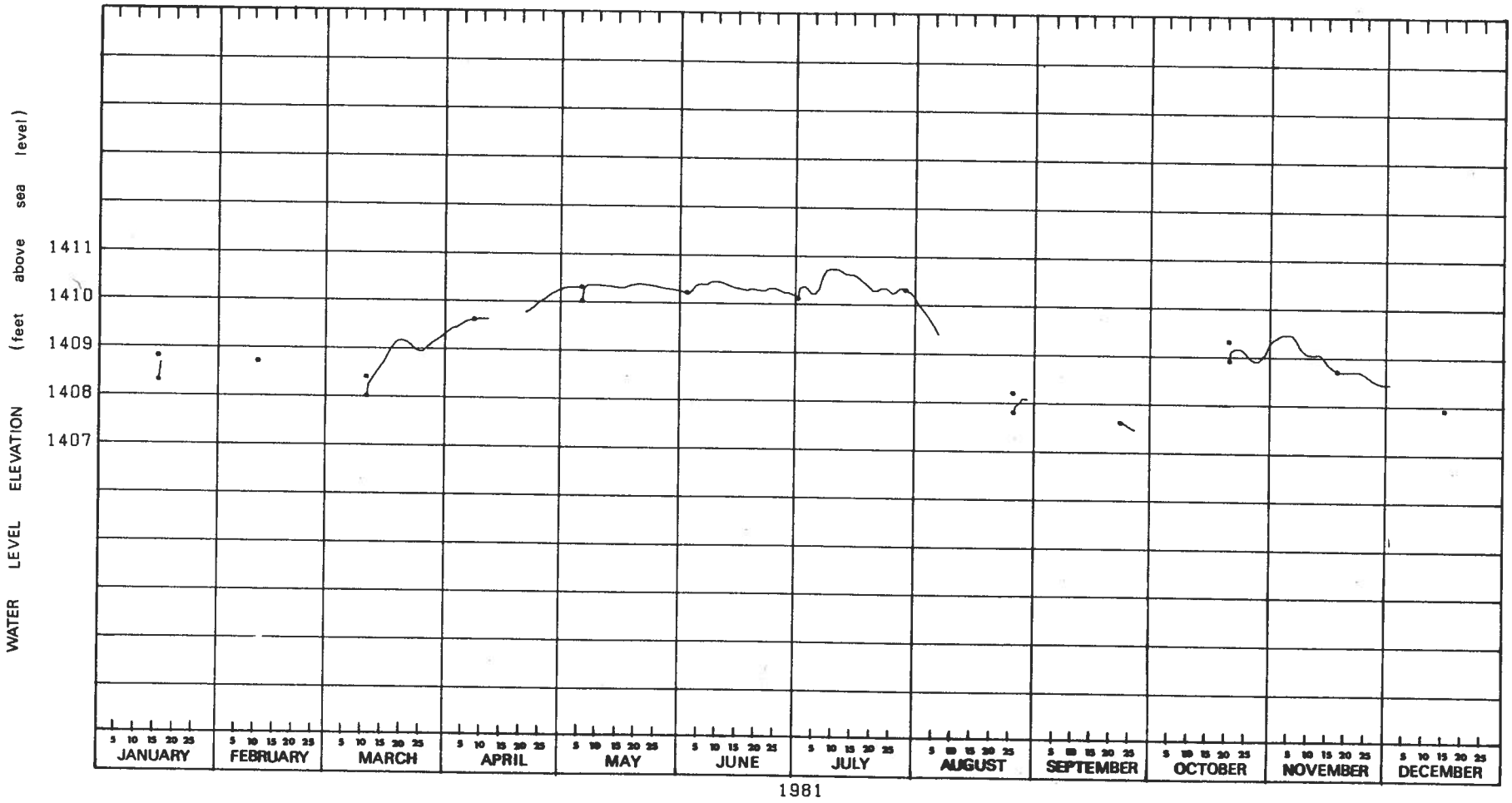
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-34-H-82



WELL HISTORY

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.18

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 9/75 | | | Well completed |
| Feb 21/75 | Frozen | | Bail 20 gallons |
| Feb 22/75 | 1.80 TOC | 1407.28 | Bail 20 gallons; water sample |
| Feb 26/75 | 1.35 MP | 1411.11 | Install shelter and recorder; MP = 2.36 TOC, (1415.54) |
| Mar 14/75 | 2.55 MP | 1407.19 | Measurement questionable |
| Apr 16/75 | 1.23 MP | 1411.48 | |
| May 13/75 | 1.23 MP | 1411.50 | |
| June 9/75 | 1.25 MP | 1411.44 | |
| July 9/75 | 1.30 MP | 1411.28 | |
| Aug 13/75 | 1.33 MP | 1411.17 | |
| Sept 10/75 | 1.20 MP | 1411.60 | Sampled well; temp. 6.5°C |
| | 1.49 MP | 1410.65 | after sample |
| Oct 7/75 | 1.20 MP | 1411.60 | |
| Nov 7/75 | 1.21 MP | 1411.57 | Frozen |
| Dec 7/75 | 1.20 MP | 1411.60 | Did not change chart; frozen |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.18

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 1.20 MP | 1411.6 | MP (1415.5); frozen |
| Feb 7/76 | 1.15 MP | 1411.7 | Frozen |
| Mar 6/76 | 1.15 MP | 1411.7 | Frozen |
| Apr 7/76 | 1.23 MP | 1411.5 | Frozen |
| May 5/76 | 1.32 MP | 1411.2 | |
| June 2/76 | 1.30 MP | 1411.2 | |
| June 23/76 | 1.45 MP | 1410.7 | |
| July 17/76 | 1.42 MP | 1410.8 | |
| | 1.74 MP | 1409.8 | After sample; temp. 6°C |
| Aug 11/76 | 1.49 MP | 1410.6 | |
| Aug 31/76 | 1.27 MP | 1411.3 | Added 1.5 gallons of kerosene; water level elevation adjusted |
| | TOC | 1412.80 | downward by .4 ft after this date |
| Sept 28/76 | 1.30 MP | 1410.8 | |
| | .80 MP | 1412.0 | Added 2 gallons of kerosene; water level elevation adjusted downward by .9 ft after this date |
| Oct 26/76 | 1.04 MP | 1411.2 | |
| | .72 MP | 1412.0 | Added 1 gallon of kerosene; water level elevation adjusted downward by 1.1 ft after this date |
| Nov 24/76 | 1.13 MP | 1410.7 | |
| | .74 MP | 1411.7 | Added 1 gallon of kerosene; water level elevation adjusted downward by 1.4 ft after this date |
| Dec 21/76 | 1.41 MP | 1409.5 | Added 1.5 gallon of kerosene; water |
| | .81 MP | 1411.0 | level elevation adjusted downward by 1.8 ft after this date |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.18

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 1.65 MP | 1408.3 | MP (1415.5); added 3 gallons of kerosene |
| | 0.95 MP | 1409.9 | Water level elevation adjusted downward by 2.5 ft after this date |
| Feb 16/77 | 1.75 MP | 1407.3 | |
| Mar 16/77 | 1.68 MP | 1407.5 | |
| Apr 14/77 | 1.07 MP | 1409.5 | |
| May 11/77 | 0.87 MP | 1410.1 | Kerosene flowed over top of casing |
| June 8/77 | 0.77 MP | 1410.5 | |
| July 9/77 | 0.76 MP | 1410.5 | |
| | 1.15 MP | 1409.2 | After sample; temp. 4°C |
| Aug 4/77 | 0.84 MP | 1410.2 | |
| Aug 31/77 | 0.85 MP | 1410.2 | |
| | 3.48 MP | 1404.2 | After sample; bailed out kerosene |
| Sept 28/77 | 1.25 MP | 1411.4 | |
| | 1.35 MP | 1408.6 | Bailed out water; added 10 gallons of kerosene; water level elevation adjusted downward by 2.5 ft after this date |
| Oct 26/77 | 0.76 MP | 1410.5 | Temp. 5.1°C |
| | 0.85 MP | 1410.2 | After sample |
| Nov 23/77 | 0.87 MP | 1410.1 | |
| | 1.00 MP | 1409.7 | After sample |
| Dec 20/77 | 1.12 MP | 1409.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.18

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 1.40 MP | 1408.4 | MP (1415.5) water level elevation adjusted downward by 2.5 ft to compensate for kerosene |
| | 1.55 MP | 1407.9 | After sample |
| Feb 14/78 | 1.76 MP | 1407.2 | |
| Mar 15/78 | 1.90 MP | 1406.8 | |
| | 2.06 MP | 1406.2 | After sample |
| Apr 13/78 | 1.60 MP | 1407.7 | |
| May 10/78 | 0.76 MP | 1410.5 | |
| | 0.90 MP | 1410.0 | After sample |
| June 7/78 | 0.80 MP | 1410.4 | |
| July 9/78 | 0.92 MP | 1410.0 | |
| | 1.21 MP | 1409.0 | After sample; temp. 4.5°C |
| Aug 2/78 | 1.09 MP | 1409.4 | |
| Aug 29/78 | 0.76 MP | 1410.5 | |
| | 0.90 MP | 1410.0 | After sample |
| Sept 27/78 | 0.73 MP | 1410.6 | |
| Oct 25/78 | 0.75 MP | 1410.5 | |
| | 0.88 MP | 1410.1 | After sample |
| Nov 22/78 | 0.87 MP | 1410.1 | |
| | 1.01 MP | 1409.7 | After sample |
| Dec 20/78 | 0.98 MP | 1409.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.18

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 1.20 MP | 1409.1 | MP (1415.5) water level elevation adjusted downward by 2.5 ft to compensate for kerosene |
| | 1.36 MP | 1408.5 | After sample |
| Feb 14/79 | 1.58 MP | 1407.8 | |
| Mar 14/79 | 1.81 MP | 1407.0 | |
| | 1.90 MP | 1406.8 | After sample |
| Apr 10/79 | 1.79 MP | 1407.1 | |
| May 9/79 | 1.15 MP | 1409.2 | |
| | 1.28 MP | 1408.8 | After sample |
| June 6/79 | 0.84 MP | 1410.2 | |
| July 7/79 | 1.10 MP | 1409.4 | |
| | 1.40 MP | 1408.4 | After sample; temp. 3°C |
| Aug 2/79 | 1.15 MP | 1409.2 | |
| Aug 29/79 | 0.92 MP | 1410.0 | |
| | 1.02 MP | 1409.6 | After sample |
| Sept 26/79 | 0.85 MP | 1410.2 | |
| Oct 24/79 | 0.83 MP | 1410.3 | |
| | 0.97 MP | 1409.8 | After sample |
| Nov 21/79 | 0.85 MP | 1410.2 | |
| | 0.95 MP | 1409.9 | After sample |
| Dec 19/79 | 1.04 MP | 1409.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.18

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 1.28 MP | 1408.8 | |
| | 1.44 MP | 1408.3 | After Sample |
| Feb 13/80 | 1.25 MP | 1408.9 | |
| Mar 11/80 | 1.74 MP | 1407.3 | |
| | 1.87 MP | 1406.9 | After Sample |
| Apr 10/80 | 1.31 MP | 1408.7 | |
| May 6/80 | 0.89 MP | 1410.1 | |
| | 1.02 MP | 1409.6 | After Sample |
| June 4/80 | 0.84 MP | 1410.2 | |
| July 8/80 | 1.31 MP | 1408.7 | Temp. 4°C |
| | 1.61 MP | 1407.7 | After Sample |
| July 30/80 | 1.03 MP | 1409.6 | |
| Aug 27/80 | 0.81 MP | 1410.3 | |
| | 0.94 MP | 1409.9 | After Sample |
| Sept 25/80 | 0.77 MP | 1410.5 | |
| Oct 22/80 | 0.82 MP | 1410.3 | |
| | 0.91 MP | 1410.0 | After Sample |
| Nov 19/80 | 0.85 MP | 1410.2 | |
| Dec 19/80 | 1.17 MP | 1409.2 | |
| Jan 16/81 | 1.29 MP | 1408.8 | |
| | 1.42 MP | 1408.3 | After Sample |
| Feb 11/81 | 1.32 MP | 1408.7 | |
| Mar 11/81 | 1.40 MP | 1408.4 | |
| | 1.53 MP | 1408.0 | After Sample |
| Apr 8/81 | 1.03 MP | 1409.6 | |
| May 6/81 | 0.83 MP | 1410.3 | |
| | 0.96 MP | 1410.0 | After Sample |
| June 2/81 | 0.86 MP | 1410.2 | |
| July 1/81 | 0.88 MP | 1410.1 | |
| July 29/81 | 0.81 MP | 1410.3 | |
| Aug 26/81 | 1.45 MP | 1408.2 | |
| | 1.59 MP | 1407.8 | After Sample |
| Sept 23/81 | 1.66 MP | 1407.6 | |
| Oct 21/81 | 1.17 MP | 1409.3 | |
| | 1.26 MP | 1408.9 | After Sample |
| Nov 18/81 | 1.32 MP | 1408.7 | |
| Dec 16/81 | 1.55 MP | 1407.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

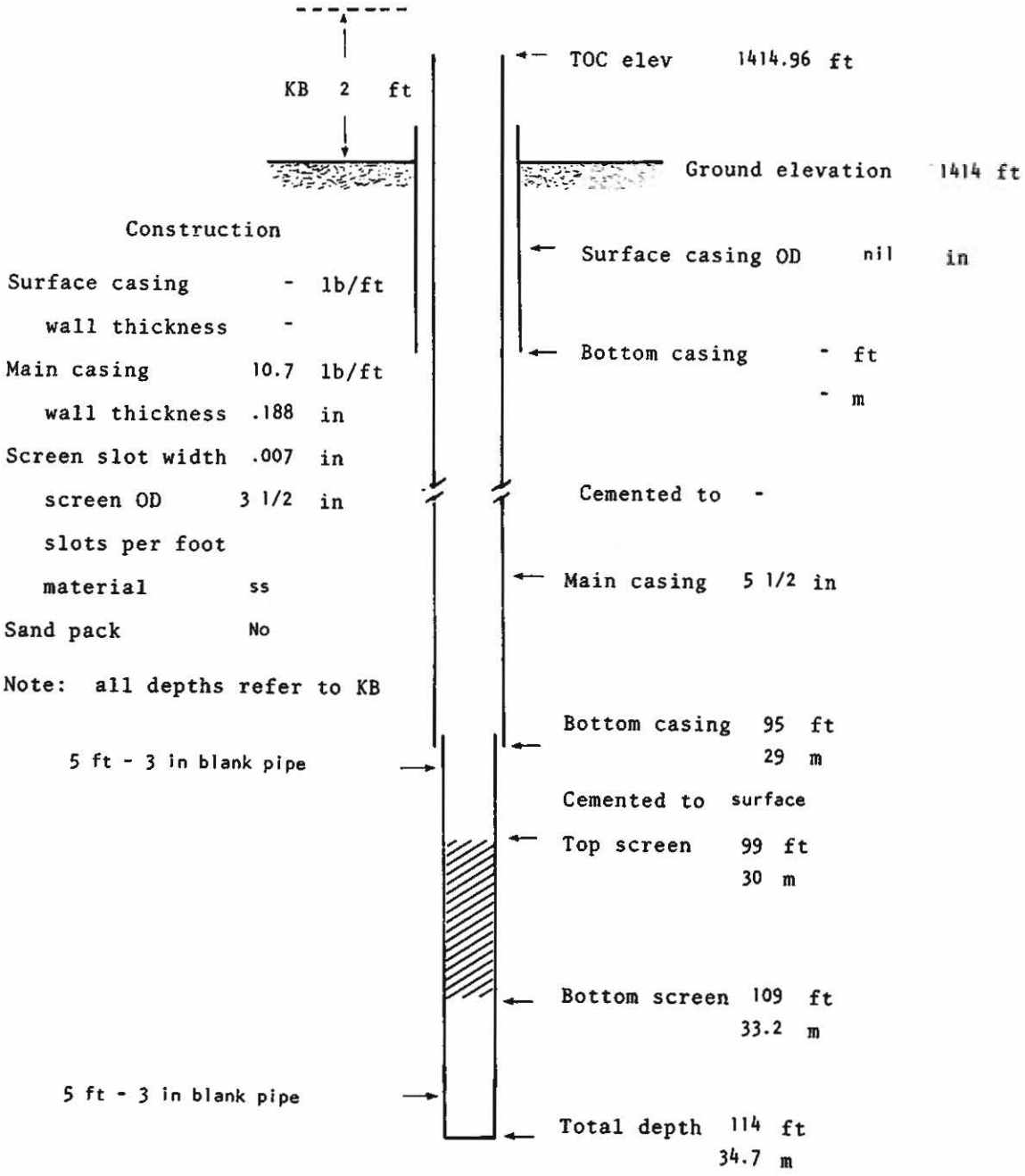
8-114-C-76

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Tp 94 R 7 W4th

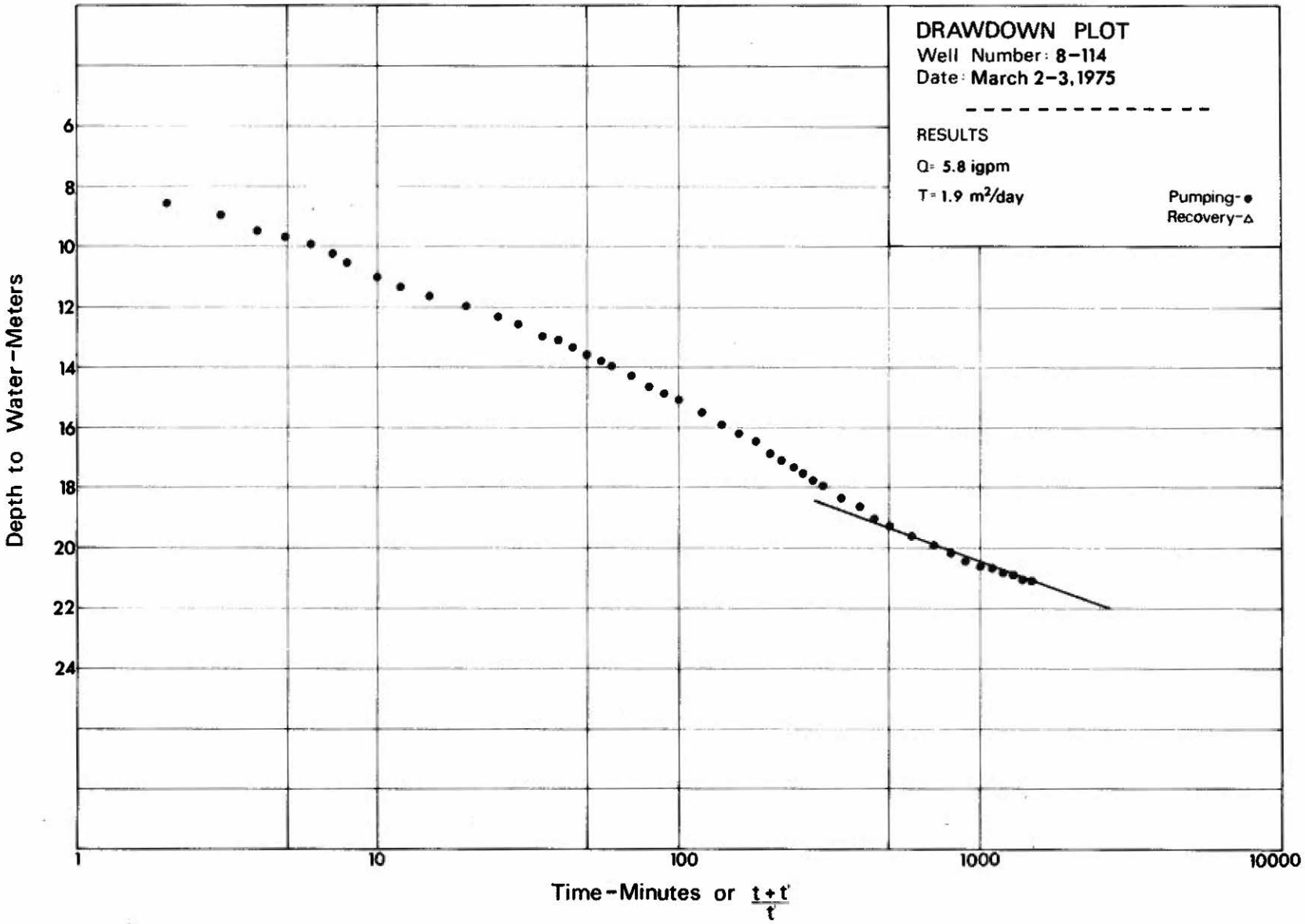
Alberta Research Council



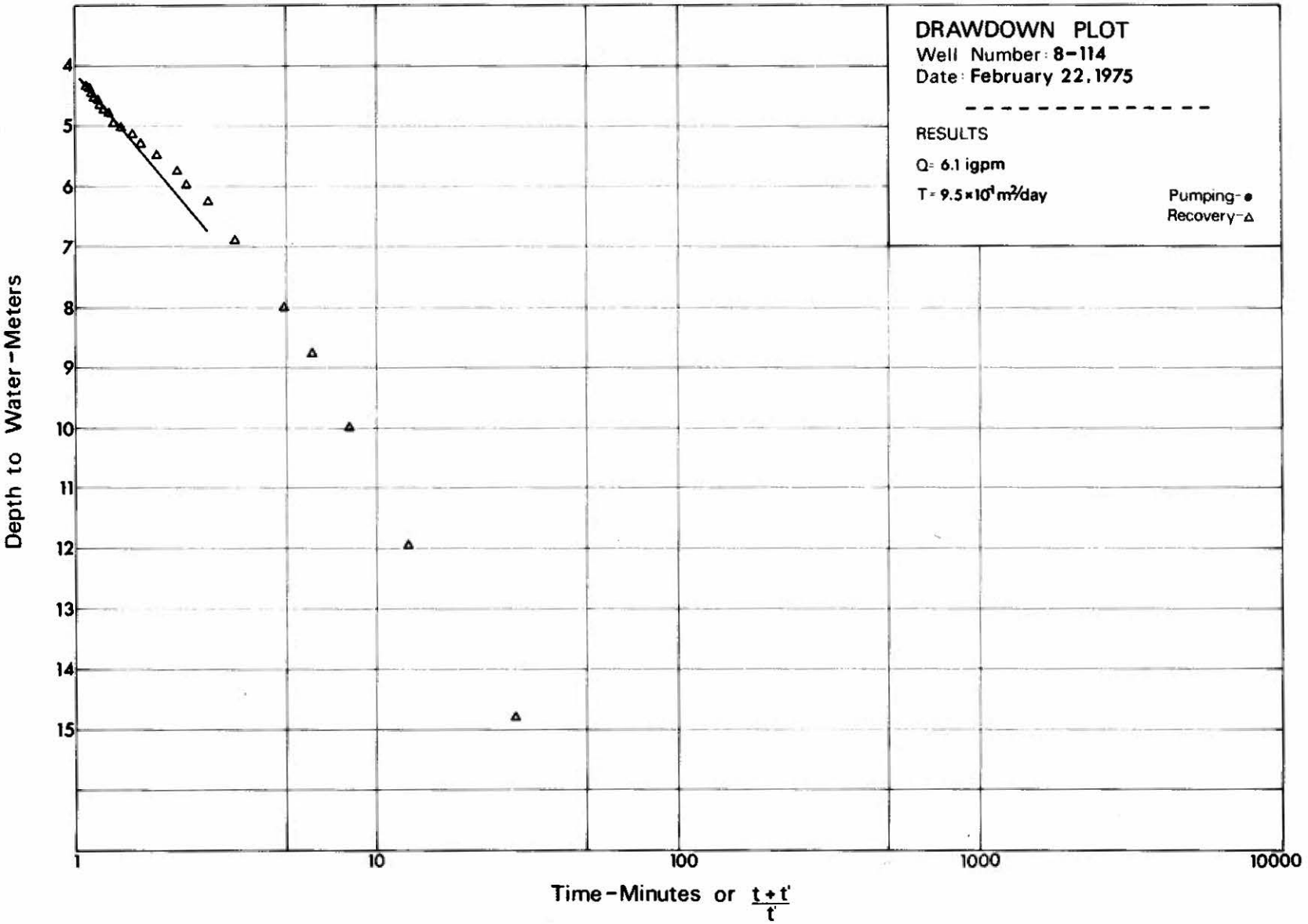

Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 10.7 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

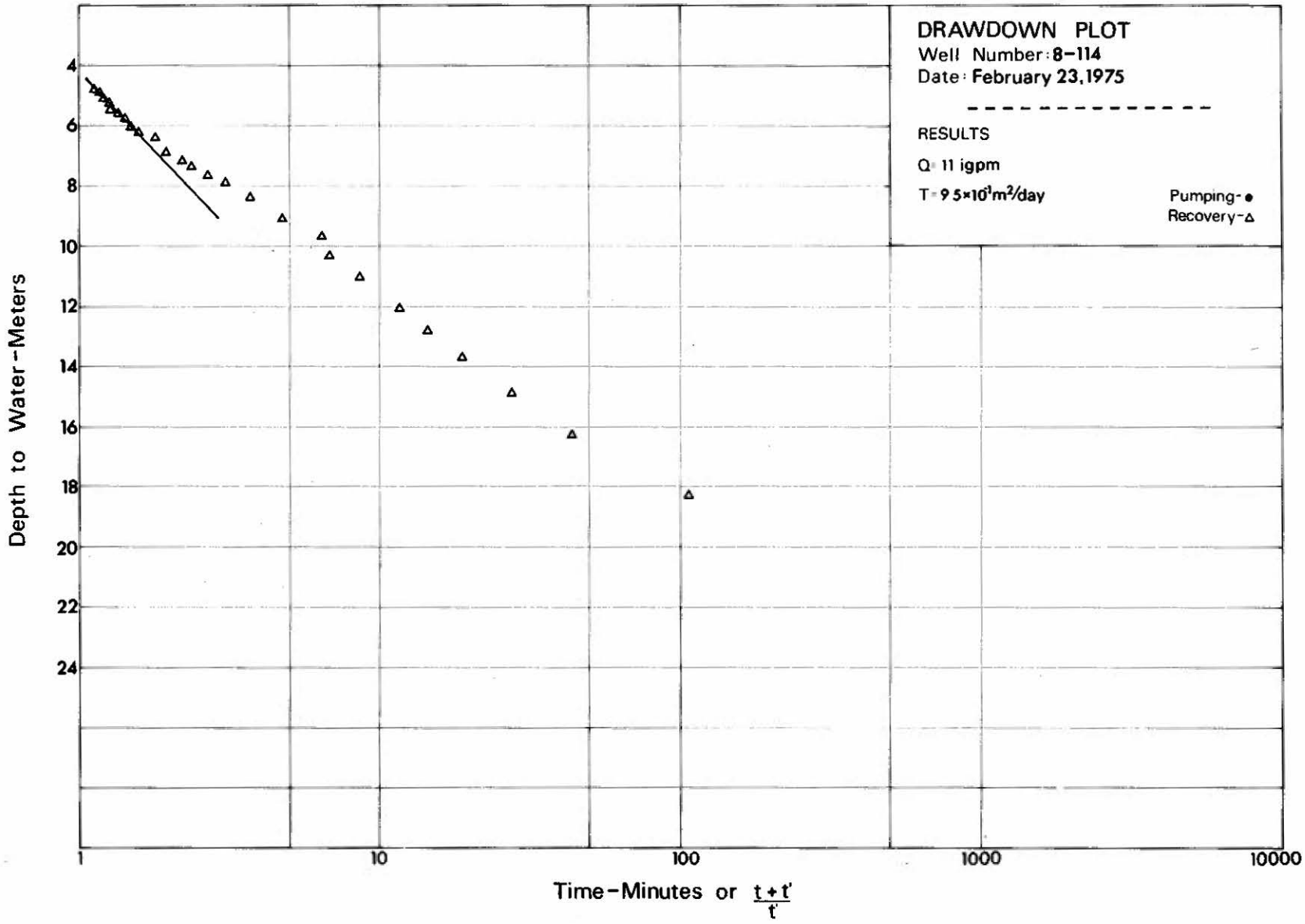
Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 8-114
Date: March 2-3, 1975
RESULTS
Q= 5.8 igpm
T= 1.9 m²/day
Pumping-●
Recovery-△
Depth to Water-Meters
6
8
10
12
14
16
18
20
22
24
1
10
100
1000
10000
Time-Minutes or (t+t')/t

8-114-A-76


DRAWDOWN PLOT
Well Number: 8-114
Date: February 22, 1975
RESULTS
Q= 6.1 igpm
T= 9.5×10¹ m²/day
Pumping-●
Recovery-△
Depth to Water-Meters
4
5
6
7
8
9
10
11
12
13
14
15
1
10
100
1000
10000
Time-Minutes or (t+t')/t'

8-114-A-76


DRAWDOWN PLOT
Well Number: 8-114
Date: February 23, 1975
RESULTS
Q = 11 igpm
T = 9.5×10³m²/day
Pumping-●
Recovery-△
Depth to Water-Meters
4
6
8
10
12
14
16
18
20
22
24
1
10
100
1000
10000
Time-Minutes or (t+t')/t'

8-114-A-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Pump test on well 8-114

Date sampled March 3, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 28 | 1.4 | 7.6 |
| Magnesium ($Mg^{++}$) | 7 | 0.6 | 3.2 |
| Sodium ($Na^{+}$) | 380 | 16.5 | 89.2 |
| Potassium ($K^{+}$) | Not analyzed | | |
| Carbonate ($CO_3^{=}$) | 431 | 14.4 | 77.8 |
| Bicarbonate ($HCO_3^{-}$) | 247 | 4.0 | 21.6 |
| Sulfate ($SO_4^{=}$) | 4 | 0.1 | 0.5 |
| Chloride ($Cl^{-}$) | 0 | 0 | 0 |
| Nitrate ($NO_3^{=}$) | Not analyzed | | |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 560 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 18.5 | Total Cations (epm) | 18.5 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | | Temperature (C) | 4.0 | |
| pH | 8.7 | pH | 8.05 | |
| Fluoride ($F^{-}$) | | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 616 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | 727 | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Pump test on well 8- 114

Date of sampling March 3, 1975

Total dissolved solids 560 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .009 | Mg | .01 |
| As | <.01 | Mn | ND |
| B | .04 | Mo | ND |
| Ba | .005 | Ni | ND |
| Be | ND | Pb | .005 |
| Bi | ND | Sb | ND |
| Ca | .1 | Si | M |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .01 | V | ND |
| Fe | .02 | Zn | .001 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed from 8-114

Date sampled February 22, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 19.6 | 0.98 | 8.0 |
| Magnesium ($Mg^{++}$) | 6.6 | 0.54 | 4.4 |
| Sodium ($Na^{+}$) | 239.0 | 10.40 | 84.8 |
| Potassium ($K^{+}$) | 13.3 | 0.34 | 2.8 |
| Carbonate ($CO_3^{=}$) | 16.8 | 0.56 | 4.4 |
| Bicarbonate ($HCO_3^{-}$) | 525.0 | 8.61 | 67.5 |
| Sulfate ($SO_4^{=}$) | 97.0 | 2.02 | 15.9 |
| Chloride ($Cl^{-}$) | 54.0 | 1.52 | 12.0 |
| Nitrate ($NO_3^{=}$) | 2.0 | 0.03 | 0.3 |
| Silica ($SiO_2$) | 11.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 692.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.740 | Total Cations (epm) | 12.257 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1100 | Temperature (C) | 3.0 |
| pH | 8.5 | pH | 9.2 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | 96 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 544 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | 1100 |

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 8 | 0.40 | 3 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 249 | 10.83 | 76 |
| Potassium ($K^{+}$) | 117 | 2.99 | 21 |
| Carbonate ($CO_3^{=}$) | 216 | 7.20 | 42 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 6 | 0.12 | 1 |
| Chloride ($Cl^{-}$) | 94 | 2.65 | 16 |
| Nitrate ($NO_3^{=}$) | 1 | 0.02 | 0 |
| Silica ($SiO_2$) | 12.2 | | |
| Hydroxide ($OH^{-}$) | 121 | 7.11 | 42 |
| Calcium (Acidified) | 8.3 | | |
| Magnesium (Acidified) | 0.8 | | |
| Total dissolved solids | 876 | | |
| Total Anions (epm) | 17.10 | Total Cations (epm) | 14.22 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2900 |
| pH | 11.3 |
| Fluoride ($F^{-}$) | 0.5 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 3.0 |
| pH | 12.2 |
| Carbonate ($CO_3^{=}$) | 192 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| Hydroxide ($OH^{-}$) | 143 ppm |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 38 Twp 97 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 8.1 | 0.40 | 3 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 238.0 | 10.35 | 75 |
| Potassium ($K^{+}$) | 117.0 | 2.99 | 22 |
| Carbonate ($CO_3^{=}$) | 192.0 | 6.40 | 73 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 41 |
| Sulfate ($SO_4^{=}$) | 3.3 | 0.07 | 1 |
| Chloride ($Cl^{-}$) | 80.0 | 2.26 | 14 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 11.3 | | |
| Hydroxide ($OH^{-}$) | 118.0 | 6.94 | 44 |
| Calcium (Acidified) | 9.0 | | |
| Magnesium (Acidified) | 0.1 | | |
| Total dissolved solids | 792 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 15.67 | Total Cations (epm) | 13.76 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2600 | Temperature (C) | 5.0 |
| pH | 11.7 | pH | 11.9 |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 120 Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 163 Mg/L |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.2 | 0.16 | 1.5 |
| Magnesium ($Mg^{++}$) | 1.9 | 0.16 | 1.5 |
| Sodium ($Na^{+}$) | 210.0 | 9.13 | 86.7 |
| Potassium ($K^{+}$) | 42.5 | 1.09 | 10.3 |
| Carbonate ($CO_3^{=}$) | 182.0 | 6.07 | 55.9 |
| Bicarbonate ($HCO_3^{-}$) | 244.0 | 4.00 | 36.9 |
| Sulfate ($SO_4^{=}$) | 7.7 | 0.16 | 1.5 |
| Chloride ($Cl^{-}$) | 22.0 | 0.62 | 5.7 |
| Nitrate ($NO_3^{=}$) | 0.1 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 2.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 7.3 | | |
| Magnesium (Acidified) | 2.5 | | |
| Total dissolved solids | 554.0 | | |
| Total Anions (epm) | 10.54 | Total Cations (epm) | 10.85 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1080 | Temperature (C) | 3.0 |
| pH | 10.1 | pH | 10.1 |
| Fluoride ($F^{-}$) | 0.6 ppm | Carbonate ($CO_3^{=}$) | 240.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 112.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

8-114-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 5.9 | 0.29 | 2.2 |
| Magnesium(Mg) | 18.5 | 1.52 | 11.6 |
| Sodium(Na) | 204.0 | 8.87 | 67.8 |
| Potassium(K) | 94.0 | 2.40 | 18.4 |
| Carbonate(CO3) | 259.0 | 8.63 | 67.3 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 9.6 | 0.20 | 1.6 |
| Chloride(Cl) | 20.0 | 0.56 | 4.4 |
| Nitrate(NO3) | 1.3 | 0.02 | 0.2 |
| Silica(SiO2) | 6.0 | | |
| Hydroxide(OH) | 58.0 | 3.41 | 26.6 |
| Calcium(Acidified) | 5.7 | | |
| Magnesium(Acidified) | 17.0 | | |
| TDS(mg/l) | 710.0 | | |
| Total Anions(epm) | 12.83 | Total Cations(epm) | 13.10 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1620 | | Temperature(C) | 4.00 | |
| pH | 11.1 | | pH | 11.6 | |
| Fluoride(F) | 0.5 | mg/l | Carbonate(CO3) | 216 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 72 | mg/l |

8-114-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3.7 | 0.18 | 1.6 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.1 |
| Sodium(Na) | 208.0 | 9.05 | 76.7 |
| Potassium(K) | 100.0 | 2.56 | 21.7 |
| Carbonate(CO3) | 161.0 | 5.37 | 41.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 6.8 | 0.14 | 1.1 |
| Chloride(Cl) | 46.0 | 1.30 | 9.9 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 8.0 | | |
| Hydroxide(OH) | 107.0 | 6.29 | 48.0 |
| Calcium(Acidified) | 7.4 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 740.0 | | |
| Total Anions(epm) | 13.10 | Total Cations(epm) | 11.80 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1850 | | Temperature(C) | 3.50 | |
| pH | 11.8 | | pH | 11.8 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | 139 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 122 | mg/l |

WATER ANALYSIS 8-114-E-82

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.0 | 0.05 | 0.4 |
| Magnesium(Mg) | 0.0 | 0.0 | 0.0 |
| Sodium(Na) | 218.0 | 9.48 | 75.7 |
| Potassium(K) | 117.0 | 3.00 | 23.9 |
| Carbonate(CO3) | 247.0 | 8.23 | 93.8 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 6.0 | 0.13 | 1.4 |
| Chloride(Cl) | 15.0 | 0.42 | 4.8 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 13.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 5.4 | | |
| Magnesium(Acidified) | 0.2 | | |
| TDS(mg/l) | 819.0 | | |
| Total Anions(epm) | 8.78 | Total Cations(epm) | 12.53 |

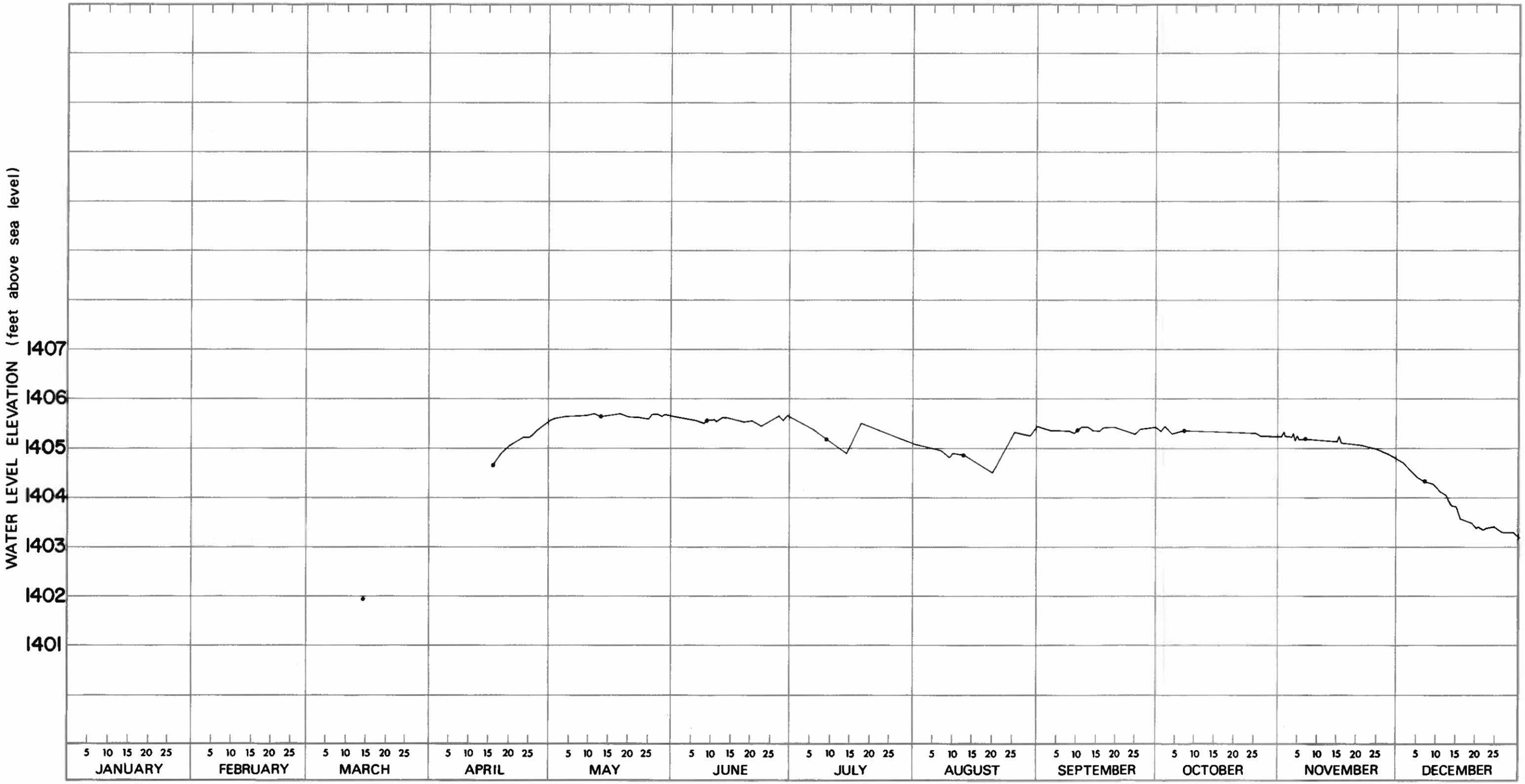
Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1950 | Temperature | 6.00 | |
| pH | 11.4 | pH | 11.8 | |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | 158 | mg/l |
| | | Bicarbonate(HCO3) | 0 | mg/l |
| | | Hydroxide(OH) | 107 | mg/l |

## WATER LEVEL HYDROGRAPH

8-114-H-76

OBSERVATION WELL NUMBER 8-114
Lsd 5 Sec 30 Twp 94 R 7 W4th
Alberta Research Council



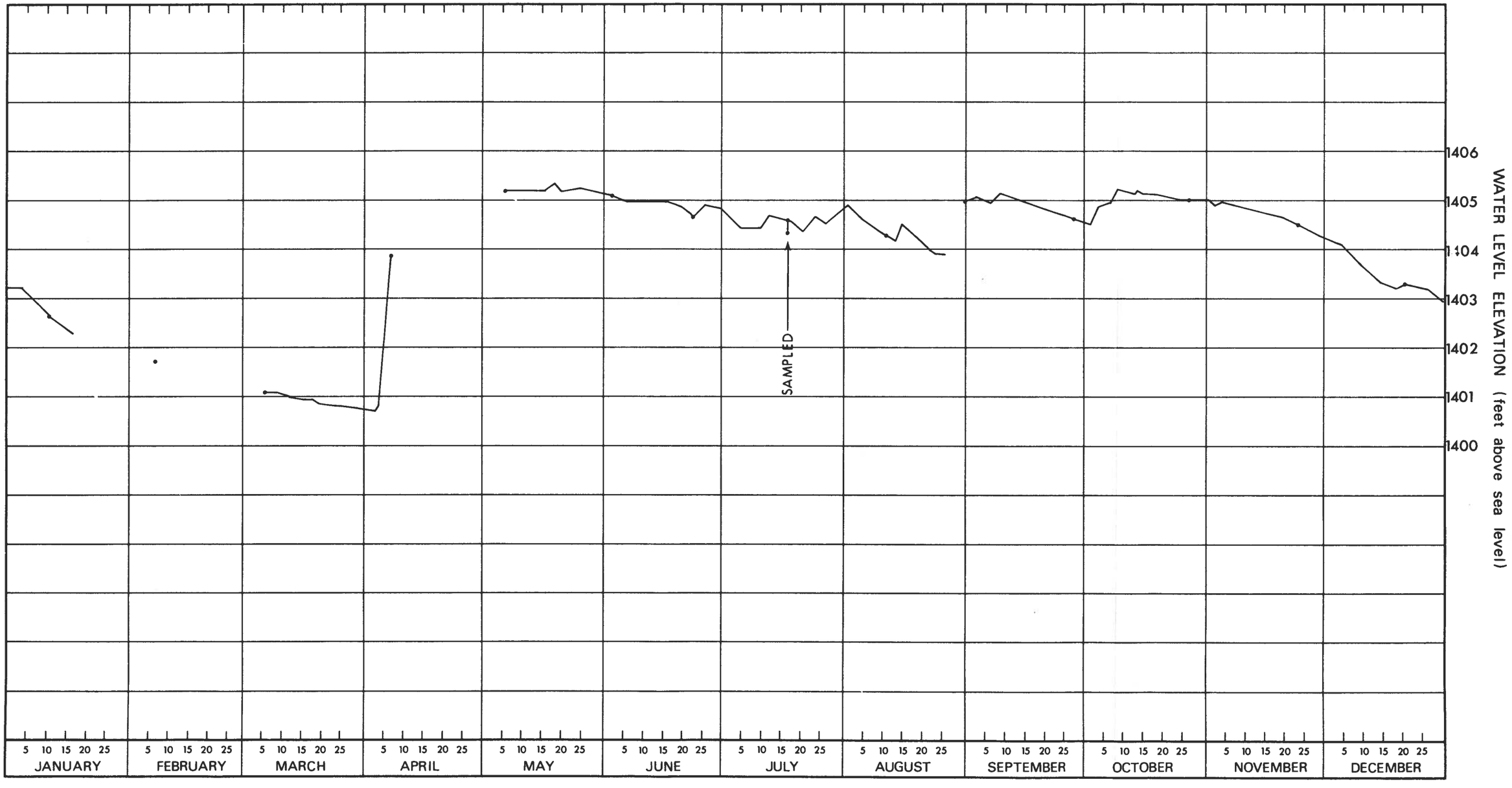
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

8 - 114 - H - 77




1976

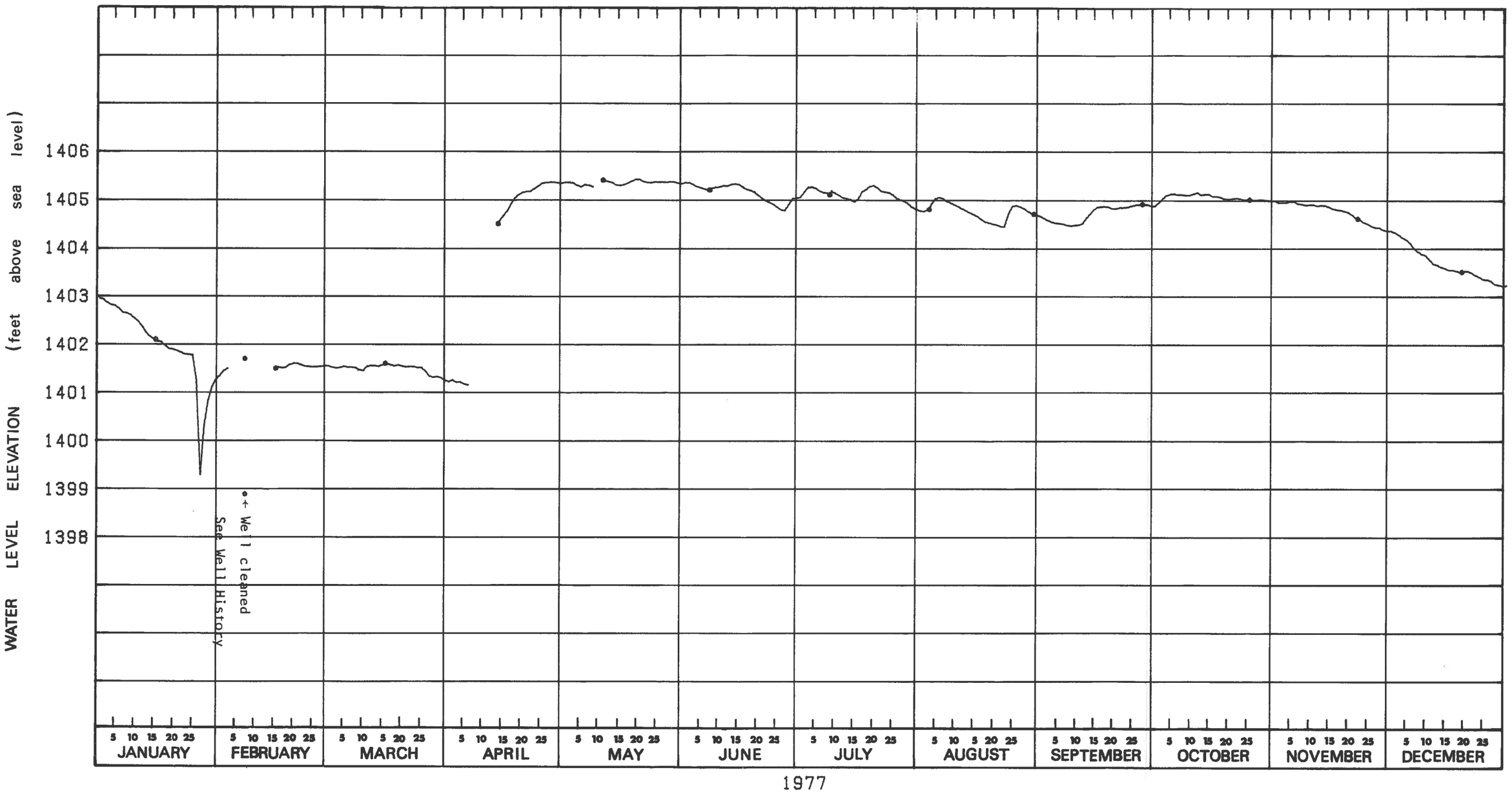
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-114-H-78




1977

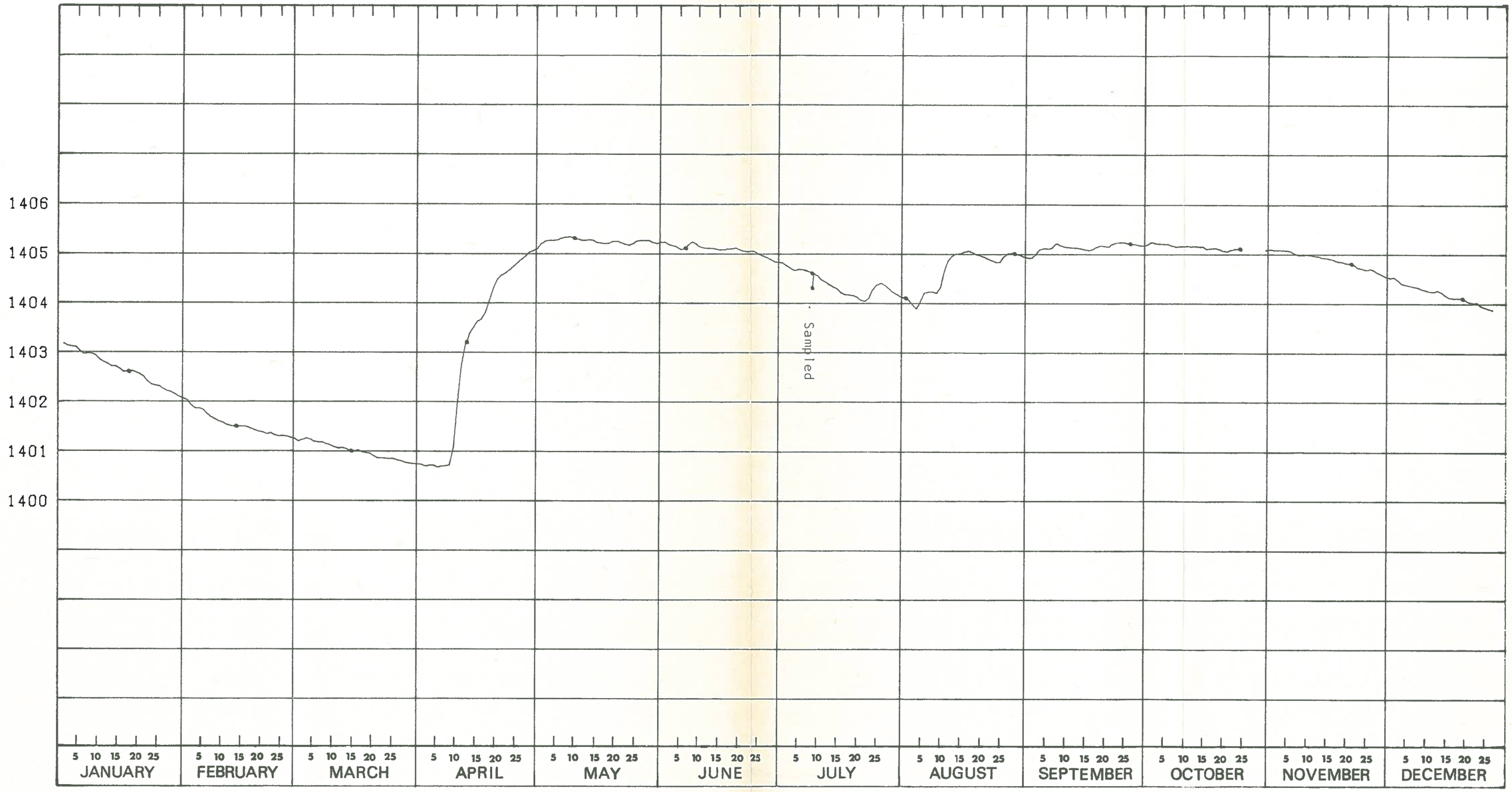
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-114

LSD 5 SEC 30 TWP 94 R 7 W4TH

8-114-H-79

Alberta Research Council




1978

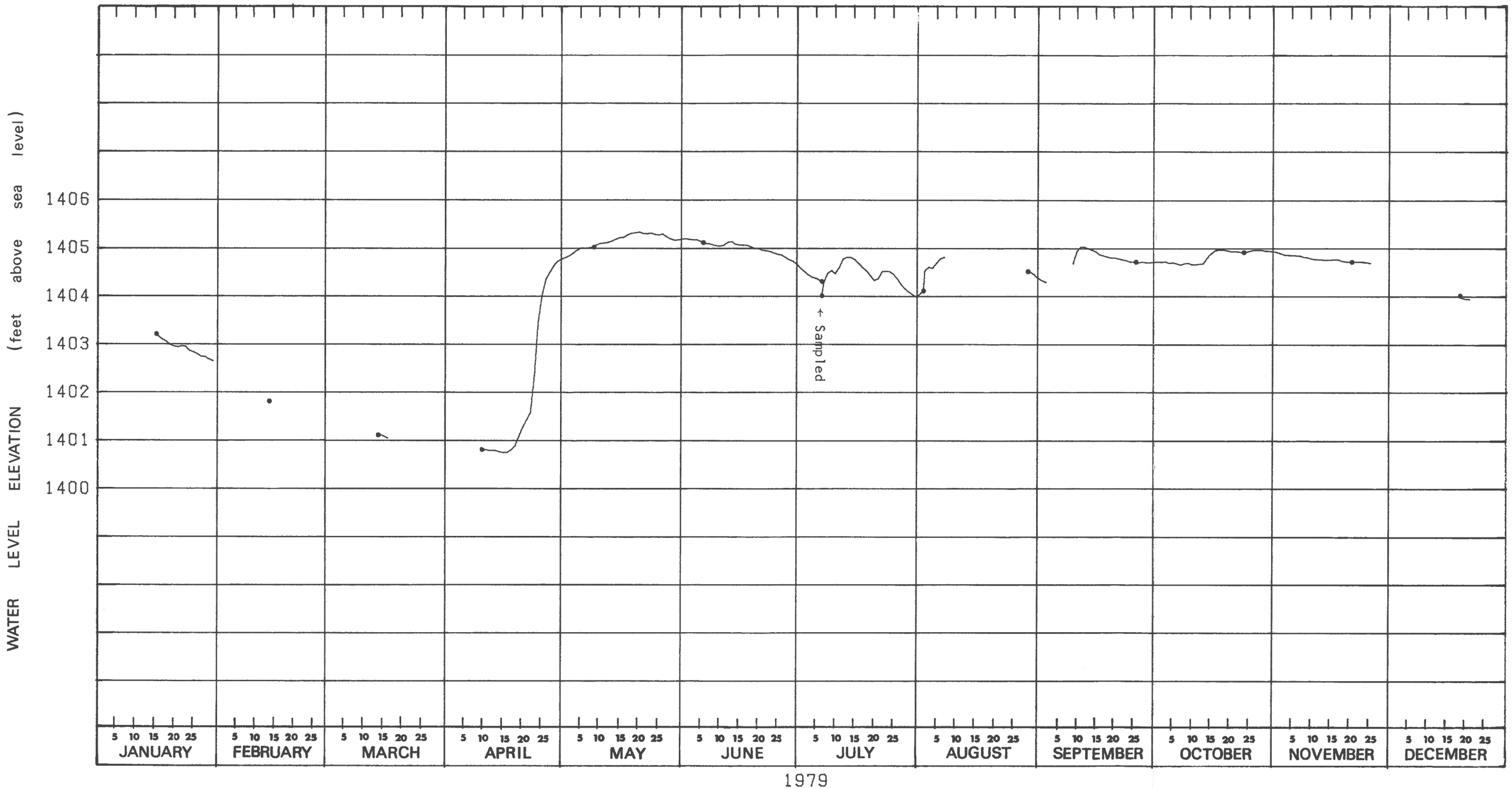
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-114

8-114-H-80

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council



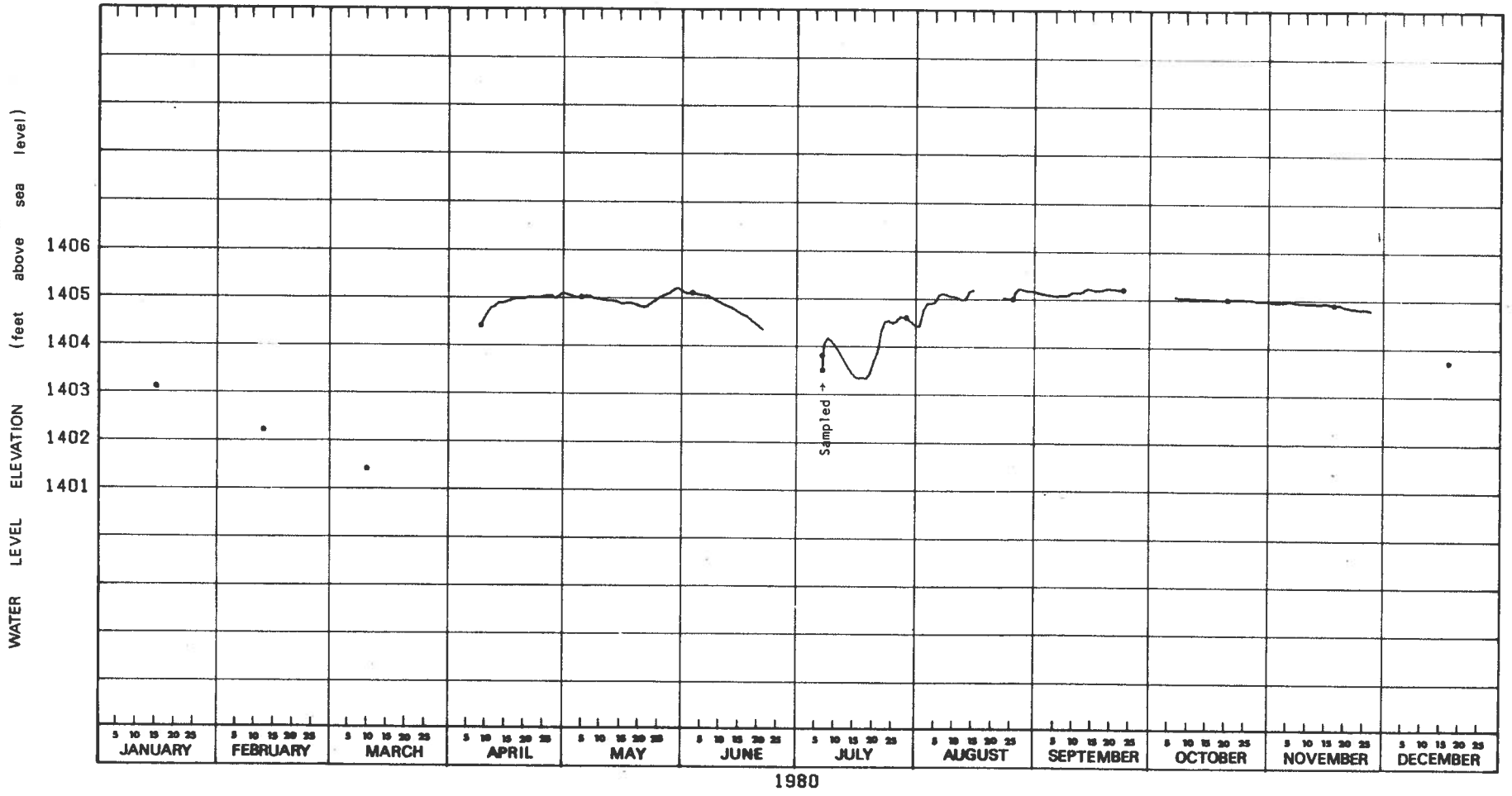
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-114-H-81



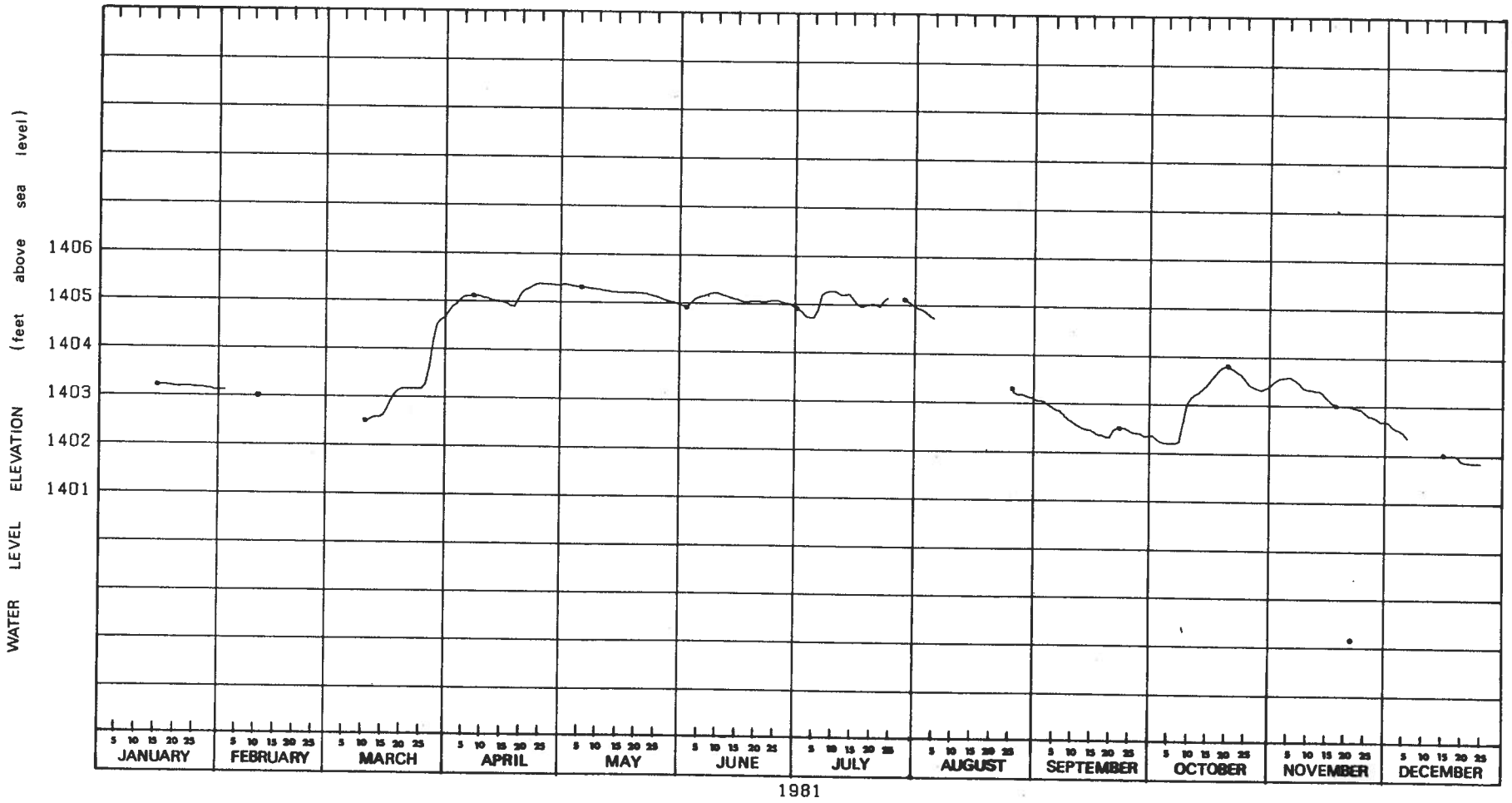
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-114-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 15/75 | | | Well completed |
| Feb 22/75 | 4.05 TOC | 1401.68 | Bail 140 gallons; producing sand; water sample |
| Feb 23/75 | 1.23 TOC | 1400.63 | Bail 820 gallons; producing sand |
| Mar 1/75 | | | Develop with air for 5 hours; production clears up; water samples |
| Mar 2/75 | 4.64 TOC | 1399.74 | Water sample; pump test @ 7 USGPM/1440 min; T = 106 USGPD/Ft |
| Mar 7/75 | 5.19 MP | 1400.73 | Install shelter and recorder; MP = 2.79 TOC, (1417.75) |
| Apr 16/75 | 3.99 MP | 1404.65 | Clock did not work from last time |
| May 13/75 | 4.22 MP | 1403.92 | |
| June 9/75 | 3.73 MP | 1405.52 | |
| July 9/75 | 3.85 MP | 1405.12 | |
| Aug 13/75 | 3.95 MP | 1404.79 | |
| Sept 10/75 | 3.79 MP | 1405.31 | Sampled well; temp. 3°C |
| | 3.82 MP | 1405.22 | after sample |
| Oct 7/75 | 3.79 MP | 1405.31 | |
| Nov 7/75 | 3.84 MP | 1405.15 | |
| Dec 7/75 | 4.10 MP | 1404.30 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 4.62 MP | 1402.6 | MP (1417.8) |
| Feb 7/76 | 4.90 MP | 1401.7 | |
| Mar 6/76 | 5.09 MP | 1401.1 | |
| Apr 7/76 | 4.25 MP | 1403.9 | |
| May 5/76 | 3.84 MP | 1405.2 | |
| June 2/76 | 3.87 MP | 1405.1 | |
| June 23/76 | 4.00 MP | 1404.7 | |
| July 17/76 | 4.02 MP | 1404.6 | |
| | 4.10 MP | 1404.3 | After sample; temp. 5°C |
| Aug 11/76 | 4.12 MP | 1404.3 | |
| Aug 31/76 | 3.90 MP | 1405.0 | |
| Sept 28/76 | 4.01 MP | 1404.6 | |
| Oct 27/76 | 3.90 MP | 1405.0 | |
| Nov 24/76 | 4.04 MP | 1404.5 | |
| Dec 21/76 | 4.43 MP | 1403.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 4.78 MP | 1402.1 | MP (1417.8) |
| Jan 27/77 | | | Treated with 70lb NU-WELL acid well conditioner |
| Feb 4/77 | | | Blown with air |
| Feb 16/77 | 4.97 MP | 1401.5 | New MP = 0.87 m TOC, (1417.8) |
| Mar 16/77 | 4.95 MP | 1401.6 | |
| Apr 14/77 | 4.06 MP | 1404.5 | |
| May 11/77 | 3.53 MP | 1405.4 | New MP = 0.62 m TOC, (1417.0) |
| June 8/77 | 3.60 MP | 1405.2 | |
| July 9/77 | 3.62 MP | 1405.1 | |
| | 3.64 MP | 1405.1 | After sample; temp. 3°C |
| Aug 4/77 | 3.72 MP | 1404.8 | |
| Aug 31/77 | 3.74 MP | 1404.7 | |
| Sept 28/77 | 3.68 MP | 1404.9 | |
| Oct 26/77 | 3.65 MP | 1405.0 | Temp. 3.1°C |
| Nov 23/77 | 3.79 MP | 1404.6 | |
| Dec 20/77 | 4.11 MP | 1403.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 4.40 MP | 1402.6 | MP (1417.0) |
| Feb 14/78 | 4.72 MP | 1401.5 | |
| Mar 15/78 | 4.89 MP | 1401.0 | |
| Apr 13/78 | 4.20 MP | 1403.2 | |
| May 10/78 | 3.57 MP | 1405.3 | |
| June 7/78 | 3.63 MP | 1405.1 | |
| July 9/78 | 3.77 MP | 1404.6 | |
| | 3.87 MP | 1404.3 | After sample; temp. 4°C |
| Aug 2/78 | 3.92 MP | 1404.1 | |
| Aug 29/78 | 3.65 MP | 1405.0 | |
| Sept 27/78 | 3.61 MP | 1405.2 | |
| Oct 25/78 | 3.62 MP | 1405.1 | |
| Nov 22/78 | 3.73 MP | 1404.8 | |
| Dec 20/78 | 3.92 MP | 1404.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 4.22 MP | 1403.2 | MP (1417.0) |
| Feb 14/79 | 4.62 MP | 1401.8 | |
| Mar 14/79 | 4.85 MP | 1401.1 | |
| Apr 10/79 | 4.95 MP | 1400.8 | |
| May 9/79 | 3.66 MP | 1405.0 | |
| June 6/79 | 3.63 MP | 1405.1 | |
| July 7/79 | 3.87 MP | 1404.3 | |
| | 3.96 MP | 1404.0 | After sample; temp. 3.5°C |
| Aug 2/79 | 3.94 MP | 1404.1 | |
| Aug 29/79 | 3.81 MP | 1404.5 | |
| Sept 26/79 | 3.74 MP | 1404.7 | |
| Oct 24/79 | 3.69 MP | 1404.9 | |
| Nov 21/79 | 3.75 MP | 1404.7 | |
| Dec 19/79 | 3.97 MP | 1404.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 4.24 MP | 1403.1 | |
| Feb 13/80 | 4.50 MP | 1402.2 | |
| Mar 11/80 | 4.74 MP | 1401.4 | |
| Apr 10/80 | 3.85 MP | 1404.4 | |
| May 6/80 | 3.65 MP | 1405.0 | |
| June 4/80 | 3.62 MP | 1405.1 | |
| July 8/80 | 4.02 MP | 1403.8 | Temp. 6°C |
| | 4.10 MP | 1403.5 | After Sample |
| July 30/80 | 3.78 MP | 1404.6 | |
| Aug 27/80 | 3.66 MP | 1405.0 | |
| Sept 25/80 | 3.61 MP | 1405.2 | |
| Oct 22/80 | 3.67 MP | 1405.0 | |
| Nov 19/80 | 3.70 MP | 1404.9 | |
| Dec 19/80 | 4.04 MP | 1403.7 | |
| Jan 16/81 | 4.20 MP | 1403.2 | |
| Feb 11/81 | 4.28 MP | 1403.0 | |
| Mar 11/81 | 4.41 MP | 1402.5 | |
| Apr 8/81 | 3.63 MP | 1405.1 | |
| May 6/81 | 3.58 MP | 1405.3 | |
| June 2/81 | 3.69 MP | 1404.9 | |
| July 1/81 | 3.70 MP | 1404.9 | |
| July 29/81 | 3.64 MP | 1405.1 | |
| Aug 26/81 | 4.18 MP | 1403.3 | |
| Sept 23/81 | 4.43 MP | 1402.5 | |
| Oct 21/81 | 4.02 MP | 1403.8 | |
| Nov 18/81 | 4.26 MP | 1403.0 | |
| Dec 16/81 | 4.56 MP | 1402.0 | |

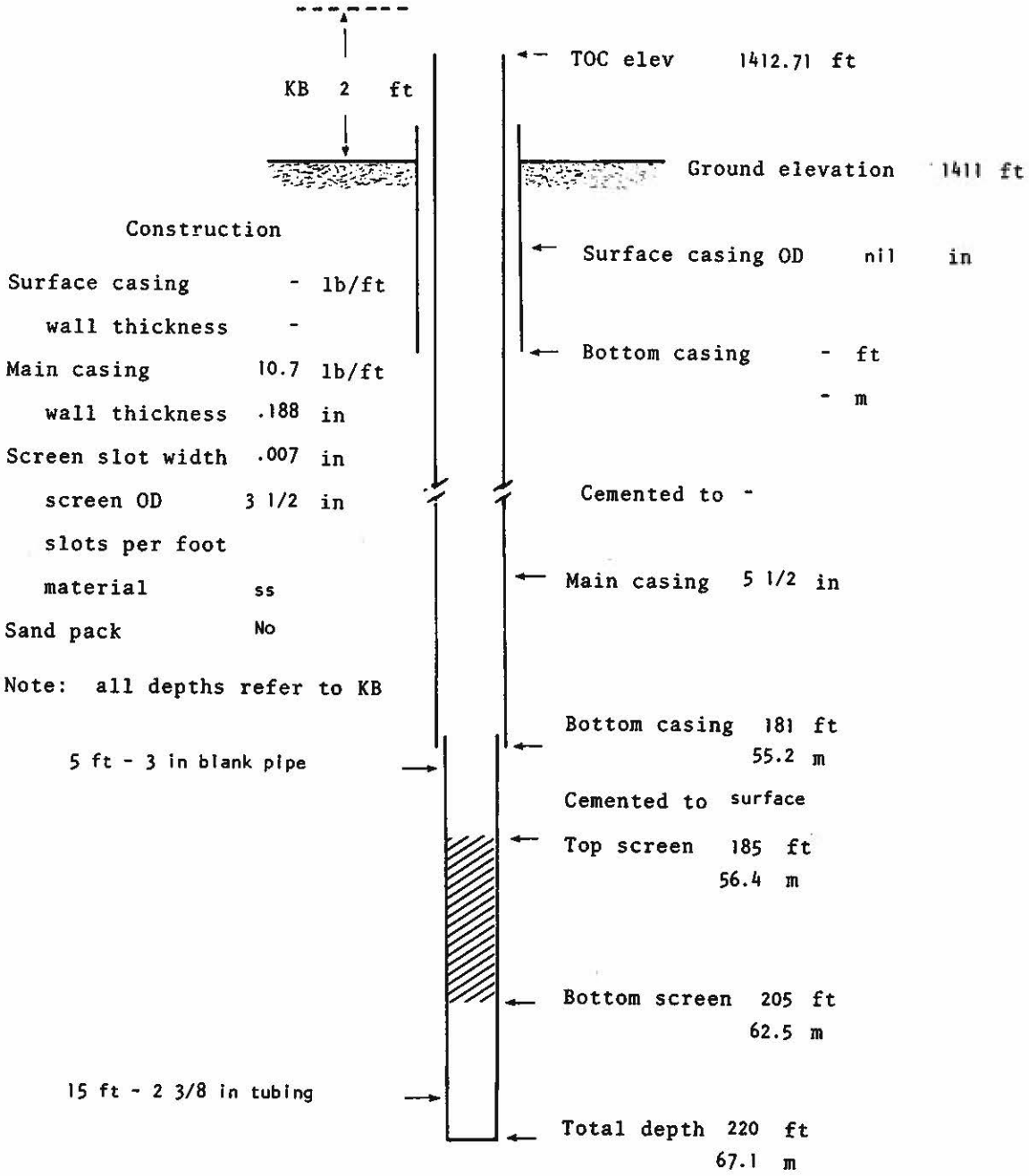
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Tp 94 R 7 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 10.7 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

# DRILL STEM TEST

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Tp 94 R 7 W4th

Alberta Research Council

Elevation: gl 1411
KB 1413

Type of test - Casing Positrieve

Date of test March 6, 1975

Testing company Johnston Testers

## TEST DATA

| | | |
|---|---|---|
| Time started | 0900 | hrs |
| Tool opened | 0949 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 45 | min |
| Final shut in | 45 | min |
| Pulled loose at | 1230 | hrs |
| Out of hole at | 1300 | hrs |
| Wt on packers | 3000 | lbs |

Description of blow Strong initial puff, gas to surface in 1 minute.

Total water recovered 15 ft

Water sample No. -

Gas blow Yes, T S T M

Remarks Test satisfactory
5-1/2" RBP set @ 165'

## HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 185 - 205

Formation tested Clearwater

## TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

## PRESSURE DATA (psi)

| Instrument No. | | RPG-92N | RPG-89N |
|---|---|---|---|
| Capacity (psig) | | 431 | 400 |
| Instrument set at (ft) | | 169 | 177 |
| Initial hydrostatic | A | 35 | 37 |
| First flow | B | 12 | 18 |
| | B1 | 12 | 18 |
| Initial shut in | C | 25 | 27 |
| Second flow | D | 14 | 18 |
| | D1 | 22 | 25 |
| Final shut in | G | 26 | 27 |
| Final hydrostatic | H | 31 | 30 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

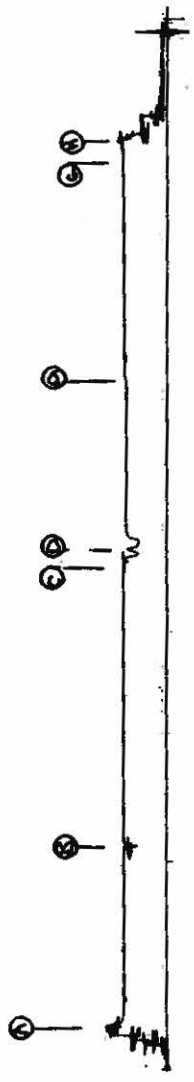
OBSERVATION WELL NUMBER 8-220

PRESSURE INCREMENTS

Recorder RPG-89N

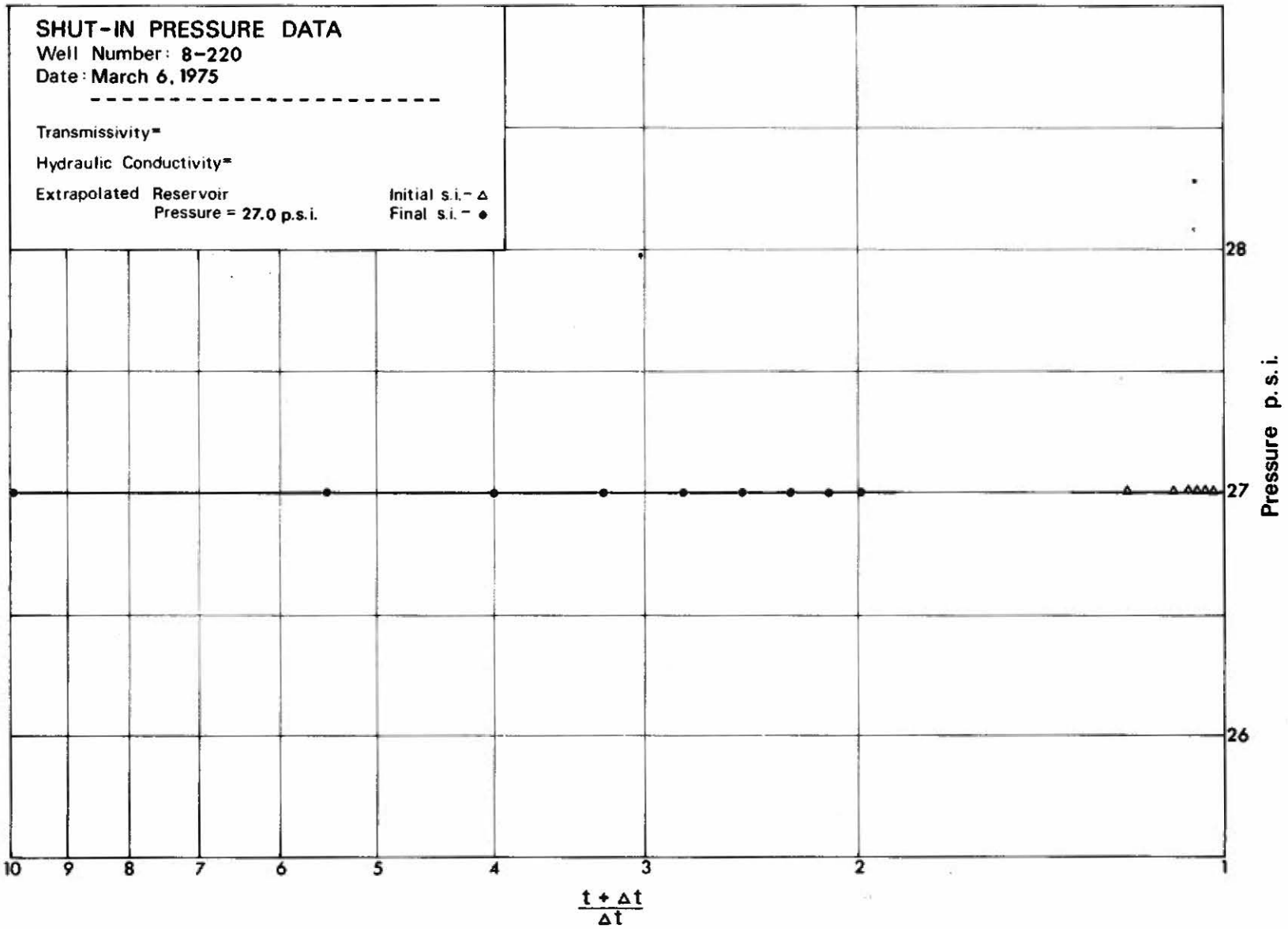
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 27 | 1.20 |
| 10 | 27 | 1.10 |
| 15 | 27 | 1.07 |
| 20 | 27 | 1.05 |
| 25 | 27 | 1.04 |
| 30 | 27 | 1.033 |



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 27 | 10.00 |
| 10 | 27 | 5.50 |
| 15 | 27 | 4.00 |
| 20 | 27 | 3.25 |
| 25 | 27 | 2.80 |
| 30 | 27 | 2.50 |
| 35 | 27 | 2.29 |
| 40 | 27 | 2.125 |
| 45 | 27 | 2.000 |


SHUT-IN PRESSURE DATA
Well Number: 8-220
Date: March 6, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 27.0 p.s.i.
Initial s.i.- Δ
Final s.i. - ●
28
27
26
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

8-220-D-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Drill Stem test on 8-220

Date sampled March 6, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 34.0 | 1.70 | 4.8 |
| Magnesium ($Mg^{++}$) | 3.2 | 0.26 | 0.7 |
| Sodium ($Na^{+}$) | 700.0 | 30.45 | 86.0 |
| Potassium ($K^{+}$) | 117.00 | 2.99 | 8.5 |
| Carbonate ($CO_3^{=}$) | 9.6 | 0.32 | 1.0 |
| Bicarbonate ($HCO_3^{-}$) | 1898.0 | 31.11 | 96.3 |
| Sulfate ($SO_4^{=}$) | 5.7 | 0.12 | 0.4 |
| Chloride ($Cl^{-}$) | 4.0 | 0.11 | 0.3 |
| Nitrate ($NO_3^{=}$) | 39.3 | 0.63 | 2.0 |
| Silica ($SiO_2$) | 24.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 3058.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 32.295 | Total Cations (epm) | 35.401 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1800 | Temperature (C) | 2.0 |
| pH | 8.4 | pH | 8.5 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | 94.4 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 2072.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed from 8-220

Date sampled February 23, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 44.4 | 2.22 | 9.9 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0.0 |
| Sodium ($Na^{+}$) | 403.0 | 17.53 | 78.6 |
| Potassium ($K^{+}$) | 100.0 | 2.56 | 11.5 |
| Carbonate ($CO_3^{=}$) | 53.0 | 1.77 | 7.3 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 103.0 | 2.14 | 8.9 |
| Chloride ($Cl^{-}$) | 87.0 | 2.45 | 10.1 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 18.5 | | |
| Hydroxide ($OH^{-}$) | 303.0 | 17.81 | 73.7 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1236.0 | | |
| Total Anions (epm) 24.178 | | Total Cations (epm) | 22.311 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 5000.0 | Temperature (C) | 4.00 | |
| pH | 12.1 | pH | 7.3 | |
| Fluoride ($F^{-}$) | 0.30 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1413 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | 3500 | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Drill stem test on well 8-220

Date of sampling March 6, 1975

Total dissolved solids 3058 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | .01 |
| Al | .1 | Mg | .05 |
| As | <.01 | Mn | .002 |
| B | .03 | Mo | ND |
| Ba | .01 | Ni | .02 |
| Be | ND | Pb | M |
| Bi | ND | Sb | ND |
| Ca | M | Si | M |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | .001 |
| Cu | .01 | V | .02 |
| Fe | .1 | Zn | M |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.6 | 0.18 | 1 |
| Magnesium ($Mg^{++}$) | 2.3 | 0.19 | 1 |
| Sodium ($Na^{+}$) | 601.0 | 26.14 | 98 |
| Potassium ($K^{+}$) | 7.9 | 0.20 | 1 |
| Carbonate ($CO_3^{=}$) | 21.6 | 0.72 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 1274.0 | 20.88 | 79 |
| Sulfate ($SO_4^{=}$) | 9.6 | 0.20 | 1 |
| Chloride ($Cl^{-}$) | 158.0 | 4.46 | 17 |
| Nitrate ($NO_3^{=}$) | 7.8 | 0.13 | 1 |
| Silica ($SiO_2$) | 5.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 4.0 | | |
| Magnesium (Acidified) | 2.1 | | |
| Total dissolved solids | 1000 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 26.38 | Total Cations (epm) | 26.71 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 5.0 | |
| pH | 8.4 | pH | 8.7 | |
| Fluoride ($F^{-}$) | 1.1 Mg/L | Carbonate ($CO_3^{=}$) | 57 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 1235 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 7.9 | 0.39 | 1.4 |
| Magnesium ($Mg^{++}$) | 2.1 | 0.17 | 0.6 |
| Sodium ($Na^{+}$) | 638.0 | 27.75 | 97.5 |
| Potassium ($K^{+}$) | 5.8 | 0.15 | 0.5 |
| Carbonate ($CO_3^{=}$) | 43.2 | 1.44 | 4.9 |
| Bicarbonate ($HCO_3^{-}$) | 1340.0 | 21.96 | 74.8 |
| Sulfate ($SO_4^{=}$) | 33.8 | 0.70 | 2.4 |
| Chloride ($Cl^{-}$) | 184.0 | 5.19 | 17.7 |
| Nitrate ($NO_3^{=}$) | 3.7 | 0.06 | 0.2 |
| Silica ($SiO_2$) | 6.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 12.2 | | |
| Magnesium (Acidified) | 1.7 | | |
| Total dissolved solids | 1570.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 29.36 | Total Cations (epm) | 28.47 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2700 | Temperature (C) | 5.0 |
| pH | 8.7 | pH | 8.8 |
| Fluoride ($F^{-}$) | 1.3 ppm | Carbonate ($CO_3^{=}$) | 77.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1279.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Date sampled: July/7, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .002 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 595 |
| As | <.038 | Ni | <.010 |
| B | 3.63 | P | .66 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 4.31 | Si | 3.07 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .160 |
| Cr | <.006 | Te | <.065 |
| Cu | .012 | Ti | .059 |
| Eu | <.015 | U | <.020 |
| Fe | .957 | V | .019 |
| K | <.150 | W | <.078 |
| Mg | 1.79 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 6.1 | 0.30 | 1.1 |
| Magnesium(Mg) | 1.8 | 0.15 | 0.6 |
| Sodium(Na) | 604.0 | 26.27 | 98.0 |
| Potassium(K) | 3.8 | 0.10 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1386.0 | 22.72 | 81.2 |
| Sulphate(SO4) | 5.2 | 0.11 | 0.4 |
| Chloride(Cl) | 180.0 | 5.08 | 18.2 |
| Nitrate(NO3) | 3.9 | 0.06 | 0.2 |
| Silica(SiO2) | 6.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 7.4 | | |
| Magnesium(Acidified) | 2.1 | | |
| TDS(mg/l) | 1540.0 | | |
| Total Anions(epm) | 27.96 | Total Cations(epm) | 26.82 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2230 | Temperature(C) | 8.00 | |
| pH | 8.3 | pH | 8.6 | |
| Fluoride(F) | 1.3 mg/l | Carbonate(CO3) | 48 | mg/l |
| | | Bicarbonate(HCO3) | 1293 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 4.6 | 0.23 | 0.8 |
| Magnesium(Mg) | 2.0 | 0.16 | 0.6 |
| Sodium(Na) | 618.0 | 26.88 | 98.1 |
| Potassium(K) | 4.6 | 0.12 | 0.4 |
| Carbonate(CO3) | 36.0 | 1.20 | 4.3 |
| Bicarbonate(HCO3) | 1276.0 | 20.91 | 75.1 |
| Sulphate(SO4) | 28.3 | 0.59 | 2.1 |
| Chloride(Cl) | 180.0 | 5.08 | 18.2 |
| Nitrate(NO3) | 3.9 | 0.06 | 0.2 |
| Silica(SiO2) | 5.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 4.3 | | |
| Magnesium(Acidified) | 2.4 | | |
| TDS(mg/l) | 1508.0 | | |
| Total Anions(epm) | 27.84 | Total Cations(epm) | 27.39 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2040 | | Temperature(C) | 4.50 | |
| pH | 8.6 | | pH | 8.7 | |
| Fluoride(F) | 1.2 | mg/l | Carbonate(CO3) | 48 | mg/l |
| | | | Bicarbonate(HCO3) | 1283 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 8-220-E-82

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 6.7 | 0.33 | 1.0 |
| Magnesium(Mg) | 2.6 | 0.22 | 0.7 |
| Sodium(Na) | 681.0 | 29.61 | 92.6 |
| Potassium(K) | 71.0 | 1.82 | 5.7 |
| Carbonate(CO3) | 70.0 | 2.33 | 8.4 |
| Bicarbonate(HCO3) | 1235.0 | 20.25 | 72.5 |
| Sulphate(SO4) | 13.0 | 0.27 | 1.0 |
| Chloride(Cl) | 180.0 | 5.07 | 18.2 |
| Nitrate(NO3) | 0.9 | 0.01 | 0.1 |
| Silica(SiO2) | 5.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 9.1 | | |
| Magnesium(Acidified) | 2.2 | | |
| TDS(mg/l) | 1614.0 | | |
| Total Anions(epm) | 27.93 | Total Cations(epm) | 31.98 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2780 |
| pH | 8.7 |
| Fluoride | 1.2 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 7.00 | |
| pH | 8.6 | |
| Carbonate(CO3) | 58 | mg/l |
| Bicarbonate(HCO3) | 1313 | mg/l |
| Hydroxide(OH) | | |

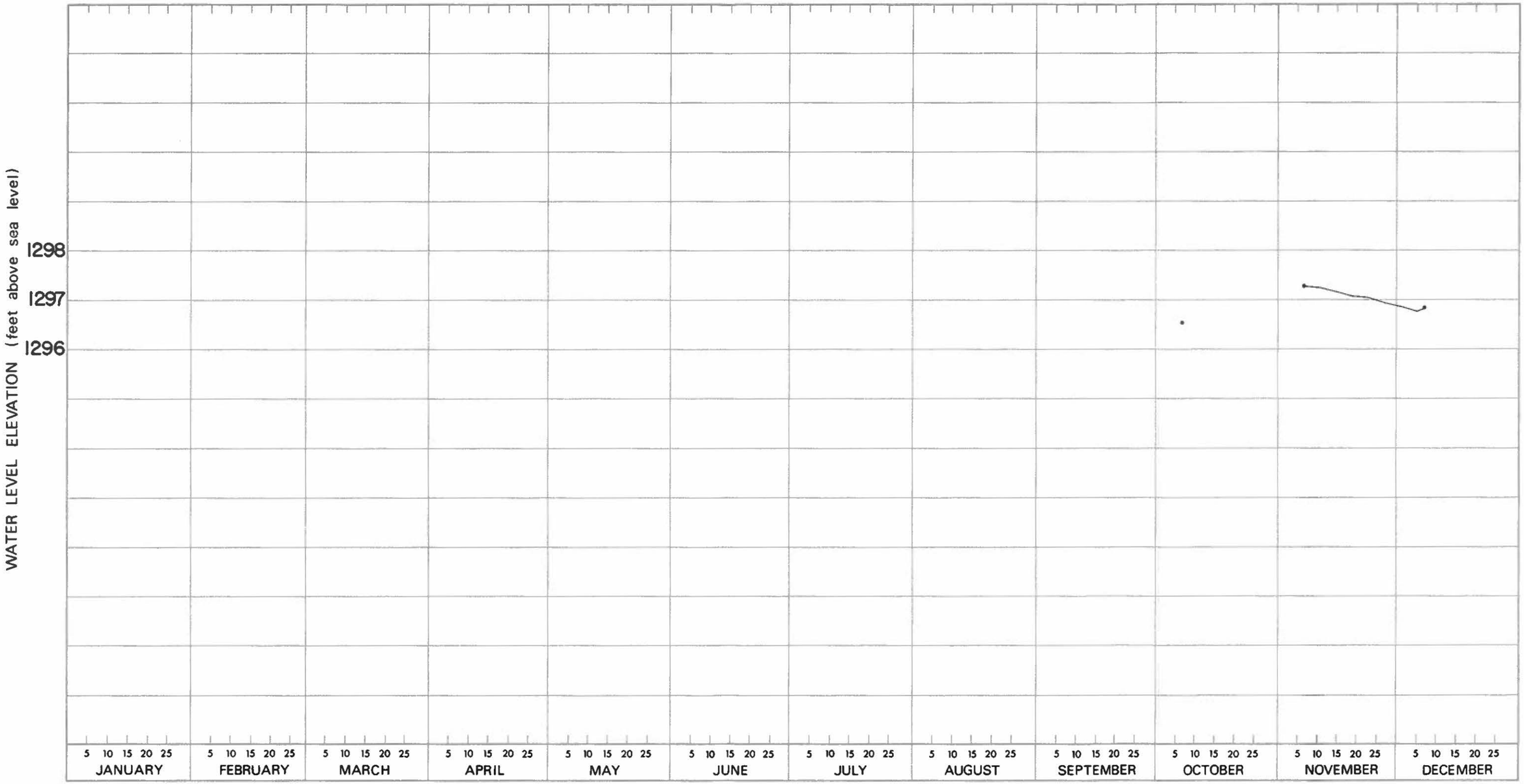
**WATER LEVEL HYDROGRAPH**

8-220-H-76

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council



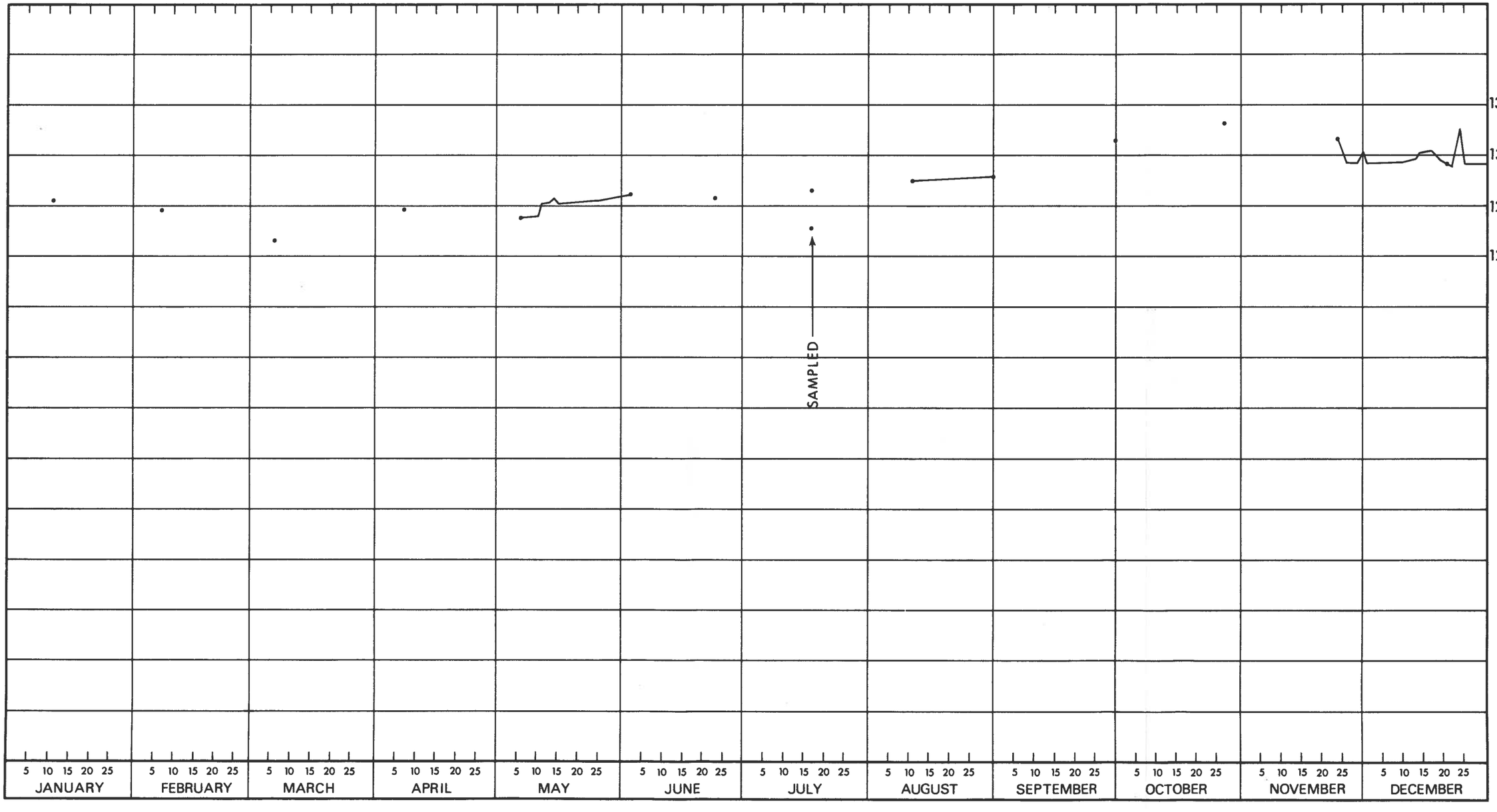
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-220

8 - 220 - H - 77

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council




1976

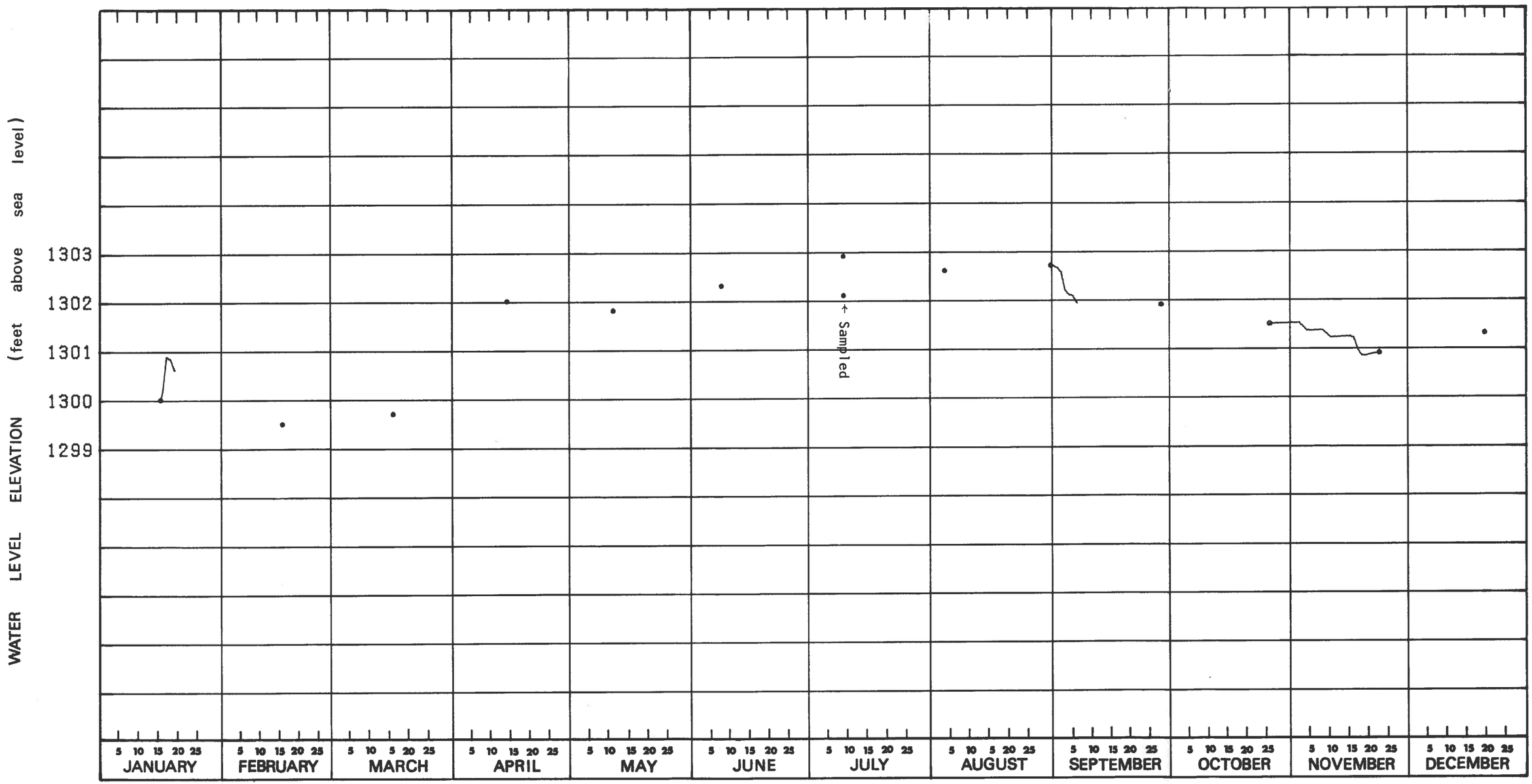
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-220-H-78




1977

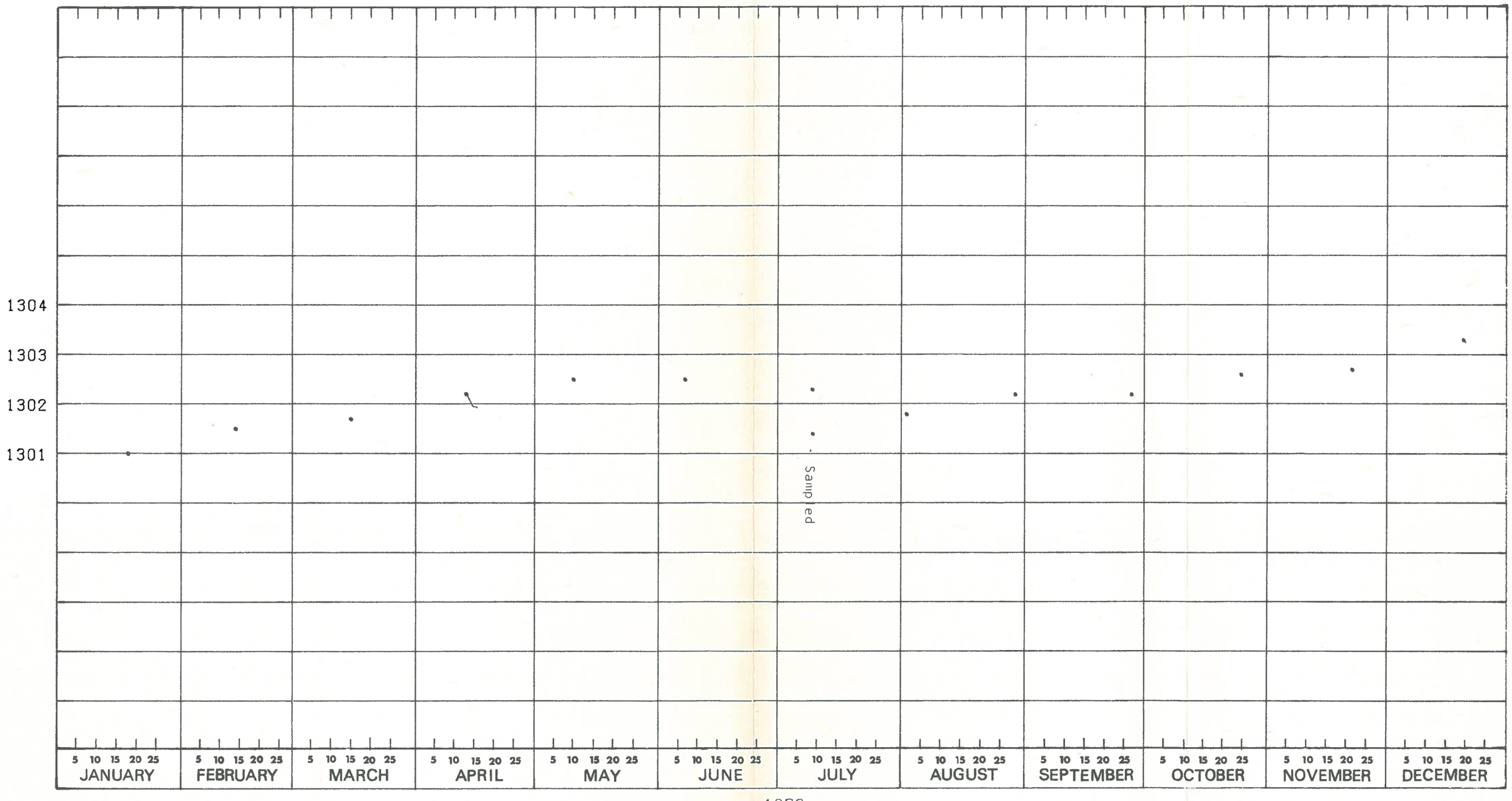
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-220

LSD 5 SEC 30 TWP 94 R 7 W4TH

Alberta Research Council

8-220-H-79




1978

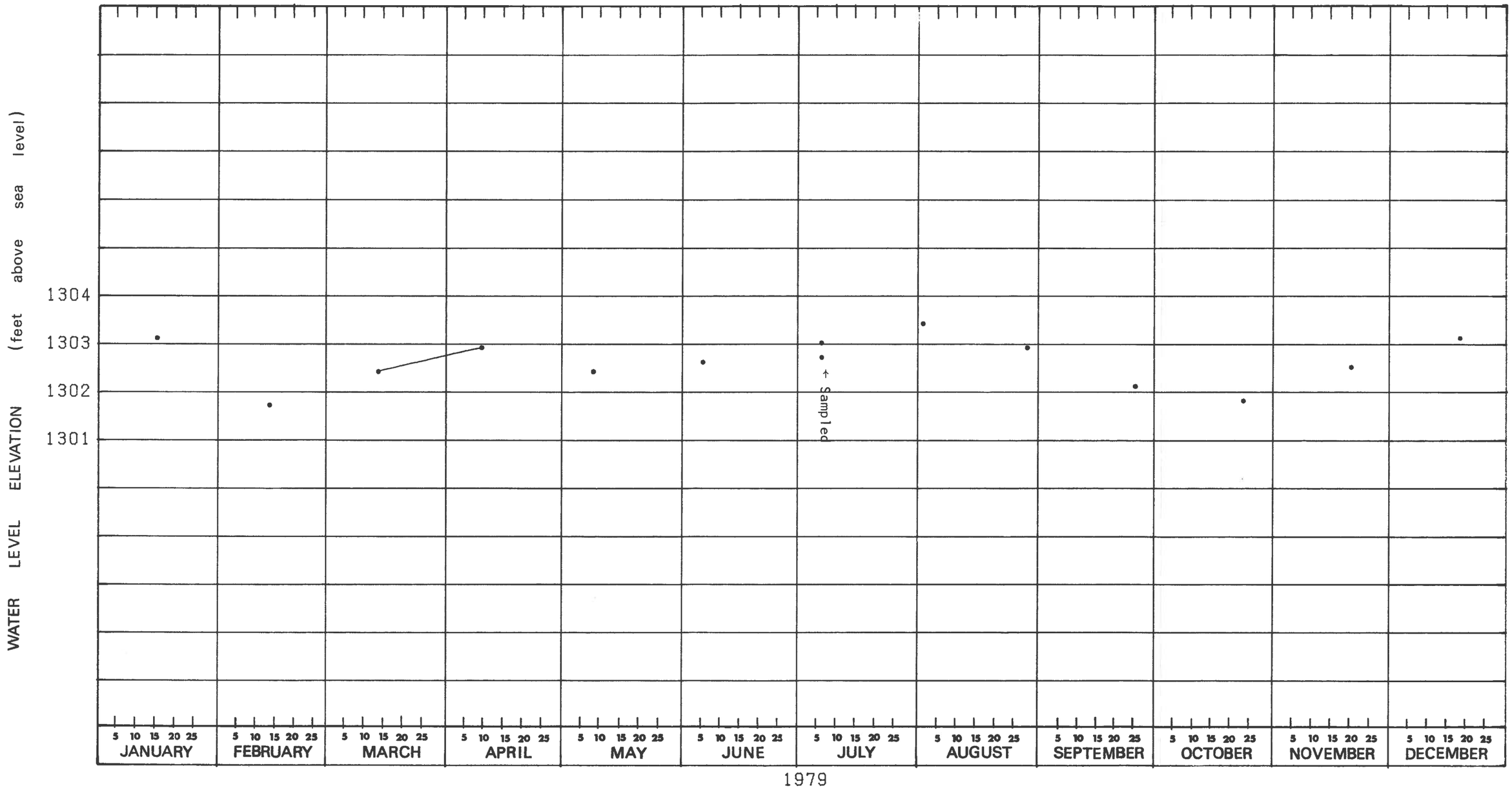
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-220

8-220-H-80

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council




1979

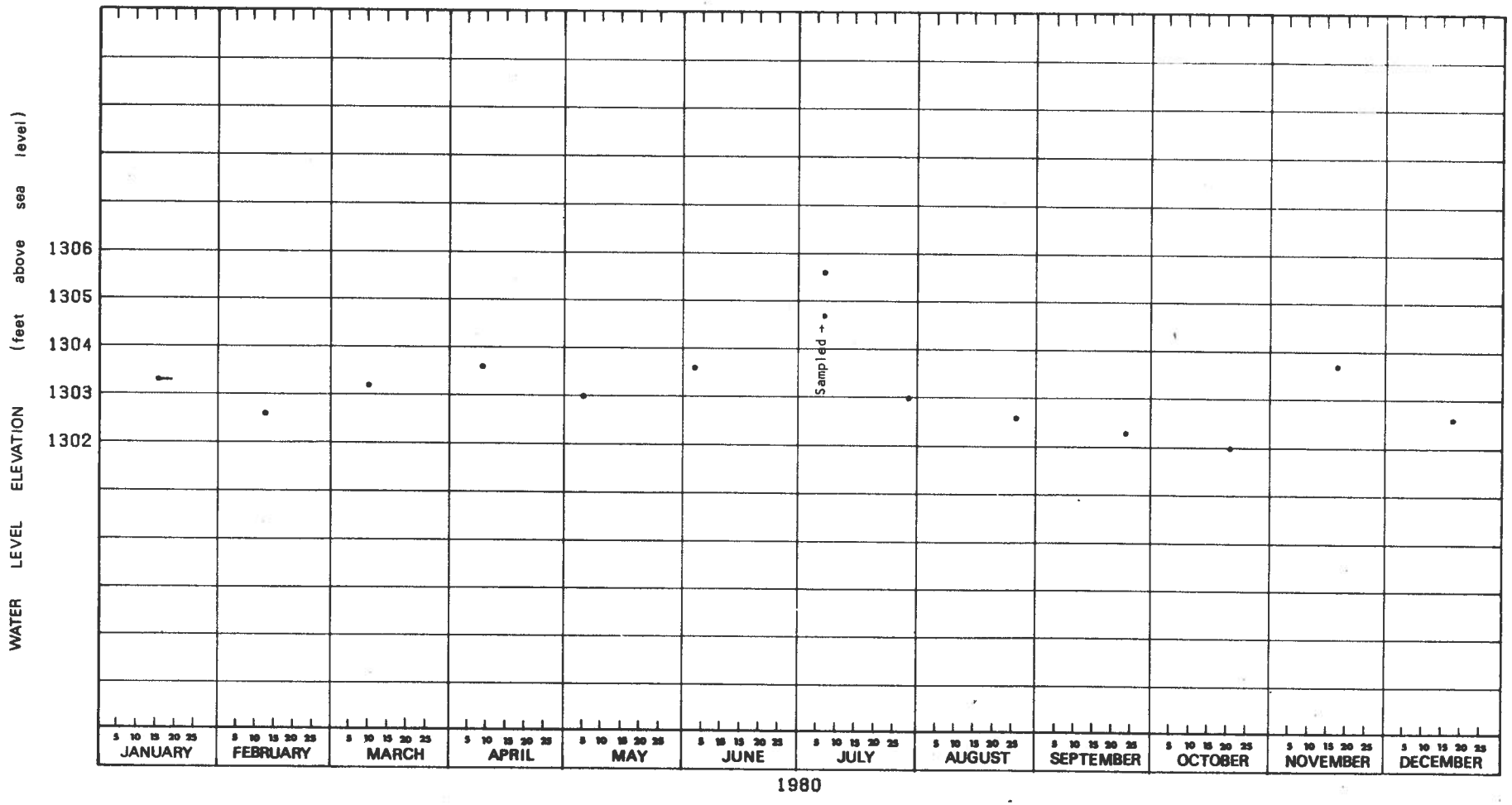
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-220-H-81



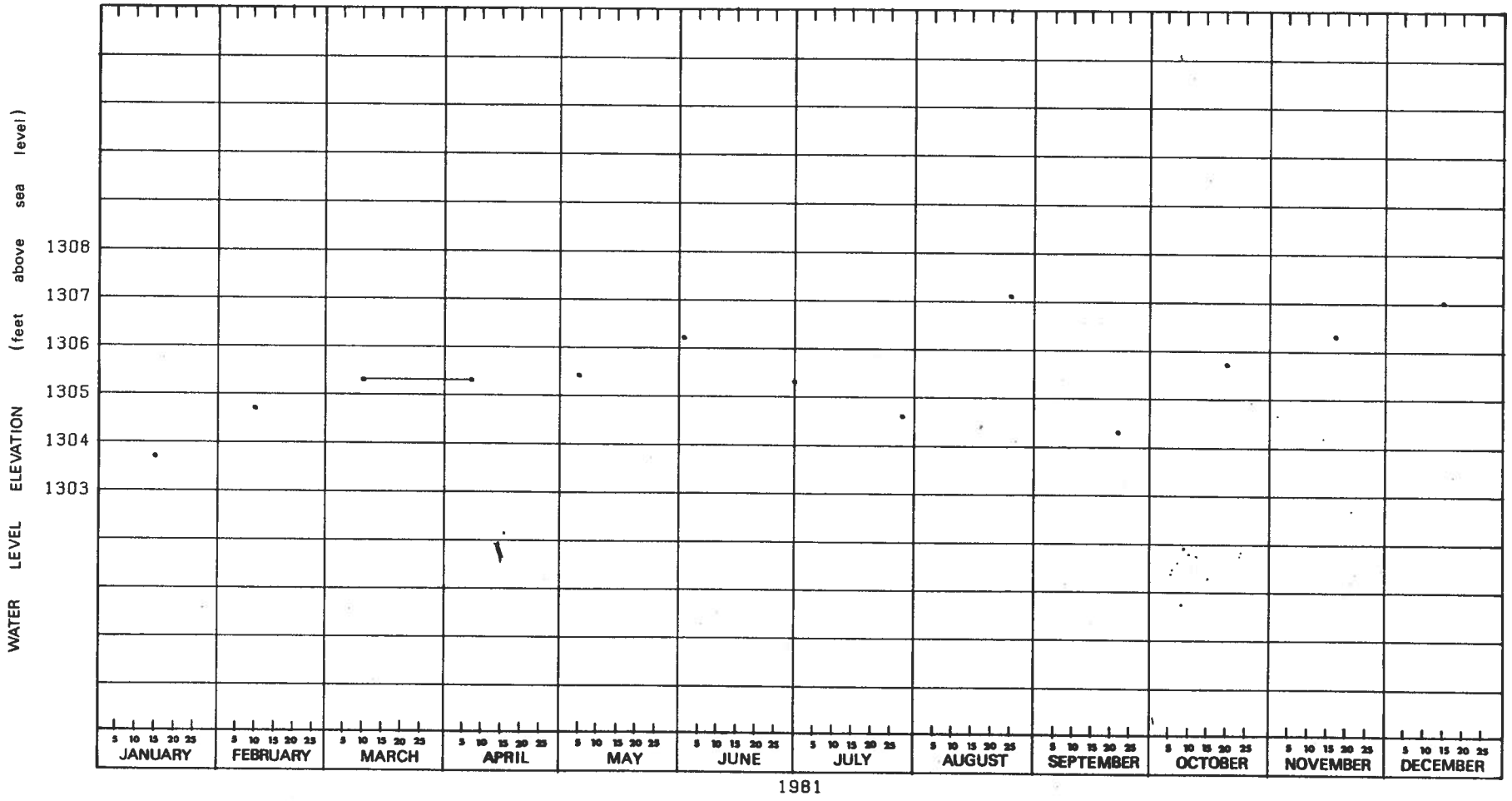
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-220-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1412.57 (Until March 1/75)
1412.71 (After March 1/75)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 18/75 | | | Well completed |
| Feb 23/75 | 18.84 TOC | 1350.8 | Bail 80 gallons; water sample well producing gas |
| Mar 1/75 | | | Cut off casing; weld on gas flange |
| Mar 6/75 | | | DST; water sample; FSI = 26# from 169'; gas sample |
| Mar 14/75 | | | Reinstall shelter; relevel |
| Aug 13/75 | | | MP = 0.71 m TOC, (1415.0) |
| Oct 7/75 | 35.42 MP | 1298.8 | Gas flow has stopped |
| Nov 7/75 | 35.19 MP | 1299.6 | |
| Dec 7/75 | 35.33 MP | 1299.1 | |
| Jan 11/76 | 35.33 MP | 1299.1 | MP (1415.0) |
| Feb 7/76 | 35.38 MP | 1298.9 | |
| Mar 6/76 | 35.57 MP | 1298.3 | |
| Apr 7/76 | 35.49 MP | 1298.9 | New MP = 0.78 m TOC, (1415.3) |
| May 6/76 | 35.52 MP | 1298.8 | |
| June 2/76 | 35.38 MP | 1299.2 | |
| June 23/76 | 35.41 MP | 1299.1 | |
| July 17/76 | 35.36 MP | 1299.3 | |
| | 35.59 MP | 1298.6 | After sample; temp. 5°C |
| Aug 11/76 | 35.30 MP | 1299.5 | |
| Aug 31/76 | 35.28 MP | 1299.6 | |
| Sept 28/76 | 35.06 MP | 1300.3 | |
| Oct 27/76 | 34.97 MP | 1300.6 | |
| Nov 24/76 | 35.05 MP | 1300.3 | |
| Dec 21/76 | 35.20 MP | 1299.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1412.71

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 35.14 MP | 1300.0 | MP (1415.3) |
| Jan 27/77 | | | Treated with 35 lb NU-WELL acid well conditioner |
| Feb 4/77 | | | Blown with air |
| Feb 16/77 | 35.43 MP | 1299.5 | New MP = 0.90 m TOC, (1415.7) |
| Mar 16/77 | 35.35 MP | 1299.7 | |
| Apr 14/77 | 34.65 MP | 1302.0 | |
| May 11/77 | 34.73 MP | 1301.8 | |
| June 8/77 | 34.56 MP | 1302.3 | |
| July 9/77 | 34.38 MP | 1302.9 | |
| | 34.63 MP | 1302.1 | After sample; temp. 5°C |
| Aug 4/77 | 34.49 MP | 1302.6 | |
| Aug 31/77 | 34.46 MP | 1302.7 | |
| Sept 28/77 | 34.68 MP | 1301.9 | |
| Oct 26/77 | 34.83 MP | 1301.5 | Temp. 3.3°C |
| Nov 23/77 | 34.99 MP | 1300.9 | |
| Dec 20/77 | 34.88 MP | 1301.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1412.71

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 34.96 MP | 1301.0 | MP (1415.7) |
| Feb 14/78 | 34.82 MP | 1301.5 | |
| Mar 15/78 | 34.75 MP | 1301.7 | |
| Apr 13/78 | 34.59 MP | 1302.2 | |
| May 10/78 | 34.50 MP | 1302.5 | |
| June 7/78 | 34.51 MP | 1302.5 | |
| July 9/78 | 34.56 MP | 1302.3 | |
| | 34.86 MP | 1301.4 | After sample; temp. 8°C |
| Aug 2/78 | 34.73 MP | 1301.8 | |
| Aug 29/78 | 34.59 MP | 1302.2 | |
| Sept 27/78 | 34.61 MP | 1302.2 | |
| Oct 25/78 | 34.47 MP | 1302.6 | |
| Nov 22/78 | 34.45 MP | 1302.7 | |
| Dec 20/78 | 34.28 MP | 1303.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1412.71

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 34.33 MP | 1303.1 | MP (1415.7) |
| Feb 14/79 | 34.74 MP | 1301.7 | |
| Mar 14/79 | 34.53 MP | 1302.4 | |
| Apr 10/79 | 34.38 MP | 1302.9 | |
| May 9/79 | 34.54 MP | 1302.4 | |
| June 6/79 | 34.47 MP | 1302.6 | |
| July 7/79 | 34.35 MP | 1303.0 | |
| | 34.45 MP | 1302.7 | After sample; temp. 4.5°C |
| Aug 2/79 | 34.23 MP | 1303.4 | |
| Aug 29/79 | 34.40 MP | 1302.9 | |
| Sept 26/79 | 34.64 MP | 1302.1 | |
| Oct 24/79 | 34.72 MP | 1301.8 | |
| Nov 21/79 | 34.51 MP | 1302.5 | |
| Dec 19/79 | 34.33 MP | 1303.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8 - 220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1412.71

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 34.26 MP | 1303.3 | |
| Feb 13/80 | 34.49 MP | 1302.6 | |
| Mar 11/80 | 34.31 MP | 1303.2 | |
| Apr 10/80 | 34.19 MP | 1303.6 | |
| May 6/80 | 34.36 MP | 1303.0 | |
| June 4/80 | 34.18 MP | 1303.6 | |
| July 8/80 | 33.57 MP | 1305.6 | Temp. 7°C |
| | 33.83 MP | 1304.7 | After Sample |
| July 30/80 | 34.35 MP | 1303.0 | |
| Aug 27/80 | 34.48 MP | 1302.6 | |
| Sept 25/80 | 34.58 MP | 1302.3 | |
| Oct 22/80 | 34.66 MP | 1302.0 | |
| Nov 19/80 | 34.14 MP | 1303.7 | |
| Dec 19/80 | 34.48 MP | 1302.6 | |
| Jan 16/81 | 34.14 MP | 1303.7 | |
| Feb 11/81 | 33.83 MP | 1304.7 | |
| Mar 11/81 | 33.66 MP | 1305.3 | |
| Apr 8/81 | 33.65 MP | 1305.3 | |
| May 6/81 | 33.64 MP | 1305.4 | |
| June 2/81 | 33.35 MP | 1306.2 | |
| July 1/81 | 33.65 MP | 1305.3 | |
| July 29/81 | 33.88 MP | 1304.6 | |
| Aug 26/81 | 33.12 MP | 1307.1 | |
| Sept 23/81 | 33.95 MP | 1304.3 | |
| Oct 21/81 | 33.54 MP | 1305.7 | |
| Nov 18/81 | 33.36 MP | 1306.3 | |
| Dec 16/81 | 33.13 MP | 1307.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1412.57 (Until March 1/75)
1412.71 (After March 1/75)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 18/75 | | | Well completed |
| Feb 23/75 | 18.84 TOC | 1350.77 | Bail 80 gallons; water sample; well producing gas |
| Mar 1/75 | | | Cut off casing; weld on gas flange |
| Mar 6/75 | | | DST; water sample; FSI = 26# from 169'; gas sample |
| Mar 14/75 | | | Reinstall shelter; relevel |
| Aug 13/75 | | | Gas flow has stopped |
| Oct 7/75 | 35.42 MP | 1296.53 | |
| Nov 7/75 | 35.19 MP | 1297.28 | |
| Dec 7/75 | 35.33 MP | 1296.82 | |

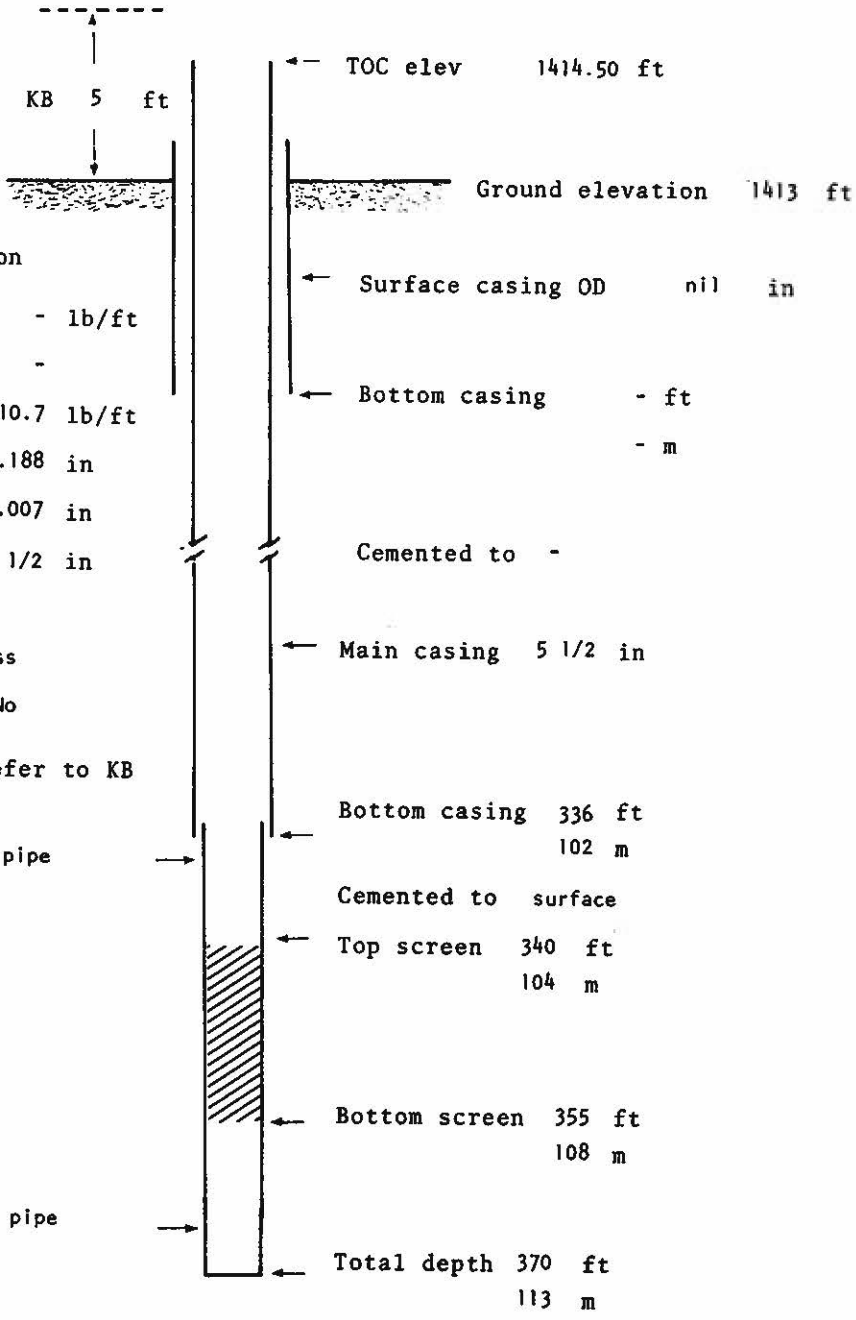
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Tp 94 R 7 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 10.7 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

# DRILL STEM TEST

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Tp 94 R 7 W4th

Alberta Research Council

Elevation: gl 1413
KB 1415

Type of test - Casing Positrieve

Date of test March 6, 1975

Testing company Johnston Testers

## TEST DATA

| | | |
|---|---|---|
| Time started | 1345 | hrs |
| Tool opened | 1429 | hrs |
| First flow | 2 | min |
| Initial shut in | 30 | min |
| Second flow | 45 | min |
| Final shut in | 45 | min |
| Pulled loose at | - | hrs |
| Out of hole at | - | hrs |
| Wt on packers | 3000 | lbs |

Description of blow: Very weak puff blow decreasing to nil in one minute.

Total water recovered nil ft

Water sample No. -

Gas blow No

Remarks: Misrun - set tool above fluid level

## HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 340-355

Formation tested Clearwater

## TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

## PRESSURE DATA (psi)

| | |
|---|---|
| Instrument No. | |
| Capacity (psig) | |
| Instrument set at (ft) | |
| Initial hydrostatic | A |
| First flow | B |
| | B1 |
| Initial shut in | C |
| Second flow | D |
| | D1 |
| Final shut in | G |
| Final hydrostatic | H |

B1, D1, etc. Initial Hyd. Pressure

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed from 8-370

Date sampled February 23, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 17.9 | 0.89 | 4.5 |
| Magnesium ($Mg^{++}$) | 7.0 | 0.58 | 2.9 |
| Sodium ($Na^{+}$) | 409.0 | 17.79 | 90.5 |
| Potassium ($K^{+}$) | 15.4 | 0.39 | 2.0 |
| Carbonate ($CO_3^{=}$) | 9.6 | 0.32 | 1.5 |
| Bicarbonate ($HCO_3^{-}$) | 1054.0 | 17.28 | 82.8 |
| Sulfate ($SO_4^{=}$) | 117.0 | 2.44 | 11.7 |
| Chloride ($Cl^{-}$) | 27.0 | 0.76 | 3.6 |
| Nitrate ($NO_3^{=}$) | 4.6 | 0.07 | 0.4 |
| Silica ($SiO_2$) | 10.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1258.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 20.867 | Total Cations (epm) | 19.653 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1710 |
| pH | 8.4 |
| Fluoride ($F^{-}$) | 1.0 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 3.0 |
| pH | 12.3 |
| Carbonate ($CO_3^{=}$) | 1316 ppm |
| Bicarbonate ($HCO_3^{-}$) | 151 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | 4200 |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed from well 8-370

Date of sampling February 23, 1975

Total dissolved solids 1258 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .01 | Mg | M |
| As | <.01 | Mn | .002 |
| B | .03 | Mo | ND |
| Ba | ND | Ni | .02 |
| Be | ND | Pb | ND |
| Bi | ND | Sb | ND |
| Ca | M | Si | M |
| Cd | ND | Sn | ND |
| Co | .001 | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .001 | V | ND |
| Fe | .004 | Zn | <.005 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.0 | 0.10 | 0 |
| Magnesium ($Mg^{++}$) | 1.0 | 0.08 | 0 |
| Sodium ($Na^{+}$) | 415.0 | 18.05 | 73 |
| Potassium ($K^{+}$) | 254.0 | 6.50 | 26 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1449.0 | 23.75 | 95 |
| Sulfate ($SO_4^{=}$) | 6.3 | 0.13 | 1 |
| Chloride ($Cl^{-}$) | 40.0 | 1.13 | 5 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1.4 | | |
| Magnesium (Acidified) | 1.3 | | |
| Total dissolved solids | 1560 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 25.02 | Total Cations (epm) | 24.73 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2400 | Temperature (C) | 6.0 |
| pH | 7.8 | pH | 8.0 |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 1474 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

**MULTIELEMENT ANALYSIS**

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Date sampled: July 17, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .006 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 421 |
| As | <.038 | Ni | <.010 |
| B | .566 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 1.6 | Si | 1.09 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .037 |
| Cr | <.006 | Te | <.065 |
| Cu | .018 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .044 | V | <.0008 |
| K | 242 | W | <.078 |
| Mg | .957 | Zn | <.002 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 197.0 | 9.83 | 14.6 |
| Magnesium ($Mg^{++}$) | 80.0 | 6.58 | 9.8 |
| Sodium ($Na^{+}$) | 1100.0 | 47.85 | 71.0 |
| Potassium ($K^{+}$) | 121.0 | 3.10 | 4.6 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 15.7 | 0.33 | 0.9 |
| Chloride ($Cl^{-}$) | 1240.0 | 34.97 | 96.7 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 7.9 | | |
| Hydroxide ($OH^{-}$) | 14.6 | 0.86 | 2.4 |
| Calcium (Acidified) | 190.0 | | |
| Magnesium (Acidified) | 70.0 | | |
| Total dissolved solids | 9766.0 | | |
| Total Anions (epm) 36.15 | | Total Cations (epm) | 67.36 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | >8000 |
| pH | 5.1 |
| Fluoride ($F^{-}$) | 0.9 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 6.0 |
| pH | 5.9 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | 127.0 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

8-370-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 140.0 | 6.99 | 13.0 |
| Magnesium(Mg) | 54.0 | 4.44 | 8.3 |
| Sodium(Na) | 850.0 | 36.97 | 68.7 |
| Potassium(K) | 213.0 | 5.45 | 10.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 9.6 | 0.20 | 89.8 |
| Chloride(Cl) | 0.0 | 0.00 | 0.0 |
| Nitrate(NO3) | 1.4 | 0.02 | 10.2 |
| Silica(SiO2) | 1.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 120.0 | | |
| Magnesium(Acidified) | 55.0 | | |
| TDS(mg/l) | 6418.0 | | |
| Total Anions(epm) | 0.22 | Total Cations(epm) | 53.85 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 535 | | Temperature(C) | 9.00 | |
| pH | 4.3 | | pH | 6.0 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 151 | mg/l |
| | | | Hydroxide(OH) | | |

8-370-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 103.0 | 5.14 | 11.4 |
| Magnesium(Mg) | 42.0 | 3.46 | 7.7 |
| Sodium(Na) | 705.0 | 30.67 | 68.3 |
| Potassium(K) | 221.0 | 5.65 | 12.6 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 8.1 | 0.17 | 0.9 |
| Chloride(Cl) | 640.0 | 18.05 | 99.0 |
| Nitrate(NO3) | 0.7 | 0.01 | 0.1 |
| Silica(SiO2) | 0.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 90.0 | | |
| Magnesium(Acidified) | 40.0 | | |
| TDS(mg/l) | 4830.0 | | |
| Total Anions(epm) | 18.23 | Total Cations(epm) | 44.92 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3940 | Temperature(C) | 5.00 | |
| pH | 4.5 | pH | 6.5 | |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 200 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 8-370-E-82

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 83.0 | 4.15 | 8.9 |
| Magnesium(Mg) | 32.0 | 2.67 | 5.7 |
| Sodium(Na) | 763.0 | 33.17 | 71.0 |
| Potassium(K) | 263.0 | 6.74 | 14.4 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 154.0 | 2.52 | 15.0 |
| Sulphate(SO4) | 10.0 | 0.21 | 1.2 |
| Chloride(Cl) | 500.0 | 14.08 | 83.7 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 0.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 67.0 | | |
| Magnesium(Acidified) | 28.4 | | |
| TDS(mg/l) | 4351.0 | | |
| Total Anions(epm) | 16.82 | Total Cations(epm) | 46.73 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4540 | Temperature | 6.00 | |
| pH | 8.1 | pH | 6.6 | |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 312 | mg/l |
| | | Hydroxide(OH) | | |

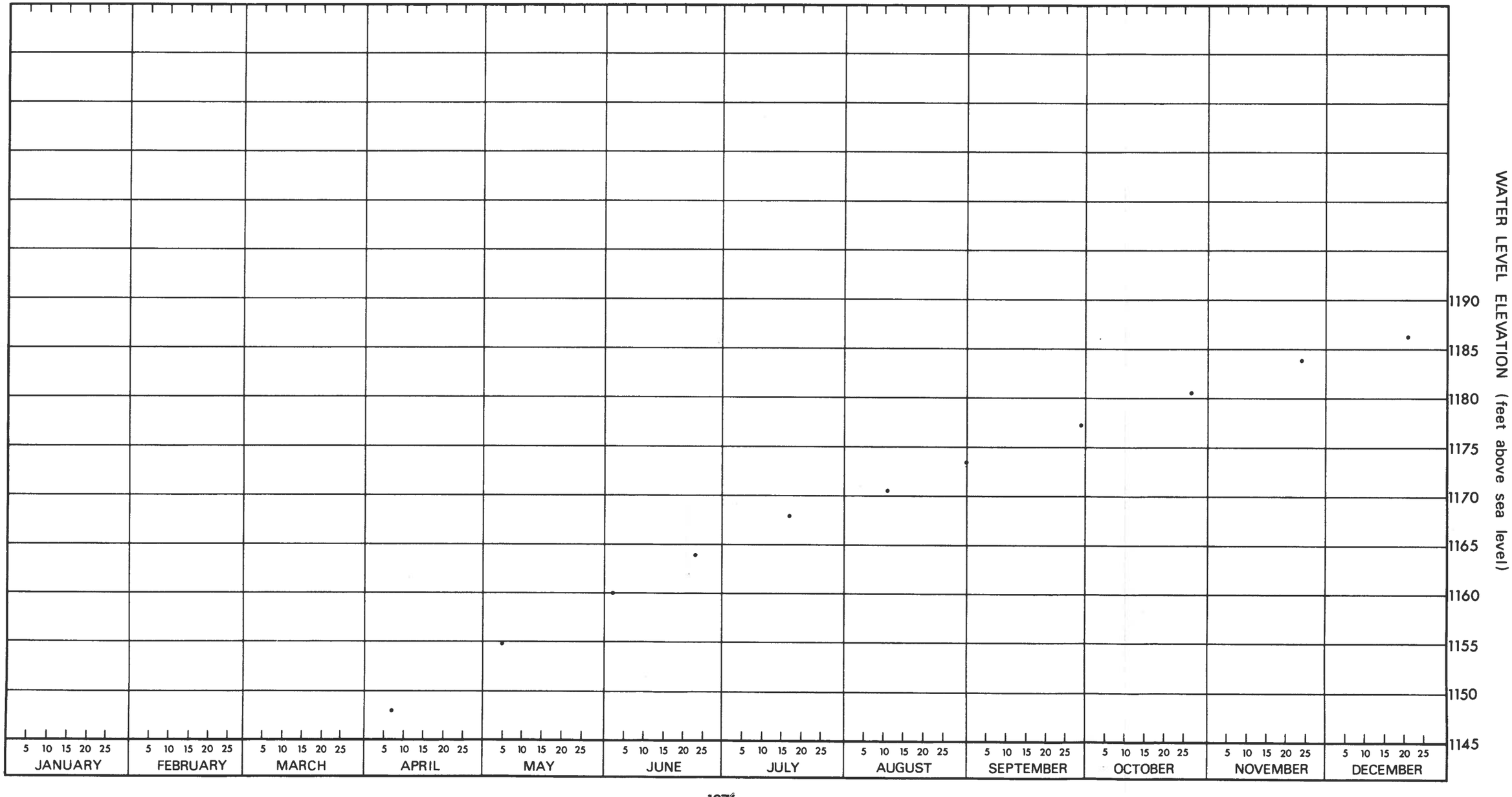
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8 - 370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

8 - 370 - H - 77




1976

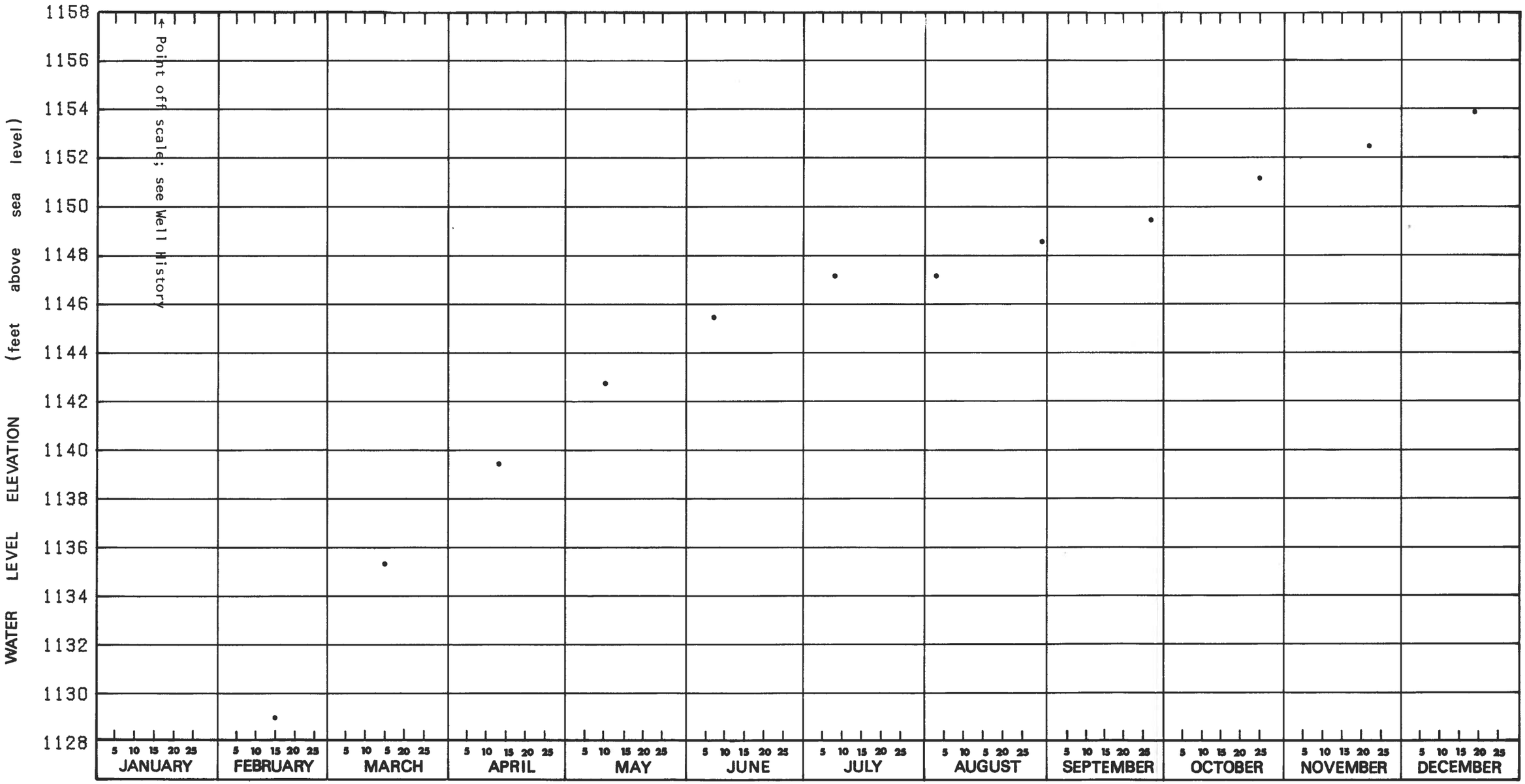
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-370-H-78



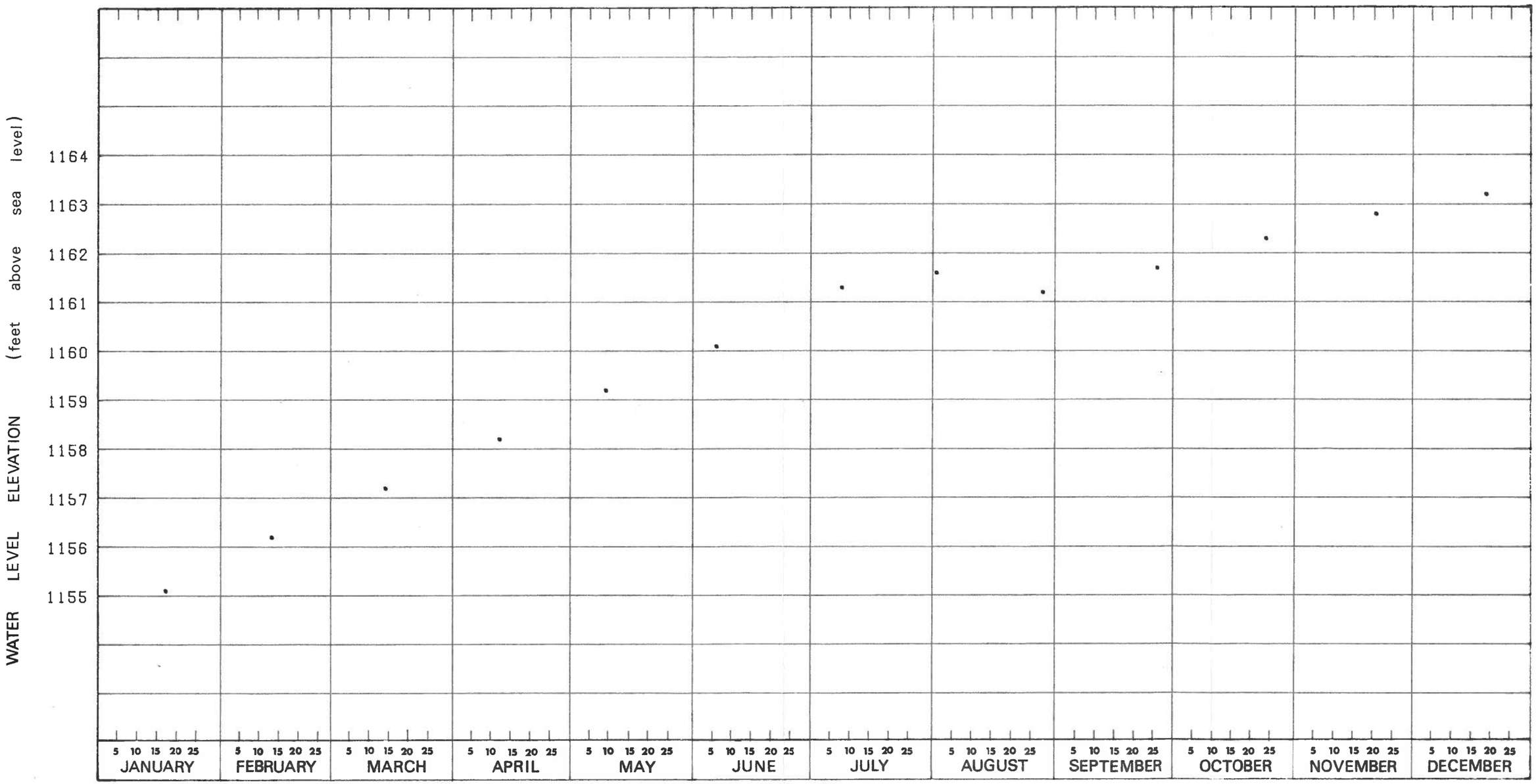
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-370

LSD 5 SEC 30 TWP 94 R 7 W4TH

8-370-H-79

Alberta Research Council



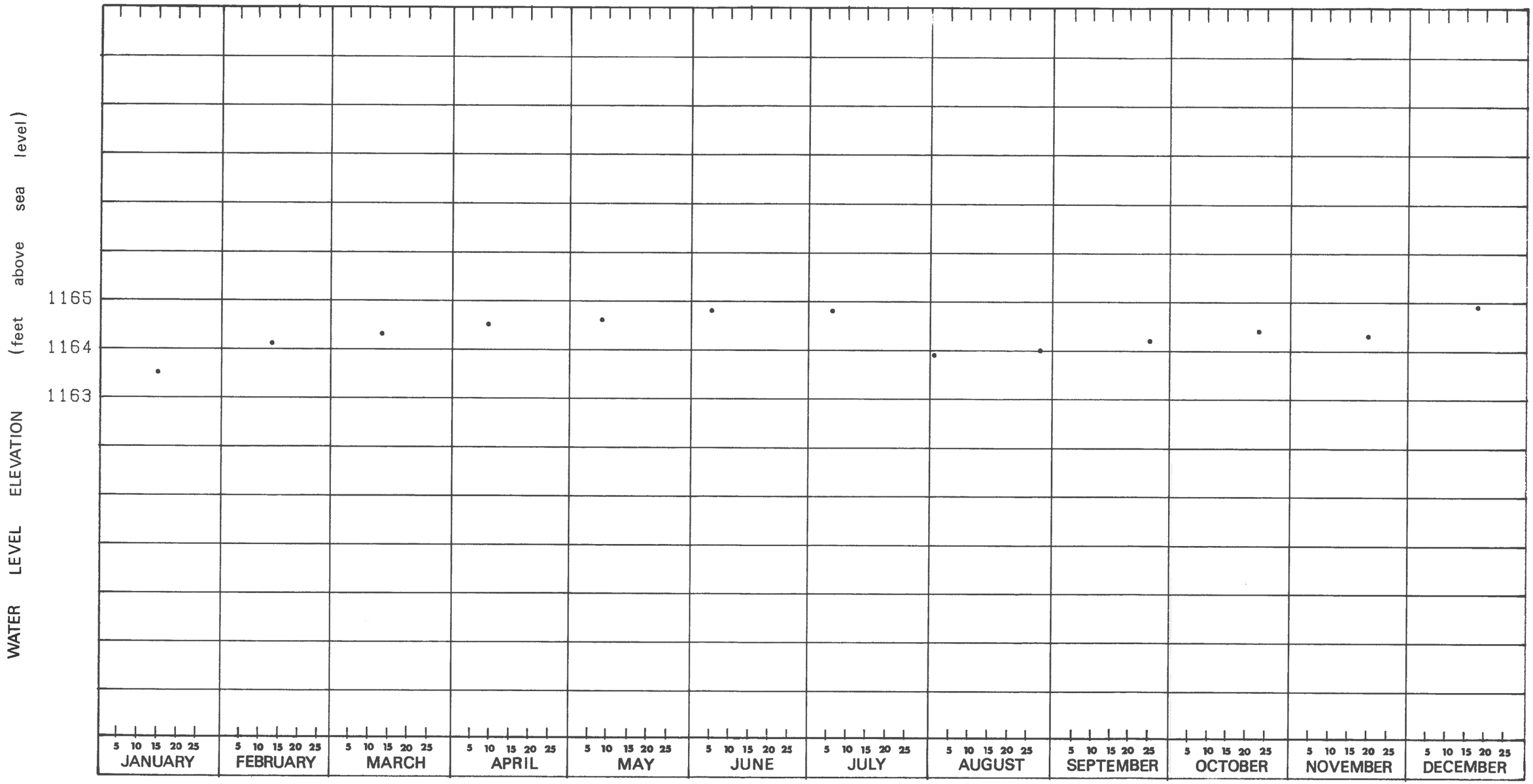
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-370-H-80




1979

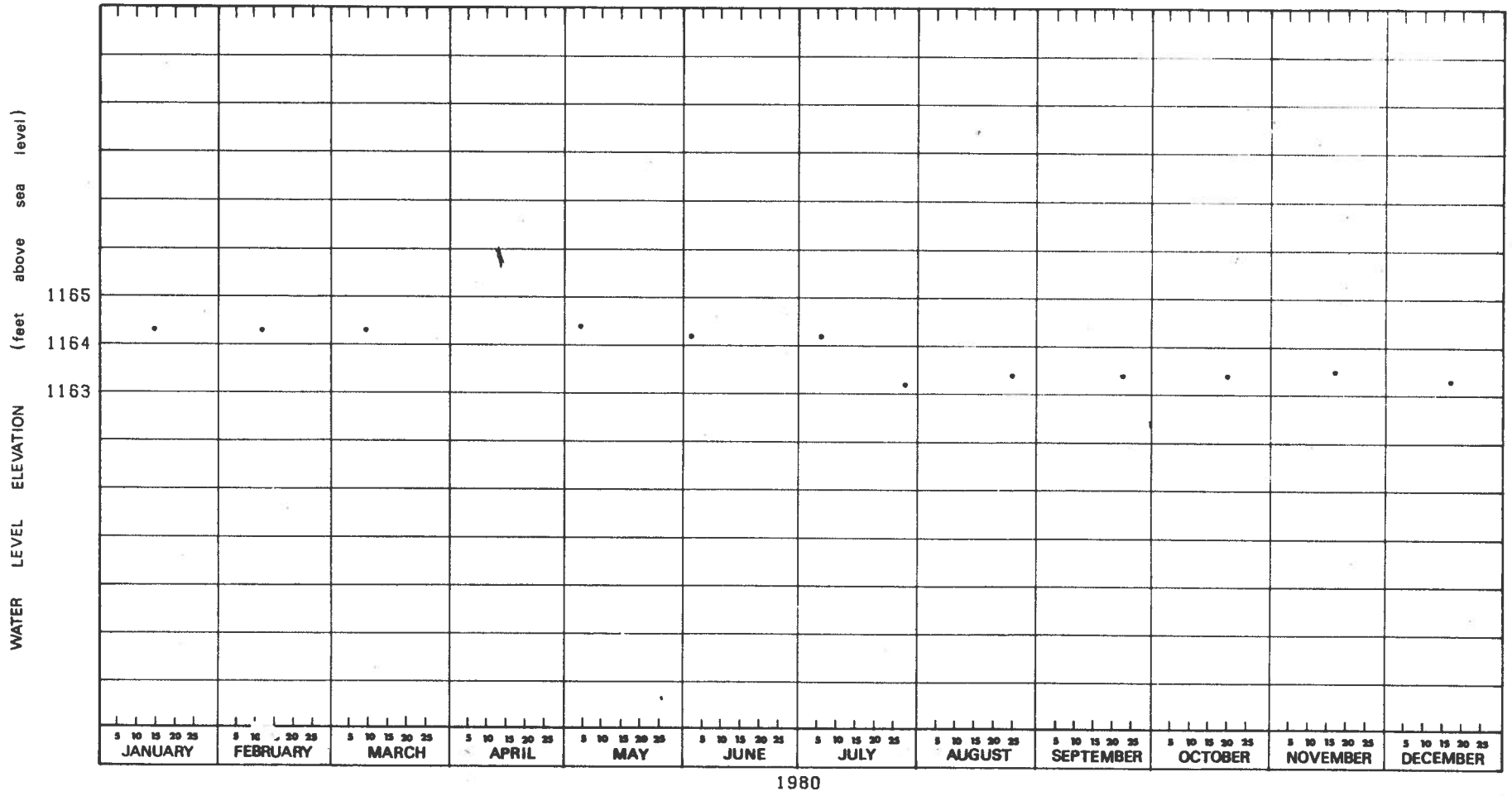
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-370-H-81



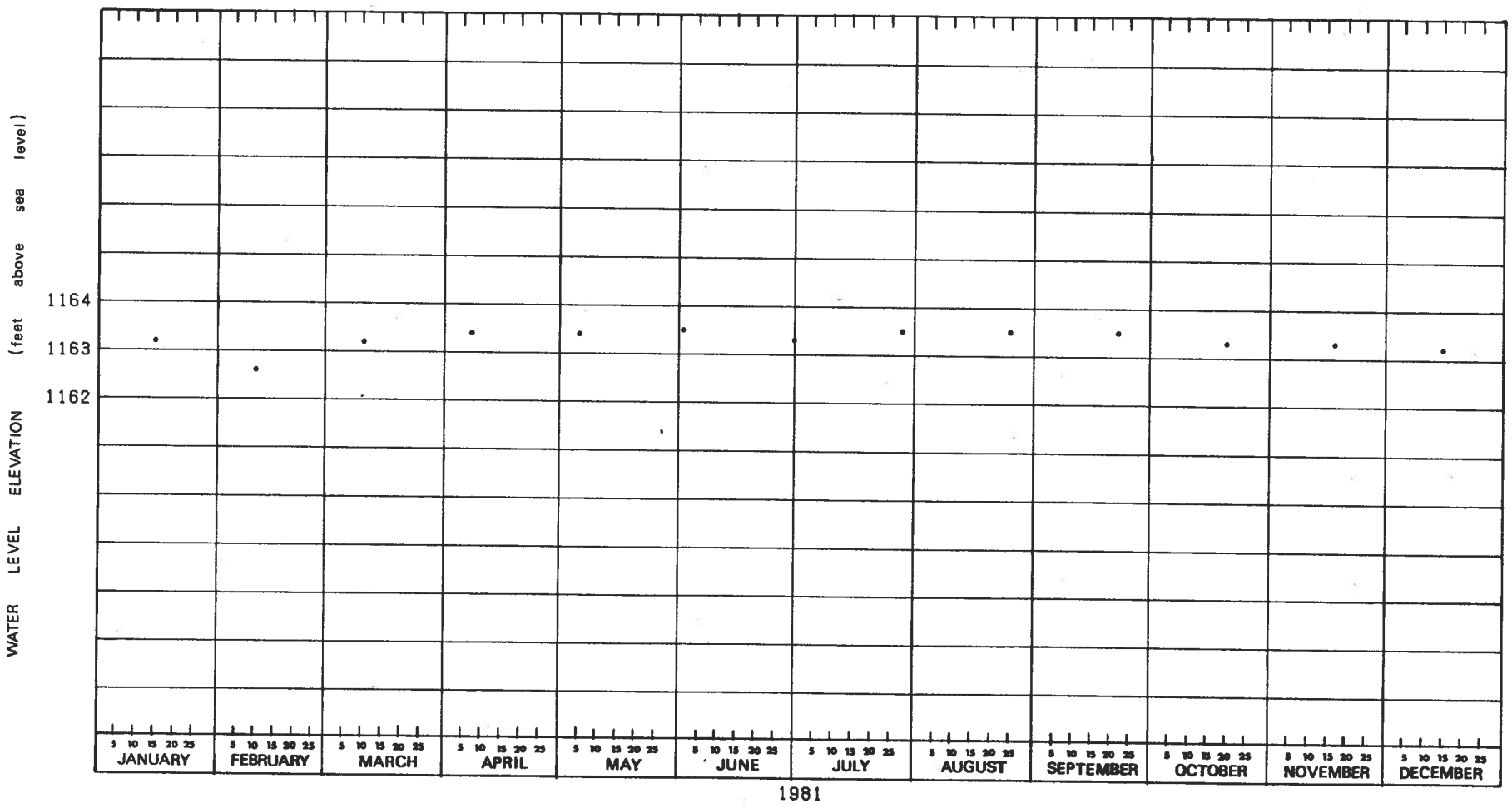
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-370-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.44 (Until March 1, 1975)
1414.50 (After March 1, 1975)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 17/75 | | | Well completed |
| Feb 23/75 | 61.13 TOC | 1213.87 | Bail 125 gallons; water sample; producing gas |
| Feb 24/75 | 97.84 TOC | 1093 | |
| Mar 1/75 | | | Cut off casing; gas sample; weld on casing flange |
| Mar 6/75 | | | DST; misrun; water sample |
| Mar 17/75 | | | Relevel |
| | | | No further measurements of water level due to gas flow. |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Apr 7/76 | 81.26 TOC | 1148.0 | |
| May 5/76 | 79.97 MP | 1154.8 | MP = 0.80 m TOC, (1417.1) |
| June 2/76 | 78.33 MP | 1160.2 | |
| June 23/76 | 77.17 MP | 1164.0 | |
| July 17/76 | 75.95 MP | 1168.0 | Sampled; temp. 6°C |
| Aug 11/76 | 75.15 MP | 1170.6 | |
| Aug 31/76 | 74.28 MP | 1173.5 | |
| Sept 29/76 | 73.11 MP | 1177.3 | |
| Oct 27/76 | 72.06 MP | 1180.7 | |
| Nov 24/76 | 71.11 MP | 1183.9 | |
| Dec 21/76 | 70.28 MP | 1186.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 69.54 MP | 1189.0 | MP (1417.1) |
| Jan 27/77 | | | Treated with 35 lb NU-WELL acid well conditioner |
| Feb 5/77 | | | Blown with air |
| Feb 16/77 | 87.94 MP | 1129.0 | New MP = 0.88 m TOC, (1417.4) |
| Mar 16/77 | 86.00 MP | 1135.3 | |
| Apr 14/77 | 84.75 MP | 1139.4 | |
| May 11/77 | 83.60 MP | 1142.7 | New MP = 0.73 m TOC, (1416.9) |
| June 8/77 | 82.92 MP | 1145.4 | |
| July 9/77 | 82.26 MP | 1147.1 | Sampled; temp. 6°C |
| Aug 4/77 | 82.24 MP | 1147.1 | |
| Aug 31/77 | 81.84 MP | 1148.5 | |
| Sept 28/77 | 81.55 MP | 1149.4 | |
| Oct 26/77 | 81.04 MP | 1151.1 | Temp. 5.3°C |
| Nov 23/77 | 80.64 MP | 1152.4 | |
| Dec 20/77 | 80.21 MP | 1153.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 79.81 MP | 1155.1 | MP (1416.9) |
| Feb 14/78 | 79.49 MP | 1156.2 | |
| Mar 15/78 | 79.18 MP | 1157.2 | |
| Apr 13/78 | 78.88 MP | 1158.2 | |
| May 10/78 | 78.57 MP | 1159.2 | |
| June 7/78 | 78.30 MP | 1160.1 | |
| July 9/78 | 77.91 MP | 1161.3 | Sampled; temp. 9°C |
| Aug 2/78 | 77.84 MP | 1161.6 | |
| Aug 29/78 | 77.95 MP | 1161.2 | |
| Sept 27/78 | 77.80 MP | 1161.7 | |
| Oct 25/78 | 77.63 MP | 1162.3 | |
| Nov 22/78 | 77.48 MP | 1162.8 | |
| Dec 20/78 | 77.34 MP | 1163.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 77.24 MP | 1163.5 | MP (1416.9) |
| Feb 14/79 | 77.07 MP | 1164.1 | |
| Mar 14/79 | 77.00 MP | 1164.3 | |
| Apr 10/79 | 76.94 MP | 1164.5 | |
| May 9/79 | 76.93 MP | 1164.6 | |
| June 6/79 | 76.86 MP | 1164.8 | |
| July 7/79 | 76.86 MP | 1164.8 | Sampled; temp. 5°C |
| Aug 2/79 | 77.14 MP | 1163.9 | |
| Aug 29/79 | 77.10 MP | 1164.0 | |
| Sept 26/79 | 77.03 MP | 1164.2 | |
| Oct 24/79 | 76.98 MP | 1164.4 | |
| Nov 21/79 | 77.01 MP | 1164.3 | |
| Dec 19/79 | 76.83 MP | 1164.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 77.00 MP | 1164.3 | |
| Feb 13/80 | 77.00 MP | 1164.3 | |
| Mar 11/80 | 77.00 MP | 1164.3 | |
| Apr 10/80 | | | Could not measure |
| May 6/80 | 76.99 MP | 1164.4 | |
| June 4/80 | 77.04 MP | 1164.2 | |
| July 8/80 | 77.05 MP | 1164.2 | Temp. 6°C |
| July 30/80 | 77.36 MP | 1163.2 | |
| Aug 27/80 | 77.29 MP | 1163.4 | |
| Sept 25/80 | 77.28 MP | 1163.4 | |
| Oct 22/80 | 77.30 MP | 1163.4 | |
| Nov 19/80 | 77.27 MP | 1163.5 | |
| Dec 19/80 | 77.31 MP | 1163.3 | |
| Jan 16/81 | 77.35 MP | 1163.2 | |
| Feb 11/81 | 77.54 MP | 1162.6 | |
| Mar 11/81 | 77.34 MP | 1163.2 | |
| Apr 8/81 | 77.29 MP | 1163.4 | |
| May 6/81 | 77.29 MP | 1163.4 | |
| June 2/81 | 77.26 MP | 1163.5 | |
| July 1/81 | 77.32 MP | 1163.3 | |
| July 29/81 | 77.27 MP | 1163.5 | |
| Aug 26/81 | 77.27 MP | 1163.5 | |
| Sept 23/81 | 77.26 MP | 1163.5 | |
| Oct 21/81 | 77.32 MP | 1163.3 | |
| Nov 18/81 | 77.32 MP | 1163.3 | |
| Dec 16/81 | 77.34 MP | 1163.2 | |

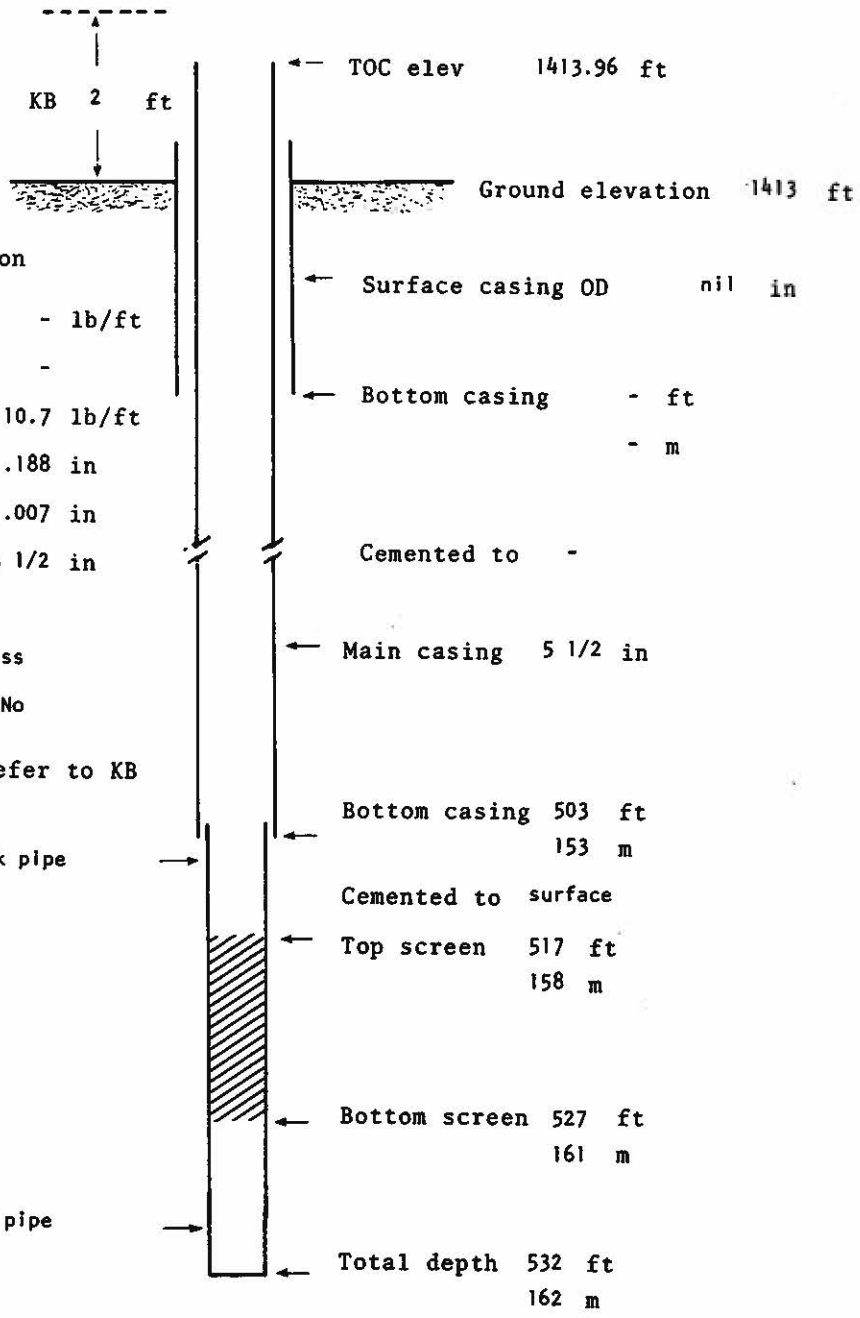
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Tp 94 R 7 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 10.7 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

## DRILL STEM TEST

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Tp 94 R 7 W4th

Alberta Research Council

Elevation: gl 1413
KB 1415

Type of test - Casing Positrieve

Date of test March 7, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0415 | hrs |
| Tool opened | 1020 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 30 | min |
| Pulled loose at | 1210 | hrs |
| Out of hole at | 1245 | hrs |
| Wt on packers | 4000 | lbs |

Description of blow Strong initial puff, strong blow decreasing to nil in 7 minutes.

Total water recovered 120 ft

Water sample No. DH 47

Gas blow No

Remarks Test satisfactory
5-1/2" RBP @ 487'

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 517-527

Formation tested Waterways

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Total Interval | 11.20 | |

### PRESSURE DATA (psi)

| | | |
|---|---|---|
| Instrument No. | | RPG-92N |
| Capacity (psig) | | 431 |
| Instrument set at (ft) | | 491 |
| Initial hydrostatic | A | 86 |
| First flow | B | 27 |
| | B1 | 27 |
| Initial shut in | C | 65 |
| Second flow | D | 65 |
| | D1 | 65 |
| Final shut in | G | 65 |
| Final hydrostatic | H | 76 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

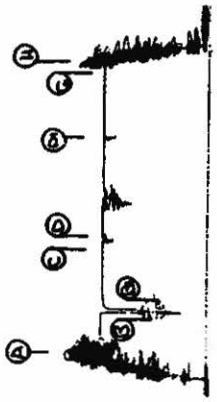
OBSERVATION WELL NUMBER 8-532

PRESSURE INCREMENTS

Recorder RPG-92N

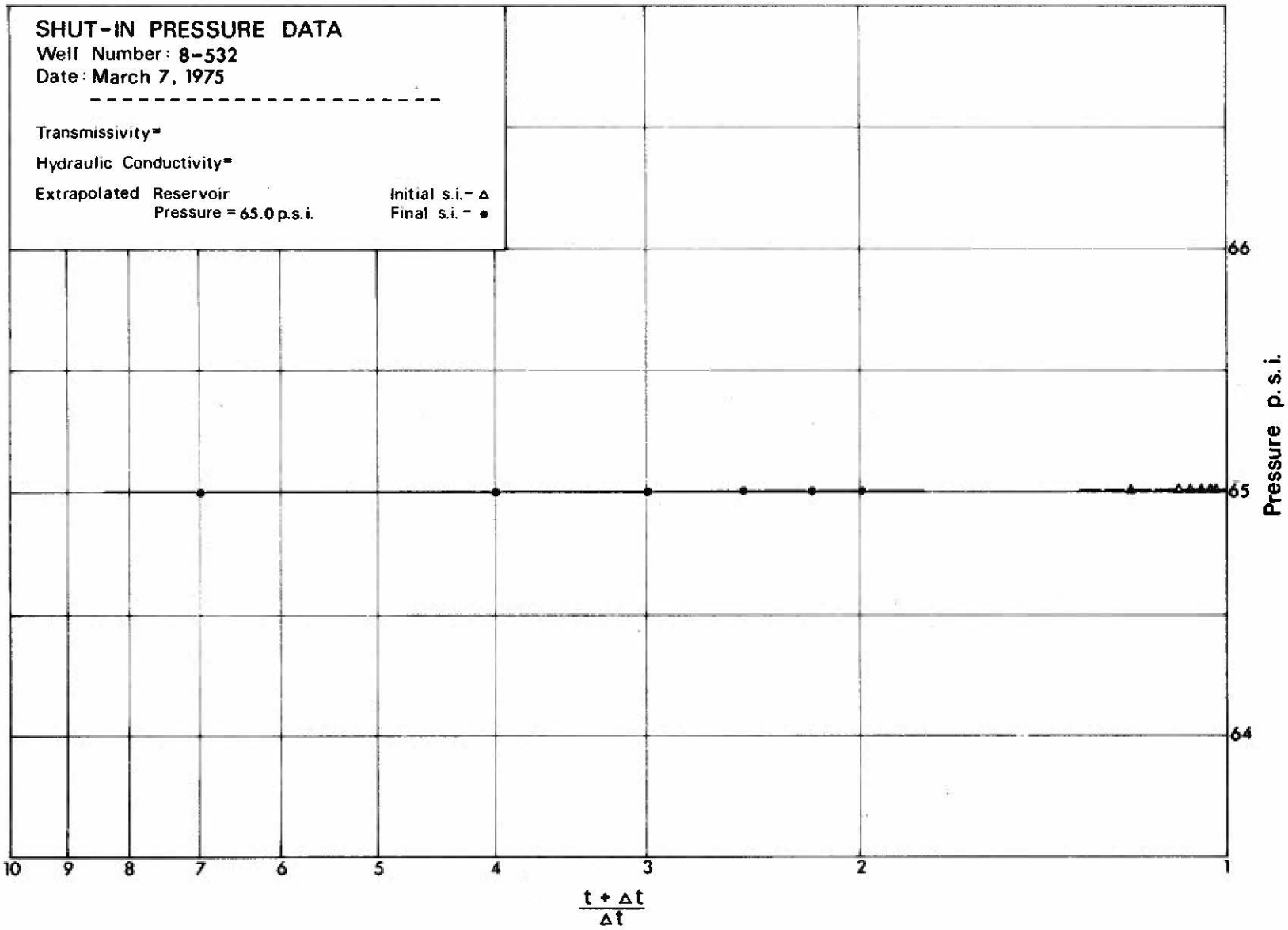
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 65 | 1.20 |
| 10 | 65 | 1.10 |
| 15 | 65 | 1.07 |
| 20 | 65 | 1.05 |
| 25 | 65 | 1.04 |
| 30 | 65 | 1.033 |



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 65 | 7.00 |
| 10 | 65 | 4.00 |
| 15 | 65 | 3.00 |
| 20 | 65 | 2.50 |
| 25 | 65 | 2.20 |
| 30 | 65 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 8-532
Date: March 7, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 65.0 p.s.i.
Initial s.i.- Δ
Final s.i. - •
66
65
64
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

8-532-D-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Drill stem test on 8-532

Date sampled March 7, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 5.5 | 0.27 | 0.7 |
| Magnesium ($Mg^{++}$) | 25.9 | 2.13 | 5.6 |
| Sodium ($Na^{+}$) | 813.0 | 35.36 | 92.7 |
| Potassium ($K^{+}$) | 15.0 | 0.38 | 1.0 |
| Carbonate ($CO_3^{=}$) | 110.0 | 3.67 | 8.5 |
| Bicarbonate ($HCO_3^{-}$) | 1161.0 | 19.03 | 44.1 |
| Sulfate ($SO_4^{=}$) | 12.5 | 0.26 | 0.6 |
| Chloride ($Cl^{-}$) | 717.0 | 20.22 | 46.8 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 11.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 2114.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 43.177 | Total Cations (epm) | 38.151 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3600 | Temperature (C) | | |
| pH | 8.9 | pH | 7.5 | |
| Fluoride ($F^{-}$) | 1.1 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1632 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed from 8-532

Date sampled February 24, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 19.5 | 0.97 | 2.6 |
| Magnesium ($Mg^{++}$) | 27.5 | 2.26 | 6.1 |
| Sodium ($Na^{+}$) | 775.0 | 33.71 | 90.3 |
| Potassium ($K^{+}$) | 14.6 | 0.37 | 1.0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1396.0 | 22.88 | 61.1 |
| Sulfate ($SO_4^{=}$) | 7.7 | 0.16 | 0.4 |
| Chloride ($Cl^{-}$) | 511.0 | 14.41 | 38.5 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 0.0 |
| Silica ($SiO_2$) | 8.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 2034.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 37.469 | Total Cations (epm) | 37.318 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3500 | Temperature (C) | 4.0 | |
| pH | 8.1 | pH | 7.3 | |
| Fluoride ($F^{-}$) | 1.1 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1391 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | 3500 | |

SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Drill stem test on well 8-532

Date of sampling March 7, 1975

Total dissolved solids 2114 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | .01 |
| Al | .001 | Mg | M |
| As | <.01 | Mn | .001 |
| B | .03 | Mo | ND |
| Ba | .02 | Ni | .005 |
| Be | ND | Pb | ND |
| Bi | ND | Sb | ND |
| Ca | M | Si | .1 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .001 | V | ND |
| Fe | ND | Zn | M |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.6 | 0.13 | 1 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 371 | 16.14 | 75 |
| Potassium ($K^{+}$) | 208 | 5.32 | 25 |
| Carbonate ($CO_3^{=}$) | 209 | 6.97 | 26 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 22.3 | 0.46 | 2 |
| Chloride ($Cl^{-}$) | 238 | 6.71 | 26 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 2 | | |
| Hydroxide ($OH^{-}$) | 207 | 12.17 | 46 |
| Calcium (Acidified) | 17 | | |
| Magnesium (Acidified) | 1 | | |
| Total dissolved solids | 1356 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 26.31 | Total Cations (epm) | 21.59 |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 5100 |
| pH | 11.6 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | 4.5 | |
| pH | 12.4 | |
| Carbonate ($CO_3^{=}$) | 240 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 | ppm |
| Hydroxide ($OH^{-}$) | 204 | ppm |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1.0 | 0.05 | 0 |
| Magnesium ($Mg^{++}$) | 0.7 | 0.06 | 0 |
| Sodium ($Na^{+}$) | 389.0 | 16.92 | 72 |
| Potassium ($K^{+}$) | 258.0 | 6.60 | 28 |
| Carbonate ($CO_3^{=}$) | 554.0 | 18.47 | 77 |
| Bicarbonate ($HCO_3^{-}$) | 151.0 | 2.48 | 10 |
| Sulfate ($SO_4^{=}$) | 16.8 | 0.35 | 2 |
| Chloride ($Cl^{-}$) | 98.0 | 2.76 | 12 |
| Nitrate ($NO_3^{=}$) | 1.1 | 0.02 | 0 |
| Silica ($SiO_2$) | 0.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1.4 | | |
| Magnesium (Acidified) | 0.9 | | |
| Total dissolved solids | 1436 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 24.07 | Total Cations (epm) | 23.63 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2500 | Temperature (C) | 6.0 | |
| pH | 10.3 | pH | 10.7 | |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 624 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 20 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 41.0 | 2.05 | 6.9 |
| Magnesium ($Mg^{++}$) | 19.2 | 1.58 | 5.3 |
| Sodium ($Na^{+}$) | 583.0 | 25.36 | 85.4 |
| Potassium ($K^{+}$) | 27.1 | 0.69 | 2.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1164.0 | 19.08 | 65.9 |
| Sulfate ($SO_4^{=}$) | 6.3 | 0.13 | 0.5 |
| Chloride ($Cl^{-}$) | 346.0 | 9.76 | 33.7 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 5.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 31.0 | | |
| Magnesium (Acidified) | 19.3 | | |
| Total dissolved solids | 1634.0 | | |
| Total Anions (epm) | 28.97 | Total Cations (epm) | 29.68 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2900 | Temperature (C) | 7.0 |
| pH | 7.8 | pH | 7.2 |
| Fluoride ($F^{-}$) | 1.1 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 1279.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

8-532-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 16.3 | 0.81 | 4.2 |
| Magnesium(Mg) | 7.7 | 0.63 | 3.3 |
| Sodium(Na) | 339.0 | 14.75 | 76.0 |
| Potassium(K) | 125.0 | 3.20 | 16.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 934.0 | 15.31 | 76.9 |
| Sulphate(SO4) | 3.9 | 0.08 | 0.4 |
| Chloride(Cl) | 160.0 | 4.51 | 22.7 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 5.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 15.2 | | |
| Magnesium(Acidified) | 7.5 | | |
| TDS(mg/l) | 1136.0 | | |
| Total Anions(epm) | 19.90 | Total Cations(epm) | 19.39 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1690 | | Temperature(C) | 8.00 | |
| pH | 7.4 | | pH | 7.8 | |
| Fluoride(F) | 0.7 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 927 | mg/l |
| | | | Hydroxide(OH) | | |

8-532-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 35.0 | 1.75 | 5.0 |
| Magnesium(Mg) | 25.0 | 2.06 | 5.9 |
| Sodium(Na) | 688.0 | 29.93 | 85.9 |
| Potassium(K) | 43.3 | 1.11 | 3.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1381.0 | 22.64 | 62.0 |
| Sulphate(SO4) | 16.3 | 0.34 | 0.9 |
| Chloride(Cl) | 480.0 | 13.54 | 37.1 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 5.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 32.0 | | |
| Magnesium(Acidified) | 26.0 | | |
| TDS(mg/l) | 1942.0 | | |
| Total Anions(epm) | 36.52 | Total Cations(epm) | 34.84 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2730 | | Temperature(C) | 6.00 | |
| pH | 7.6 | | pH | 7.4 | |
| Fluoride(F) | 1.0 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 1400 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 8-532-E-82

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.9 | 0.09 | 0.5 |
| Magnesium(Mg) | 3.1 | 0.26 | 1.3 |
| Sodium(Na) | 335.0 | 14.57 | 72.7 |
| Potassium(K) | 200.0 | 5.13 | 25.6 |
| Carbonate(CO3) | 70.0 | 2.33 | 12.8 |
| Bicarbonate(HCO3) | 864.0 | 14.16 | 77.5 |
| Sulphate(SO4) | 6.0 | 0.13 | 0.7 |
| Chloride(Cl) | 56.0 | 1.58 | 8.6 |
| Nitrate(NO3) | 4.3 | 0.07 | 0.4 |
| Silica(SiO2) | 1.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 4.0 | | |
| Magnesium(Acidified) | 3.6 | | |
| TDS(mg/l) | 1278.0 | | |
| Total Anions(epm) | 18.27 | Total Cations(epm) | 20.05 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2050 | Temperature | -1.00 |
| pH | 9.1 | pH | 8.6 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

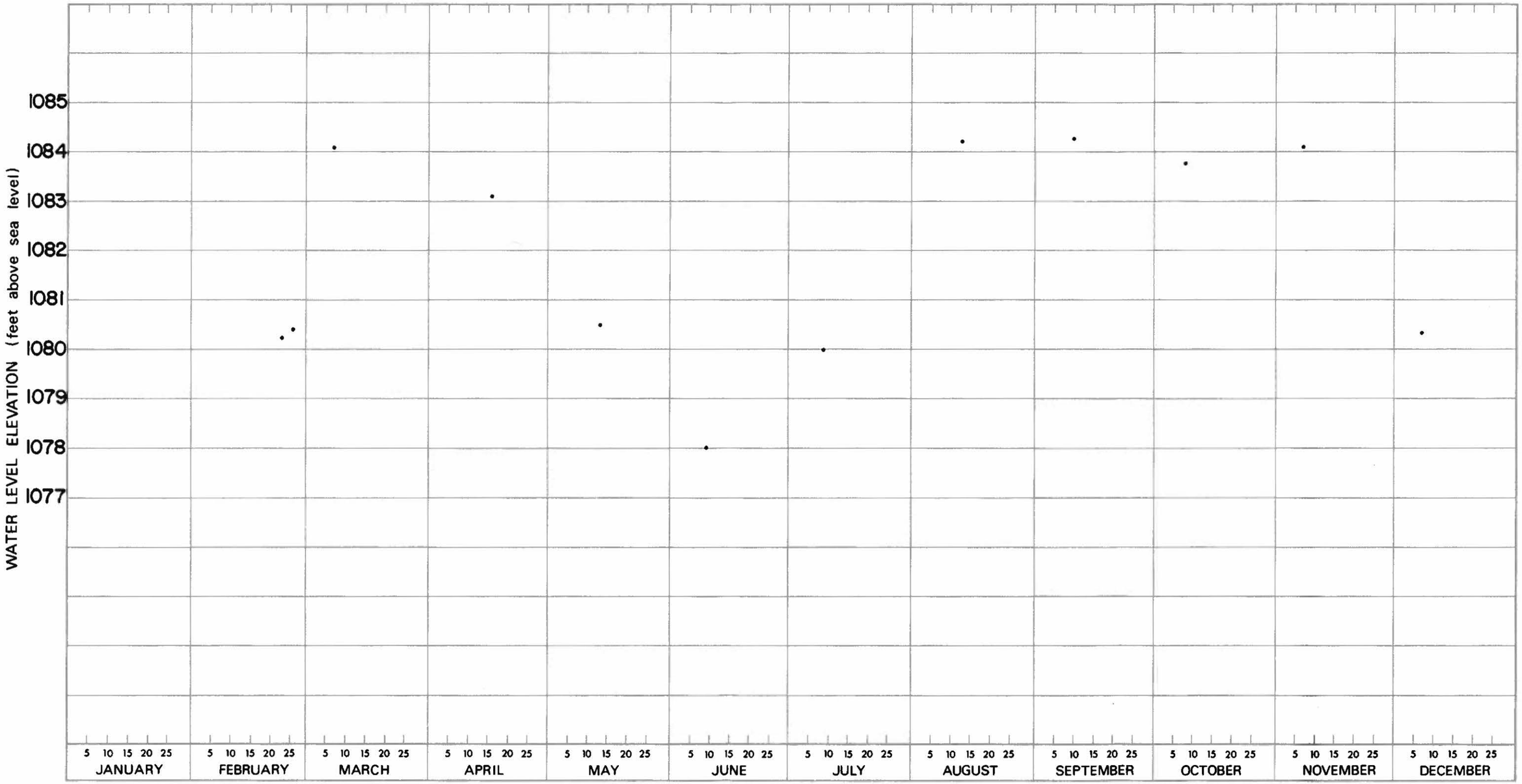
8-532-H-76

## WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council



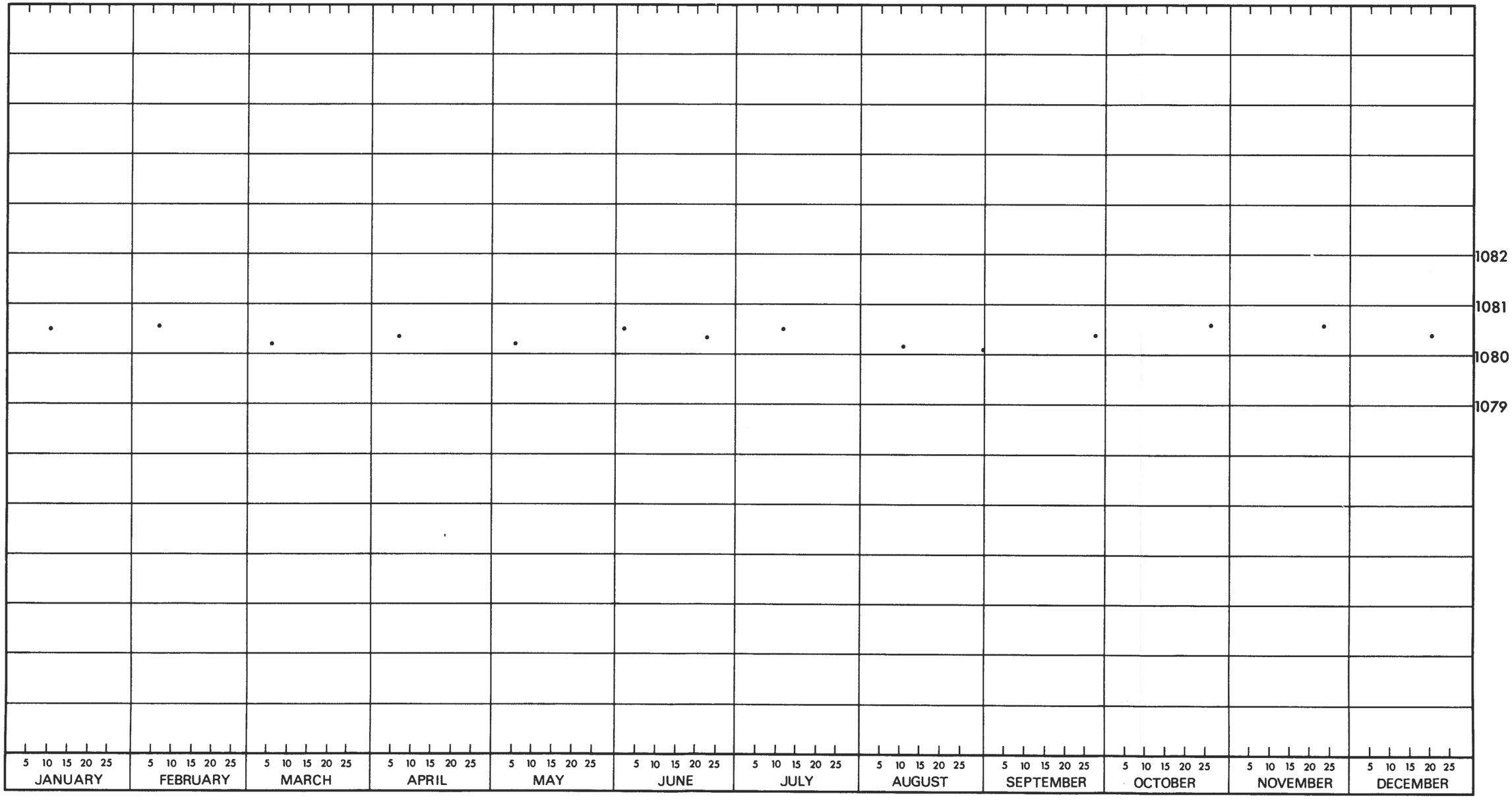
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **8-532**

Lsd **5** Sec **30** Twp **94** R **7** W4th

Alberta Research Council

8 - 532 - H - 77




1976

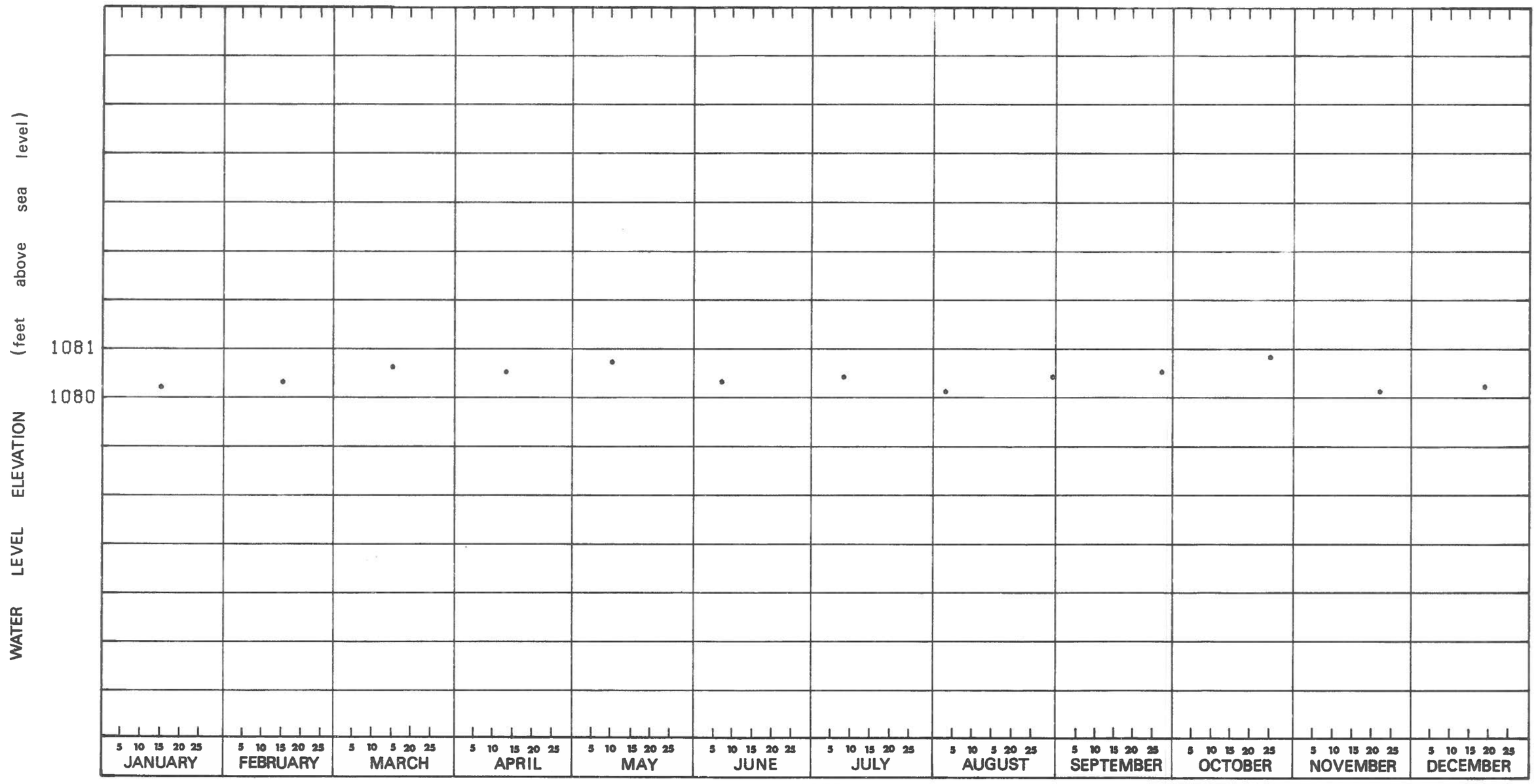
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-532

8-532-H-78

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council



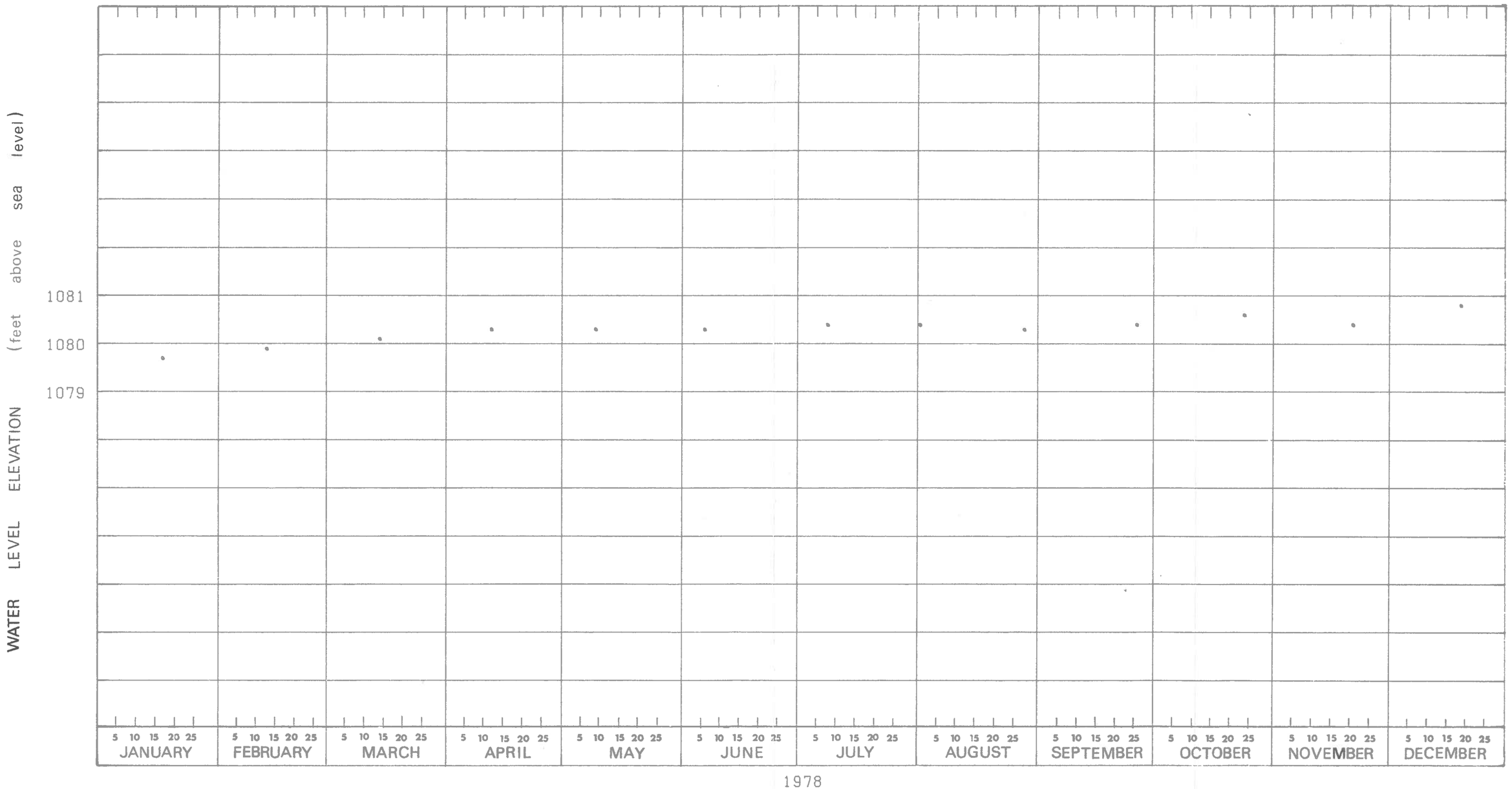
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-532

LSD 5 SEC 30 TWP 94 R 7 W4TH

8-532-H-79

Alberta Research Council



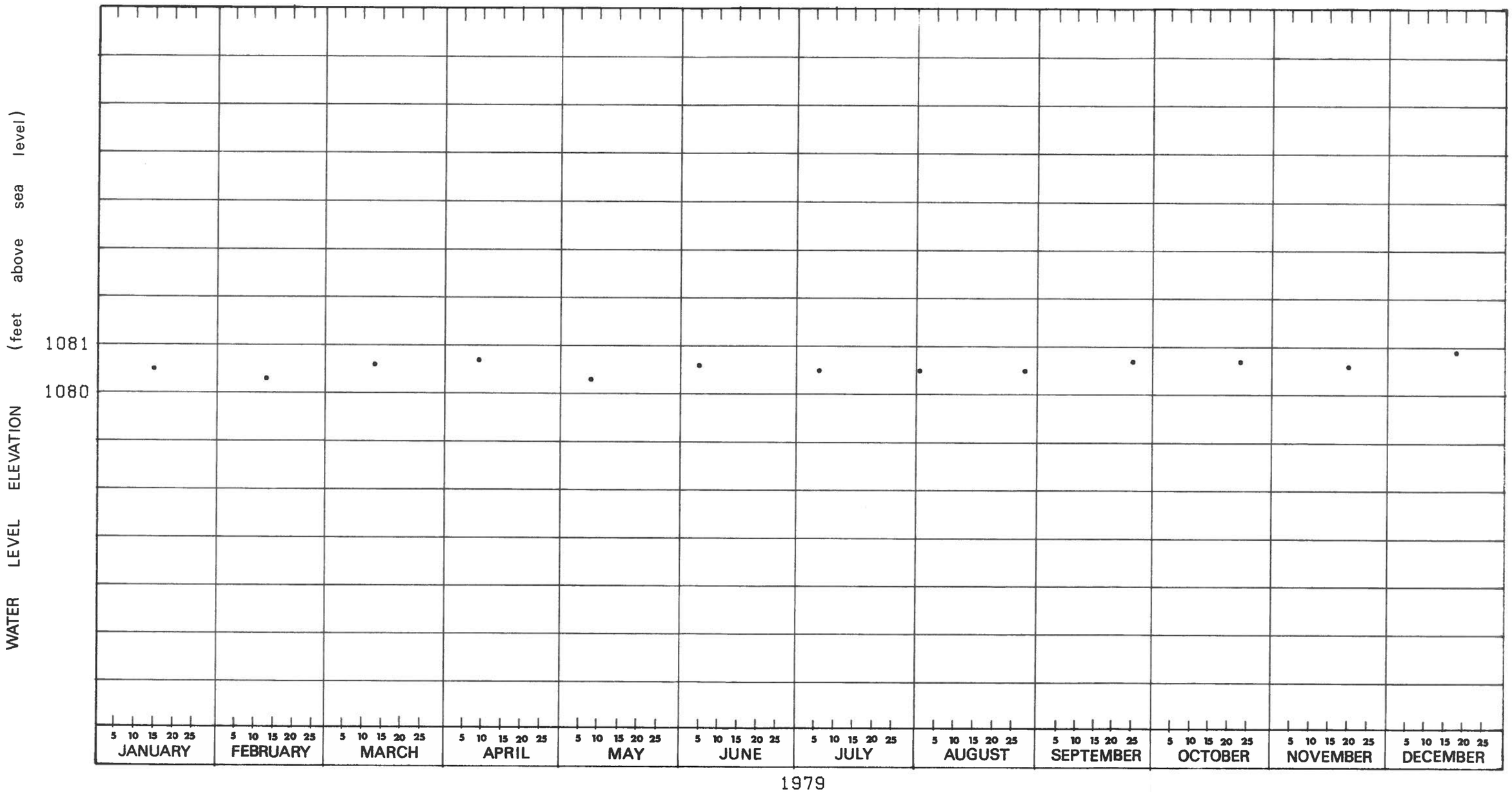
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-532-H-80



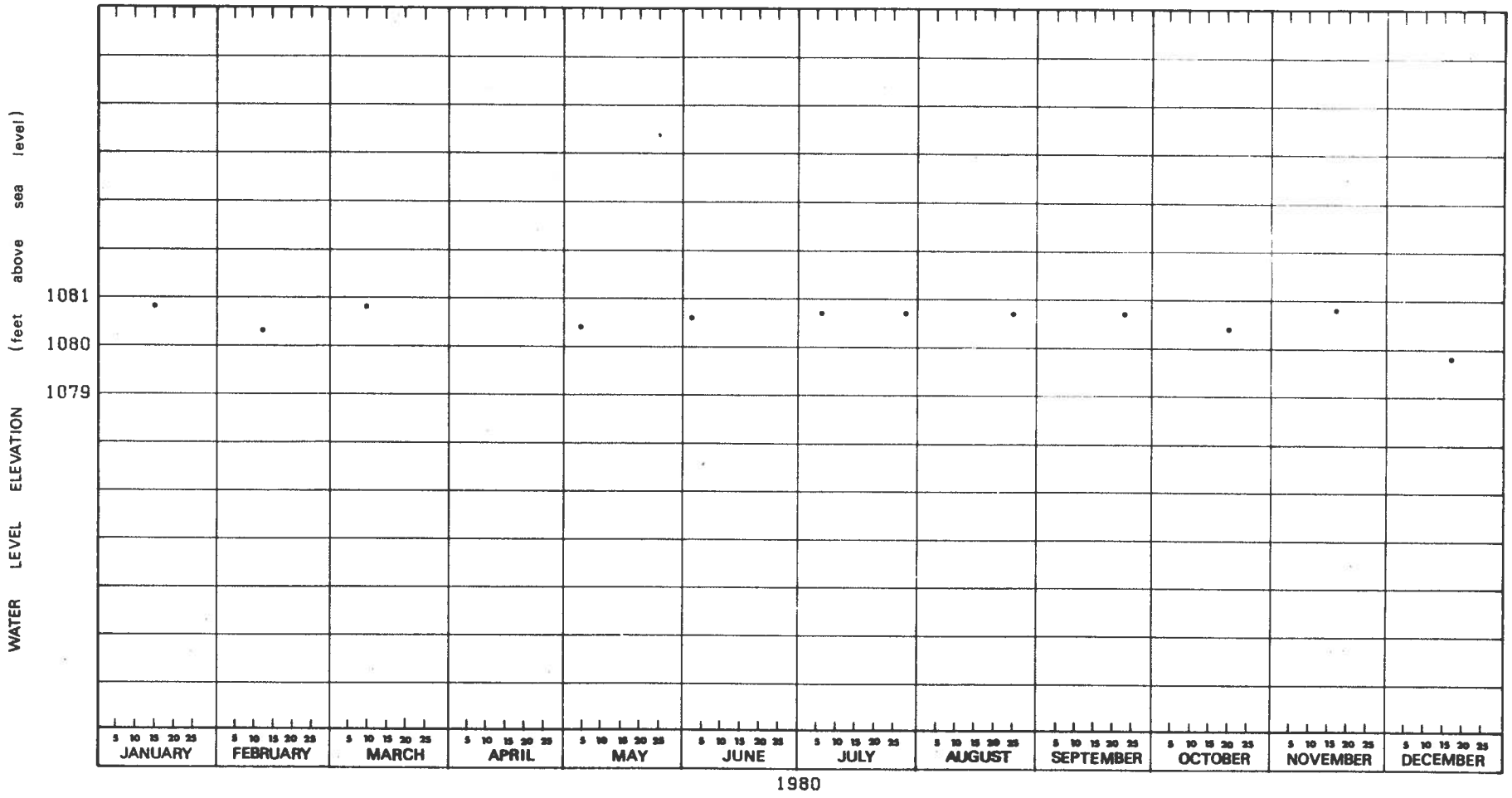
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-532-H-81



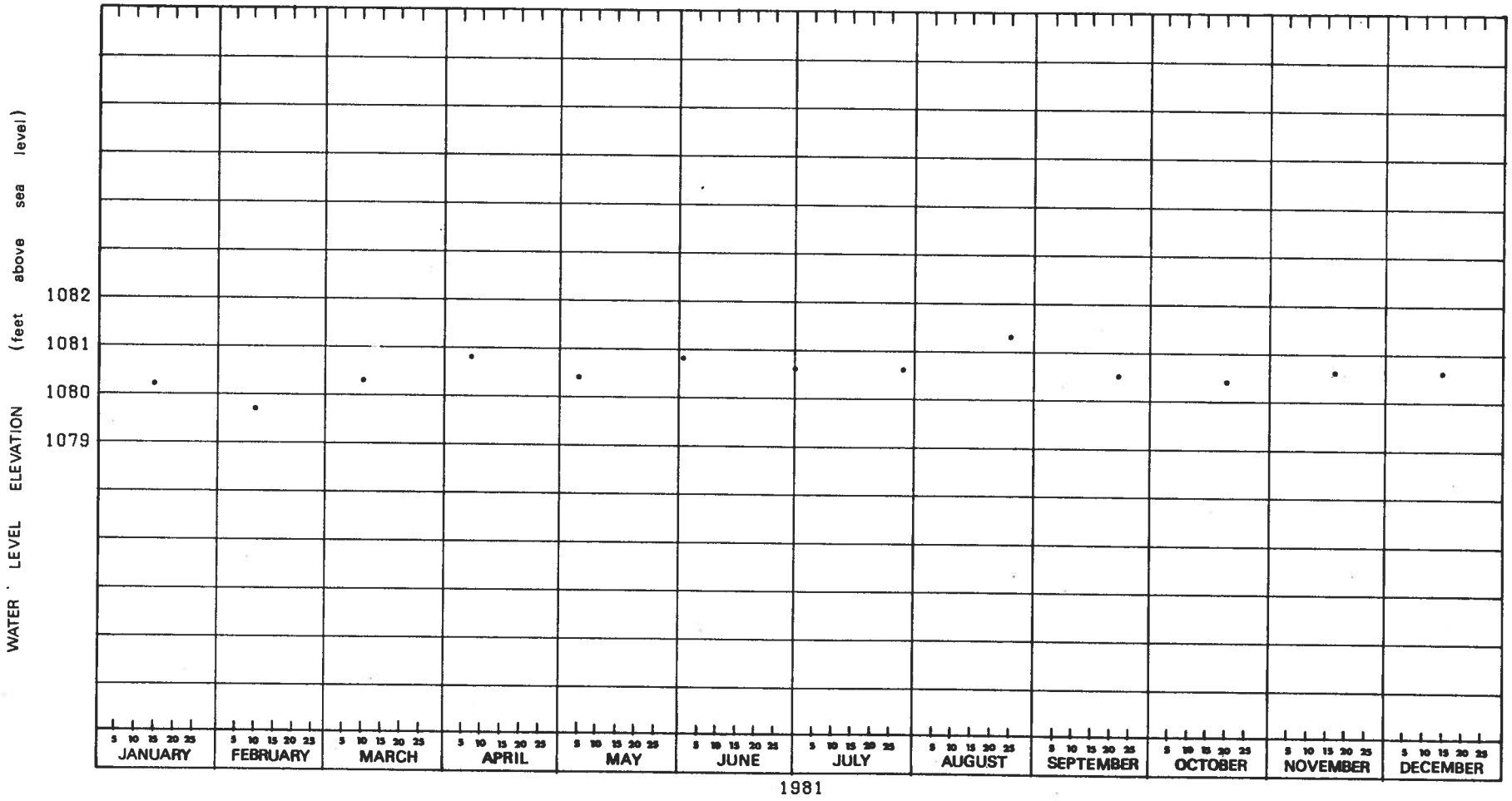
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-532-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 14/75 | | | Well completed |
| Feb 22/75 | 53.68 TOC | 1237.9 | Bail 300 gallons |
| Feb 23/75 | 101.76 TOC | 1080.2 | Bail 70 gallons; water sample |
| Feb 26/75 | 102.45 MP | 1080.4 | Install shelter; MP = 2.43' TOC, (1416.4) |
| Mar 7/75 | | | DST; water sample, FSI = 65# from 491' |
| | 101.50 TOC | 1081.1 | Reinstall shelter; MP = 3.02' TOC, (1417.0) |
| Apr 16/75 | 101.50 MP | 1084.1 | |
| May 13/75 | 102.59 MP | 1079.8 | MP = 27.75" (1416.3) |
| June 9/75 | approx 103 MP | 1078 | |
| July 9/75 | 102.53 MP | 1080.0 | |
| Aug 13/75 | 101.46 MP | 1083.5 | |
| Sept 10/75 | 101.45 MP | 1083.5 | Sampled; temp. 4.5°C |
| Oct 8/75 | 101.38 MP | 1083.8 | |
| Nov 7/75 | 101.28 MP | 1084.1 | |
| Dec 7/75 | 102.41 MP | 1080.4 | |
| Jan 11/76 | 102.37 MP | 1080.5 | MP (1416.3) |
| Feb 7/76 | 102.36 MP | 1080.6 | |
| Mar 6/76 | 102.46 MP | 1080.2 | |
| Apr 7/76 | 102.40 MP | 1080.4 | |
| May 6/76 | 102.45 MP | 1080.3 | |
| June 2/76 | 102.35 MP | 1080.6 | |
| June 23/76 | 102.40 MP | 1080.4 | |
| July 17/76 | 102.35 MP | 1080.6 | Sampled; temp. 6°C |
| Aug 11/76 | 102.46 MP | 1080.2 | |
| Aug 31/76 | 102.47 MP | 1080.2 | |
| Sept 28/76 | 102.38 MP | 1080.5 | |
| Oct 27/76 | 102.35 MP | 1080.6 | |
| Nov 24/76 | 102.35 MP | 1080.6 | |
| Dec 21/76 | 102.40 MP | 1080.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 102.46 MP | 1080.2 | MP (1416.3) |
| Jan 27/77 | | | Treated with 70 lb NU-WELL acid well conditioner |
| Feb 7/77 | | | Blown with air |
| Feb 16/77 | 102.52 MP | 1080.3 | New MP = 0.82 m TOC, (1416.6) |
| Mar 16/77 | 102.45 MP | 1080.6 | |
| Apr 14/77 | 102.47 MP | 1080.5 | |
| May 11/77 | 102.32 MP | 1080.7 | New MP = 0.70 m TOC, (1416.3) |
| June 8/77 | 102.45 MP | 1080.3 | |
| July 9/77 | 102.40 MP | 1080.4 | Sampled; temp. 7°C |
| Aug 4/77 | 102.51 MP | 1080.1 | |
| Aug 31/77 | 102.41 MP | 1080.4 | |
| Sept 28/77 | 102.39 MP | 1080.5 | |
| Oct 26/77 | 102.27 MP | 1080.8 | Temp. 6.4°C |
| Nov 23/77 | 102.51 MP | 1080.1 | |
| Dec 20/77 | 102.48 MP | 1080.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 102.61 MP | 1079.7 | MP (1416.3) |
| Feb 14/78 | 102.56 MP | 1079.9 | |
| Mar 15/78 | 102.50 MP | 1080.1 | |
| Apr 13/78 | 102.45 MP | 1080.3 | |
| May 10/78 | 102.43 MP | 1080.3 | |
| June 7/78 | 102.45 MP | 1080.3 | |
| July 9/78 | 102.40 MP | 1080.4 | Sampled; temp. 8°C |
| Aug 2/78 | 102.42 MP | 1080.4 | |
| Aug 29/78 | 102.43 MP | 1080.3 | |
| Sept 27/78 | 102.42 MP | 1080.4 | |
| Oct 25/78 | 102.36 MP | 1080.6 | |
| Nov 22/78 | 102.42 MP | 1080.4 | |
| Dec 20/78 | 102.30 MP | 1080.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 102.38 MP | 1080.5 | MP (1416.3) |
| Feb 14/79 | 102.44 MP | 1080.3 | |
| Mar 14/79 | 102.35 MP | 1080.6 | |
| Apr 10/79 | 102.32 MP | 1080.7 | |
| May 9/79 | 102.44 MP | 1080.3 | |
| June 6/79 | 102.35 MP | 1080.6 | |
| July 7/79 | 102.39 MP | 1080.5 | Sampled; temp. 6°C |
| Aug 2/79 | 102.38 MP | 1080.5 | |
| Aug 29/79 | 102.37 MP | 1080.5 | |
| Sept 26/79 | 102.31 MP | 1080.7 | |
| Oct 24/79 | 102.32 MP | 1080.7 | |
| Nov 21/79 | 102.34 MP | 1080.6 | |
| Dec 19/79 | 102.26 MP | 1080.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

8 - 532 - W - 82

WELL HISTORY

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 102.27 MP | 1080.8 | |
| Feb 13/80 | 102.43 MP | 1080.3 | |
| Mar 11/80 | 102.28 MP | 1080.8 | |
| Apr 10/80 | | | Could not measure |
| May 6/80 | 102.41 MP | 1080.4 | |
| June 4/80 | 102.34 MP | 1080.6 | |
| July 8/80 | 102.33 MP | 1080.7 | |
| July 30/80 | 102.32 MP | 1080.7 | |
| Aug 27/80 | 102.31 MP | 1080.7 | |
| Sept 25/80 | 102.32 MP | 1080.7 | |
| Oct 22/80 | 102.41 MP | 1080.4 | |
| Nov 19/80 | 102.30 MP | 1080.8 | |
| Dec 19/80 | 102.59 MP | 1079.8 | |
| Jan 16/81 | 102.46 MP | 1080.2 | |
| Feb 11/81 | 102.63 MP | 1079.7 | |
| Mar 11/81 | 102.44 MP | 1080.3 | |
| Apr 8/81 | 102.29 MP | 1080.8 | |
| May 6/81 | 102.40 MP | 1080.4 | |
| June 2/81 | 102.30 MP | 1080.8 | |
| July 1/81 | 102.36 MP | 1080.6 | |
| July 29/81 | 102.35 MP | 1080.6 | |
| Aug 26/81 | 102.12 MP | 1081.3 | |
| Sept 23/81 | 102.38 MP | 1080.5 | |
| Oct 21/81 | 102.41 MP | 1080.4 | |
| Nov 18/81 | 102.35 MP | 1080.6 | |
| Dec 16/81 | 102.36 MP | 1080.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 14/75 | | | Well completed |
| Feb 22/75 | 53.67 TOC | 1237.89 | Bail 300 gallons |
| Feb 23/75 | 101.73 TOC | 1080.19 | Bail 70 gallons; water sample |
| Feb 26/75 | 102.42 MP | 1080.35 | Install shelter; MP = 2.43' TOC, (1413.39) |
| Mar 7/75 | | | DST; water sample; FSI = 65# from 491' |
| | 101.47 TOC | 1084.06 | Reinstall shelter; MP - 3.02' TOC, (1416.98) |
| Apr 16/75 | 101.78 MP | 1083.06 | |
| May 13/75 | 111.71 new MP | 1080.48 | MP = 27.75" TOC, (1416.27) |
| June 9/75 | 103 MP | 1078 | |
| July 9/75 | 102.53 MP | 1079.97 | |
| Aug 13/75 | 101.46 MP | 1084.19 | |
| Sept 10/75 | 101.45 MP | 1084.22 | Sampled well; temp. 4.5°C |
| Oct 8/75 | 101.38 MP | 1083.74 | |
| Nov 7/75 | 101.28 MP | 1084.07 | |
| Dec 7/75 | 102.41 MP | 1080.32 | |

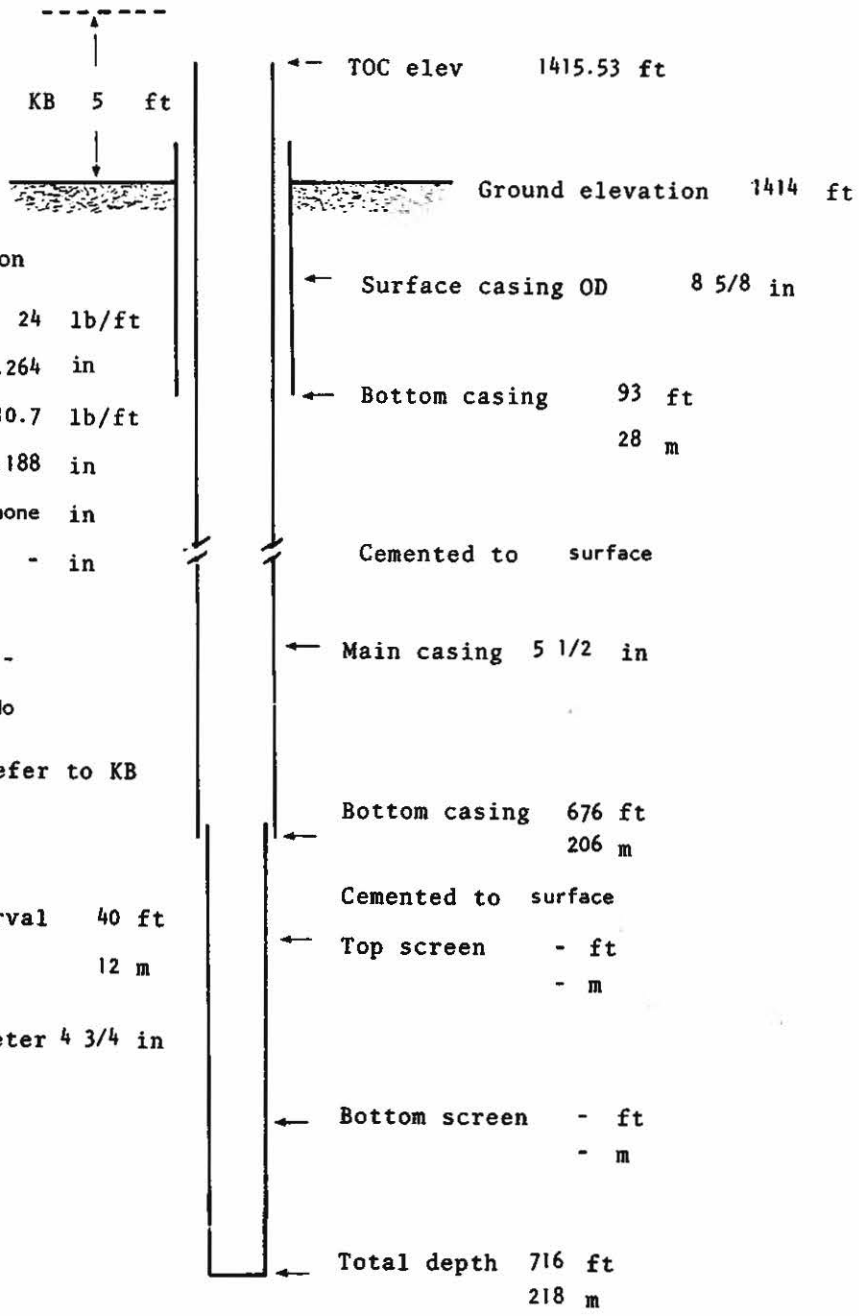
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Tp 94 R 7 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 10.7 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | none | in |
| screen OD | - | in |
| slots per foot | | |
| material | - | |
| Sand pack | No | |

Note: all depths refer to KB

Open hole interval 40 ft
12 m

Open hole diameter 4 3/4 in

## DRILL STEM TEST

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Tp 94 R 7 W4th

Alberta Research Council

Elevation: gl 1414
KB 1416

Type of test - Casing Positrieve

Date of test March 7, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1430 | hrs |
| Tool opened | 1529 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 45 | min |
| Pulled loose at | 1730 | hrs |
| Out of hole at | 1815 | hrs |
| Wt on packers | 3000 | lbs |

Description of blow Weak initial puff, very weak blow, decreasing to nil in 20 seconds

Total water recovered 4 ft

Water sample No. DH 49

Gas blow No

Remarks Test satisfactory
5-1/2" RBP @ 665'

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 676-716

Formation tested Waterways

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Total Interval | 11.20 | |

### PRESSURE DATA (psi)

| | | |
|---|---|---|
| Instrument No. | | RPG-92N |
| Capacity (psig) | | 431 |
| Instrument set at (ft) | | 669 |
| Initial hydrostatic | A | 52 |
| First flow | B | 9 |
| | B1 | 9 |
| Initial shut in | C | 54 |
| Second flow | D | 11 |
| | D1 | 11 |
| Final shut in | G | 55 |
| Final hydrostatic | H | 55 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

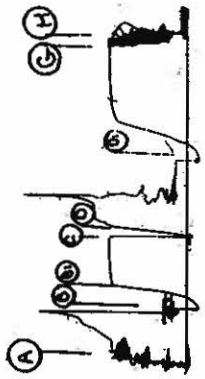
OBSERVATION WELL NUMBER 8-716

PRESSURE INCREMENTS

Recorder RPG-92N

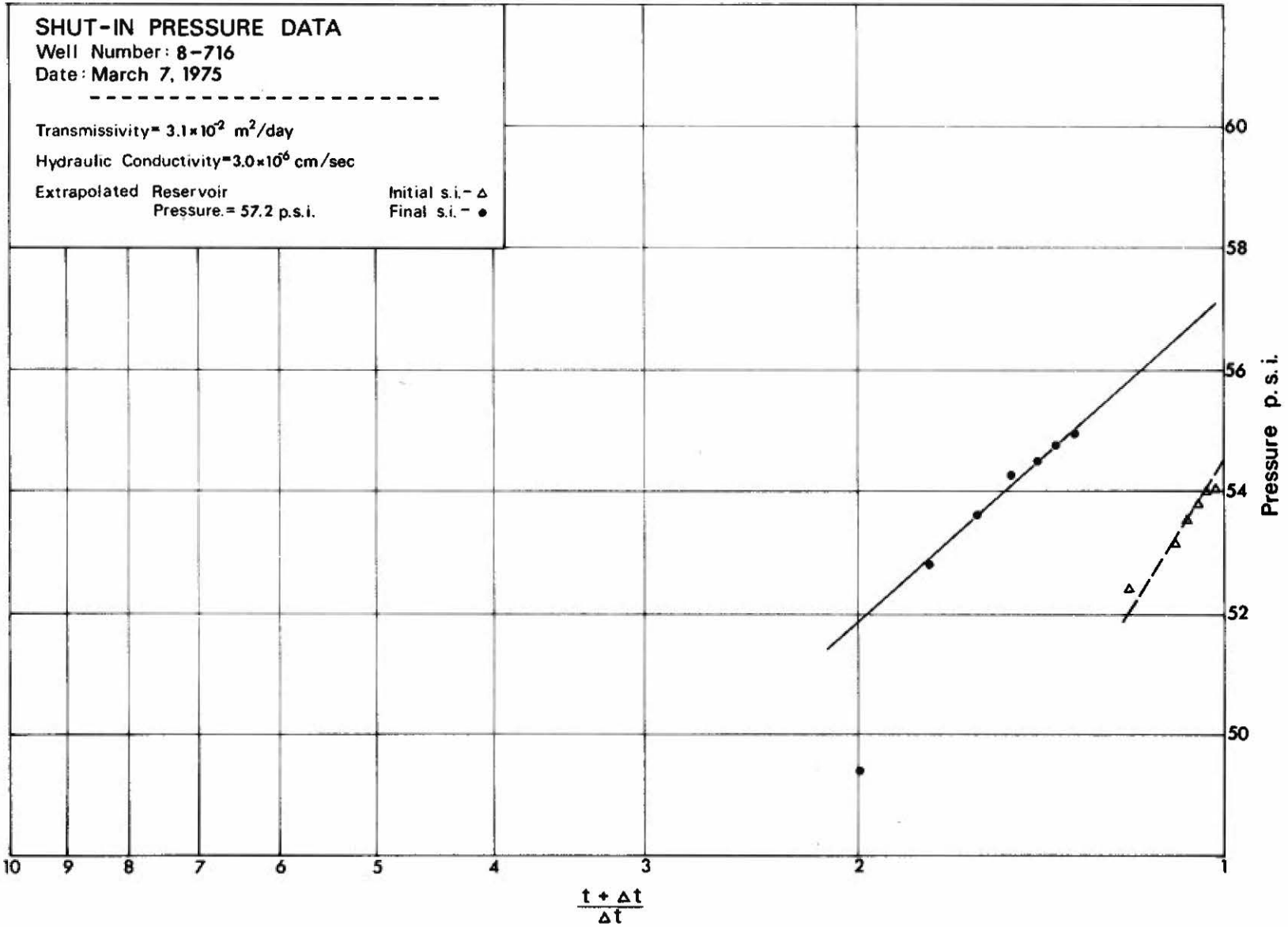
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 52.4 | 1.20 |
| 10 | 53.1 | 1.10 |
| 15 | 53.5 | 1.07 |
| 20 | 53.8 | 1.05 |
| 25 | 54.0 | 1.04 |
| 30 | 54.0 | 1.033 |

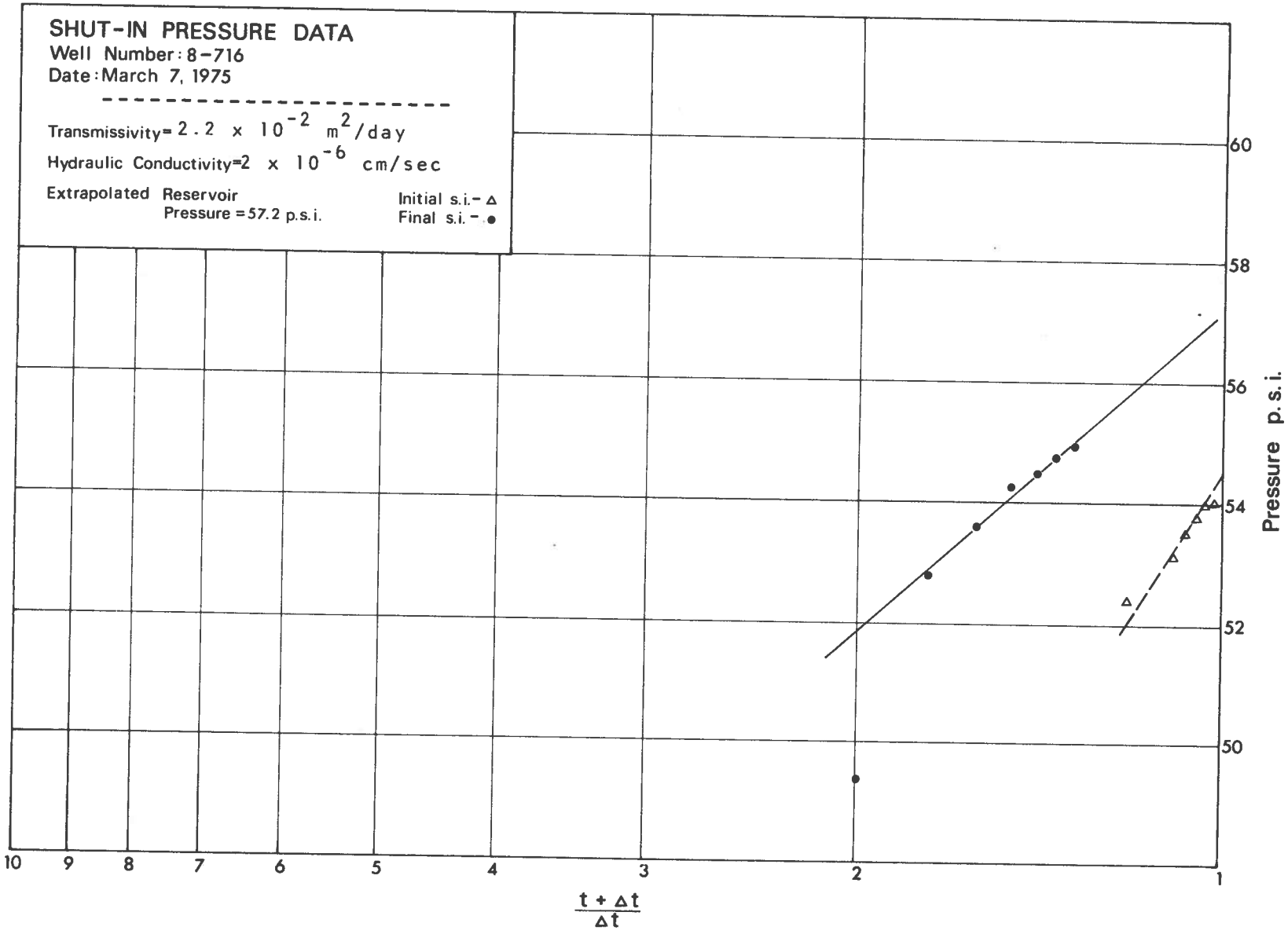


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 0 | 4.00 |
| 10 | 19.4 | 2.50 |
| 15 | 49.4 | 2.00 |
| 20 | 52.8 | 1.75 |
| 25 | 53.6 | 1.60 |
| 30 | 54.3 | 1.50 |
| 35 | 54.5 | 1.43 |
| 40 | 54.8 | 1.375 |
| 45 | 55.0 | 1.333 |


SHUT-IN PRESSURE DATA
Well Number: 8-716
Date: March 7, 1975
Transmissivity= 3.1×10⁻² m²/day
Hydraulic Conductivity=3.0×10⁶ cm/sec
Extrapolated Reservoir Pressure.= 57.2 p.s.i.
Initial s.i.- Δ
Final s.i. - •
60
58
56
54
52
50
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

8-716-D-76


SHUT-IN PRESSURE DATA
Well Number: 8-716
Date: March 7, 1975
Transmissivity= 2.2 x 10^-2 m^2/day
Hydraulic Conductivity=2 x 10^-6 cm/sec
Extrapolated Reservoir Pressure = 57.2 p.s.i.
Initial s.i.- Δ
Final s.i. - ●
60
58
56
54
52
50
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

8-716-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 10, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 47 | 2.35 | 2 |
| Magnesium ($Mg^{++}$) | 142 | 11.68 | 11 |
| Sodium ($Na^{+}$) | 2125 | 92.43 | 86 |
| Potassium ($K^{+}$) | 50 | 1.28 | 1 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1491 | 24.44 | 23 |
| Sulfate ($SO_4^{=}$) | 160 | 3.33 | 3 |
| Chloride ($Cl^{-}$) | 2838 | 80.03 | 74 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 17.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 89 | | |
| Magnesium (Acidified) | 129 | | |
| Total dissolved solids | 6014 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 107.80 | Total Cations (epm) | 107.74 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | |
| pH | 7.9 |
| Fluoride ($F^{-}$) | 1.6 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 4.0 |
| pH | 8.1 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 1708 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed from 8-716

Date sampled February 24, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 167.0 | 8.33 | 66.5 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 00.0 |
| Sodium ($Na^{+}$) | 69.0 | 3.00 | 23.9 |
| Potassium ($K^{+}$) | 47.1 | 1.20 | 9.6 |
| Carbonate ($CO_3^{=}$) | 21.6 | 0.72 | 5.6 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 22.3 | 0.46 | 3.6 |
| Chloride ($Cl^{-}$) | 27.0 | 0.76 | 5.9 |
| Nitrate ($NO_3^{=}$) | 1.5 | 0.02 | 0.2 |
| Silica ($SiO_2$) | 5.4 | | |
| Hydroxide ($OH^{-}$) | 186.0 | 10.93 | 84.7 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 654 | | |
| Total Anions (epm) 12.905 | | Total Cations (epm) | 12.540 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2550 |
| pH | 12.0 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 6.0 |
| pH | 12.6 |
| Carbonate ($CO_3^{=}$) | 773.0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 41.5 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | 8000+ |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Drill stem test on 8-716

Date sampled March 7, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 7.5 | 0.37 | 1.1 |
| Magnesium ($Mg^{++}$) | 10.3 | 0.85 | 2.4 |
| Sodium ($Na^{+}$) | 738.0 | 32.10 | 92.8 |
| Potassium ($K^{+}$) | 49.2 | 1.26 | 3.6 |
| Carbonate ($CO_3^{=}$) | 106.0 | 3.53 | 10.4 |
| Bicarbonate ($HCO_3^{-}$) | 215.0 | 3.52 | 10.4 |
| Sulfate ($SO_4^{=}$) | 81.0 | 1.69 | 5.0 |
| Chloride ($Cl^{-}$) | 895.0 | 25.24 | 74.2 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 13.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 2050.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 33.996 | Total Cations (epm) | 34.581 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | |
| pH | 9.6 | pH | 10.3 |
| Fluoride ($F^{-}$) | 0.9 ppm | Carbonate ($CO_3^{=}$) | 192 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 . ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 37.0 | 1.85 | 2 |
| Magnesium ($Mg^{++}$) | 141.0 | 11.60 | 11 |
| Sodium ($Na^{+}$) | 2050.0 | 89.17 | 86 |
| Potassium ($K^{+}$) | 54.0 | 1.38 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1537.0 | 25.19 | 24 |
| Sulfate ($SO_4^{=}$) | 227.0 | 4.73 | 5 |
| Chloride ($Cl^{-}$) | 2600.0 | 73.32 | 71 |
| Nitrate ($NO_3^{=}$) | 7.5 | 0.12 | 0 |
| Silica ($SiO_2$) | 16.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 39.6 | | |
| Magnesium (Acidified) | 146.3 | | |
| Total dissolved solids | 6020 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 103.36 | Total Cations (epm) | 104.00 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 9.0 |
| pH | 8.3 | pH | 7.9 |
| Fluoride ($F^{-}$) | 1.6 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 1591 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Date sampled: July 17, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .161 |
| Au | <.003 | Mo | <.006 |
| Al | 0.44 | Na | 2255 |
| As | <.038 | Ni | <.010 |
| B | 5.24 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 38.4 | Si | 9.30 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 3.51 |
| Cr | <.006 | Te | <.065 |
| Cu | .021 | Ti | .003 |
| Eu | .015 | U | <.020 |
| Fe | .297 | V | .012 |
| K | 110 | W | <.078 |
| Mg | 146 | Zn | .099 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1540.0 | 76.85 | 33.7 |
| Magnesium ($Mg^{++}$) | 225.0 | 18.52 | 8.1 |
| Sodium ($Na^{+}$) | 3025.0 | 131.58 | 57.7 |
| Potassium ($K^{+}$) | 47.9 | 1.23 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 622.0 | 10.20 | 7.6 |
| Sulfate ($SO_4^{=}$) | 331.0 | 6.89 | 5.1 |
| Chloride ($Cl^{-}$) | 4180.0 | 117.88 | 87.3 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 10.6 | | |
| Hydroxide ($OH^{-}$) | 0.0 | 0.00 | 0.0 |
| Calcium (Acidified) | 1420.0 | | |
| Magnesium (Acidified) | 203.0 | | |
| Total dissolved solids | 20430.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 134.98 | Total Cations (epm) | 228.17 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 8.0 |
| pH | 6.8 | pH | 6.9 |
| Fluoride ($F^{-}$) | 1.1 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 761.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 700.0 | 34.93 | 21.2 |
| Magnesium(Mg) | 190.0 | 15.64 | 9.5 |
| Sodium(Na) | 2588.0 | 112.57 | 68.5 |
| Potassium(K) | 49.2 | 1.26 | 0.8 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 468.0 | 7.67 | 6.6 |
| Sulphate(SO4) | 156.0 | 3.25 | 2.8 |
| Chloride(Cl) | 3760.0 | 106.03 | 90.7 |
| Nitrate(NO3) | 0.7 | 0.01 | 0.0 |
| Silica(SiO2) | 6.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 680.0 | | |
| Magnesium(Acidified) | 185.0 | | |
| TDS(mg/l) | 13656.0 | | |
| Total Anions(epm) | 116.97 | Total Cations(epm) | 164.40 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 13100 | | Temperature(C) | 8.00 | |
| pH | 7.0 | | pH | 7.0 | |
| Fluoride(F) | 1.1 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 654 | mg/l |
| | | | Hydroxide(OH) | | |

8-716-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 104.0 | 5.19 | 4.5 |
| Magnesium(Mg) | 148.0 | 12.18 | 10.6 |
| Sodium(Na) | 2213.0 | 96.26 | 83.9 |
| Potassium(K) | 44.2 | 1.13 | 1.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 273.0 | 4.47 | 4.8 |
| Sulphate(SO4) | 27.4 | 0.57 | 0.6 |
| Chloride(Cl) | 3160.0 | 89.11 | 94.6 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 2.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 111.0 | | |
| Magnesium(Acidified) | 139.0 | | |
| TDS(mg/l) | 9030.0 | | |
| Total Anions(epm) | 94.16 | Total Cations(epm) | 114.76 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 10200 | | Temperature(C) | 8.00 | |
| pH | 8.2 | | pH | 8.2 | |
| Fluoride(F) | 0.7 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 351 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 8-716-E-82

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Rge 7 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 575.0 | 28.75 | 16.9 |
| Magnesium(Mg) | 340.0 | 28.33 | 16.7 |
| Sodium(Na) | 2563.0 | 111.43 | 65.6 |
| Potassium(K) | 53.0 | 1.36 | 0.8 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 163.0 | 2.67 | 2.6 |
| Sulphate(SO4) | 330.0 | 6.88 | 6.7 |
| Chloride(Cl) | 3300.0 | 92.96 | 90.7 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 10.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 490.0 | | |
| Magnesium(Acidified) | 143.0 | | |
| TDS(mg/l) | 12950.0 | | |
| Total Anions(epm) | 102.50 | Total Cations(epm) | 169.88 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 15000 | Temperature | 11.00 | |
| pH | 7.3 | pH | 7.7 | |
| Fluoride | 0.9 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 278 | mg/l |
| | | Hydroxide(OH) | | |

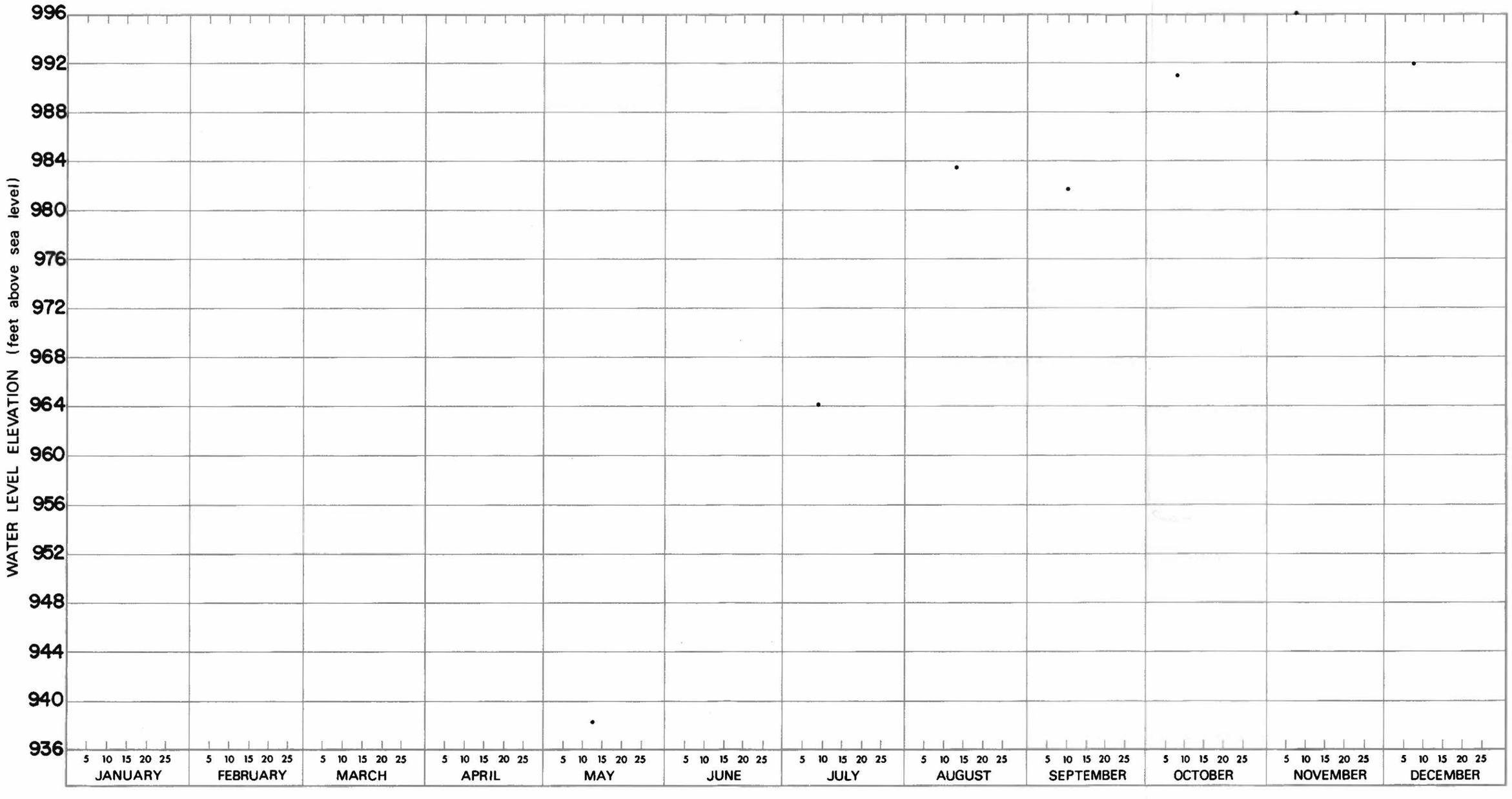
WATER LEVEL HYDROGRAPH

8-716-H-76

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council



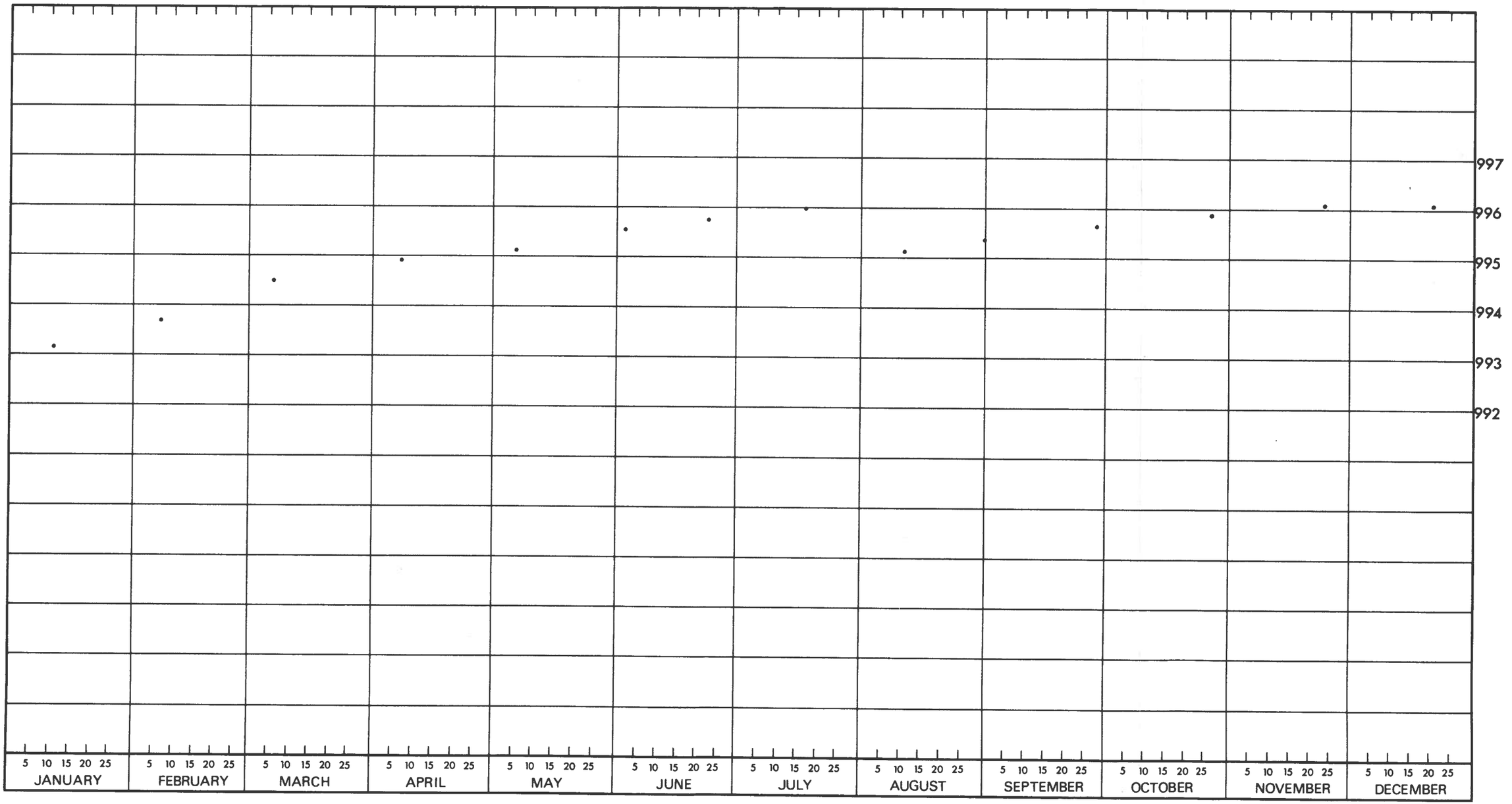
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **8-716**

Lsd **5** Sec **30** Twp **94** R **7** W4th

Alberta Research Council

**8 - 716 - H - 77**




1976

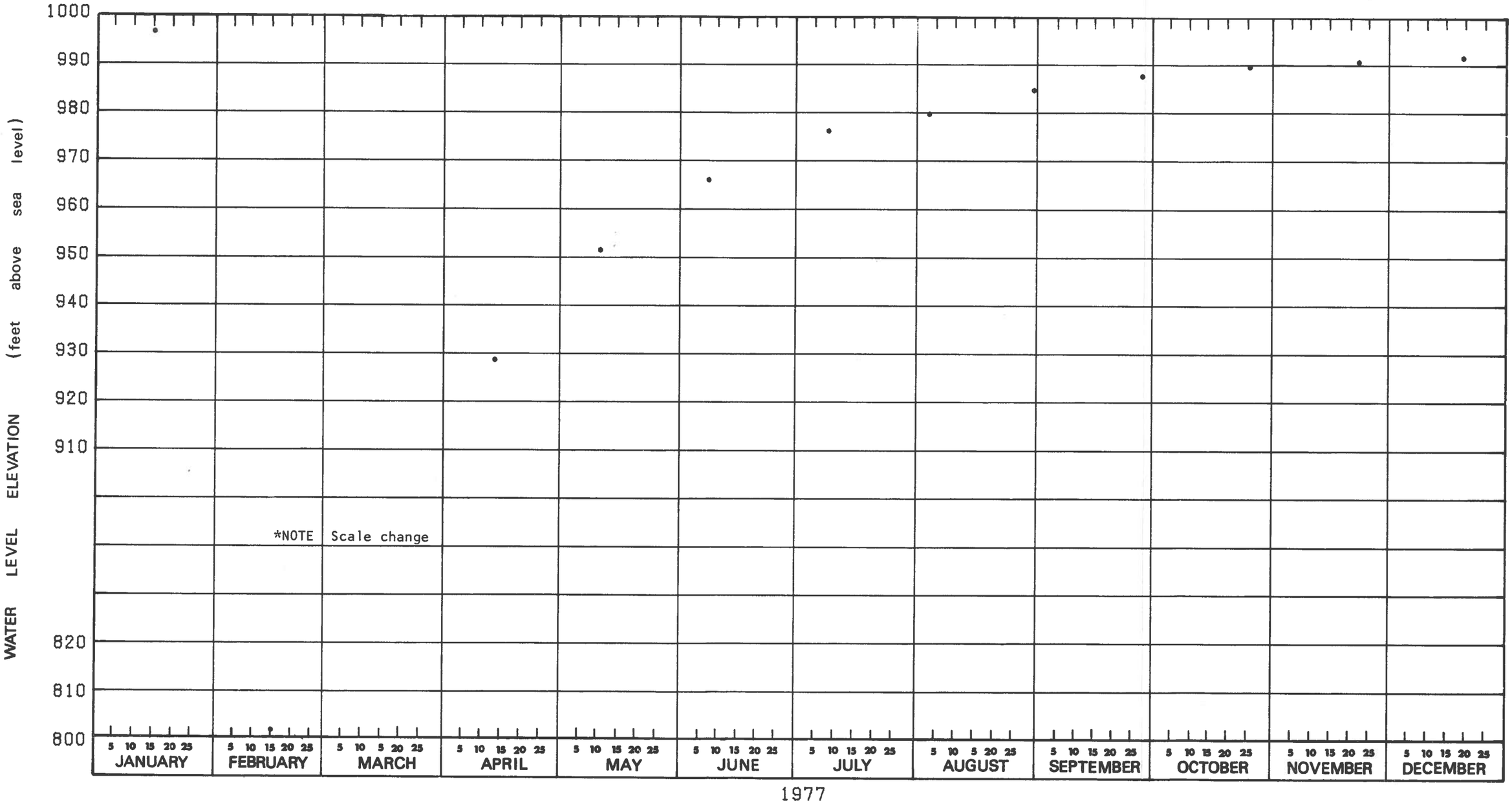
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-716-H-78




1977

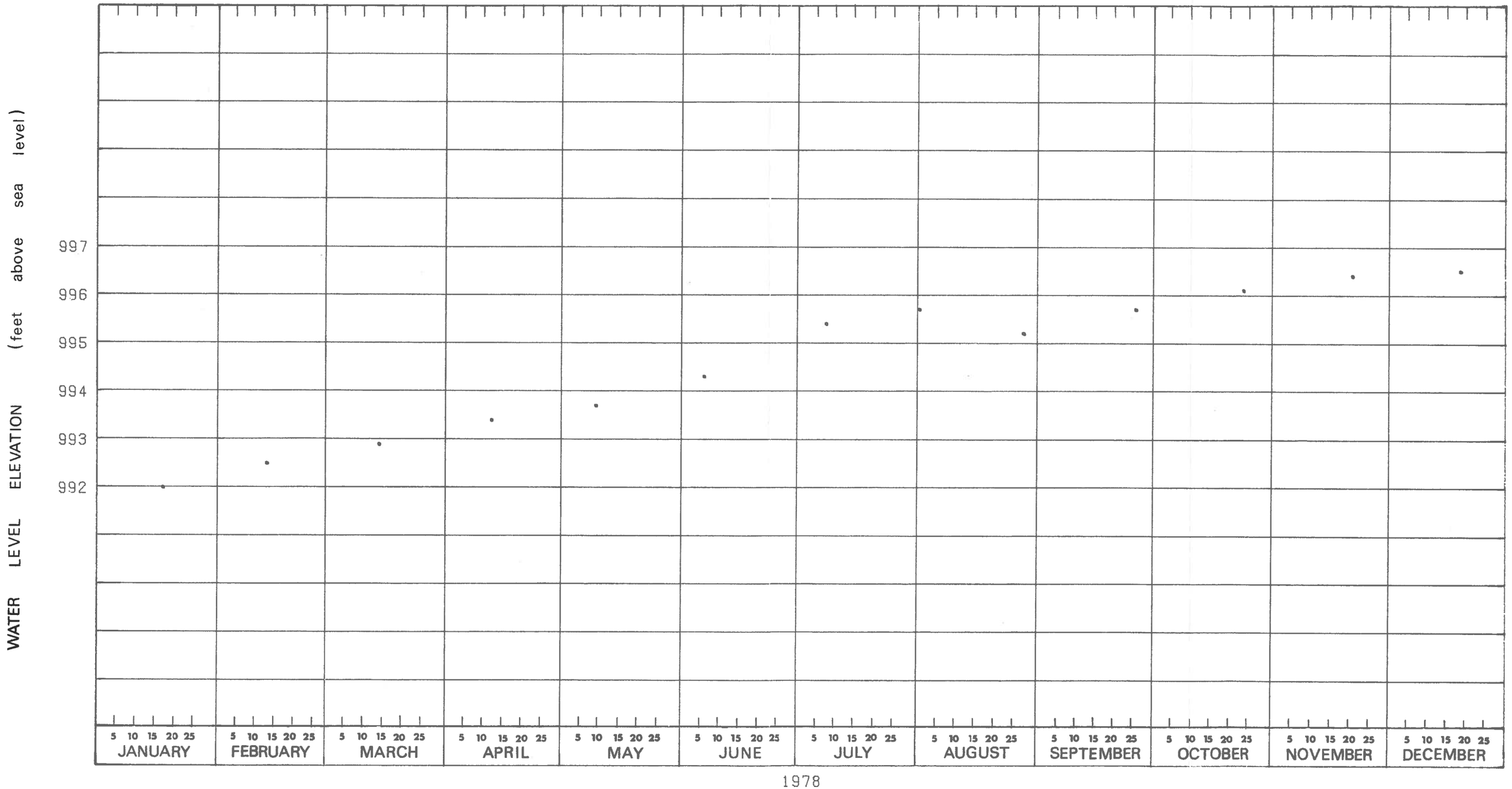
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-716

LSD 5 SEC 30 TWP 94 R 7 W4TH

8-716-H-79

Alberta Research Council




1978

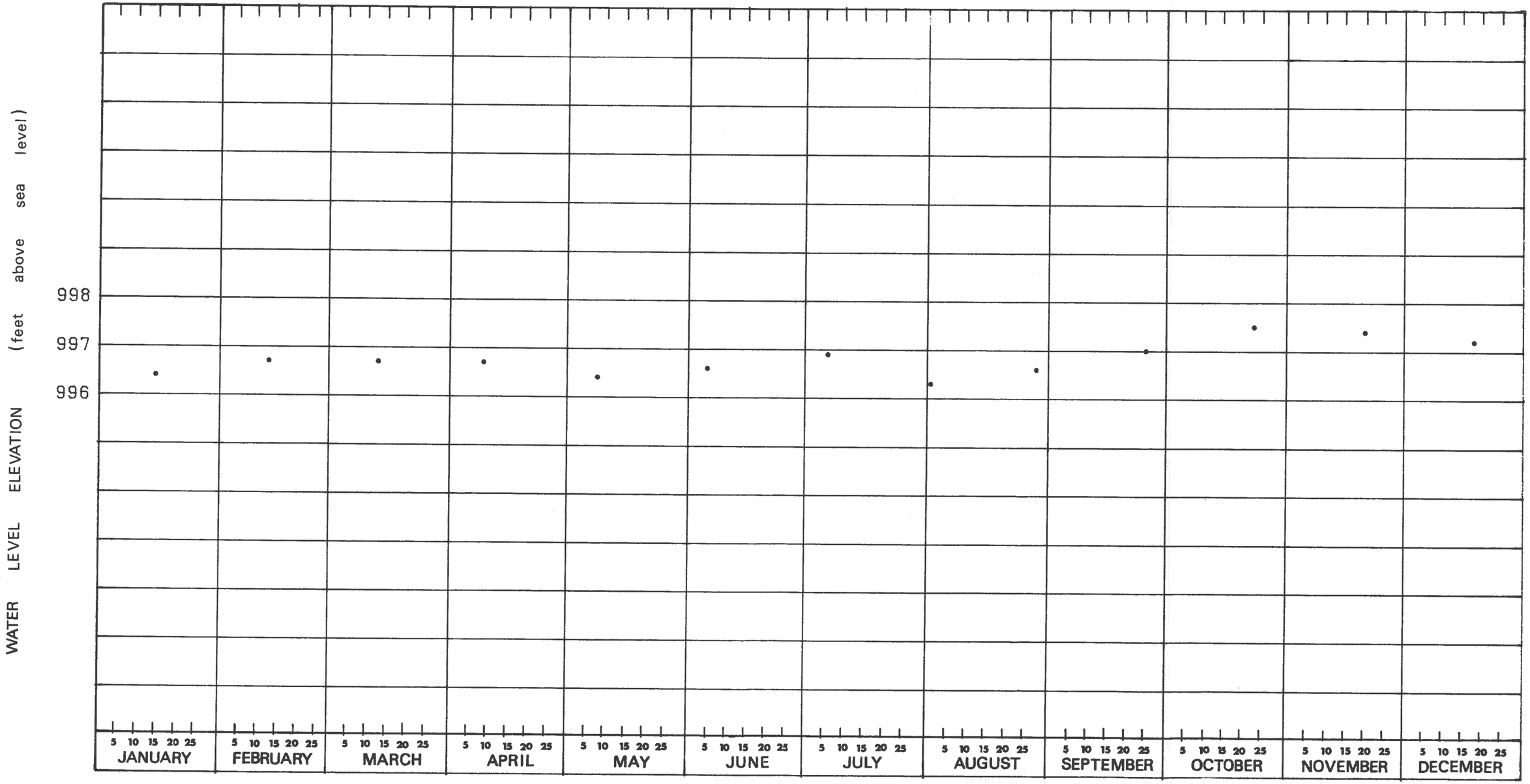
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-716-H-80



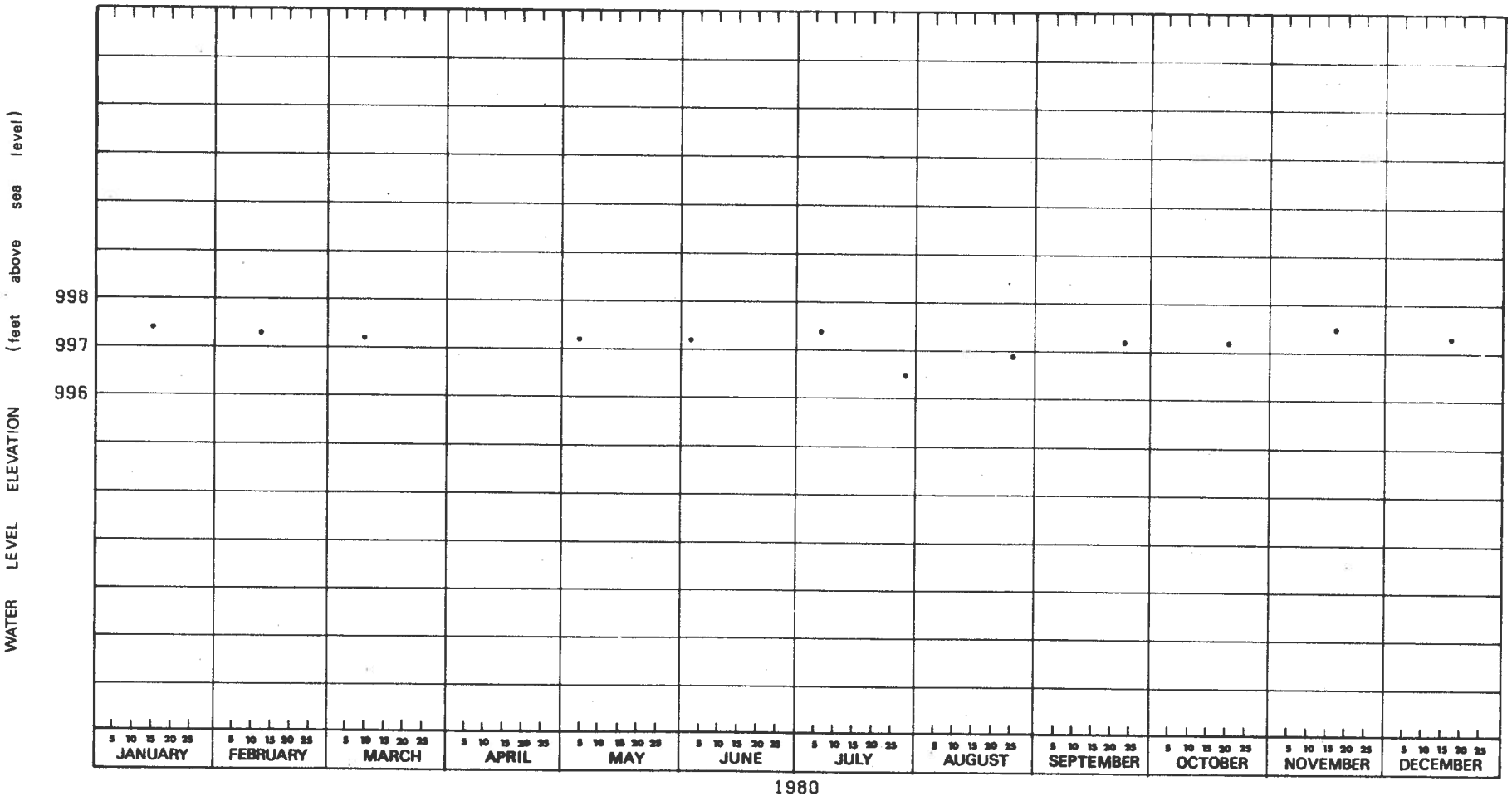
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-716-H-81



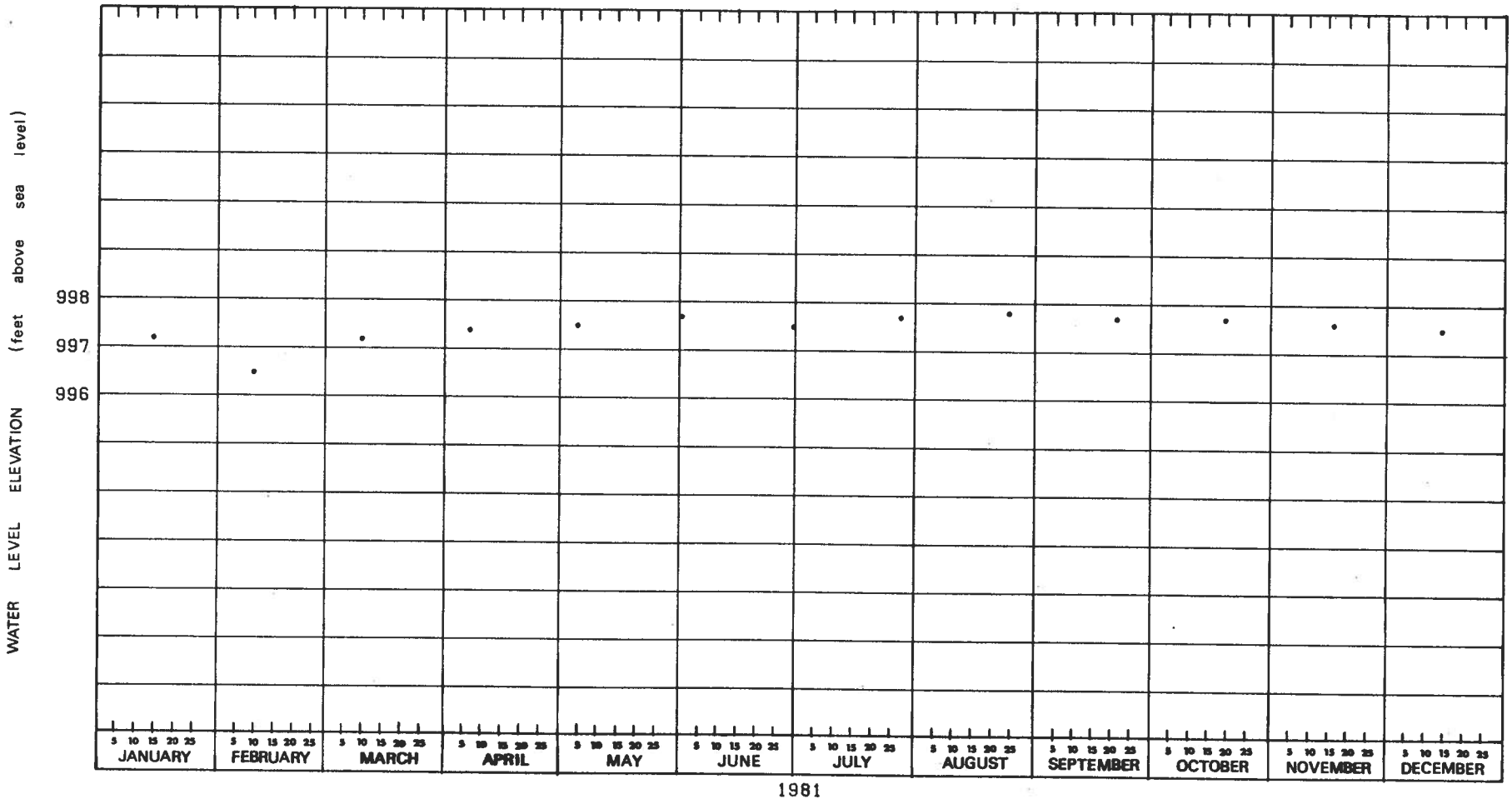
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4 th

Alberta Research Council

8-716-H-82



WELL HISTORY

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1416.63 (Until March 1/75)
1415.53 (After March 1/75)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 23/75 | | | Well completed |
| | 40.78 TOC | 1282.84 | Bail 140 gallons |
| Feb 24/75 | 90.58 TOC | 1119.46 | Bail 350 gallons; water sample |
| Mar 1/75 | | | Cut off casing |
| Mar 7/75 | | | DST; water sample; FSI = 57# from 669'; reinstall shelter |
| Mar 14/75 | | | Relevel |
| Apr 16/75 | 154.69 MP | 910.73 | MP = 2.72' TOC, (1418.25) |
| May 13/75 | 146.30 new MP | 938.25 | New MP = 27"(1417.78) |
| July 9/75 | 138.35 MP | 963.99 | Install recorder |
| Aug 13/75 | 132.42 MP | 983.44 | Bailer to app - 702' |
| Sept 10/75 | 132.97 MP | 981.64 | Sampled well; temp. 6°C |
| Oct 8/75 | 130.14 MP | 990.92 | |
| Nov 7/75 | 128.29 MP | 996.98 | |
| Dec 7/75 | 129.86 MP | 991.84 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1415.53

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 129.44 MP | 993.2 | MP (1417.8) |
| Feb 7/76 | 129.21 MP | 994.0 | |
| Mar 6/76 | 129.05 MP | 994.5 | |
| Apr 7/76 | 128.92 MP | 994.9 | |
| May 6/76 | 128.85 MP | 995.2 | |
| June 2/76 | 128.73 MP | 995.6 | |
| June 23/76 | 128.66 MP | 995.8 | |
| July 17/76 | 128.60 MP | 996.0 | Sampled; temp. 9°C |
| Aug 11/76 | 128.85 MP | 995.2 | |
| Aug 31/76 | 128.78 MP | 995.4 | |
| Sept 29/76 | 128.69 MP | 995.7 | |
| Oct 27/76 | 128.63 MP | 995.9 | |
| Nov 24/76 | 128.58 MP | 996.1 | |
| Dec 21/76 | 128.58 MP | 996.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1415.53

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 128.56 MP | 996.1 | MP (1417.8) |
| Jan 27/77 | | | Treated with 70 lb NU-WELL acid well conditioner |
| Feb 6/77 | | | Blown with air |
| Feb 16/77 | 187.76 MP | 802.1 | New MP = 0.74 m TOC, (1418.0) |
| Mar 16/77 | | | Could not measure (tape sticking to casing) |
| Apr 14/77 | 149.28 MP | 928.4 | |
| May 11/77 | 142.25 MP | 951.1 | New MP = 0.66 m TOC, (1417.7) |
| June 8/77 | 137.81 MP | 965.7 | |
| July 9/77 | 134.70 MP | 975.9 | Sampled; temp. 8°C |
| Aug 4/77 | 133.63 MP | 979.4 | |
| Aug 31/77 | 132.10 MP | 984.4 | |
| Sept 28/77 | 131.21 MP | 987.3 | |
| Oct 26/77 | 130.60 MP | 989.3 | Temp. 8.2°C |
| Nov 23/77 | 130.28 MP | 990.4 | |
| Dec 20/77 | 130.00 MP | 991.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1415.53

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 129.80 MP | 992.0 | MP (1417.7) |
| Feb 14/78 | 129.64 MP | 992.5 | |
| Mar 15/78 | 129.50 MP | 992.9 | |
| Apr 13/78 | 129.37 MP | 993.4 | |
| May 10/78 | 129.28 MP | 993.7 | |
| June 7/78 | 129.08 MP | 994.3 | |
| July 9/78 | 128.75 MP | 995.4 | Sampled; temp. 8°C |
| Aug 2/78 | 128.67 MP | 995.7 | |
| Aug 29/78 | 128.81 MP | 995.2 | |
| Sept 27/78 | 128.66 MP | 995.7 | |
| Oct 25/78 | 128.53 MP | 996.1 | |
| Nov 22/78 | 128.45 MP | 996.4 | |
| Dec 20/78 | 128.42 MP | 996.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1415.53

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 128.43 MP | 996.4 | MP (1417.7) |
| Feb 14/79 | 128.35 MP | 996.7 | |
| Mar 14/79 | 128.35 MP | 996.7 | |
| Apr 10/79 | 128.35 MP | 996.7 | |
| May 9/79 | 128.43 MP | 996.4 | |
| June 6/79 | 128.39 MP | 996.6 | |
| July 7/79 | 128.28 MP | 996.9 | Sampled; temp. 8°C |
| Aug 2/79 | 128.48 MP | 996.3 | |
| Aug 29/79 | 128.38 MP | 996.6 | |
| Sept 26/79 | 128.25 MP | 997.0 | |
| Oct 24/79 | 128.12 MP | 997.5 | |
| Nov 21/79 | 128.15 MP | 997.4 | |
| Dec 19/79 | 128.19 MP | 997.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

8 - 716 - W - 82

WELL HISTORY

OBSERVATION WELL NUMBER 8-716

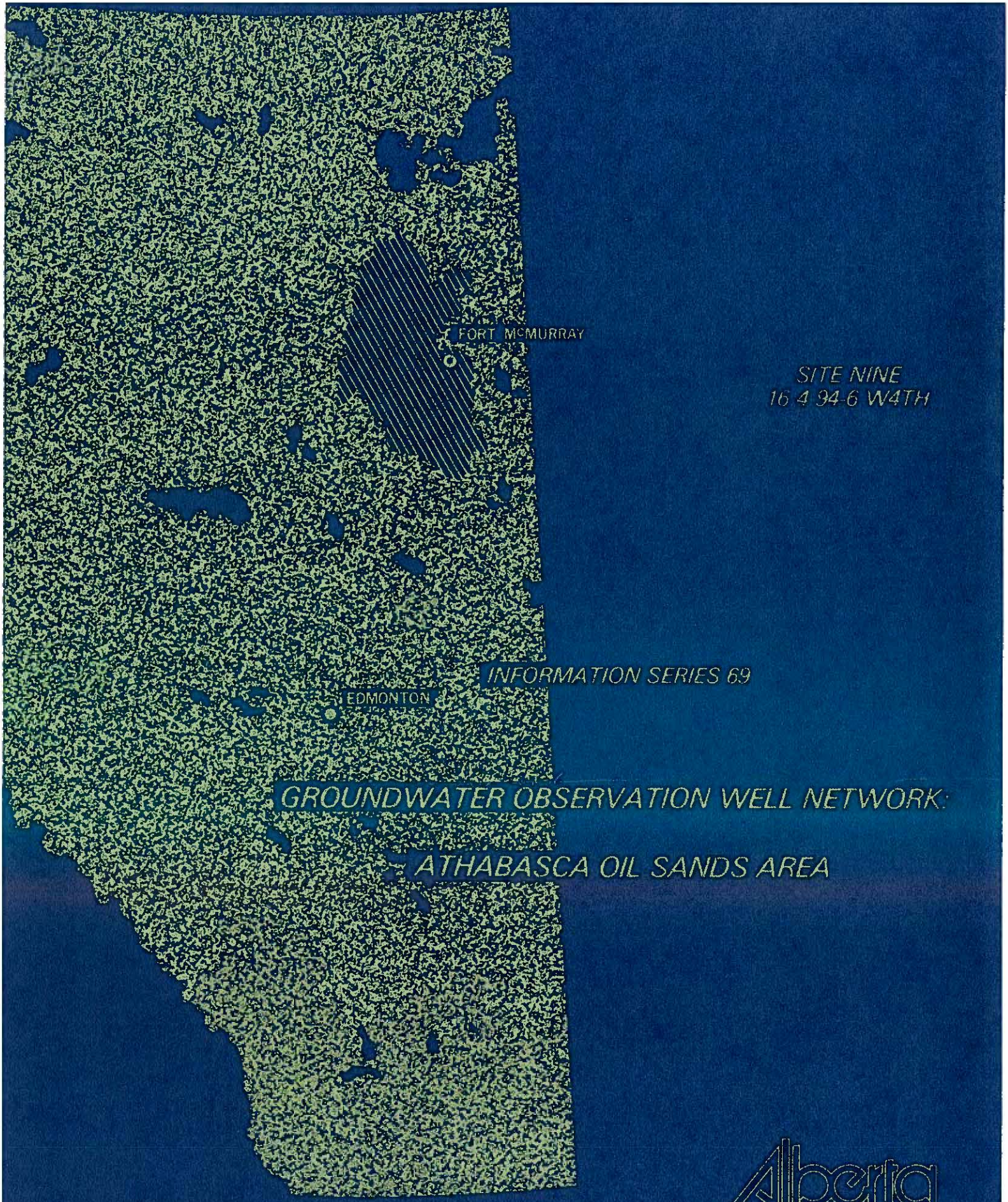
Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1415.53

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 128.15 MP | 997.4 | |
| Feb 13/80 | 128.17 MP | 997.3 | |
| Mar 11/80 | 128.19 MP | 997.2 | |
| Apr 10/80 | | | Could not measure |
| May 6/80 | 128.19 MP | 997.2 | |
| June 4/80 | 128.19 MP | 997.2 | |
| July 8/80 | 128.15 MP | 997.4 | Temp. 11°C |
| July 30/80 | 128.41 MP | 996.5 | |
| Aug 27/80 | 128.28 MP | 996.9 | |
| Sept 25/80 | 128.21 MP | 997.2 | |
| Oct 22/80 | 128.20 MP | 997.2 | |
| Nov 19/80 | 128.12 MP | 997.5 | |
| Dec 19/80 | 128.16 MP | 997.3 | |
| Jan 16/81 | 128.21 MP | 997.2 | |
| Feb 11/81 | 128.41 MP | 996.5 | |
| Mar 11/81 | 128.19 MP | 997.2 | |
| Apr 8/81 | 128.13 MP | 997.4 | |
| May 6/81 | 128.12 MP | 997.5 | |
| June 2/81 | 128.05 MP | 997.7 | |
| July 1/81 | 128.11 MP | 997.5 | |
| July 29/81 | 128.05 MP | 997.7 | |
| Aug 26/81 | 128.03 MP | 997.8 | |
| Sept 23/81 | 128.04 MP | 997.7 | |
| Oct 21/81 | 128.04 MP | 997.7 | |
| Nov 18/81 | 128.08 MP | 997.6 | |
| Dec 16/81 | 128.11 MP | 997.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing




SITE NINE
16-4-94-6 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites, containing 36 individual wells, were instrumented in this manner during the winter of 1974-75.

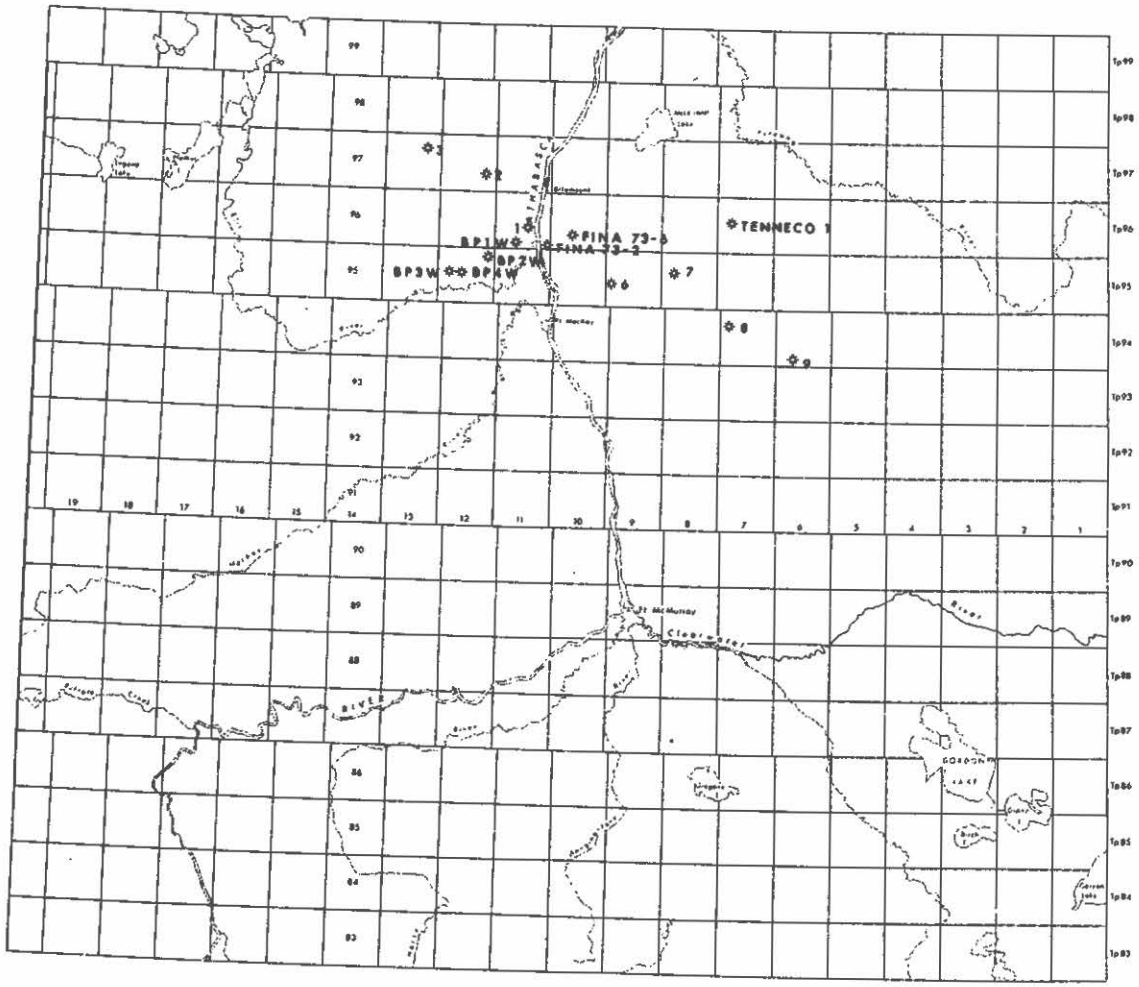
The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill-stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The loose-leaf format has been chosen to facilitate periodic updating with such information as hydrographs, water analyses and well history. The page indexing system is also consistent with the updating process. All updating packages will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this introduction and legend.

There were seven piezometer nests in the system on August 31, 1975. Four companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing. Table I lists the location of wells in the system as of August 31, 1975. Map 1 indicates the location of these wells. Publications available as of the date of this document include those for sites 1, 2, 3, 6, 7, 8 and 9.

Table I
Athabasca Oil Sands Observation Wells
August 31, 1975

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |




MAP 1
ATHABASCA OIL SANDS
OBSERVATION WELL NETWORK
August 31, 1975

## Acknowledgments

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, C. Seibert, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1975: BOPG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., and Shell Canada Ltd.

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

Well Number - the name used for designating the well

Subject Code - as follows:

- I - Introduction (no site number indicated)
- L - Legend (no site number indicated)
- G - General site information including geological logs, geophysical logs and site plan (no well number indicated)
- C - Well construction details
- D - Drill stem testing
- A - Aquifer testing
- E - Chemical analyses including spectral emission estimates and routine water analyses
- H - Annual hydrograph
- W - Well history

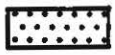
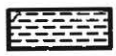
So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within the tabbed section for that particular well.

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| Mer | meridian |
| Meg/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diamter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| Sec. | section |
| ss | stainless steel |

| Symbol | Units or Parameter |
|---|---|
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) *or* time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| Wt | weight |

## GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
|  | sandstone |
| | arkosic sandstone |
| | silt |
| | siltstone |
| | silt & sandstone |
|  | clay |
| | sandy clay |
| | shale |
| | sandstone & shale |
| | oilsand |
| | shaley dolomite |
| | gypsum |
| | dolomite |
| | limestone |

| Symbol | Stratigraphic Unit |
|---|---|
| Qd | unconsolidated deposits |
| Klb | La Biche Fm. |
| Kpl | Pelican Fm. |
| Kj | Joli Fou Fm. |
| Kg | Grand Rapids Fm. |
| Kc | Clearwater Fm. |
| Km | McMurray Fm. |
| Dbl | Beaverhill Lake Gp. |
| Dw | Waterways Fm. |
| Dpe | Prairie Evaporite Fm. |
| Dmt | Methy Fm. |
| Dmr | McLean River Fm. |
| Dl | La Loche Fm. |
| P€ | Precambrian |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: complete routine analysis and a spectral emission estimate for 29 elements. Many of the samples collected during 1975 appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years.

Most water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source".

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface

3. drill through the aquifer using very light mud
4. insert a screening device (if necessary).

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

Two drilling rigs were used simultaneously during the 1974-1975 drilling season. Both were Failing 1500; one was trailer mounted and capable of 2,000-foot depths, the other was truck mounted and capable of about 1,200-foot depths.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma and uncompensated density were the logs run during the 1974-75 drilling. The geological log presented represents an interpretation based upon the sample description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells when the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, all wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the

measuring tape sticking to the wet casing. Conventional oil-field drill stem testing equipment was selected in an attempt to produce permeability and head values in the wells with deep water levels. Information from these drill stem tests is presented in the section on "Drill Stem Testing". A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

| | | |
|---|---|---|
| $Q_b$ | = | production rate in barrels per day |
| V | = | volume of production into drill collars and stem |
| t | = | total flow time of test |
| T | = | transmissivity in millidarcy-feet |
| M | = | slope of final shut-in pressure plot |
| k | = | permeability in millidarcys |
| h | = | thickness of the aquifer - usually the length of the tested section. |

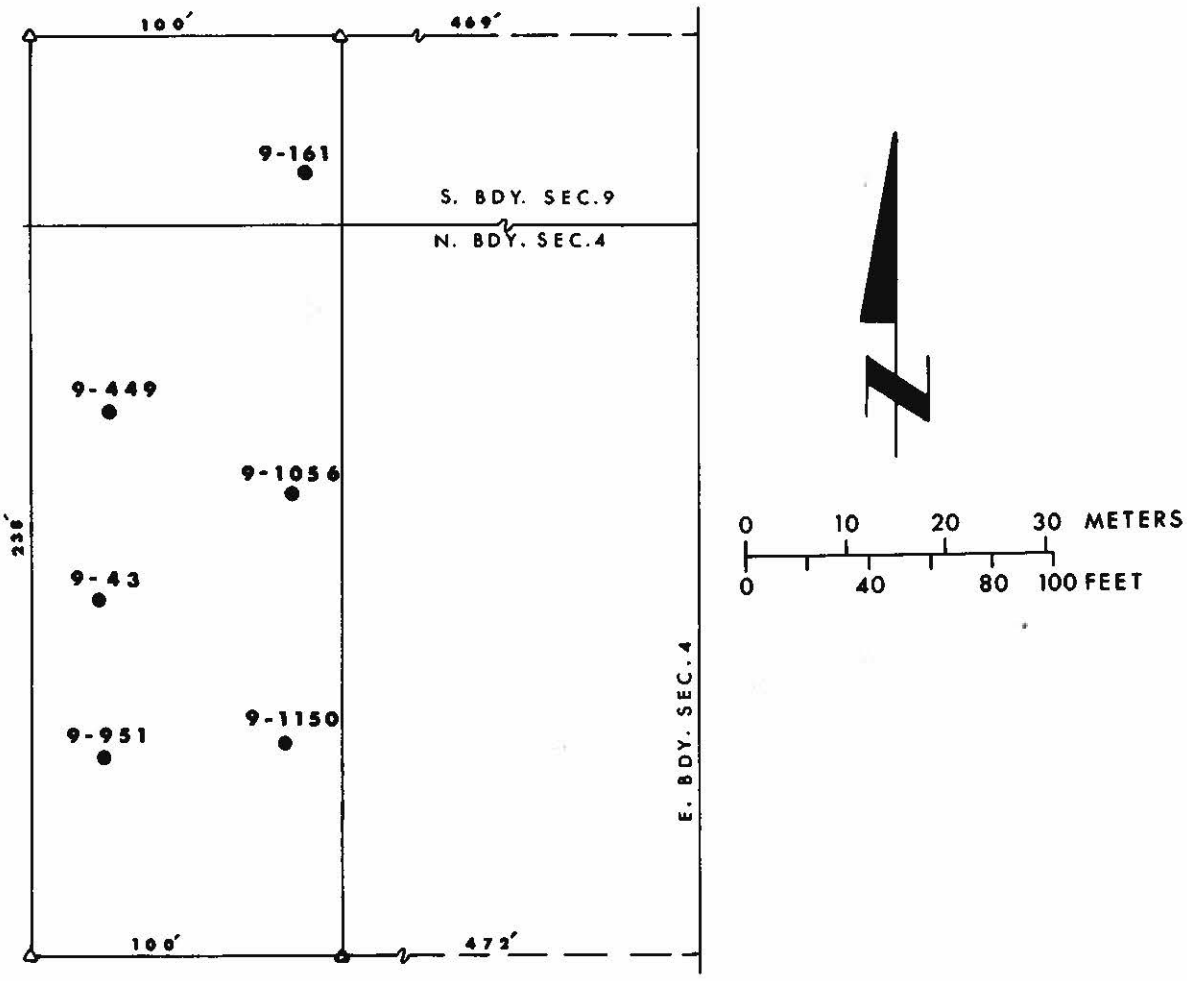
The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot.

Values of transmissivity are expressed in the metric units of square metres per day. Permeability is expressed as centimetres per second.

# OBSERVATION WELL SITE 9

16-4-94-6 W4th
1-9-94-6 W4th

ALBERTA RESEARCH COUNCIL



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Hine

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Ground elevation 2017 Total depth 1150

KB elevation 2022

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| | 10 | Till, quartz sand, fine to coarse grained, sub-rounded, to sub-angular | Drift |
| | 20 | Quartz sand, fine to coarse grained, sub-rounded, to sub-angular, poorly sorted, white | |
| | 30 | Till, quartz sand, same as above hematitic < 1% | |
| 30 | 60 | Clay, sandy; sand is same as above | |
| 60 | 110 | Till, quartz sand, same as above | |
| | 120 | Clay, sandy, quartz sand, same as above | |
| | 130 | Clay, sandy | |
| | 140 | Sand, clayey; quartz sand, fine to coarse grained, sub-rounded to sub-angular | |
| | 150 | Clay, sand; quartz sand, same as above | |
| 150 | 170 | Till | |
| 170 | 190 | Clay, sandy; quartz sand, same as above | |
| | 200 | Quartz sand, fine to coarse, sub-rounded to sub-angular, bituminous 5% | |
| 200 | 220 | Gravel | |
| | 230 | Silstone and quartz sand, fine to coarse, sub-rounded to sub-angular | |
| | 240 | Clay, sandy; quartz sand, fine to coarse, sub-rounded, to sub-angular; siltstone chips | |
| | 250 | Gravel, some siltstone chips, quartz sand, fine to coarse, sub-rounded to sub-angular | |
| 290 | 340 | Same as above, coal fragments < 1%, pyrite < 1% < 1%, biotite < 1% | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Nine (continued)

Lsd Sec Twp R W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 340 | 350 | Same as above, some muscovite < 1% | |
| 350 | 400 | Siltstone and gravels (increasing siltstone content) quartz sands | |
| 400 | 420 | Siltstone and gravels, quartz fragements, coarse | |
| 420 | 460 | Siltstone | |
| 460 | 500 | Siltstone and gravels | |
| 500 | 520 | Siltstone, quartz fragments, muscovite 15% | |
| 520 | 540 | Claystone, with some quartz fragments, sub-angular | |
| | 550 | Chert gravels | |
| 550 | 580 | Cherty claystone and coal, 2% | |
| 580 | 600 | Gravels and quartz sand, fine to coarse, sub-rounded to sub-angular | |
| 600 | 630 | Clay with < 1% quartz | |
| 630 | 670 | Clay | |
| 670 | 710 | Clay and siltstone chips | |
| 710 | 760 | Clay and chert | |
| 760 | 780 | Clay, some quartz and chert | |
| | 790 | Clayey limestone | |
| 790 | 810 | Clayey limestone | |
| | 820 | No sample | |
| 820 | 850 | Clay, calcareous | |
| 850 | 910 | Calcareous clay and chert (5%) | |

GEOLOGICAL SAMPLE DESCRIPTION

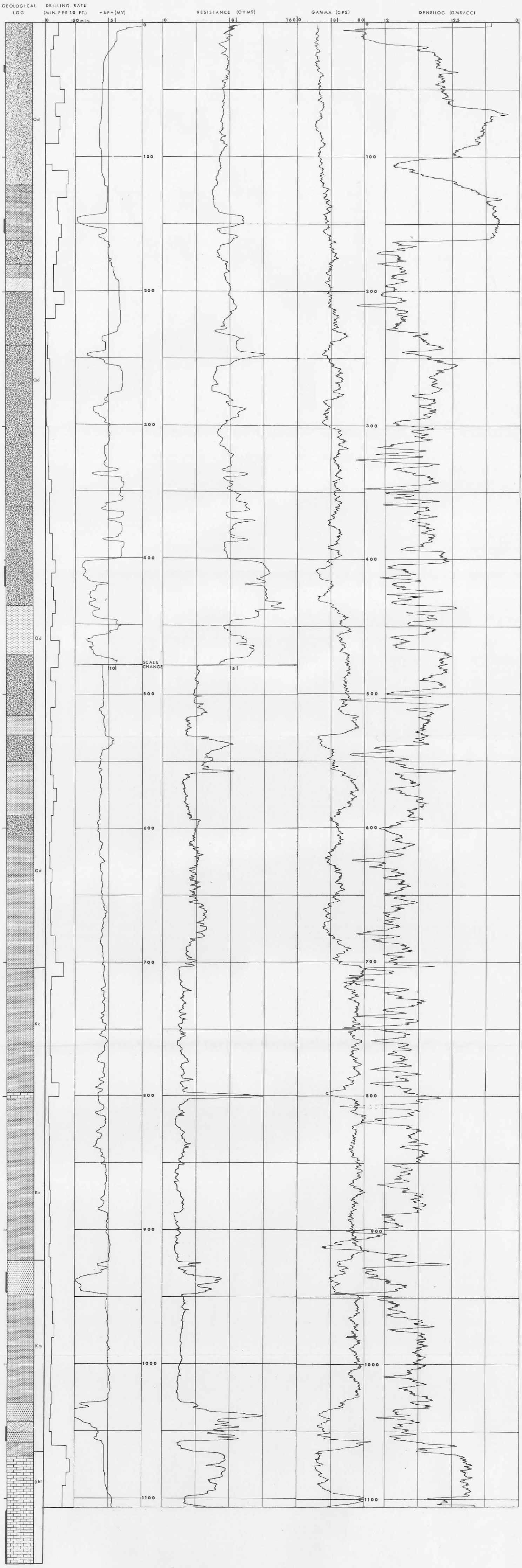
SITE NUMBER Cline (continued)

Lsd Sec Twp R W4th

Alberta Research Council

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 910 | 930 | Shale; some chert pebbles; fine grained, well cemented sandstone | McMurray |
| | 940 | Clay | |
| | 950 | Clay, with chert, coal and limestone fragments (grey clay) | |
| 950 | 980 | Clay with chert, limestone fragments, coal | |
| 980 | 1000 | Clay, brownish, limestone fragements, chert | |
| | 1010 | Clay, brownish | |
| 1010 | 1030 | Shaly clay | |
| | 1040 | Oil sand, quartz sand, fine grained, sub-rounded to sub-angular; bitumen content 25%. | |
| | 1050 | Quartz sand, fine to coarse grained, sub-rounded to sub-angular; quartz granules are from 2 - 8 mm in size | |
| | 1060 | Quartz sand as above 10% bitumen chunks | |
| | 1070 | Limestone and quartz sand as above 5% bitumen | |
| | 1080 | Limestone and quartz granules, 2 - 8 mm < 5% | |
| | 1090 | Limestone, chert, some pyrite < 1%, limestone, fine grained | Beaverhill Lake |
| | 1100 | Limestone and chert, and pyrite | |
| | 1110 | Limestone, chert, bitumen 5% | |
| 1110 | 1150 | Same as above, no bitumen | |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 9
### 16-4-94-6 W4th
ALBERTA RESEARCH COUNCIL



## SUMMARY OF CONTENTS

SITE NUMBER NINE

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | | | |
|---|---|---|---|---|---|---|---|
| | site | 9-43 | 9-161 | 9-449 | 9-951 | 9-1056 | 9-1150 |
| Introduction | 4 | — | — | — | — | — | — |
| Legend | 8 | — | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — | — |
| Geological Sample Description | 3 | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 1 | 1 | 0 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 2 | 4 | 2 | 2 |
| Shut-In Pressure Data | — | 0 | 0 | 1 | 3 | 2 | 2 |
| Water Analysis | — | 2 | 2 | 2 | 1 | 1 | 2 |
| Spectral Emission Estimates | — | 0 | 1 | 1 | 0 | 0 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 0 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER NINE

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | 9-43 | 9-161 | 9-449 | 9-951 | 9-1050 | 9-1156 |
| Shut-In Pressure Data | 0 | 0 | 0 | 0 | 0 | 1* |
| Water Analysis | 1 | 1 | 1 | 1 | 1 | 1 |
| Water Level Hydrograph | 1* | 1 | 1 | 1 | 1 | 1 |
| Well History | 1* | 1 | 1 | 1 | 1 | 1 |

*Supersedes page issued in 1976

ERRATUM STATEMENT

Material Distributed in 1976

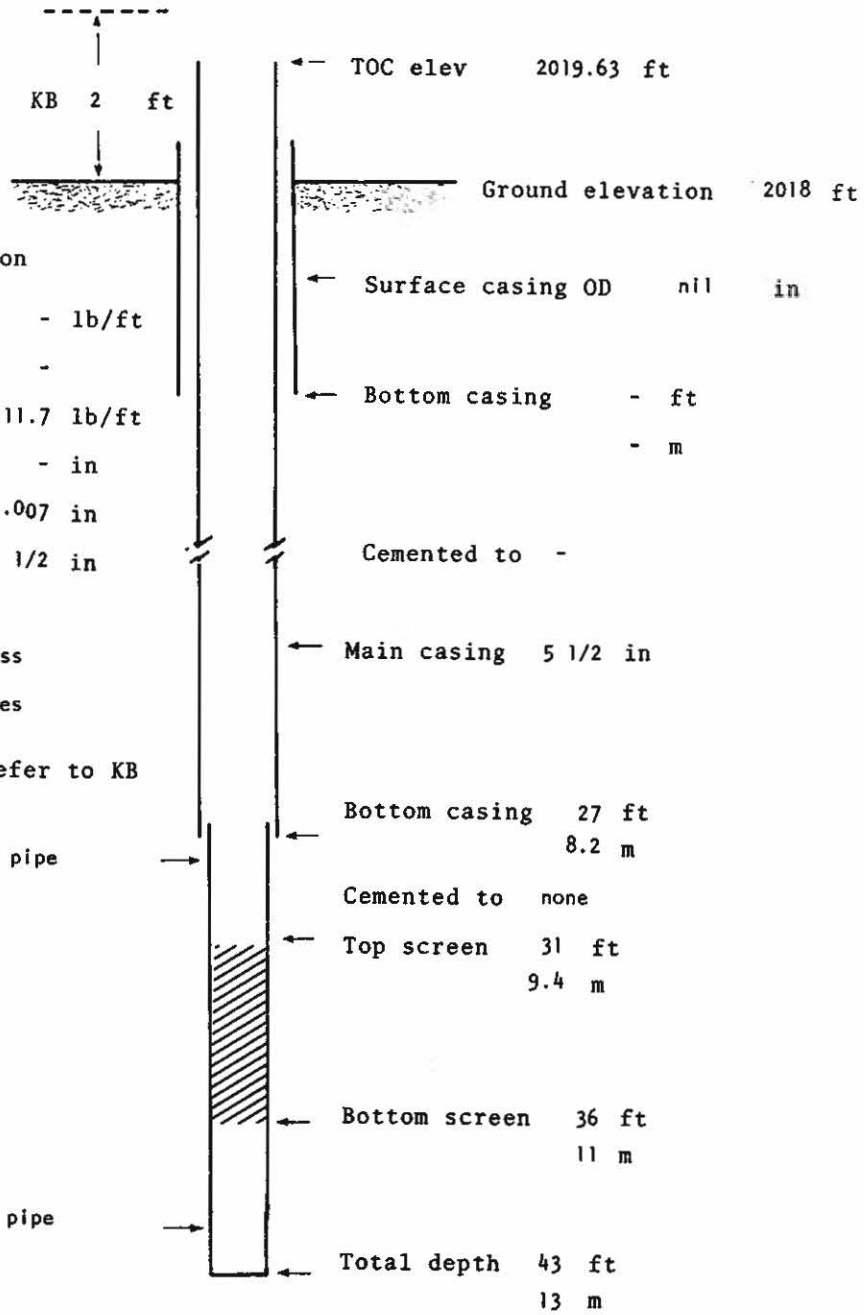
1. The location on the second and third pages of the GEOLOGICAL SAMPLE DESCRIPTION was omitted. The location for both these pages is Lsd 16 Sec 4 Twp 94 R 6 W4th.
2. Well 9-43 - A different WELL HISTORY page has been issued covering 1975. The page index is 9-43-W-77 and replaces 9-43-W-76.
3. Grand Rapids Formation should be listed on the GEOLOGICAL SAMPLE DESCRIPTION at the interval 580 to 600 and from depths of 587 to 705 feet on the GEOPHYSICAL AND GEOLOGICAL LOGS.
4. Clearwater Formation should be listed on the GEOLOGICAL SAMPLE DESCRIPTION at the interval 670 to 710 and from depths of 705 to 917 feet on the GEOLOGICAL AND GEOPHYSICAL LOGS.
5. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
6. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.
7. A new WATER LEVEL HYDROGRAPH has been issued for well 9-43 covering 1975. The page index is 9-43-H-77 and replaces 9-43-H-76.
8. A new SHUT-IN PRESSURE DATA page has been issued for well 9-1150. The page indexed 9-1150-D-77 replaces 9-1150-D-76.

**WELL CONSTRUCTION.**

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Tp 94 R 6 W4th

Alberta Research Council



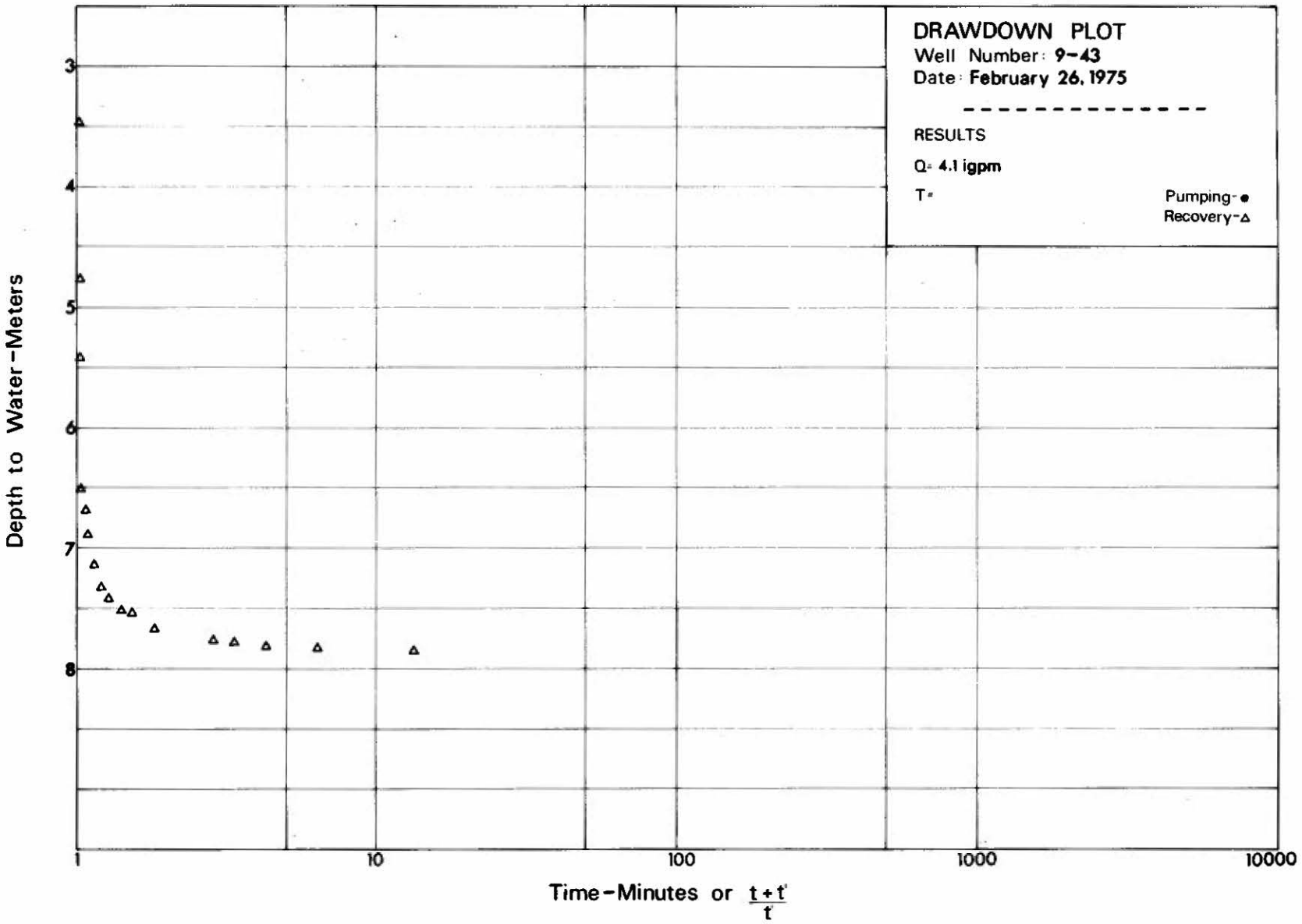

Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 11.7 | lb/ft |
| wall thickness | - | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | Yes | |

Note: all depths refer to KB

* Sloughed to 41 ft *

Note: well was drilled to 157 ft and plugged back to 43 ft.


DRAWDOWN PLOT
Well Number: 9-43
Date: February 26, 1975
RESULTS
Q= 4.1 igpm
T=
Pumping-●
Recovery-△
Depth to Water-Meters
3
4
5
6
7
8
1
10
100
1000
10000
Time-Minutes or $\frac{t+t'}{t'}$

9-43-A-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed from 9-43

Date sampled March 5, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 566.0 | 28.24 | 87.6 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0.0 |
| Sodium ($Na^{+}$) | 51.0 | 2.22 | 6.9 |
| Potassium ($K^{+}$) | 69.0 | 1.77 | 5.5 |
| Carbonate ($CO_3^{=}$) | 53.0 | 1.77 | 5.5 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.0 | 0.0 |
| Sulfate ($SO_4^{=}$) | 350.0 | 7.29 | 22.8 |
| Chloride ($Cl^{-}$) | 163.0 | 4.60 | 14.4 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 3.3 | | |
| Hydroxide ($OH^{-}$) | 311.0 | 18.28 | 57.3 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1678.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 31.934 | Total Cations (epm) | 32.227 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 5000 |
| pH | 12.2 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | | |
| pH | 12.6 | |
| Carbonate ($CO_3^{=}$) | 67 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 | ppm |
| Hydroxide ($OH^{-}$) | 338 | ppm |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled August 12, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 240 | 11.98 | 84 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 36.2 | 1.57 | 11 |
| Potassium ($K^{+}$) | 26.7 | 0.68 | 5 |
| Carbonate ($CO_3^{=}$) | 67 | 2.23 | 13 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 118 | 2.46 | 14 |
| Chloride ($Cl^{-}$) | 118 | 3.33 | 19 |
| Nitrate ($NO_3^{=}$) | 1 | 0.02 | 0 |
| Silica ($SiO_2$) | 4.3 | | |
| Hydroxide ($OH^{-}$) | 160 | 9.41 | 54 |
| Calcium (Acidified) | 265 | | |
| Magnesium (Acidified) | 0.4 | | |
| Total dissolved solids | 874 | | |
| Total Anions (epm) 17.44 | | Total Cations (epm) | 14.23 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2700 |
| pH | 12.0 |
| Fluoride ($F^{-}$) | 0.3 ppm |

Field:

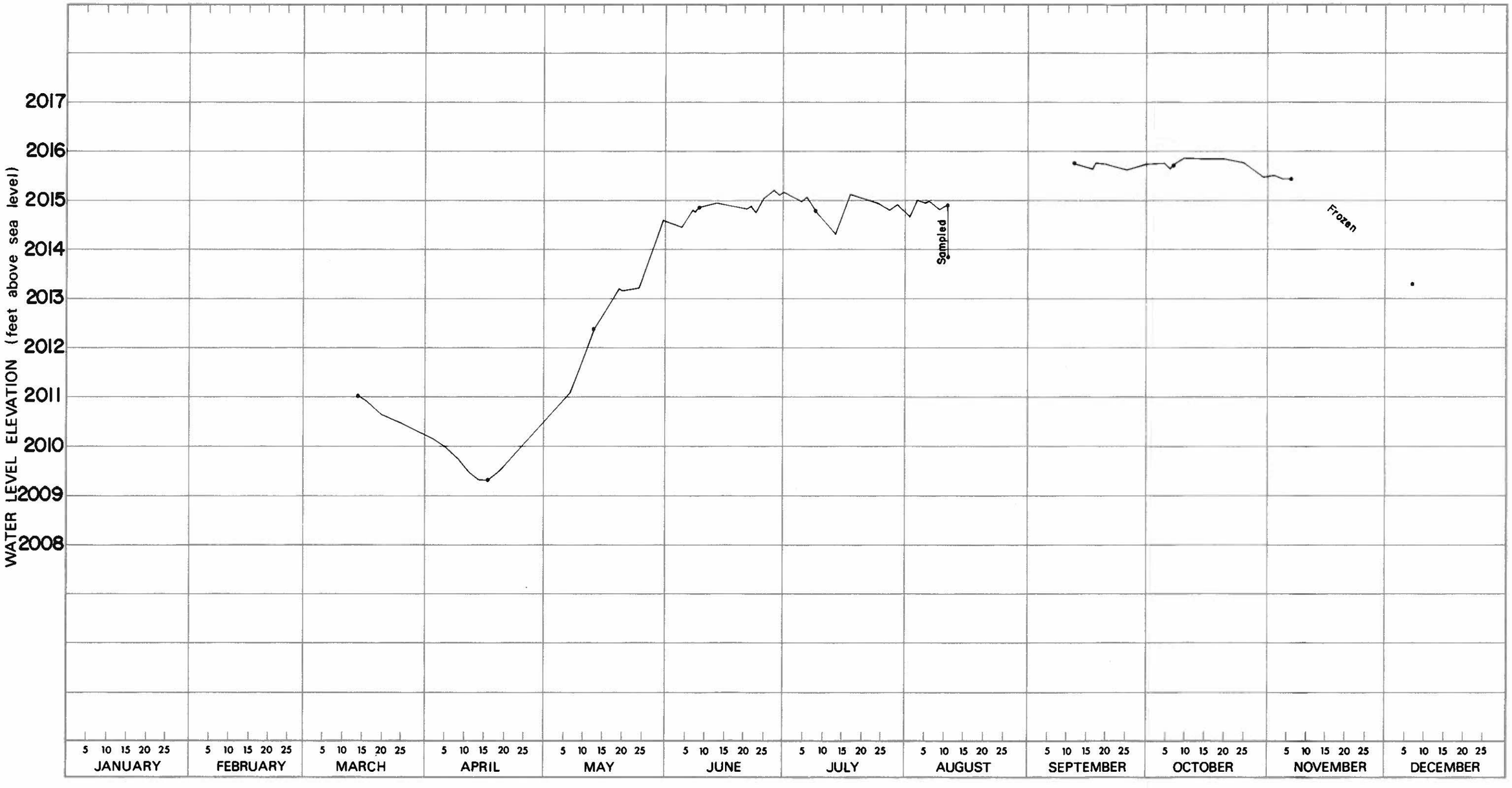
| | |
|---|---|
| Temperature (C) | 9.0 |
| pH | 11.0 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council



WELL HISTORY

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.63

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 25/75 | | | Well completed |
| Feb 26/75 | 0.75 TOC | 2017.17 | Bail 25 gallons |
| Mar 5/75 | | | Bail water sample; install shelter and recorder; MP = 2.76' TOC, (2020.39) |
| Apr 16/75 | 3.21 MP | 2009.86 | |
| May 12/75 | 2.24 MP | 2013.04 | |
| June 9/75 | 1.84 MP | 2014.35 | |
| July 8/75 | 1.53 MP | 2015.37 | |
| Aug 11/75 | 1.50 MP | 2015.47 | Sampled well |
| | 1.83 MP | 2014.38 | after sample |
| Sept 12/75 | 1.42 MP | 2015.73 | Recorder stuck |
| Oct 7/75 | 1.43 MP | 2015.69 | |
| Nov 7/75 | 1.51 MP | 2015.44 | Frozen |
| Dec 7/75 | 2.14 MP | 2013.37 | Did not change chart; frozen |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 103.0 | 5.14 | 76 |
| Magnesium ($Mg^{++}$) | 0.2 | 0.02 | 0 |
| Sodium ($Na^{+}$) | 28.8 | 1.25 | 19 |
| Potassium ($K^{+}$) | 12.9 | 0.33 | 5 |
| Carbonate ($CO_3^{=}$) | 19.2 | 0.64 | 9 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 55.0 | 1.15 | 16 |
| Chloride ($Cl^{-}$) | 80.0 | 2.26 | 32 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 7.2 | | |
| Hydroxide ($OH^{-}$) | 52.4 | 3.08 | 43 |
| Calcium (Acidified) | 130.9 | | |
| Magnesium (Acidified) | 0.6 | | |
| Total dissolved solids | 404 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 7.13 | Total Cations (epm) | 6.74 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1050 | Temperature (C) | 5.5 | |
| pH | 11.2 | pH | 11.4 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | 276 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 127 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 900.0 | 44.91 | 33.9 |
| Magnesium ($Mg^{++}$) | 103.0 | 8.48 | 6.4 |
| Sodium ($Na^{+}$) | 1813.0 | 78.86 | 59.5 |
| Potassium ($K^{+}$) | 14.2 | 0.36 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 14.6 | 0.24 | 0.3 |
| Sulfate ($SO_4^{=}$) | 146.0 | 3.04 | 3.5 |
| Chloride ($Cl^{-}$) | 2920.0 | 82.35 | 96.2 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 17.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 820.0 | | |
| Magnesium (Acidified) | 88.0 | | |
| Total dissolved solids | 19010.0 | | |
| Total Anions (epm) | 85.64 | Total Cations (epm) | 132.61 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | >8000 |
| pH | 4.8 |
| Fluoride ($F^{-}$) | 0.5 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 5.0 |
| pH | 6.1 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | 166.0 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 610.0 | 30.44 | 47.3 |
| Magnesium(Mg) | 36.0 | 2.96 | 4.6 |
| Sodium(Na) | 700.0 | 30.45 | 47.3 |
| Potassium(K) | 19.2 | 0.49 | 0.8 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 49.3 | 1.03 | 2.9 |
| Chloride(Cl) | 1220.0 | 34.40 | 97.0 |
| Nitrate(NO3) | 1.3 | 0.02 | 0.1 |
| Silica(SiO2) | 5.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 555.0 | | |
| Magnesium(Acidified) | 29.5 | | |
| TDS(mg/l) | 7590.0 | | |
| Total Anions(epm) | 35.45 | Total Cations(epm) | 64.34 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 6300 | | Temperature(C) | 7.00 | |
| pH | 4.5 | | pH | 5.7 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 34 | mg/l |
| | | | Hydroxide(OH) | | |

9-43-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 386.0 | 19.26 | 52.8 |
| Magnesium(Mg) | 1.5 | 0.12 | 0.3 |
| Sodium(Na) | 386.0 | 16.79 | 46.1 |
| Potassium(K) | 10.8 | 0.28 | 0.8 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 2.4 | 0.04 | 0.2 |
| Sulphate(SO4) | 29.7 | 0.62 | 2.9 |
| Chloride(Cl) | 720.0 | 20.30 | 96.7 |
| Nitrate(NO3) | 2.2 | 0.04 | 0.2 |
| Silica(SiO2) | 1.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 329.0 | | |
| Magnesium(Acidified) | 1.0 | | |
| TDS(mg/l) | 4756.0 | | |
| Total Anions(epm) | 21.00 | Total Cations(epm) | 36.45 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3970 | Temperature(C) | 5.00 | |
| pH | 4.8 | pH | 5.9 | |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 24 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 9-43-E-82

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

Major constituents

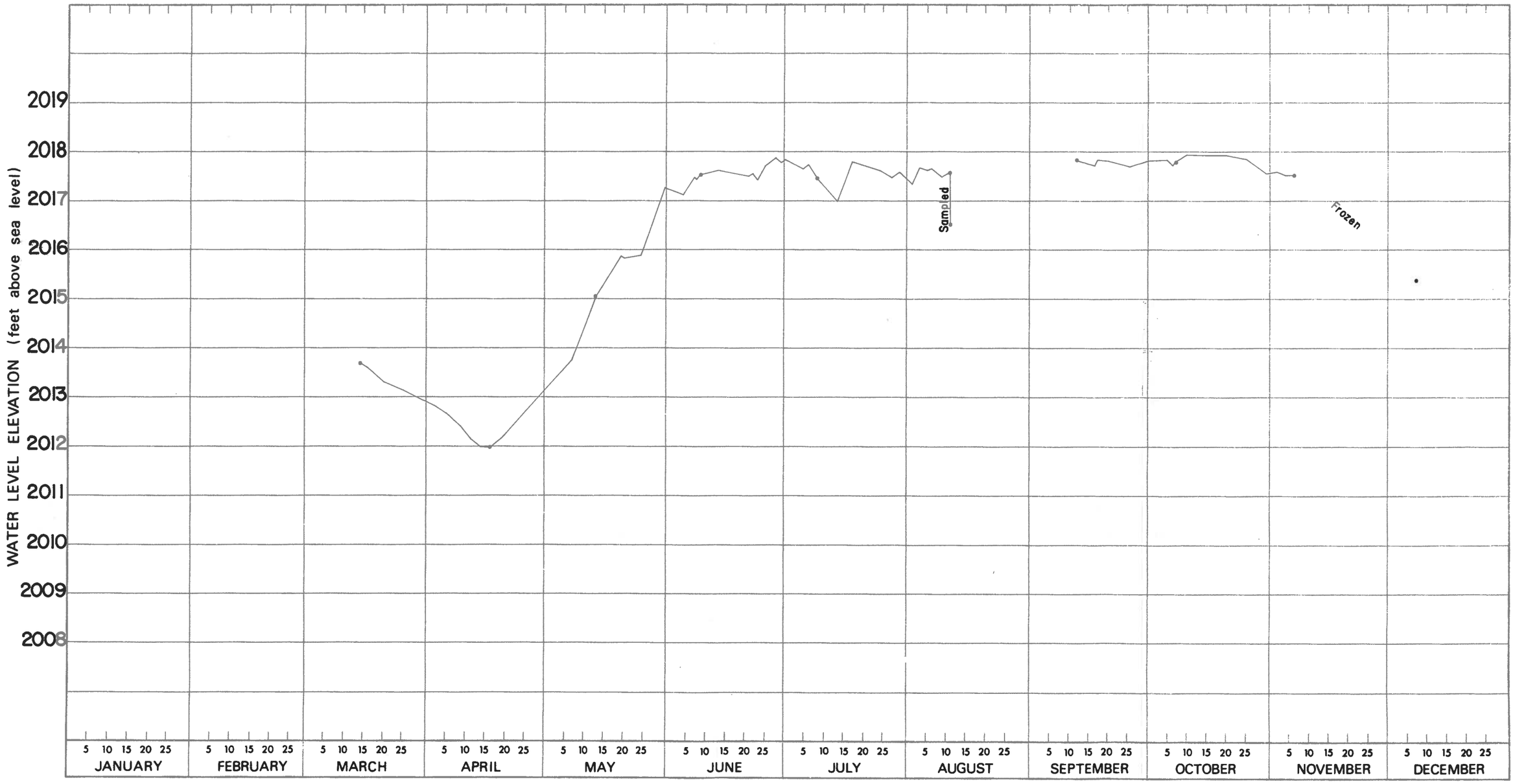
| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 350.0 | 17.50 | 56.2 |
| Magnesium(Mg) | 10.6 | 0.88 | 2.8 |
| Sodium(Na) | 288.0 | 12.52 | 40.2 |
| Potassium(K) | 9.2 | 0.24 | 0.8 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 27.8 | 0.58 | 81.3 |
| Chloride(Cl) | 4.0 | 0.11 | 15.8 |
| Nitrate(NO3) | 1.3 | 0.02 | 2.9 |
| Silica(SiO2) | 2.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 340.0 | | |
| Magnesium(Acidified) | 10.0 | | |
| TDS(mg/l) | 3676.0 | | |
| Total Anions(epm) | 0.71 | Total Cations(epm) | 31.14 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3280 | Temperature | 8.00 | |
| pH | 3.8 | pH | 5.7 | |
| Fluoride | 0.1 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 20 | mg/l |
| | | Hydroxide(OH) | | |

## WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-43
Lsd 16 Sec 4 Twp 94 R 6 W4th
Alberta Research Council



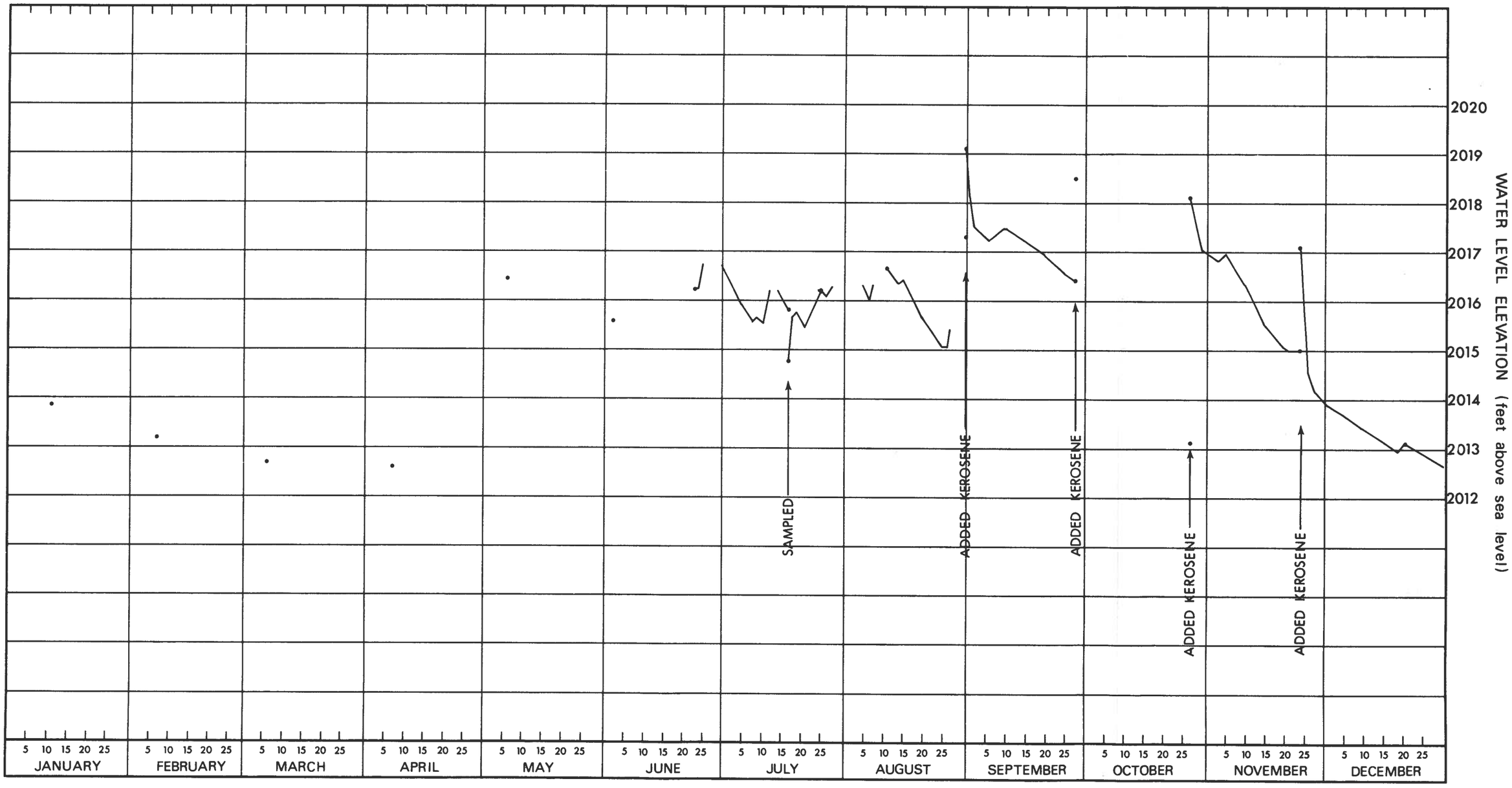
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

9 - 43 - H - 77




1976

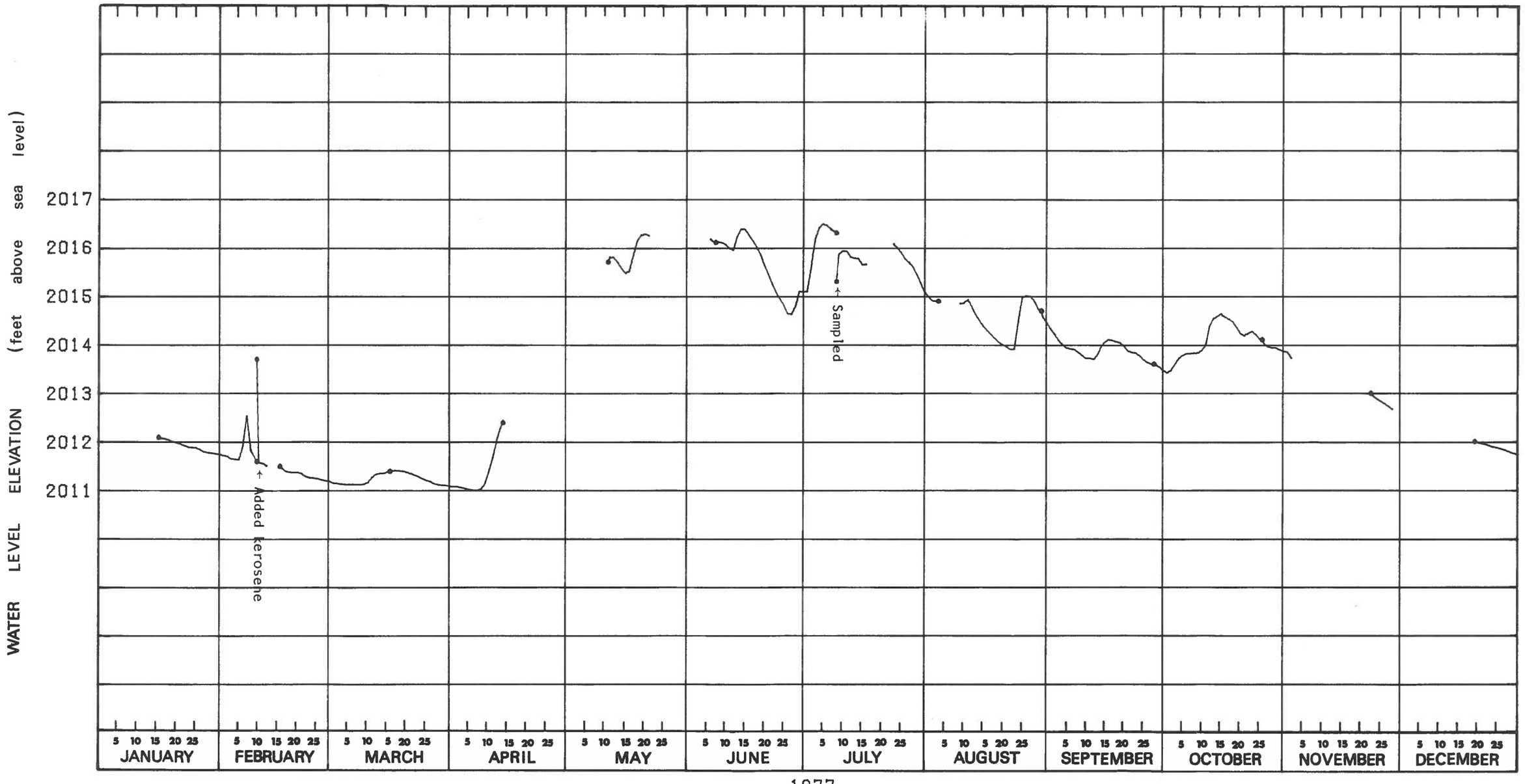
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-43

9-43-H-78

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council




1977

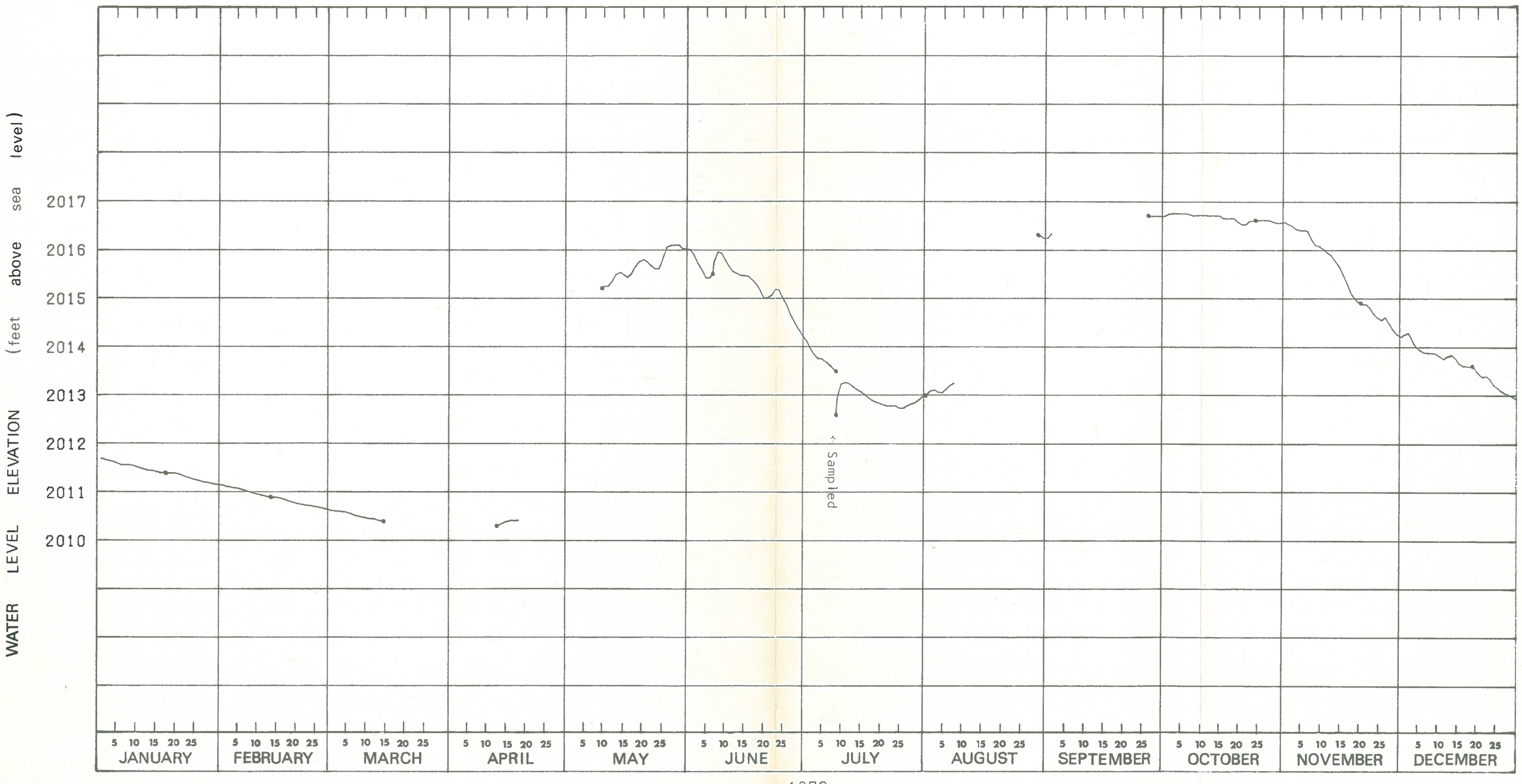
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-43

LSD 16 SEC 4 TWP 94 R 6 W4TH

9-43-H-79

Alberta Research Council




1978

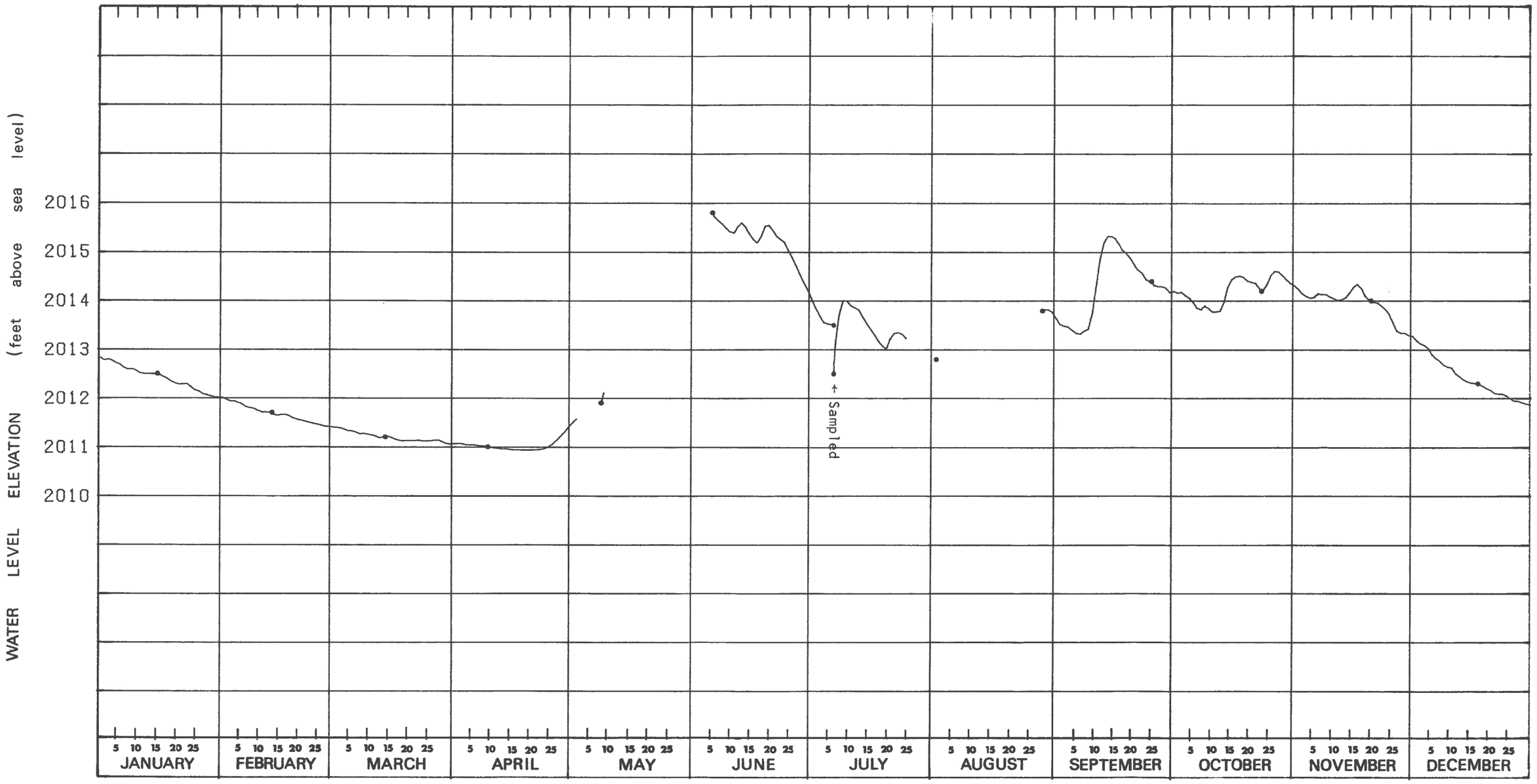
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-43

9-43-H-80

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council




1979

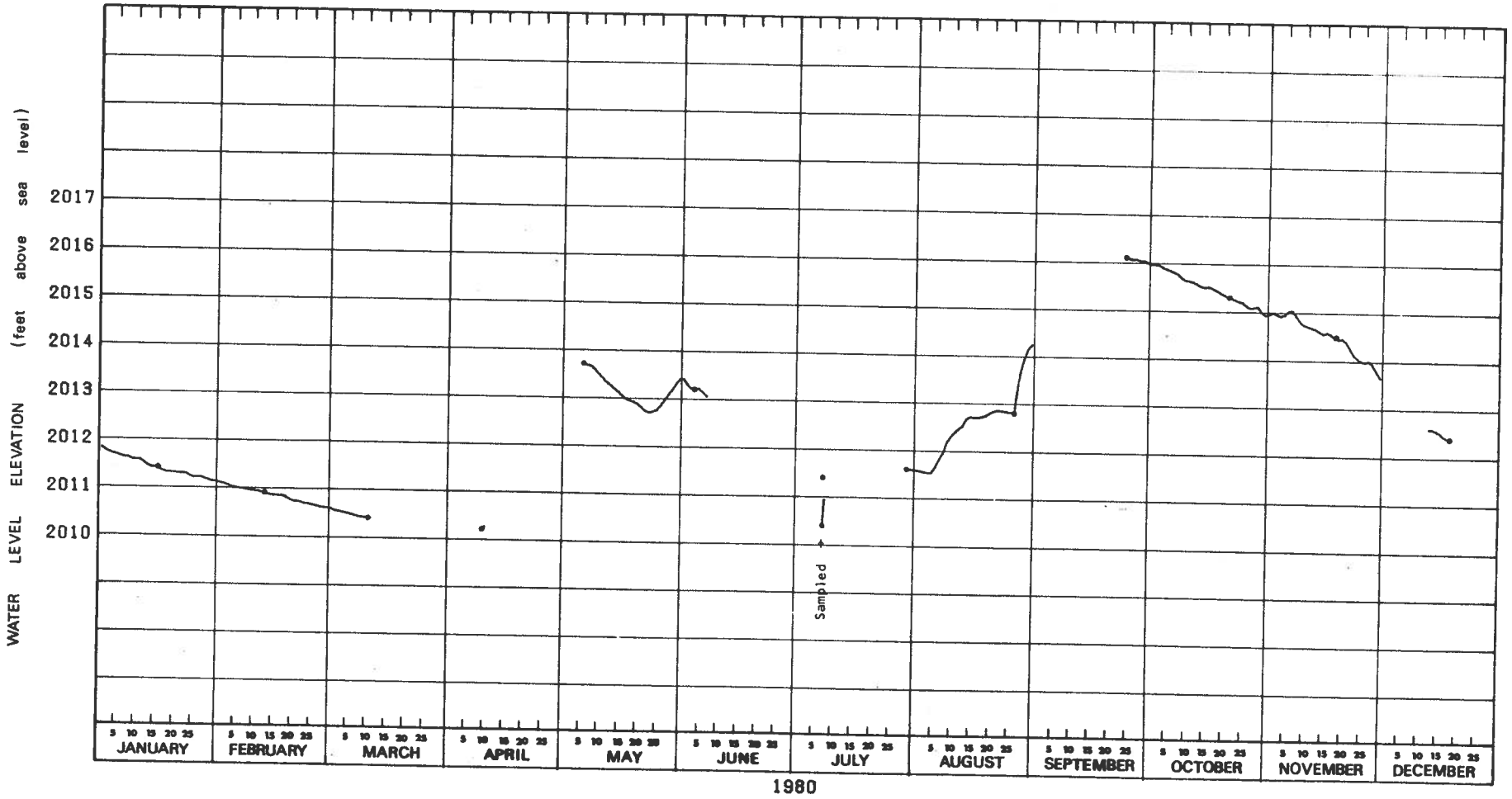
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-43-H-81



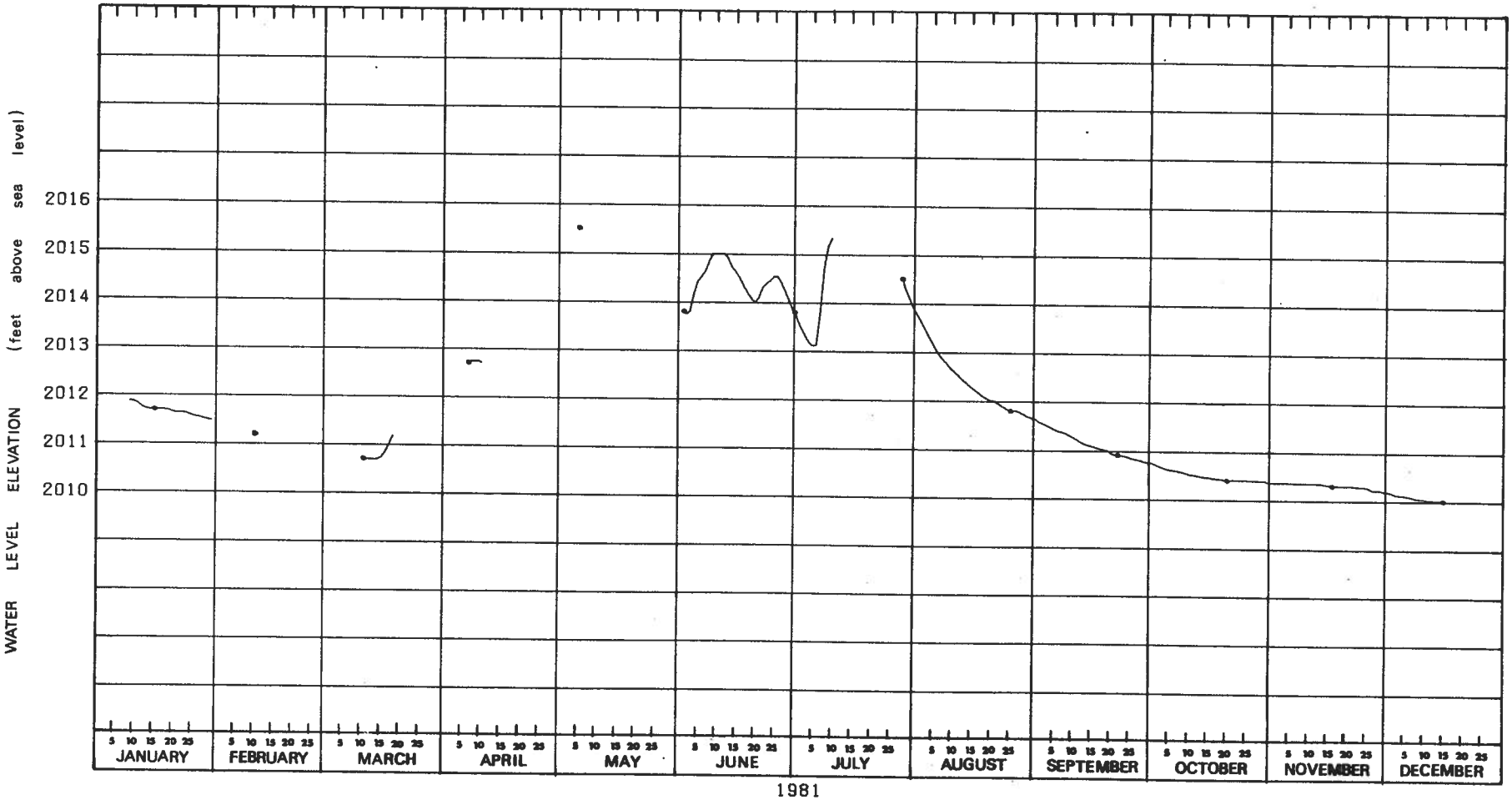
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-43-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.63

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 25/75 | | | Well completed |
| Feb 26/75 | 0.75 TOC | 2017.1 | Bail 25 gallons |
| Mar 5/75 | | | Bail sample; install shelter & recorder |
| Apr 16/75 | 3.21 MP | 2011.9 | MP = 2.76' TOC, (2022.4) |
| May 12/75 | 2.24 MP | 2015.0 | |
| June 9/75 | 1.84 MP | 2016.4 | |
| July 8/75 | 1.53 MP | 2017.4 | |
| Aug 11/75 | 1.50 MP | 2017.5 | Sampled well |
| | 1.83 MP | 2016.4 | After sample |
| Sept 12/75 | 1.42 MP | 2017.7 | Recorder stuck |
| Oct 7/75 | 1.43 MP | 2017.7 | |
| Nov 7/75 | 1.51 MP | 2017.4 | Frozen |
| Dec 7/75 | 2.14 MP | 2015.4 | Frozen; did not change chart |
| Jan 11/76 | 2.60 MP | 2013.9 | MP (2022.4) |
| Feb 7/76 | 2.80 MP | 2013.2 | |
| Mar 6/76 | 2.96 MP | 2012.7 | |
| Apr 7/76 | 2.98 MP | 2012.6 | |
| May 6/76 | 1.82 MP | 2016.4 | |
| June 2/76 | 2.08 MP | 2015.6 | |
| June 23/76 | 1.88 MP | 2016.2 | |
| July 17/76 | 2.01 MP | 2015.8 | |
| | 2.33 MP | 2014.8 | After sample; temp. 5.5°C |
| Aug 11/76 | 1.75 MP | 2016.7 | |
| Aug 31/76 | 1.55 MP | 2017.3 | Added 2 gallons of kerosene; water level elevation adjusted downward by 0.5 ft after this date |
| | TOC | 2019.1 | |
| Sept 28/76 | 1.67 MP | 2016.4 | Added 2.5 gallons of kerosene; water level elevation adjusted downward by 1.1 ft after this date |
| | TOC | 2018.5 | |
| Oct 27/76 | 2.50 | 2013.1 | Added 1.5 gallons of kerosene; water level elevation adjusted downward by 1.5 ft after this date |
| | TOC | 2018.1 | |
| Nov 24/76 | 1.81 MP | 2015.0 | Added 4 gallons of kerosene; water level elevation adjusted downward by 2.5 ft after this date |
| | TOC | 2017.1 | |
| Dec 21/76 | 2.08 MP | 2013.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.63

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 2.37 MP | 2012.1 | MP (2022.4) water level elevation adjusted downward by 2.5 ft to compensate for kerosene |
| Feb 7/77 | 2.45 MP | 2011.9 | Treated with 35 lb NU-WELL acid well conditioner |
| Feb 9/77 | | | Blown with air |
| Feb 10/77 | | | Added 10 gallons of kerosene |
| | 1.90 MP | 2013.7 | water level elevation adjusted downward by 2.5 ft after this date |
| Feb 16/77 | 2.55 MP | 2011.5 | |
| Mar 16/77 | 2.58 MP | 2011.4 | |
| Apr 14/77 | 2.29 MP | 2012.4 | |
| May 11/77 | 1.27 MP | 2015.7 | |
| June 8/77 | 1.15 MP | 2016.1 | |
| July 9/77 | 1.10 MP | 2016.3 | |
| | 1.41 MP | 2015.3 | After sample; temp. 5°C |
| Aug 4/77 | 1.51 MP | 2014.9 | |
| Aug 30/77 | 1.58 MP | 2014.7 | |
| Sept 28/77 | 1.91 MP | 2013.6 | |
| Oct 26/77 | 1.76 MP | 2914.1 | |
| Nov 23/77 | 2.11 MP | 2013.0 | |
| Dec 20/77 | 2.40 MP | 2012.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.63

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 2.60 MP | 2011.4 | MP (2022.4) water level elevation adjusted downward by 2.5 ft to compensate for kerosene |
| Feb 14/78 | 2.74 MP | 2010.9 | |
| Mar 15/78 | 2.88 MP | 2010.4 | |
| Apr 13/78 | 2.93 MP | 2010.3 | |
| May 10/78 | 1.42 MP | 2015.2 | |
| June 7/78 | 1.35 MP | 2015.5 | |
| July 9/78 | 1.95 MP | 2013.5 | |
| | 2.23 MP | 2012.6 | After sample; temp. 7°C |
| Aug 1/78 | 2.11 MP | 2013.0 | |
| Aug 30/78 | 1.09 MP | 2016.3 | |
| Sept 27/78 | 0.98 MP | 2016.7 | |
| Oct 25/78 | 0.71 MP | 2016.6 | New MP 0.53 m TOC (2021.4) |
| Nov 21/78 | 1.22 MP | 2014.9 | |
| Dec 20/78 | 1.62 MP | 2013.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.63

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 1.95 MP | 2012.5 | MP (2021.4) water level elevation adjusted downward by 2.5 ft to compensate for kerosene |
| Feb 14/79 | 2.20 MP | 2011.7 | |
| Mar 15/79 | 2.34 MP | 2011.2 | |
| Apr 10/79 | 2.42 MP | 2011.0 | |
| May 9/79 | 2.14 MP | 2011.9 | |
| June 6/79 | 0.94 MP | 2015.8 | |
| July 7/79 | 1.63 MP | 2013.5 | |
| | 1.94 MP | 2012.5 | After sample; temp. 5°C |
| Aug 2/79 | 1.87 MP | 2012.8 | |
| Aug 29/79 | 1.54 MP | 2013.8 | |
| Sept 26/79 | 1.38 MP | 2014.4 | |
| Oct 24/79 | 1.44 MP | 2014.2 | |
| Nov 21/79 | 1.50 MP | 2014.0 | |
| Dec 18/79 | 2.00 MP | 2012.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

9 - 43 - W - 82

## WELL HISTORY

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.63

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 2.27 MP | 2011.4 | |
| Feb 13/80 | 2.45 MP | 2010.9 | |
| Mar 11/80 | 2.60 MP | 2010.4 | |
| Apr 10/80 | 2.64 MP | 2010.2 | |
| May 6/80 | 1.59 MP | 2013.7 | |
| June 4/80 | 1.73 MP | 2013.2 | |
| July 8/80 | 2.28 MP | 2011.4 | Temp. 8°C |
| | 2.58 MP | 2010.4 | After Sample |
| July 30/80 | 2.21 MP | 2011.6 | |
| Aug 27/80 | 1.86 MP | 2012.8 | |
| Sept 25/80 | 0.86 MP | 2016.1 | |
| Oct 22/80 | 1.09 MP | 2015.3 | |
| Nov 19/80 | 1.35 MP | 2014.5 | |
| Dec 19/80 | 1.98 MP | 2012.4 | |
| Jan 16/81 | 2.21 MP | 2011.7 | |
| Feb 11/81 | 2.35 MP | 2011.2 | |
| Mar 11/81 | 2.50 MP | 2010.7 | |
| Apr 7/81 | 1.89 MP | 2012.7 | |
| May 6/81 | 1.04 MP | 2015.5 | |
| June 2/81 | 1.57 MP | 2013.8 | |
| July 1/81 | 1.57 MP | 2013.8 | |
| July 29/81 | 1.35 MP | 2014.5 | |
| Aug 26/81 | 2.16 MP | 2011.8 | |
| Sept 23/81 | 2.44 MP | 2010.9 | |
| Oct 21/81 | 2.58 MP | 2010.4 | |
| Nov 17/81 | 2.61 MP | 2010.3 | |
| Dec 16/81 | 2.70 MP | 2010.0 | |

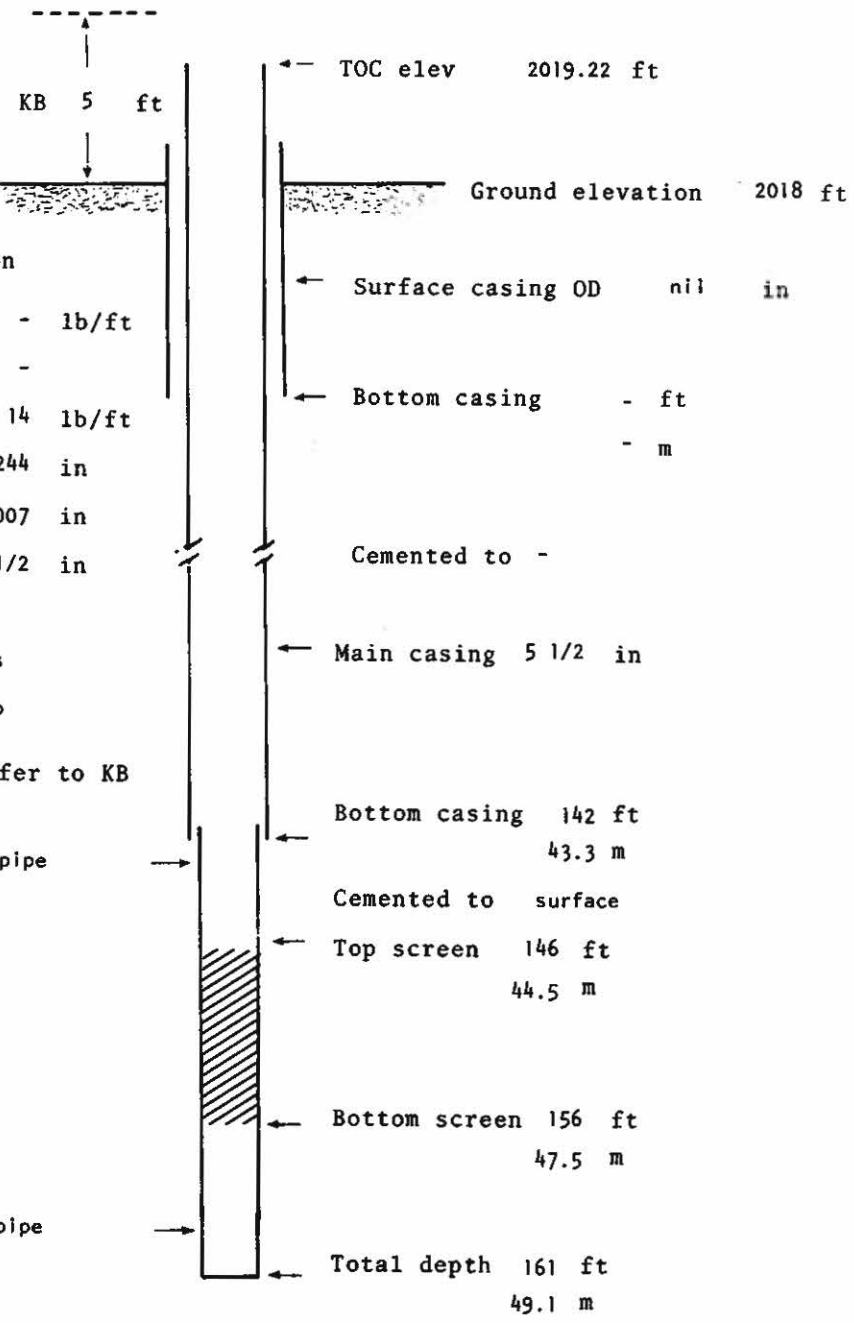
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Tp 94 R 6 W4th

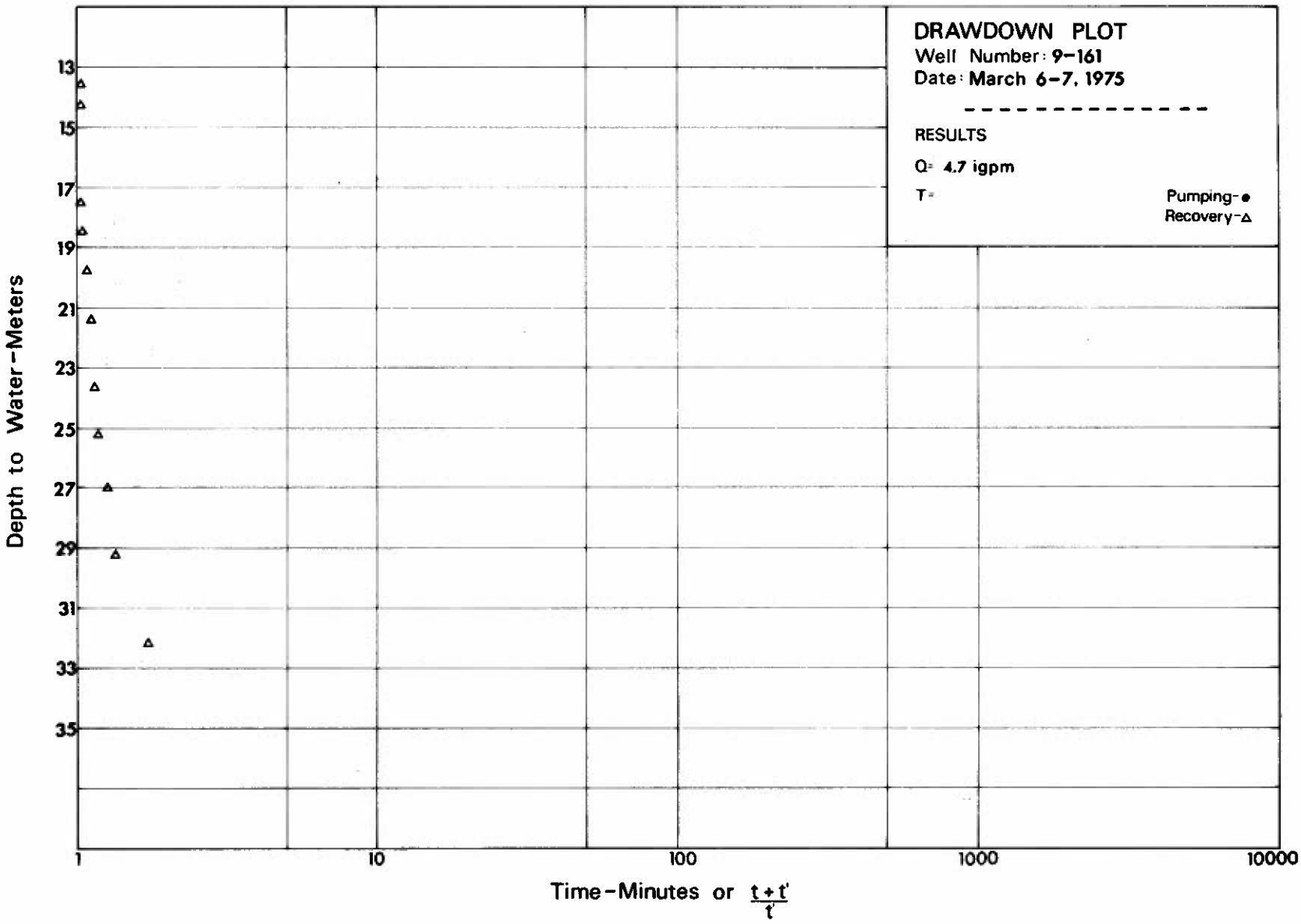
Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 9-161
Date: March 6-7, 1975
RESULTS
Q= 4.7 igpm
T=
Pumping-●
Recovery-△
Depth to Water-Meters
13
15
17
19
21
23
25
27
29
31
33
35
1
10
100
1000
10000
Time-Minutes or (t+t')/t'

9-161-A-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed from 9-161

Date sampled March 8, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 40.6 | 2.03 | 33.1 |
| Magnesium ($Mg^{++}$) | 24.1 | 1.98 | 32.4 |
| Sodium ($Na^{+}$) | 40.0 | 1.74 | 28.4 |
| Potassium ($K^{+}$) | 14.6 | 0.37 | 6.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 325.0 | 5.33 | 85.6 |
| Sulfate ($SO_4^{=}$) | 8.2 | 0.17 | 2.7 |
| Chloride ($Cl^{-}$) | 25.0 | 0.17 | 11.3 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0.3 |
| Silica ($SiO_2$) | 14.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 300.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 6.222 | Total Cations (epm) | 6.121 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 560 |
| pH | 8.3 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 4.0 |
| pH | 8.2 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 527 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-161

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled August 12, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 154 | 7.68 | 25 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 218 | 9.48 | 31 |
| Potassium ($K^{+}$) | 533 | 13.64 | 44 |
| Carbonate ($CO_3^{=}$) | 48 | 1.60 | 4 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 6.6 | 0.14 | 0 |
| Chloride ($Cl^{-}$) | 338 | 9.53 | 25 |
| Nitrate ($NO_3^{=}$) | 1 | 0.02 | 0 |
| Silica ($SiO_2$) | 2.6 | | |
| Hydroxide ($OH^{-}$) | 460 | 27.04 | 71 |
| Calcium (Acidified) | 198 | | |
| Magnesium (Acidified) | 35 | | |
| Total dissolved solids | 1942 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 38.32 | Total Cations (epm) | 30.80 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 6000 | Temperature (C) | 4.0 |
| pH | 12.3 | pH | 11.4 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed from well 9-161

Date of sampling March 8, 1975

Total dissolved solids 300 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .05 | Mg | M |
| As | <.01 | Mn | .004 |
| B | .03 | Mo | ND |
| Ba | .01 | Ni | .02 |
| Be | ND | Pb | .01 |
| Bi | ND | Sb | ND |
| Ca | M | Si | M |
| Cd | ND | Sn | ND |
| Co | .001 | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .01 | V | ND |
| Fe | M | Zn | .01 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-161

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 540.0 | 26.95 | 75 |
| Magnesium ($Mg^{++}$) | 0.2 | 0.02 | 0 |
| Sodium ($Na^{+}$) | 81.0 | 3.52 | 10 |
| Potassium ($K^{+}$) | 212.0 | 5.42 | 15 |
| Carbonate ($CO_3^{=}$) | 31.2 | 1.04 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 2.4 | 0.05 | 0 |
| Chloride ($Cl^{-}$) | 100.0 | 2.82 | 7 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.8 | | |
| Hydroxide ($OH^{-}$) | 575.0 | 33.80 | 90 |
| Calcium (Acidified) | 550.0 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 1898 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 37.73 | Total Cations (epm) | 35.91 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 8000 | Temperature (C) | 5.0 | |
| pH | 12.4 | pH | 12.3 | |
| Fluoride ($F^{-}$) | 0.1 Mg/L | Carbonate ($CO_3^{=}$) | 73 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 591 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-161

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 430.0 | 21.46 | 71.7 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0.0 |
| Sodium ($Na^{+}$) | 134.0 | 5.83 | 19.5 |
| Potassium ($K^{+}$) | 104.0 | 2.66 | 8.9 |
| Carbonate ($CO_3^{=}$) | 33.6 | 1.12 | 4.0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 3.8 | 0.08 | 0.3 |
| Chloride ($Cl^{-}$) | 158.0 | 4.46 | 16.1 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0.1 |
| Silica ($SiO_2$) | 1.1 | | |
| Hydroxide ($OH^{-}$) | 375.0 | 22.05 | 79.5 |
| Calcium (Acidified) | 435.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 865.6 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 27.72 | Total Cations (epm) | 29.95 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 6500 |
| pH | 12.3 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 4.0 |
| pH | 12.3 |
| Carbonate ($CO_3^{=}$) | 34.0 ppm |
| Bicarbonate ($HCO_3^{-}$) | |
| Hydroxide ($OH^{-}$) | 374.0 ppm |
| Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-161

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 360.0 | 17.96 | 75.4 |
| Magnesium(Mg) | 0.0 | 0.00 | 0.0 |
| Sodium(Na) | 59.0 | 2.57 | 10.8 |
| Potassium(K) | 129.0 | 3.30 | 13.8 |
| Carbonate(CO3) | 33.6 | 1.12 | 4.4 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 4.5 | 0.09 | 0.4 |
| Chloride(Cl) | 58.0 | 1.64 | 6.5 |
| Nitrate(NO3) | 3.2 | 0.05 | 0.2 |
| Silica(SiO2) | 0.0 | | |
| Hydroxide(OH) | 379.0 | 22.28 | 88.5 |
| Calcium(Acidified) | 325.0 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 1168.0 | | |
| Total Anions(epm) | 25.18 | Total Cations(epm) | 23.83 |

## Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4570 | Temperature(C) | 5.00 | |
| pH | 12.3 | pH | 12.3 | |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) | 25 | mg/l |
| | | Bicarbonate(HCO3) | | |
| | | Hydroxide(OH) | 386 | mg/l |

9-161-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-161

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 266.0 | 13.27 | 74.3 |
| Magnesium(Mg) | 0.0 | 0.00 | 0.0 |
| Sodium(Na) | 53.0 | 2.31 | 12.9 |
| Potassium(K) | 89.0 | 2.28 | 12.8 |
| Carbonate(CO3) | 24.0 | 0.80 | 4.1 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 5.0 | 0.10 | 0.5 |
| Chloride(Cl) | 60.0 | 1.69 | 8.7 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 1.7 | | |
| Hydroxide(OH) | 287.0 | 16.87 | 86.6 |
| Calcium(Acidified) | 229.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 928.0 | | |
| Total Anions(epm) | 19.48 | Total Cations(epm) | 17.86 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3580 | Temperature(C) | 5.50 | |
| pH | 12.0 | pH | 12.2 | |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) | 15 | mg/l |
| | | Bicarbonate(HCO3) | | |
| | | Hydroxide(OH) | 305 | mg/l |

WATER ANALYSIS 9-161-E-82

OBSERVATION WELL NUMBER 9-161

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 235.0 | 11.75 | 66.2 |
| Magnesium(Mg) | 0.0 | 0.0 | 0.0 |
| Sodium(Na) | 69.0 | 3.00 | 16.9 |
| Potassium(K) | 117.0 | 3.00 | 16.9 |
| Carbonate(CO3) | 40.8 | 1.36 | 48.8 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 6.0 | 0.13 | 4.5 |
| Chloride(Cl) | 46.0 | 1.30 | 46.5 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.2 |
| Silica(SiO2) | 7.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 255.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 964.0 | | |
| Total Anions(epm) | 2.79 | Total Cations(epm) | 17.75 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 4000 |
| pH | 12.1 |
| Fluoride | 0.0 mg/l |

Field:

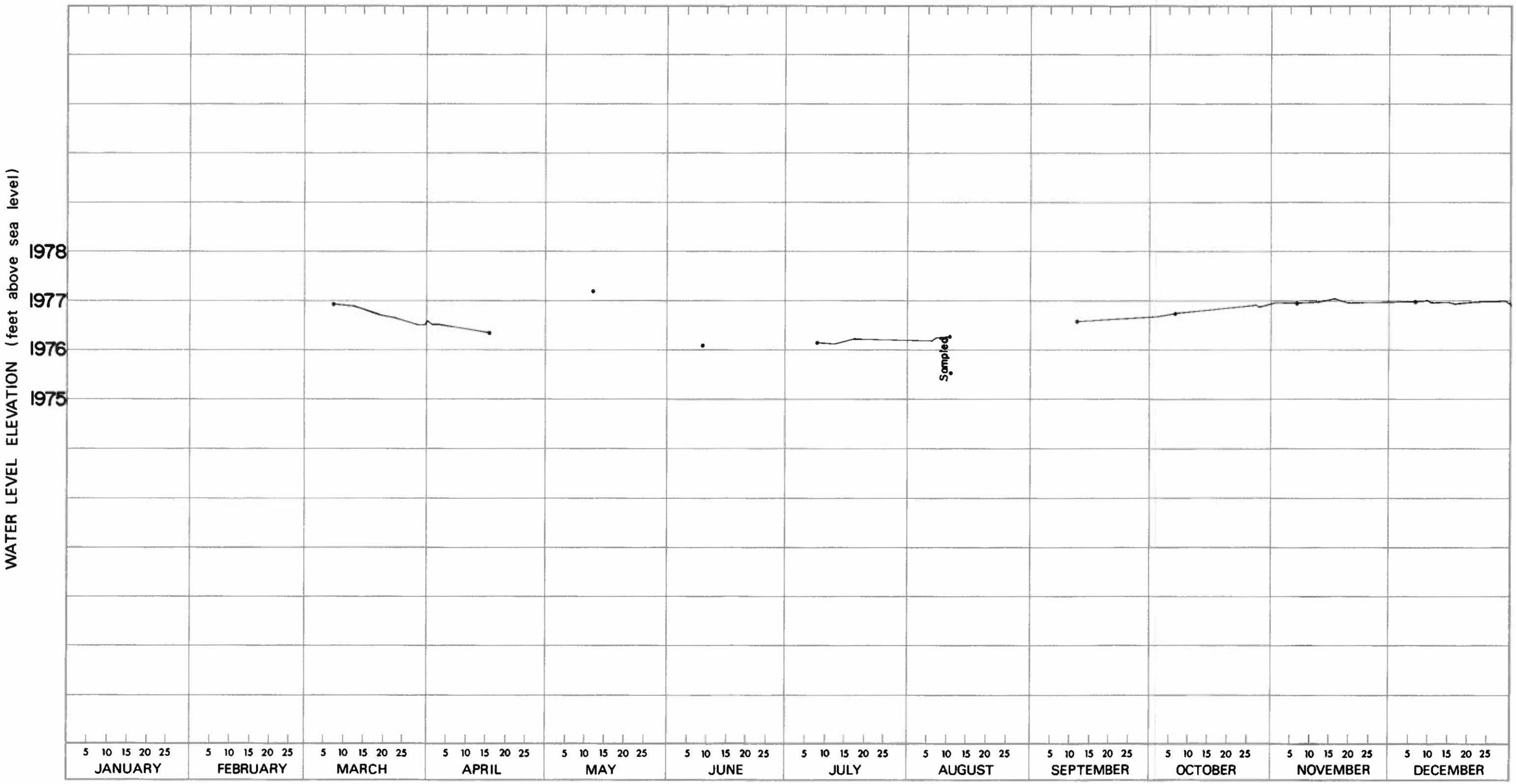
| | | |
|---|---|---|
| Temperature | 7.00 | |
| pH | 12.3 | |
| Carbonate(CO3) | 29 | mg/l |
| Bicarbonate(HCO3) | 0 | mg/l |
| Hydroxide(OH) | 306 | mg/l |

## WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-161

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council



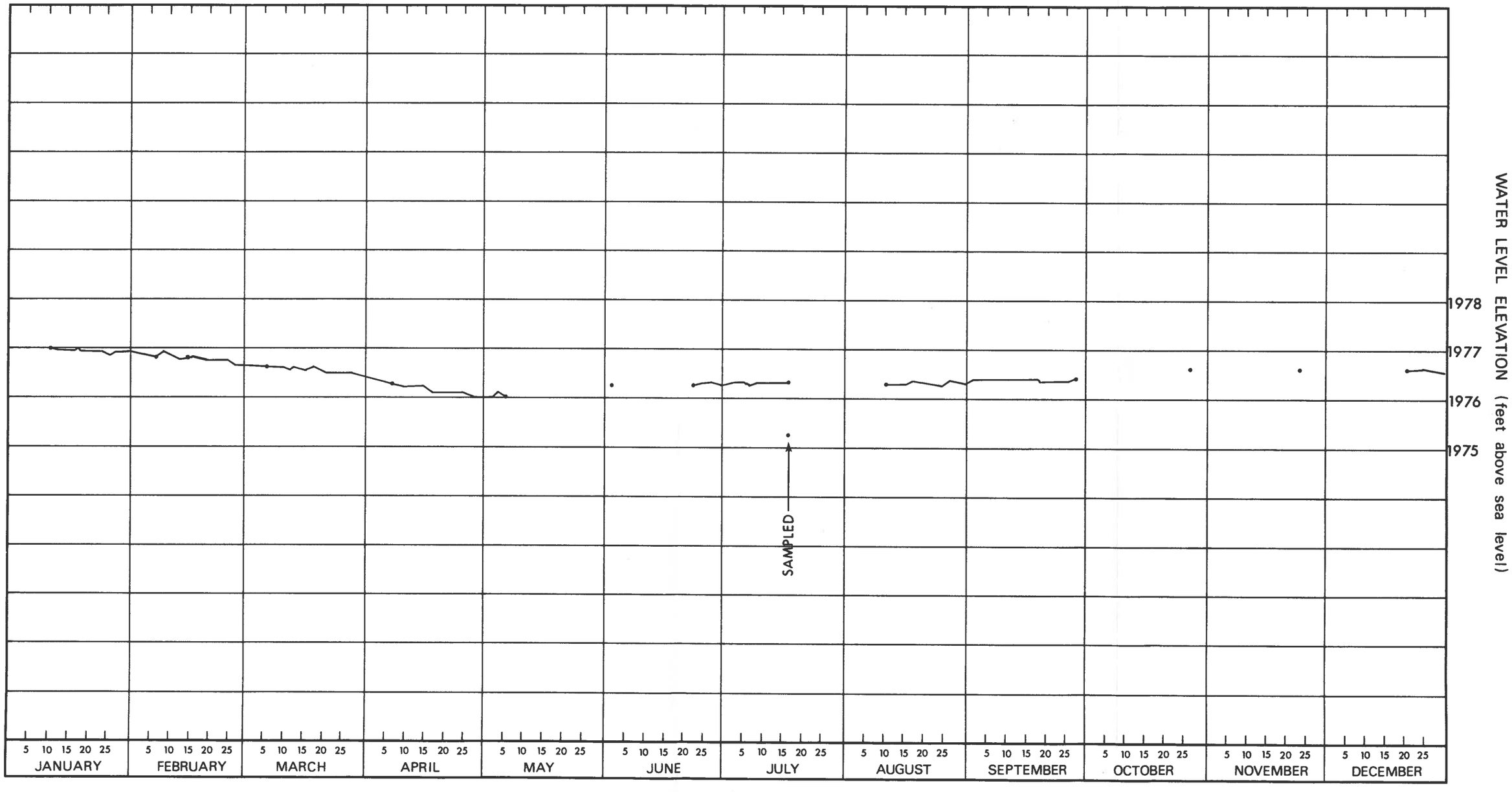
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4th

Alberta Research Council

9 - 161 - H - 77




1976

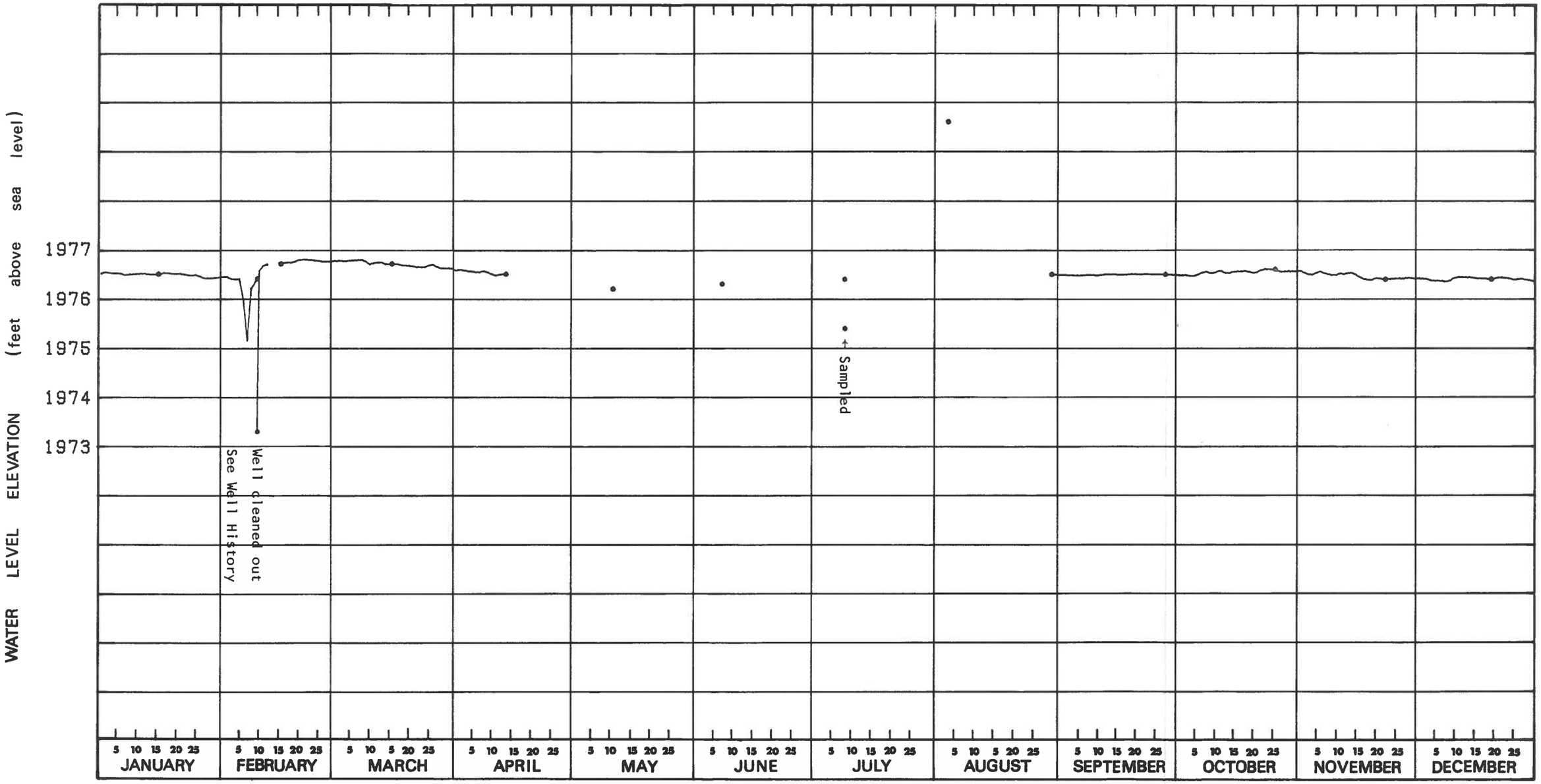
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4 th

Alberta Research Council

9-161-H-78



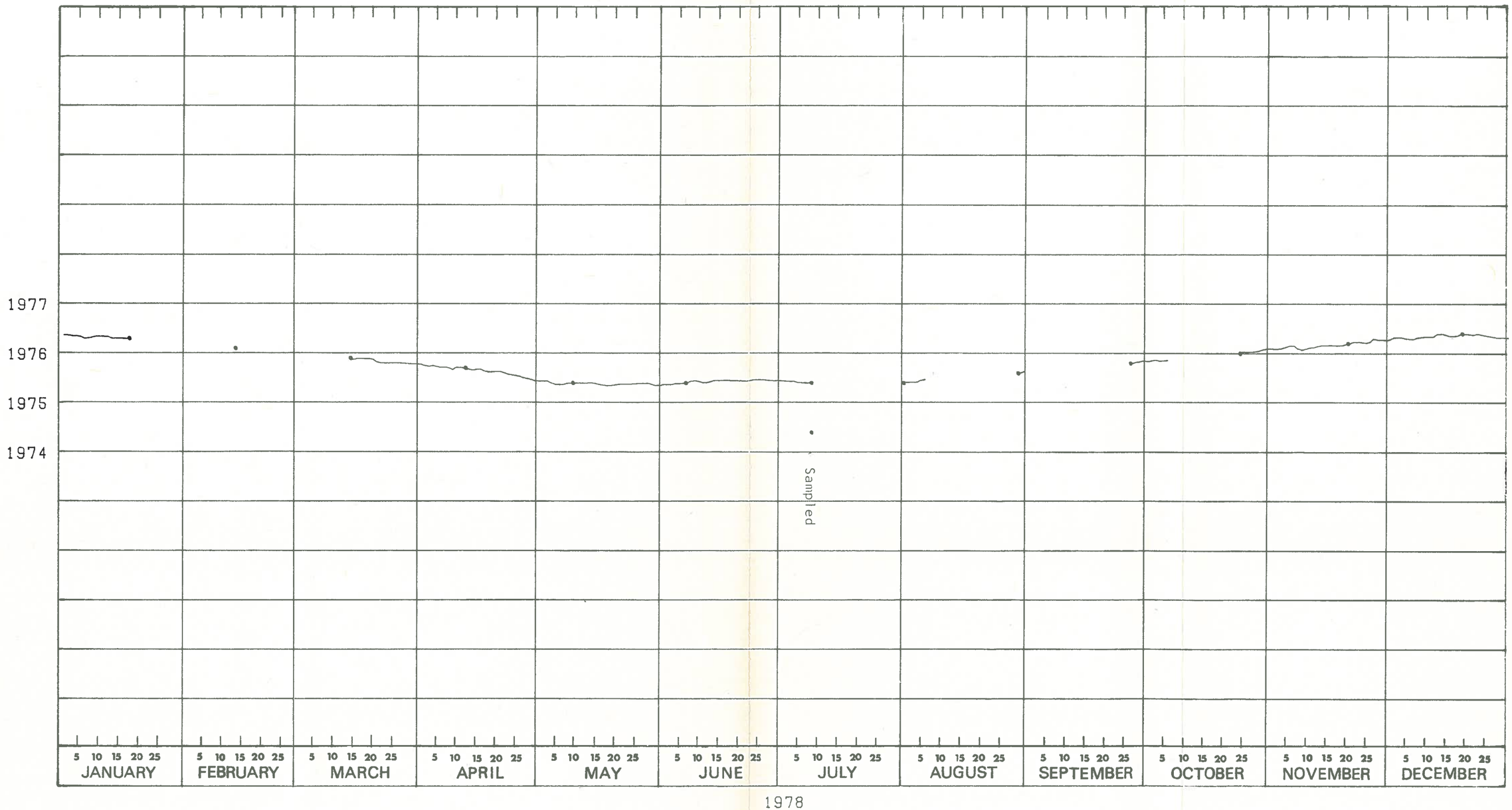
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-161

LSD 1 SEC 9 TWP 94 R 6 W4TH

9-161-H-79

Alberta Research Council



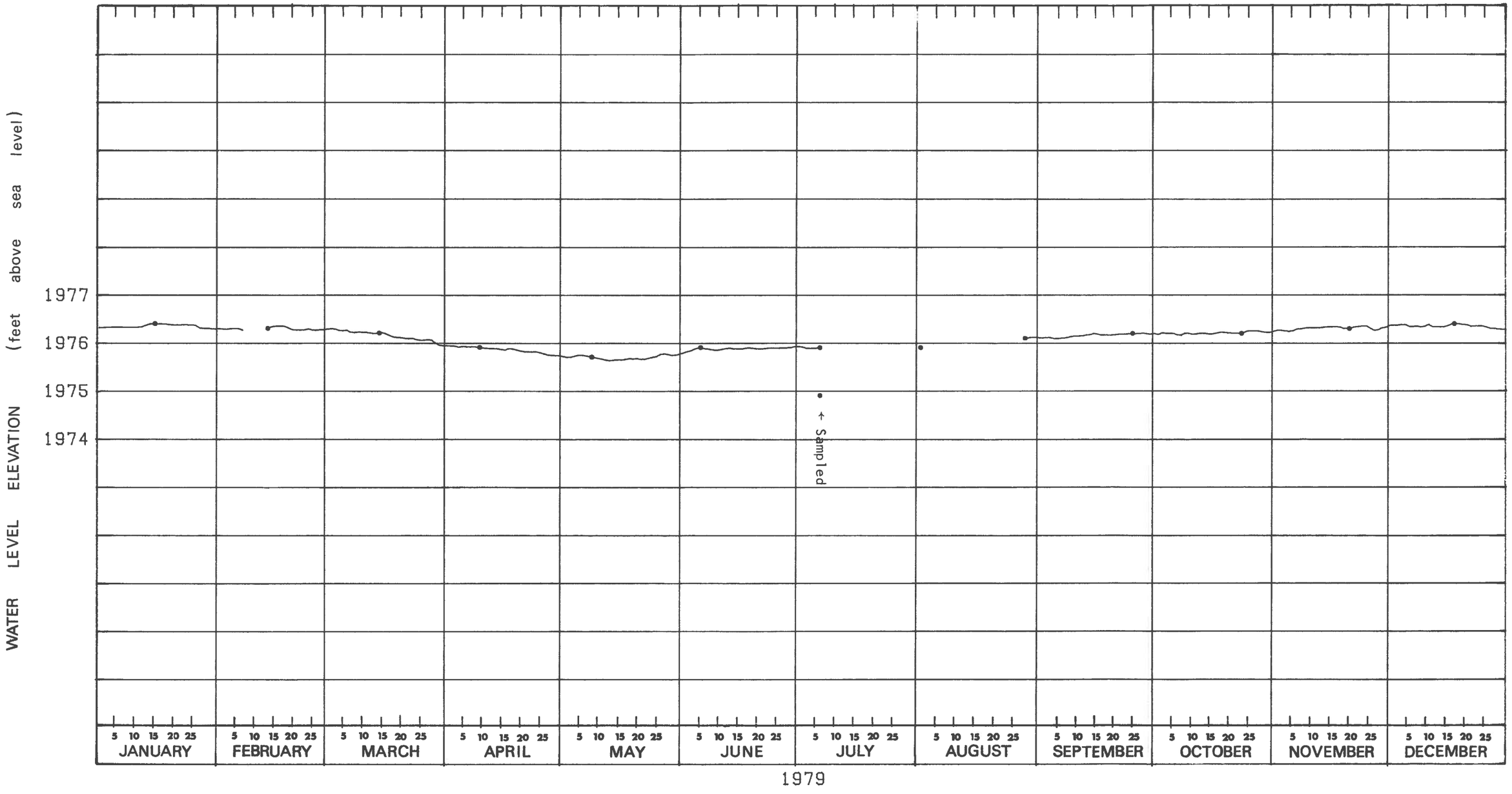
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-161

9-161-H-80

Lsd 1 Sec 9 Twp 94 R 6 W4 th

Alberta Research Council



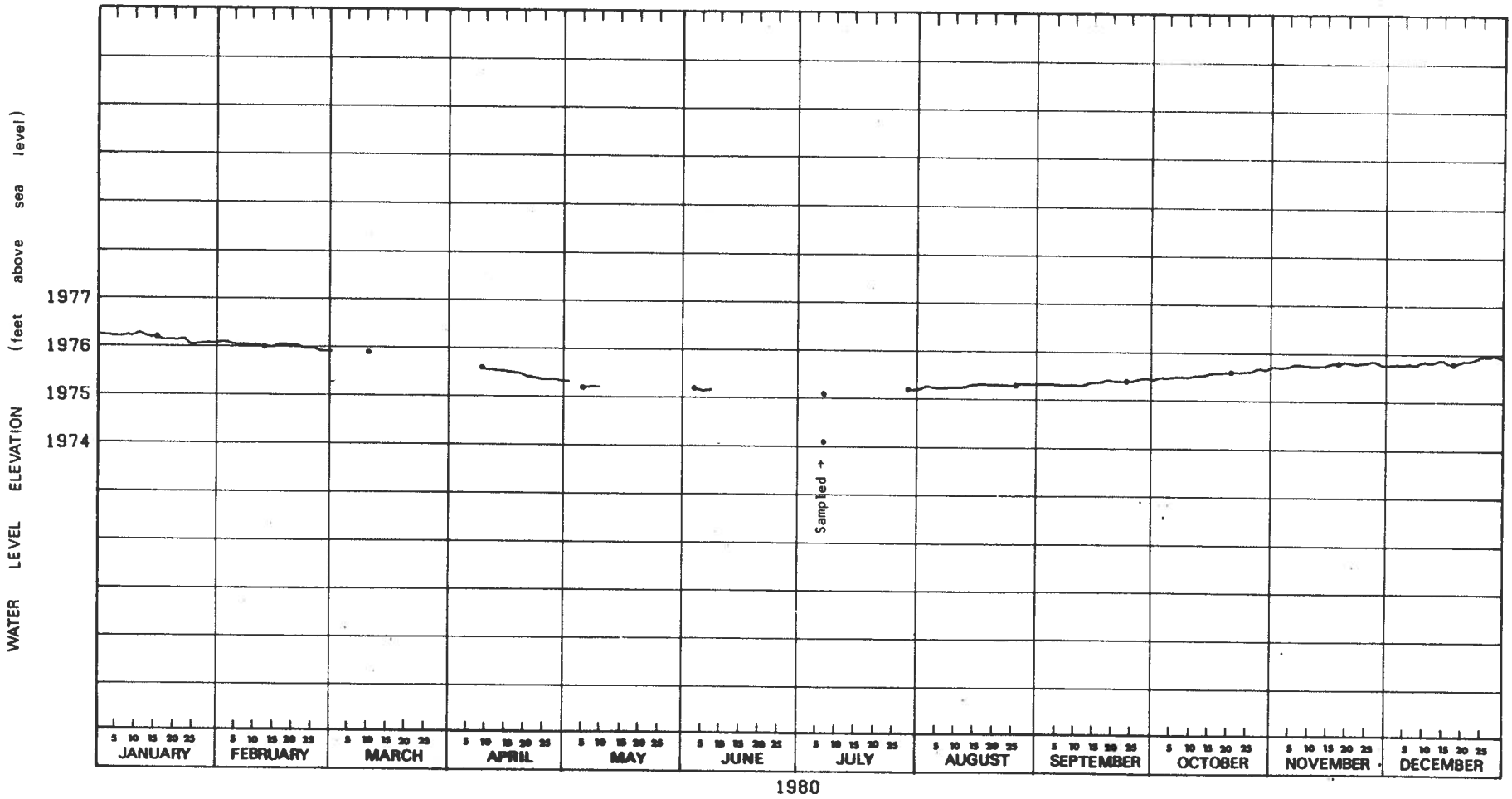
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4 th

Alberta Research Council

9-161-H-81



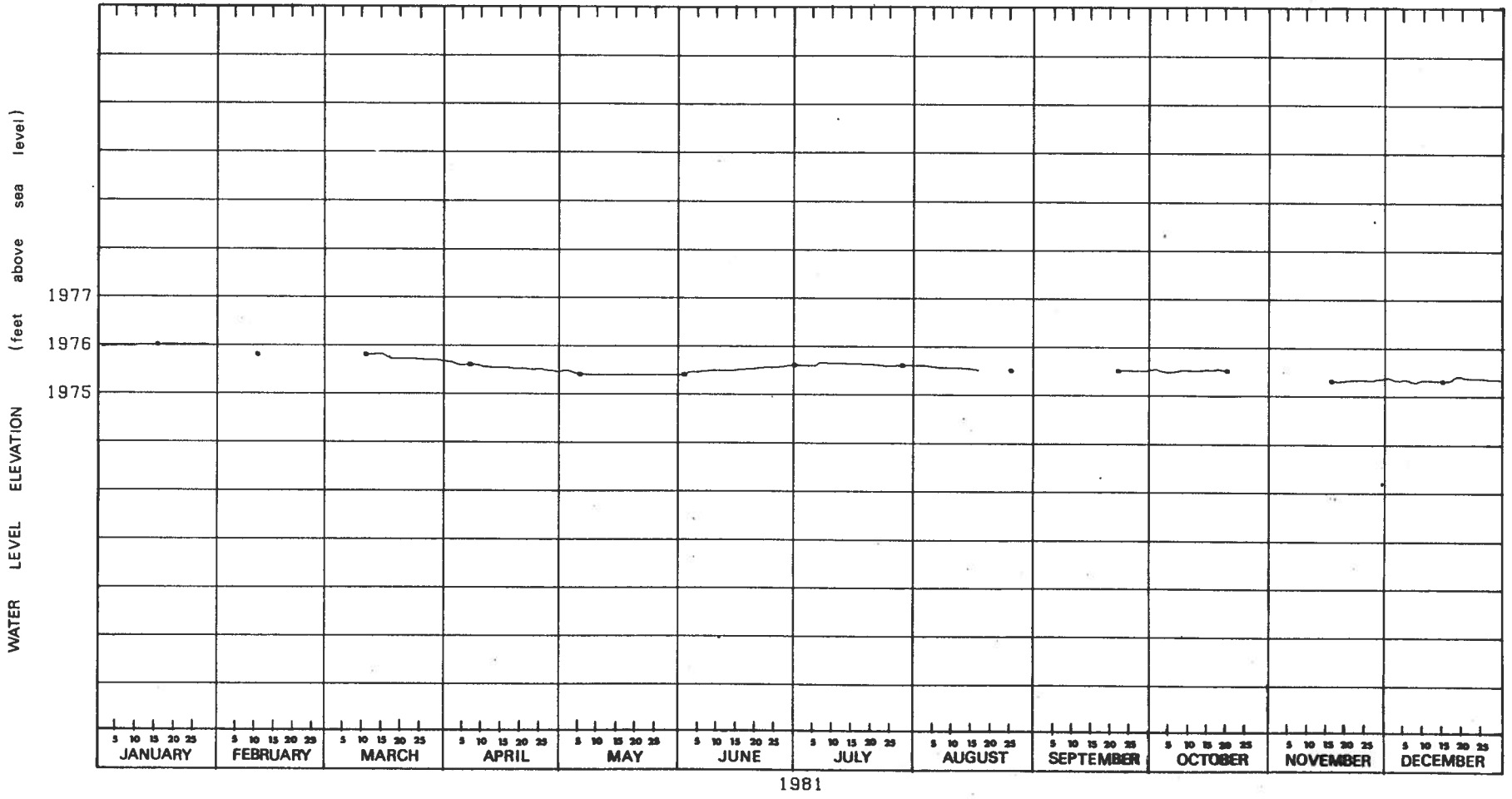
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-161

9-161-H-82

Lsd 1 Sec 9 Twp 94 R 6 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar 3/75 | | | Well completed |
| Mar 5/75 | | | Bail 140 gallons |
| Mar 6/75 | 13.10 TOC | 1976.25 | Bail 70 gallons |
| Mar 7/75 | 13.65 TOC | 1974.74 | |
| Mar 14/75 | | | Install shelter; drop float in well; MP = 273' TOC, (2021.95) |
| Mar 15/75 | | | Shoot holes in Float; install recorder |
| Apr 16/75 | 13.74 MP | 1976.88 | |
| May 13/75 | 13.94 old MP | 1976.23 | New MP = 27" TOC, (2021.47) |
| June 9/75 | 13.83 MP | 1976.11 | |
| July 8/75 | 12.72 MP | 1979.75 | Clock stopped |
| Aug 11/75 | 13.76 MP | 1976.33 | Sampled well at 130' |
| | 14.00 MP | 1975.55 | after sample |
| Sept 12/75 | 13.69 MP | 1976.56 | |
| Oct 7/75 | 13.64 MP | 1976.73 | |
| Nov 7/75 | 13.57 MP | 1976.96 | |
| Dec 7/75 | 13.56 MP | 1976.99 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 13.56 MP | 1977.0 | MP (2021.5) |
| Feb 7/76 | 13.61 MP | 1976.9 | |
| Mar 6/76 | 13.68 MP | 1976.6 | |
| Apr 7/76 | 13.78 MP | 1976.3 | |
| May 6/76 | 13.86 MP | 1976.0 | |
| June 2/76 | 13.79 MP | 1976.3 | |
| June 23/76 | 13.79 MP | 1976.3 | |
| July 17/76 | 13.77 MP | 1976.3 | |
| | 14.09 MP | 1975.3 | After sample; temp. 5°C |
| Aug 11/76 | 13.78 MP | 1976.3 | |
| Aug 31/76 | 13.77 MP | 1976.3 | |
| Sept 28/76 | 13.74 MP | 1976.4 | |
| Oct 27/76 | 13.70 MP | 1976.6 | |
| Nov 24/76 | 13.69 MP | 1976.6 | |
| Dec 21/76 | 13.69 MP | 1976.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 13.73 MP | 1976.5 | MP (2021.5) |
| Feb 7/77 | | | Treated with 70 lb NU-WELL acid well conditioner |
| Feb 10/77 | | | Blown with air |
| | 14.90 MP | 1973.3 | New MP = 0.92 m TOC, (2022.2) |
| Feb 16/77 | 13.87 MP | 1976.7 | |
| Mar 16/77 | 13.87 MP | 1976.7 | |
| Apr 14/77 | 13.83 MP | 1976.5 | New MP = 0.81 m TOC, (2021.9) |
| May 11/77 | 13.92 MP | 1976.2 | |
| June 8/77 | 13.91 MP | 1976.3 | |
| July 9/77 | 13.87 MP | 1976.4 | |
| | 14.17 MP | 1975.4 | After sample; temp. 4°C |
| Aug 4/77 | 12.90 MP | 1979.6 | |
| Aug 30/77 | 13.84 MP | 1976.5 | |
| Sept 28/77 | 13.85 MP | 1976.5 | |
| Oct 26/77 | 13.81 MP | 1976.6 | |
| Nov 23/77 | 13.87 MP | 1976.4 | |
| Dec 20/77 | 13.86 MP | 1976.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 13.91 MP | 1976.3 | MP (2021.9) |
| Feb 14/78 | 13.96 MP | 1976.1 | |
| Mar 15/78 | 14.02 MP | 1975.9 | |
| Apr 13/78 | 14.07 MP | 1975.7 | |
| May 10/78 | 14.17 MP | 1975.4 | |
| June 7/78 | 14.18 MP | 1975.4 | |
| July 9/78 | 14.17 MP | 1975.4 | |
| | 14.49 MP | 1974.4 | After sample; temp. 5°C |
| Aug 1/78 | 14.18 MP | 1975.4 | |
| Aug 30/78 | 14.12 MP | 1975.6 | |
| Sept 27/78 | 14.05 MP | 1975.8 | |
| Oct 25/78 | 13.99 MP | 1976.0 | |
| Nov 21/78 | 13.92 MP | 1976.2 | |
| Dec 20/78 | 13.87 MP | 1976.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 13.87 MP | 1976.4 | MP (2021.9) |
| Feb 14/79 | 13.91 MP | 1976.3 | |
| Mar 15/79 | 13.94 MP | 1976.2 | |
| Apr 10/79 | 14.01 MP | 1975.9 | |
| May 9/79 | 14.07 MP | 1975.7 | |
| June 6/79 | 13.86 MP | 1975.9 | New MP 0.66m TOC (2021.4) |
| July 7/79 | 13.86 MP | 1975.9 | |
| | 14.18 MP | 1974.9 | After sample; temp. 5.5°C |
| Aug 2/79 | 13.86 MP | 1975.9 | |
| Aug 29/79 | 13.82 MP | 1976.1 | |
| Sept 26/79 | 13.79 MP | 1976.2 | |
| Oct 24/79 | 13.77 MP | 1976.2 | |
| Nov 21/79 | 13.75 MP | 1976.3 | |
| Dec 18/79 | 13.73 MP | 1976.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 13.77 MP | 1976.2 | |
| Feb 13/80 | 13.84 MP | 1976.0 | |
| Mar 11/80 | 13.87 MP | 1975.9 | |
| Apr 10/80 | 13.96 MP | 1975.6 | |
| May 6/80 | 14.07 MP | 1975.2 | |
| June 4/80 | 14.07 MP | 1975.2 | |
| July 8/80 | 14.11 MP | 1975.1 | Temp. 7°C |
| | 14.41 MP | 1974.1 | After Sample |
| July 30/80 | 14.07 MP | 1975.2 | |
| Aug 27/80 | 14.05 MP | 1975.3 | |
| Sept 25/80 | 14.01 MP | 1975.4 | |
| Oct 22/80 | 13.97 MP | 1975.6 | |
| Nov 19/80 | 13.89 MP | 1975.8 | |
| Dec 19/80 | 13.89 MP | 1975.8 | |
| Jan 16/81 | 13.85 MP | 1976.0 | |
| Feb 11/81 | 13.89 MP | 1975.8 | |
| Mar 11/81 | 13.91 MP | 1975.8 | |
| Apr 7/81 | 13.96 MP | 1975.6 | |
| May 6/81 | 14.02 MP | 1975.4 | |
| June 2/81 | 14.01 MP | 1975.4 | |
| July 1/81 | 13.97 MP | 1975.6 | |
| July 29/81 | 13.95 MP | 1975.6 | |
| Aug 26/81 | 13.98 MP | 1975.5 | |
| Sept 23/81 | 14.00 MP | 1975.5 | |
| Oct 21/81 | 13.98 MP | 1975.5 | |
| Nov 17/81 | 14.07 MP | 1975.3 | |
| Dec 16/81 | 14.06 MP | 1975.3 | |

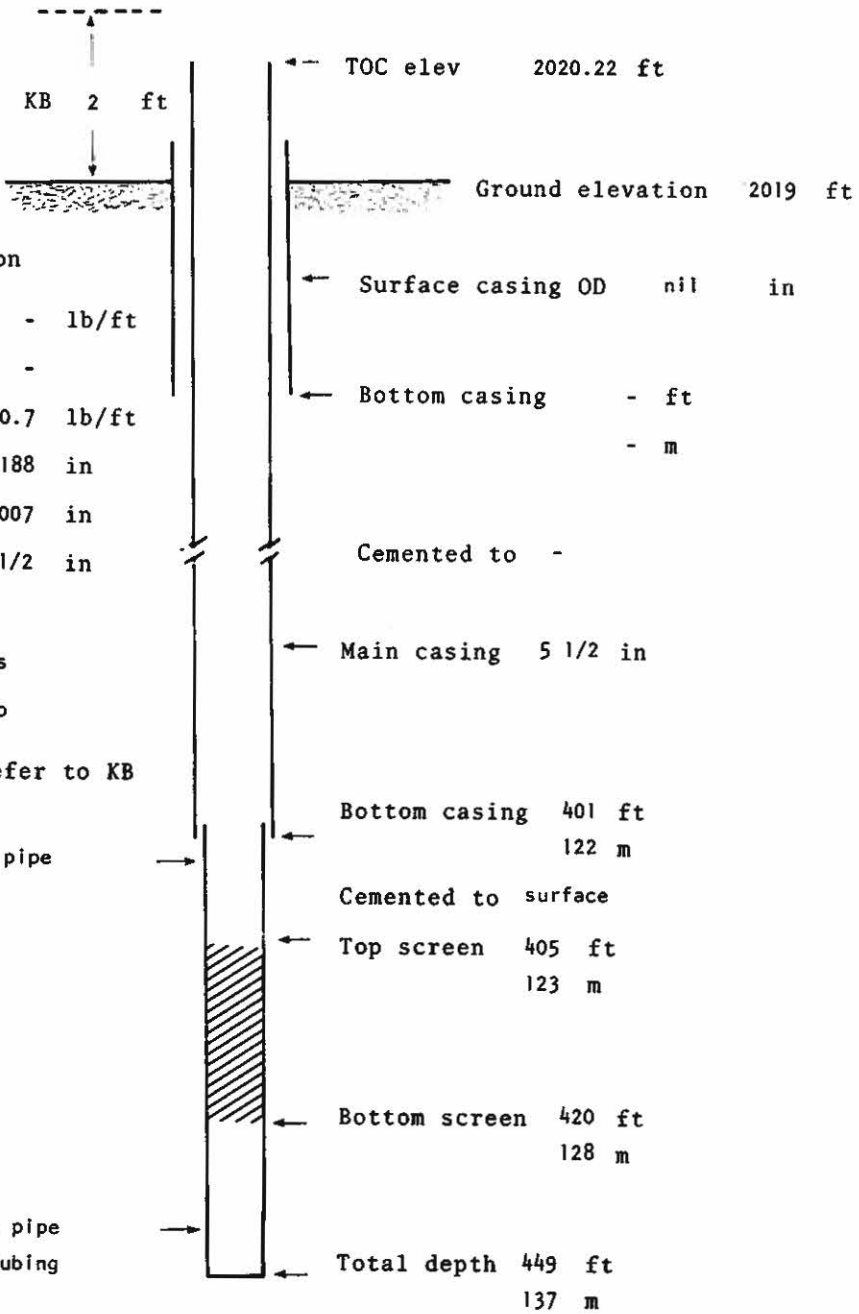
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Tp 94 R 6 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 10.7 | lb/ft |
| wall thickness | .188 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

## DRILL STEM TEST

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Tp 94 R 6 W4th

Alberta Research Council

Elevation: gl 2019
KB 2021

Type of test - Casing Positrieve

Date of test March 5, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1030 | hrs |
| Tool opened | 1145 | hrs |
| First flow | 2 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 30 | min |
| Pulled loose at | 1340 | hrs |
| Out of hole at | 1430 | hrs |
| Wt on packers | 3000 | lbs |
| Description of blow | Fair initial puff, fair blow decreasing to nil in 3 minutes | |
| Total water recovered | 200 | ft |
| Water sample No. | - | |
| Gas blow | No | |
| Remarks | Test satisfactory<br>5-1/2" RBP set @ 381' | |

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 405-420

Formation tested Quaternary

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

### PRESSURE DATA (psi)

| Instrument No. | | RPG-92N | RPG-89N |
|---|---|---|---|
| Capacity (psig) | | 431 | 400 |
| Instrument set at (ft) | | 385 | 393 |
| Initial hydrostatic | A | 101 | 104 |
| First flow | B | 93 | 97 |
| | B1 | 59 | 63 |
| Initial shut in | C | 93 | 97 |
| Second flow | D | 93 | 97 |
| | D1 | 94 | 97 |
| Final shut in | G | 94 | 97 |
| Final hydrostatic | H | 96 | 98 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

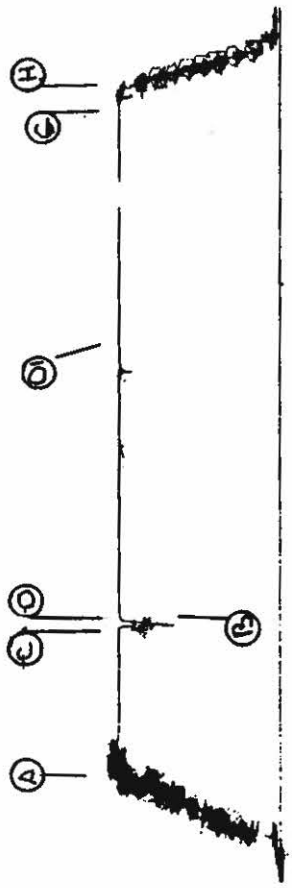
OBSERVATION WELL NUMBER 9-449

PRESSURE INCREMENTS

Recorder RPG 89N

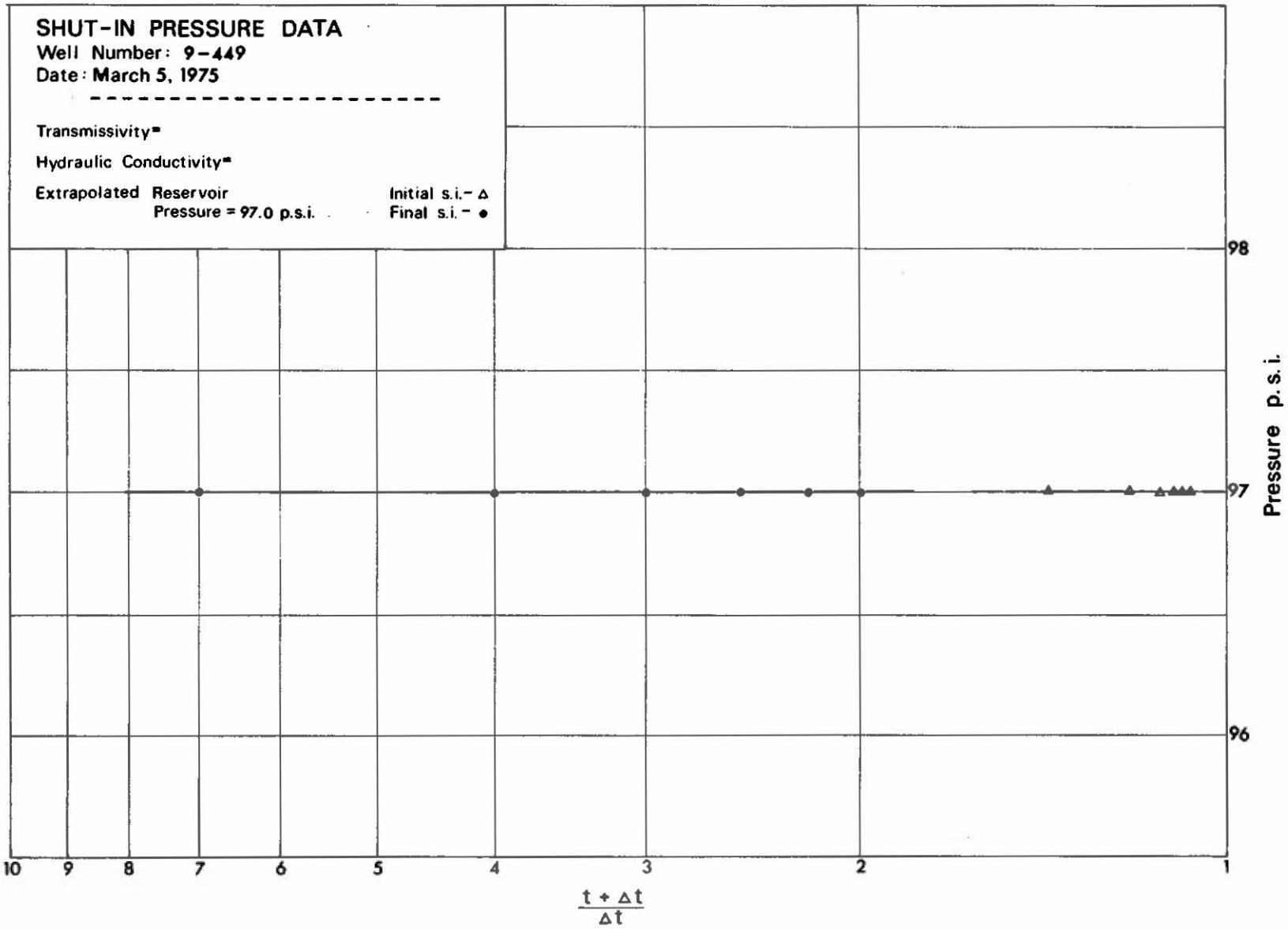
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 97 | 1.40 |
| 10 | 97 | 1.20 |
| 15 | 97 | 1.13 |
| 20 | 97 | 1.10 |
| 25 | 97 | 1.08 |
| 30 | 97 | 1.07 |



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 97 | 7.00 |
| 10 | 97 | 4.00 |
| 15 | 97 | 3.00 |
| 20 | 97 | 2.50 |
| 25 | 97 | 2.20 |
| 30 | 97 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 9-449
Date: March 5, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 97.0 p.s.i.
Initial s.i.- Δ
Final s.i. - •
98
97
96
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

9-449-D-76

**WATER ANALYSIS**

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Drill stem test on 9-449

Date sampled March 4, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 7.6 | 0.38 | 2.6 |
| Magnesium ($Mg^{++}$) | 0.00 | 0.00 | 0.0 |
| Sodium ($Na^{+}$) | 300.00 | 13.05 | 88.8 |
| Potassium ($K^{+}$) | 49.2 | 1.26 | 8.6 |
| Carbonate ($CO_3^{=}$) | 60.0 | 2.00 | 13.2 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 23.4 | 0.49 | 3.2 |
| Chloride ($Cl^{-}$) | 414.00 | 11.68 | 76.9 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 14.4 | | |
| Hydroxide ($OH^{-}$) | 17.0 | 1.00 | 6.6 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 706.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 15.175 | Total Cations (epm) | 14.687 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1500 |
| pH | 11.0 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 5.0 |
| pH | 11.8 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| Hydroxide ($OH^{-}$) | 45.7 ppm |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled August 12, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 46 | 2.30 | 10 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 233 | 10.13 | 42 |
| Potassium ($K^{+}$) | 458 | 11.72 | 48 |
| Carbonate ($CO_3^{=}$) | 28.8 | 0.96 | 4 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 5.5 | 0.11 | 0 |
| Chloride ($Cl^{-}$) | 438 | 12.35 | 45 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 4.1 | | |
| Hydroxide ($OH^{-}$) | 241 | 14.17 | 51 |
| Calcium (Acidified) | 74 | | |
| Magnesium (Acidified) | 1.9 | | |
| Total dissolved solids | 1526 | | |
| Total Anions (epm) 27.60 | | Total Cations (epm) | 24.15 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 5000 |
| pH | 12.0 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 4.0 |
| pH | 11.7 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Drill stem test on well 9-449

Date of sampling March 4, 1976

Total dissolved solids 706 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .1 | Mg | .05 |
| As | <.01 | Mn | .002 |
| B | .02 | Mo | ND |
| Ba | .01 | Ni | .02 |
| Be | ND | Pb | .01 |
| Bi | ND | Sb | ND |
| Ca | M | Si | M |
| Cd | ND | Sn | ND |
| Co | .002 | Te | <.005 |
| Cr | ND | Ti | .001 |
| Cu | .01 | V | .03 |
| Fe | M | Zn | .04 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 120.0 | 5.99 | 27 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 189.0 | 8.22 | 37 |
| Potassium ($K^{+}$) | 313.0 | 8.01 | 36 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 3.0 | 0.06 | 0 |
| Chloride ($Cl^{-}$) | 334.0 | 9.42 | 39 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.7 | | |
| Hydroxide ($OH^{-}$) | 239.0 | 14.05 | 58 |
| Calcium (Acidified) | 143.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 1416 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 24.34 | Total Cations (epm) | 22.22 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4700 | Temperature (C) | 5.0 | |
| pH | 11.9 | pH | 12.1 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | 25 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 272 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 130.0 | 6.49 | 45.0 |
| Magnesium ($Mg^{++}$) | 18.5 | 1.52 | 10.6 |
| Sodium ($Na^{+}$) | 104.0 | 4.52 | 31.4 |
| Potassium ($K^{+}$) | 74.0 | 1.89 | 13.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 193.0 | 3.16 | 30.6 |
| Sulfate ($SO_4^{=}$) | 13.6 | 0.28 | 2.7 |
| Chloride ($Cl^{-}$) | 244.0 | 6.88 | 66.6 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 2.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 126.0 | | |
| Magnesium (Acidified) | 18.0 | | |
| Total dissolved solids | 1228.0 | | |
| Total Anions (epm) 10.34 | | Total Cations (epm) | 14.43 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1580 |
| pH | 7.5 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 5.0 |
| pH | 6.8 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | 180.0 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 182.0 | 9.08 | 51.1 |
| Magnesium(Mg) | 0.0 | 0.00 | 0.0 |
| Sodium(Na) | 114.0 | 4.96 | 27.9 |
| Potassium(K) | 146.0 | 3.73 | 21.0 |
| Carbonate(CO3) | 19.2 | 0.64 | 3.6 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 4.2 | 0.09 | 0.5 |
| Chloride(Cl) | 244.0 | 6.88 | 39.1 |
| Nitrate(NO3) | 2.8 | 0.05 | 0.3 |
| Silica(SiO2) | 2.6 | | |
| Hydroxide(OH) | 169.0 | 9.94 | 56.5 |
| Calcium(Acidified) | 154.0 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 924.0 | | |
| Total Anions(epm) | 17.59 | Total Cations(epm) | 17.78 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2820 | | Temperature(C) | 7.00 | |
| pH | 12.0 | | pH | 11.9 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | 29 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 163 | mg/l |

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 106.0 | 5.29 | 44.7 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.1 |
| Sodium(Na) | 99.0 | 4.31 | 36.4 |
| Potassium(K) | 86.7 | 2.22 | 18.8 |
| Carbonate(CO3) | 16.8 | 0.56 | 4.6 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 3.0 | 0.06 | 0.5 |
| Chloride(Cl) | 184.0 | 5.19 | 42.4 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.1 |
| Silica(SiO2) | 4.2 | | |
| Hydroxide(OH) | 109.0 | 6.41 | 52.4 |
| Calcium(Acidified) | 120.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 666.0 | | |
| Total Anions(epm) | 12.23 | Total Cations(epm) | 11.82 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1920 | | Temperature(C) | 4.00 | |
| pH | 11.8 | | pH | 11.9 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | 39 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 117 | mg/l |

WATER ANALYSIS 9-449-E-82

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 114.0 | 5.70 | 47.7 |
| Magnesium(Mg) | 0.0 | 0.0 | 0.0 |
| Sodium(Na) | 99.0 | 4.30 | 36.0 |
| Potassium(K) | 76.0 | 1.95 | 16.3 |
| Carbonate(CO3) | 24.0 | 0.80 | 14.4 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 4.0 | 0.08 | 1.5 |
| Chloride(Cl) | 166.0 | 4.68 | 84.1 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.1 |
| Silica(SiO2) | 8.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 120.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 628.0 | | |
| Total Anions(epm) | 5.56 | Total Cations(epm) | 11.95 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2075 | Temperature | 4.00 | |
| pH | 11.8 | pH | 12.0 | |
| Fluoride | 0.1 mg/l | Carbonate(CO3) | 38 | mg/l |
| | | Bicarbonate(HCO3) | 0 | mg/l |
| | | Hydroxide(OH) | 122 | mg/l |

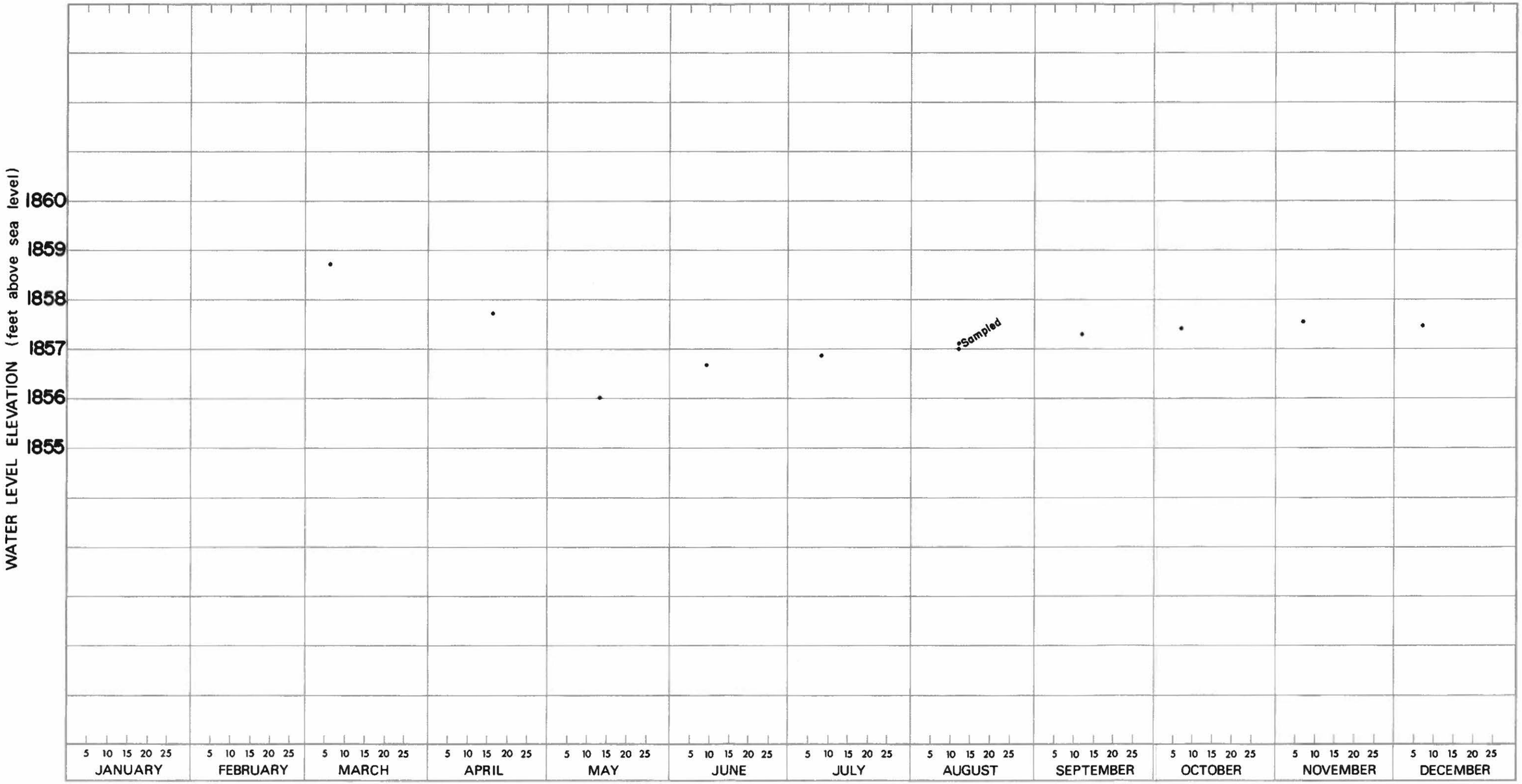
**WATER LEVEL HYDROGRAPH**

9-449-H-76

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council



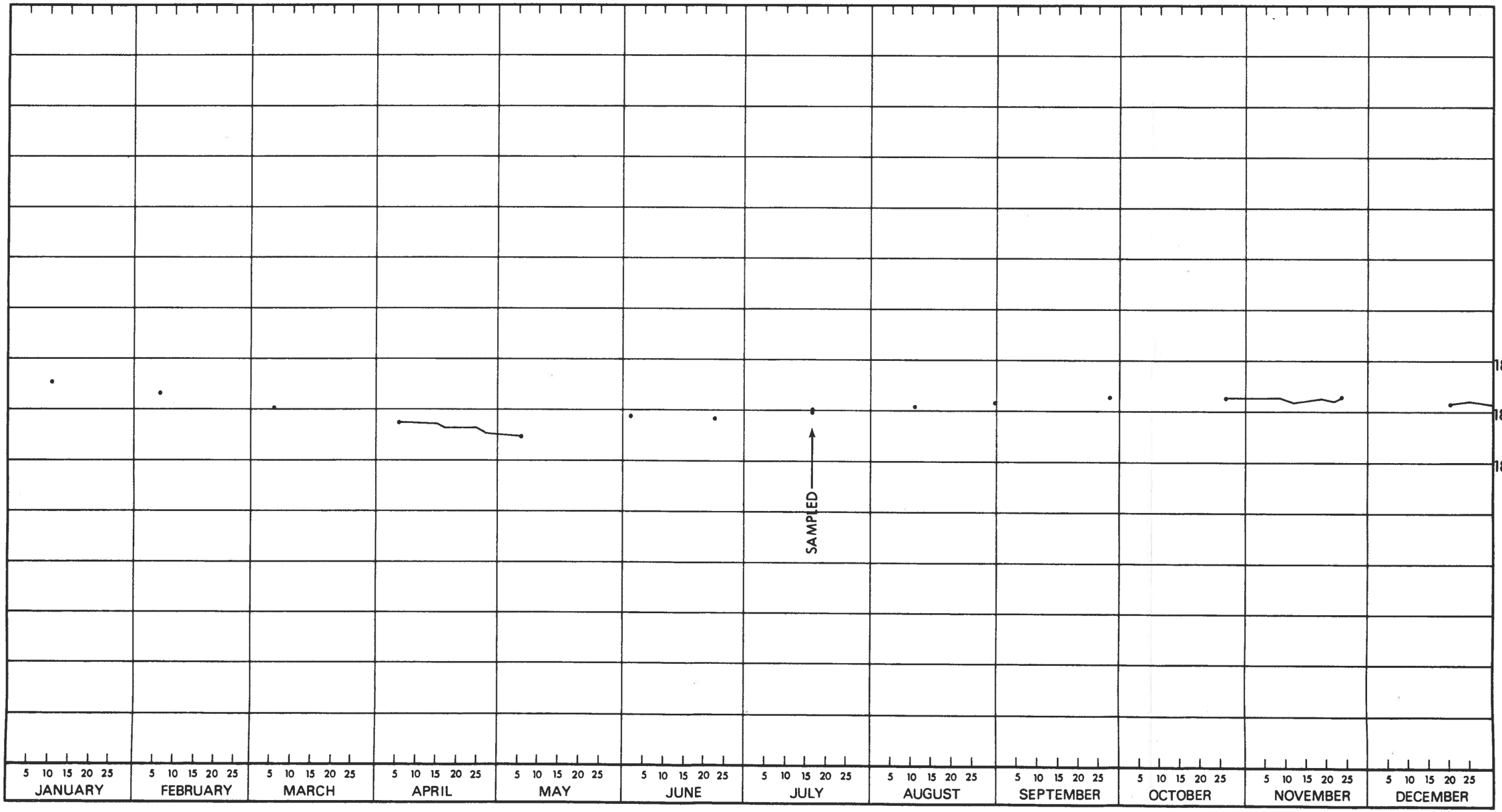
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

9 - 449 - H - 77




WATER LEVEL ELEVATION (feet above sea level)

1976

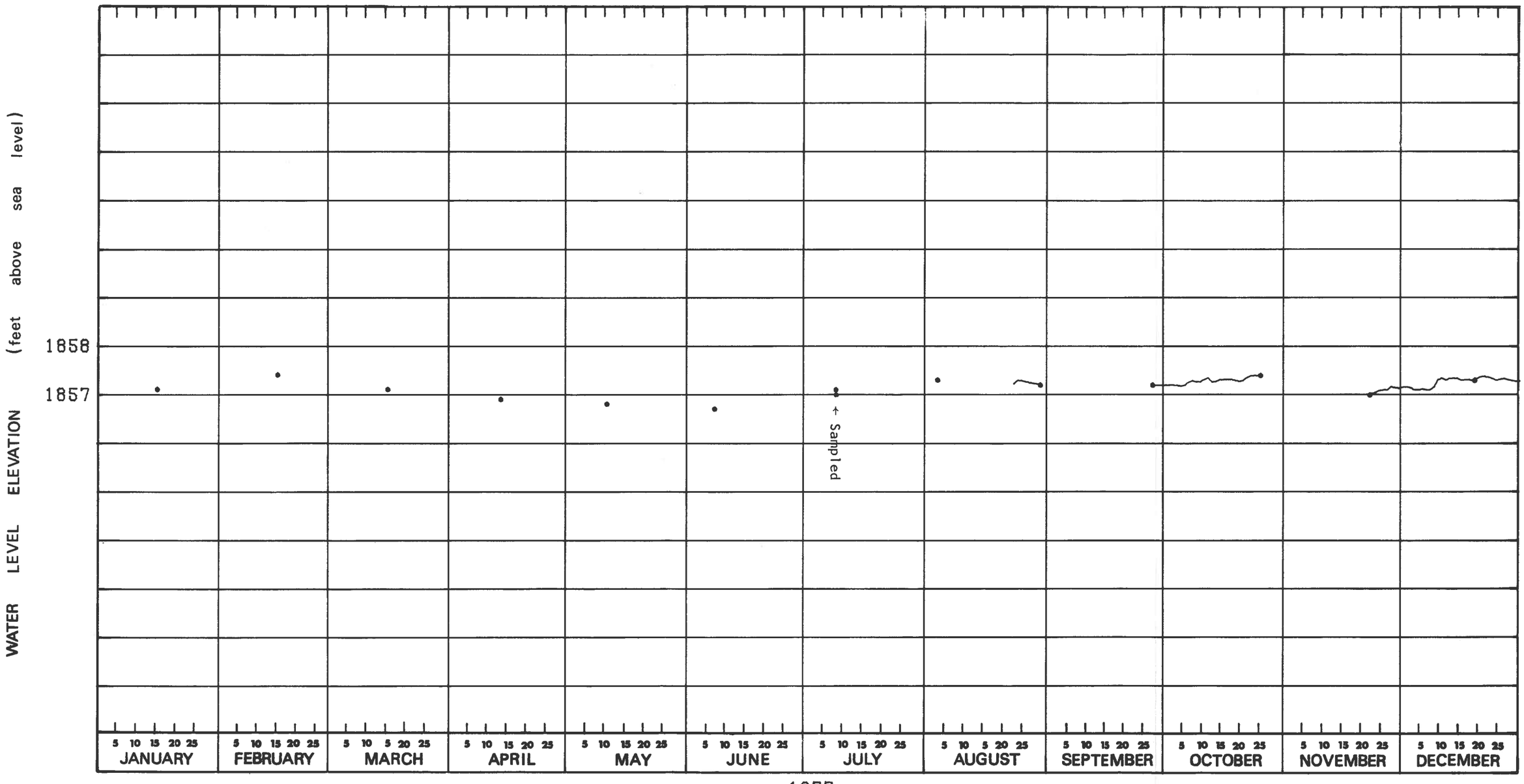
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-449

9-449-H-78

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council




1977

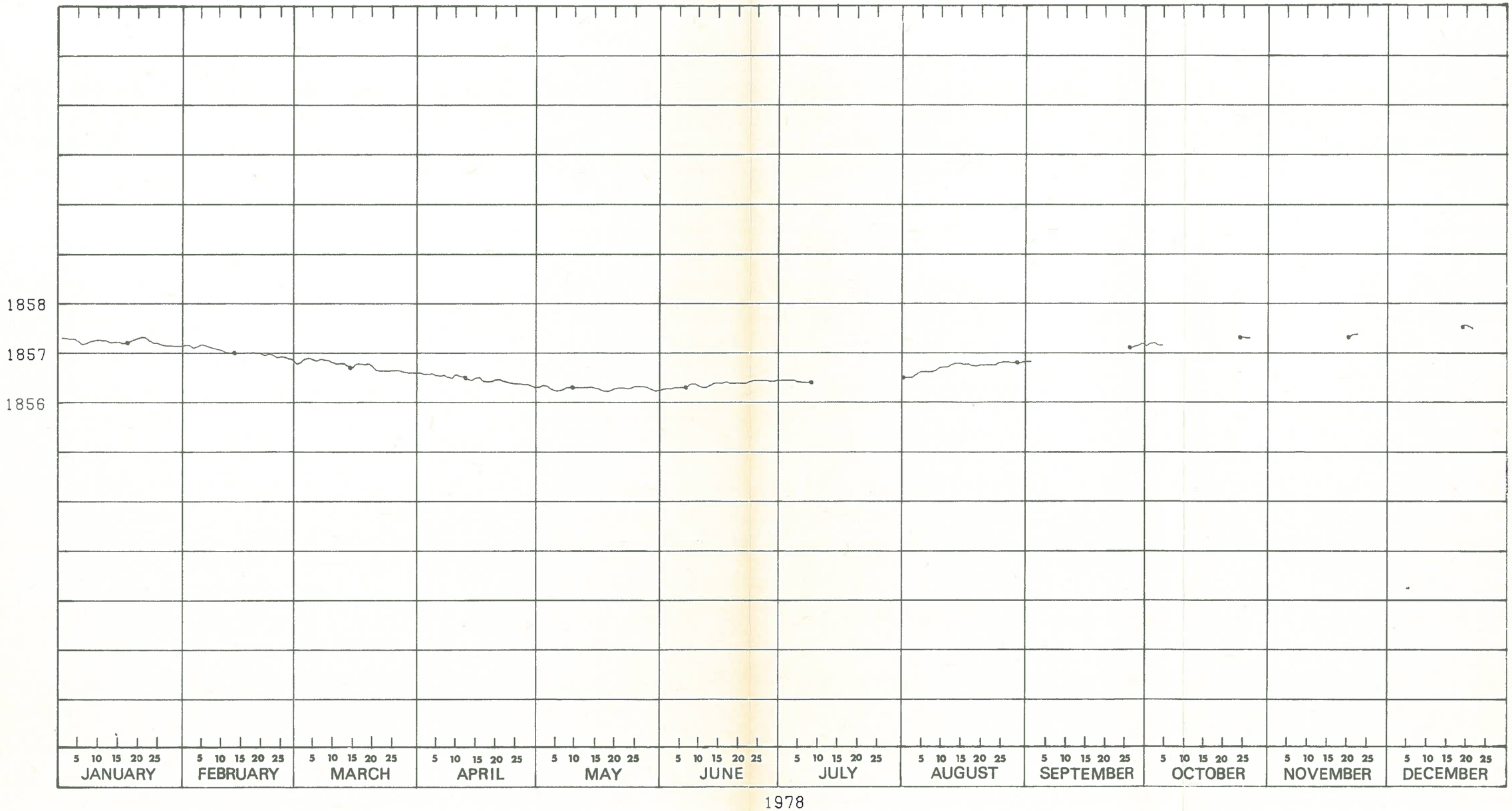
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-449

LSD 16 SEC 4 TWP 94 R 6 W4TH

Alberta Research Council

9-449-H-79



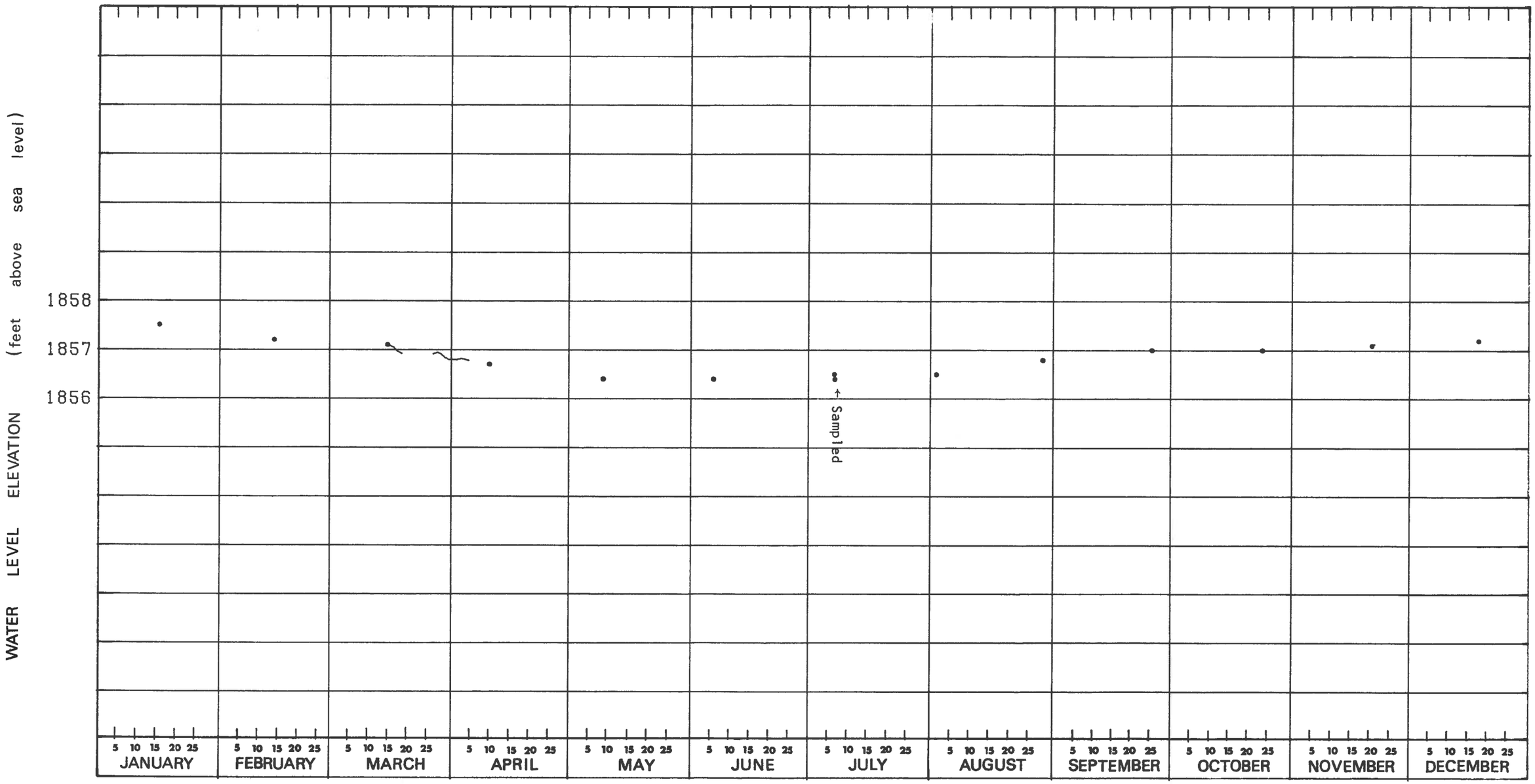
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-449-H-80



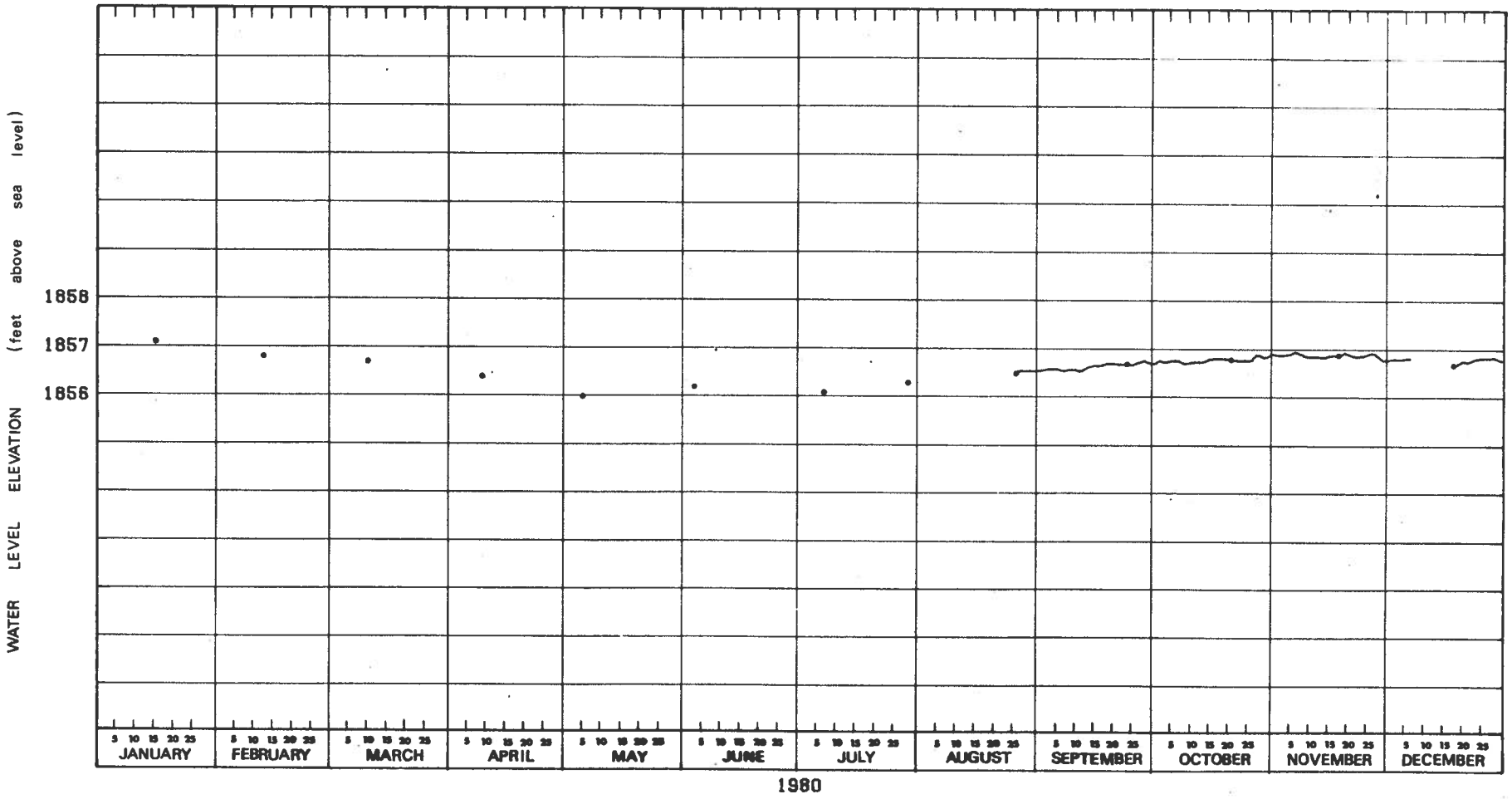
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-449-H-81



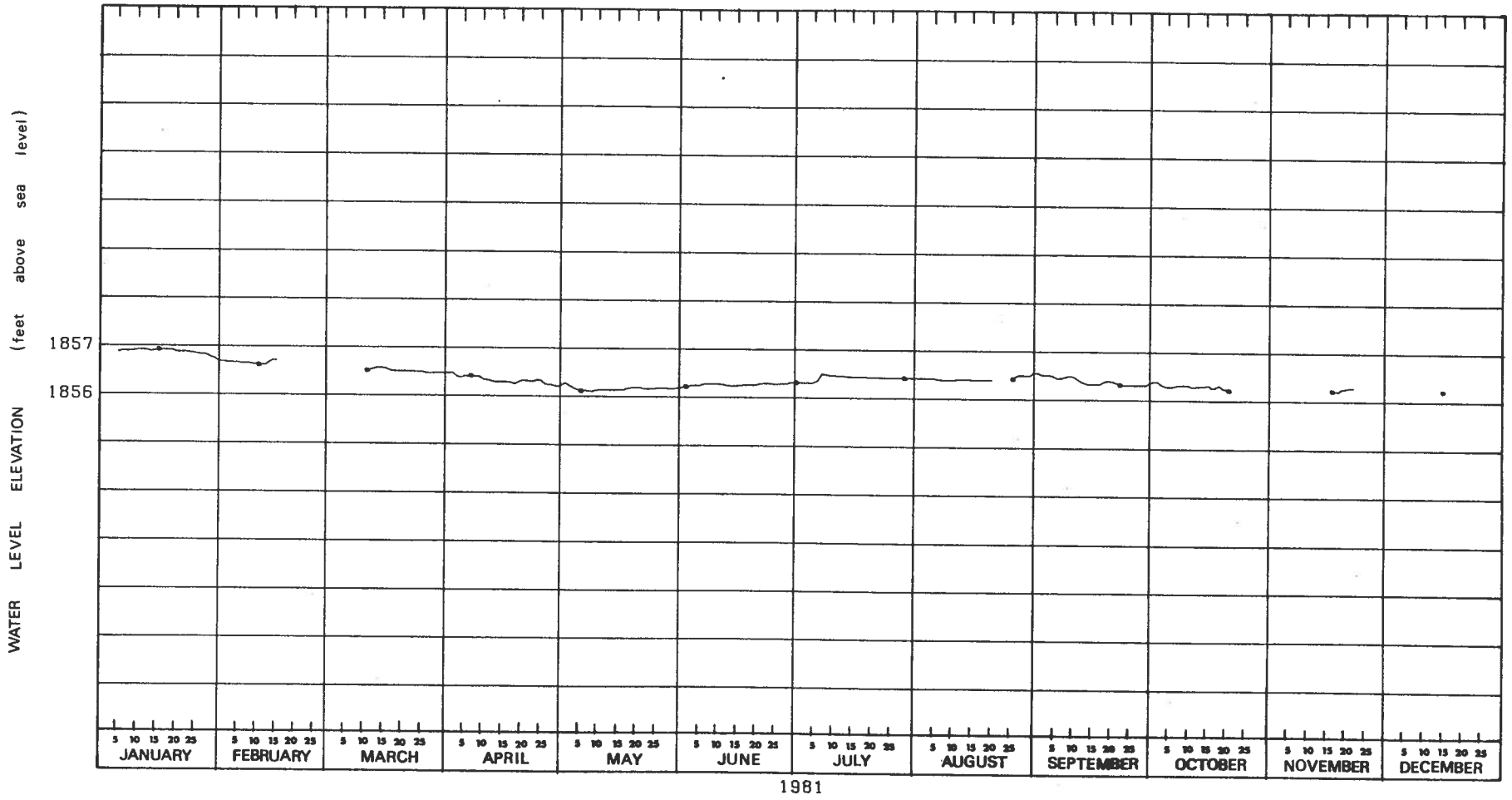
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-449-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2020.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 23/75 | | | Well completed |
| Mar 5/75 | | | DST; water sample; FSI = 94# from 385' |
| Mar 6/75 | | | Bail 245 gallons |
| | 50.09 TOC | 1855.89 | Bail 70 gallons |
| Mar 14/75 | | | Install shelter and recorder; MP = 3.51' TOC, (2023.73) |
| Apr 16/75 | 50.39 MP | 1858.34 | Shelter tipped over; chart did not run; MP = 3.45' TOC, (2023.67) |
| May 13/75 | 50.92 old MP | 1856.65 | New MP = 33.5", (2023.01) |
| June 9/75 | 50.72 MP | 1856.65 | |
| July 8/75 | 50.67 MP | 1856.81 | |
| Aug 17/75 | 50.62 MP | 1856.98 | Sampled well; recorder stuck after sample |
| | 50.60 MP | 1857.04 | |
| Sept 12/75 | 50.53 MP | 1857.27 | |
| Oct 7/75 | 50.49 MP | 1857.40 | |
| Nov 7/75 | 50.45 MP | 1857.53 | |
| Dec 7/75 | 50.48 MP | 1857.44 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2020.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 50.45 MP | 1857.5 | MP (2023.0) |
| Feb 7/76 | 50.51 MP | 1857.3 | |
| Mar 6/76 | 50.60 MP | 1857.0 | |
| Apr 6/76 | 50.69 MP | 1856.7 | |
| May 6/76 | 50.77 MP | 1856.4 | |
| June 2/76 | 50.62 MP | 1856.9 | New MP = 0.83 m TOC, (2022.9) |
| June 23/76 | 50.64 MP | 1856.8 | |
| July 17/76 | 50.59 MP | 1857.0 | |
| | 50.60 MP | 1856.9 | After sample; temp. 5°C |
| Aug 11/76 | 50.56 MP | 1857.1 | |
| Aug 31/76 | 50.55 MP | 1857.1 | |
| Sept 28/76 | 50.50 MP | 1857.3 | |
| Oct 27/76 | 50.49 MP | 1857.3 | |
| Nov 24/76 | 50.50 MP | 1857.3 | |
| Dec 21/76 | 50.52 MP | 1857.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2020.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 50.55 MP | 1857.1 | MP (2022.9) |
| Feb 7/77 | | | Treated with 105 lb NU-WELL acid well conditioner |
| Feb 11/77 | | | Blown with air |
| | 50.74 MP | 1857.4 | New MP = 1.10 m TOC, (2023.8) |
| Feb 16/77 | 50.72 MP | 1857.4 | |
| Mar 16/77 | 50.83 MP | 1857.1 | |
| Apr 14/77 | 50.69 MP | 1856.9 | New MP = 0.91 m TOC, (2023.2) |
| May 11/77 | 50.73 MP | 1856.8 | |
| June 8/77 | 50.76 MP | 1856.7 | |
| July 9/77 | 50.65 MP | 1857.1 | |
| | 50.66 MP | 1857.0 | After sample; temp. 5°C |
| Aug 4/77 | 50.59 MP | 1857.3 | |
| Aug 30/77 | 50.60 MP | 1857.2 | |
| Sept 28/77 | 50.61 MP | 1857.2 | |
| Oct 26/77 | 50.54 MP | 1857.4 | |
| Nov 23/77 | 50.66 MP | 1857.0 | |
| Dec 20/77 | 50.58 MP | 1857.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2020.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 50.62 MP | 1857.2 | MP (2023.2) |
| Feb 14/78 | 50.67 MP | 1857.0 | |
| Mar 15/78 | 50.75 MP | 1856.7 | |
| Apr 13/78 | 50.81 MP | 1856.5 | |
| May 10/78 | 50.88 MP | 1856.3 | |
| June 7/78 | 50.88 MP | 1856.3 | |
| July 9/78 | 50.85 MP | 1856.4 | |
| | 50.85 MP | 1856.4 | After sample; temp. 7°C |
| Aug 1/78 | 50.81 MP | 1856.5 | |
| Aug 30/78 | 50.72 MP | 1856.8 | |
| Sept 27/78 | 50.65 MP | 1857.1 | |
| Oct 25/78 | 50.59 MP | 1857.3 | |
| Nov 21/78 | 50.57 MP | 1857.3 | |
| Dec 20/78 | 50.51 MP | 1857.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2020.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 50.53 MP | 1857.5 | MP (2023.2) |
| Feb 14/79 | 50.62 MP | 1857.2 | |
| Mar 15/79 | 50.63 MP | 1857.1 | |
| Apr 10/79 | 50.76 MP | 1856.7 | |
| May 9/79 | 50.84 MP | 1856.4 | |
| June 6/79 | 50.66 MP | 1856.4 | New MP 0.74m TOC (2022.6) |
| July 7/79 | 50.65 MP | 1856.5 | |
| | 50.67 MP | 1856.4 | After sample; temp. 4°C |
| Aug 2/79 | 50.65 MP | 1856.5 | |
| Aug 29/79 | 50.56 MP | 1856.8 | |
| Sept 26/79 | 50.50 MP | 1857.0 | |
| Oct 24/79 | 50.48 MP | 1857.0 | |
| Nov 21/79 | 50.47 MP | 1857.1 | |
| Dec 18/79 | 50.44 MP | 1857.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2020.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 50.47 MP | 1857.1 | |
| Feb 13/80 | 50.56 MP | 1856.8 | |
| Mar 11/80 | 50.57 MP | 1856.7 | |
| Apr 10/80 | 50.68 MP | 1856.4 | |
| May 6/80 | 50.78 MP | 1856.0 | |
| June 4/80 | 50.74 MP | 1856.2 | |
| July 8/80 | 50.76 MP | 1856.1 | Temp. 4°C |
| | 50.76 MP | 1856.1 | After Sample |
| July 30/80 | 50.70 MP | 1856.3 | |
| Aug 27/80 | 50.65 MP | 1856.5 | |
| Sept 25/80 | 50.58 MP | 1856.7 | |
| Oct 22/80 | 50.56 MP | 1856.8 | |
| Nov 19/80 | 50.52 MP | 1856.9 | |
| Dec 19/80 | 50.58 MP | 1856.7 | |
| Jan 16/81 | 50.53 MP | 1856.9 | |
| Feb 11/81 | 50.60 MP | 1856.6 | |
| Mar 11/81 | 50.64 MP | 1856.5 | |
| Apr 7/81 | 50.68 MP | 1856.4 | |
| May 6/81 | 50.75 MP | 1856.1 | |
| June 2/81 | 50.72 MP | 1856.2 | |
| July 1/81 | 50.69 MP | 1856.3 | |
| July 29/81 | 50.66 MP | 1856.4 | |
| Aug 26/81 | 50.68 MP | 1856.4 | |
| Sept 23/81 | 50.69 MP | 1856.3 | |
| Oct 21/81 | 50.72 MP | 1856.2 | |
| Nov 17/81 | 50.74 MP | 1856.2 | |
| Dec 16/81 | 50.73 MP | 1856.2 | |

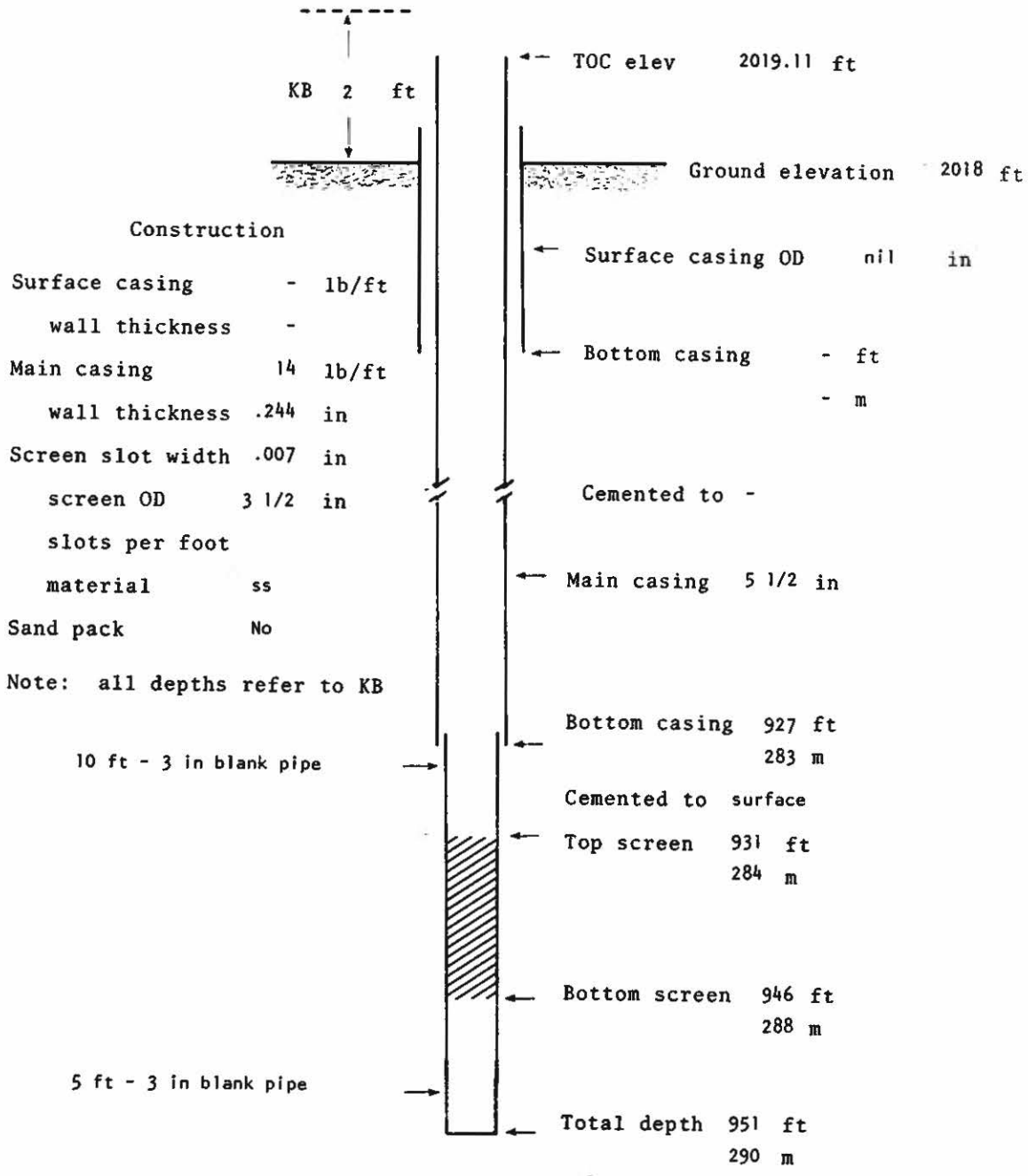
MP - Depth from measuring point
TOC - Depth from top of casing

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Tp 94 R 6 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

Note: unable to flush screen after completion, suspected that bottom casing joint had backed off and fell over. Well completed as is.

## DRILL STEM TEST

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Tp 94 R 6 W4th

Alberta Research Council

Elevation: gl 2018
KB 2020

Type of test - Casing Positrieve

Date of test March 2, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1100 | hrs |
| Tool opened | 1138 | hrs |
| First flow | 3 | min |
| Initial shut in | 60 | min |
| Second flow | 30 | min |
| Final shut in | 30 | min |
| Pulled loose at | 1350 | hrs |
| Out of hole at | - | hrs |
| Wt on packers | 7000 | lbs |

Description of blow Very weak, decreasing to nil in 2 minutes.

Total water recovered 160 ft

Water sample No. -

Gas blow No

Remarks Test satisfactory
5-1/2" RBP @ 877'
Fish at 910', joint of pipe was leaking.

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 931-946

Formation tested McMurray

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

### PRESSURE DATA (psi)

| Instrument No. | | RPG-92N | RPG-89N |
|---|---|---|---|
| Capacity (psig) | | 431 | 400 |
| Instrument set at (ft) | | 881 | 889 |
| Initial hydrostatic | A | 265 | 266 |
| First flow | B | 31 | 31 |
| | B1 | 31 | 31 |
| Initial shut in | C | 67 | 69 |
| Second flow | D | 63 | 64 |
| | D1 | 68 | 67 |
| Final shut in | G | 76 | 77 |
| Final hydrostatic | H | 254 | 255 |

B1, D1, etc. Initial Hyd. Pressure

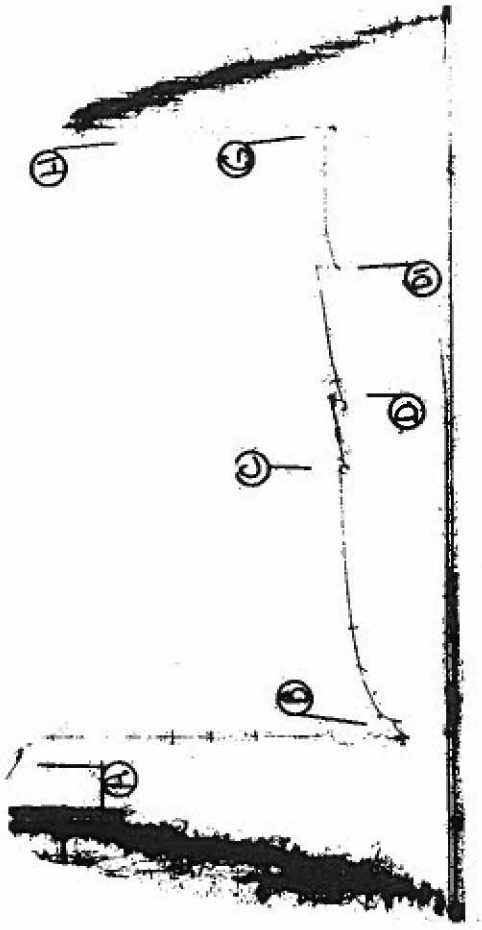
DRILL STEM TEST

OBSERVATION WELL NUMBER 9-951

PRESSURE INCREMENTS

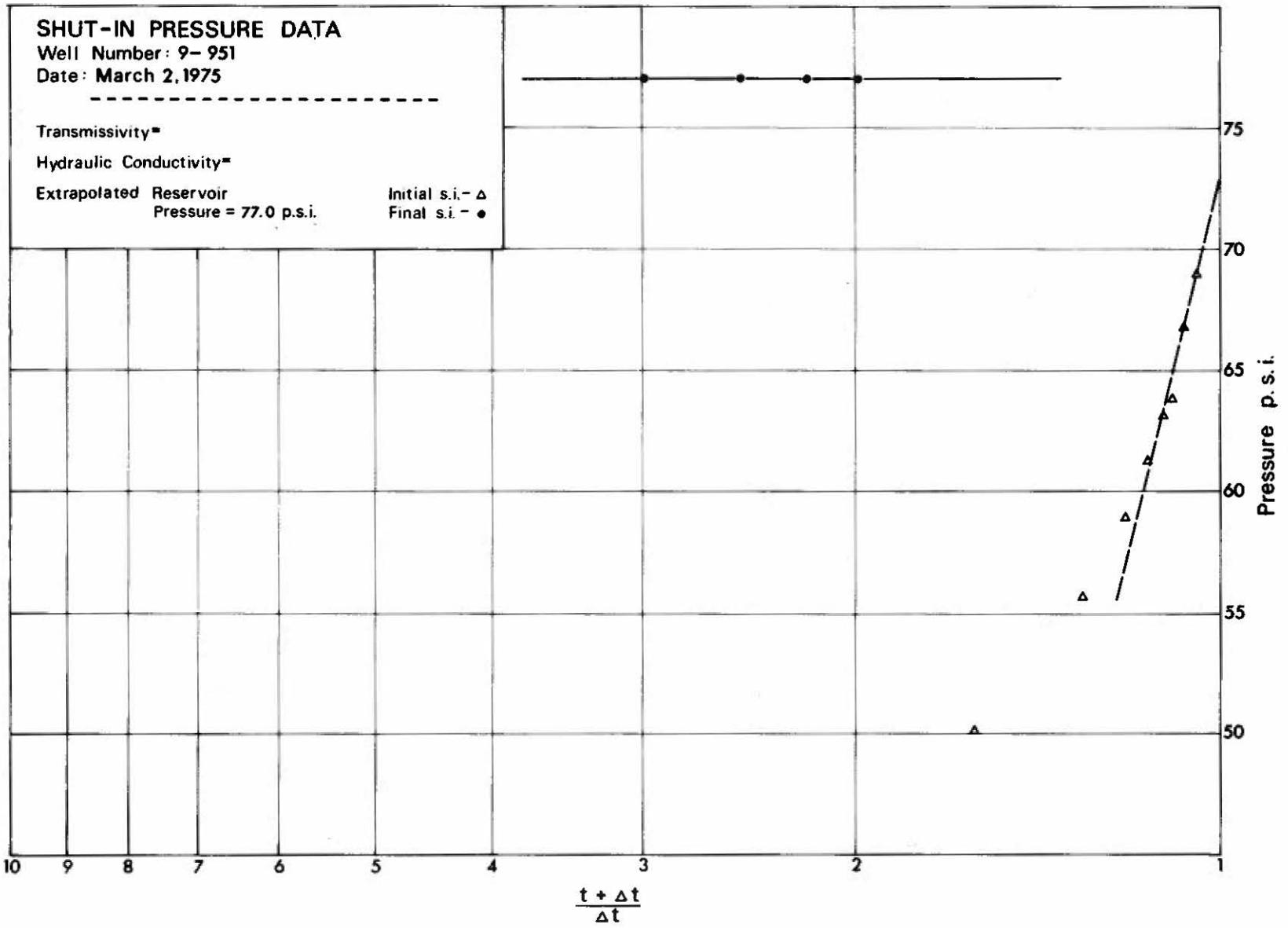
Recorder RPG-89N
March 2 1975
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 50.1 | 1.60 |
| 10 | 55.7 | 1.30 |
| 15 | 59.0 | 1.20 |
| 20 | 61.4 | 1.15 |
| 25 | 63.2 | 1.12 |
| 30 | 63.9 | 1.10 |
| 35 | 66.1 | 1.086 |
| 40 | 66.9 | 1.075 |
| 45 | 67.6 | 1.066 |
| 50 | 68.2 | 1.060 |
| 55 | 68.6 | 1.055 |
| 60 | 69.0 | 1.050 |



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 74.5 | 7.00 |
| 10 | 76.8 | 4.00 |
| 15 | 77.0 | 3.00 |
| 20 | 77.0 | 2.50 |
| 25 | 77.0 | 2.20 |
| 30 | 77.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 9-951
Date: March 2, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 77.0 p.s.i.
Initial s.i.- Δ
Final s.i. - ●
75
70
65
60
55
50
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

9-951-D-76

## DRILL STEM TEST

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Tp 94 R 6 W4th

Alberta Research Council

Elevation: gl 2018
KB 2020

Type of test - Casing Positrieve

Date of test March 3, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0830 | hrs |
| Tool opened | 1012 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 60 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1300 | hrs |
| Out of hole at | 1430 | hrs |
| Wt on packers | 7000 | lbs |
| Description of blow | Very weak decreasing to nil in 10 minutes. | |
| Total water recovered | 5 | ft |

Water sample No. -

Gas blow No

Remarks Test satisfactory
5-1/2" RBP @ 877'
Fish at 910'

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 931-946

Formation tested McMurray

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

### PRESSURE DATA (psi)

| Instrument No. | | RPG-92N | RPG-89N |
|---|---|---|---|
| Capacity (psig) | | 431 | 400 |
| Instrument set at (ft) | | 881 | 889 |
| Initial hydrostatic | A | 220 | 223 |
| First flow | B | 4 | 12 |
| | B1 | 4 | 12 |
| Initial shut in | C | 35 | 39 |
| Second flow | D | 12 | 14 |
| | D1 | 10 | 13 |
| Final shut in | G | 18 | 21 |
| Final hydrostatic | H | 203 | 207 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 9-951

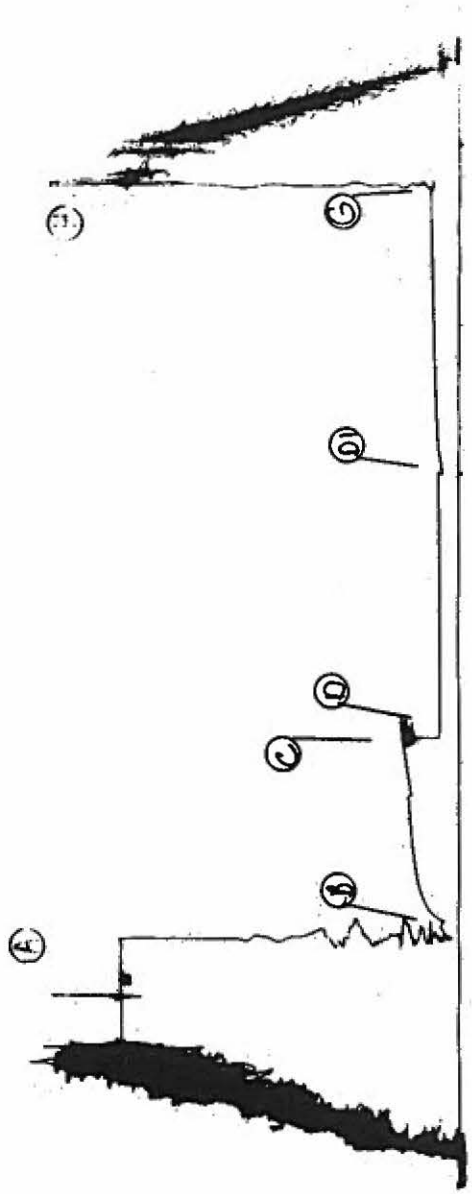
PRESSURE INCREMENTS

Recorder RPG-92N

March 3 1975

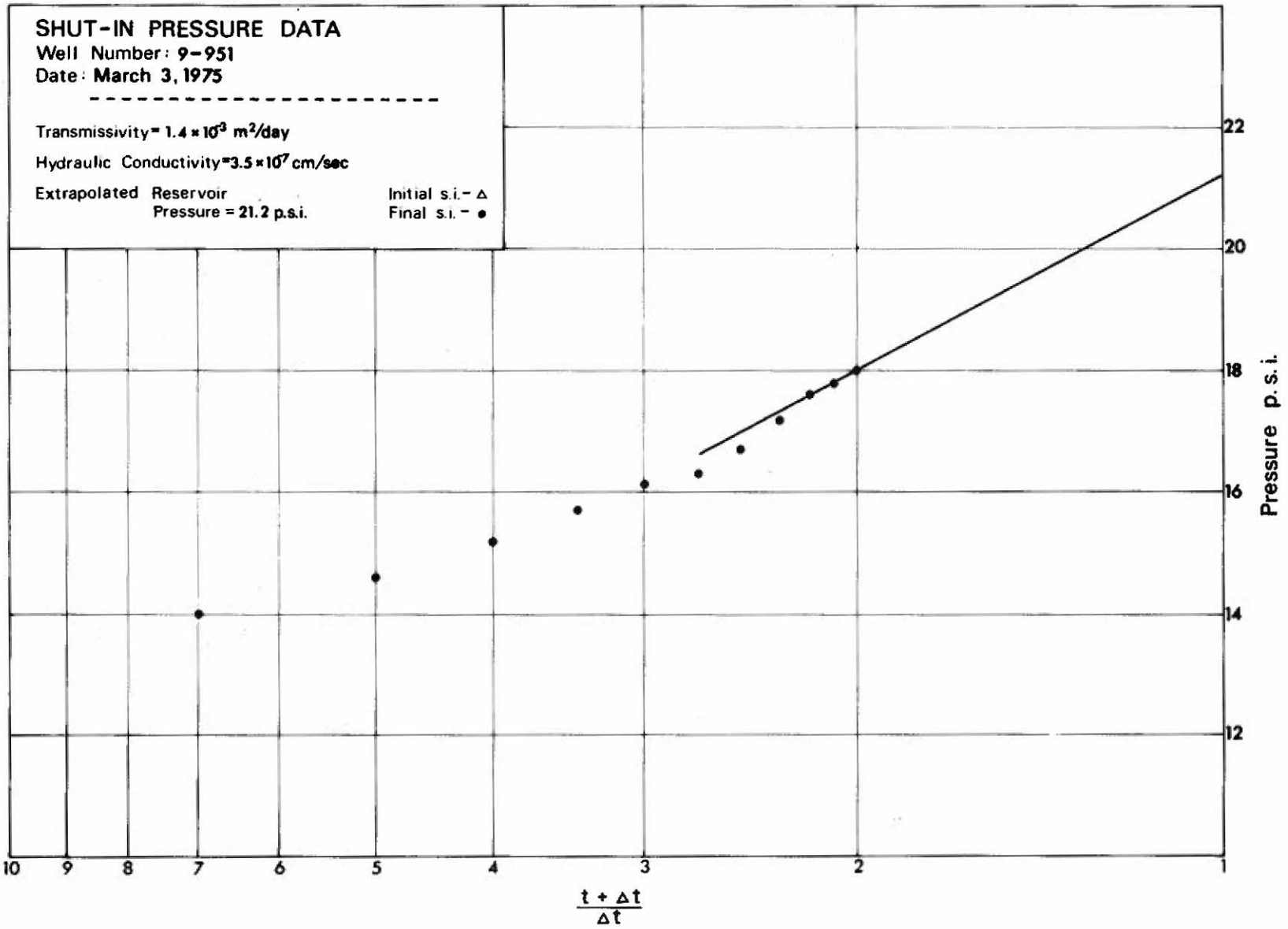
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 24.1 | 1.60 |
| 10 | 27.8 | 1.30 |
| 15 | 29.9 | 1.20 |
| 20 | 31.3 | 1.15 |
| 25 | 32.3 | 1.12 |
| 30 | 35.0 | 1.10 |

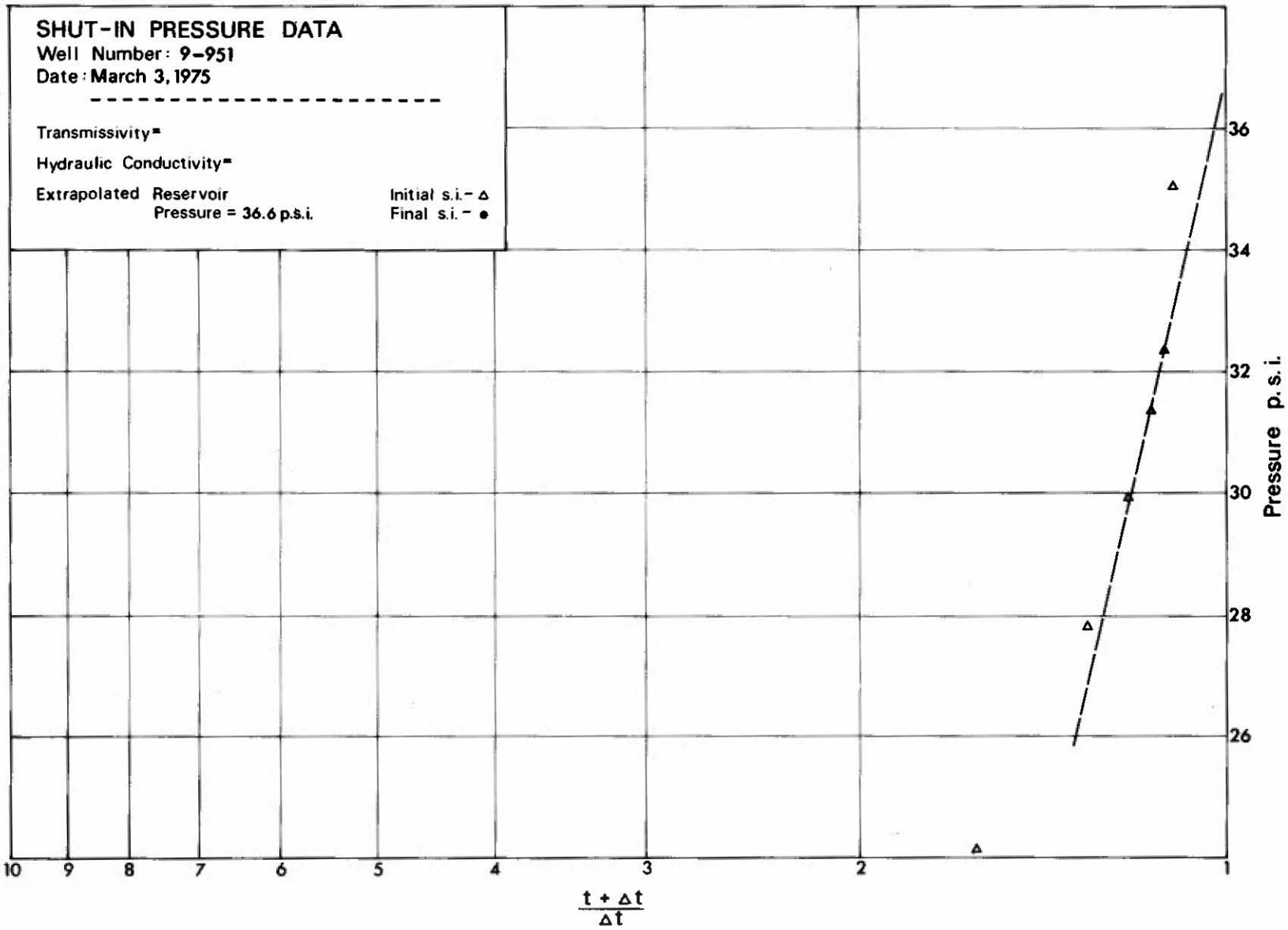


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 12.9 | 13.00 |
| 10 | 14.0 | 7.00 |
| 15 | 14.6 | 5.00 |
| 20 | 15.2 | 4.00 |
| 25 | 15.7 | 3.40 |
| 30 | 16.1 | 3.00 |
| 35 | 16.3 | 2.71 |
| 40 | 16.7 | 2.50 |
| 45 | 17.2 | 2.33 |
| 50 | 17.6 | 2.20 |
| 55 | 17.8 | 2.09 |
| 60 | 18.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 9-951
Date: March 3, 1975
Transmissivity = 1.4 × 10⁻³ m²/day
Hydraulic Conductivity = 3.5 × 10⁻⁷ cm/sec
Extrapolated Reservoir Pressure = 21.2 p.s.i.
Initial s.i. - Δ
Final s.i. - •
22
20
18
16
14
12
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

9-951-D-76


SHUT-IN PRESSURE DATA
Well Number: 9-951
Date: March 3, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 36.6 p.s.i.
Initial s.i.- Δ
Final s.i. - •
36
34
32
30
28
26
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

9-951-D-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled August 12, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 273 | 13.62 | 21 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 750 | 32.62 | 50 |
| Potassium ($K^{+}$) | 725 | 18.55 | 29 |
| Carbonate ($CO_3^{=}$) | 72 | 2.40 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 7.3 | 0.15 | 0 |
| Chloride ($Cl^{-}$) | 598 | 16.86 | 22 |
| Nitrate ($NO_3^{=}$) | 1.4 | 0.02 | 0 |
| Silica ($SiO_2$) | 2.8 | | |
| Hydroxide ($OH^{-}$) | 950 | 55.85 | 74 |
| Calcium (Acidified) | 290 | | |
| Magnesium (Acidified) | 0.1 | | |
| Total dissolved solids | 3696 | | |
| Total Anions (epm) | 75.29 | Total Cations (epm) | 64.79 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | 7.0 |
| pH | 12.6 | pH | 12.0 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 310.0 | 15.47 | 24 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 725.0 | 31.54 | 49 |
| Potassium ($K^{+}$) | 700.0 | 17.91 | 28 |
| Carbonate ($CO_3^{=}$) | 55.0 | 1.83 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 2.3 | 0.05 | 0 |
| Chloride ($Cl^{-}$) | 400.0 | 11.28 | 17 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.0 | | |
| Hydroxide ($OH^{-}$) | 936.0 | 55.03 | 81 |
| Calcium (Acidified) | 308.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 3706 | | |
| Total Anions (epm) | 68.21 | Total Cations (epm) | 64.92 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 7.0 | |
| pH | 12.8 | pH | 12.6 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | 74 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 945 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 213.0 | 10.63 | 43.2 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0.0 |
| Sodium ($Na^{+}$) | 243.0 | 10.57 | 43.0 |
| Potassium ($K^{+}$) | 133.0 | 3.40 | 13.8 |
| Carbonate ($CO_3^{=}$) | 31.0 | 1.03 | 4.1 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 4.2 | 0.09 | 0.3 |
| Chloride ($Cl^{-}$) | 260.0 | 7.33 | 28.7 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 2.0 | | |
| Hydroxide ($OH^{-}$) | 290.0 | 17.05 | 66.8 |
| Calcium (Acidified) | 205.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 886.4 | | |
| Total Anions (epm) 25.51 | | Total Cations (epm) | 24.60 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 5500 | Temperature (C) | 7.0 |
| pH | 12.2 | pH | 12.3 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 44.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 283.0 ppm |
| | | Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 600.0 | 29.94 | 51.8 |
| Magnesium(Mg) | 46.0 | 3.79 | 6.5 |
| Sodium(Na) | 464.0 | 20.18 | 34.9 |
| Potassium(K) | 154.0 | 3.94 | 6.8 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 63.0 | 1.03 | 4.7 |
| Sulphate(SO4) | 14.9 | 0.31 | 1.4 |
| Chloride(Cl) | 736.0 | 20.76 | 93.8 |
| Nitrate(NO3) | 1.2 | 0.02 | 0.1 |
| Silica(SiO2) | 0.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 104.0 | | |
| Magnesium(Acidified) | 30.5 | | |
| TDS(mg/l) | 5780.0 | | |
| Total Anions(epm) | 22.12 | Total Cations(epm) | 57.85 |

## Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 4830 | | Temperature(C) | 8.00 | |
| pH | 6.8 | | pH | 8.5 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | 5 | mg/l |
| | | | Bicarbonate(HCO3) | 19 | mg/l |
| | | | Hydroxide(OH) | | |

9-951-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 438.0 | 21.86 | 64.5 |
| Magnesium(Mg) | 0.0 | 0.00 | 0.0 |
| Sodium(Na) | 213.0 | 9.26 | 27.3 |
| Potassium(K) | 109.0 | 2.79 | 8.2 |
| Carbonate(CO3) | 36.0 | 1.20 | 3.4 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 3.7 | 0.08 | 0.2 |
| Chloride(Cl) | 232.0 | 6.54 | 18.7 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 0.0 | | |
| Hydroxide(OH) | 462.0 | 27.16 | 77.6 |
| Calcium(Acidified) | 363.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 1882.0 | | |
| Total Anions(epm) | 34.99 | Total Cations(epm) | 33.91 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 5800 | | Temperature(C) | 8.00 | |
| pH | 12.4 | | pH | 12.5 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | 40 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 522 | mg/l |

WATER ANALYSIS 9-951-E-82

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

## Major constituents

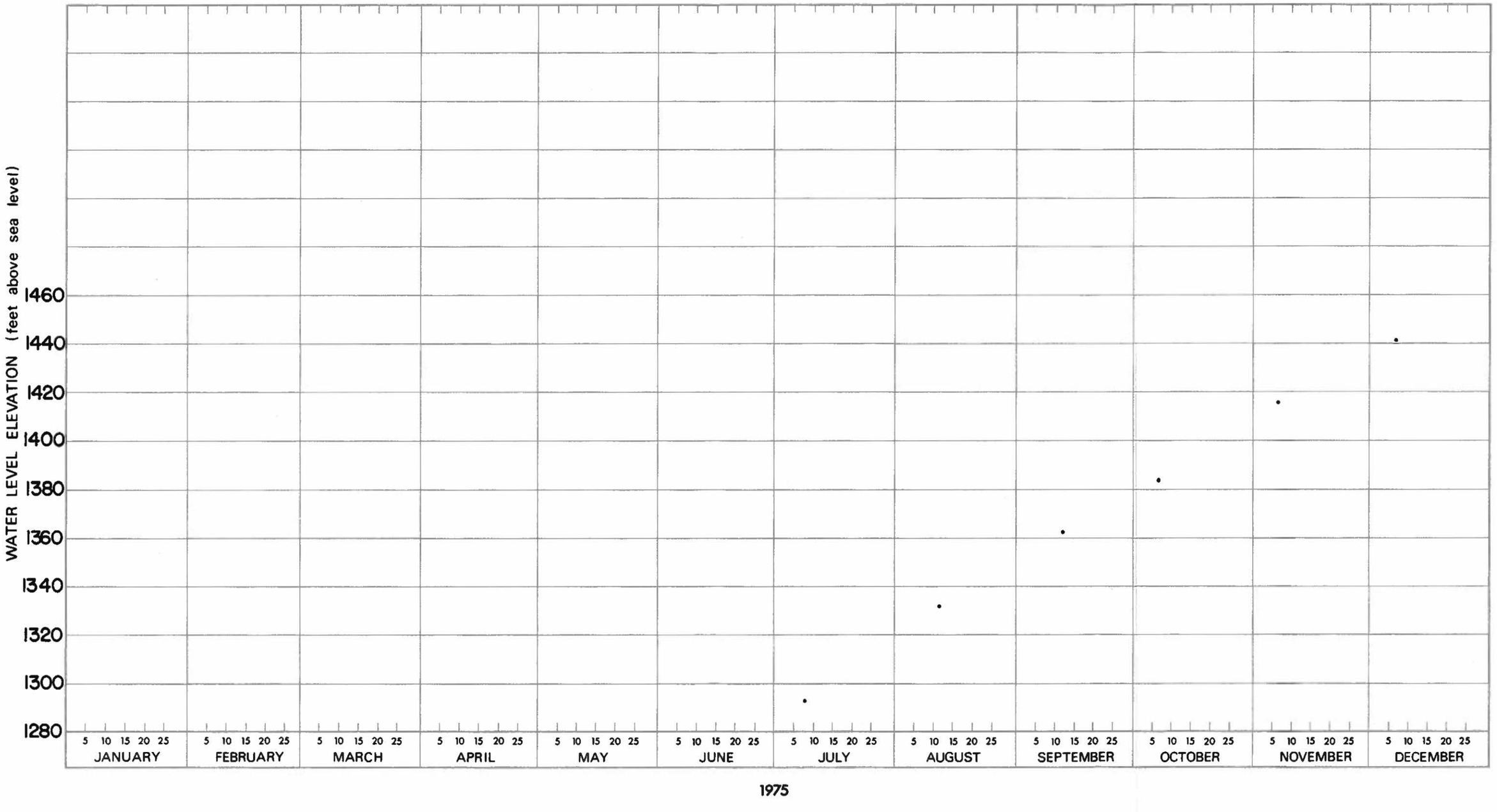
| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 570.0 | 28.50 | 73.4 |
| Magnesium(Mg) | 0.0 | 0.0 | 0.0 |
| Sodium(Na) | 180.0 | 7.83 | 20.2 |
| Potassium(K) | 98.0 | 2.51 | 6.5 |
| Carbonate(CO3) | 65.0 | 2.17 | 26.8 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 5.5 | 0.11 | 1.4 |
| Chloride(Cl) | 206.0 | 5.80 | 71.7 |
| Nitrate(NO3) | 0.9 | 0.01 | 0.2 |
| Silica(SiO2) | 4.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 475.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 1646.0 | | |
| Total Anions(epm) | 8.10 | Total Cations(epm) | 38.84 |

## Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 6900 | Temperature | 9.00 | |
| pH | 12.2 | pH | 12.6 | |
| Fluoride | 0.1 mg/l | Carbonate(CO3) | 54 | mg/l |
| | | Bicarbonate(HCO3) | 0 | mg/l |
| | | Hydroxide(OH) | 531 | mg/l |

## WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-951
Lsd 16 Sec 4 Twp 94 R 6 W4th
Alberta Research Council



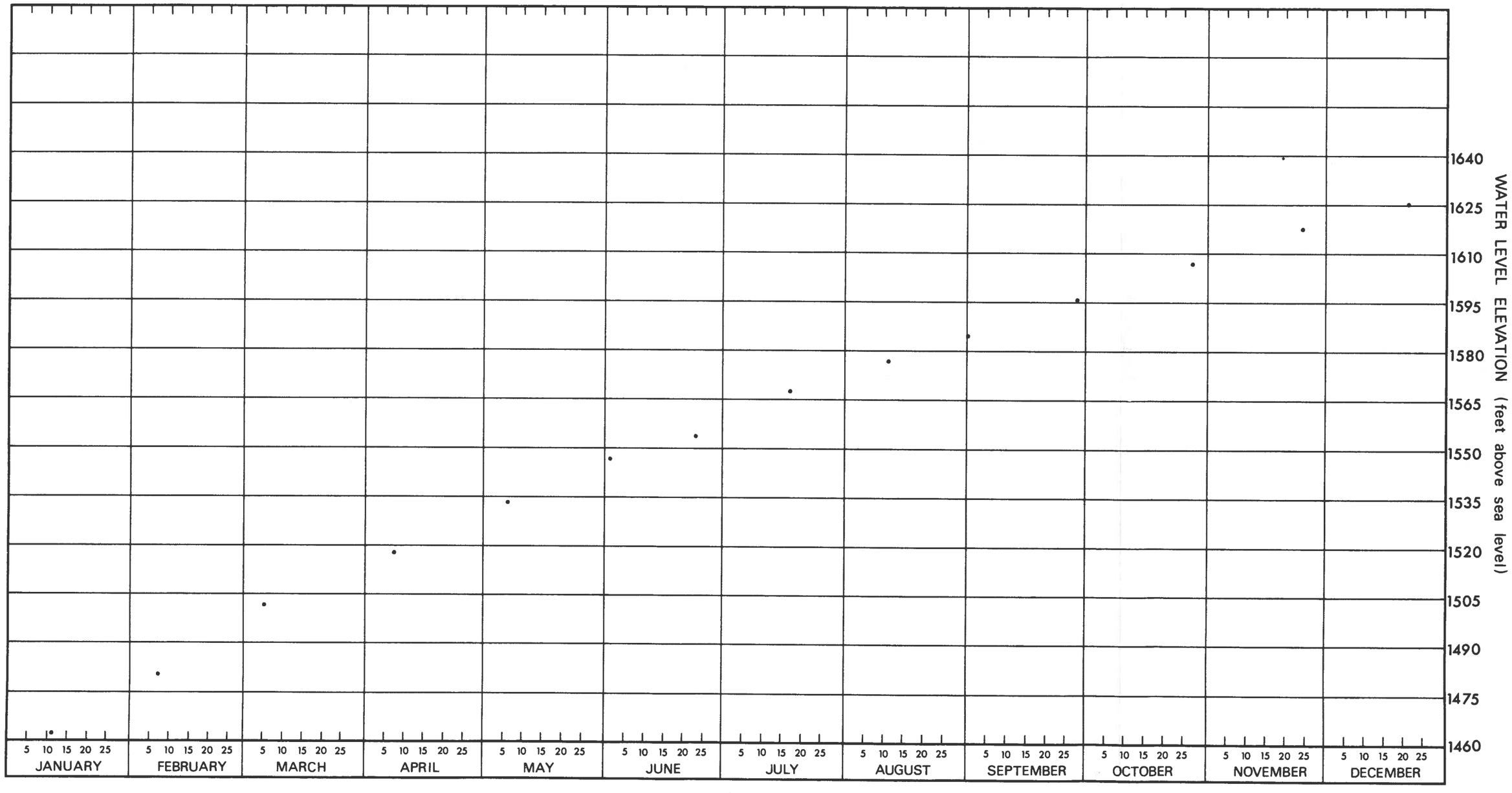
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

9 - 951 - H - 77




1976

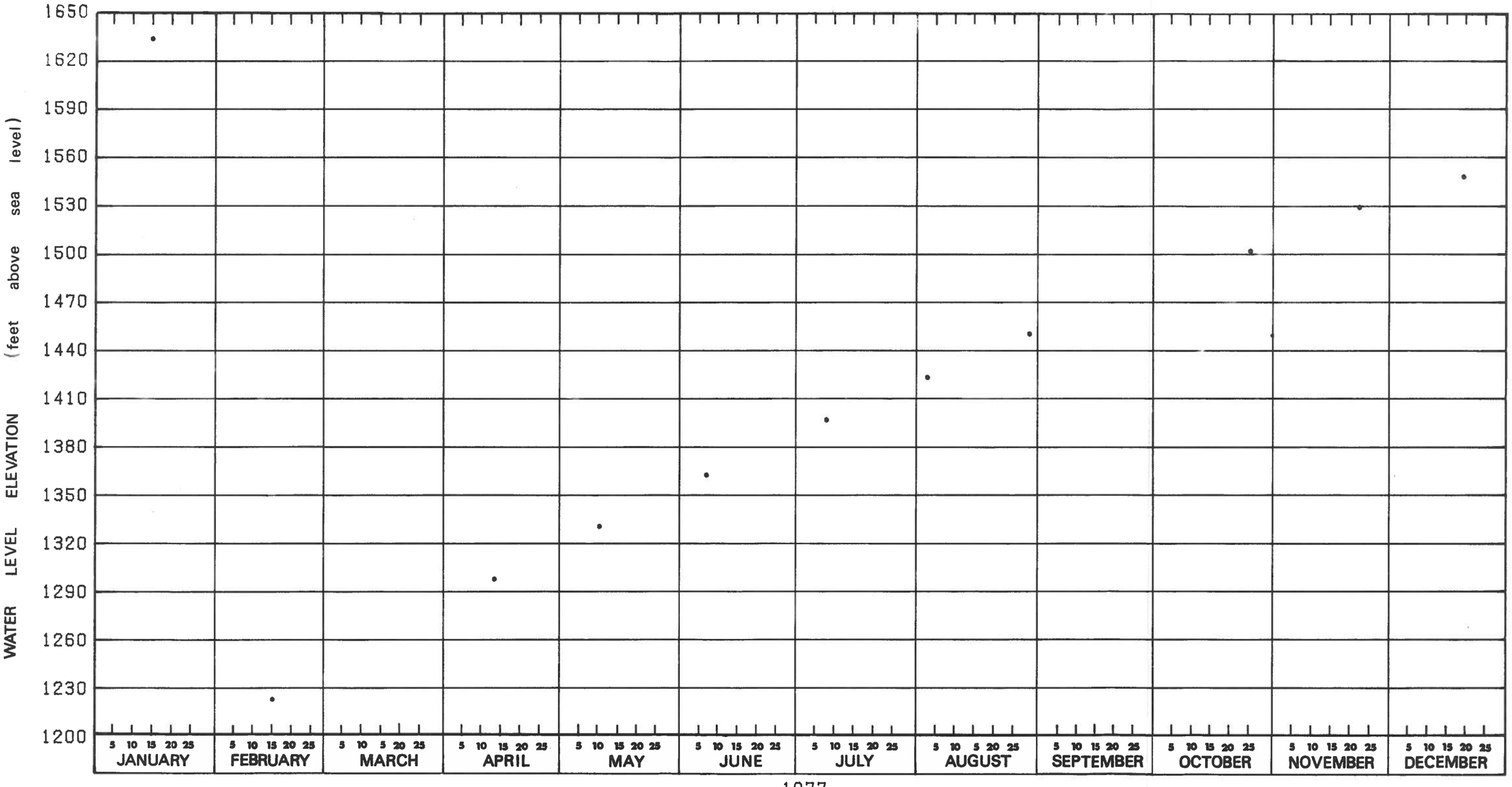
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-951-H-78




1977

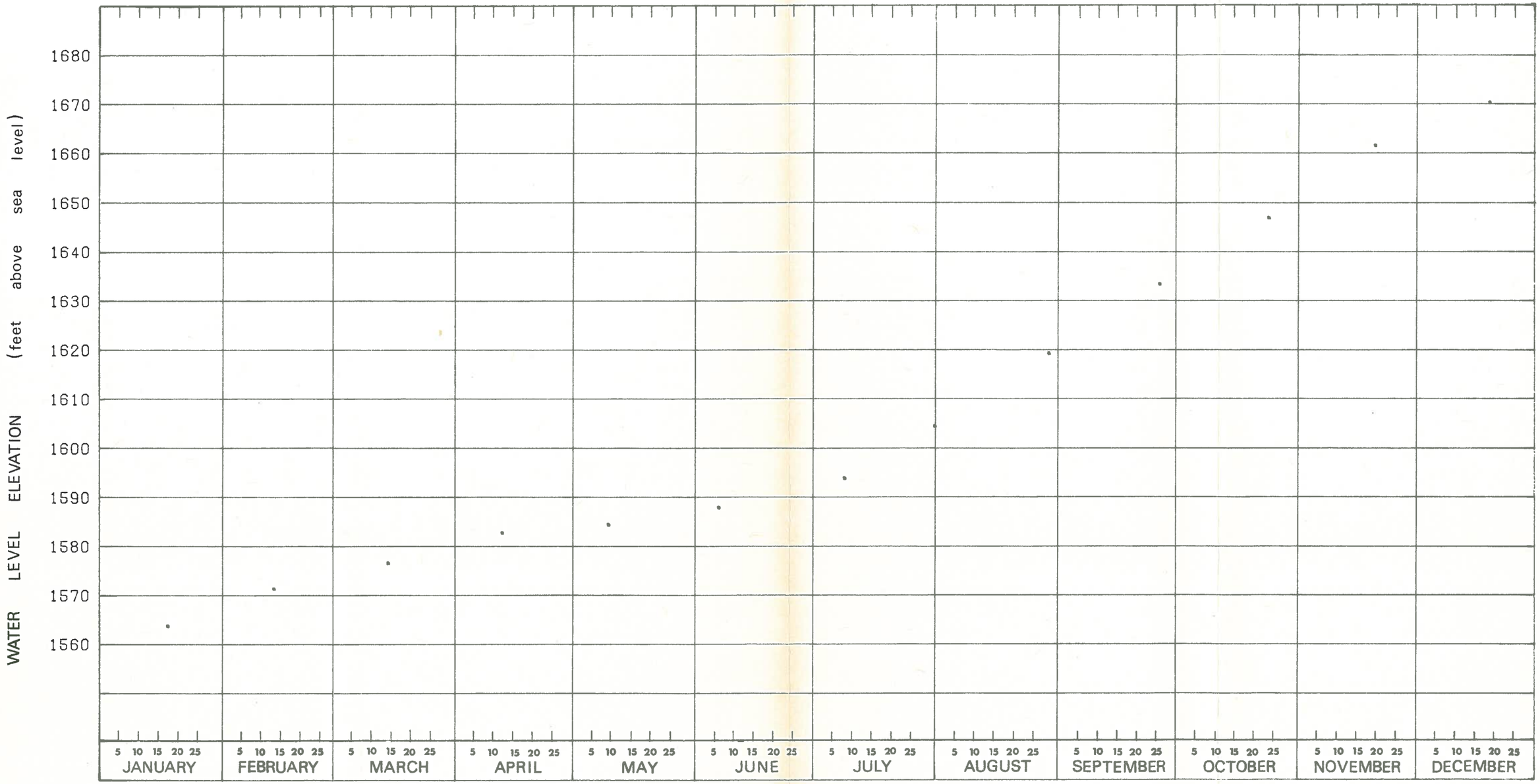
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-951

LSD 16 SEC 4 TWP 94 R 6 W4TH

9-951-H-79

Alberta Research Council




1978

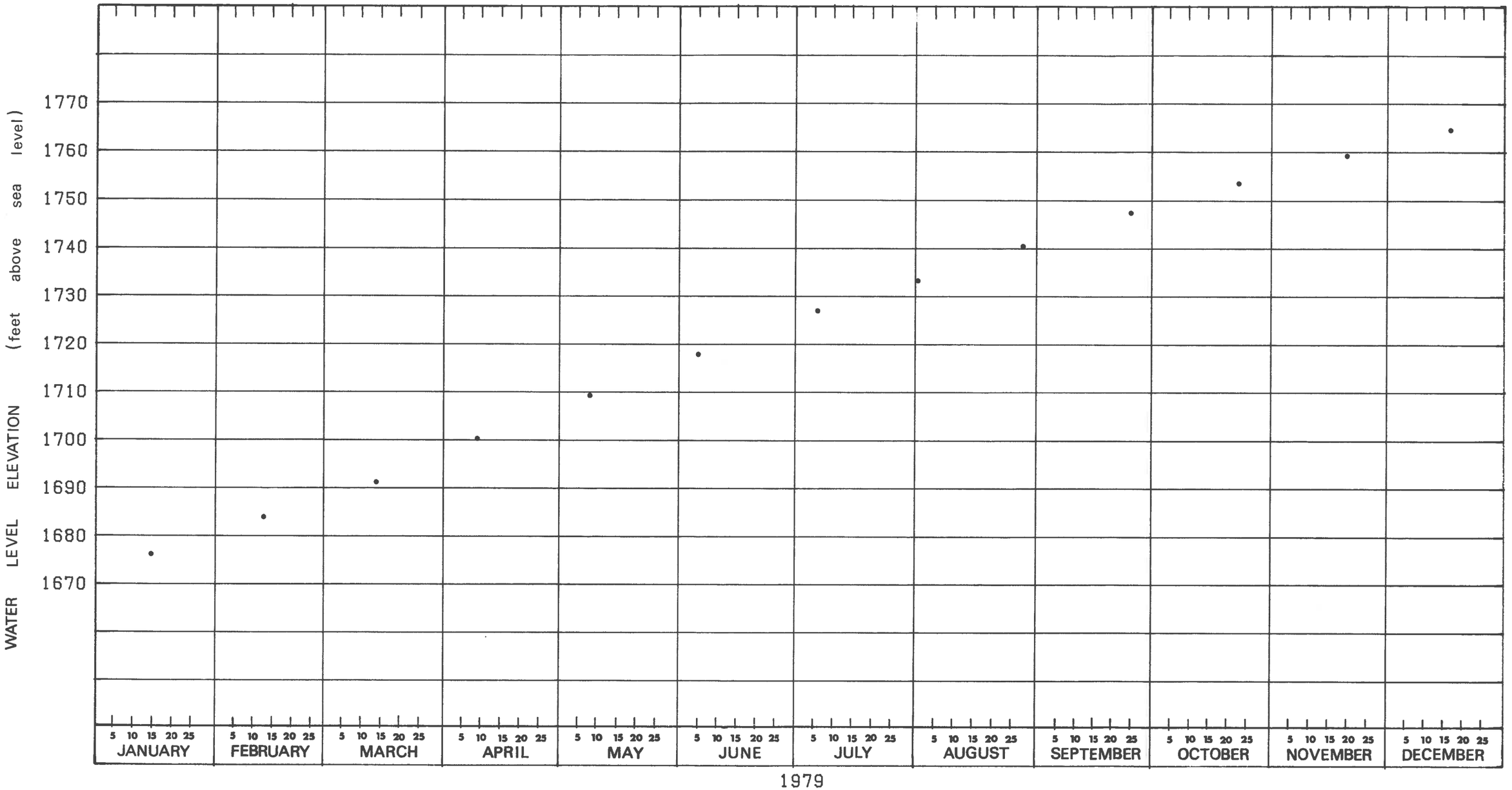
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-951-H-80



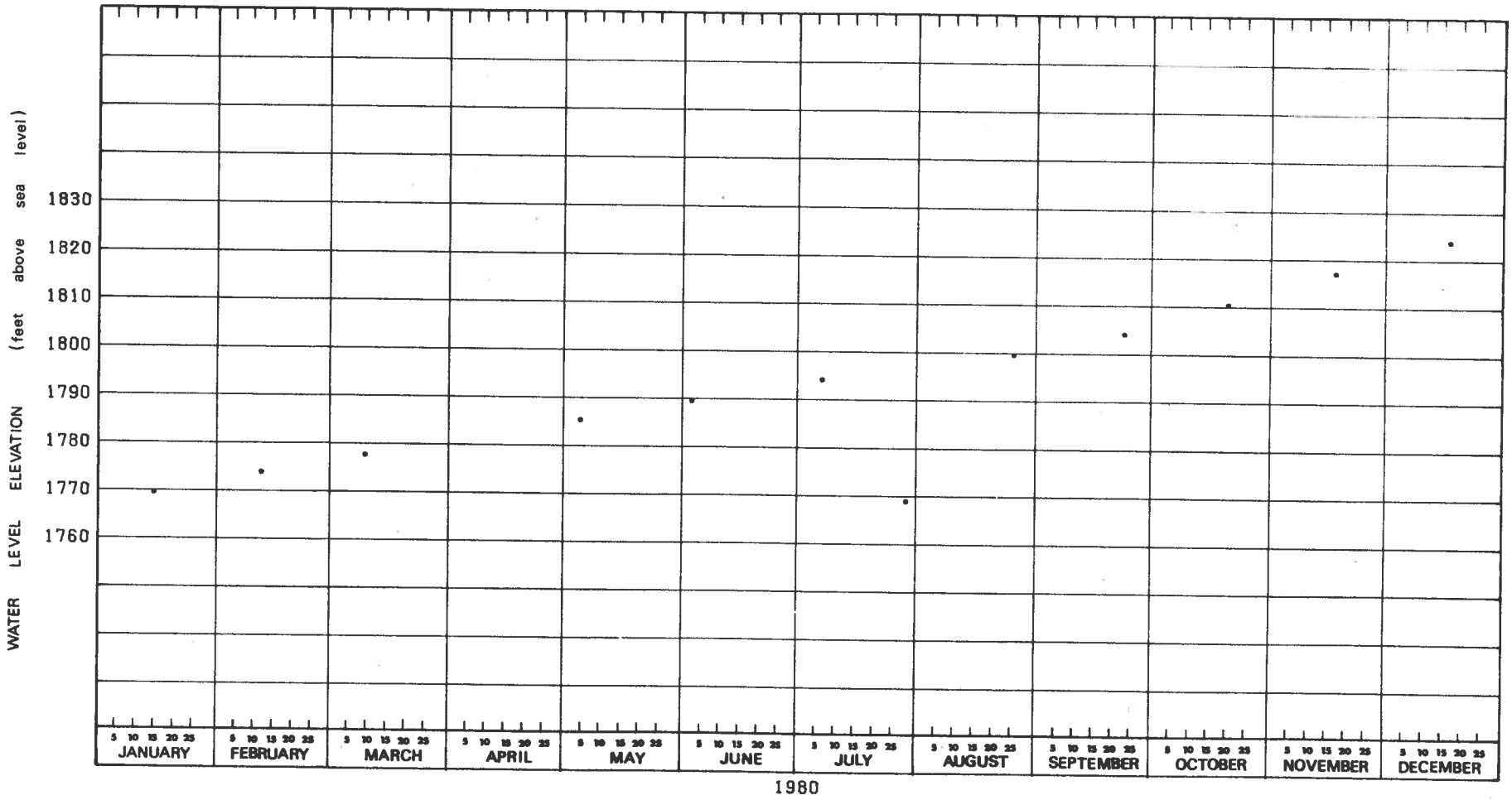
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-951-H-81



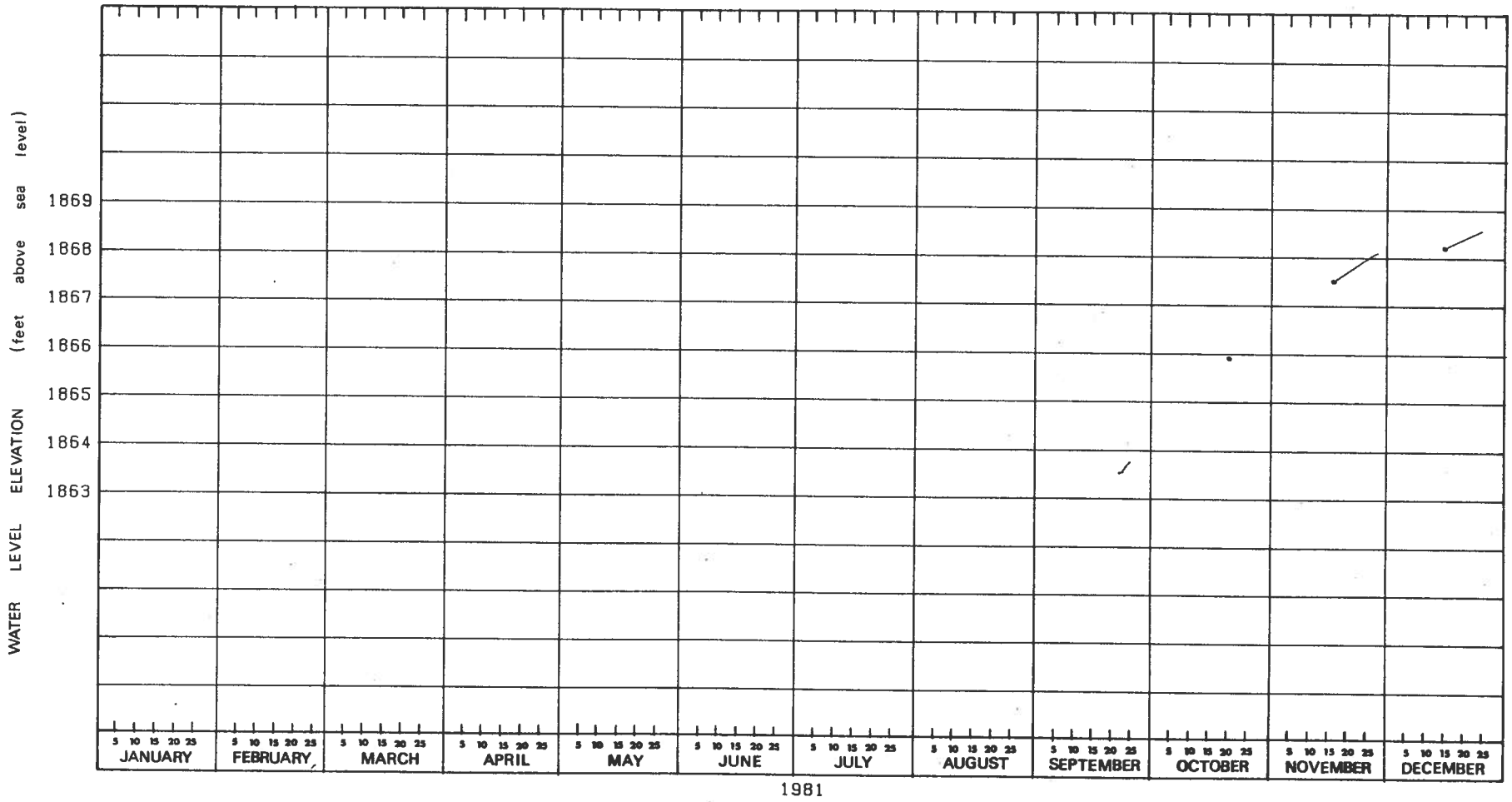
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-951-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.11

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar 2/75 | | | Well completed |
| | | | DST; misrun - pipe leak |
| Mar 3/75 | | | DST; water sample; FSI = 37# from 881" |
| Mar 8/75 | 121.92 TOC | 1619 | Bail 300 gallons |
| Mar 14/75 | | | Install shelter; MP = 3.11' TOC, (2022.22) |
| Apr 16/75 | | | Unable to measure water with 750' tape |
| May 13/75 | | | Greater than 200 m tape; new MP = 35.12", (2022.04); takes 17 seconds for rock to hit water |
| June 9/75 | | | 14 seconds for rock to hit water |
| July 8/75 | 222.10 MP | 1293.55 | Install Keck recorder |
| Aug 12/75 | 210.62 MP | 1331.38 | Sampled well - removed Keck |
| Sept 12/75 | 201.17 MP | 1362.38 | |
| Oct 7/75 | 194.62 MP | 1383.68 | |
| Nov 7/75 | 184.93 MP | 1415.47 | |
| Dec 7/75 | 177.25 MP | 1440.66 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.11

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 170.49 MP | 1462.8 | MP (2022.0) |
| Feb 7/76 | 164.89 MP | 1481.2 | |
| Mar 6/76 | 159.45 MP | 1499.0 | |
| Apr 7/76 | 153.65 MP | 1518.0 | |
| May 6/76 | 148.90 MP | 1533.6 | |
| June 2/76 | 144.83 MP | 1547.0 | |
| June 23/76 | 141.80 MP | 1556.9 | |
| July 17/76 | 138.50 MP | 1567.7 | Sample; temp. 7°C |
| Aug 11/76 | 135.51 MP | 1577.5 | |
| Aug 31/76 | 133.21 MP | 1585.1 | |
| Sept 28/76 | 129.90 MP | 1595.9 | |
| Oct 27/76 | 126.45 MP | 1607.2 | |
| Nov 24/76 | 123.15 MP | 1618.1 | |
| Dec 21/76 | 120.77 MP | 1625.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.11

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 118.71 MP | 1632.6 | MP (2022.0) |
| Feb 7/77 | | | Treated with 105 lb NU-WELL acid well conditioner |
| Feb 10/77 | | | Blown with air |
| Feb 16/77 | 243.70 MP | 1223.1 | New MP = 1.00 m TOC, (2022.4) |
| Mar 16/77 | | | >200 m |
| Apr 14/77 | 220.82 MP | 1297.8 | New MP = 0.90 m, TOC (2022.1) |
| May 11/77 | 210.87 MP | 1330.4 | |
| June 8/77 | 201.14 MP | 1362.4 | |
| July 9/77 | 190.65 MP | 1396.8 | Sample; temp. 7°C |
| Aug 4/77 | 182.65 MP | 1423.0 | |
| Aug 30/77 | 174.43 MP | 1450.0 | |
| Sept 28/77 | | | Could not measure; tape stuck to casing |
| Oct 26/77 | 158.85 MP | 1501.4 | |
| Nov 23/77 | 150.52 MP | 1528.7 | |
| Dec 20/77 | 144.74 MP | 1547.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.11

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 139.88 MP | 1563.6 | MP (2022.4) |
| Feb 14/78 | 137.56 MP | 1571.2 | |
| Mar 15/78 | 135.98 MP | 1576.4 | |
| Apr 13/78 | 134.09 MP | 1582.6 | |
| May 10/78 | 133.57 MP | 1584.3 | |
| June 7/78 | 132.50 MP | 1587.8 | |
| July 9/78 | 130.66 MP | 1593.8 | Sampled; temp. 8°C |
| Aug 1/78 | 127.44 MP | 1604.4 | |
| Aug 30/78 | 122.93 MP | 1619.2 | |
| Sept 27/78 | 118.62 MP | 1633.3 | |
| Oct 25/78 | 114.50 MP | 1646.8 | |
| Nov 21/78 | 110.02 MP | 1661.5 | |
| Dec 20/78 | 107.34 MP | 1670.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.11

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 105.54 MP | 1676.2 | MP (2022.4) |
| Feb 14/79 | 103.18 MP | 1684.0 | |
| Mar 15/79 | 100.94 MP | 1691.3 | |
| Apr 10/79 | 98.17 MP | 1700.4 | |
| May 9/79 | 95.42 MP | 1709.4 | |
| June 6/79 | 92.81 MP | 1718.0 | |
| July 7/79 | 90.03 MP | 1727.1 | Sampled; temp. 8°C |
| Aug 2/79 | 88.10 MP | 1733.4 | |
| Aug 29/79 | 85.92 MP | 1740.6 | |
| Sept 26/79 | 83.82 MP | 1747.5 | |
| Oct 24/79 | 81.95 MP | 1753.6 | |
| Nov 21/79 | 80.20 MP | 1759.3 | |
| Dec 18/79 | 78.56 MP | 1764.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.11

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 77.11 MP | 1769.5 | |
| Feb 13/80 | 75.77 MP | 1773.9 | |
| Mar 11/80 | 74.60 MP | 1777.7 | |
| Apr 10/80 | | | Could not measure |
| May 6/80 | 72.26 MP | 1785.4 | |
| June 4/80 | 70.99 MP | 1789.5 | |
| July 8/80 | 69.58 MP | 1794.2 | Temp. 9°C |
| July 30/80 | 69.01 MP | 1796.0 | |
| Aug 27/80 | 67.89 MP | 1799.7 | |
| Sept 25/80 | 66.49 MP | 1804.3 | |
| Oct 22/80 | 64.60 MP | 1810.5 | |
| Nov 19/80 | 62.53 MP | 1817.3 | |
| Dec 19/80 | 60.48 MP | 1824.0 | |
| Jan 16/81 | 58.62 MP | 1830.1 | |
| Feb 11/81 | 57.47 MP | 1833.9 | |
| Mar 11/81 | 56.24 MP | 1837.9 | |
| Apr 7/81 | 55.30 MP | 1841.0 | |
| May 6/81 | 54.40 MP | 1844.0 | |
| June 2/81 | 53.44 MP | 1847.1 | |
| July 1/81 | 52.04 MP | 1851.7 | |
| July 29/81 | 50.59 MP | 1856.5 | |
| Aug 26/81 | 49.39 MP | 1860.4 | |
| Sept 23/81 | 48.45 MP | 1863.5 | Installed Recorder MP 0.93 m T.O.C. |
| Oct 21/81 | 47.72 MP | 1865.9 | |
| Nov 17/81 | 47.23 MP | 1867.5 | |
| Dec 16/81 | 47.02 MP | 1868.2 | |

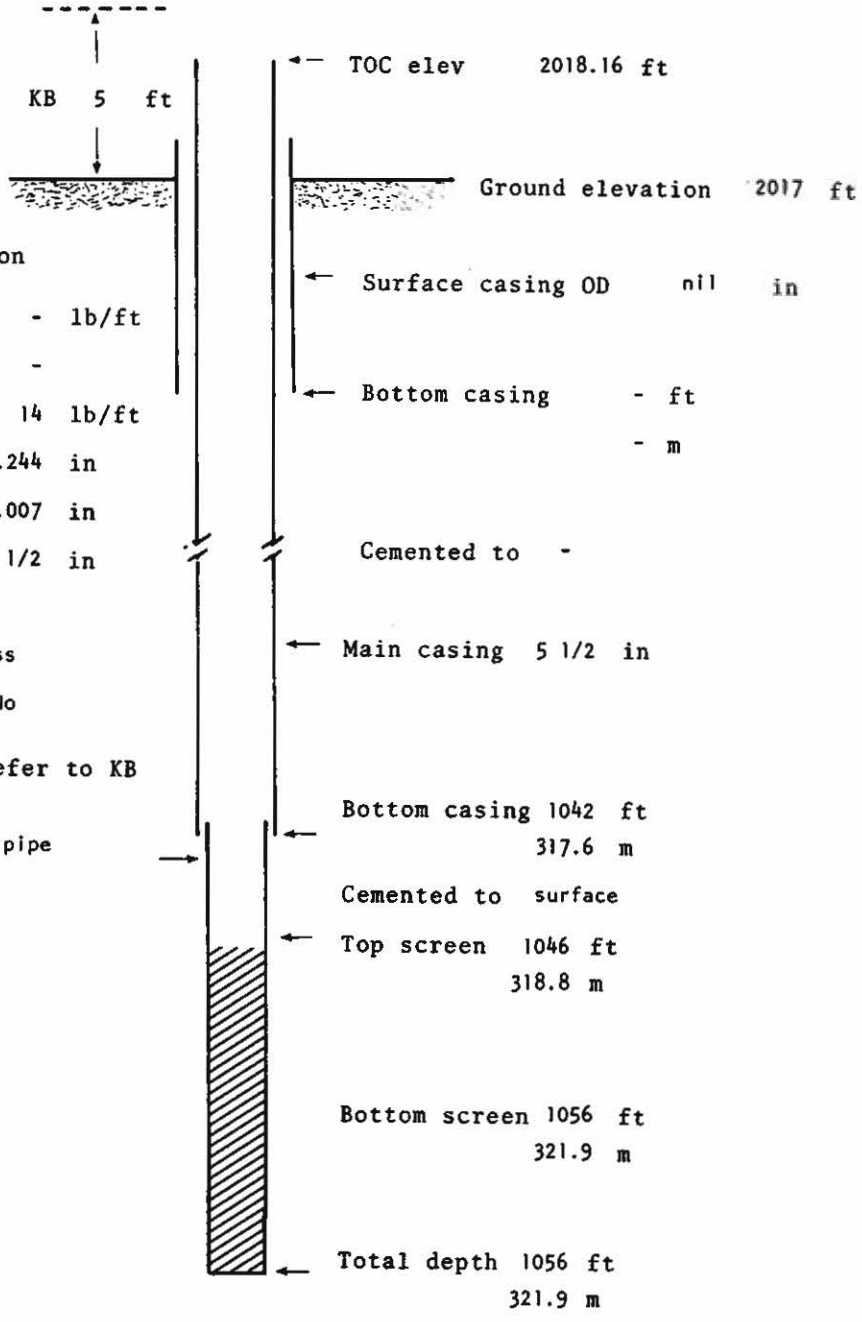
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Tp 94 R 6 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

## DRILL STEM TEST

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Tp 94 R 6 W4th

Alberta Research Council

Elevation: gl 2017
KB 2019

Type of test - Casing Positrieve

Date of test March 4, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1600 | hrs |
| Tool opened | 1750 | hrs |
| First flow | 2 | min |
| Initial shut in | 60 | min |
| Second flow | 60 | min |
| Final shut in | 720 | min |
| Pulled loose at | 0800 | hrs |
| Out of hole at | 0930 | hrs |
| Wt on packers | 5000 | lbs |
| Description of blow | Weak initial puff, weak blow decreasing to nil in 40 minutes | |
| Total water recovered | 80 | ft |

Water sample No. -

Gas blow No

Remarks Test satisfactory
5-1/2" RBP @ 1032'

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 1046-1056

Formation tested McMurray

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

### PRESSURE DATA (psi)

| | | |
|---|---|---|
| Instrument No. | | RPG-92N |
| Capacity (psig) | | 431 |
| Instrument set at (ft) | | 1036 |
| Initial hydrostatic | A | Over Capacity |
| First flow | B | 3 |
| | B1 | 3 |
| Initial shut in | C | 55 |
| Second flow | D | 19 |
| | D1 | 43 |
| Final shut in | G | 49 |
| Final hydrostatic | H | Off Chart |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 9-1056

PRESSURE INCREMENTS

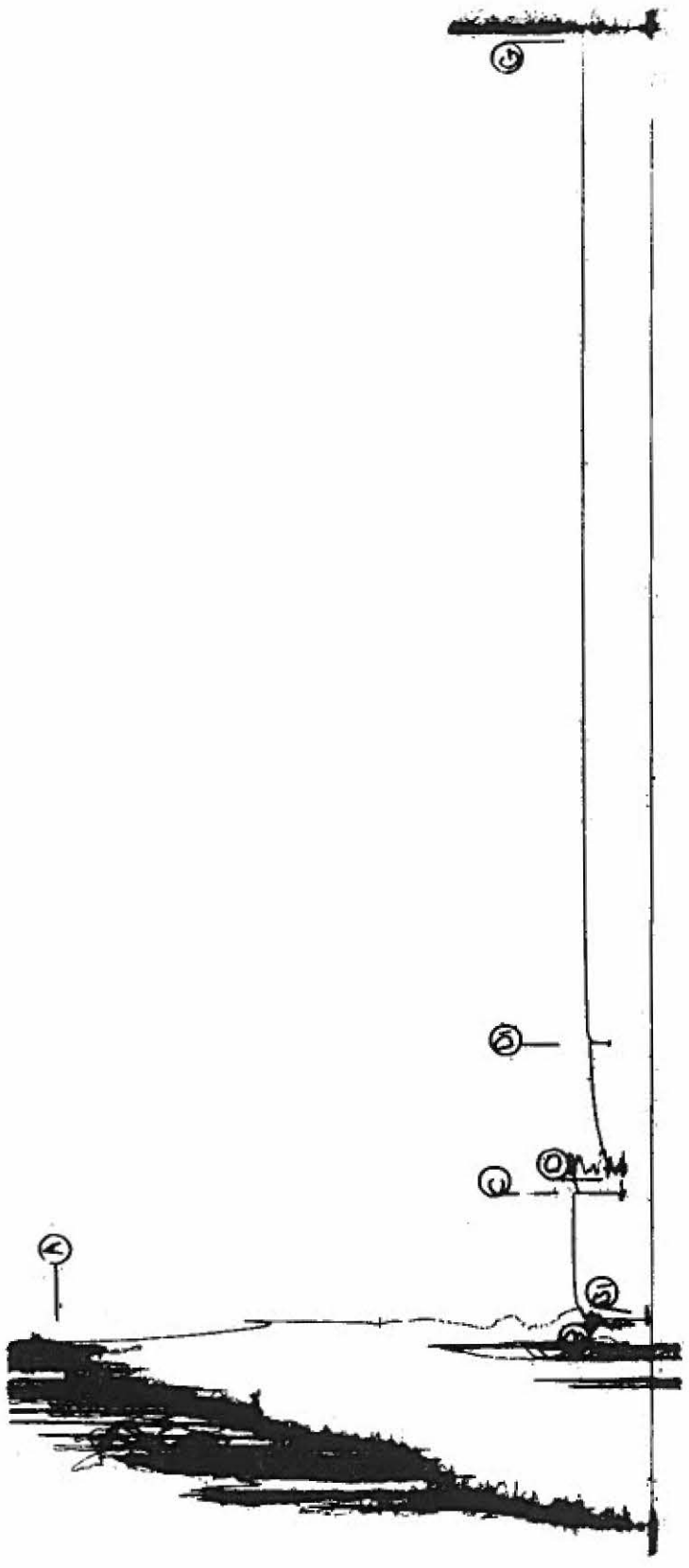
Recorder RPG92N

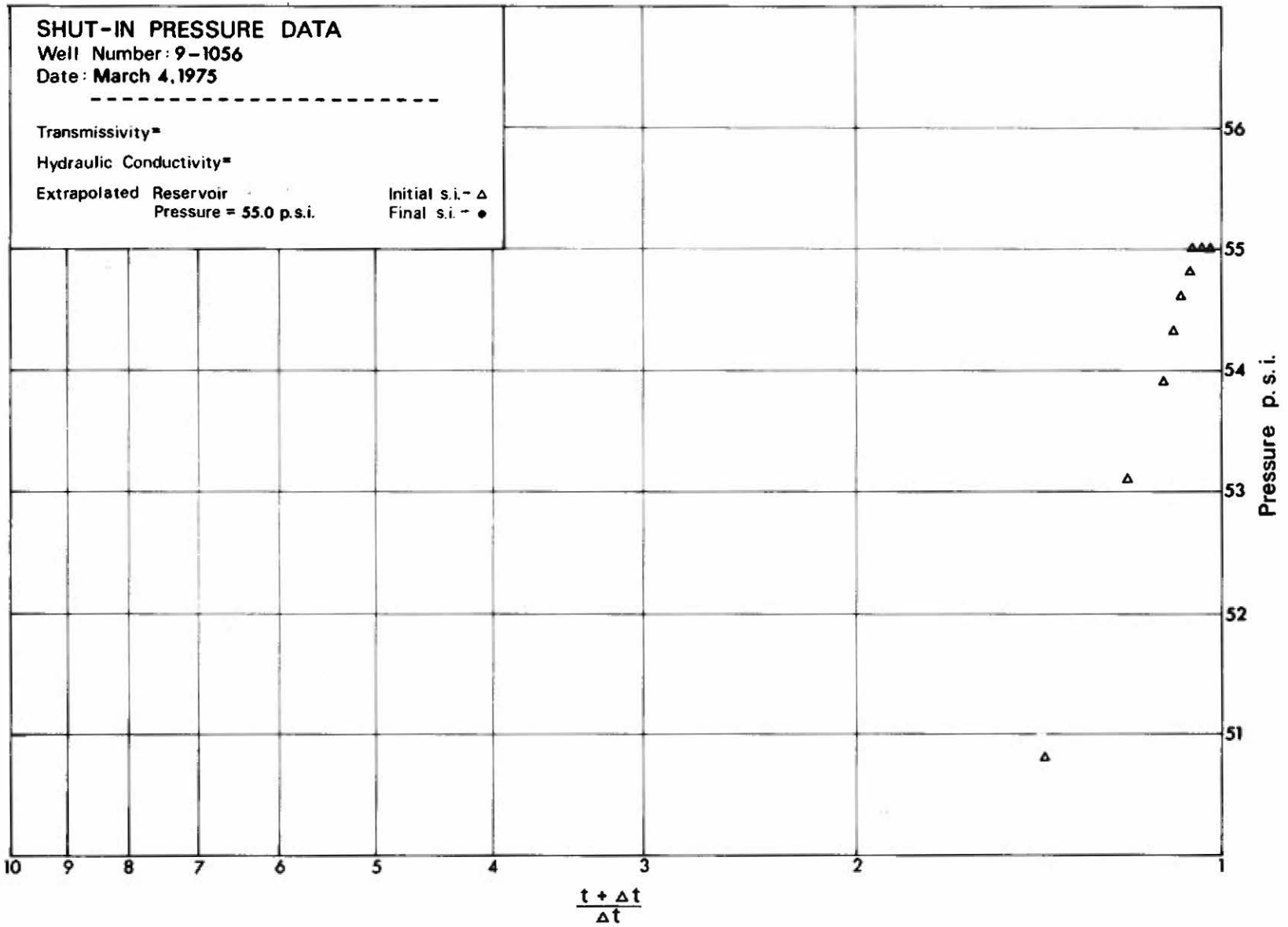
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 50.8 | 1.40 |
| 10 | 53.1 | 1.20 |
| 15 | 53.9 | 1.13 |
| 20 | 54.3 | 1.10 |
| 25 | 54.6 | 1.08 |
| 30 | 54.8 | 1.07 |
| 35 | 55.0 | 1.06 |
| 40 | 55.0 | 1.05 |
| 45 | 55.0 | 1.044 |
| 50 | 55.0 | 1.040 |
| 55 | 55.0 | 1.036 |
| 60 | 55.0 | 1.030 |

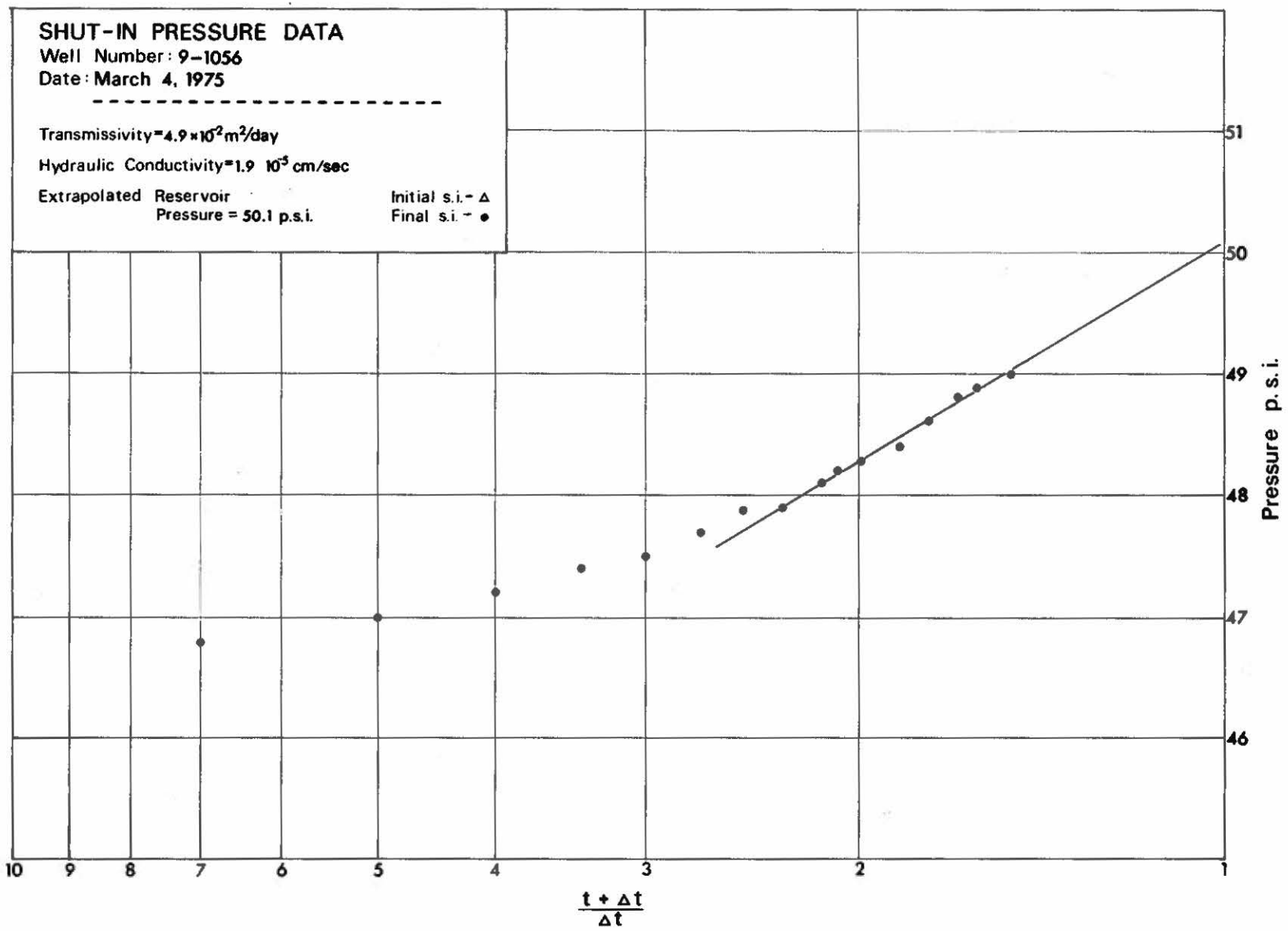
Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 46.2 | 13.00 |
| 10 | 46.8 | 7.00 |
| 15 | 47.0 | 5.00 |
| 20 | 47.2 | 4.00 |
| 25 | 47.4 | 3.40 |
| 30 | 47.5 | 3.00 |
| 35 | 47.7 | 2.71 |
| 40 | 47.9 | 2.50 |
| 45 | 47.9 | 2.33 |
| 50 | 48.1 | 2.20 |
| 55 | 48.2 | 2.09 |
| 60 | 48.3 | 2.00 |
| 70 | 48.4 | 1.86 |
| 80 | 48.6 | 1.75 |
| 90 | 48.8 | 1.67 |
| 100 | 48.9 | 1.60 |
| 120 | 49.0 | 1.50 |




SHUT-IN PRESSURE DATA
Well Number: 9-1056
Date: March 4, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 55.0 p.s.i.
Initial s.i.- Δ
Final s.i. - •
56
55
54
53
52
51
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

9-1056-D-76


SHUT-IN PRESSURE DATA
Well Number: 9-1056
Date: March 4, 1975
Transmissivity = 4.9 × 10⁻² m²/day
Hydraulic Conductivity = 1.9 10⁻⁵ cm/sec
Extrapolated Reservoir Pressure = 50.1 p.s.i.
Initial s.i. - Δ
Final s.i. - •
51
50
49
48
47
46
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

9-1056-D-76

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled August 12, 1975 Time

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 665 | 33.18 | 74 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 193 | 8.39 | 19 |
| Potassium ($K^{+}$) | 120 | 3.07 | 7 |
| Carbonate ($CO_3^{=}$) | 48 | 1.60 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 5.1 | 0.11 | 0 |
| Chloride ($Cl^{-}$) | 438 | 12.35 | 25 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.7 | | |
| Hydroxide ($OH^{-}$) | 609 | 35.80 | 72 |
| Calcium (Acidified) | 690 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 2122 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 49.87 | Total Cations (epm) | 44.65 |

### Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | 7.0 |
| pH | 12.4 | pH | 12.0 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 515.0 | 25.70 | 81 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 105.0 | 4.57 | 14 |
| Potassium ($K^{+}$) | 59.0 | 1.51 | 5 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 2 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 3.7 | 0.08 | 0 |
| Chloride ($Cl^{-}$) | 148.0 | 4.17 | 13 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0 |
| Silica ($SiO_2$) | 0.0 | | |
| Hydroxide ($OH^{-}$) | 481.0 | 28.28 | 85 |
| Calcium (Acidified) | 528.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 1548 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 33.33 | Total Cations (epm) | 31.78 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 7000 |
| pH | 12.2 |
| Fluoride ($F^{-}$) | 0.2 Mg/L |

Field:

| | | |
|---|---|---|
| Temperature (C) | | |
| pH | 12.2 | |
| Carbonate ($CO_3^{=}$) | 1080 | Mg/L |
| Bicarbonate ($HCO_3^{-}$) | | |
| Hydroxide ($OH^{-}$) | 197 | Mg/L |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 365.0 | 18.21 | 77.9 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0.0 |
| Sodium ($Na^{+}$) | 96.0 | 4.18 | 17.9 |
| Potassium ($K^{+}$) | 39.2 | 1.00 | 4.3 |
| Carbonate ($CO_3^{=}$) | 26.4 | 0.88 | 3.3 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 3.8 | 0.08 | 0.3 |
| Chloride ($Cl^{-}$) | 132.0 | 3.72 | 14.0 |
| Nitrate ($NO_3^{=}$) | 2.7 | 0.04 | 0.2 |
| Silica ($SiO_2$) | 2.0 | | |
| Hydroxide ($OH^{-}$) | 373.0 | 21.93 | 82.3 |
| Calcium (Acidified) | 370.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 667.1 | | |
| Total Anions (epm) | 26.65 | Total Cations (epm) | 23.39 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 5500 |
| pH | 12.3 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 8.0 |
| pH | 12.4 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | 6.0 ppm |
| Hydroxide ($OH^{-}$) | 377.0 ppm |
| Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 248.0 | 12.38 | 71.7 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.0 |
| Sodium(Na) | 94.0 | 4.09 | 23.7 |
| Potassium(K) | 31.0 | 0.79 | 4.6 |
| Carbonate(CO3) | 28.8 | 0.96 | 5.1 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 5.3 | 0.11 | 0.6 |
| Chloride(Cl) | 78.0 | 2.20 | 11.7 |
| Nitrate(NO3) | 3.2 | 0.05 | 0.3 |
| Silica(SiO2) | 0.5 | | |
| Hydroxide(OH) | 264.0 | 15.52 | 82.4 |
| Calcium(Acidified) | 230.0 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 934.0 | | |
| Total Anions(epm) | 18.84 | Total Cations(epm) | 17.27 |

## Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3630 | | Temperature(C) | 10.00 | |
| pH | 12.3 | | pH | 12.1 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | 20 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 304 | mg/l |

9-1056-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 252.0 | 12.57 | 71.2 |
| Magnesium(Mg) | 0.0 | 0.00 | 0.0 |
| Sodium(Na) | 103.0 | 4.48 | 25.4 |
| Potassium(K) | 23.8 | 0.61 | 3.4 |
| Carbonate(CO3) | 24.0 | 0.80 | 4.2 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 6.2 | 0.13 | 0.7 |
| Chloride(Cl) | 70.0 | 1.97 | 10.3 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.0 |
| Silica(SiO2) | 1.6 | | |
| Hydroxide(OH) | 277.0 | 16.28 | 84.8 |
| Calcium(Acidified) | 218.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 872.0 | | |
| Total Anions(epm) | 19.20 | Total Cations(epm) | 17.66 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3390 | Temperature(C) | 8.00 | |
| pH | 12.2 | pH | 12.1 | |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) | 25 | mg/l |
| | | Bicarbonate(HCO3) | | |
| | | Hydroxide(OH) | 292 | mg/l |

WATER ANALYSIS 9-1056-E-82

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 290.0 | 14.50 | 72.7 |
| Magnesium(Mg) | 0.0 | 0.0 | 0.0 |
| Sodium(Na) | 110.0 | 4.78 | 24.0 |
| Potassium(K) | 25.8 | 0.66 | 3.3 |
| Carbonate(CO3) | 53.0 | 1.77 | 40.5 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 5.5 | 0.11 | 2.6 |
| Chloride(Cl) | 88.0 | 2.48 | 56.8 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.1 |
| Silica(SiO2) | 5.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 290.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 868.0 | | |
| Total Anions(epm) | 4.36 | Total Cations(epm) | 19.94 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 4150 |
| pH | 12.0 |
| Fluoride | 0.1 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 11.00 | |
| pH | 12.4 | |
| Carbonate(CO3) | 24 | mg/l |
| Bicarbonate(HCO3) | 0 | mg/l |
| Hydroxide(OH) | 329 | mg/l |

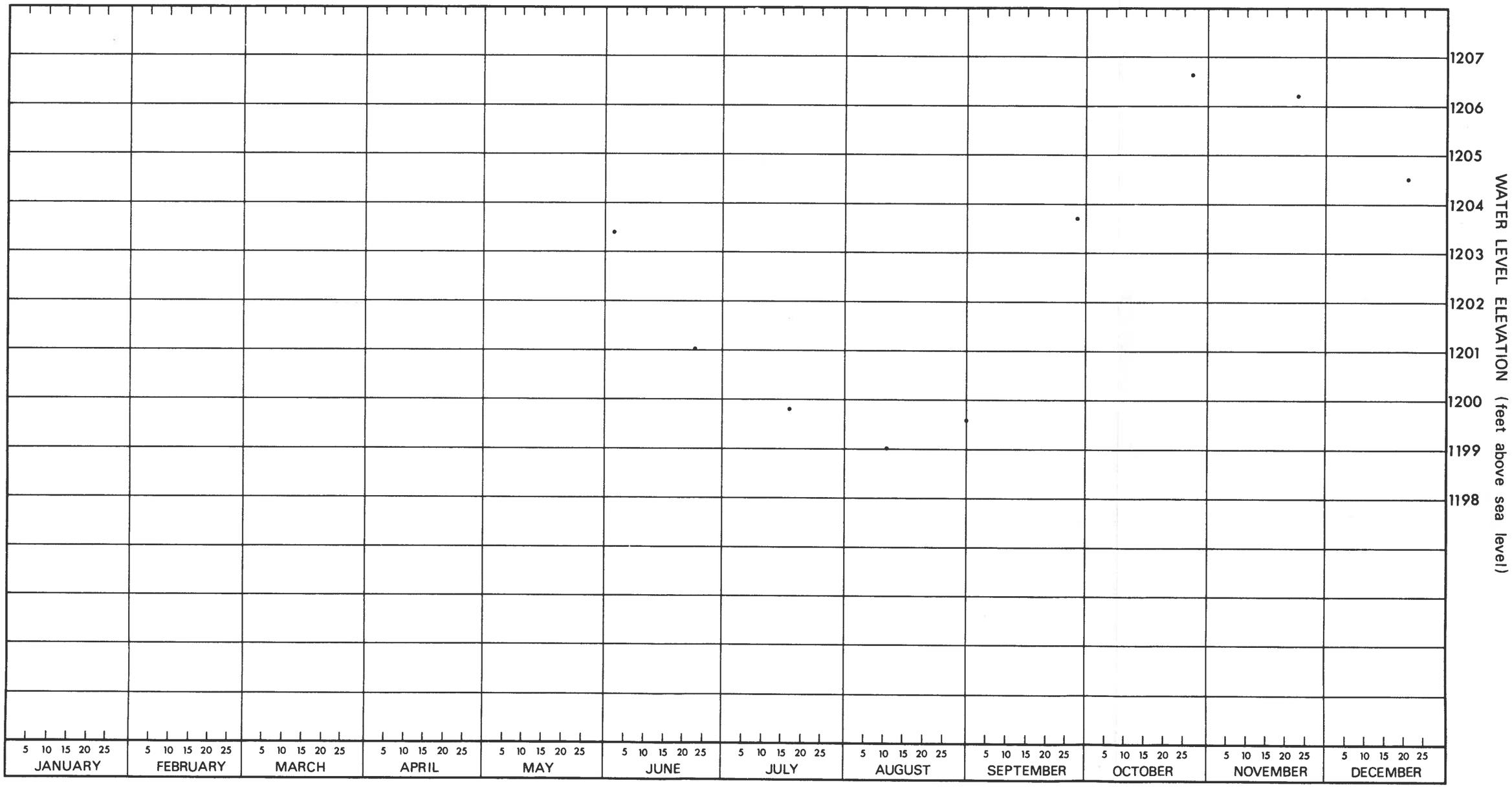
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **9-1056**

9 - 1056 - H - 77

Lsd **16** Sec **4** Twp **94** R **6** W4th

Alberta Research Council




1976

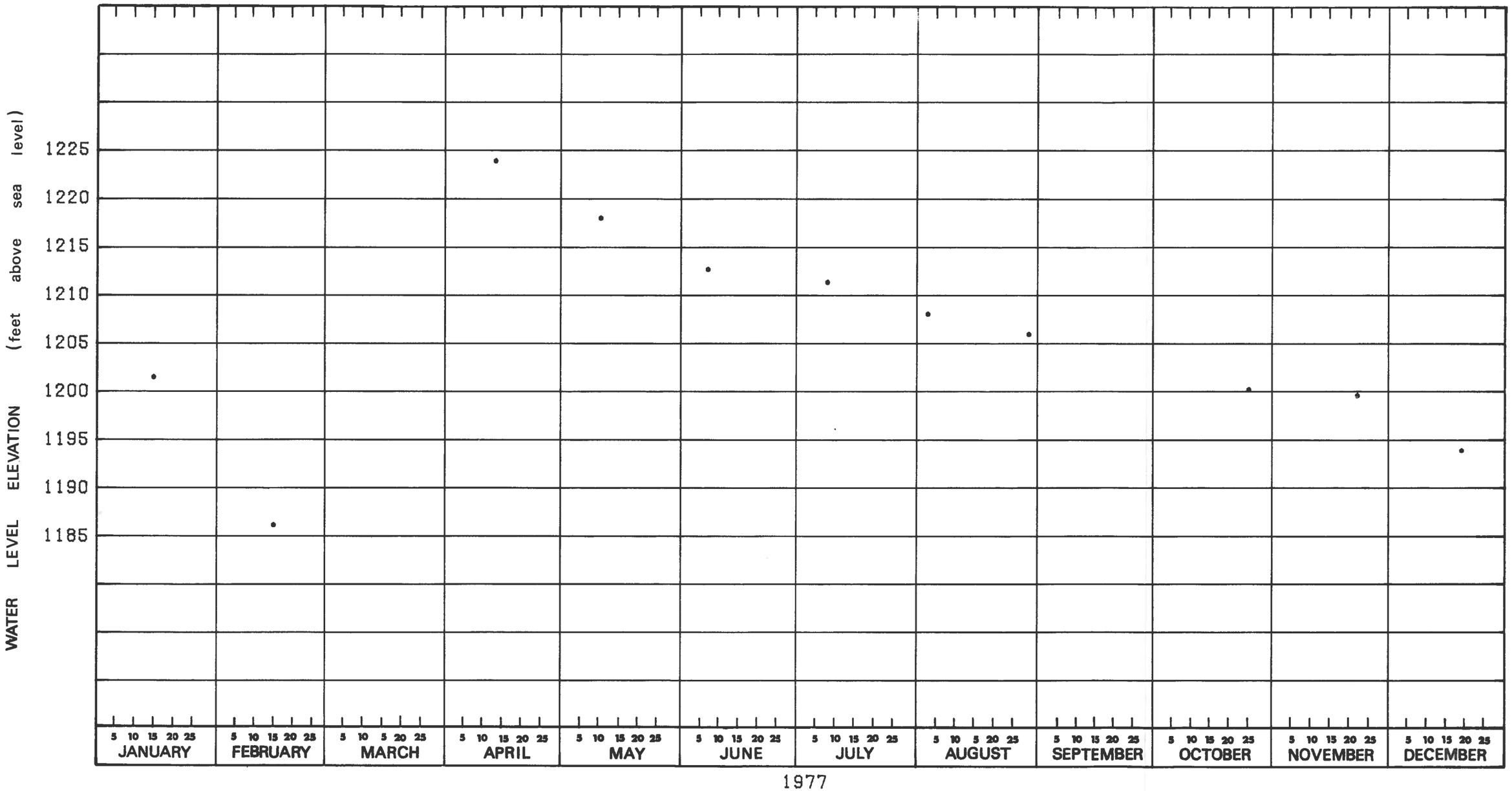
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-1056-H-78




1977

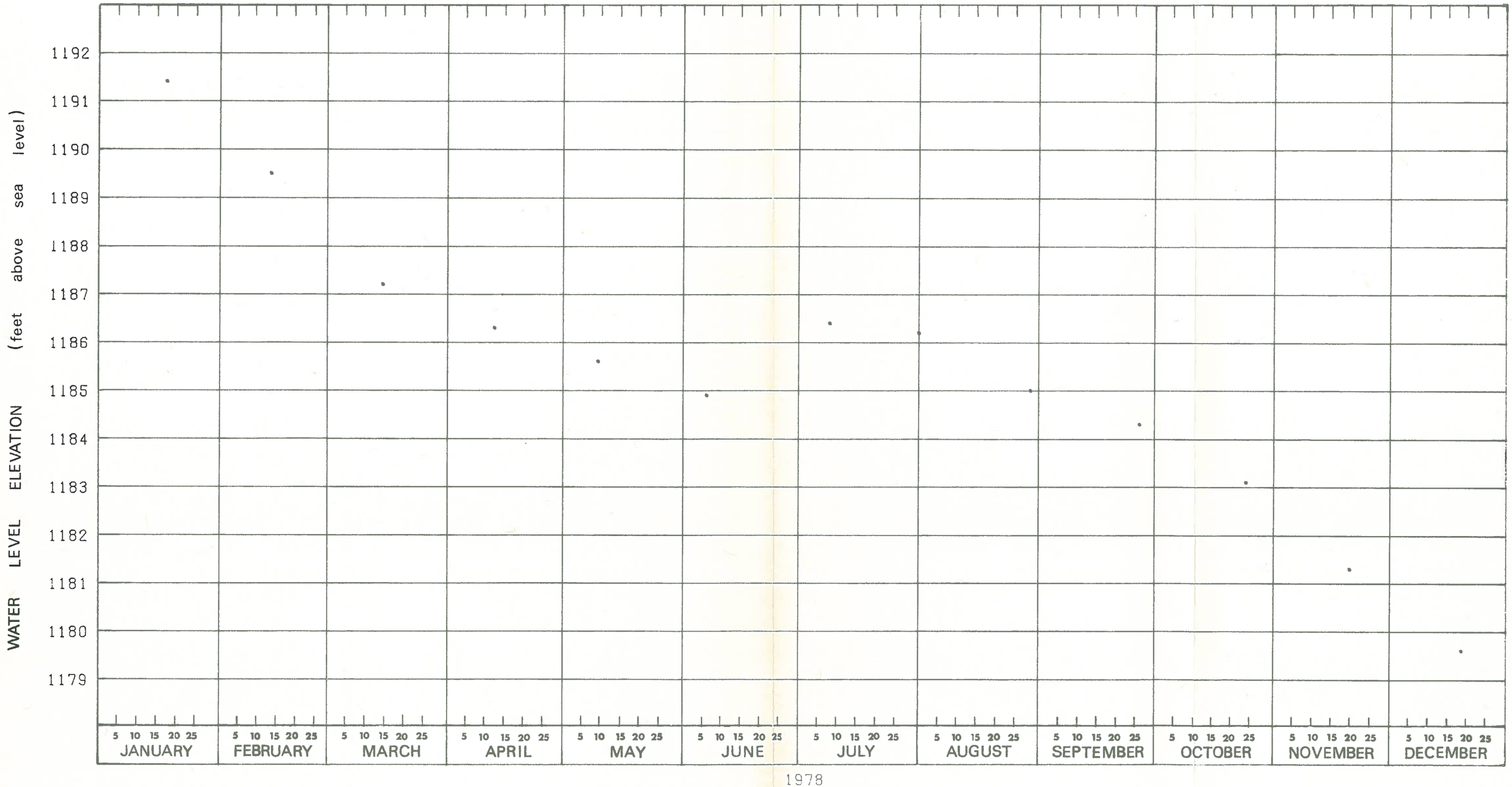
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1056

LSD 16 SEC 4 TWP 94 R 6 W4TH

9-1056-H-79

Alberta Research Council




1978

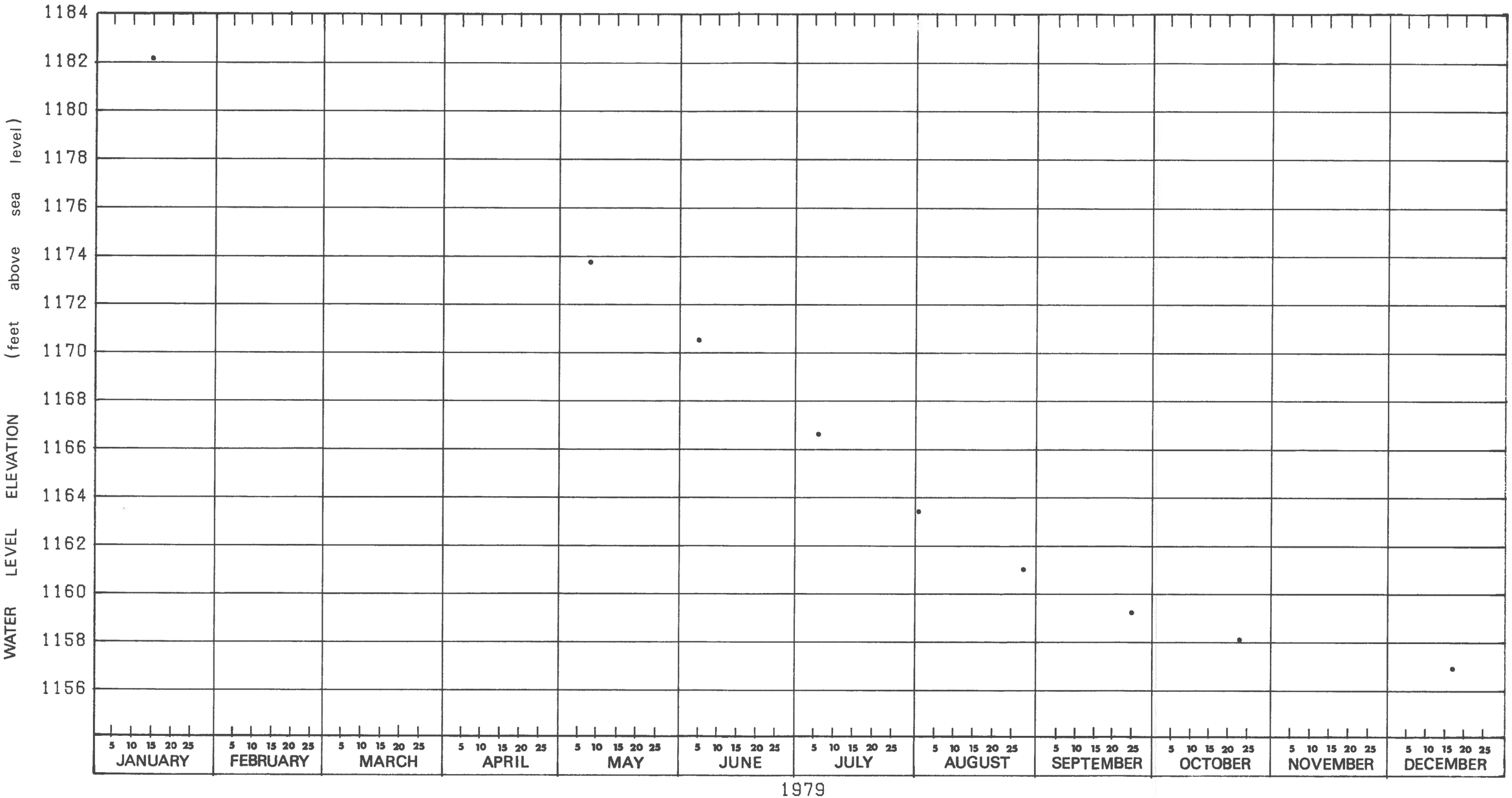
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-1056-H-80



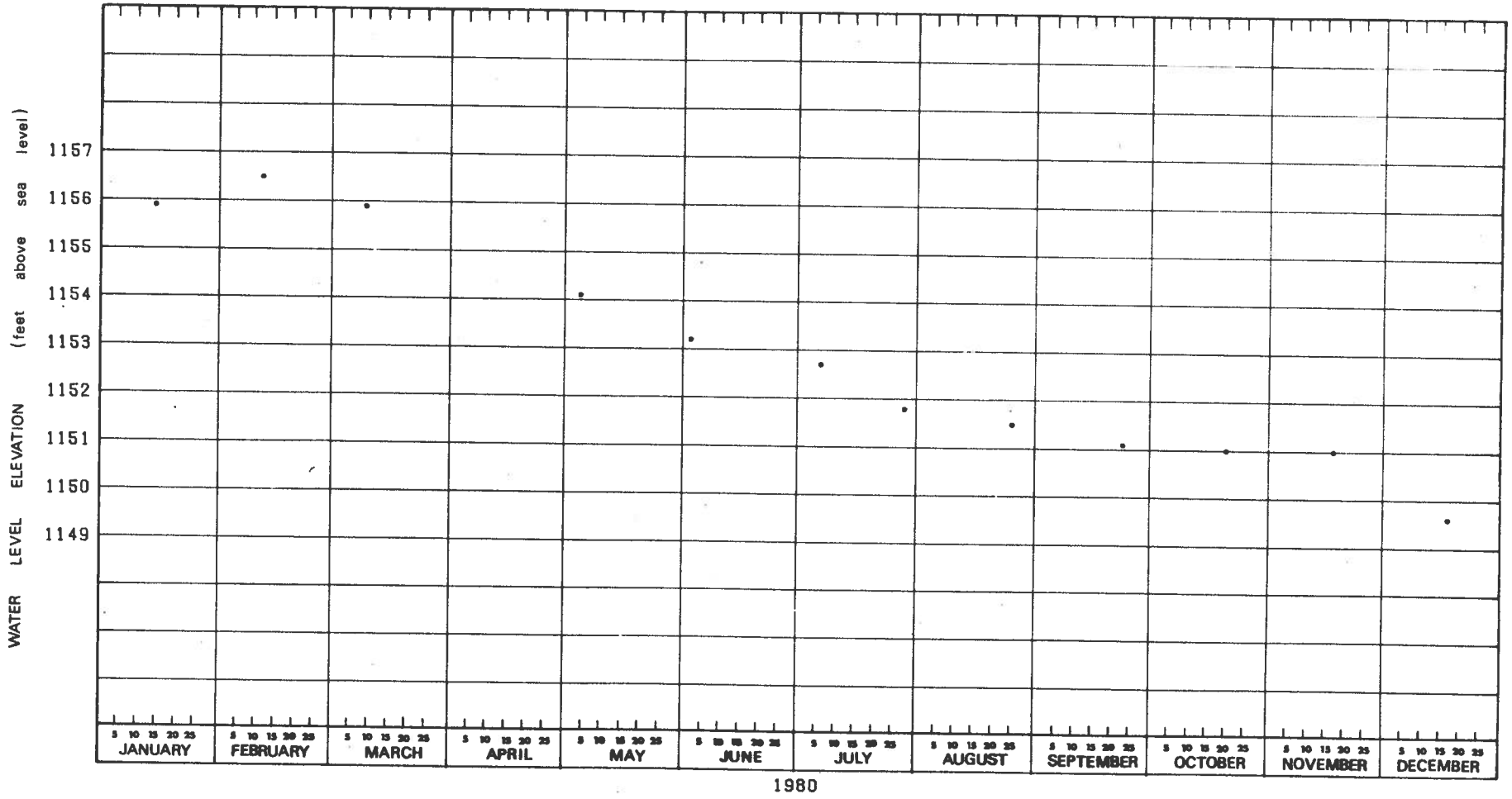
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-1056-H-81



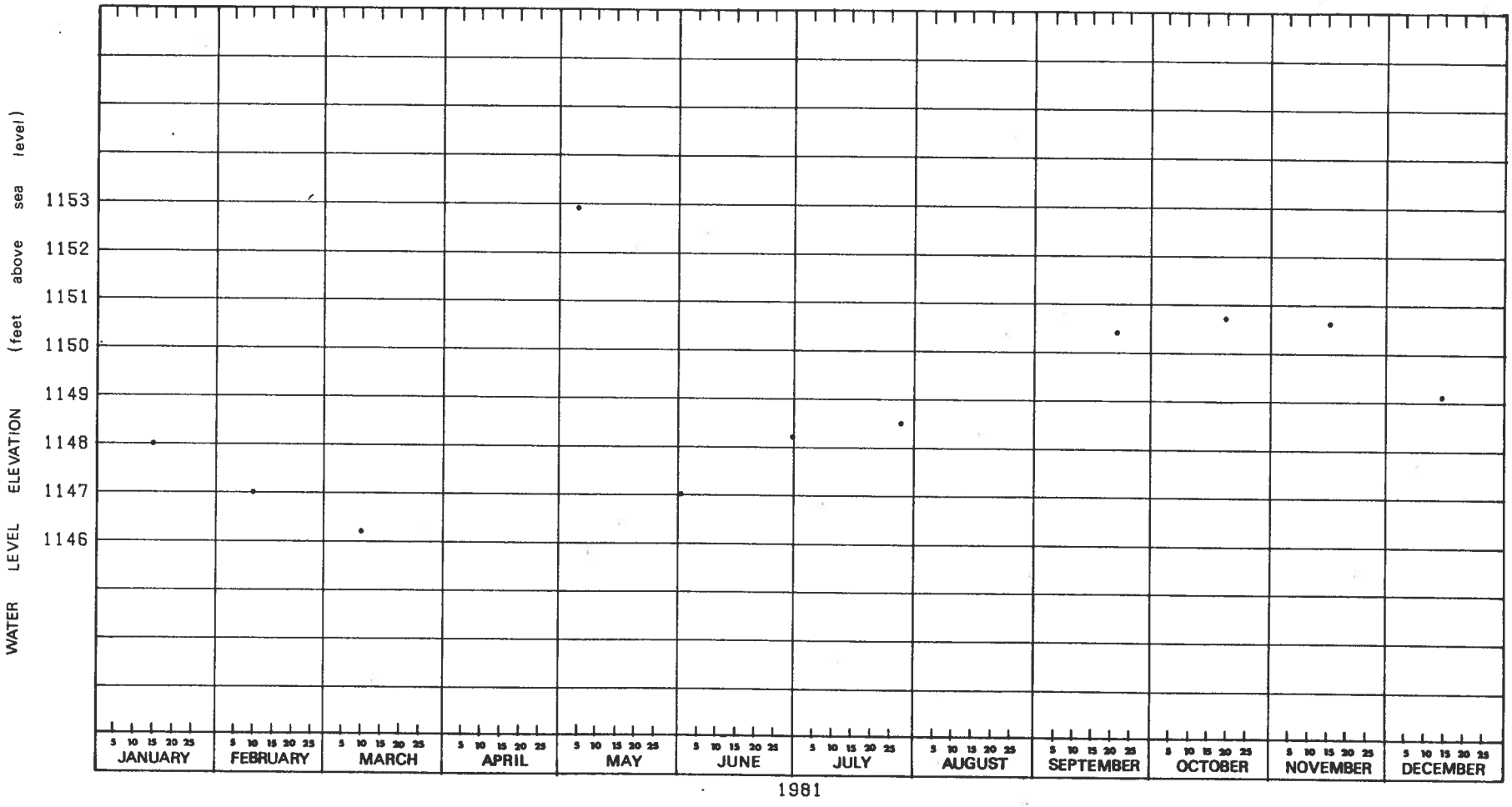
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-1056-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2018.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar 2/75 | | | Well completed |
| Mar 4/75 | | | DST; water sample; FSI = 55# from 1036' |
| Mar 7/75 | 102.97 TOC | 1680.32 | Bail 75 gallons |
| Mar 8/75 | | | Bail 70 gallons |
| Mar 9/75 | | | Bail 35 gallons |
| Mar 14/75 | | | Install shelter; MP = 3.32' TOC, (2021.78) |
| Apr 16/75 | 121.92 MP | 1621.48 | Trouble measuring due to condensation on casing |
| May 13/75 | 157.28 new MP | 1505.48 | New MP = 31.38" TOC, (2020.78) |
| June 9/75 | 95 MP | 1709 | |
| July 8/75 | 156 MP | 1509 | |
| Aug 12/75 | 251.46 MP | | Sampled well 996' |
| Sept 12/75 | | | Could not measure |
| Oct 7/75 | | | Could not measure |
| Nov 7/75 | | | Could not measure > 223 m |
| Dec 7/75 | | | Could not measure |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2018.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | | | MP (2020.8); could not measure |
| Apr 7/76 | | | Install Bassani Packer |
| June 2/76 | 249.20 MP | 1203.4 | |
| June 23/76 | 249.93 MP | 1201.0 | |
| July 17/76 | 250.29 MP | 1199.8 | Sampled |
| Aug 11/76 | 250.54 MP | 1199.0 | |
| Aug 31/76 | 250.37 MP | 1199.6 | |
| Sept 28/76 | 249.10 MP | 1203.7 | |
| Oct 27/76 | 248.24 MP | 1206.6 | |
| Nov 24/76 | 248.36 MP | 1206.2 | |
| Dec 21/76 | 248.86 MP | 1204.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2018.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 249.82 MP | 1201.4 | MP (2020.8) |
| Feb 6/77 | | | Treated with 105 lb NU-WELL acid well conditioner |
| Feb 11/77 | | | Blown with air |
| Feb 16/77 | 254.73 MP | 1186.1 | New MP = 1.05 m, TOC (2021.6) |
| Mar 16/77 | | | >200 m |
| Apr 14/77 | 243.10 MP | 1223.8 | New MP = 0.93 m TOC, (2021.2) |
| May 11/77 | 244.80 MP | 1217.9 | New MP = 0.84 m TOC, (2020.9) |
| June 8/77 | 246.42 MP | 1212.6 | |
| July 9/77 | 246.82 MP | 1211.3 | Sampled; temp. 8°C |
| Aug 4/77 | 247.83 MP | 1208.0 | |
| Aug 30/77 | 248.48 MP | 1205.9 | |
| Sept 28/77 | | | Could not measure |
| Oct 26/77 | 250.21 MP | 1200.2 | |
| Nov 23/77 | 250.40 MP | 1199.6 | |
| Dec 20/77 | 252.13 MP | 1193.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2018.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 252.88 MP | 1191.4 | MP (2020.9) |
| Feb 14/78 | 253.48 MP | 1189.5 | |
| Mar 15/78 | 254.16 MP | 1187.2 | |
| Apr 13/78 | 254.46 MP | 1186.3 | |
| May 10/78 | 254.67 MP | 1185.6 | |
| June 7/78 | 254.88 MP | 1184.9 | |
| July 9/78 | 254.41 MP | 1186.4 | Sample; temp. 10°C |
| Aug 1/78 | 254.47 MP | 1186.2 | |
| Aug 30/78 | 254.83 MP | 1185.0 | |
| Sept 27/78 | 255.07 MP | 1184.3 | |
| Oct 25/78 | 255.44 MP | 1183.1 | |
| Nov 21/78 | 255.97 MP | 1181.3 | |
| Dec 20/78 | 256.50 MP | 1179.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2018.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 255.73 MP | 1182.1 | MP (2020.9) |
| Feb 14/79 | | | Could not measure |
| Mar 15/79 | | | Could not measure |
| Apr 10/79 | | | Could not measure |
| May 9/79 | 258.30 MP | 1173.7 | |
| June 6/79 | 259.14 MP | 1170.5 | New MP 0.72m TOC (2020.5) |
| July 7/79 | 260.32 MP | 1166.6 | Sampled; temp. 8°C |
| Aug 2/79 | 261.30 MP | 1163.4 | |
| Aug 29/79 | 262.03 MP | 1161.0 | |
| Sept 26/79 | 262.59 MP | 1159.2 | |
| Oct 24/79 | 262.91 MP | 1158.1 | |
| Nov 21/79 | | | Could not measure |
| Dec 18/79 | 263.30 MP | 1156.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2018.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 263.59 MP | 1155.9 | |
| Feb 13/80 | 263.42 MP | 1156.5 | |
| Mar 11/80 | 263.59 MP | 1155.9 | |
| Apr 10/80 | | | Could not measure |
| May 6/80 | 264.14 MP | 1154.1 | |
| June 4/80 | 264.43 MP | 1153.2 | |
| July 8/80 | 264.57 MP | 1152.7 | Temp. 11°C |
| July 30/80 | 264.84 MP | 1151.8 | |
| Aug 27/80 | 264.93 MP | 1151.5 | |
| Sept 25/80 | 265.07 MP | 1151.1 | |
| Oct 22/80 | 265.09 MP | 1151.0 | |
| Nov 19/80 | 265.10 MP | 1151.0 | |
| Dec 19/80 | 265.51 MP | 1149.6 | |
| Jan 16/81 | 266.01 MP | 1148.0 | |
| Feb 11/81 | 266.30 MP | 1147.0 | |
| Mar 11/81 | 266.55 MP | 1146.2 | |
| Apr 7/81 | | | Could not measure |
| May 6/81 | 264.52 MP | 1152.9 | |
| June 2/81 | 266.32 MP | 1147.0 | |
| July 1/81 | 265.96 MP | 1148.2 | |
| July 29/81 | 265.85 MP | 1148.5 | |
| Aug 26/81 | | | Could not measure |
| Sept 23/81 | 265.27 MP | 1150.4 | |
| Oct 21/81 | 265.17 MP | 1150.7 | |
| Nov 17/81 | 265.22 MP | 1150.6 | |
| Dec 16/81 | 265.68 MP | 1149.1 | |

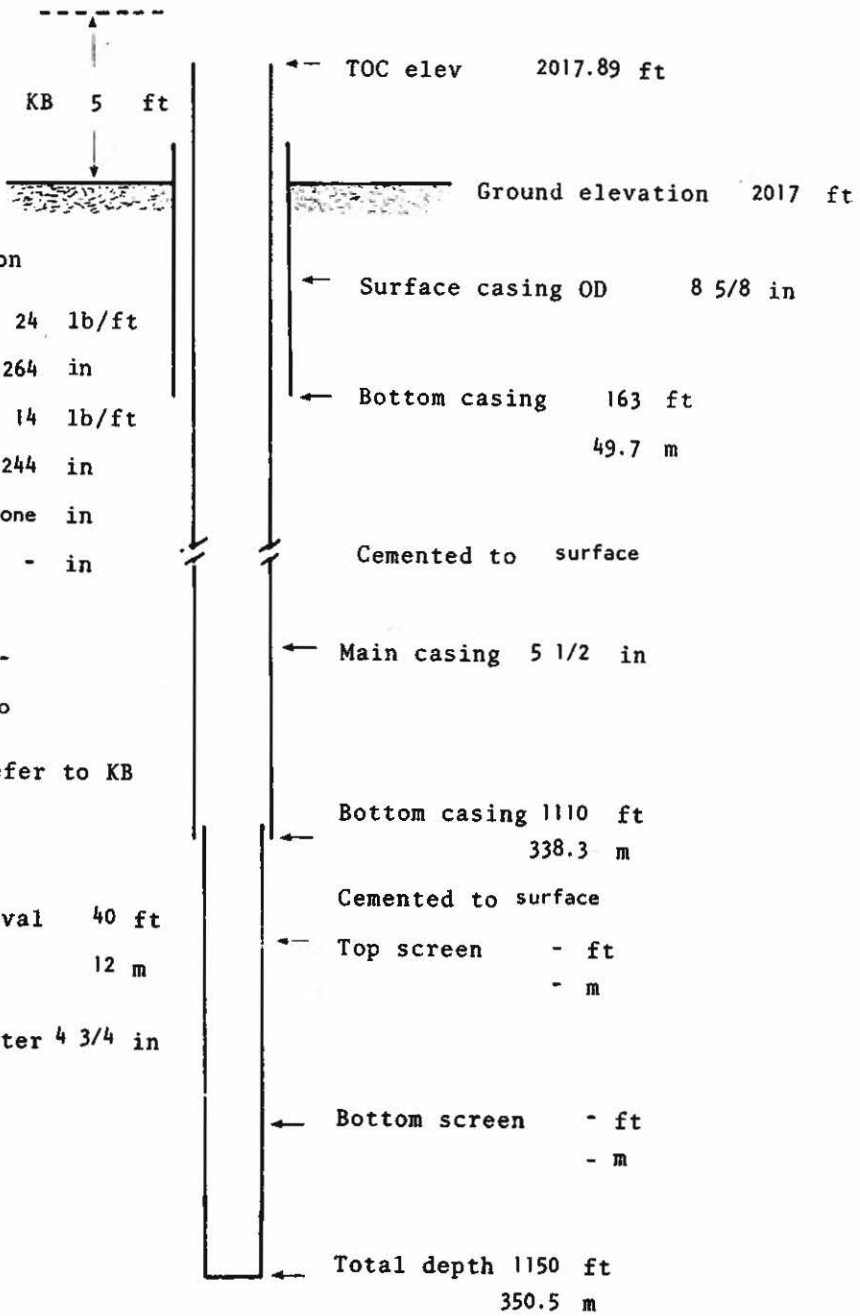
MP - Depth from measuring point
TOC - Depth from top of casing

**WELL CONSTRUCTION.**

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Tp 94 R 6 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | none | in |
| screen OD | - | in |
| slots per foot | | |
| material | - | |
| Sand pack | No | |

Note: all depths refer to KB

Open hole interval 40 ft
12 m

Open hole diameter 4 3/4 in

## DRILL STEM TEST

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Tp 94 R 6 W4th

Alberta Research Council

Elevation: gl 2017
KB 2019

Type of test - Casing Positrieve

Date of test March 4, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0830 | hrs |
| Tool opened | 1012 | hrs |
| First flow | 4 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1230 | hrs |
| Out of hole at | 1430 | hrs |
| Wt on packers | 5000 | lbs |

Description of blow Very faint initial puff, blow decreasing to nil in one minute.

Total water recovered 50 ft

Water sample No. DH 56

Gas blow No

Remarks Test satisfactory
5-1/2" RBP set @ 1066'

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2-3/8" IF

Drill collar size (ID) 2-3/8" IF

Drill collar length (ft) 41 ft

Open or screened interval 1110-1150

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 3.05 | |
| MFE Tool | 9.95 | |
| Sub | 0.60 | |
| Positrieve Packer | 1.85 | 5-1/2 IN |
| Total | 15.45 | |
| Packer Stub | 3.50 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.90 | |

### PRESSURE DATA (psi)

| Instrument No. | | RPG-92N | RPG-89N |
|---|---|---|---|
| Capacity (psig) | | 431 | 400 |
| Instrument set at (ft) | | 1068 | 1076 |
| Initial hydrostatic | A | 254 | 262 |
| First flow | B | 1 | 9 |
| | B1 | 30 | 43 |
| Initial shut in | C | 52 | 58 |
| Second flow | D | 25 | 37 |
| | D1 | 20 | 48 |
| Final shut in | G | 51 | 58 |
| Final hydrostatic | H | 245 | 252 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 9-1150

PRESSURE INCREMENTS

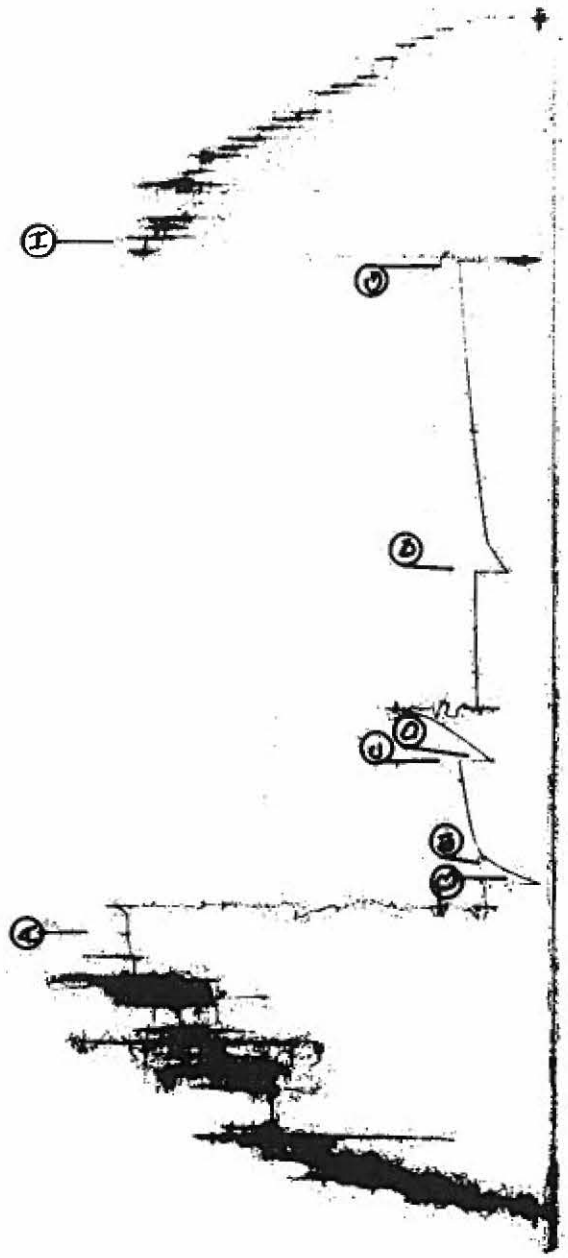
Recorder RPG-89N

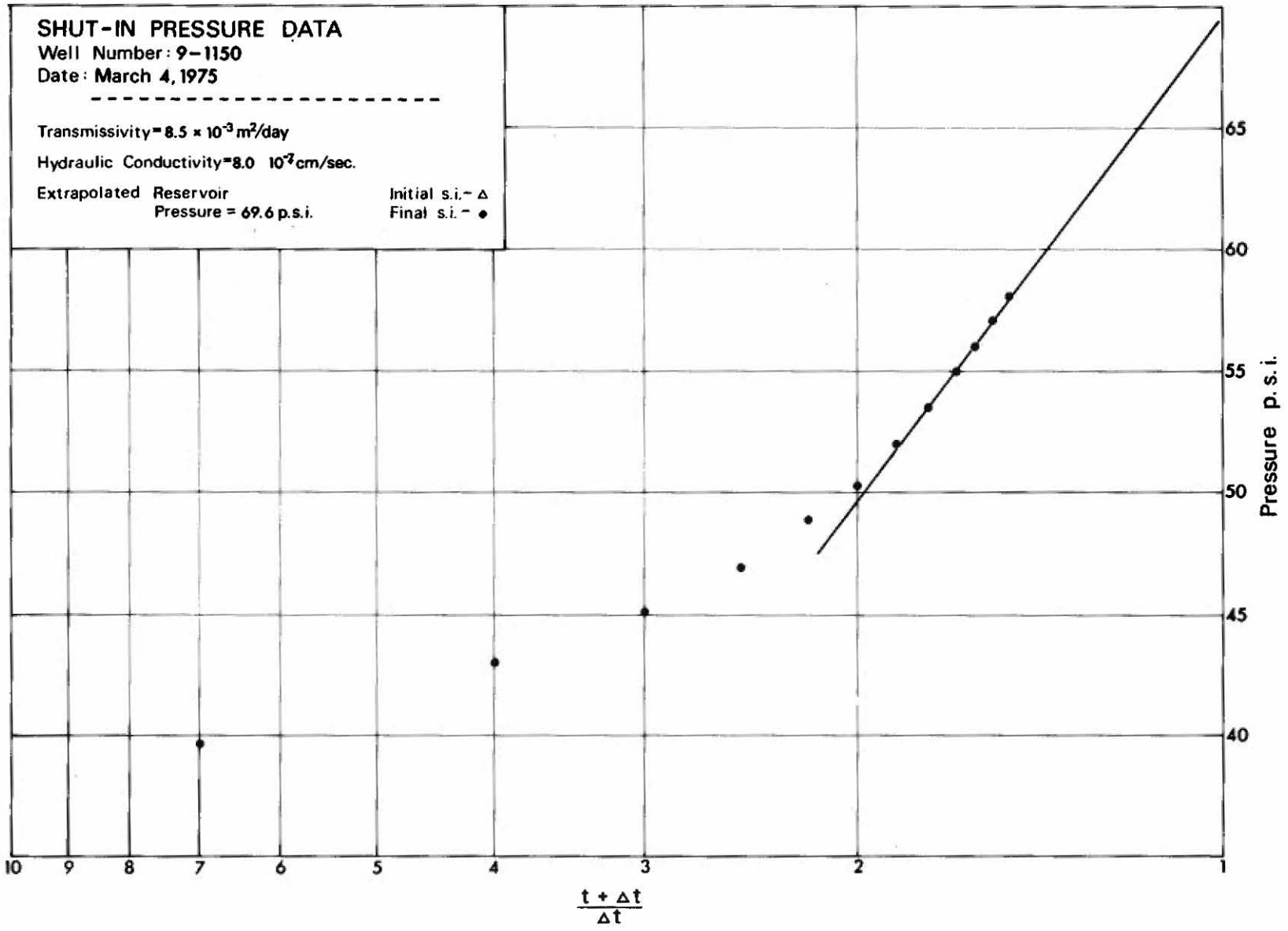
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 36.9 | 1.80 |
| 10 | 48.2 | 1.40 |
| 15 | 51.6 | 1.27 |
| 20 | 54.0 | 1.20 |
| 25 | 56.2 | 1.16 |
| 30 | 58.0 | 1.133 |

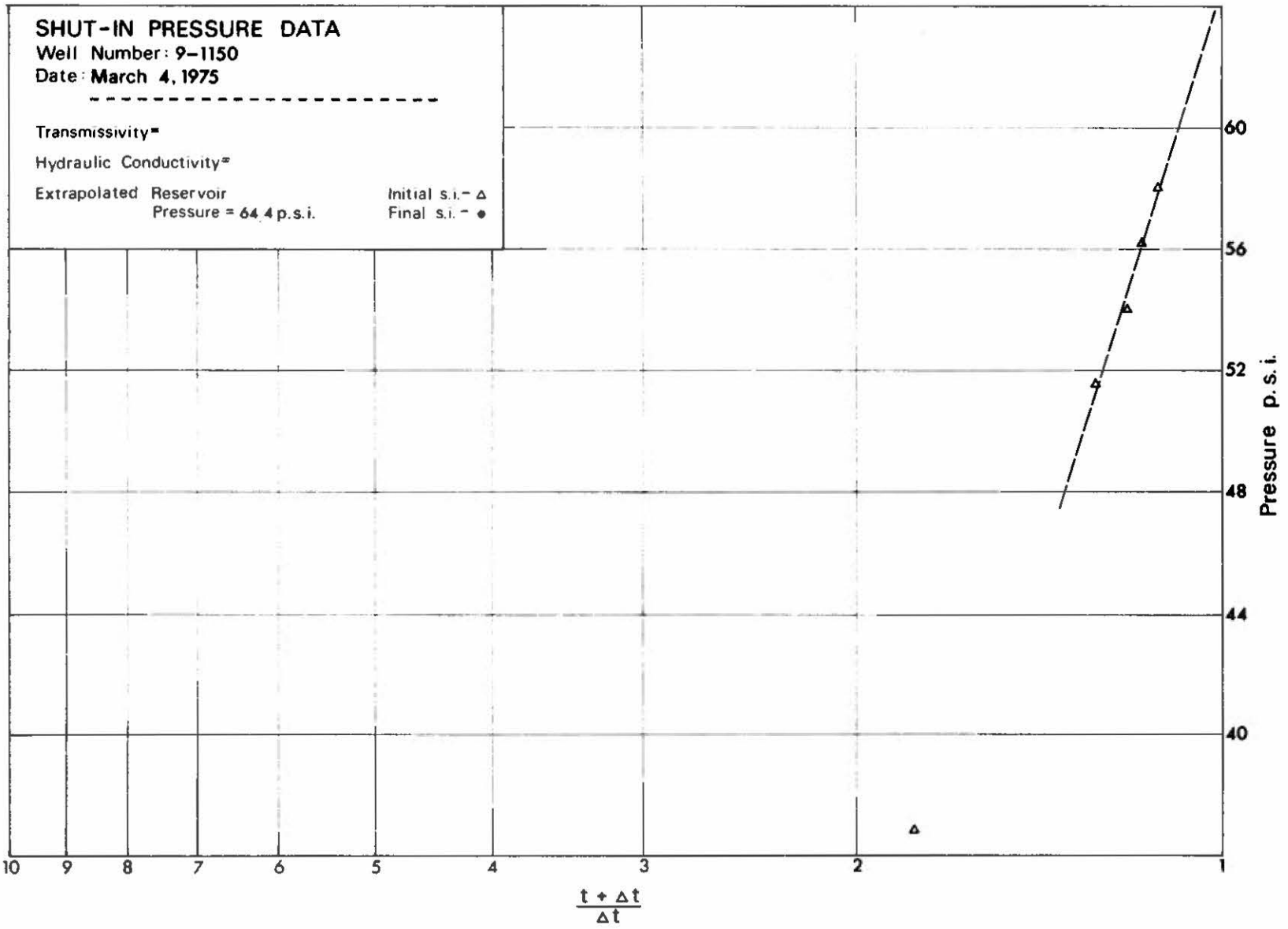
Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 39.6 | 7.00 |
| 10 | 42.9 | 4.00 |
| 15 | 45.1 | 3.00 |
| 20 | 46.9 | 2.50 |
| 25 | 48.8 | 2.20 |
| 20 | 50.3 | 3.00 |
| 35 | 52.0 | 1.86 |
| 40 | 53.6 | 1.75 |
| 45 | 54.9 | 1.67 |
| 50 | 56.0 | 1.60 |
| 55 | 57.0 | 1.55 |
| 60 | 58.0 | 1.50 |

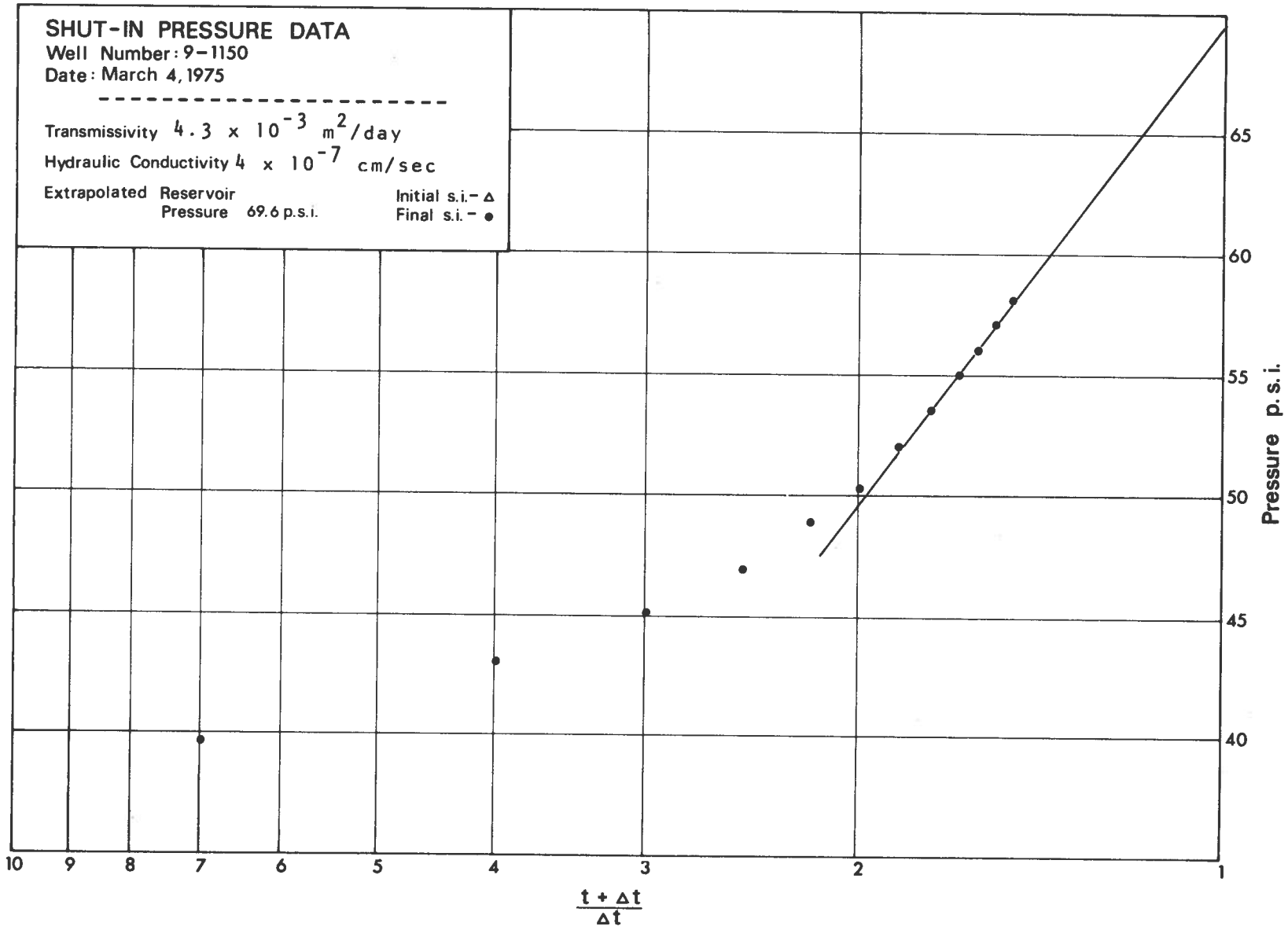



SHUT-IN PRESSURE DATA
Well Number: 9-1150
Date: March 4, 1975
Transmissivity = 8.5 × 10⁻³ m²/day
Hydraulic Conductivity = 8.0 10⁻² cm/sec.
Extrapolated Reservoir Pressure = 69.6 p.s.i.
Initial s.i. - Δ
Final s.i. - ●
65
60
55
50
45
40
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

9-1150-D-76


SHUT-IN PRESSURE DATA
Well Number: 9-1150
Date: March 4, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 64.4 p.s.i.
Initial s.i.- Δ
Final s.i. - ●
60
56
52
48
44
40
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

9-1150-D-76


SHUT-IN PRESSURE DATA
Well Number: 9-1150
Date: March 4, 1975
Transmissivity 4.3 x 10^-3 m^2/day
Hydraulic Conductivity 4 x 10^-7 cm/sec
Extrapolated Reservoir Pressure 69.6 p.s.i.
Initial s.i.- Δ
Final s.i. - ●
65
60
55
50
45
40
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

9-1150-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Drill stem test on 9-1150

Date sampled March 4, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 38.5 | 1.92 | 57.7 |
| Magnesium ($Mg^{++}$) | 1.6 | 0.13 | 3.9 |
| Sodium ($Na^{+}$) | 21.3 | 0.93 | 27.8 |
| Potassium ($K^{+}$) | 13.8 | 0.35 | 10.6 |
| Carbonate ($CO_3^{=}$) | 7.2 | 0.24 | 7.6 |
| Bicarbonate ($HCO_3^{-}$) | 83.0 | 1.36 | 43.2 |
| Sulfate ($SO_4^{=}$) | 0.0 | 0.00 | 0.0 |
| Chloride ($Cl^{-}$) | 54.0 | 1.52 | 48.4 |
| Nitrate ($NO_3^{=}$) | 1.6 | 0.03 | 0.8 |
| Silica ($SiO_2$) | 6.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 250.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3.149 | Total Cations (epm) | 3.332 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 330 |
| pH | 8.9 |
| Fluoride ($F^{-}$) | 0.1 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 5.0 |
| pH | 10.4 |
| Carbonate ($CO_3^{=}$) | 133 ppm |
| Bicarbonate ($HCO_3^{-}$) | 78 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled August 12, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 238 | 11.88 | 37 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 286 | 12.44 | 38 |
| Potassium ($K^{+}$) | 313 | 8.01 | 25 |
| Carbonate ($CO_3^{=}$) | 62 | 2.07 | 5 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 8.5 | 0.18 | 1 |
| Chloride ($Cl^{-}$) | 518 | 14.61 | 38 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.5 | | |
| Hydroxide ($OH^{-}$) | 370 | 21.75 | 56 |
| Calcium (Acidified) | 293 | | |
| Magnesium (Acidified) | 3.2 | | |
| Total dissolved solids | 1924 | | |
| Total Anions (epm) 38.62 | | Total Cations (epm) | 32.32 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | 4.0 |
| pH | 12.2 | pH | 11.5 |
| Fluoride ($F^{-}$) | | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Drill stem test on well 9-1150

Date of sampling March 4, 1975

Total dissolved solids 250 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | <.01 |
| Al | .04 | Mg | .05 |
| As | <.01 | Mn | .004 |
| B | .005 | Mo | ND |
| Ba | .01 | Ni | .03 |
| Be | ND | Pb | M |
| Bi | ND | Sb | ND |
| Ca | M | Si | .1 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .01 | V | ND |
| Fe | M | Zn | M |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 150.0 | 7.49 | 32 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 260.0 | 11.31 | 48 |
| Potassium ($K^{+}$) | 188.0 | 4.81 | 20 |
| Carbonate ($CO_3^{=}$) | 43.2 | 1.44 | 6 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 3.2 | 0.07 | 0 |
| Chloride ($Cl^{-}$) | 378.0 | 10.66 | 41 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.9 | | |
| Hydroxide ($OH^{-}$) | 233.0 | 13.70 | 53 |
| Calcium (Acidified) | 154.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 1328 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 25.88 | Total Cations (epm) | 23.61 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4500 | Temperature (C) | 6.0 | |
| pH | 12.1 | pH | 12.1 | |
| Fluoride ($F^{-}$) | 0.5 Mg/L | Carbonate ($CO_3^{=}$) | 67 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 231 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 9, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 545.0 | 27.20 | 41.6 |
| Magnesium ($Mg^{++}$) | 80.0 | 6.58 | 10.1 |
| Sodium ($Na^{+}$) | 650.0 | 28.27 | 43.3 |
| Potassium ($K^{+}$) | 129.0 | 3.30 | 5.0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 710.0 | 11.64 | 30.2 |
| Sulfate ($SO_4^{=}$) | 66.5 | 1.38 | 3.6 |
| Chloride ($Cl^{-}$) | 900.0 | 25.38 | 66.0 |
| Nitrate ($NO_3^{=}$) | 4.5 | 0.07 | 0.2 |
| Silica ($SiO_2$) | 6.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 535.0 | | |
| Magnesium (Acidified) | 72.0 | | |
| Total dissolved solids | 6352.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 38.48 | Total Cations (epm) | 65.35 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 7000 | Temperature (C) | 10.0 |
| pH | 6.9 | pH | 6.8 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 908.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 232.0 | 11.58 | 26.9 |
| Magnesium(Mg) | 32.0 | 2.63 | 6.1 |
| Sodium(Na) | 579.0 | 25.18 | 58.5 |
| Potassium(K) | 142.0 | 3.63 | 8.4 |
| Carbonate(CO3) | 14.4 | 0.48 | 1.2 |
| Bicarbonate(HCO3) | 1232.0 | 20.19 | 50.3 |
| Sulphate(SO4) | 8.0 | 0.17 | 0.4 |
| Chloride(Cl) | 684.0 | 19.29 | 48.0 |
| Nitrate(NO3) | 1.9 | 0.03 | 0.1 |
| Silica(SiO2) | 0.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 218.0 | | |
| Magnesium(Acidified) | 25.6 | | |
| TDS(mg/l) | 4044.0 | | |
| Total Anions(epm) | 40.16 | Total Cations(epm) | 43.03 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3760 | | Temperature(C) | 11.00 | |
| pH | 8.9 | | pH | 10.2 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | 29 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 4 | mg/l |

9-1150-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 306.0 | 15.27 | 56.6 |
| Magnesium(Mg) | 0.0 | 0.00 | 0.0 |
| Sodium(Na) | 215.0 | 9.35 | 34.6 |
| Potassium(K) | 93.0 | 2.38 | 8.8 |
| Carbonate(CO3) | 31.2 | 1.04 | 3.8 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 5.6 | 0.12 | 0.4 |
| Chloride(Cl) | 288.0 | 8.12 | 29.9 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 0.5 | | |
| Hydroxide(OH) | 304.0 | 17.87 | 65.8 |
| Calcium(Acidified) | 233.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 1496.0 | | |
| Total Anions(epm) | 27.15 | Total Cations(epm) | 27.00 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 4460 | | Temperature(C) | 11.00 | |
| pH | 12.2 | | pH | 12.2 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | 39 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 305 | mg/l |

WATER ANALYSIS 9-1150-E-82

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Rge 6 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

## Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 305.0 | 15.25 | 57.9 |
| Magnesium(Mg) | 0.0 | 0.0 | 0.0 |
| Sodium(Na) | 206.0 | 8.96 | 34.0 |
| Potassium(K) | 83.0 | 2.13 | 8.1 |
| Carbonate(CO3) | 45.6 | 1.52 | 16.7 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 4.9 | 0.10 | 1.1 |
| Chloride(Cl) | 266.0 | 7.49 | 82.2 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 6.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 265.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 1208.0 | | |
| Total Anions(epm) | 9.12 | Total Cations(epm) | 26.33 |

## Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 4440 |
| pH | 12.2 |
| Fluoride | 0.2 mg/l |

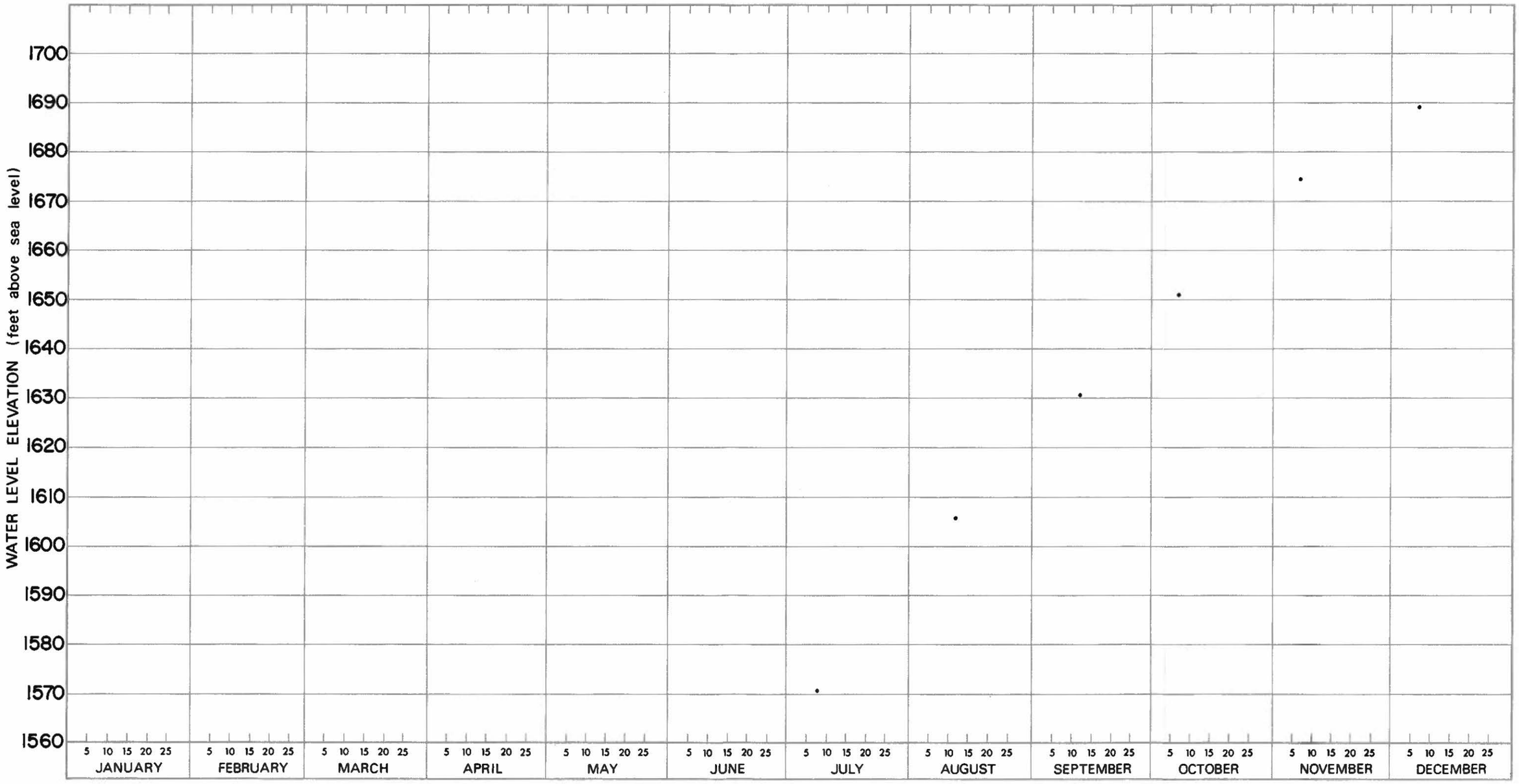
Field:

| | | |
|---|---|---|
| Temperature | 11.00 | |
| pH | 12.3 | |
| Carbonate(CO3) | 29 | mg/l |
| Bicarbonate(HCO3) | 0 | mg/l |
| Hydroxide(OH) | 292 | mg/l |

WATER LEVEL HYDROGRAPH

9-1150-H-76

OBSERVATION WELL NUMBER 9-1150
Lsd 16 Sec 4 Twp 94 R 6 W4th
Alberta Research Council




1975

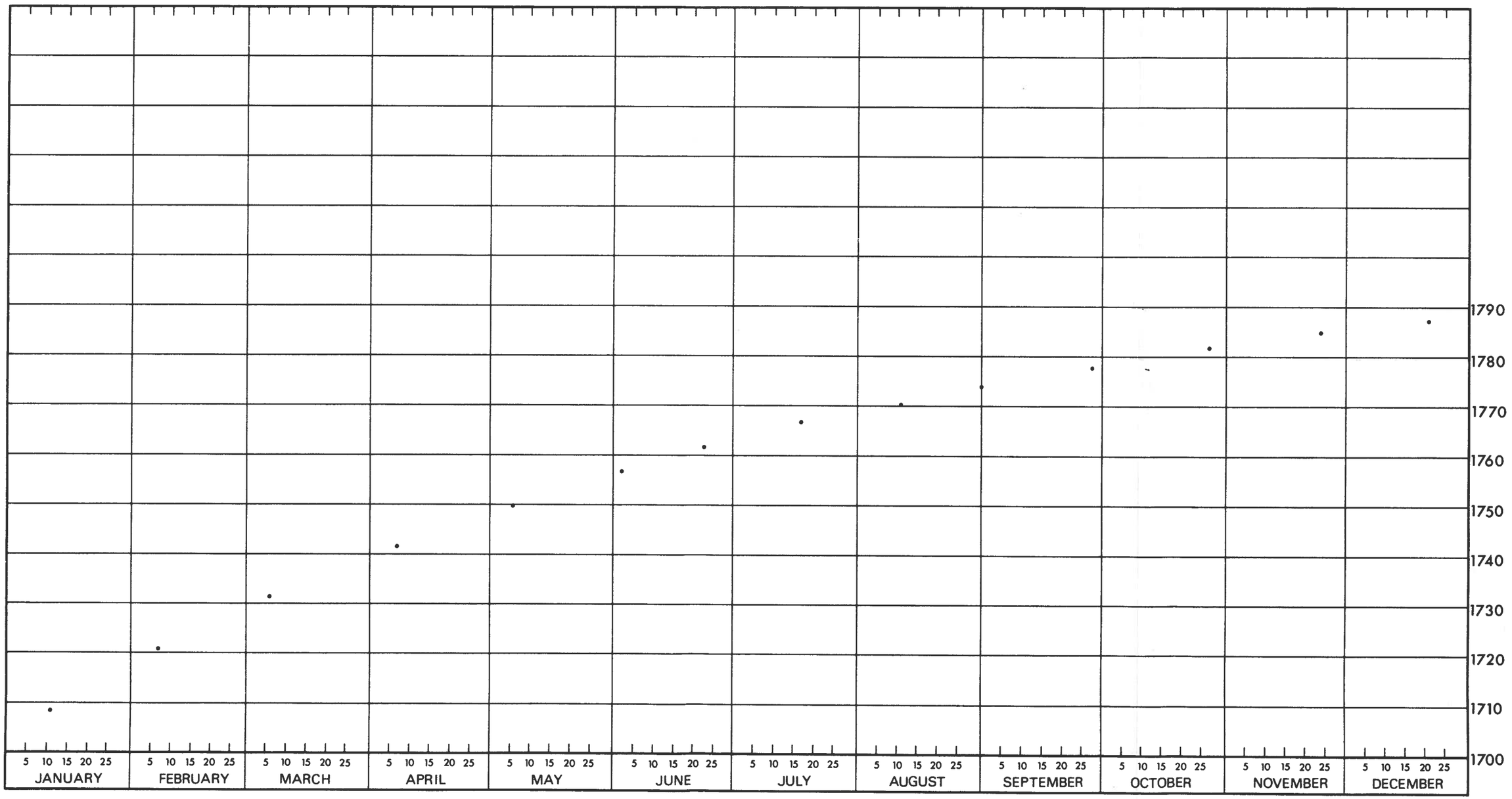
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **9-1150**

Lsd **16** Sec **4** Twp **94** R **6** W4th

Alberta Research Council

9 - 1150 - H - 77




1976

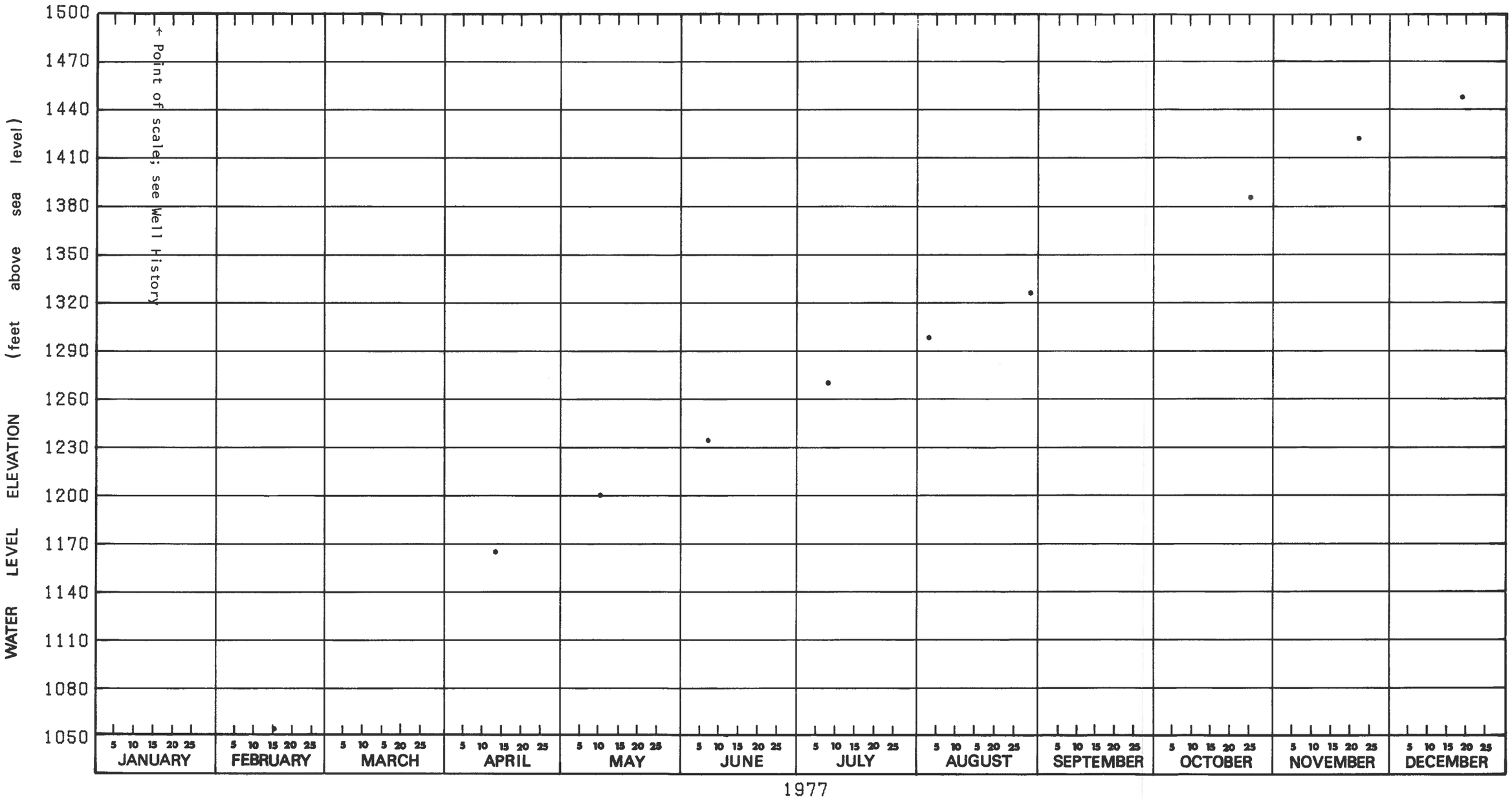
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6W 4 th

Alberta Research Council

9-1150-H-78



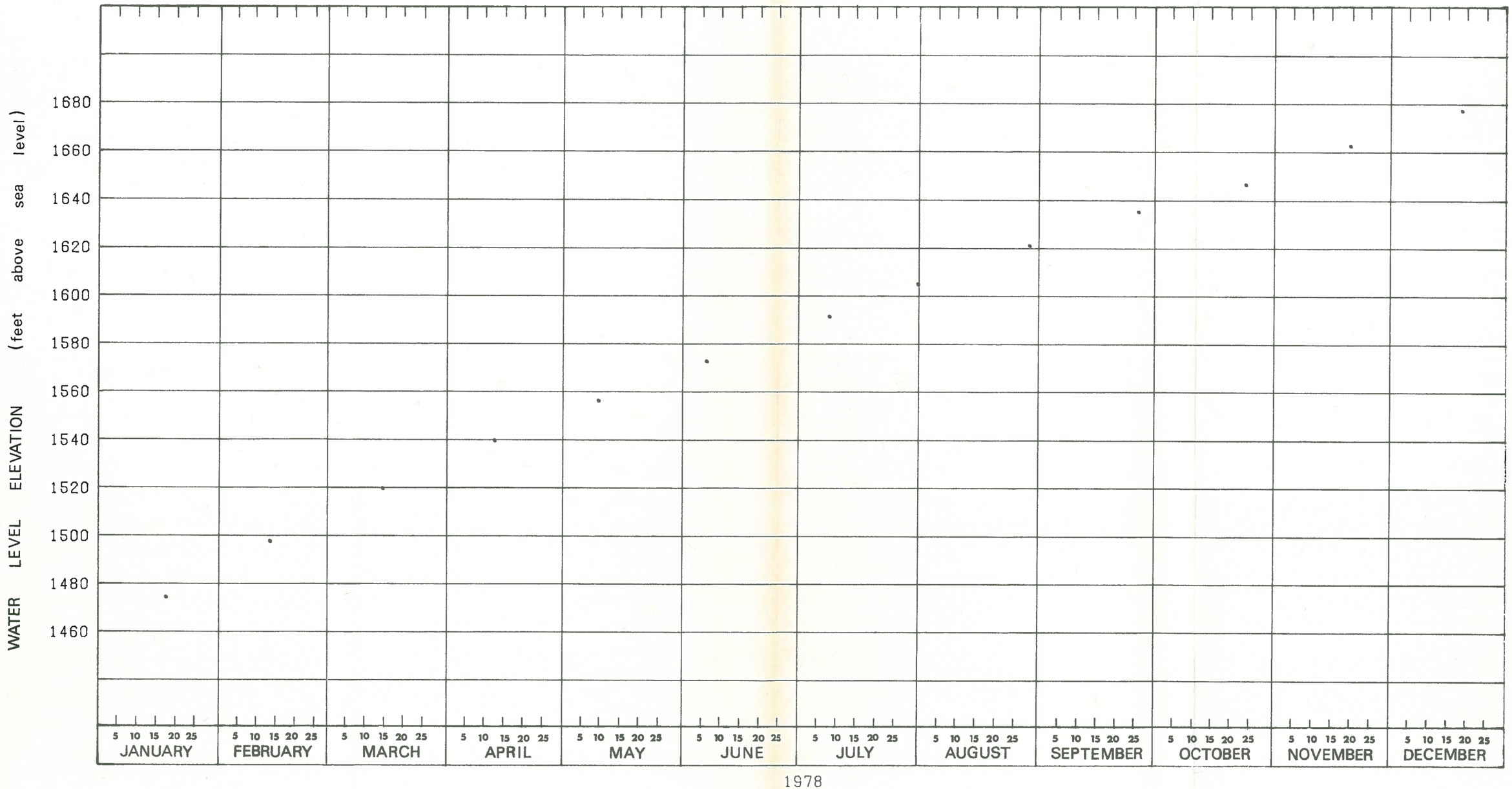
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1150

LSD 16 SEC 4 TWP 94 R 6 W4TH

Alberta Research Council

9-1150-H-79




1978

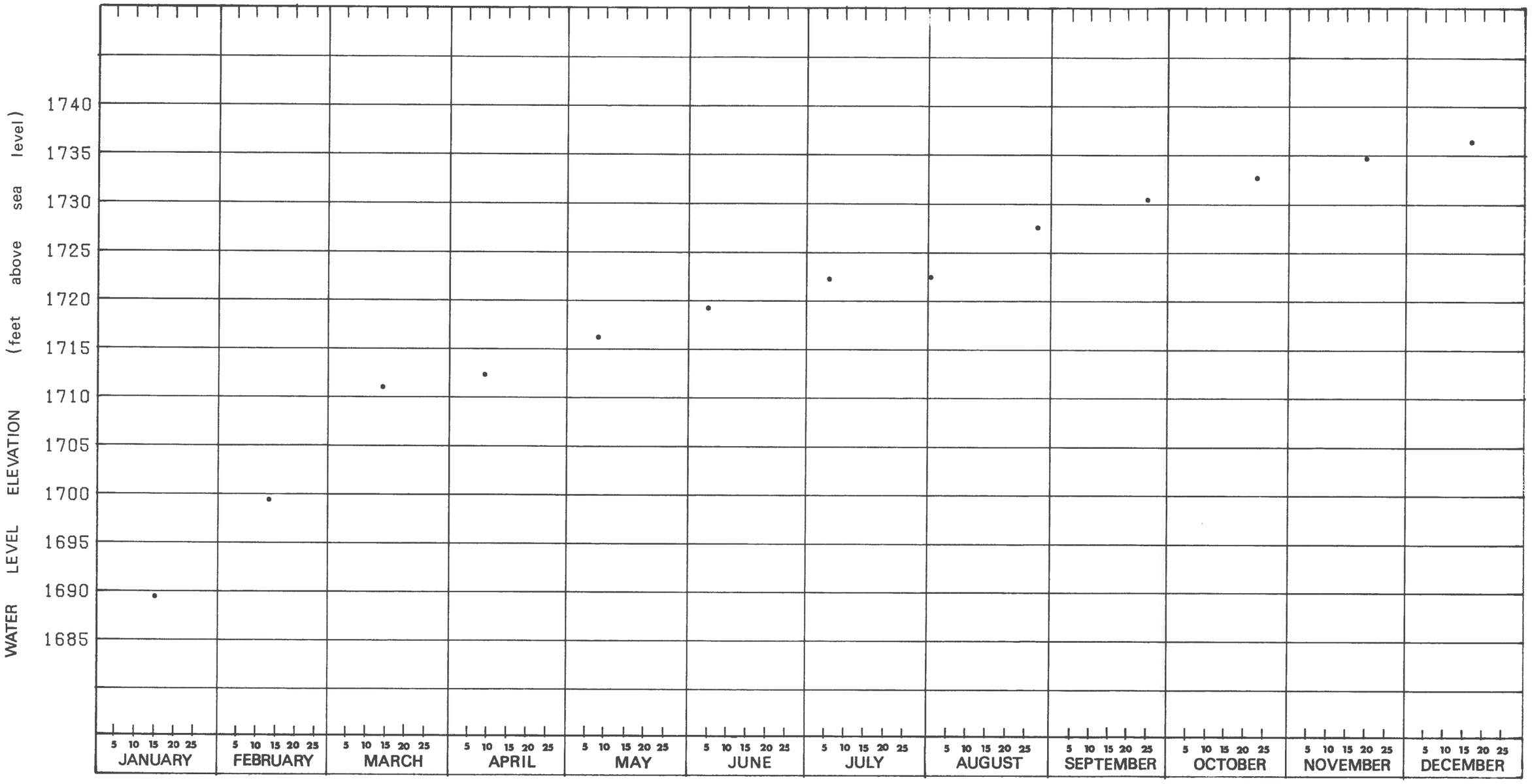
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-1150-H-80




1979

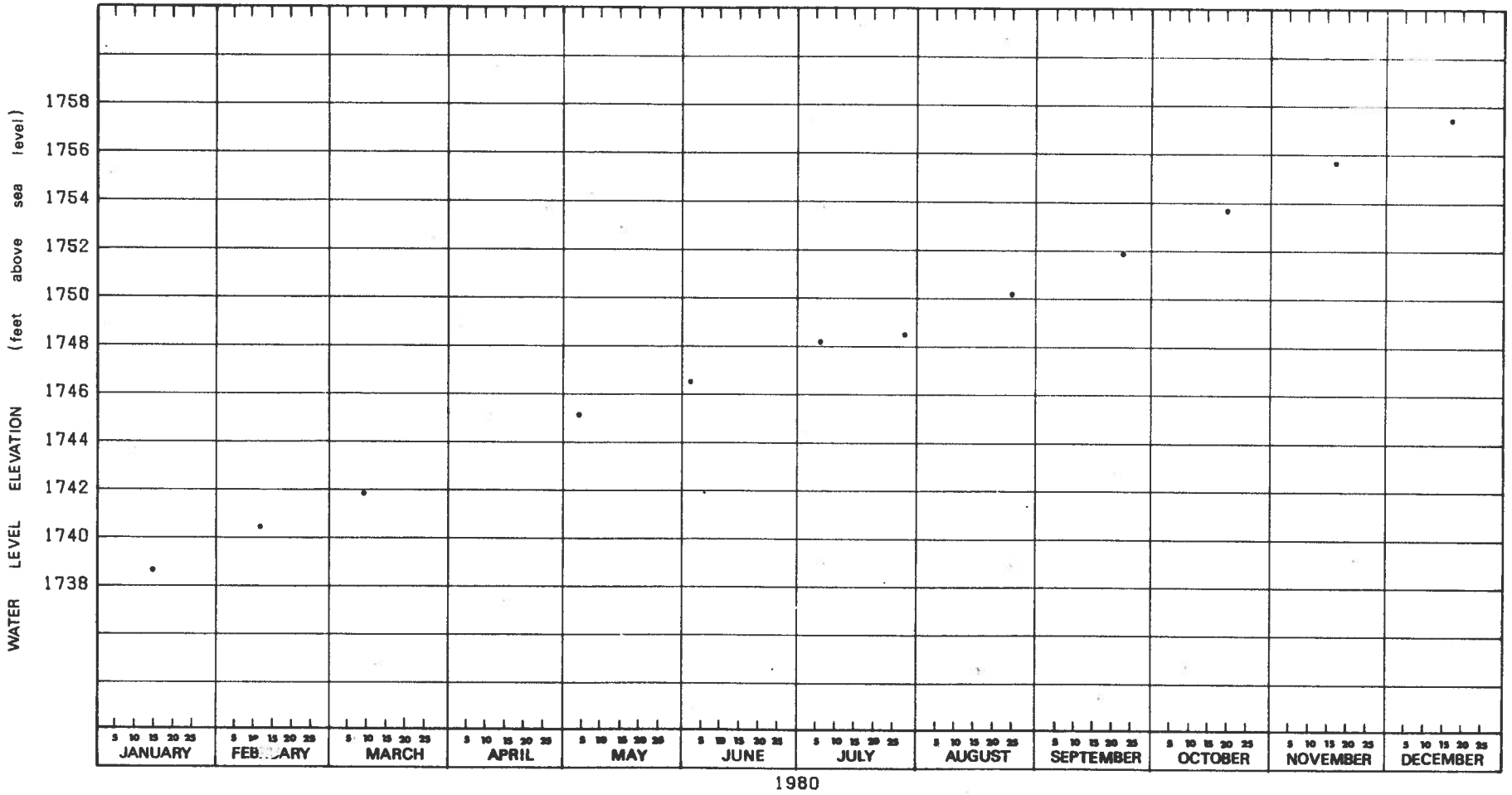
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-1150-H-81



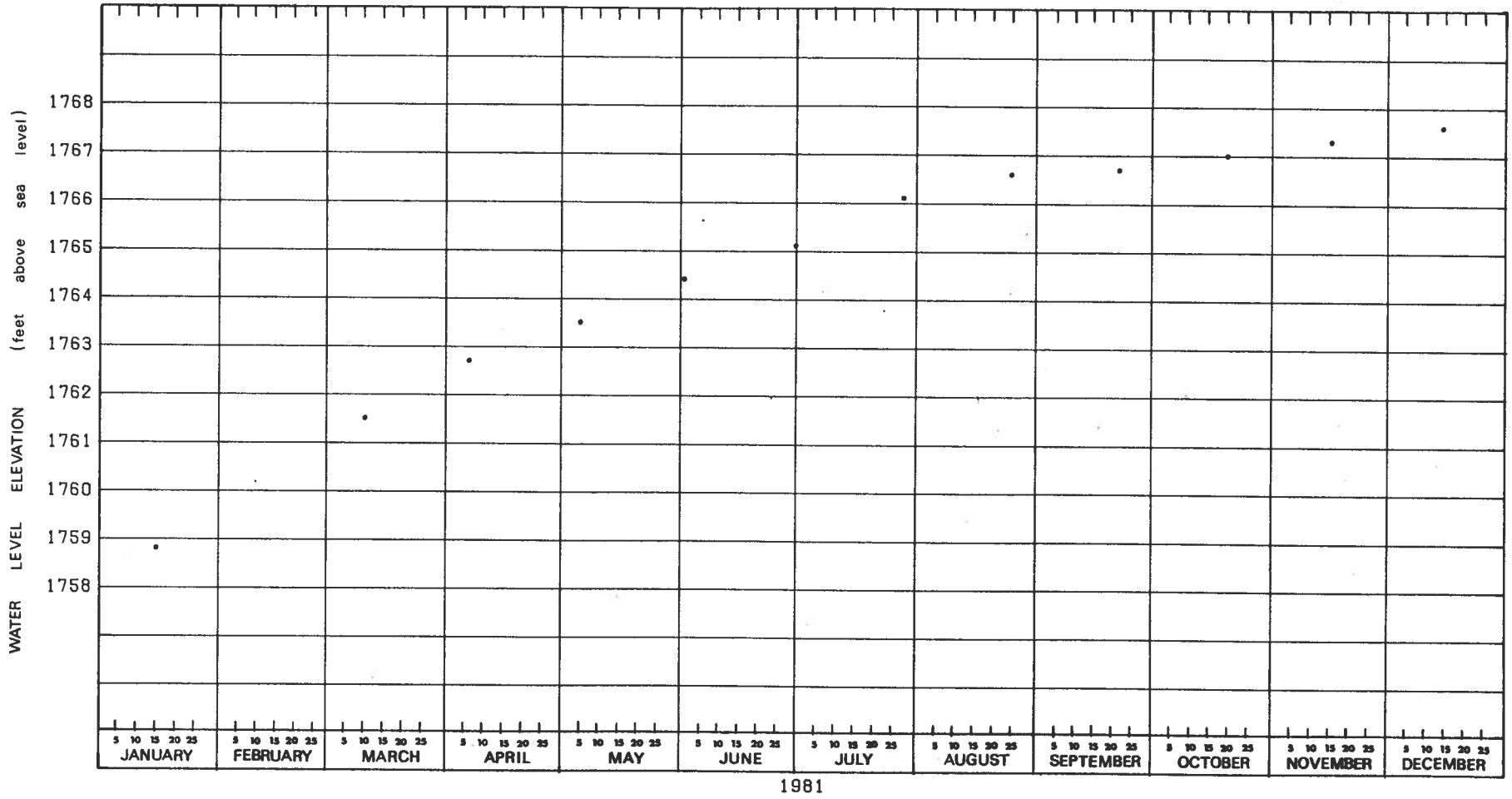
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4 th

Alberta Research Council

9-1150-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2017.89

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 25/75 | | | Well completed |
| Feb 26/75 | 57.63 TOC | 1828.80 | Bail 420 gallons |
| Mar 4/75 | | | DST; water sample; FSI = 69.6# from 1068 |
| Mar 14/75 | | | Shelter installed; MP = 2.80' TOC, (2020.69) |
| May 13/75 | | | New MP = 32", (2020.56) |
| July 8/75 | 137.23 MP | 1570.44 | |
| Aug 12/75 | 126.50 MP | 1605.64 | Sampled well at 1117' |
| Sept 12/75 | 118.98 MP | 1630.31 | |
| Oct 7/75 | 112.74 MP | 1650.77 | |
| Nov 7/75 | 105.60 MP | 1674.19 | |
| Dec 7/75 | 101.06 MP | 1689.08 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2017.89

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 95.18 MP | 1708.4 | MP (2020.6) |
| Feb 7/76 | 91.35 MP | 1721.0 | |
| Mar 6/76 | 88.11 MP | 1731.6 | |
| Apr 7/76 | 85.04 MP | 1741.7 | |
| May 6/76 | 82.54 MP | 1750.0 | New MP = 0.85 m TOC, (2020.7) |
| June 2/76 | 80.42 MP | 1756.9 | |
| June 23/76 | 78.88 MP | 1762.0 | |
| July 17/76 | 77.33 MP | 1767.1 | Sampled; temp. 6°C |
| Aug 11/76 | 76.28 MP | 1770.5 | |
| Aug 31/76 | 75.20 MP | 1774.0 | |
| Sept 28/76 | 73.89 MP | 1778.3 | |
| Oct 27/76 | 72.75 MP | 1782.1 | |
| Nov 24/76 | 71.81 MP | 1785.2 | |
| Dec 21/76 | 71.05 MP | 1787.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2017.89

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 70.56 MP | 1789.2 | MP (2020.7) |
| Feb 6/77 | | | Treated with 140 lb NU-WELL acid well conditioner |
| Feb 8/77 | | | Blown with air |
| Feb 16/77 | 294.59 MP | 1055.0 | New MP = 1.03 m TOC, (2021.3) |
| Mar 16/77 | | | >200 m |
| Apr 14/77 | 261.05 MP | 1164.6 | New MP = 0.88 m TOC, (2020.8) |
| May 11/77 | 250.26 MP | 1199.9 | |
| June 8/77 | 239.96 MP | 1233.7 | |
| July 9/77 | 229.06 MP | 1269.5 | Sampled; temp. 10°C |
| Aug 4/77 | 220.48 MP | 1297.6 | |
| Aug 30/77 | 212.05 MP | 1325.3 | |
| Sept 28/77 | | | Could not measure; tape stuck to casing |
| Oct 26/77 | 193.92 MP | 1384.7 | |
| Nov 23/77 | 182.82 MP | 1421.1 | |
| Dec 20/77 | 175.00 MP | 1446.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2017.89

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 166.58 MP | 1474.4 | MP (2020.8) |
| Feb 14/78 | 159.52 MP | 1497.6 | |
| Mar 15/78 | 152.73 MP | 1519.8 | |
| Apr 13/78 | 146.65 MP | 1539.8 | |
| May 10/78 | 141.55 MP | 1556.5 | |
| June 7/78 | 136.59 MP | 1572.8 | |
| July 9/78 | 130.85 MP | 1591.6 | Sampled; temp. 11°C |
| Aug 1/78 | 126.76 MP | 1605.0 | |
| Aug 30/78 | 121.85 MP | 1621.1 | |
| Sept 27/78 | 117.55 MP | 1635.2 | |
| Oct 25/78 | 114.08 MP | 1646.6 | |
| Nov 21/78 | 109.14 MP | 1662.8 | |
| Dec 20/78 | 104.64 MP | 1677.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2017.89

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 100.99 MP | 1689.5 | MP (2020.8) |
| Feb 14/79 | 97.96 MP | 1699.5 | |
| Mar 15/79 | 94.43 MP | 1711.1 | |
| Apr 10/79 | 94.03 MP | 1712.4 | |
| May 9/79 | 92.85 MP | 1716.3 | |
| June 6/79 | 91.92 MP | 1719.3 | |
| July 7/79 | 90.92 MP | 1722.3 | New MP 0.84m TOC (2020.5) |
| July 7/79 | | | Sample; temp. 11°C |
| Aug 2/79 | 90.84 MP | 1722.5 | |
| Aug 29/79 | 89.29 MP | 1727.6 | |
| Sept 26/79 | 88.42 MP | 1730.5 | |
| Oct 24/79 | 87.74 MP | 1732.7 | |
| Nov 21/79 | 87.13 MP | 1734.7 | |
| Dec 18/79 | 86.60 MP | 1736.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 9-1150

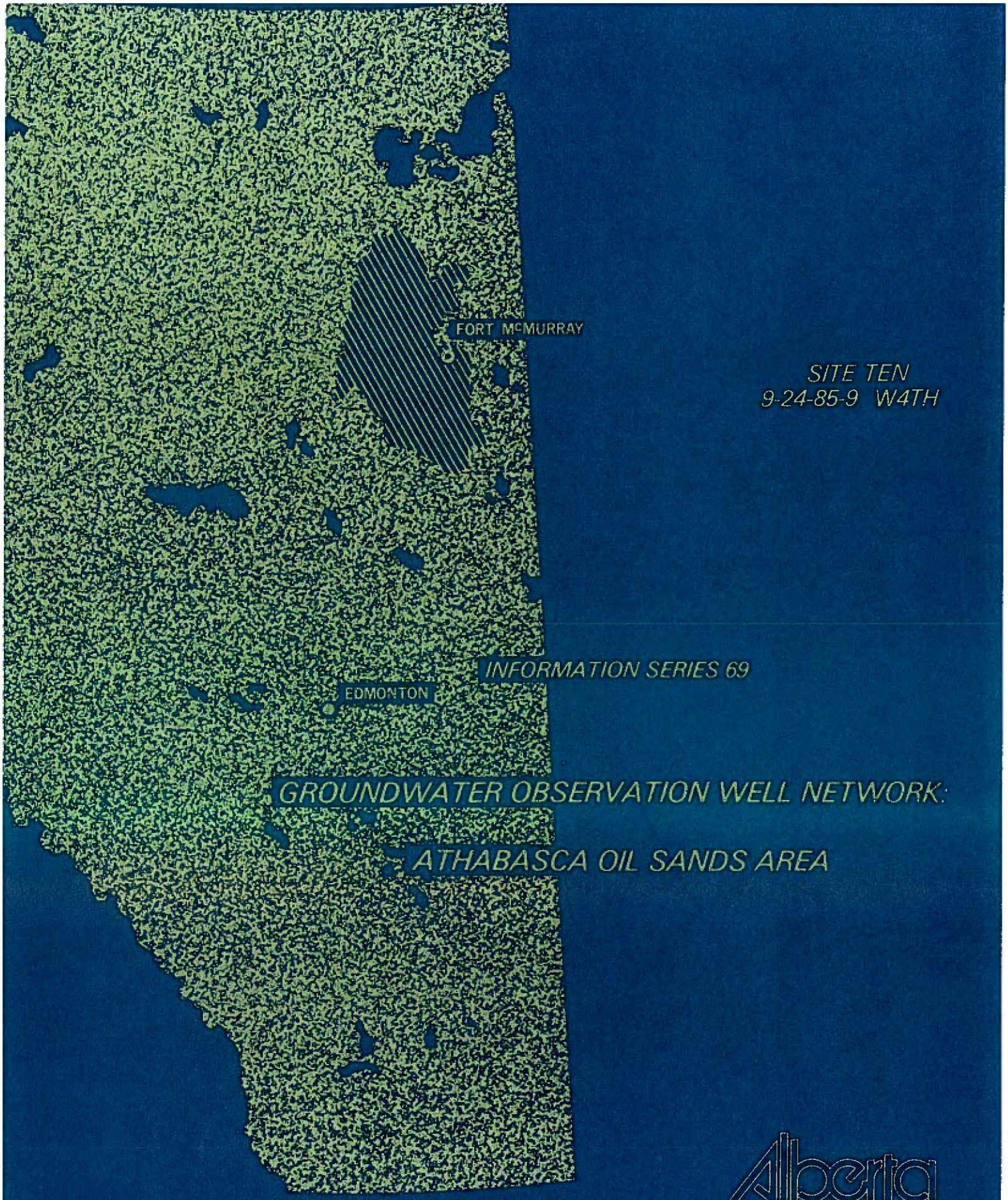
Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2017.89

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 85.95 MP | 1738.6 | |
| Feb 13/80 | 85.40 MP | 1740.4 | |
| Mar 11/80 | 84.96 MP | 1741.8 | |
| Apr 10/80 | | | Could not measure |
| May 6/80 | 83.97 MP | 1745.1 | |
| June 4/80 | 83.54 MP | 1746.5 | |
| July 8/80 | 83.02 MP | 1748.2 | Temp. 11°C |
| July 30/80 | 82.93 MP | 1748.5 | |
| Aug 27/80 | 82.42 MP | 1750.2 | |
| Sept 25/80 | 81.90 MP | 1751.9 | |
| Oct 22/80 | 81.33 MP | 1753.7 | |
| Nov 19/80 | 80.74 MP | 1755.7 | |
| Dec 19/80 | 80.19 MP | 1757.5 | |
| Jan 16/81 | 79.79 MP | 1758.8 | |
| Feb 11/81 | 79.36 MP | 1760.2 | |
| Mar 11/81 | 78.96 MP | 1761.5 | |
| Apr 7/81 | 78.60 MP | 1762.7 | |
| May 6/81 | 78.36 MP | 1763.5 | |
| June 2/81 | 78.09 MP | 1764.4 | |
| July 1/81 | 77.86 MP | 1765.1 | |
| July 29/81 | 77.56 MP | 1766.1 | |
| Aug 26/81 | 77.42 MP | 1766.6 | |
| Sept 23/81 | 77.37 MP | 1766.7 | |
| Oct 21/81 | 77.28 MP | 1767.0 | |
| Nov 17/81 | 77.18 MP | 1767.3 | |
| Dec 16/81 | 77.10 MP | 1767.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing




SITE TEN
9-24-85-9 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

## INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites (numbers 1, 2, 3, 6, 7, 8 and 9), containing 36 individual wells, were instrumented in this manner during the winter of 1974-75. Eight sites (numbered 10, 11, 12, 13, 14, 15 16 and 17), containing 38 individual wells, were instrumented during the winter of 1975-76.

The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The page indexing system is also consistent with the updating process. All update volumes will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this Introduction and a Legend. There are 15 piezometer nests in the system and thus there are 15 separate

site publications in Information Series 69. Table 1 lists the location of wells in the system as of August 31, 1976. Figure 1 indicates the location of these wells. Publications are available as of the date of this document for all sites.

Five oil companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing.

## ACKNOWLEDGMENTS

The installation and monitoring of wells in this Program was funded by Alberta Energy and Natural Resources; Non-Renewable Resources Division.

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1976: BPOG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., Shell Canada Ltd. and Home Oil Company Ltd.

D. Hackbarth

EDMONTON

1977

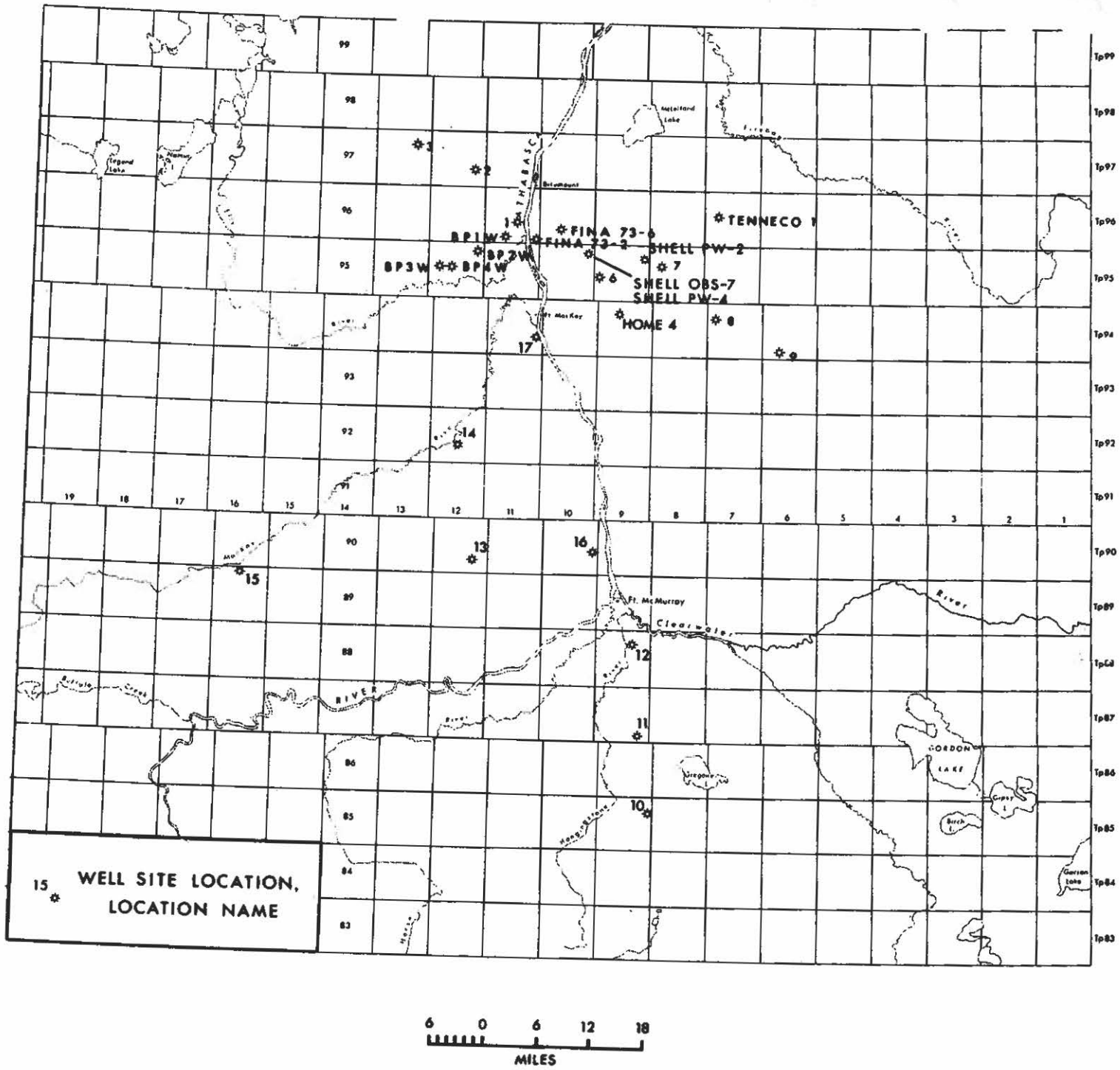



FIGURE 1. Athabasca Oil Sands observation well network, January 1977

Table 1

Athabasca Oil Sands Observation Wells

August 31, 1976

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 9-24-85-9 | 10 |
| Lsd 16-2-87-9 | 11 |
| Lsd 8-27-88-9 | 12 |
| Lsd 8-11-90-12 | 13 |
| Lsd 4-15-92-12 | 14 |
| Lsd 15-33-89-16 | 15 |
| Lsd 6-13-90-10 | 16 |
| Lsd 13-12-94-11 | 17 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |
| Lsd 3-28-94-9 | Home 4 |
| Lsd 10-25-95-10 | Shell PW-4 |
| Lsd 10-24-95-9 | Shell PW-2 |
| Lsd 10-25-95-10 | Shell Obs-7 |

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

Well Number - the name used for designating the well

Subject Code - as follows:

| | |
|---|---|
| I | - Introduction (no site number indicated) |
| L | - Legend (no site number indicated) |
| G | - General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents |
| C | - Well construction details |
| D | - Drill stem testing |
| A | - Aquifer testing |
| E | - Chemical analyses including multielement analyses and routine water analyses |
| H | - Annual hydrograph |
| W | - Well history |

Year of Publication - the last two numerals of the year of publication.

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within tha tabbed section for that particular well.

# GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
| | sandstone, arkosic |
| | silt |
| | siltstone |
| | siltstone & sandstone |
| | clay |
| | clay, sandy |
| | claystone, shale |
| | sandstone & shale |
| | oil sand |
| | limestone |
| | limestone, shaley |
| | dolomite |
| | dolomite, argillaceous |
| | rock salt |
| | gypsum & anhydrite |
| | coal |
| | igneous rock |

| Symbol | Stratigraphic Unit |
|---|---|
| | Pleistocene and Recent |
| Qd | Surface deposits |
| | Cretaceous |
| Ks | Smoky Group |
| Klb | La Biche Formation |
| Kd | Dunvegan Formation |
| Ksh | Shaftesbury Formation |
| Kpl | Pelican Formation |
| Kj | Joli Fou Formation |
| Kg | Grand Rapids Formation |
| Kc | Clearwater Formation |
| Kw | Wabiskaw Member |
| Km | McMurray Formation |
| | Devonian |
| Dwd | Woodbend Group |
| Dbl | Beaverhill Lake Formation |
| Dsw | Slave Point Formation & Fort Vermilion Formation & Watt Mountain Formation |
| Dmk | Muskeg Formation |
| Dpe | Prairie Evaporite Formation |
| Dm | Methy Formation (Keg River Formation equivalent) |
| Dmr | McLean River Formation (Chinchaga Formation equivalent) |
| Dl | La Loche Formation |
| | Precambrian |
| Pε | Undivided |

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

| Symbol | Units or Parameter |
|---|---|
| Sec. | section |
| ss | stainless steel |
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) or time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| WILL | Analysis done at Western Industrial Laboratories Ltd. |
| Wt | weight |

## GEOLOGICAL ABBREVIATIONS

| | |
|---|---|
| biocl | bioclast |
| brac | brachiopod |
| bry | bryozoan |
| calc | calcareous |
| carb | carbonaceous |
| cht | chert |
| fld | feldspar |
| glauc | glauconite, glauconitic |
| gvl | gravel |
| hvy | heavy |
| lt | light |
| mnrls | minerals |
| pbl | pebbles |
| qtz | quartz |
| strgr(s) | stringer(s) |
| stroms | stromotoporoids |
| subang | subangular |
| subrd | subrounded |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: a complete routine analysis and a multielement analysis (multielement radio frequency induction coupled plasma emission spectrometer). Some of the samples collected appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years. Results of analyses performed on samples obtained during July 1976 are included in this report.

Most routine water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source" and are limited to samples from wells contributed by oil companies. Spectral emission estimates were done at commercial laboratories.

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface
3. drill through the aquifer using very light mud
4. insert a screening device (if necessary)
5. develop the well with air.

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma, caliper and neutron were the logs run during the 1975-76 drilling. Results of the caliper logs are not presented. The geological log presented represents an interpretation based upon the sample

description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

4) A summary of contents page noting the number of pages in each of the subject areas that have been issued for that site. Pages which have been replaced because of errors are noted in the total.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells where the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, some wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the measuring tape sticking to the wet casing.

Drill stem testing equipment was utilized in two manners during the 1975-76 drilling program. Open hole - bottom hole drill stem tests

were conducted in the Devonian sediments to locate relatively productive zones for well completion. Casing tests were performed on completed wells at Site 10, 11 and 15 because of great depth to water or low permeability in the completion zone.

Information from these drill stem tests is presented under the heading "Drill Stem Testing". Results of open hole - bottom hole tests are presented in the section containing information about the deepest well at the Site as this is the hole in which the tests were conducted. An exception to this is at Site 14 where three tests were conducted on hole 14-699 and six tests performed in 14-1590.

A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day

V = volume of production into drill collars and stem

t = total flow time of test

T = transmissivity in millidarcy-feet

M = slope of final shut-in pressure plot

K = permeability in millidarcys (1 millidarcy = $10^{-6}$ cm/sec)

h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot. Calculations of transmissivity are according to the Modified Nonequilibrium Formula or the analogous Recovery Formula as follows:

$$T = \frac{0.92\ Q\ \log_{10}\ (t_2/t_1)}{d_2 - d_1} : \quad \text{(For pumping)}$$

or

$$T = \frac{0.92\ Q\ \log_{10}\ \left[\left(\frac{t + t'}{t'}\right)_2 - \left(\frac{t + t'}{t'}\right)_1\right]}{d_2 - d_1} : \quad \text{(For recovery)}$$

where:

$d_2$, $d_1$ = depth to water at corresponding subscripted time (meters) $d_2 > t_1$

$t_2$, $t_1$ = time since pumping started, $t_2 > t_1$

$t$ = length of time pumping

$t'$ = time since pumping stopped: $\left(\frac{t + t'}{t'}\right)_2 > \left(\frac{t + t'}{t'}\right)_1$

$T$ = transmissivity in sequence meters per day

$Q$ = pumping rate in imperial gallons per minute

That portion of the drawdown plot used to calculate the transmissivity is indicated on each drawing.

## SUMMARY OF CONTENTS

SITE NUMBER TEN

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | site | 10-47 | 10-165 | 10-592 | 10-1215 | 10-1530 | 10-1700 | 10-1905 |
| Introduction | 4 | — | — | — | — | — | — | — |
| Legend | 9 | — | — | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — | — | — |
| Geological Sample Description | 5 | — | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 2 | 2 | 2 | 4 | 6 |
| Shut-In Pressure Data | — | 0 | 0 | 2 | 2 | 2 | 3 | 5 |
| Water Analysis | — | 1 | 1 | 2 | 2 | 2 | 2 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

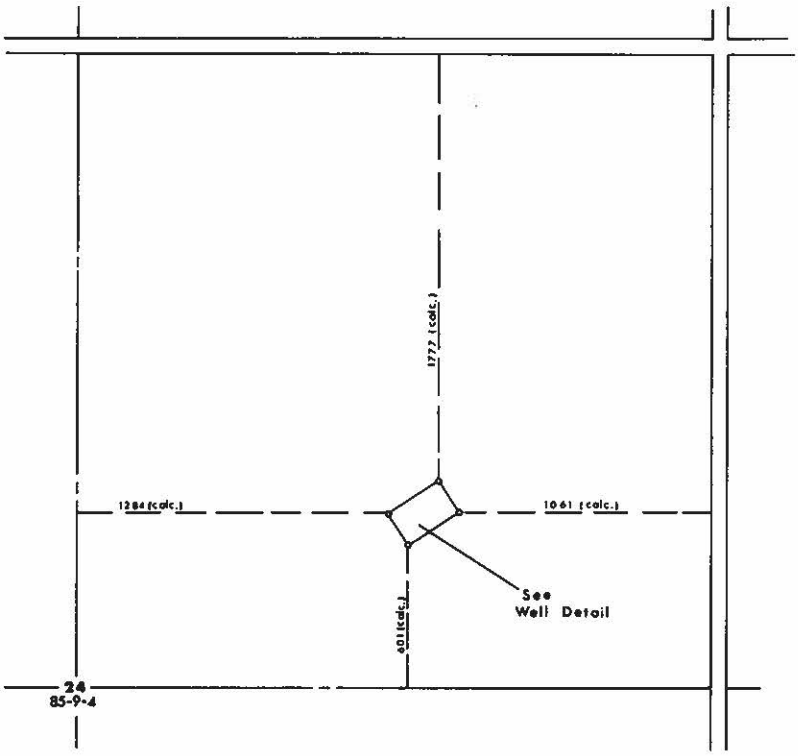
OBSERVATION WELL SITE 10

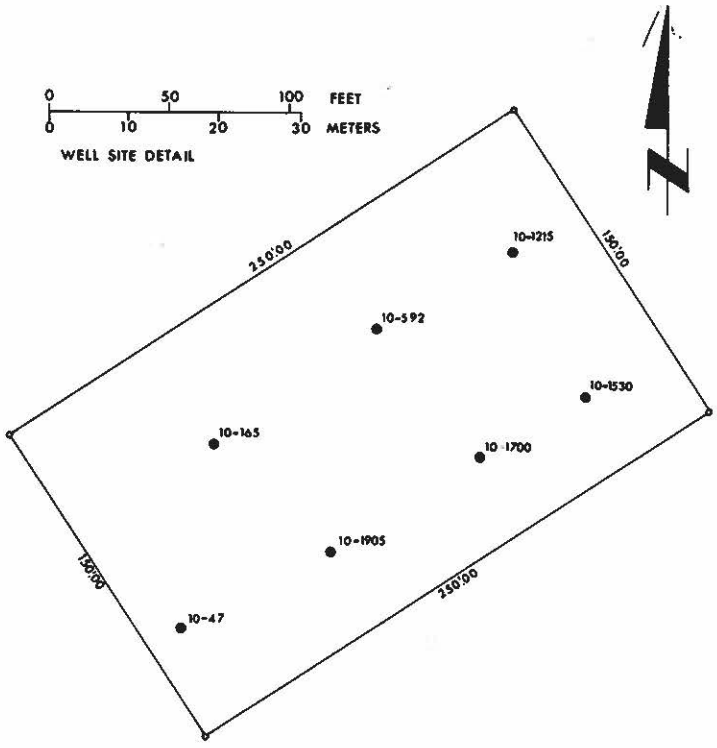
9-24-85-9 W 4th

ALBERTA RESEARCH COUNCIL

0 100 200 300 METERS

0 400 800 1000 FEET



# GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Ten

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Ground elevation 2505 Total depth 1905 feet

KB elevation 2513

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 8 | 10 | No samples | Drift |
| 10 | 30 | Sand, brown medium-coarse grained, pebbles (10%), excellent porosity, subang-subrd, qtz, cht, fld, hvy mnrl, silty strgrs (20%) | |
| 30 | 40 | Silt, grey, calc, brown, sandy strg (30-40%), good porosity subrd, qtz, cht, fld, hvy mnrl | |
| 40 | 70 | Silt, grey, calc; brown, sandy strg (10-15%), good porosity, subrd, qtz, cht, fld; dark grey clay interbed (30-40%) | |
| 70 | 90 | Sand, grey brown, fine-coarse grained, good-excellent porosity, subrd, qtz, cht, fld, calc, clay strg (20%) | |
| 90 | 110 | Sand, white-brown, fine-coarse grained, good-excellent porosity, poorly sorted, pebbles, qtz, cht, fld, hvy mnrl, mica, calc | |
| 110 | 120 | Sand, white-grey, medium-coarse grained, excellent porosity, subang-subrd, poorly sorted, boulderchips, qtz, cht, fld, dolomite, hvy mnrl, glauc, mica | |
| 120 | 130 | As above, some silty strg | |
| 130 | 160 | Gravel, to boulder size, sand of qtz, cht, fld and hvy mnrl, subang-subrd, poorly sorted, boulders of dolomite, granite, qtz. Excellent porosity | |
| 160 | 170 | Sand, white, silty-coarse grained, subang-subrd, poorly sorted, fair-good porosity, qtz, fld, cht, hvy mnrl, silt 30% | |
| 170 | 180 | Sand, white, medium-coarse grained, as above | |
| 180 | 190 | Sand, grey, as above, boulderchips; silty clay strg | |
| 190 | 240 | Clay, grey, silty, calc cement | |
| 240 | 260 | Clay, grey, silty, calc cement, sand, grey, fine strg (25-30%) | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Ten (continued)

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 260 | 290 | Clay, grey silty, calc cement; sand grey, fine strg (10-15%) | Drift |
| 290 | 350 | Unsorted drift; silt, grey, calc; sand, grey fine-coarse grained; subang, poorly sorted; pebbles, boulderchips | |
| 350 | 410 | Clay, grey, sandy, calc cement, soft; sand, grey, fine-coarse grained, strg (10-20%) | |
| 410 | 590 | Sand, light-brown, fine-coarse grained, subang-subrd, poorly sorted, excellent porosity, qtz, lt cht, fld, hvy mnrl, traces of siderite, kaolinite, mica, coal | |
| 590 | 630 | Sandy clay, grey, calc cement, pyrite traces; sand, light-brown, fine-coarse grained, strg (10-15%) | La Biche |
| 630 | 650 | Sand, light brown, fine-coarse grained, subang-subround, poorly sorted, excellent porosity, qtz, cht, fld, hvy mnrl, silty sand strg (10%) | |
| 650 | 690 | Sand, as above, fair-good porosity. Grey silty strg, calc cement (20-30%) | |
| 690 | 710 | Clay, grey-green, calc cement, silty in bottom | |
| 710 | 720 | Sand, grey-silty, coarse grained, subround, poorly sorted, fair-good porosity, qtz, fld | |
| 720 | 750 | Clay, grey-green calc cement. Sandy strg (20%) | |
| 750 | 770 | Shale, medium grey, calc; sandy and silty strg | |
| 770 | 790 | Sand, light-brown, fine-medium grained, subrd, medium sorted, good porosity, silty sand strg, qtz, fld, hvy mnrl. calc | |
| 790 | 850 | Shale, dark grey, calc, pyrite; interbedded with sand, light brown (20-30%), fine-medium grained | |

GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Ten (continued)

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 850 | 900 | Shale, dark grey, calc cement; grey, sandy clay. Traces of pyrite, kaolin, siderite, coal | |
| 900 | 935 | Shale, dark grey, calc cement. Pyrite and ferruginous traces | |
| 935 | 950 | Sand, medium grey, fine-medium grained, subang, medium sorted, fair-good porosity, qtz, fld, cht | Pelican |
| 950 | 970 | Shale, medium grey, calc, pyrite, silt lenses | Joli Fou |
| 970 | 980 | Shale, as above, coal (70%) | |
| 980 | 1000 | Sand, light grey, fine grained, subrd, well sorted fair-good porosity, qtz, fld, cht, glauc traces, silty strg 10-20% | Grand Rapids |
| 1000 | 1060 | Siltstone, light-grey, calc, micaceous, ferruginous; sand, light-grey, fine grained qtz, interbedded with shale (20-30%), medium grey, calc, pyrite, coal, ferruginous traces | |
| 1060 | 1080 | Sand, light-grey, fine grained, subrd, medium sorted, fair-good porosity, qtz, fld, cht, siderite; thin, dark grey shale strg, carb | |
| 1080 | 1090 | Shale, medium grey, silty, calc cement | |
| 1090 | 1140 | Sand, light-medium grey, fine-medium grained, subrd, well sorted, good-excellent; qtz, fld, dark cht. Shale and clay strg (10-20%) | |
| 1140 | 1160 | Clay, medium-dark grey, calc cemented, carb; sandy and silty strg (20-30%) | |
| 1160 | 1180 | Sand, light-grey, fine grained, subang-subrd, well sorted, good-excellent porosity, qtz, fld, black cht; carb, laminated grey clay and siltstone | |
| 1180 | 1210 | Sand, light-grey, fine-medium grained, subang-subrd, well sorted, excellent porosity, qtz, cht, carb, silty strg | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Ten (continued)

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 1210 | 1215 | Siltstone, grey, sandy interbeds, dark grey clay strg in bottom | |
| 1215 | 1240 | Shale, medium grey; interbedded with siltstone, grey, calc cement, carb, ferruginous | |
| 1240 | 1275 | Sandstone, light grey, fine-medium grained, subrd, good-excellent porosity, qtz, black cht, carb | |
| 1275 | 1300 | Siltstone, light grey; sand interlaminated with clay, light grey; dark grey shale and light grey, fine-grained sandstone | Clearwater |
| 1300 | 1320 | Clay, medium grey, silty, calc, ferruginous | |
| 1320 | 1375 | Siltstone, light grey, sandy, calc | |
| 1375 | 1410 | Clay, medium grey, calc, ferruginous; interbedded with light grey, sandy siltstone and dark grey shale, fossiliferous | |
| 1410 | 1460 | Clay, medium grey, calc, fossiliferous | |
| 1460 | 1470 | Sand, medium grey, fine grained, subrd, medium sorted, fair-good porosity | |
| 1470 | 1475 | Clay, medium grey-brown, silty, calc | |
| 1475 | 1490 | Sand, grey, fine grained; silty, medium grey clay, interbedded | |
| 1490 | 1515 | Clay, medium grey, silty, calc; interbedded with sand, grey, fine-medium grained, silty | |
| 1515 | 1540 | Sand, brown, fine-medium grained, subang, well sorted, good porosity, qtz, cht, fld, siderite, hvy mnrls, gypsum, carb, plant remains, lightly oil stained. Grey shale strg in the bottom | McMurray |
| 1540 | 1570 | Sand as above. Dark grey shale interbedded | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Ten (continued)

Lsd 9 Sec 24 Twp 85 R 9 W4th

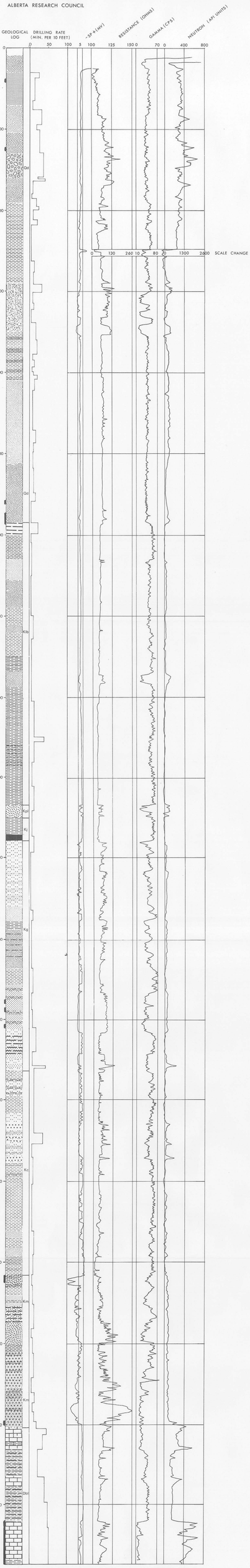
Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 1570 | 1600 | Sand, brown-grey, fine grained, subang-subrd, fair-good porosity, argillaceous, qtz, plant remains, heavily oil saturated; silt and clay strg | McMurray |
| 1600 | 1610 | Clay, light-grey, silty, carb | |
| 1610 | 1660 | Sand, light grey, fine grained, argillaceous, qtz, plant remains, heavily oil saturated; light grey siltstone and dark grey clay interbedded | |
| 1660 | 1670 | Clay, dark grey carb, bituminous | |
| 1670 | 1685 | Sand, grey, fine grained, subang-subrd, fair-good porosity, argillaceous, qtz, plant remains, heavily oil stained; light grey shale strg | |
| 1685 | 1705 | Sand, light grey, silty, carb, heavily oil stained; light grey shale strg | |
| 1705 | 1735 | Limestone, lt grey-buff, argillaceous, fossiliferous; interbedded with lt brown, calcareous siltstone and green-grey calcareous shale | Beaverhill Lake |
| 1735 | 1765 | Shale, lt grey, calcareous; limestone fragments, lt grey, argillaceous | |
| 1765 | 1775 | Limestone, lt grey, argillaceous, fossiliferous | |
| 1775 | 1820 | Shale, green-grey, calcareous | |
| 1820 | 1865 | Limestone, lt grey-buff, argillaceous, fossiliferous, pyrite traces | |
| 1865 | 1872 | Shale, medium grey, calcareous | |

GEOPHYSICAL AND GEOLOGICAL LOGS
OBSERVATION WELL SITE 10
9-24-85-9 W4th
ALBERTA RESEARCH COUNCIL



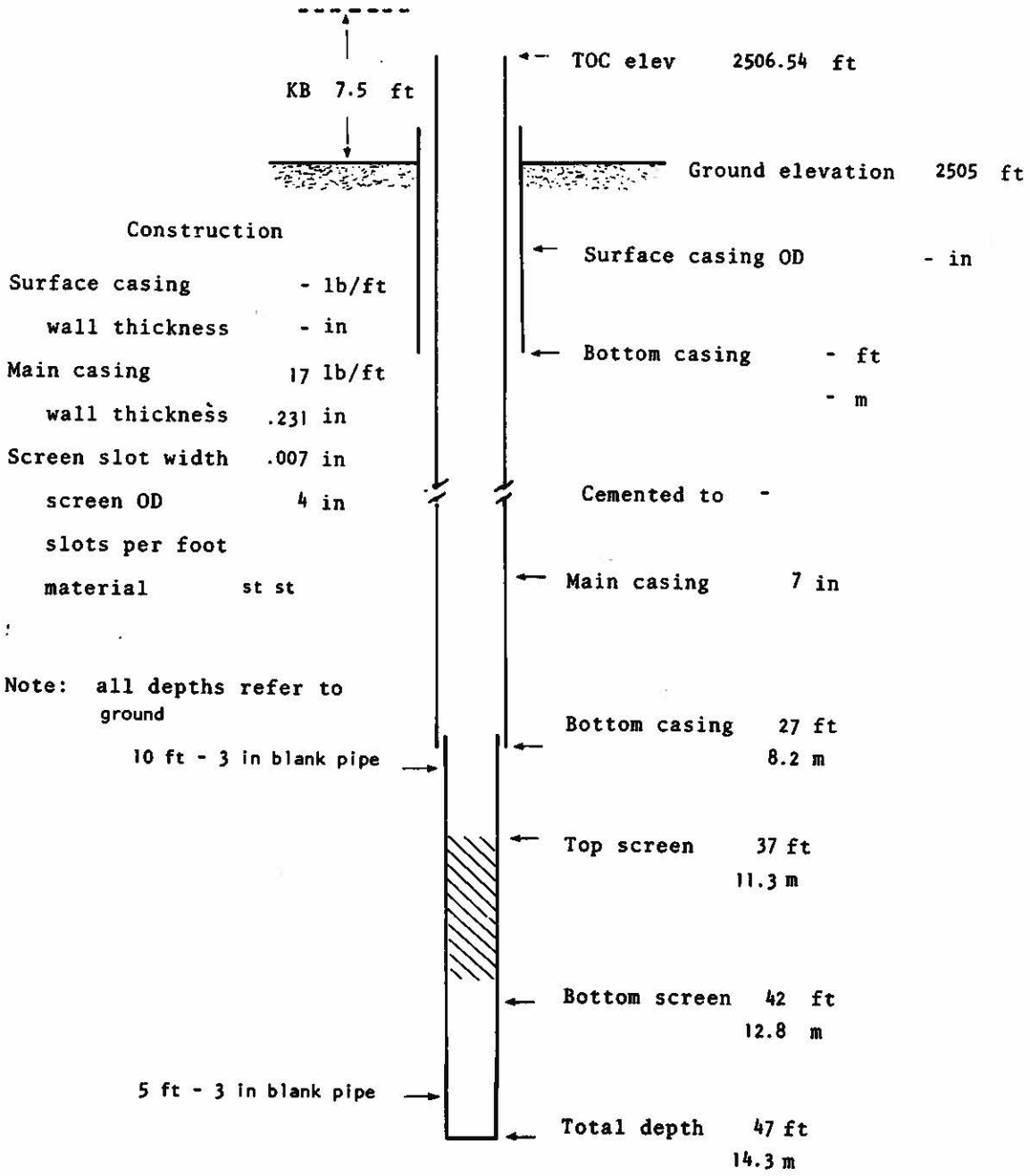

10-G-77

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Tp 85 R 9 W 4th

Alberta Research Council




Construction

| | |
|---|---|
| Surface casing | - lb/ft |
| wall thickness | - in |
| Main casing | 17 lb/ft |
| wall thickness | .231 in |
| Screen slot width | .007 in |
| screen OD | 4 in |
| slots per foot | |
| material | st st |

Note: all depths refer to ground

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 62.0 | 3.09 | 63 |
| Magnesium ($Mg^{++}$) | 13.7 | 1.13 | 23 |
| Sodium ($Na^{+}$) | 15.0 | 0.65 | 13 |
| Potassium ($K^{+}$) | 1.7 | 0.04 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 188.0 | 3.08 | 65 |
| Sulfate ($SO_4^{=}$) | 56.0 | 1.17 | 25 |
| Chloride ($Cl^{-}$) | 18.0 | 0.51 | 11 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0 |
| Silica ($SiO_2$) | 3.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 62.7 | | |
| Magnesium (Acidified) | 14.2 | | |
| Total dissolved solids | 268 | | |
| Total Anions (epm) | 4.76 | Total Cations (epm) | 4.92 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 450 | Temperature (C) | 8.0 |
| pH | 7.3 | pH | 6.8 |
| Fluoride ($F^{-}$) | 0.6 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 190 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 12, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 77.0 | 3.84 | 42.6 |
| Magnesium ($Mg^{++}$) | 30.0 | 2.47 | 27.3 |
| Sodium ($Na^{+}$) | 61.0 | 2.65 | 29.4 |
| Potassium ($K^{+}$) | 2.5 | 0.06 | 0.7 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 346.0 | 5.67 | 65.5 |
| Sulfate ($SO_4^{=}$) | 36.6 | 0.76 | 8.8 |
| Chloride ($Cl^{-}$) | 78.0 | 2.20 | 25.4 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0.2 |
| Silica ($SiO_2$) | 19.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 70.0 | | |
| Magnesium (Acidified) | 27.0 | | |
| Total dissolved solids | 596.0 | | |
| Total Anions (epm) | 8.65 | Total Cations (epm) | 9.03 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 800 | Temperature (C) | 7.0 |
| pH | 7.7 | pH | 7.2 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 342.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Date sampled: July 20, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .520 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 20.9 |
| As | <.038 | Ni | <.010 |
| B | .075 | P | 0.88 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 63.8 | Si | 1.96 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .123 |
| Cr | <.006 | Te | <.065 |
| Cu | .006 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .033 | V | <.0008 |
| K | <.150 | W | <.078 |
| Mg | 14.5 | Zn | .044 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

10-47-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 71.0 | 3.54 | 55.6 |
| Magnesium(Mg) | 22.0 | 1.81 | 28.4 |
| Sodium(Na) | 21.3 | 0.93 | 14.5 |
| Potassium(K) | 3.8 | 0.10 | 1.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 364.0 | 5.97 | 88.7 |
| Sulphate(SO4) | 16.7 | 0.35 | 5.2 |
| Chloride(Cl) | 12.0 | 0.34 | 5.0 |
| Nitrate(NO3) | 4.7 | 0.08 | 1.1 |
| Silica(SiO2) | 8.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 75.0 | | |
| Magnesium(Acidified) | 22.0 | | |
| TDS(mg/l) | 410.0 | | |
| Total Anions(epm) | 6.73 | Total Cations(epm) | 6.38 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 530 | Temperature(C) | 7.00 | |
| pH | 7.3 | pH | 7.7 | |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 385 | mg/l |
| | | Hydroxide(OH) | | |

10-47-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 75.0 | 3.74 | 52.3 |
| Magnesium(Mg) | 29.0 | 2.39 | 33.3 |
| Sodium(Na) | 18.8 | 0.82 | 11.4 |
| Potassium(K) | 8.3 | 0.21 | 3.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 283.0 | 4.64 | 62.5 |
| Sulphate(SO4) | 117.0 | 2.44 | 32.8 |
| Chloride(Cl) | 12.0 | 0.34 | 4.6 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 5.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 69.0 | | |
| Magnesium(Acidified) | 27.0 | | |
| TDS(mg/l) | 364.0 | | |
| Total Anions(epm) | 7.42 | Total Cations(epm) | 7.16 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 585 | | Temperature(C) | 7.00 | |
| pH | 8.1 | | pH | 7.7 | |
| Fluoride(F) | 0.5 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 390 | mg/l |
| | | | Hydroxide(OH) | | |

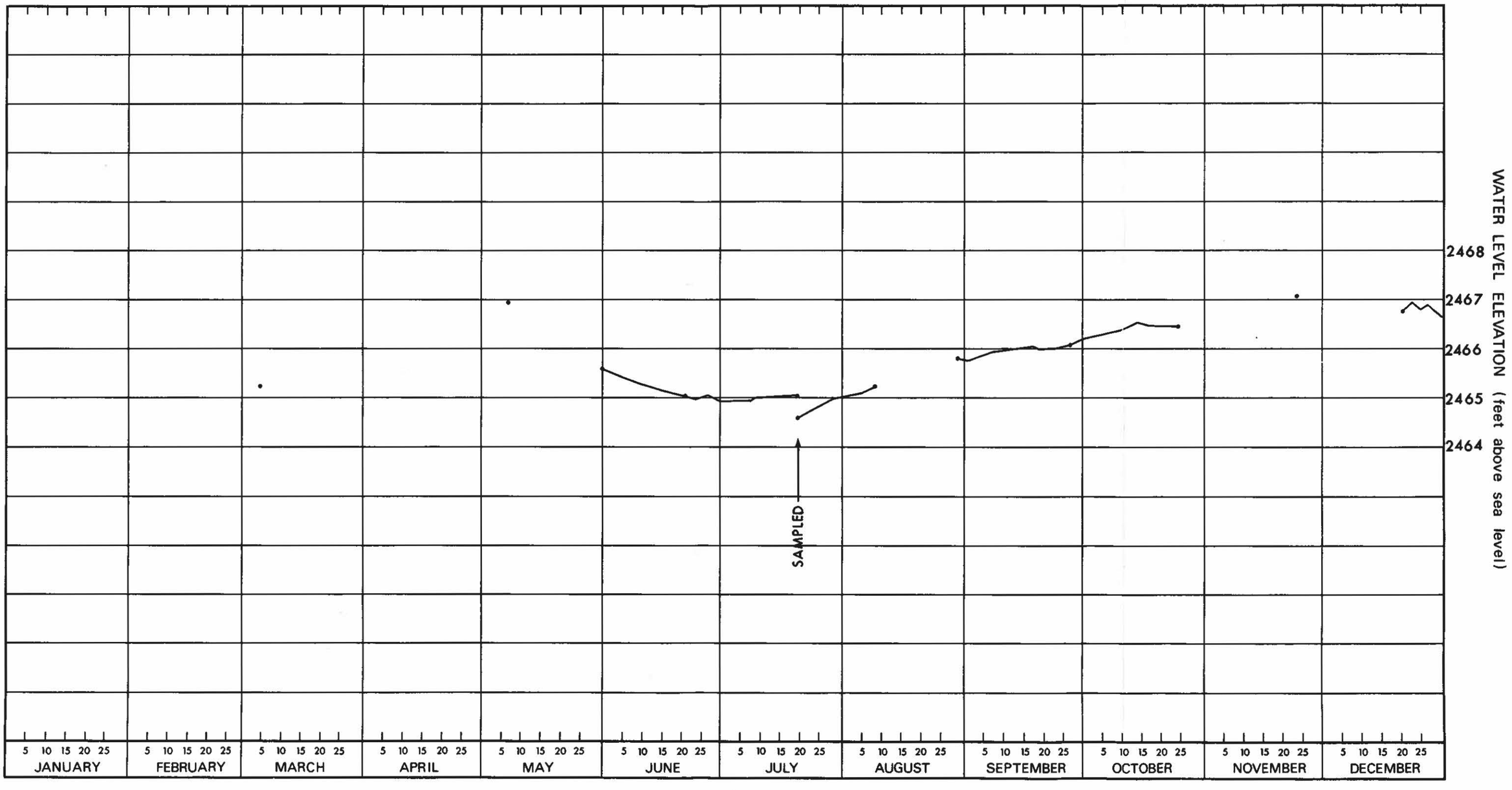
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **10-47**

10 - 47 - H - 77

Lsd **9** Sec **24** Twp **85** R **9** W4th

Alberta Research Council




1976

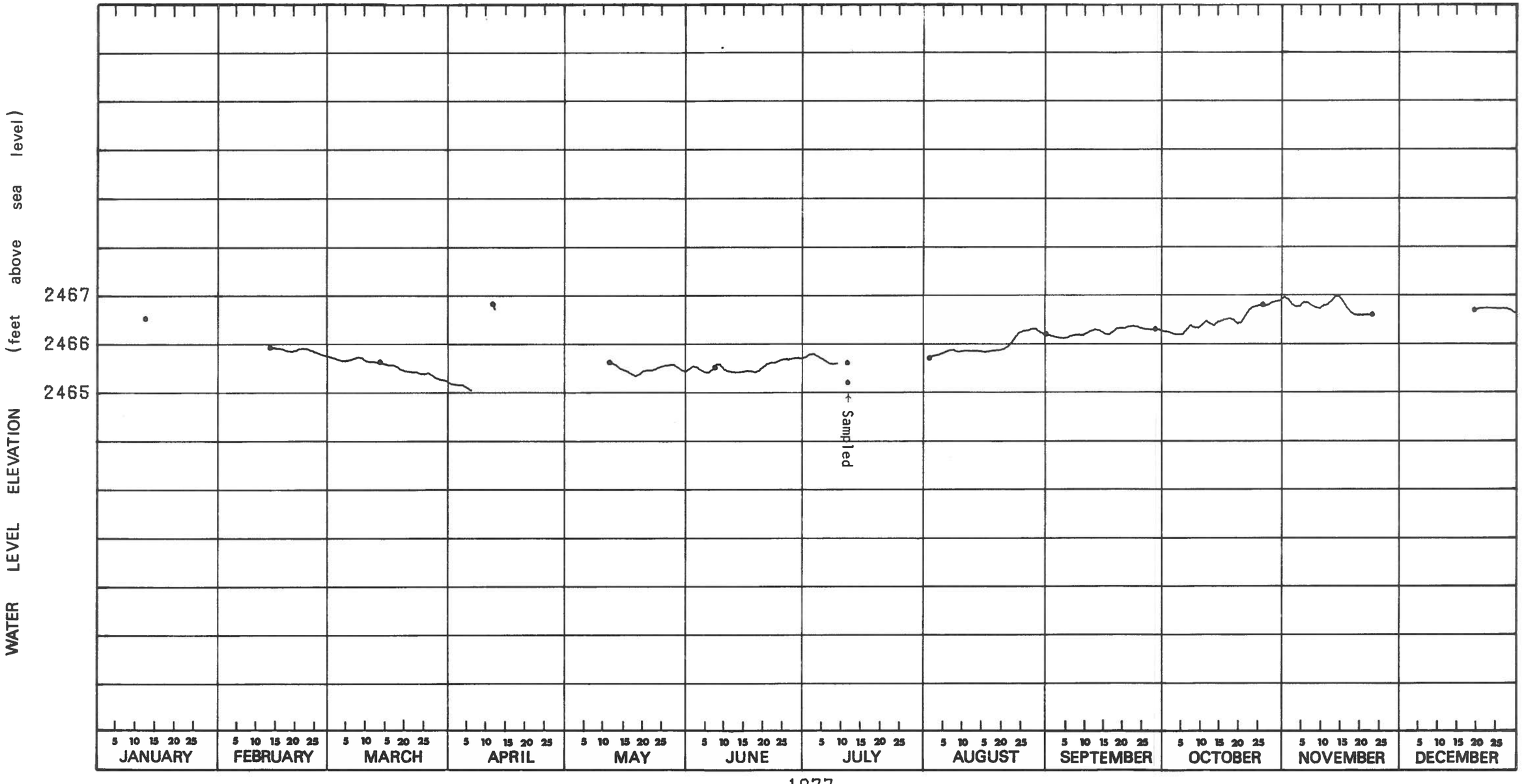
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-47-H-78



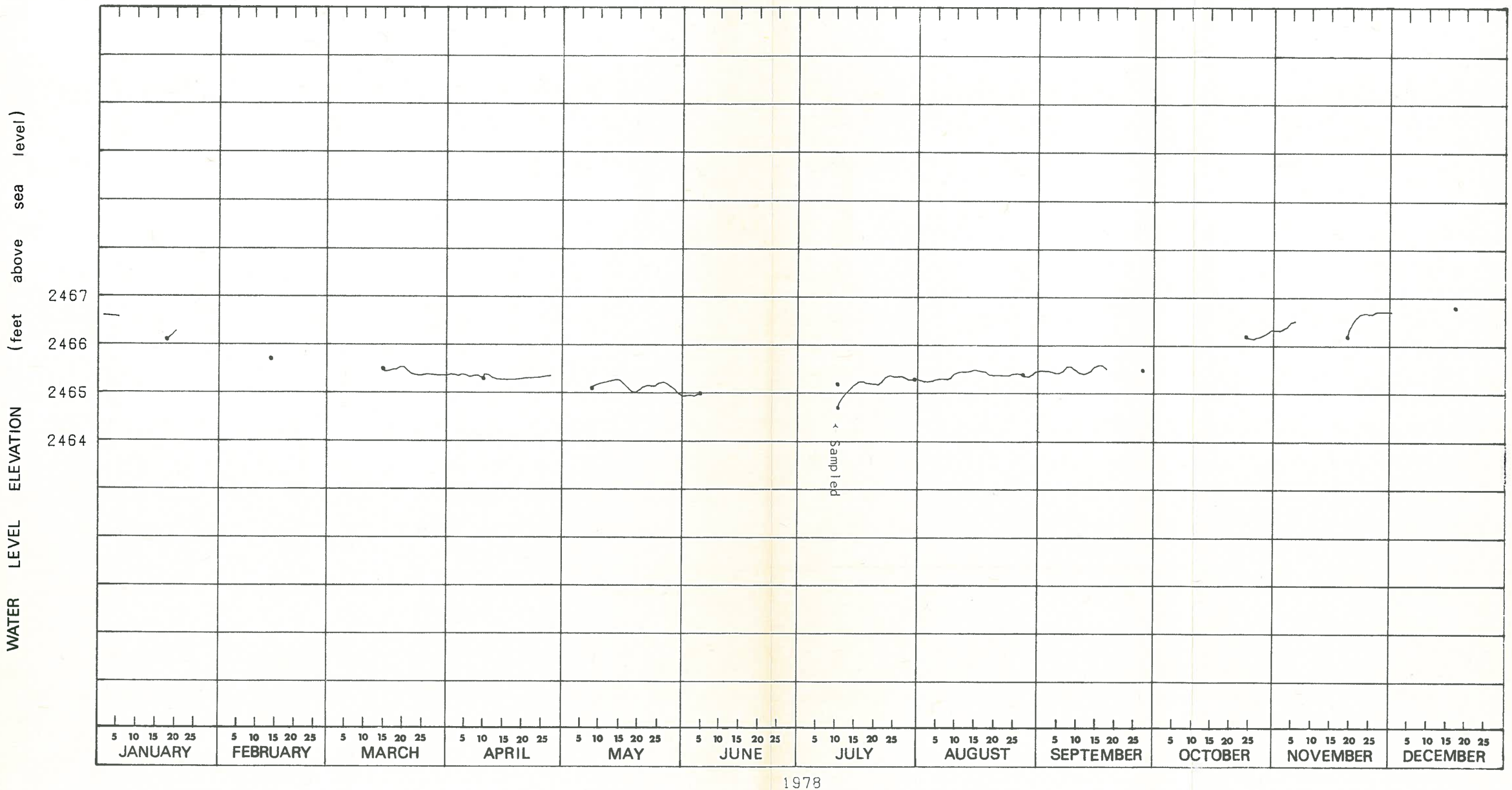
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-47

LSD 9 SEC 24 TWP 85 R 9 W4TH

Alberta Research Council

10-47-H-79




1978

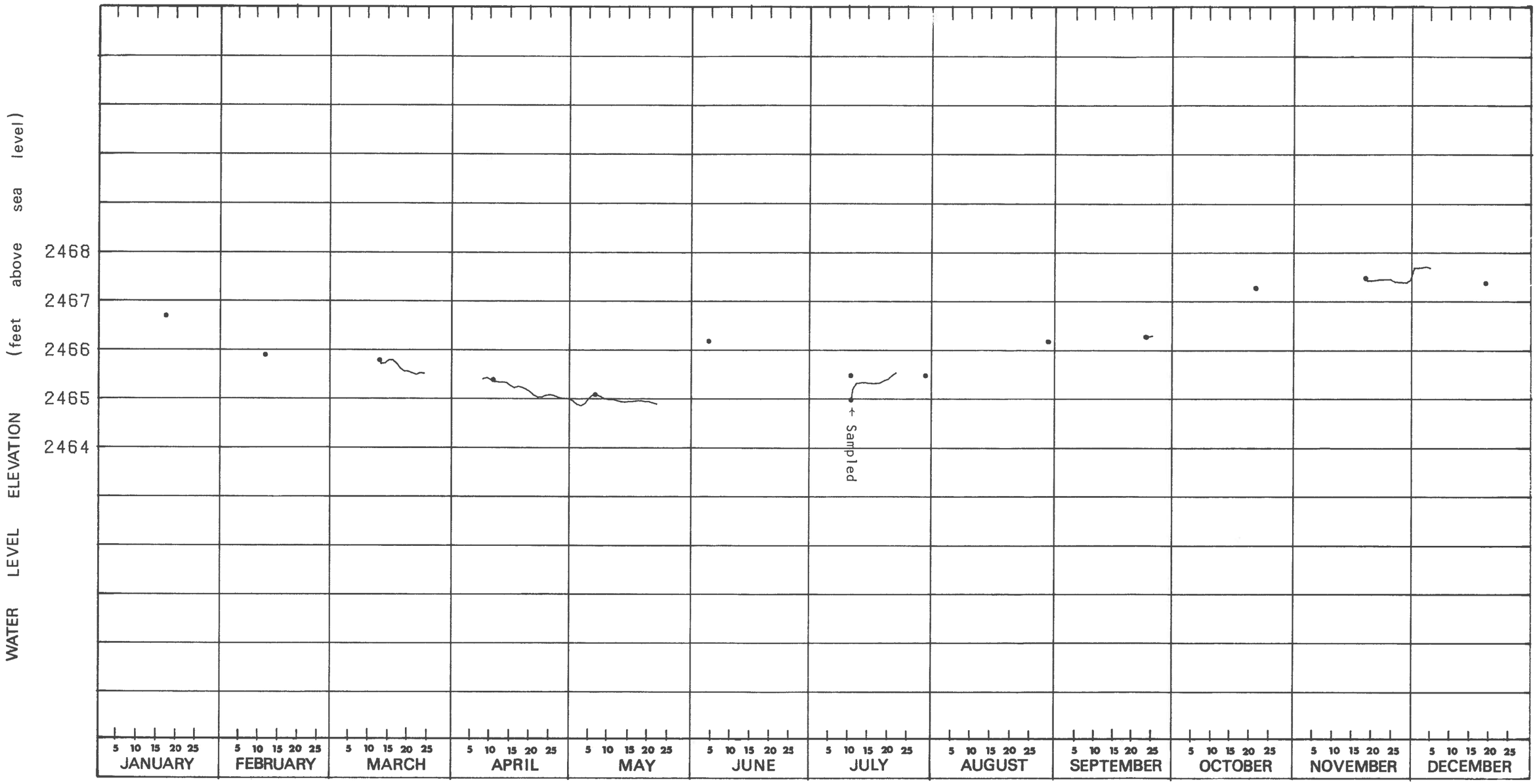
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-47-H-80



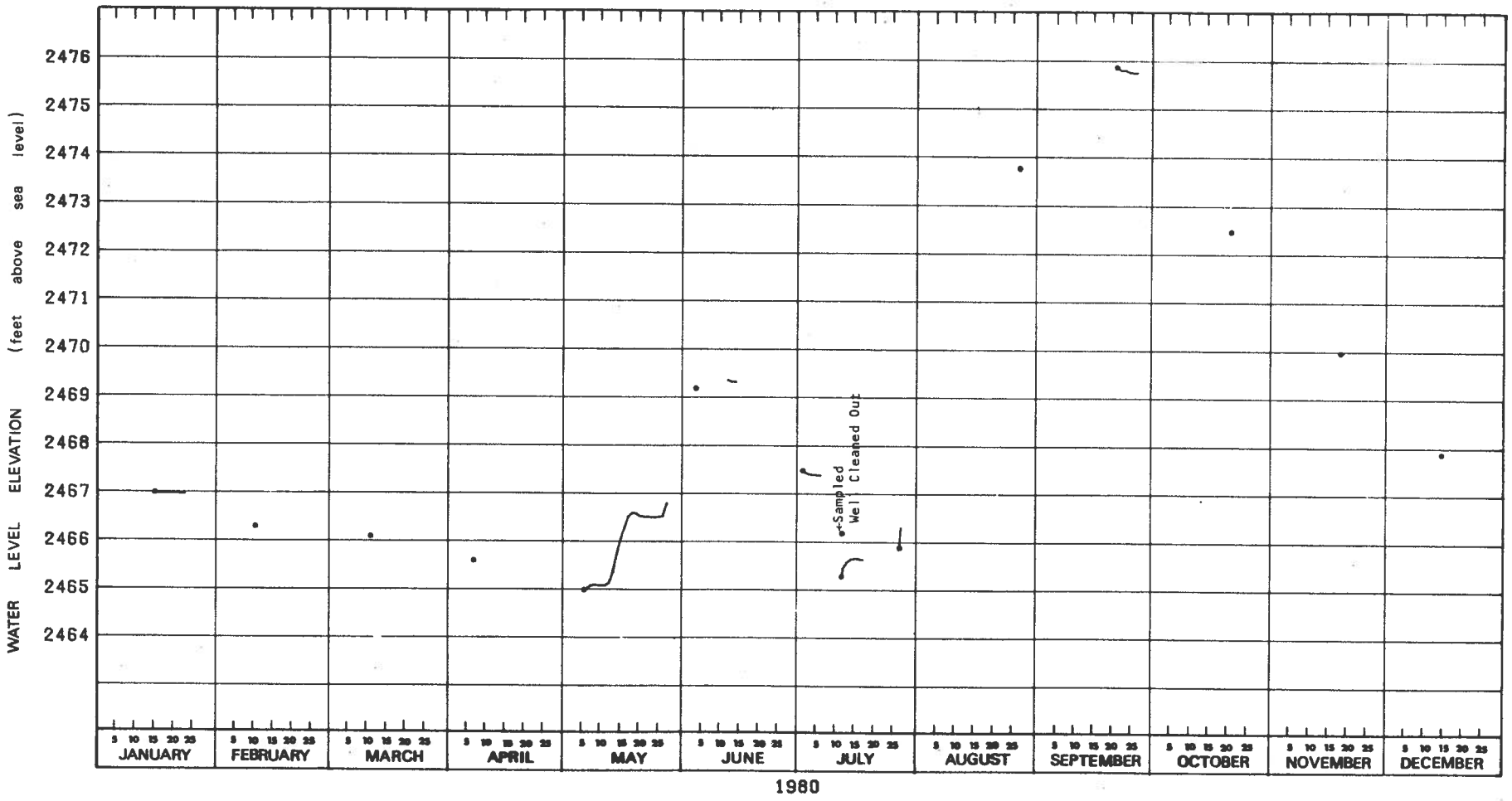
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-47-H-81



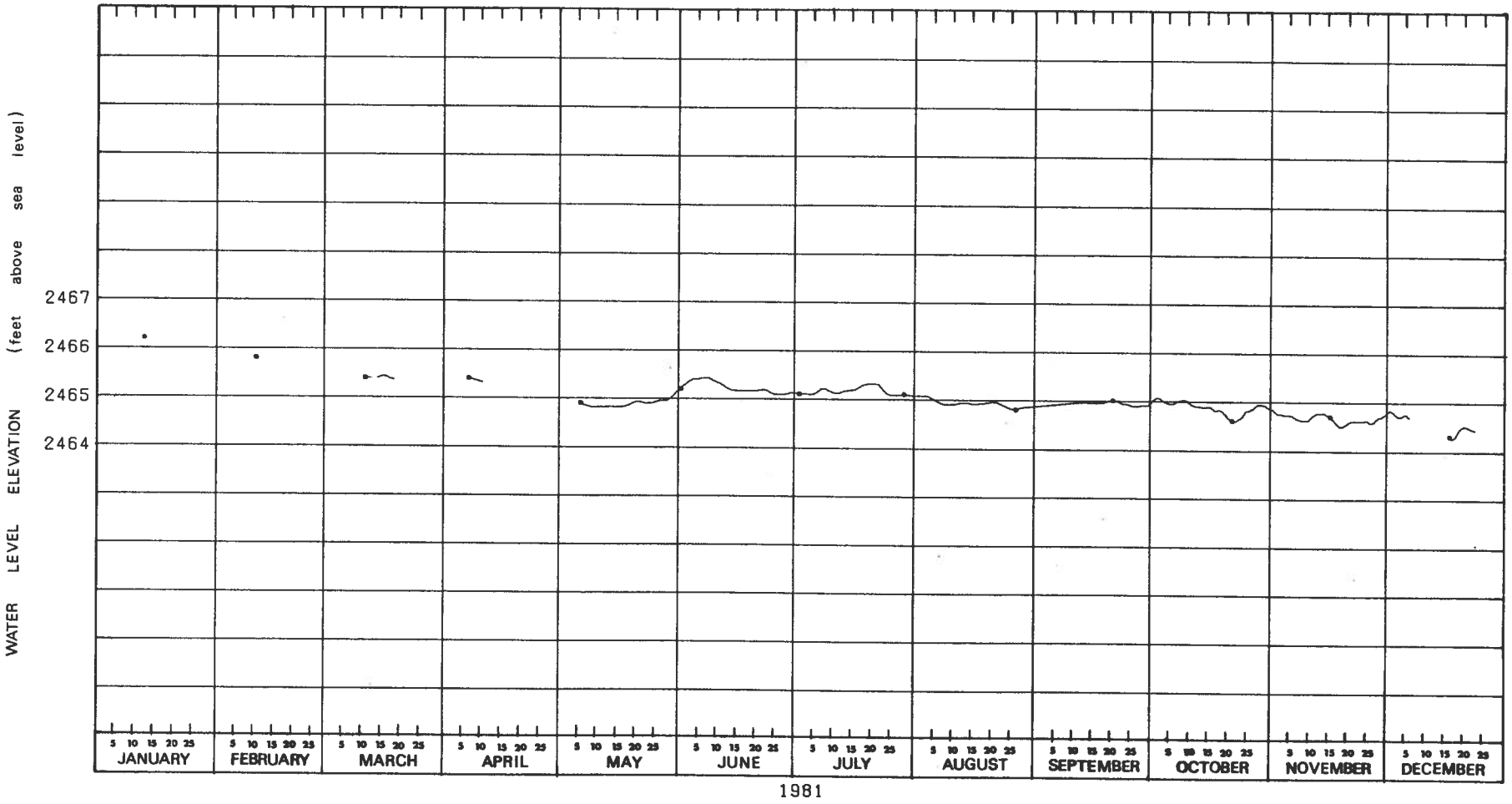
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-47

10-47-H-82

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.54

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Nov 25/75 | | | Well completed |
| Dec 18/75 | 13.96 MP | 2463.6 | Install shelter; MP = 0.86 m TOC, (2509.4) |
| Feb 10/76 | Dry | | |
| Mar 5/76 | 13.45 MP | 2465.3 | |
| Apr 5/76 | 8.27 MP | 2482.3 | |
| May 7/76 | 12.93 MP | 2467.0 | |
| May 31/76 | 13.34 MP | 2465.6 | |
| June 21/76 | 13.51 MP | 2465.1 | |
| July 20/76 | 13.51 MP | 2465.1 | |
| | 13.64 MP | 2464.7 | After sample; temp. 8°C |
| Aug 9/76 | 13.45 MP | 2465.3 | |
| Aug 30/76 | 13.27 MP | 2465.9 | |
| Sept 27/76 | 13.19 MP | 2466.1 | |
| Oct 25/76 | 13.08 MP | 2466.5 | |
| Nov 24/76 | 12.89 MP | 2467.1 | |
| Dec 21/76 | 12.99 MP | 2466.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.54

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/77 | 13.09 MP | 2466.5 | MP (2509.4) |
| Feb 14/77 | 13.27 MP | 2465.9 | |
| Mar 14/77 | 13.35 MP | 2465.6 | |
| Apr 12/77 | 13.00 MP | 2466.8 | |
| May 12/77 | 13.35 MP | 2465.6 | |
| June 8/77 | 13.38 MP | 2465.5 | |
| July 12/77 | 13.34 MP | 2465.6 | |
| | 13.47 MP | 2465.2 | After sample; temp. 7°C dropped float in well |
| Aug 2/77 | 13.33 MP | 2465.7 | Sunk float; reinstalled recorder |
| Sept 1/77 | 13.18 MP | 2466.2 | |
| Sept 29/77 | 13.14 MP | 2466.3 | |
| Oct 27/77 | 12.98 MP | 2466.8 | |
| Nov 24/77 | 13.05 MP | 2466.6 | |
| Dec 20/77 | 13.03 MP | 2466.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.54

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 13.20 MP | 2466.1 | MP (2509.4) |
| Feb 14/78 | 13.32 MP | 2465.7 | |
| Mar 15/78 | 13.37 MP | 2465.5 | |
| Apr 10/78 | 13.44 MP | 2465.3 | |
| May 8/78 | 13.51 MP | 2465.1 | |
| June 5/78 | 13.54 MP | 2465.0 | |
| July 11/78 | 13.48 MP | 2465.2 | |
| | 13.62 MP | 2464.7 | After sample; temp. 7°C |
| July 31/78 | 13.45 MP | 2465.3 | |
| Aug 28/78 | 13.42 MP | 2465.4 | |
| Sept 28/78 | 13.38 MP | 2465.5 | |
| Oct 26/78 | 13.16 MP | 2466.2 | |
| Nov 20/78 | 13.18 MP | 2466.2 | |
| Dec 18/78 | 13.00 MP | 2466.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-47

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.54

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 13.03 MP | 2466.7 | MP (2509.4) |
| Feb 12/79 | 13.25 MP | 2465.9 | |
| Mar 13/79 | 13.30 MP | 2465.8 | |
| Apr 11/79 | 13.42 MP | 2465.4 | |
| May 7/79 | 13.51 MP | 2465.1 | |
| June 5/79 | 13.17 MP | 2466.2 | |
| July 11/79 | 13.37 MP | 2465.5 | |
| | 13.55 MP | 2465.0 | After sample; temp. 7°C |
| July 30/79 | 13.38 MP | 2465.5 | |
| Aug 30/79 | 13.16 MP | 2466.2 | |
| Sept 24/79 | 13.14 MP | 2466.3 | |
| Oct 22/79 | 12.83 MP | 2467.3 | |
| Nov 19/79 | 12.77 MP | 2467.5 | |
| Dec 20/79 | 12.79 MP | 2467.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 10 - 47

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.54

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 12.91 MP | 2467.0 | |
| Feb 11/80 | 13.15 MP | 2466.3 | |
| Mar 12/80 | 13.20 MP | 2466.1 | |
| Apr 8/80 | 13.36 MP | 2465.6 | |
| May 7/80 | 13.53 MP | 2465.0 | |
| June 5/80 | 12.24 MP | 2469.2 | |
| July 3/80 | 12.78 MP | 2467.5 | Temp. 7°C |
| July 13/80 | 13.16 MP | 2466.2 | Try to clean out well |
| | 13.44 MP | 2465.3 | very little water, removed; water within screen |
| July 28/80 | 13.26 MP | 2465.9 | |
| Aug 28/80 | 10.84 MP | 2473.8 | |
| Sept 22/80 | 10.22 MP | 2475.9 | |
| Oct 22/80 | 11.24 MP | 2472.5 | |
| Nov 20/80 | 12.00 MP | 2470.0 | |
| Dec 16/80 | 12.65 MP | 2467.9 | |
| Jan 13/81 | 13.17 MP | 2466.2 | |
| Feb 12/81 | 13.30 MP | 2465.8 | |
| Mar 11/81 | 13.42 MP | 2465.4 | |
| Apr 7/81 | 13.40 MP | 2465.4 | |
| May 6/81 | 13.56 MP | 2464.9 | |
| June 1/81 | 13.48 MP | 2465.2 | |
| June 2/81 | 13.50 MP | 2465.1 | |
| July 29/81 | 13.51 MP | 2465.1 | |
| Aug 26/81 | 13.61 MP | 2464.8 | |
| Sept 21/81 | 13.55 MP | 2465.0 | |
| Oct 22/81 | 13.66 MP | 2464.6 | |
| Nov 16/81 | 13.62 MP | 2464.7 | |
| Dec 17/81 | 13.75 MP | 2464.3 | |

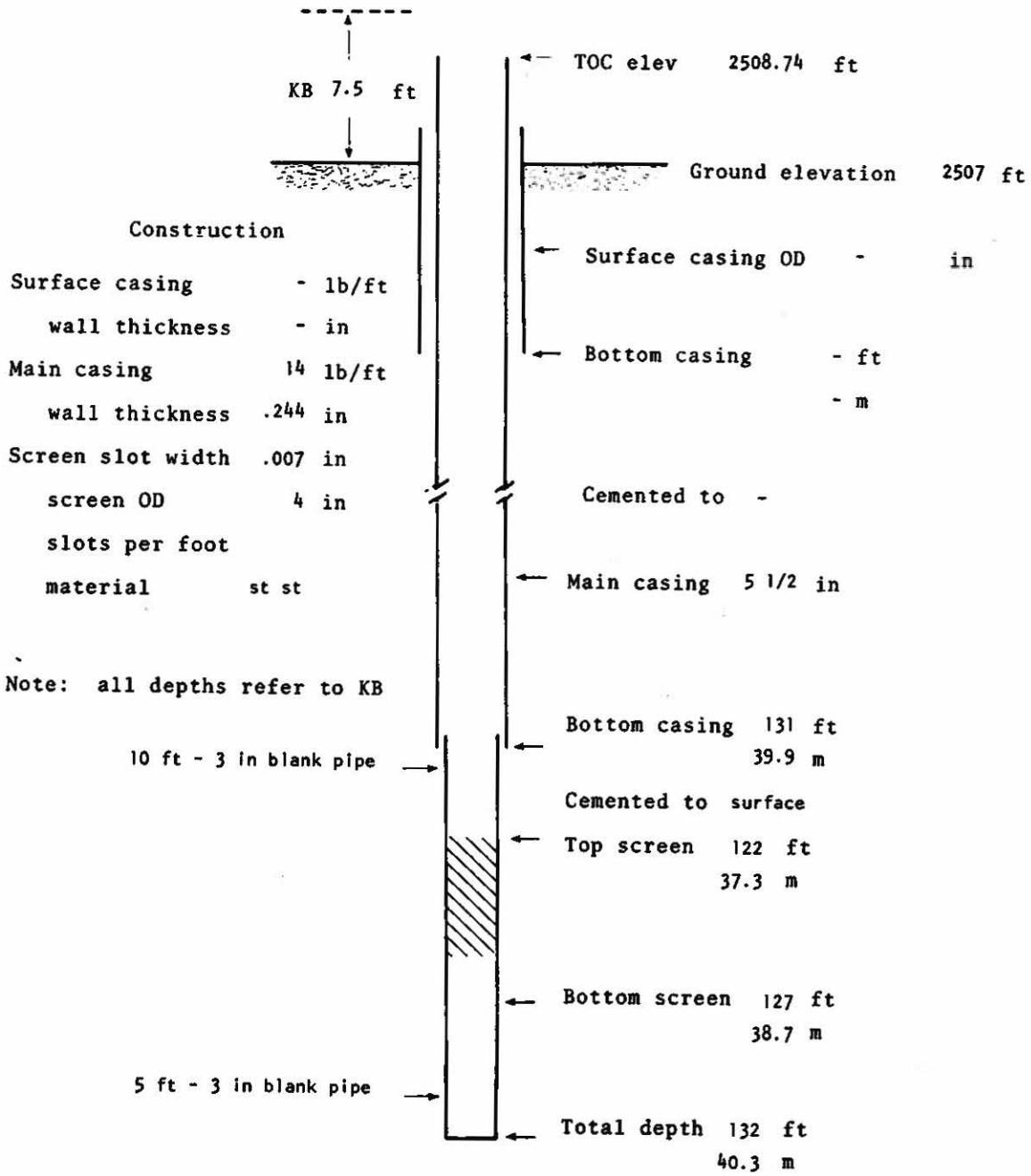
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Tp 85 R 9 W 4th

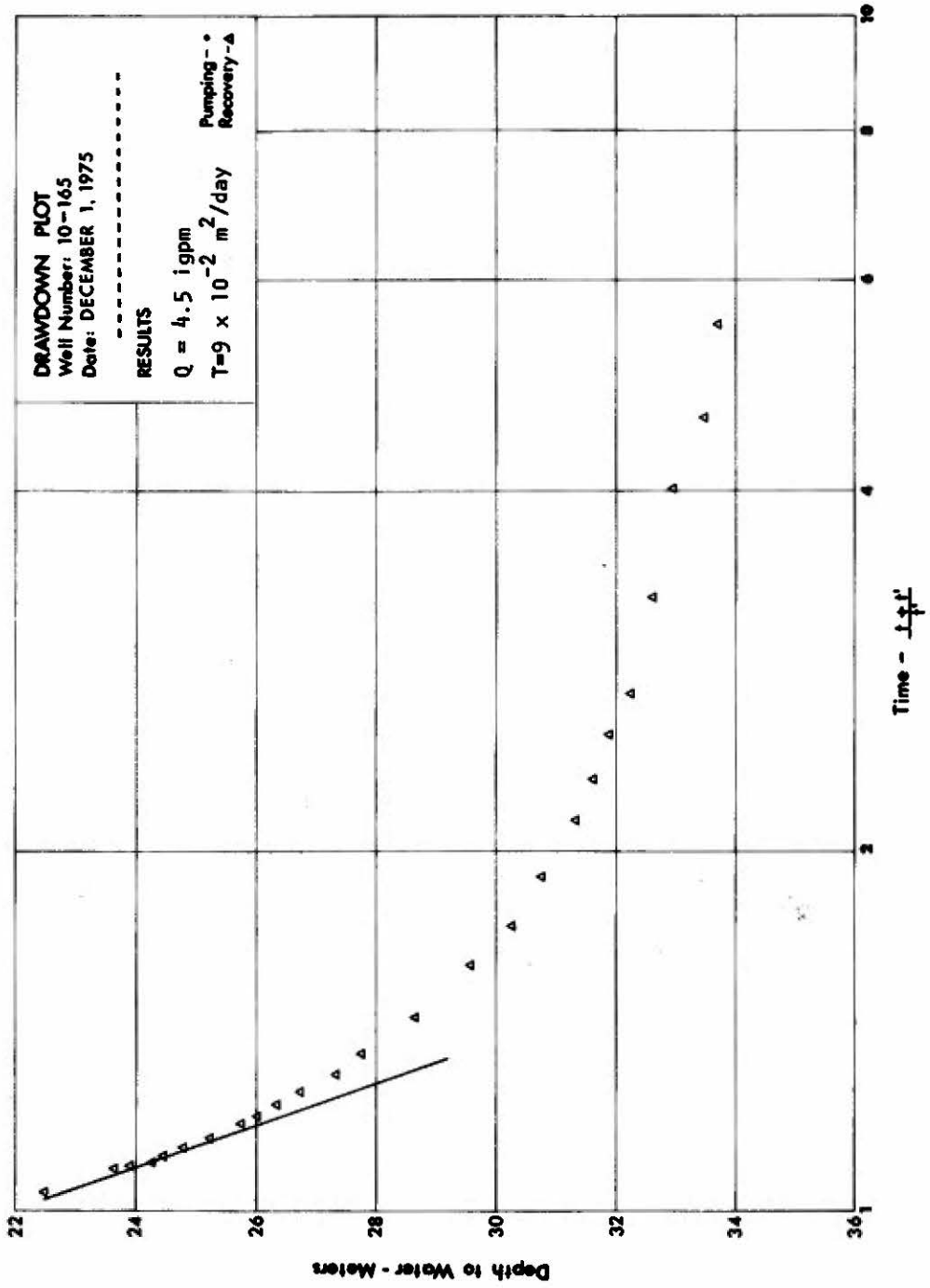
Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 10-165
Date: DECEMBER 1, 1975
RESULTS
Q = 4.5 igpm
T=9 x 10^-2 m^2/day
Pumping - •
Recovery - Δ
Depth to Water - Meters
Time - t+t'/t'
22
24
26
28
30
32
34
36
1
2
4
6
8
10

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 24.0 | 1.20 | 52 |
| Magnesium ($Mg^{++}$) | 6.1 | 0.50 | 22 |
| Sodium ($Na^{+}$) | 11.3 | 0.49 | 22 |
| Potassium ($K^{+}$) | 3.8 | 0.10 | 4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 102.0 | 1.67 | 75 |
| Sulfate ($SO_4^{=}$) | 9.7 | 0.20 | 9 |
| Chloride ($Cl^{-}$) | 12.0 | 0.34 | 15 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 1 |
| Silica ($SiO_2$) | 0.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 15.0 | | |
| Magnesium (Acidified) | 6.1 | | |
| Total dissolved solids | 146 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 2.23 | Total Cations (epm) | 2.29 |

### Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 210 | Temperature (C) | 5.0 |
| pH | 7.7 | pH | 7.1 |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 102 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Date sampled: July 20, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .072 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 9.9 |
| As | <.038 | Ni | <.010 |
| B | .025 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 19.91 | Si | .396 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .066 |
| Cr | <.006 | Te | <.065 |
| Cu | .016 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .066 | V | <.0008 |
| K | <.150 | W | <.078 |
| Mg | 5.80 | Zn | <.002 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 12, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.8 | 0.19 | 7.7 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.02 | 1.0 |
| Sodium ($Na^{+}$) | 27.5 | 1.20 | 48.3 |
| Potassium ($K^{+}$) | 41.7 | 1.07 | 43.1 |
| Carbonate ($CO_3^{=}$) | 43.2 | 1.44 | 53.1 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 8.3 | 0.17 | 6.4 |
| Chloride ($Cl^{-}$) | 20.0 | 0.56 | 20.8 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0.7 |
| Silica ($SiO_2$) | 22.0 | | |
| Hydroxide ($OH^{-}$) | 8.8 | 0.52 | 19.1 |
| Calcium (Acidified) | 6.9 | | |
| Magnesium (Acidified) | 1.0 | | |
| Total dissolved solids | 158.0 | | |
| Total Anions (epm) | 2.71 | Total Cations (epm) | 2.48 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 390 | Temperature (C) | 4.0 |
| pH | 10.8 | pH | 11.1 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | 29.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 22.0 ppm |
| | | Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 7.9 | 0.39 | 22.2 |
| Magnesium(Mg) | 3.0 | 0.25 | 13.9 |
| Sodium(Na) | 16.3 | 0.71 | 39.9 |
| Potassium(K) | 16.7 | 0.43 | 24.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 81.0 | 1.33 | 68.2 |
| Sulphate(SO4) | 7.3 | 0.15 | 7.8 |
| Chloride(Cl) | 14.0 | 0.39 | 20.3 |
| Nitrate(NO3) | 4.5 | 0.07 | 3.7 |
| Silica(SiO2) | 0.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 6.4 | | |
| Magnesium(Acidified) | 2.4 | | |
| TDS(mg/l) | 120.0 | | |
| Total Anions(epm) | 1.95 | Total Cations(epm) | 1.78 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 162 | | Temperature(C) | 9.00 | |
| pH | 7.1 | | pH | 9.4 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | 24 | mg/l |
| | | | Bicarbonate(HCO3) | 29 | mg/l |
| | | | Hydroxide(OH) | | |

10-165-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 5.3 | 0.26 | 8.5 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.3 |
| Sodium(Na) | 32.5 | 1.41 | 45.4 |
| Potassium(K) | 55.8 | 1.43 | 45.8 |
| Carbonate(CO3) | 60.0 | 2.00 | 60.4 |
| Bicarbonate(HCO3) | 22.0 | 0.36 | 10.9 |
| Sulphate(SO4) | 15.8 | 0.33 | 9.9 |
| Chloride(Cl) | 22.0 | 0.62 | 18.7 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.1 |
| Silica(SiO2) | 4.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 11.7 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 196.0 | | |
| Total Anions(epm) | 3.31 | Total Cations(epm) | 3.11 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 350 | | Temperature(C) | 5.00 | |
| pH | 10.3 | | pH | 11.4 | |
| Fluoride(F) | 0.3 | mg/l | Carbonate(CO3) | 19 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 42 | mg/l |

WATER ANALYSIS

10-165-E-82

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 3, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 4.6 | 0.23 | 11.3 |
| Magnesium(Mg) | 1.4 | 0.12 | 5.7 |
| Sodium(Na) | 23.8 | 1.03 | 50.7 |
| Potassium(K) | 25.8 | 0.66 | 32.4 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 99.0 | 1.62 | 71.7 |
| Sulphate(SO4) | 6.2 | 0.13 | 5.7 |
| Chloride(Cl) | 18.0 | 0.51 | 22.4 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.1 |
| Silica(SiO2) | 1.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 2.5 | | |
| Magnesium(Acidified) | 0.4 | | |
| TDS(mg/l) | 72.0 | | |
| Total Anions(epm) | 2.26 | Total Cations(epm) | 2.04 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 198 | Temperature | 7.00 | |
| pH | 7.7 | pH | 9.5 | |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | 24 | mg/l |
| | | Bicarbonate(HCO3) | 34 | mg/l |
| | | Hydroxide(OH) | | |

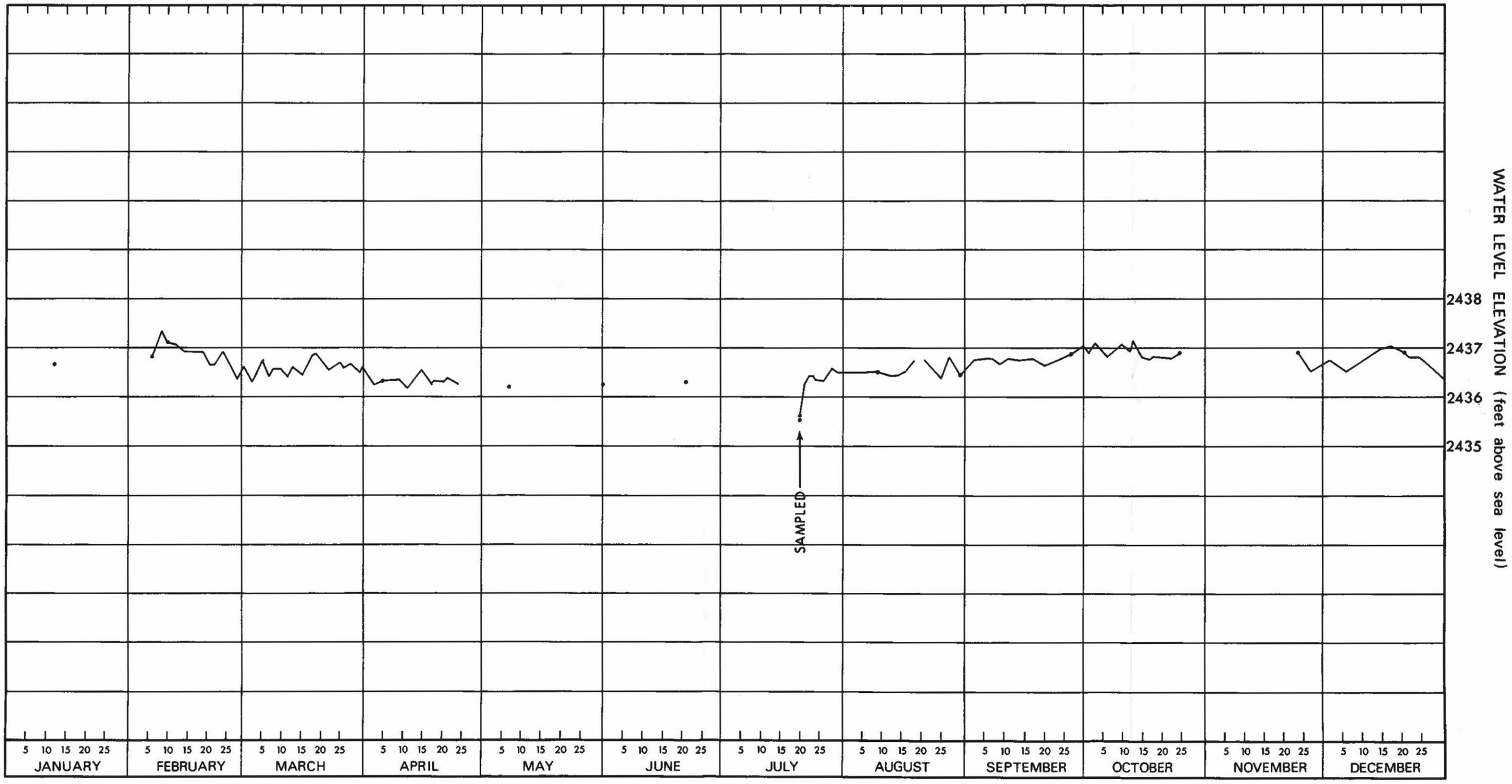
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

10 - 165 - H - 77




1976

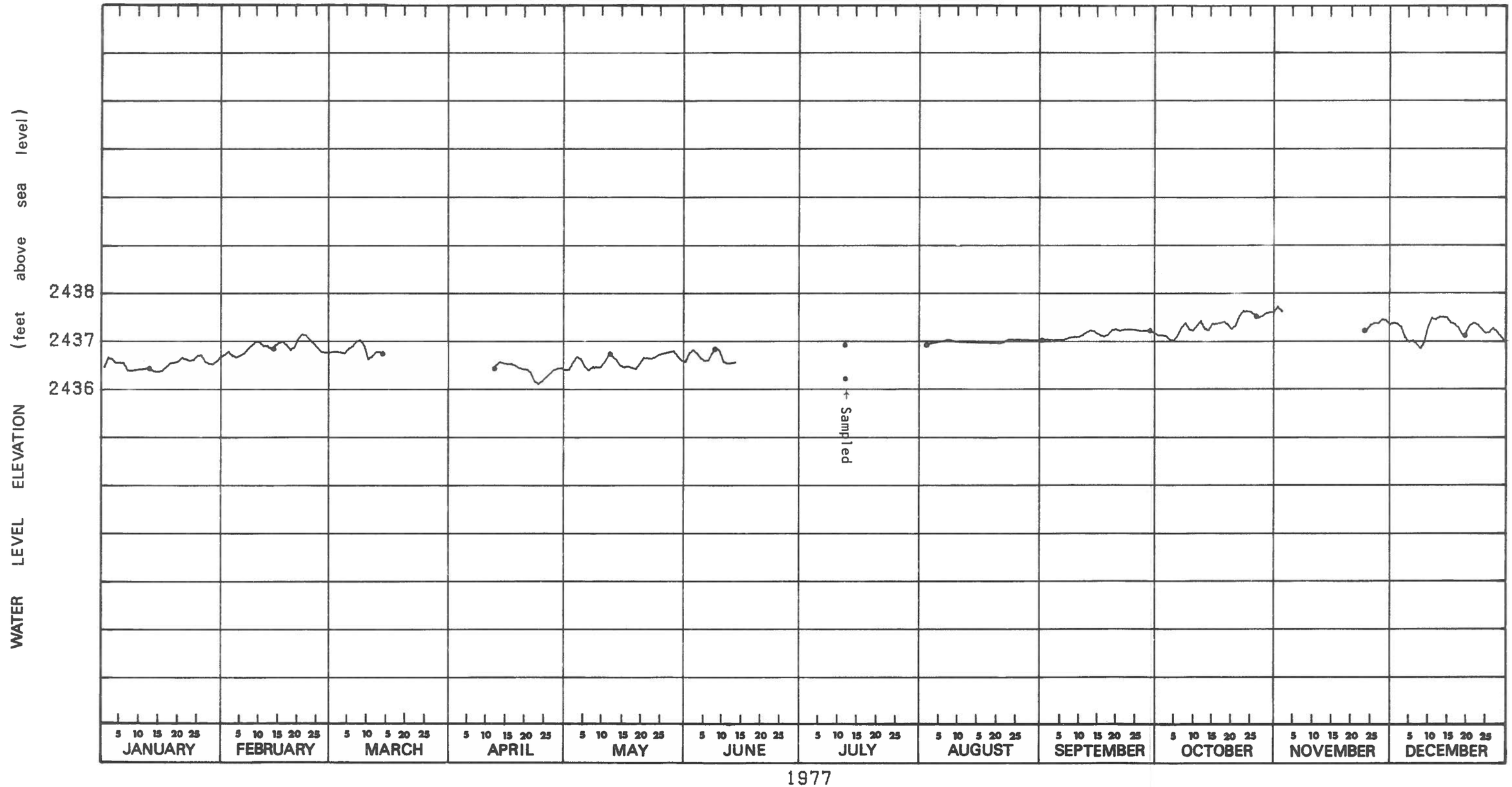
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-165-H-78




1977

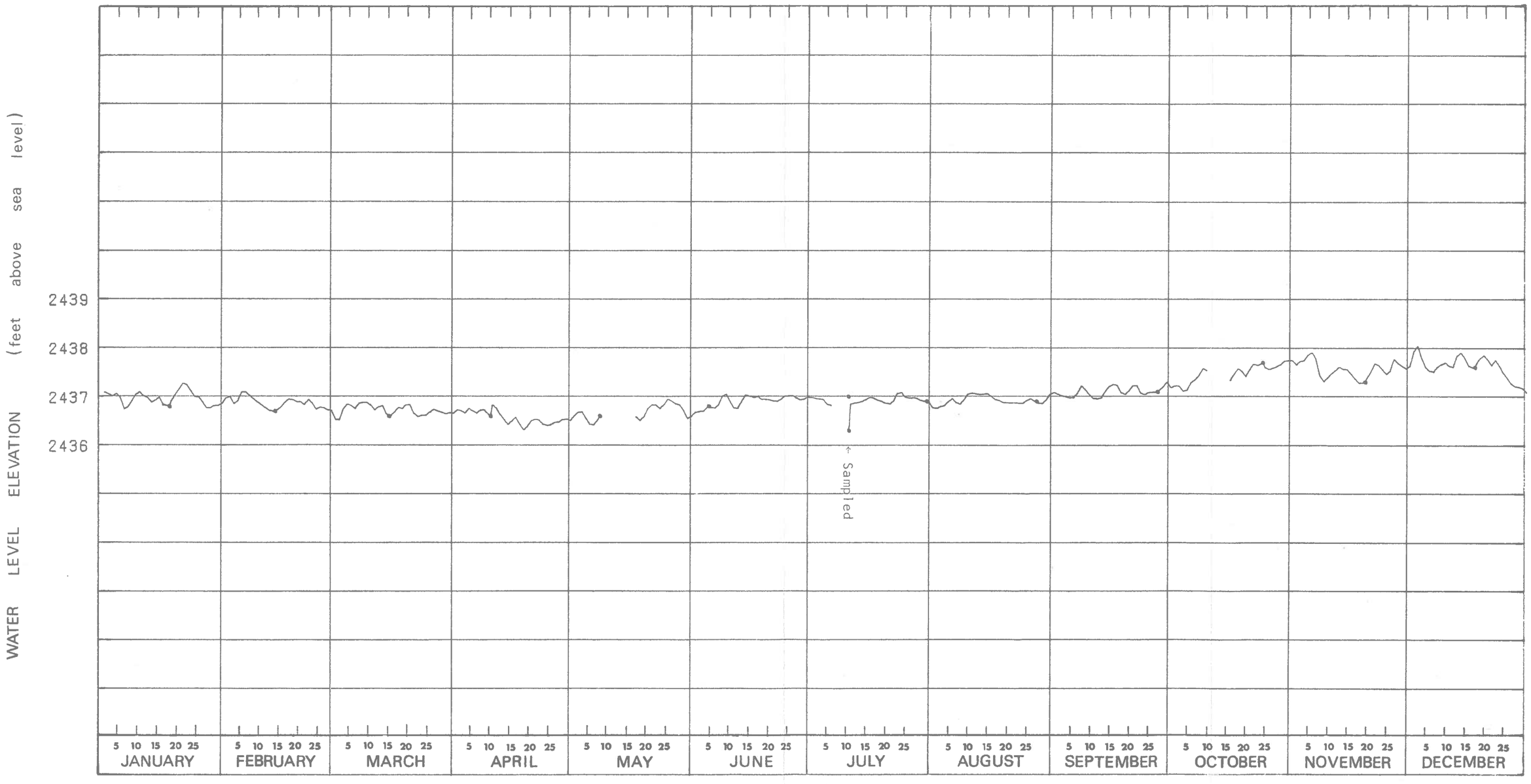
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-165

LSD 9 SEC 24 TWP 85 R 9 W4TH

10-165-H-79

Alberta Research Council




1978

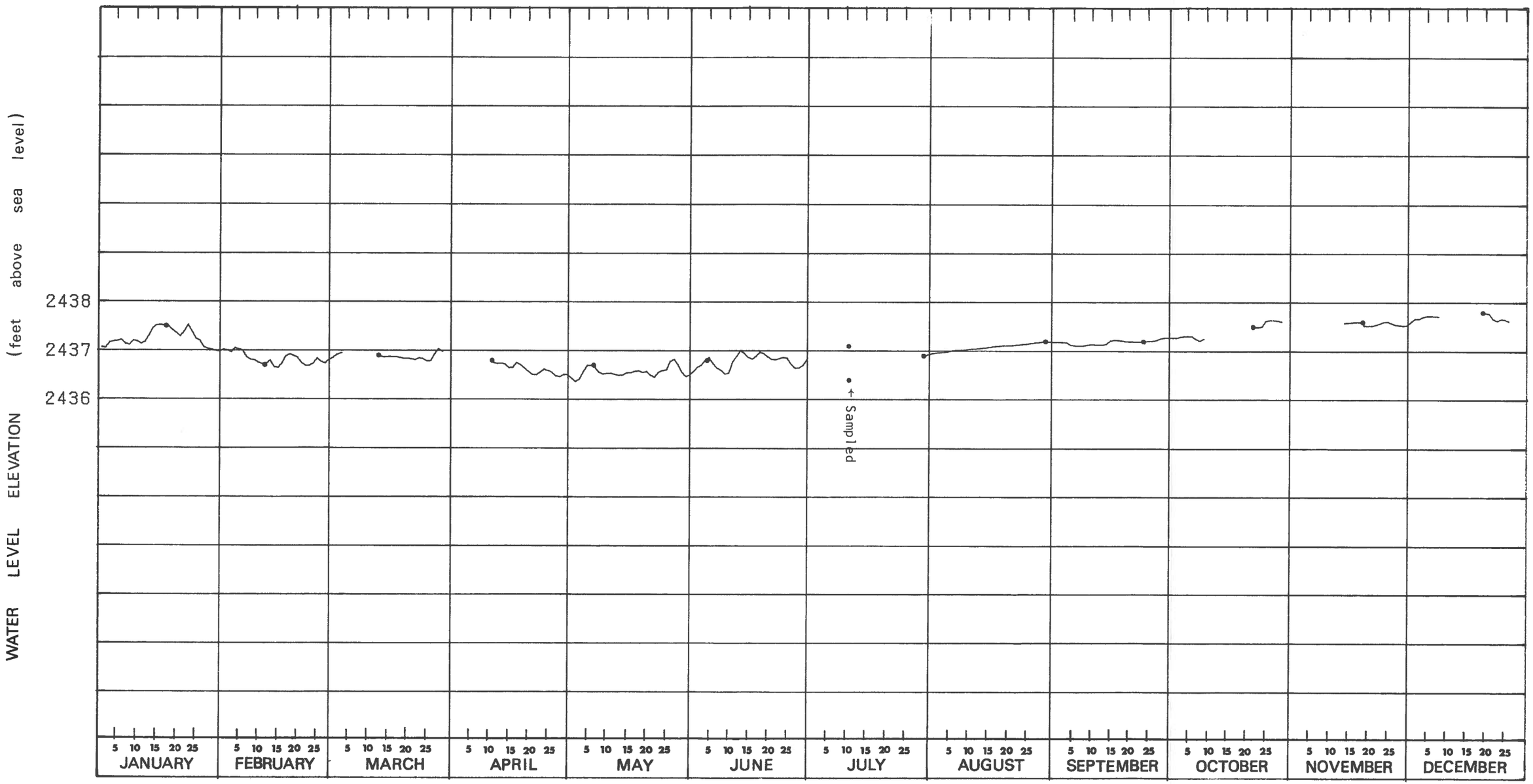
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-165-H-80



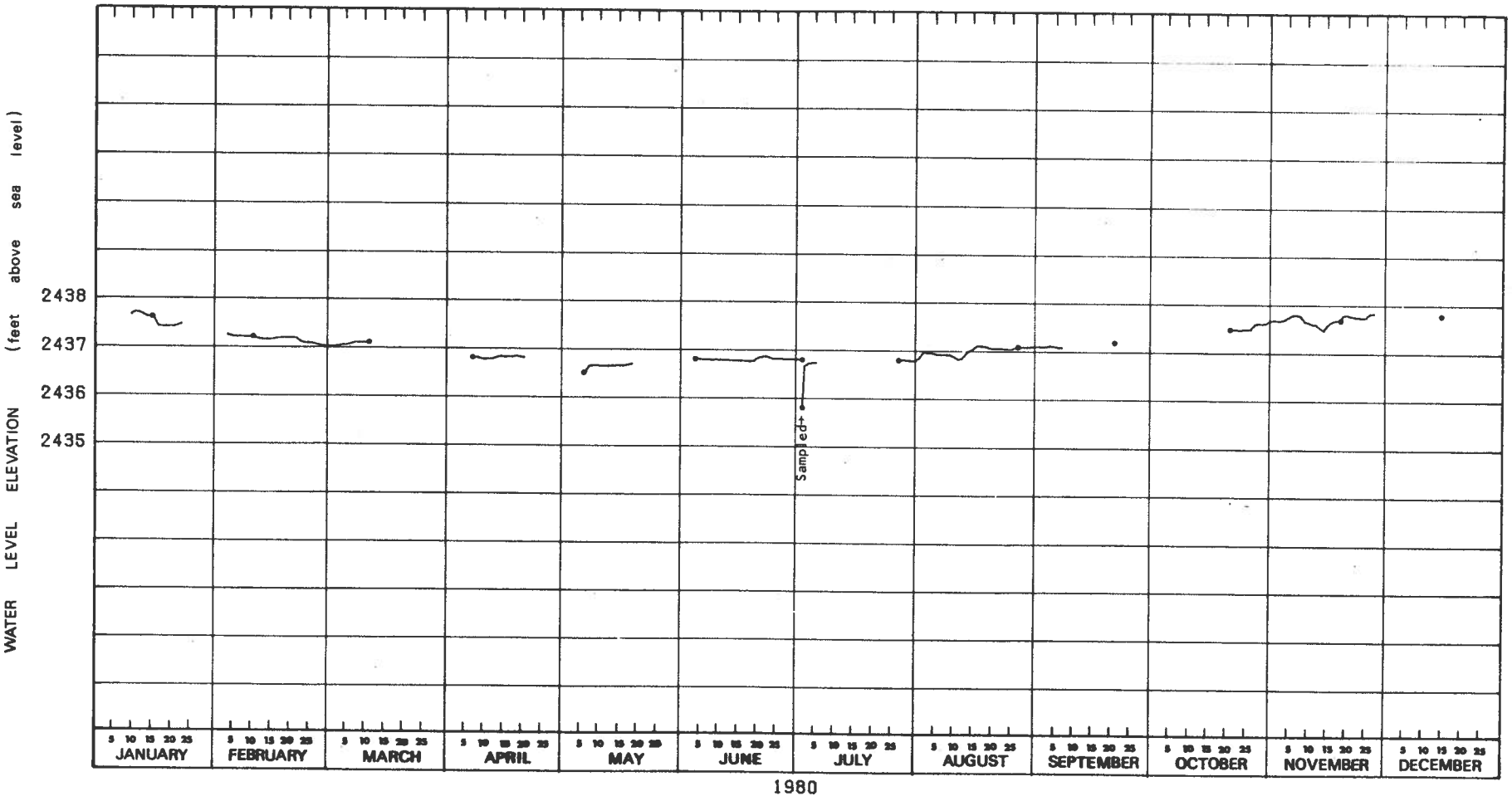
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-165-H-81



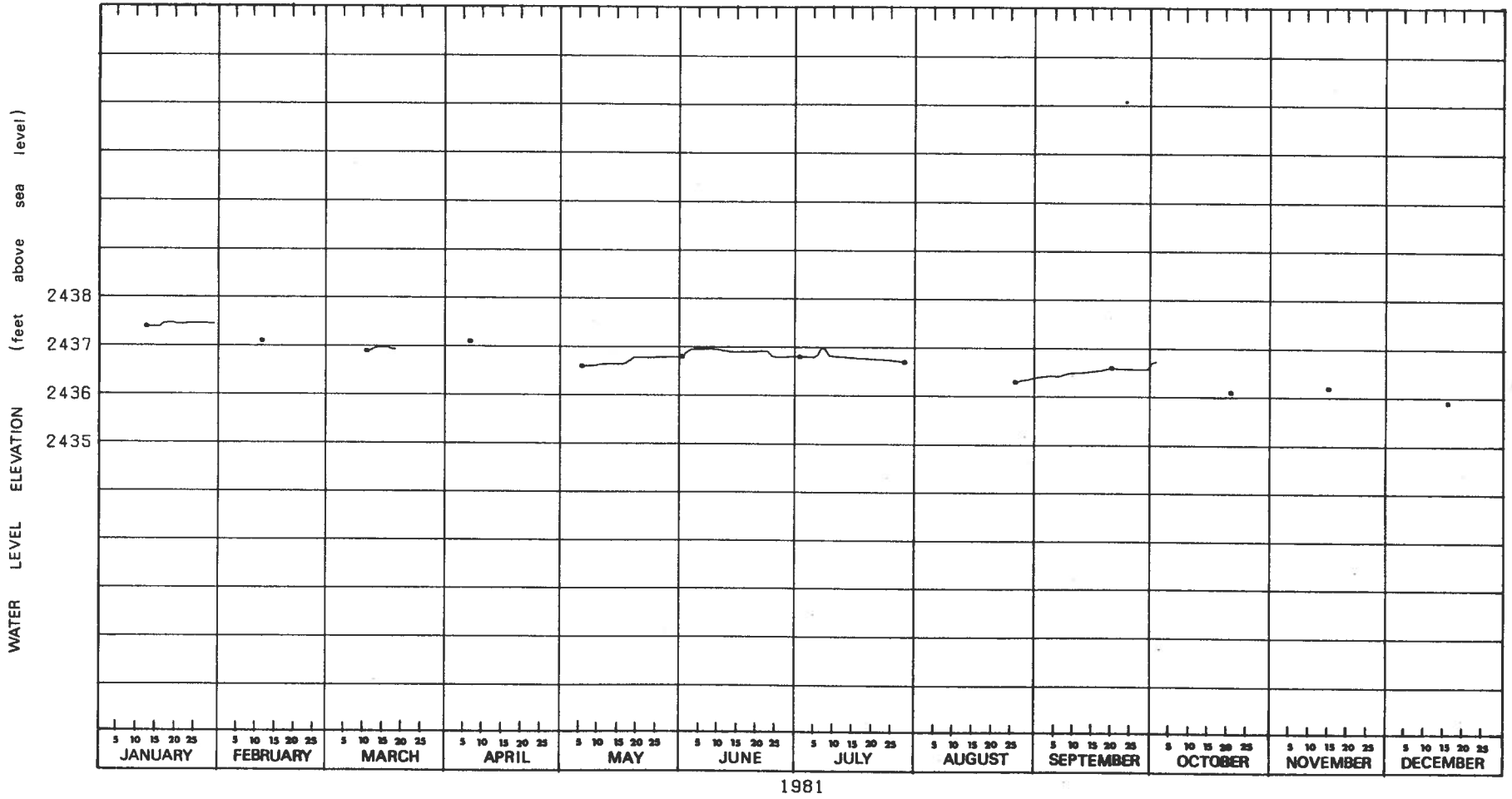
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-165

10-165-H-82

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council



WELL HISTORY

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2508.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Nov 27/75 | | | Well completed |
| Nov 29/75 | 22.17 TOC | 2436.0 | |
| Dec 8/75 | 21.70 TOC | 2437.5 | |
| Dec 16/75 | | | Pull original screen and attempt to sand pack; unsuccessful |
| Dec 18/75 | 22.53 MP | 2437.2 | Install shelter; MP = 0.72 m TOC, (2511.1) |
| Jan 12/76 | 22.70 MP | 2436.6 | |
| Feb 6/76 | 22.65 MP | 2436.8 | |
| Feb 10/76 | 22.56 MP | 2437.1 | |
| Mar 5/76 | 22.68 MP | 2436.7 | |
| Apr 5/76 | 22.80 MP | 2436.3 | |
| May 7/76 | 22.50 MP | 2436.2 | New MP = 0.38 m TOC, (2510.0) |
| May 31/76 | 22.48 MP | 2436.3 | |
| June 21/76 | 22.46 MP | 2436.3 | |
| July 20/76 | 22.70 MP | 2435.5 | |
| | 22.67 MP | 2435.6 | After sample; temp. 5°C |
| Aug 9/76 | 22.40 MP | 2436.5 | |
| Aug 30/76 | 22.42 MP | 2436.5 | |
| Sept 27/76 | 22.29 MP | 2436.9 | |
| Oct 25/76 | 22.29 MP | 2436.9 | |
| Nov 24/76 | 22.28 MP | 2436.9 | |
| Dec 21/76 | 22.29 MP | 2436.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2508.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/77 | 22.45 MP | 2436.4 | MP (2510.0) |
| Feb 14/77 | 22.33 MP | 2436.8 | |
| Mar 14/77 | 22.34 MP | 2436.7 | |
| Apr 12/77 | 22.45 MP | 2436.4 | |
| May 12/77 | 22.36 MP | 2436.7 | |
| June 8/77 | 22.32 MP | 2436.8 | |
| July 12/77 | 22.30 MP | 2436.9 | |
| | 22.49 MP | 2436.2 | After sample; temp. 4°C |
| Aug 2/77 | 22.30 MP | 2436.9 | |
| Sept 1/77 | 22.25 MP | 2437.0 | |
| Sept 29/77 | 22.20 MP | 2437.2 | |
| Oct 27/77 | 22.10 MP | 2437.5 | |
| Nov 24/77 | 22.20 MP | 2437.2 | |
| Dec 20/77 | 22.22 MP | 2437.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2508.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 22.31 MP | 2436.8 | MP (2510.0) |
| Feb 14/78 | 22.35 MP | 2436.7 | |
| Mar 15/78 | 22.38 MP | 2436.6 | |
| Apr 10/78 | 22.37 MP | 2436.6 | |
| May 8/78 | 22.37 MP | 2436.6 | |
| June 5/78 | 22.32 MP | 2436.8 | |
| July 11/78 | 22.26 MP | 2437.0 | |
| | 22.48 MP | 2436.3 | After sample; temp. 9°C |
| July 31/78 | 22.27 MP | 2436.9 | |
| Aug 28/78 | 22.27 MP | 2436.9 | |
| Sept 28/78 | 22.21 MP | 2437.1 | |
| Oct 26/78 | 22.05 MP | 2437.7 | |
| Nov 20/78 | 22.17 MP | 2437.3 | |
| Dec 18/78 | 22.07 MP | 2437.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-165

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2508.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 22.09 MP | 2437.5 | MP (2510.0) |
| Feb 12/79 | 22.36 MP | 2436.7 | |
| Mar 13/79 | 22.28 MP | 2436.9 | |
| Apr 11/79 | 22.32 MP | 2436.8 | |
| May 7/79 | 22.36 MP | 2436.7 | |
| June 5/79 | 22.31 MP | 2436.8 | |
| July 11/79 | 22.22 MP | 2437.1 | |
| | 22.45 MP | 2436.4 | After sample; temp. 5°C |
| July 30/79 | 22.28 MP | 2436.9 | New MP 0.39m TOC (2510.0) |
| Aug 30/79 | 22.19 MP | 2437.2 | |
| Sept 24/79 | 22.18 MP | 2437.2 | |
| Oct 22/79 | 22.11 MP | 2437.5 | |
| Nov 19/79 | 22.07 MP | 2437.6 | |
| Dec 20/79 | 22.01 MP | 2437.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

10 - 165 - W - 82

WELL HISTORY

OBSERVATION WELL NUMBER 10 - 165

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2508.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 22.06 MP | 2437.6 | |
| Feb 11/80 | 22.20 MP | 2437.2 | |
| Mar 12/80 | 22.21 MP | 2437.1 | |
| Apr 8/80 | 22.31 MP | 2436.8 | |
| May 7/80 | 22.41 MP | 2436.5 | |
| June 5/80 | 22.33 MP | 2436.8 | |
| July 3/80 | 22.33 MP | 2436.8 | Temp. 7°C |
| | 22.63 MP | 2435.8 | After Sample |
| July 13/80 | 22.34 MP | 2436.7 | Airlifted for 30 min @1 gal/min. |
| July 14/80 | 24.80 MP | 2428.6 | Airlifted for 90 min @.25 gal/mi Sample, Temp. = 5°C Cond. = 400 |
| July 28/80 | 22.32 MP | 2436.8 | |
| Aug 28/80 | 22.22 MP | 2437.1 | |
| Sept 22/80 | 22.18 MP | 2437.2 | |
| Oct 22/80 | 22.09 MP | 2437.5 | |
| Nov 20/80 | 22.05 MP | 2437.7 | |
| Dec 16/80 | 22.02 MP | 2437.8 | |
| Jan 13/81 | 22.14 MP | 2437.4 | |
| Feb 12/81 | 22.22 MP | 2437.1 | |
| Mar 11/81 | 22.28 MP | 2436.9 | |
| Apr 7/81 | 22.22 MP | 2437.1 | |
| May 6/81 | 22.39 MP | 2436.6 | |
| June 1/81 | 22.33 MP | 2436.8 | |
| July 2/81 | 22.32 MP | 2436.8 | |
| July 29/81 | 22.35 MP | 2436.7 | |
| Aug 27/81 | 22.46 MP | 2436.3 | |
| Sept 21/81 | 22.38 MP | 2436.6 | |
| Oct 22/81 | 22.54 MP | 2436.1 | |
| Nov 16/81 | 22.51 MP | 2436.2 | |
| Dec 17/81 | 22.58 MP | 2435.9 | |

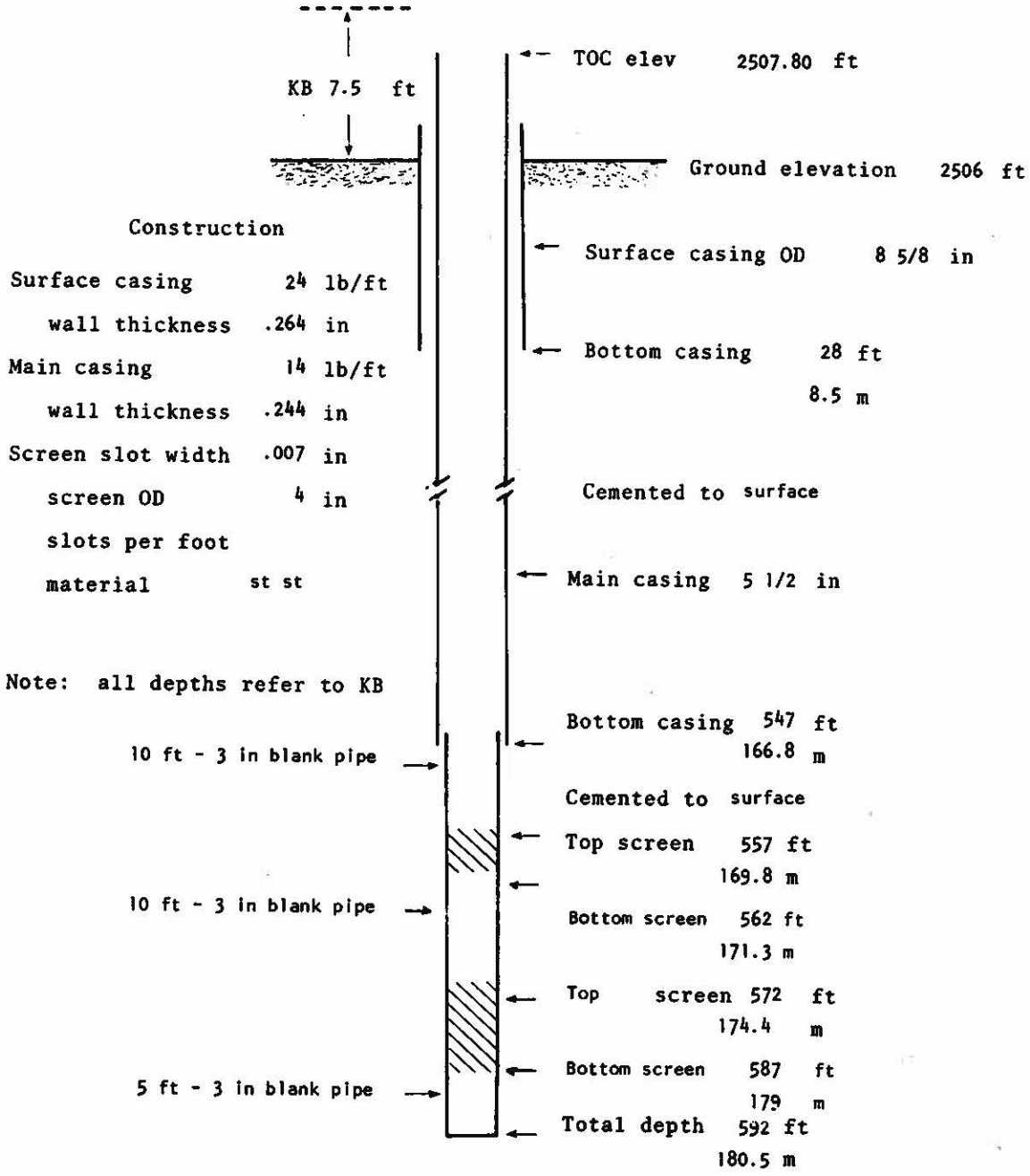
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Tp 85 R 9 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB

## DRILL STEM TEST

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Tp 85 R 9 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 2506 |
| | KB | 2514 |
| Type of test | | Casing Positrieve |
| Date of test | | December 15, 1975 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 1120 | hrs |
| Tool opened | 1156 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1415 | hrs |
| Out of hole at | | hrs |
| Wt on packers | 1500 | lbs |

Description of blow: Faint initial puff. Weak blow, dead in 5 minutes on second opening.

Total water recovered 80 ft

Water sample No.

Gas blow -

Remarks

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 3/8" EVE tubing

Drill collar size (ID) 2"

Drill collar length (ft) 29

Open or screened interval 557-562, 572-587'

Formation tested Glacial drift

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.30 | |
| D.P. Sub | 1.20 | |
| MFE Tool | 10.03 | |
| Positrieve Packer | 2.64 | 5 1/2" |
| Total | 15.17 | |
| Packer Stub | 3.53 | |
| REcorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.93 | |

### PRESSURE DATA (psi)

| Instrument No. | | 97 | 90 |
|---|---|---|---|
| Capacity (psig) | | 1250 | 1250 |
| Instrument set at (ft) | | 524 | 531 |
| Initial hydrostatic | A | 133 | 128 |
| First flow | B | 46 | 44 |
| | B1 | 46 | 44 |
| Initial shut in | C | 129 | 124 |
| Second flow | D | 48 | 47 |
| | D1 | 50 | 48 |
| Final shut in | G | 112 | 108 |
| Final hydrostatic | H | - | 125 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

10-592-D-77

OBSERVATION WELL NUMBER 10-592

INTERVAL TESTED 521 - 592'

PRESSURE INCREMENTS

Recorder RPG-4990

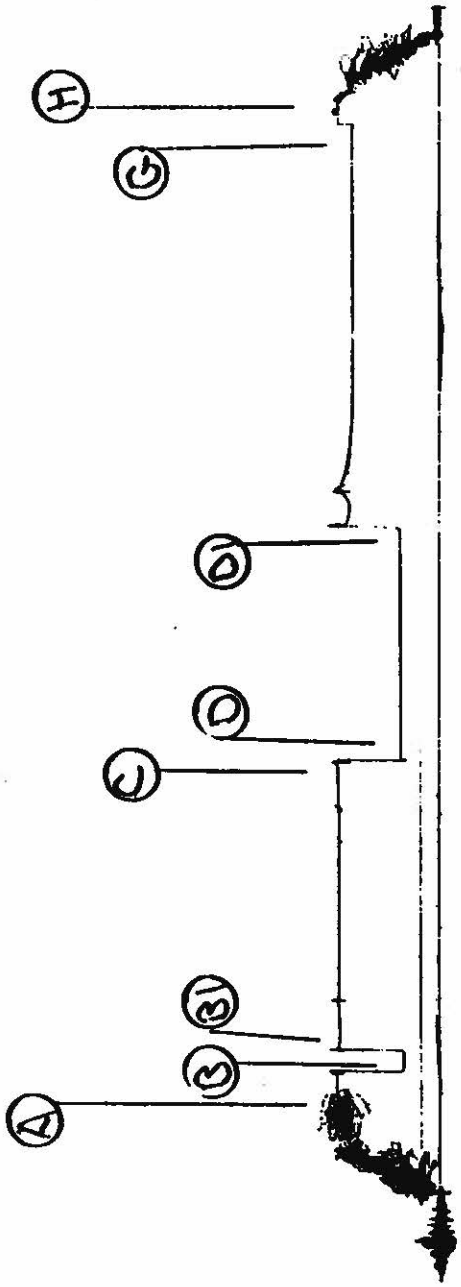
December 15, 1975

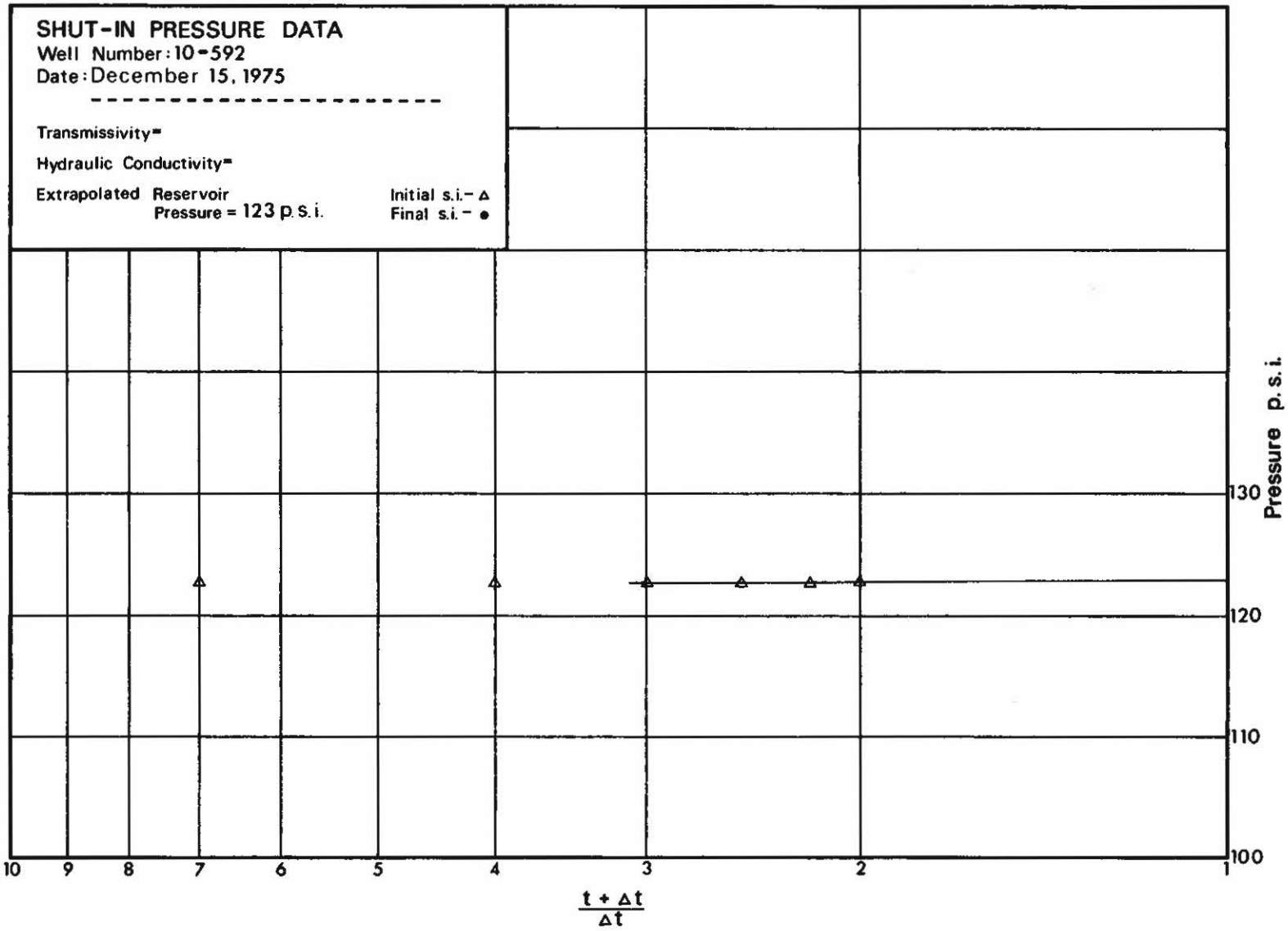
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 122.9 | 7.00 |
| 10 | 122.9 | 4.00 |
| 15 | 122.9 | 3.00 |
| 20 | 122.9 | 2.50 |
| 25 | 122.9 | 2.20 |
| 30 | 122.9 | 2.00 |

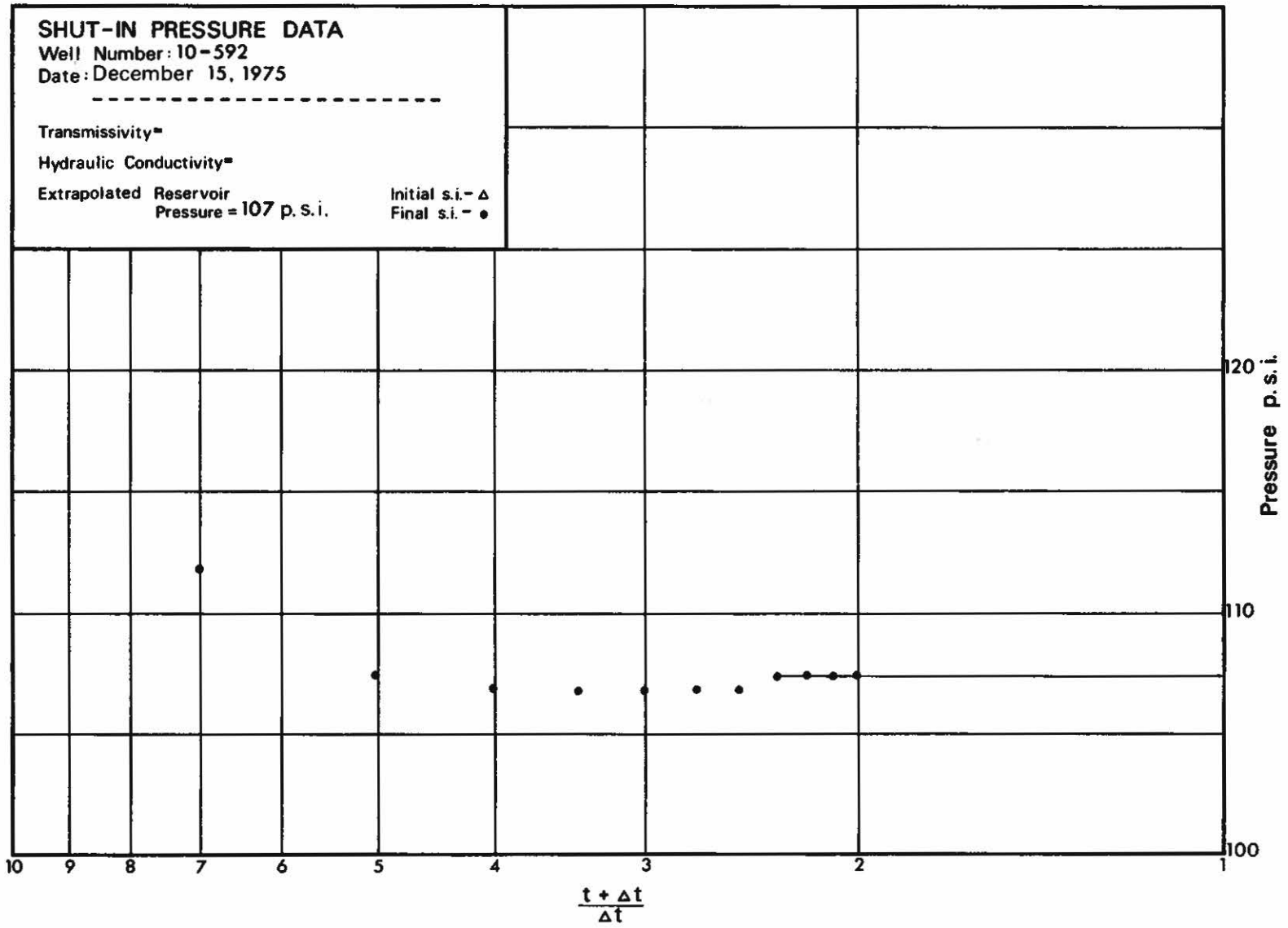
Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 119.9 | 13.00 |
| 10 | 111.8 | 7.00 |
| 15 | 107.4 | 5.00 |
| 20 | 106.8 | 4.00 |
| 25 | 106.8 | 3.40 |
| 30 | 106.8 | 3.00 |
| 35 | 106.8 | 2.71 |
| 40 | 106.8 | 2.50 |
| 45 | 107.4 | 2.33 |
| 50 | 107.4 | 2.20 |
| 55 | 107.4 | 2.09 |
| 60 | 107.4 | 2.00 |




SHUT-IN PRESSURE DATA
Well Number: 10-592
Date: December 15, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 123 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
130
120
110
100
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

10-592-0-77


SHUT-IN PRESSURE DATA
Well Number: 10-592
Date: December 15, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 107 p.s.i.
Initial s.i.- Δ
Final s.i.- •
120
110
100
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

10-592-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source DST on 10-592

Date sampled December 13, 1975 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 97.0 | 4.84 | 47.3 |
| Magnesium ($Mg^{++}$) | 8.6 | 0.71 | 6.9 |
| Sodium ($Na^{+}$) | 98.0 | 4.26 | 41.7 |
| Potassium ($K^{+}$) | 16.2 | 0.41 | 4.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 54.0 | 0.89 | 8.8 |
| Sulfate ($SO_4^{=}$) | 120.0 | 2.50 | 24.9 |
| Chloride ($Cl^{-}$) | 236.0 | 6.66 | 66.2 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 15.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 672.0 | | |
| Total Anions (epm) | 10.1 | Total Cations (epm) | 10.2 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1260 |
| pH | 6.9 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | | |
| pH | 7.8 | |
| Carbonate ($CO_3^{=}$) | 0 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 161 | ppm |
| Hydroxide ($OH^{-}$) | 0 | ppm |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 105.0 | 5.24 | 49 |
| Magnesium ($Mg^{++}$) | 12.7 | 1.05 | 10 |
| Sodium ($Na^{+}$) | 93.0 | 4.05 | 38 |
| Potassium ($K^{+}$) | 12.9 | 0.33 | 3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 100.0 | 1.64 | 16 |
| Sulfate ($SO_4^{=}$) | 125.0 | 2.60 | 25 |
| Chloride ($Cl^{-}$) | 222.0 | 6.26 | 60 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 0.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 104.5 | | |
| Magnesium (Acidified) | 11.7 | | |
| Total dissolved solids | 672 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 10.51 | Total Cations (epm) | 10.66 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1080 | Temperature (C) | 4.0 |
| pH | 7.7 | pH | 6.9 |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 102 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 12, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 75.0 | 3.74 | 40.3 |
| Magnesium ($Mg^{++}$) | 16.3 | 1.34 | 14.4 |
| Sodium ($Na^{+}$) | 90.0 | 3.91 | 42.1 |
| Potassium ($K^{+}$) | 11.3 | 0.29 | 3.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 93.0 | 1.52 | 15.1 |
| Sulfate ($SO_4^{=}$) | 132.0 | 2.75 | 27.2 |
| Chloride ($Cl^{-}$) | 206.0 | 5.81 | 57.6 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 33.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 68.0 | | |
| Magnesium (Acidified) | 14.7 | | |
| Total dissolved solids | 658.0 | | |
| Total Anions (epm) | 10.10 | Total Cations (epm) | 9.29 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1000 | Temperature (C) | 4.0 |
| pH | 8.0 | pH | 7.2 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 78.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Date sampled: July 20, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .222 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 88 |
| As | <.038 | Ni | <.010 |
| B | .243 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 107 | Si | .385 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .633 |
| Cr | <.006 | Te | <.065 |
| Cu | .165 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .044 | V | <.0008 |
| K | 33 | W | <.078 |
| Mg | 11.88 | Zn | .044 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

10-592-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 75.0 | 3.74 | 40.4 |
| Magnesium(Mg) | 15.6 | 1.28 | 13.9 |
| Sodium(Na) | 91.0 | 3.96 | 42.7 |
| Potassium(K) | 10.8 | 0.28 | 3.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 117.0 | 1.92 | 19.4 |
| Sulphate(SO4) | 119.0 | 2.48 | 25.1 |
| Chloride(Cl) | 192.0 | 5.41 | 54.8 |
| Nitrate(NO3) | 4.2 | 0.07 | 0.7 |
| Silica(SiO2) | 1.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 70.0 | | |
| Magnesium(Acidified) | 14.0 | | |
| TDS(mg/l) | 660.0 | | |
| Total Anions(epm) | 9.88 | Total Cations(epm) | 9.26 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 900 | Temperature(C) | 9.50 | |
| pH | 7.0 | pH | 7.9 | |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 83 | mg/l |
| | | Hydroxide(OH) | | |

10-592-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 94.0 | 4.69 | 47.2 |
| Magnesium(Mg) | 10.8 | 0.89 | 9.0 |
| Sodium(Na) | 91.0 | 3.96 | 39.9 |
| Potassium(K) | 15.4 | 0.39 | 4.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 98.0 | 1.61 | 17.2 |
| Sulphate(SO4) | 142.0 | 2.96 | 31.6 |
| Chloride(Cl) | 166.0 | 4.68 | 50.1 |
| Nitrate(NO3) | 6.4 | 0.10 | 1.1 |
| Silica(SiO2) | 1.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 64.0 | | |
| Magnesium(Acidified) | 9.0 | | |
| TDS(mg/l) | 498.0 | | |
| Total Anions(epm) | 9.35 | Total Cations(epm) | 9.93 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 960 | Temperature(C) | 5.50 | |
| pH | 8.2 | pH | 7.8 | |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 54 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 10-592-E-82

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 3, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.7 | 0.08 | 2.9 |
| Magnesium(Mg) | 0.4 | 0.03 | 1.1 |
| Sodium(Na) | 36.3 | 1.58 | 53.4 |
| Potassium(K) | 49.0 | 1.26 | 42.5 |
| Carbonate(CO3) | 38.4 | 1.28 | 42.0 |
| Bicarbonate(HCO3) | 56.0 | 0.92 | 30.1 |
| Sulphate(SO4) | 11.0 | 0.23 | 7.5 |
| Chloride(Cl) | 22.0 | 0.62 | 20.3 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.1 |
| Silica(SiO2) | 5.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 128.0 | | |
| Total Anions(epm) | 3.05 | Total Cations(epm) | 2.95 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 295 | Temperature | 5.50 | |
| pH | 9.6 | pH | 8.3 | |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 78 | mg/l |
| | | Hydroxide(OH) | | |

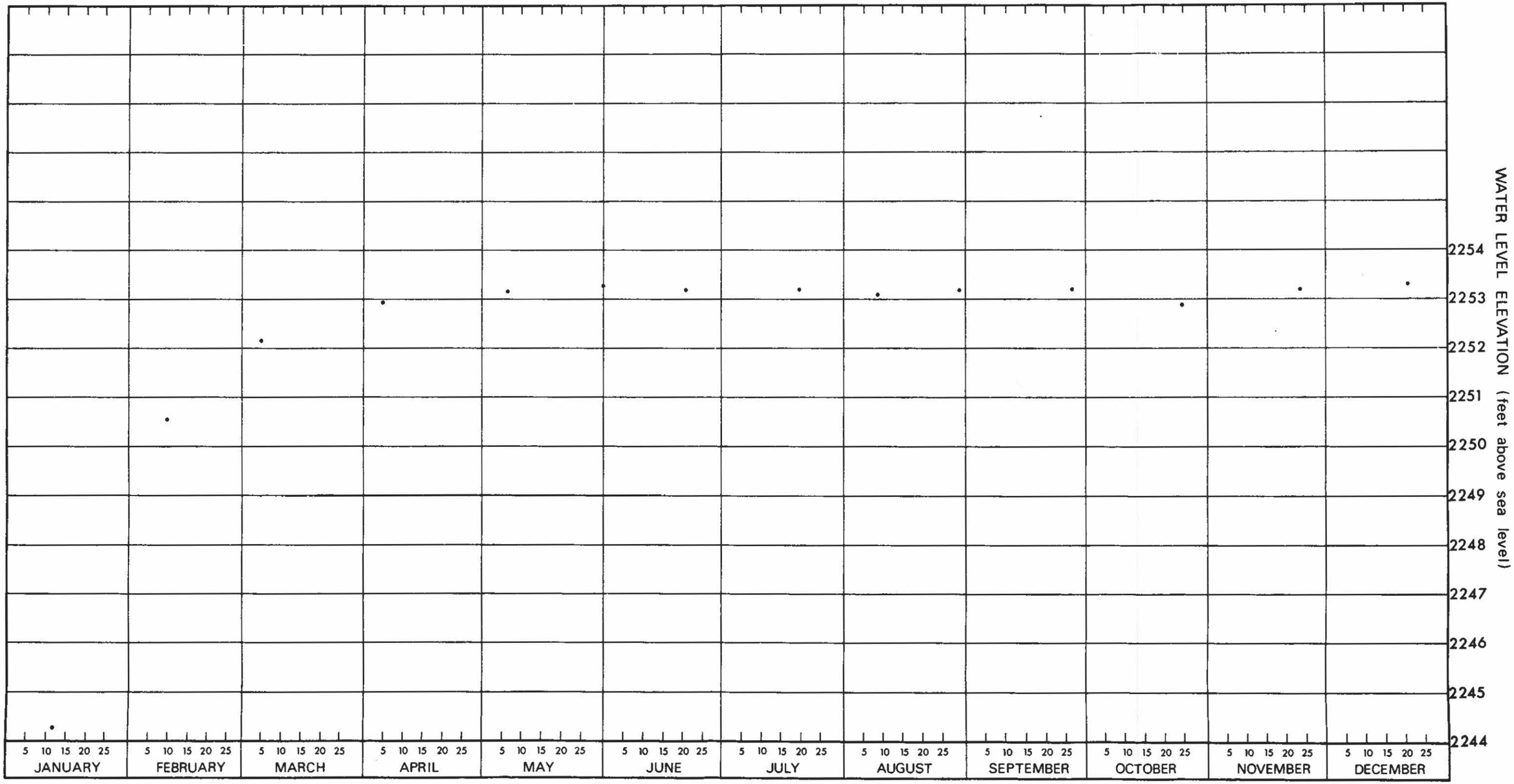
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **10-592**

Lsd **9** Sec **24** Twp **85** R **9** W4th

Alberta Research Council

10 - 592 - H - 77




1976

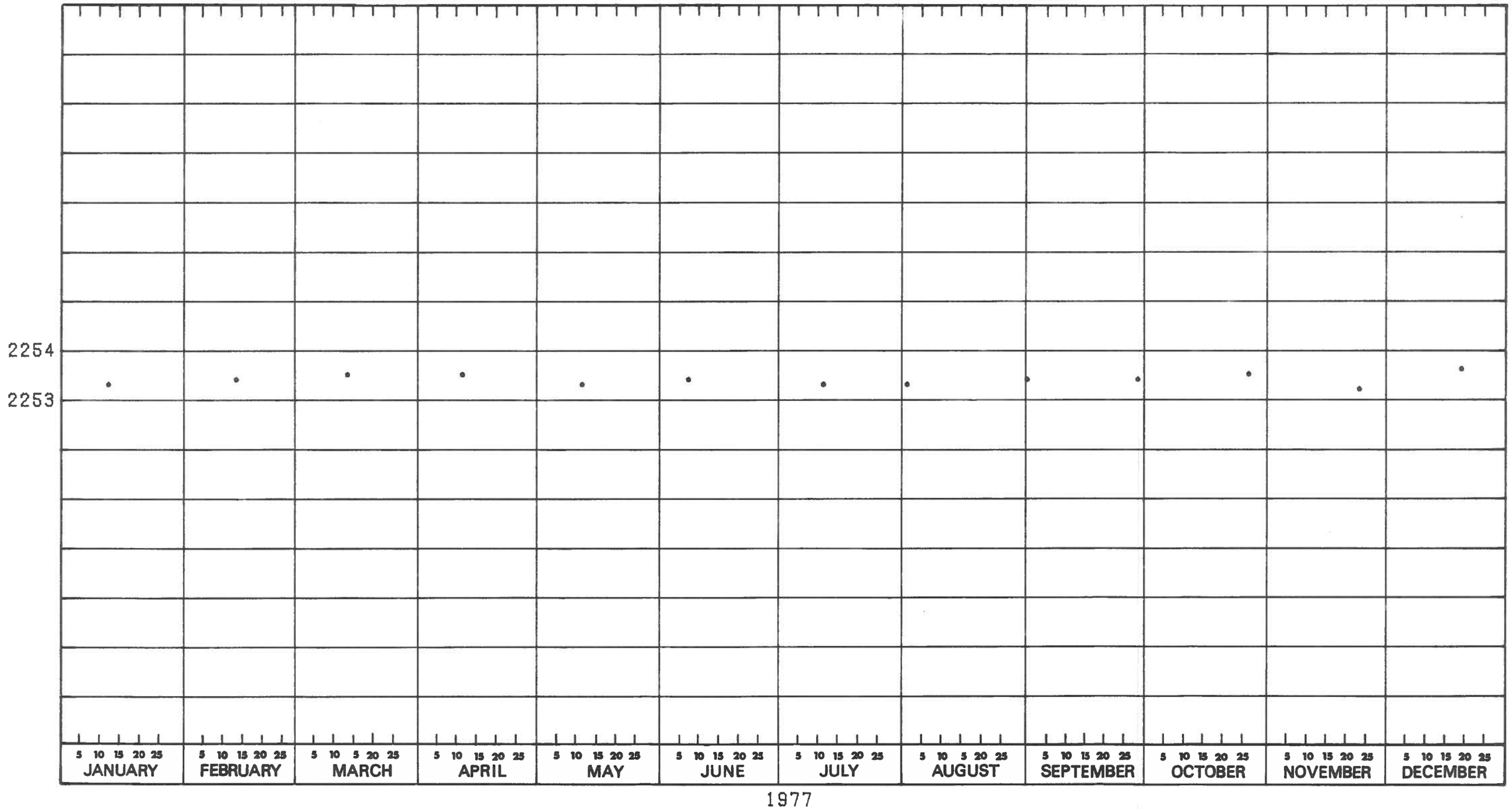
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-592-H-78




1977

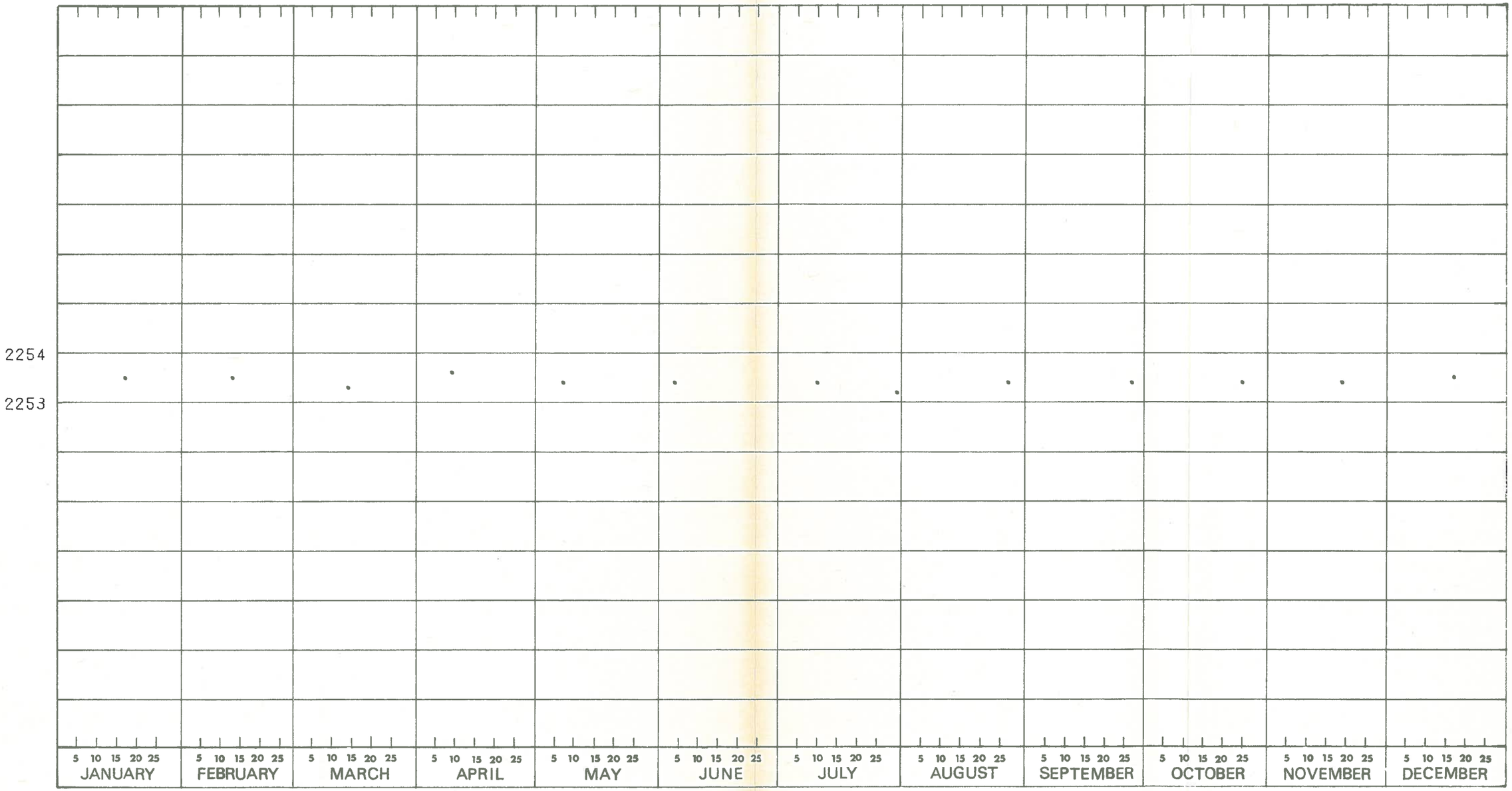
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-592

LSD 9 SEC 24 TWP 85 R 9 W4TH

10-592-H-79

Alberta Research Council




1978

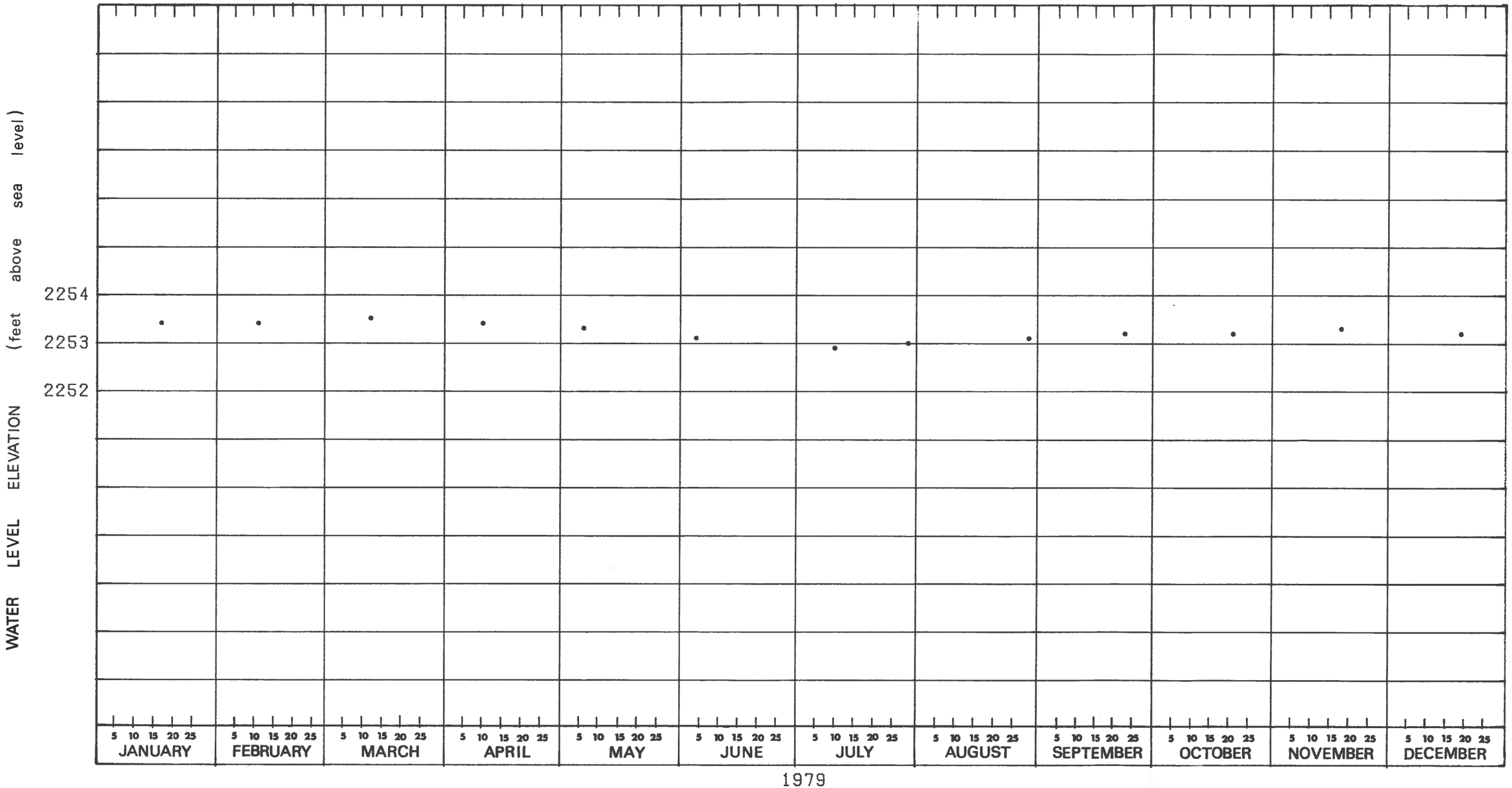
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-592

10-592-H-80

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council



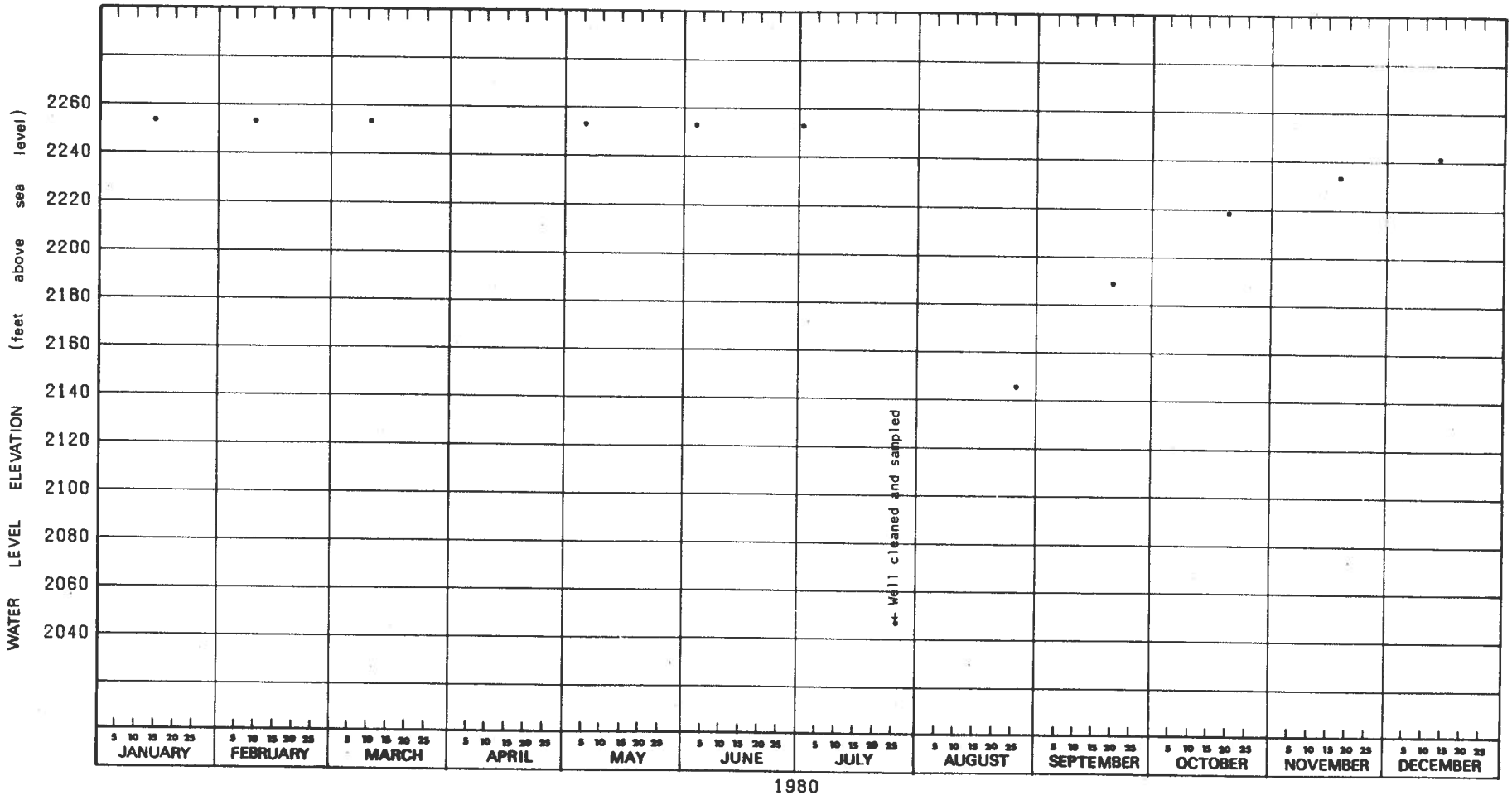
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-592-H-81



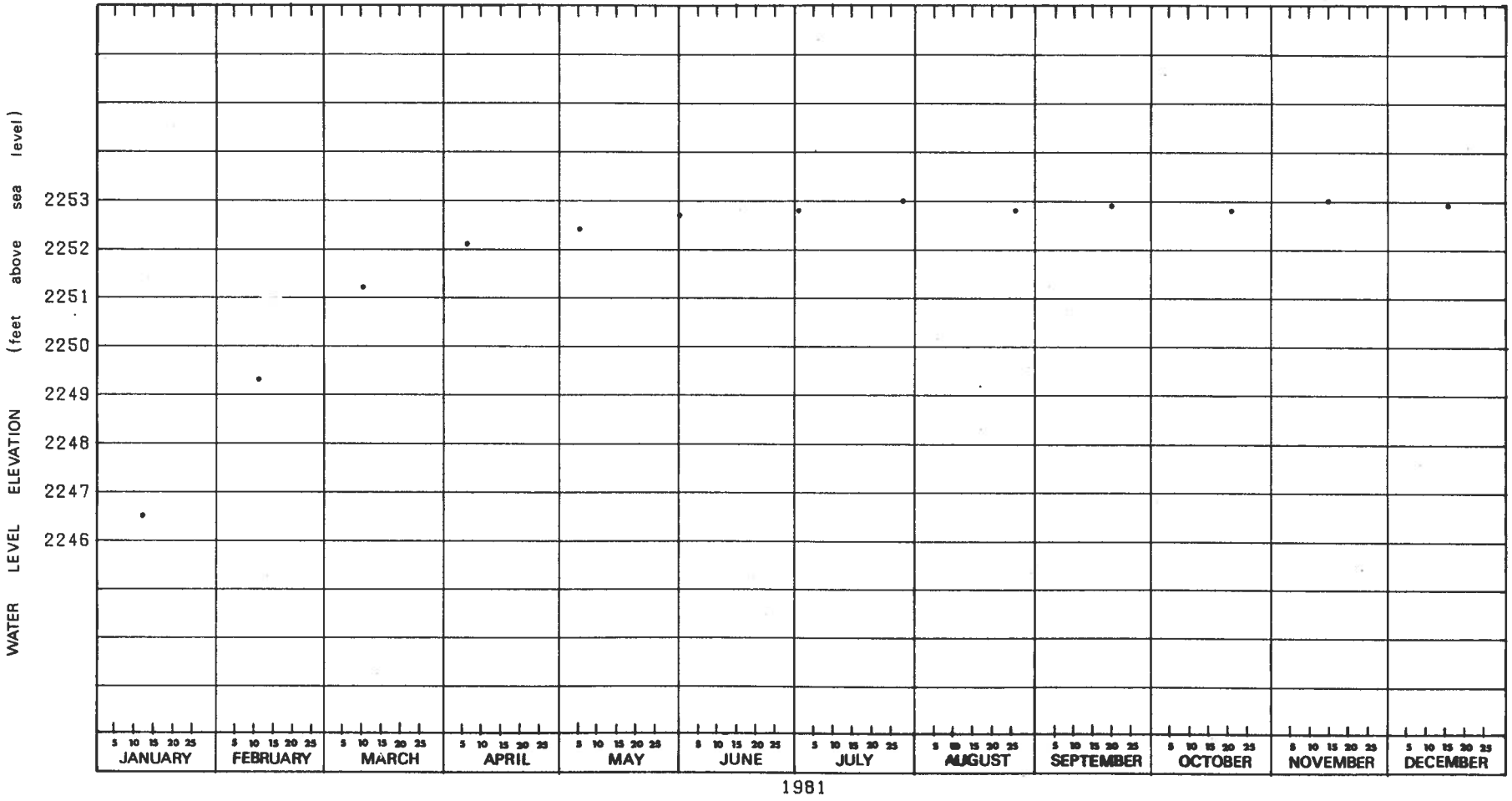
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-592

10-592-H-82

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2507.80

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Nov 27/75 | | | Well completed; blown down with air |
| Nov 29/75 | 131.62 TOC | 2076.1 | |
| Dec 1/75 | 120.05 TOC | 2114.0 | |
| Dec 3/75 | 110.52 TOC | 2145.3 | |
| Dec 4/75 | 95.12 TOC | 2195.9 | |
| Dec 15/75 | | | DST; FSI = 112# from 524 ft Water sample |
| Dec 18/75 | 87.45 MP | 2223.3 | Install shelter; MP = 0.71 m TOC, (2510.1) |
| Jan 12/76 | 81.05 MP | 2244.3 | |
| Feb 10/76 | 79.14 MP | 2250.5 | |
| Mar 5/76 | 78.65 MP | 2252.1 | |
| Apr 5/76 | 78.41 MP | 2252.9 | |
| May 7/76 | 78.27 MP | 2253.2 | New MP = 0.63 m TOC, (2509.9) |
| May 31/76 | 78.23 MP | 2253.3 | |
| June 21/76 | 78.26 MP | 2253.2 | |
| July 20/76 | 78.25 MP | 2253.2 | Sampled; temp. 4°C |
| Aug 9/76 | 78.28 MP | 2253.1 | |
| Aug 30/76 | 78.26 MP | 2253.2 | |
| Sept 27/76 | 78.25 MP | 2253.2 | |
| Oct 25/76 | 78.35 MP | 2252.9 | |
| Nov 24/76 | 78.25 MP | 2253.2 | |
| Dec 21/76 | 78.23 MP | 2253.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2507.80

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/77 | 78.23 MP | 2253.3 | MP (2509.9) |
| Feb 14/77 | 78.21 MP | 2253.4 | |
| Mar 14/77 | 78.17 MP | 2253.5 | |
| Apr 12/77 | 78.16 MP | 2253.5 | |
| May 12/77 | 78.22 MP | 2253.3 | |
| June 8/77 | 78.21 MP | 2253.4 | |
| July 12/77 | 78.22 MP | 2253.3 | Sampled; temp. 4°C |
| Aug 2/77 | 78.22 MP | 2253.3 | |
| Sept 1/77 | 78.21 MP | 2253.4 | |
| Sept 29/77 | 78.20 MP | 2253.4 | |
| Oct 27/77 | 78.16 MP | 2253.5 | |
| Nov 24/77 | 78.26 MP | 2253.2 | |
| Dec 20/77 | 78.15 MP | 2253.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2507.80

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 78.17 MP | 2253.5 | MP (2509.9) |
| Feb 14/78 | 78.17 MP | 2253.5 | |
| Mar 15/78 | 78.24 MP | 2253.3 | |
| Apr 10/78 | 78.14 MP | 2253.6 | |
| May 8/78 | 78.19 MP | 2253.4 | |
| June 5/78 | 78.19 MP | 2253.4 | |
| July 11/78 | 78.21 MP | 2253.4 | Sampled; temp. 9.5°C |
| July 31/78 | 78.25 MP | 2253.2 | |
| Aug 28/78 | 78.21 MP | 2253.4 | |
| Sept 28/78 | 78.19 MP | 2253.4 | |
| Oct 26/78 | 78.19 MP | 2253.4 | |
| Nov 20/78 | 78.21 MP | 2253.4 | |
| Dec 18/78 | 78.18 MP | 2253.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-592

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2507.80

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 78.19 MP | 2253.4 | MP (2509.9) |
| Feb 12/79 | 78.19 MP | 2253.4 | |
| Mar 13/79 | 78.18 MP | 2253.5 | |
| Apr 11/79 | 78.20 MP | 2253.4 | |
| May 7/79 | 78.24 MP | 2253.3 | |
| June 5/79 | 78.28 MP | 2253.1 | |
| July 11/79 | 78.34 MP | 2252.9 | Sampled; temp. 5.5°C |
| July 30/79 | 78.31 MP | 2253.0 | |
| Aug 30/79 | 78.29 MP | 2253.1 | |
| Sept 24/79 | 78.26 MP | 2253.2 | |
| Oct 22/79 | 78.25 MP | 2253.2 | |
| Nov 19/79 | 78.23 MP | 2253.3 | |
| Dec 20/79 | 78.26 MP | 2253.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10 - 592

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2507.80

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 78.20 MP | 2253.4 | |
| Feb 11/80 | 78.22 MP | 2253.3 | |
| Mar 12/80 | 78.21 MP | 2253.4 | |
| Apr 8/80 | | | Could not measure |
| May 7/80 | 78.27 MP | 2253.2 | |
| June 5/80 | 78.26 MP | 2253.2 | |
| July 3/80 | 78.32 MP | 2253.0 | Temp. 5.5°C |
| July 14/80 | | | Bailed 280 gal. Temp. = 6°C Cond. = 850 |
| July 28/80 | 141.22 MP | 2046.7 | |
| Aug 28/80 | 111.12 MP | 2145.4 | |
| Sept 22/80 | 97.92 MP | 2188.7 | |
| Oct 22/80 | 88.91 MP | 2218.3 | |
| Nov 20/80 | 84.29 MP | 2233.4 | |
| Dec 16/80 | 81.81 MP | 2241.6 | |
| Jan 13/81 | 80.29 MP | 2246.5 | |
| Feb 12/81 | 79.44 MP | 2249.3 | |
| Mar 11/81 | 78.88 MP | 2251.2 | |
| Apr 7/81 | 78.61 MP | 2252.1 | |
| May 6/81 | 78.50 MP | 2252.4 | |
| June 1/81 | 78.42 MP | 2252.7 | |
| July 2/81 | 78.38 MP | 2252.8 | |
| July 29/81 | 78.31 MP | 2253.0 | |
| Aug 27/81 | 78.38 MP | 2252.8 | |
| Sept 21/81 | 78.35 MP | 2252.9 | |
| Oct 22/81 | 78.37 MP | 2252.8 | |
| Nov 16/81 | 78.33 MP | 2253.0 | |
| Dec 17/81 | 78.35 MP | 2252.9 | |

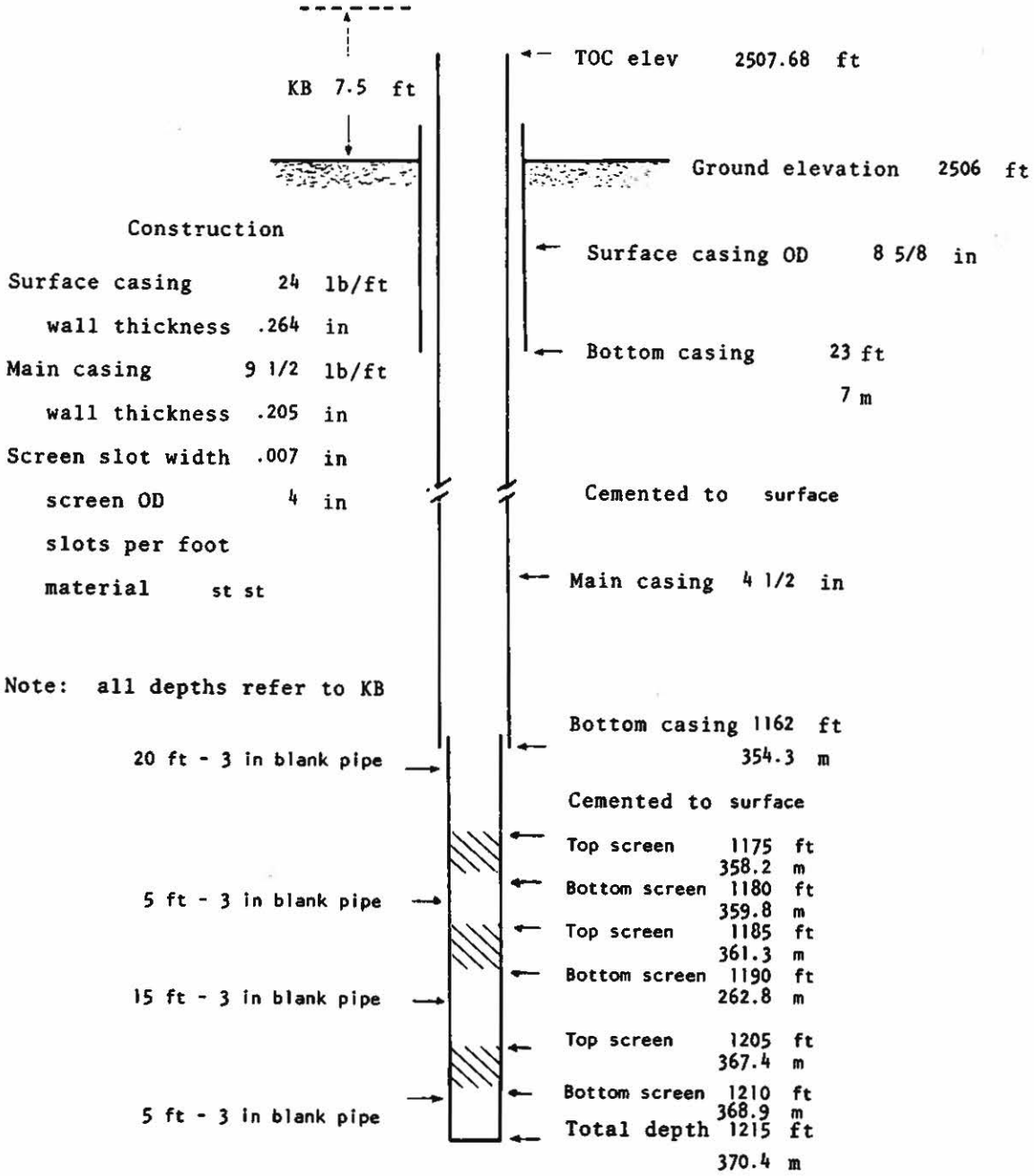
MP - Depth from measuring point
TOC - Depth from top of casing

**WELL CONSTRUCTION.**

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Tp 85 R 9 W 4th

Alberta Research Council



## DRILL STEM TEST

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Tp 85 R 9 W4th

Alberta Research Council

Elevation: gl 2506
KB 2514

Type of test Casing Positrieve

Date of test December 13, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1530 | hrs |
| Tool opened | 1704 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | | min |
| Pulled loose at | 0800 | hrs |
| Out of hole at | 0915 | hrs |
| Wt on packers | 2000 | lbs |

Description of blow Weak initial puff. Weak air blow-dead in 20 minutes on second opening.

Total water recovered 40 ft

Water sample No. DH 302

Gas blow -

Remarks Tool left over night on final shut in

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 3/8" EVE tubing

Drill collar size (ID) -

Drill collar length (ft) 29

Open or screened interval 1175-1180, 1185-1190, 1205-1210'

Formation tested Grand Rapids

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.30 | |
| D.P. Sub | 1.20 | |
| MFE Tool | 10.03 | |
| Positrieve Packer | 2.07 | 4 1/2" |
| Total | 14.60 | |
| Packer Stub | 3.53 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.93 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 97 | 90 |
| Capacity (psig) | | 1250 | 1250 |
| Instrument set at (ft) | | 1134 | 1141 |
| Initial hydrostatic | A | 127 | 123 |
| First flow | B | 11 | 11 |
| | B1 | 11 | 11 |
| Initial shut in | C | 44 | 43 |
| Second flow | D | 11 | 11 |
| | D1 | 35 | 35 |
| Final shut in | G | 53 | 48 |
| Final hydrostatic | H | - | - |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 10-1215

INTERVAL TESTED 1130-1215

PRESSURE INCREMENTS

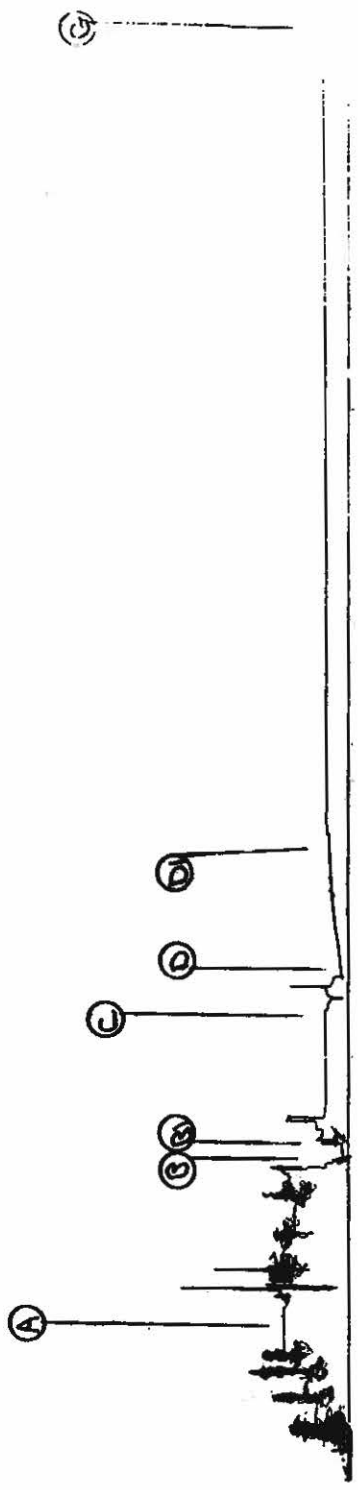
Recorder RPG-90
December 13, 1975

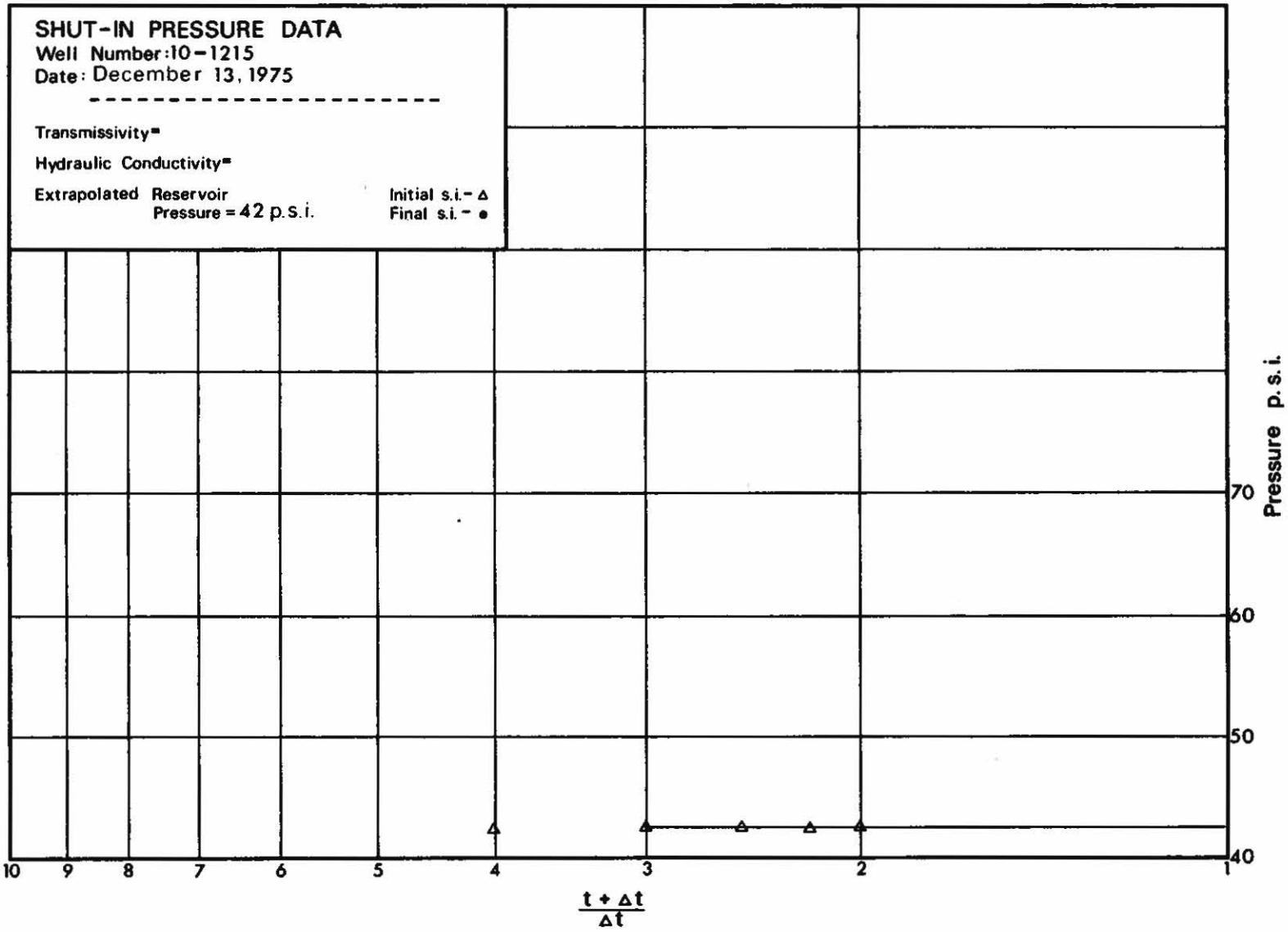
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 61.4 | 7.00 |
| 10 | 42.4 | 4.00 |
| 15 | 42.4 | 3.00 |
| 20 | 42.4 | 2.50 |
| 25 | 42.4 | 2.20 |
| 30 | 42.4 | 2.00 |

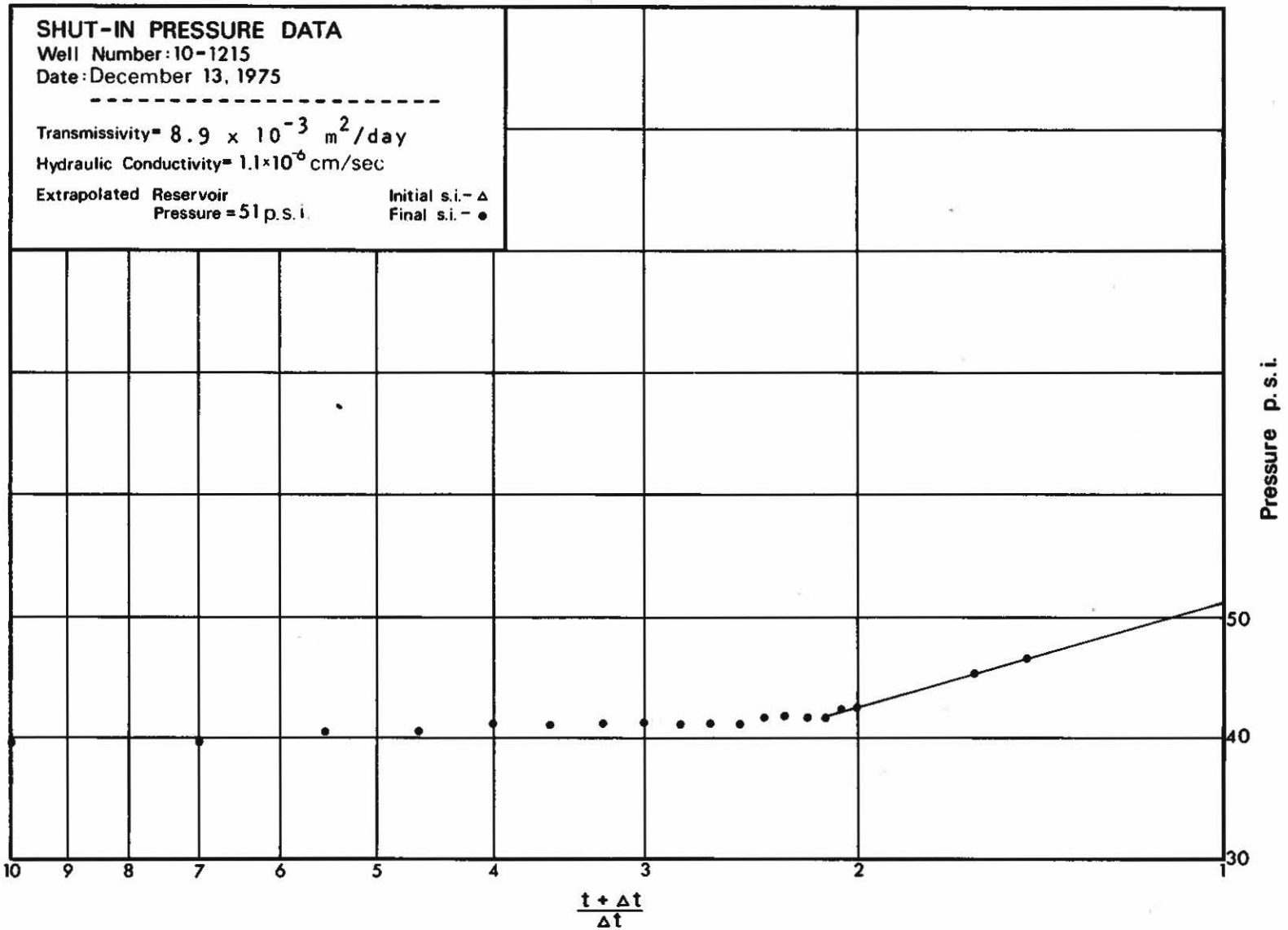
Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 41.1 | 19.00 |
| 10 | 39.9 | 10.00 |
| 15 | 39.9 | 7.00 |
| 20 | 40.5 | 5.50 |
| 25 | 40.5 | 4.60 |
| 30 | 41.1 | 4.00 |
| 35 | 41.1 | 3.57 |
| 40 | 41.1 | 3.25 |
| 45 | 41.1 | 3.00 |
| 50 | 41.1 | 2.80 |
| 55 | 41.1 | 2.64 |
| 60 | 41.1 | 2.50 |
| 65 | 41.8 | 2.38 |
| 70 | 41.8 | 2.29 |
| 80 | 41.8 | 2.13 |
| 85 | 42.4 | 2.06 |
| 90 | 42.4 | 2.00 |
| 150 | 45.6 | 1.60 |
| 200 | 46.8 | 1.45 |




SHUT-IN PRESSURE DATA
Well Number: 10-1215
Date: December 13, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 42 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
70
60
50
40
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

10-1215-D-77


SHUT-IN PRESSURE DATA
Well Number: 10-1215
Date: December 13, 1975
Transmissivity= 8.9 x 10^-3 m^2/day
Hydraulic Conductivity= 1.1×10^-6 cm/sec
Extrapolated Reservoir Pressure = 51 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
50
40
30
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

10-1215-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source DST on 10-1215

Date sampled December 12, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 375.0 | 18.71 | 55.7 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0.0 |
| Sodium ($Na^{+}$) | 320.0 | 13.92 | 41.4 |
| Potassium ($K^{+}$) | 37.1 | 0.95 | 2.8 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 2.2 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 37.6 | 0.78 | 2.2 |
| Chloride ($Cl^{-}$) | 756.0 | 21.32 | 59.1 |
| Nitrate ($NO_3^{=}$) | 2.8 | 0.05 | 0.1 |
| Silica ($SiO_2$) | 4.8 | | |
| Hydroxide ($OH^{-}$) | 223.0 | 13.11 | 36.4 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1834.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 36.1 | Total Cations (epm) | 33.6 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 7500 | Temperature (C) | |
| pH | 12 | pH | 11.9 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | 49 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| | | Hydroxide ($OH^{-}$) | 231 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 490.0 | 24.45 | 70 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 223.0 | 9.70 | 28 |
| Potassium ($K^{+}$) | 37.5 | 0.96 | 3 |
| Carbonate ($CO_3^{=}$) | 36.0 | 1.20 | 6 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 33.5 | 0.70 | 3 |
| Chloride ($Cl^{-}$) | 710.0 | 20.02 | 91 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 0.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 495.0 | | |
| Magnesium (Acidified) | 0.4 | | |
| Total dissolved solids | 1896 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 21.93 | Total Cations (epm) | 35.12 |

### Other Constituents

Lab:

- Conductivity
- pH
- Fluoride ($F^{-}$)

Field:

| | | |
|---|---|---|
| Temperature (C) | 6.0 | |
| pH | 12.5 | |
| Carbonate ($CO_3^{=}$) | 25 | Mg/L |
| Bicarbonate ($HCO_3^{-}$) | | |
| Hydroxide ($OH^{-}$) | 227 | Mg/L |
| Conductivity | | |

10-1215-E-78

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 490.0 | 24.45 | 70 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 223.0 | 9.70 | 28 |
| Potassium ($K^{+}$) | 37.5 | 0.96 | 3 |
| Carbonate ($CO_3^{=}$) | 36.0 | 1.20 | 4 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 33.5 | 0.70 | 2 |
| Chloride ($Cl^{-}$) | 710.0 | 20.02 | 58 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 0.0 | | |
| Hydroxide ($OH^{-}$) | 211.0 | 12.4 | 36 |
| Calcium (Acidified) | 495.0 | | |
| Magnesium (Acidified) | 0.4 | | |
| Total dissolved solids | 1896 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 34.33 | Total Cations (epm) | 35.12 |

Other Constituents

Lab:

- Conductivity
- pH
- Fluoride ($F^{-}$)

Field:

| | | |
|---|---|---|
| Temperature (C) | 6.0 | |
| pH | 12.5 | |
| Carbonate ($CO_3^{=}$) | 25 | Mg/L |
| Bicarbonate ($HCO_3^{-}$) | | |
| Hydroxide ($OH^{-}$) | 227 | Mg/L |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 12, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 465.0 | 23.20 | 69.1 |
| Magnesium ($Mg^{++}$) | 0.2 | 0.02 | 0.0 |
| Sodium ($Na^{+}$) | 216.0 | 9.40 | 28.0 |
| Potassium ($K^{+}$) | 37.1 | 0.95 | 2.8 |
| Carbonate ($CO_3^{=}$) | 26.4 | 0.88 | 2.5 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 35.0 | 0.73 | 2.1 |
| Chloride ($Cl^{-}$) | 740.0 | 20.87 | 58.8 |
| Nitrate ($NO_3^{=}$) | 1.6 | 0.03 | 0.1 |
| Silica ($SiO_2$) | 40.5 | | |
| Hydroxide ($OH^{-}$) | 221.0 | 12.99 | 36.6 |
| Calcium (Acidified) | 430.0 | | |
| Magnesium (Acidified) | 0.4 | | |
| Total dissolved solids | 2034.0 | | |
| Total Anions (epm) | 35.50 | Total Cations (epm) | 33.57 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 5200 | Temperature (C) | 7.0 |
| pH | 12.0 | pH | 12.2 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | 24.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 218.0 ppm |
| | | Conductivity | |

10-1215-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 405.0 | 20.21 | 65.4 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.0 |
| Sodium(Na) | 224.0 | 9.74 | 31.5 |
| Potassium(K) | 37.1 | 0.95 | 3.1 |
| Carbonate(CO3) | 36.0 | 1.20 | 4.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 32.9 | 0.68 | 2.3 |
| Chloride(Cl) | 682.0 | 19.23 | 64.3 |
| Nitrate(NO3) | 4.3 | 0.07 | 0.2 |
| Silica(SiO2) | 0.9 | | |
| Hydroxide(OH) | 148.0 | 8.70 | 29.1 |
| Calcium(Acidified) | 405.0 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 1964.0 | | |
| Total Anions(epm) | 29.89 | Total Cations(epm) | 30.91 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 4290 | | Temperature(C) | 13.00 | |
| pH | 12.4 | | pH | 12.1 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | 34 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 212 | mg/l |

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1979

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 540.0 | 26.95 | 72.1 |
| Magnesium(Mg) | 0.0 | 0.00 | 0.0 |
| Sodium(Na) | 218.0 | 9.48 | 25.4 |
| Potassium(K) | 37.0 | 0.95 | 2.5 |
| Carbonate(CO3) | 36.0 | 1.20 | 3.5 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 53.0 | 1.10 | 3.2 |
| Chloride(Cl) | 720.0 | 20.30 | 59.3 |
| Nitrate(NO3) | 0.6 | 0.01 | 0.0 |
| Silica(SiO2) | 1.5 | | |
| Hydroxide(OH) | 198.0 | 11.64 | 34.0 |
| Calcium(Acidified) | 540.0 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 1660.0 | | |
| Total Anions(epm) | 34.26 | Total Cations(epm) | 37.38 |

## Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4260 | Temperature(C) | 7.00 | |
| pH | 12.0 | pH | 12.3 | |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) | 24 | mg/l |
| | | Bicarbonate(HCO3) | | |
| | | Hydroxide(OH) | 216 | mg/l |

WATER ANALYSIS 10-1215-E-82

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 3, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 410.0 | 20.50 | 65.2 |
| Magnesium(Mg) | 0.0 | 0.0 | 0.0 |
| Sodium(Na) | 229.0 | 9.96 | 31.7 |
| Potassium(K) | 37.9 | 0.97 | 3.1 |
| Carbonate(CO3) | 43.2 | 1.44 | 6.6 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 48.0 | 1.00 | 4.6 |
| Chloride(Cl) | 682.0 | 19.21 | 88.6 |
| Nitrate(NO3) | 1.9 | 0.03 | 0.1 |
| Silica(SiO2) | 4.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 365.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 1746.0 | | |
| Total Anions(epm) | 21.68 | Total Cations(epm) | 31.43 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4450 | Temperature | 8.00 | |
| pH | 11.9 | pH | 12.1 | |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | 43 | mg/l |
| | | Bicarbonate(HCO3) | 0 | mg/l |
| | | Hydroxide(OH) | 204 | mg/l |

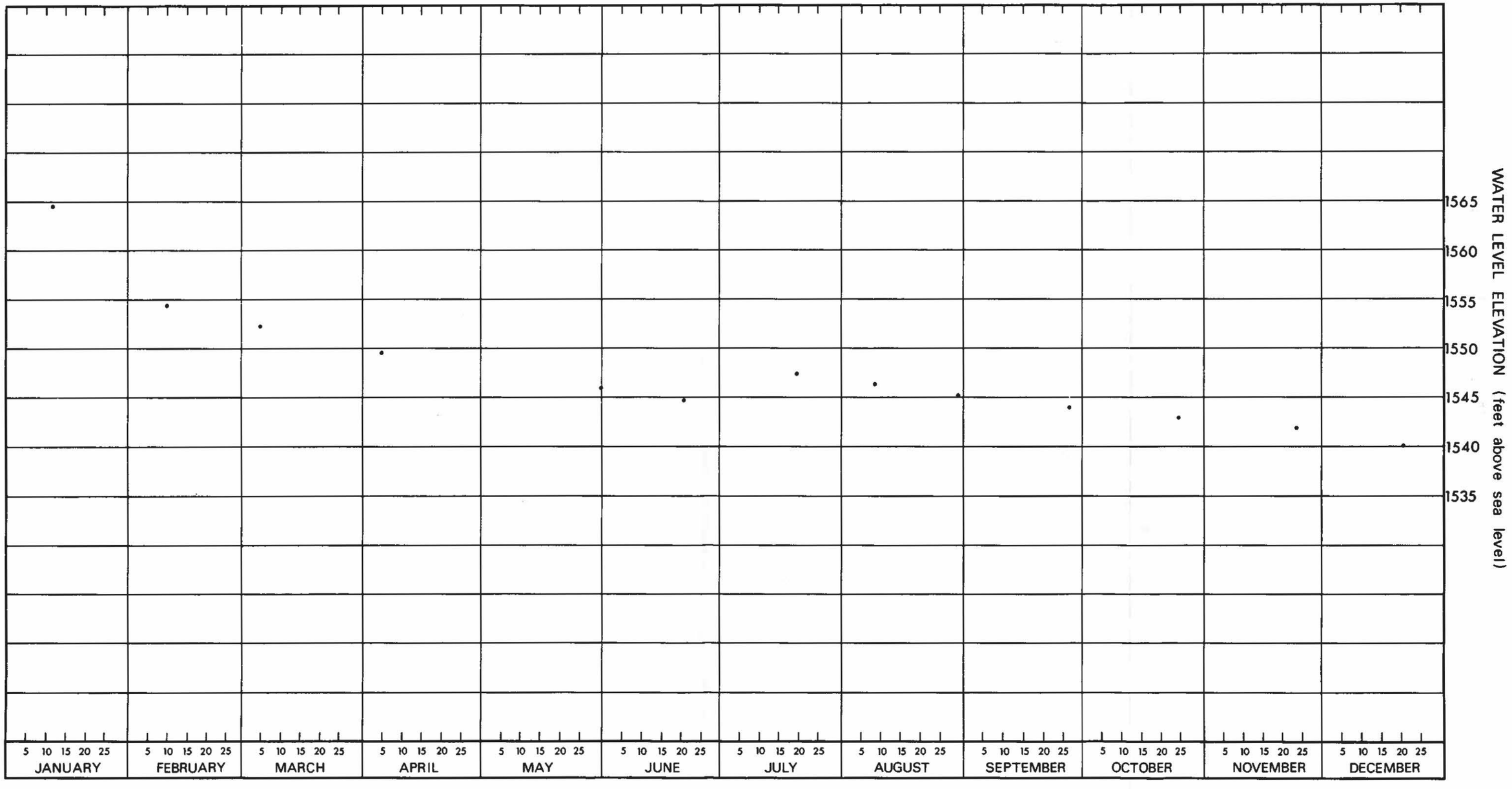
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1215

10 - 1215 - H - 77

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council




1976

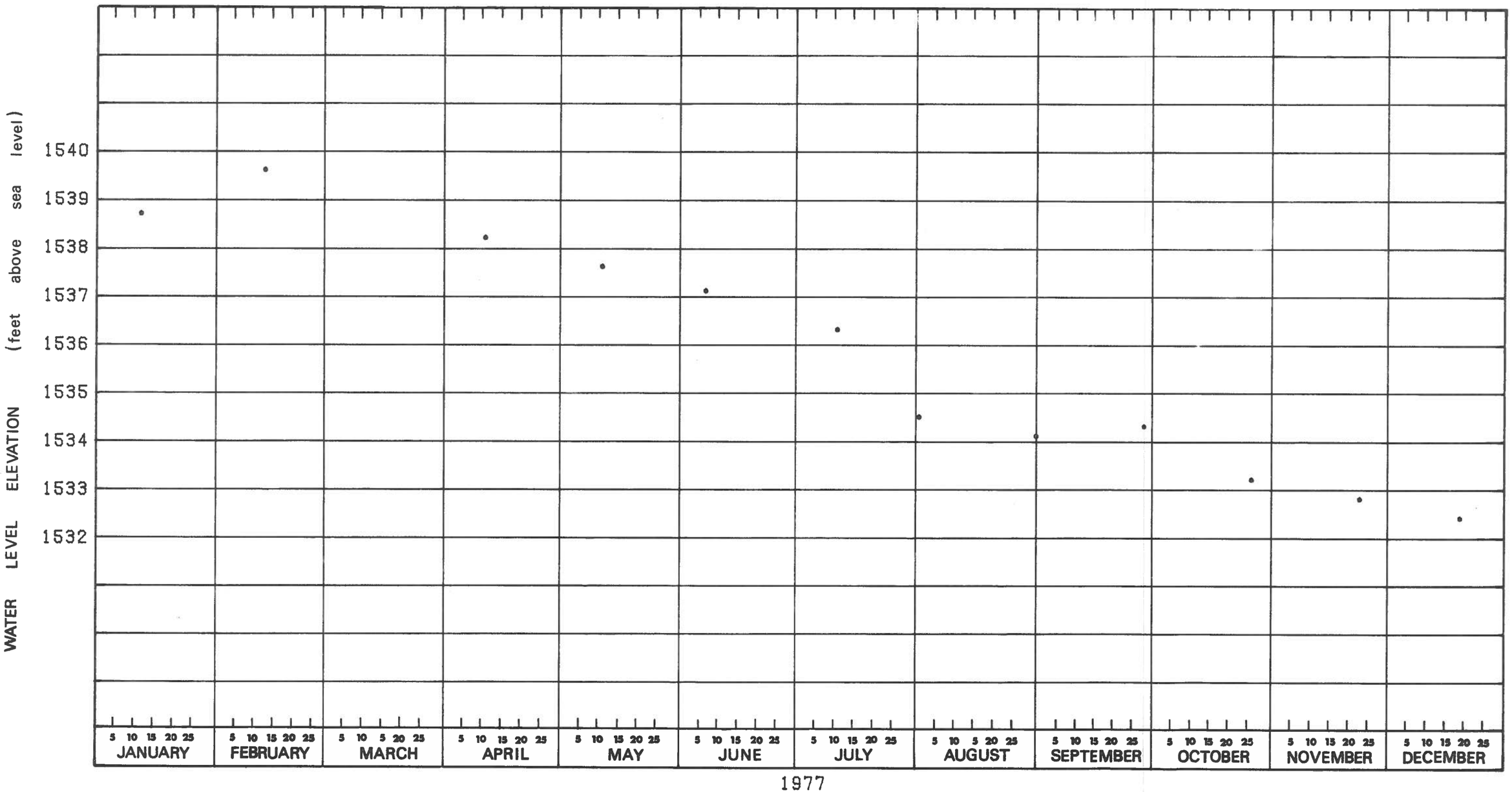
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-1215-H-78




1977

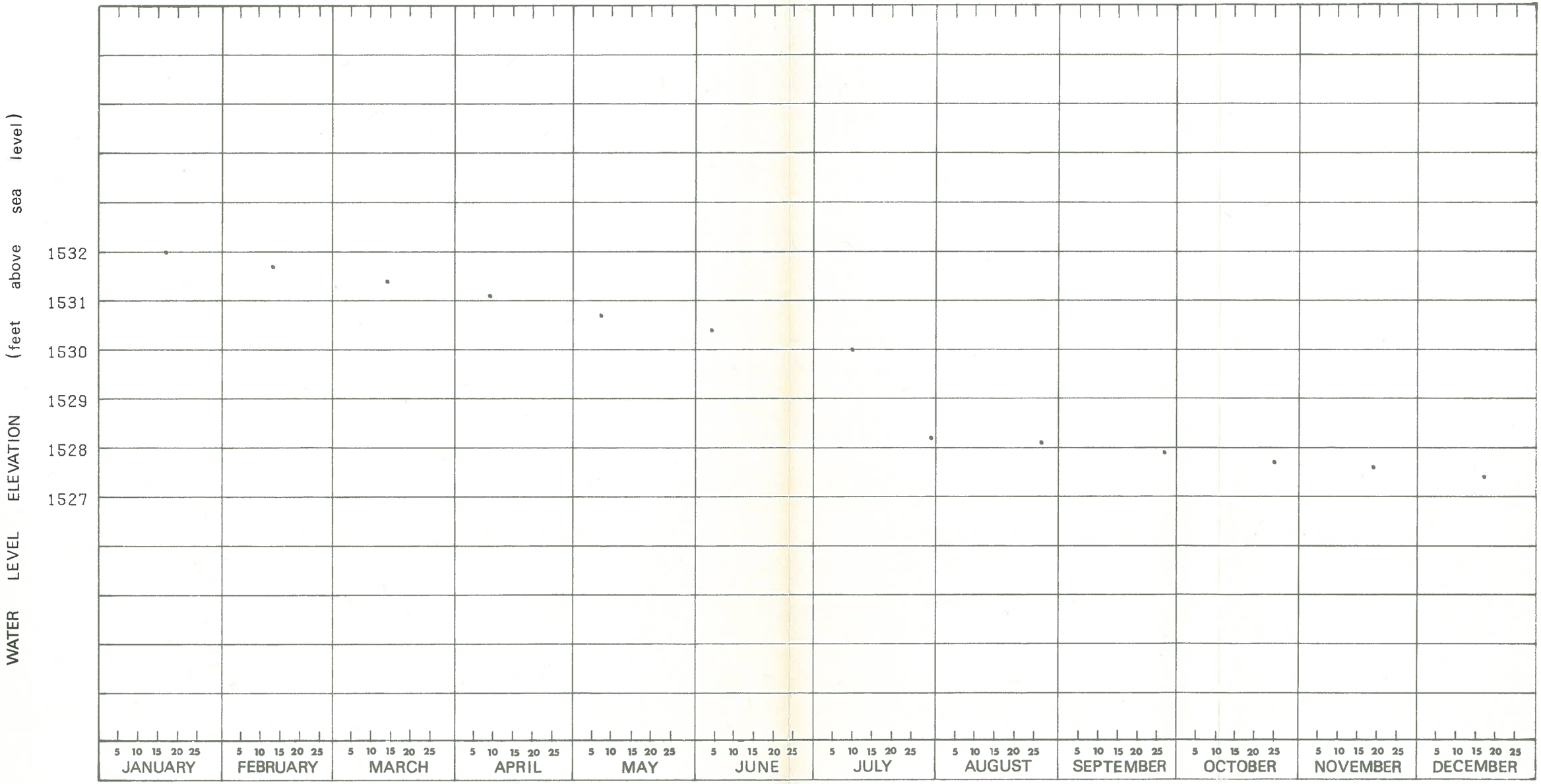
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1215

LSD 9 SEC 24 TWP 85 R 9 W4TH

10-1215-H-79

Alberta Research Council




1978

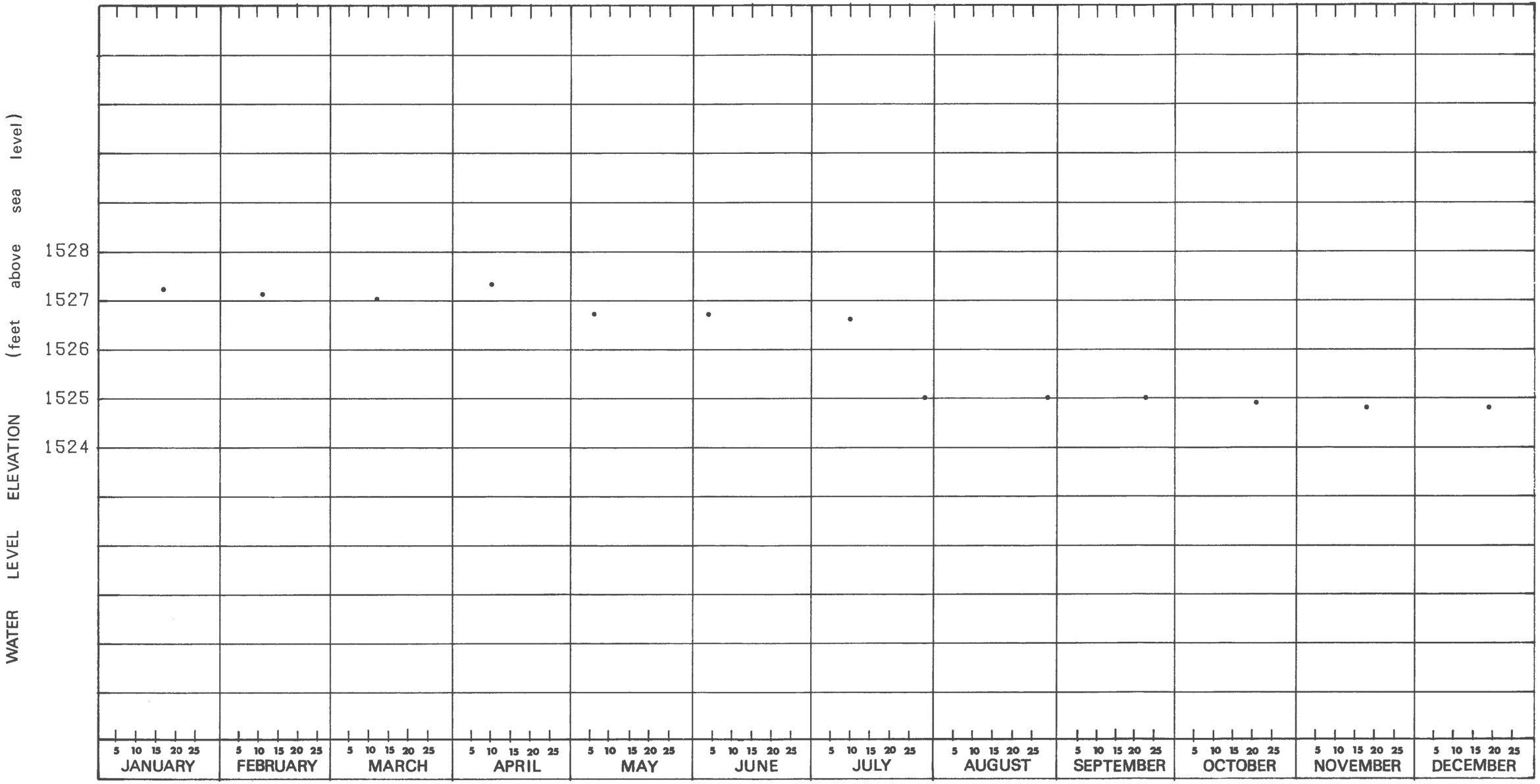
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1215

10-1215-H-80

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council




1979

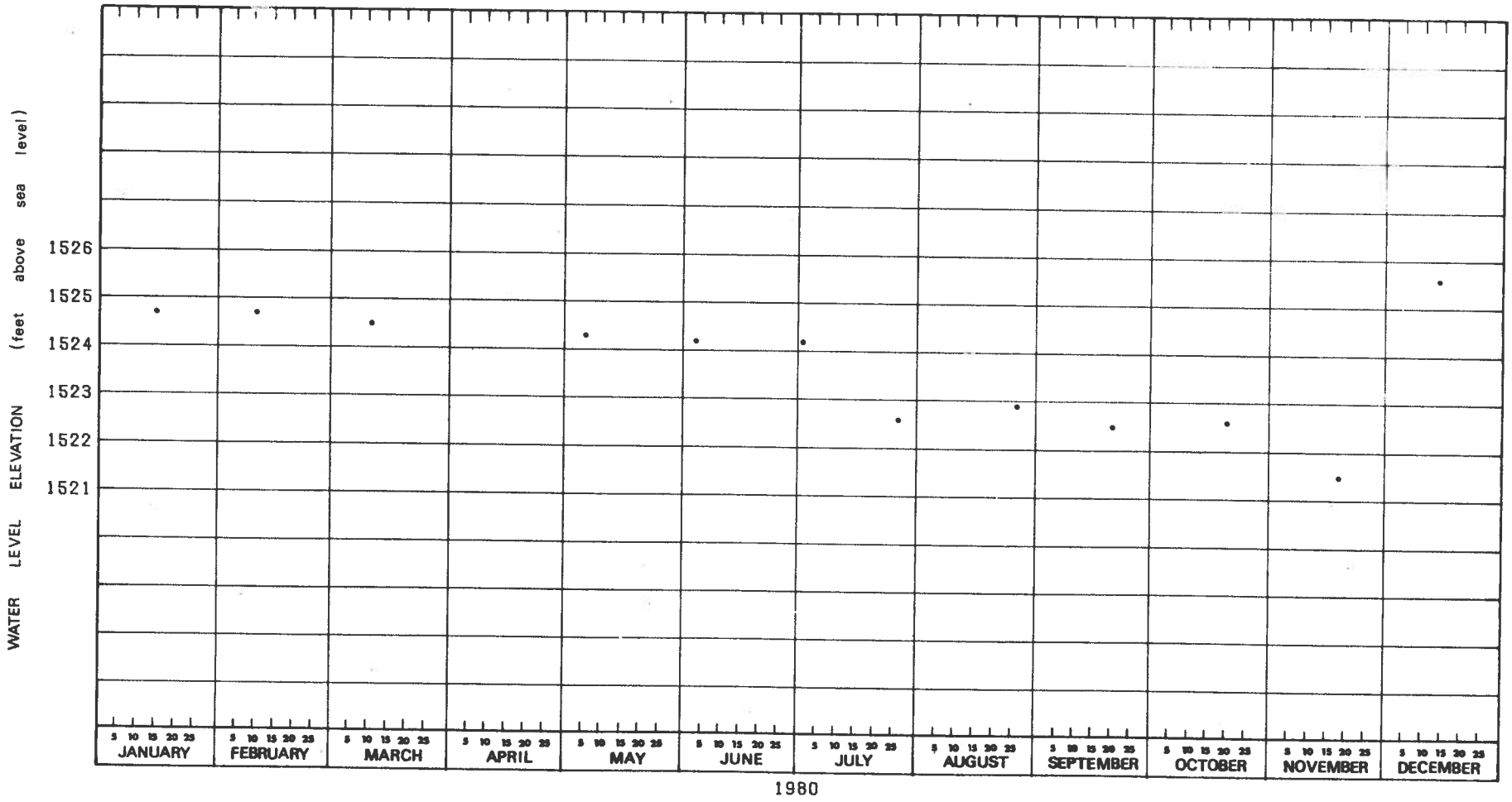
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-1215-H-81



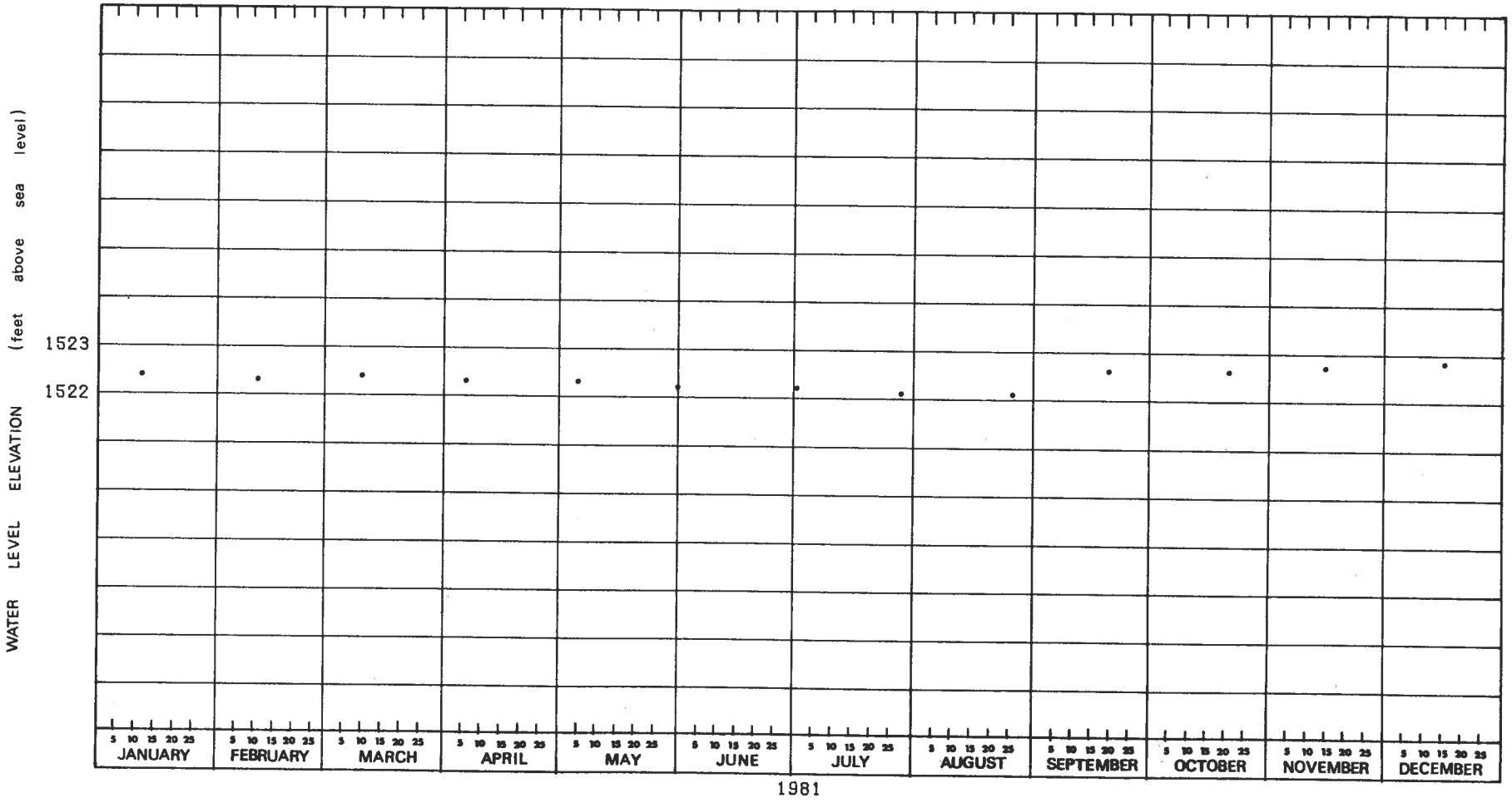
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-1215-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Nov 24/75 | | | Well completed; blown down with air |
| Nov 30/75 | 282.90 TOC | 1578.5 | |
| Dec 1/75 | 282.90 TOC | 1578.5 | |
| Dec 3/75 | 282.90 TOC | 1578.5 | |
| Dec 8/75 | 283.10 TOC | 1577.8 | |
| Dec 13/75 | | | DST; FSI = 53# from 1134 ft; Water sample |
| Dec 18/75 | 285.64 MP | 1571.4 | Install shelter; MP = 0.58 m TOC, (2508.3) |
| Jan 12/76 | 287.75 MP | 1564.5 | |
| Feb 10/76 | 290.85 MP | 1554.3 | |
| Mar 5/76 | 291.47 MP | 1552.3 | |
| Apr 5/76 | 292.28 MP | 1549.6 | |
| May 7/76 | 282.87 MP | 1580.5 | Measurement questionable |
| May 31/76 | 293.38 MP | 1546.0 | |
| June 21/76 | 293.77 MP | 1544.7 | |
| July 20/76 | 292.99 MP | 1547.3 | Sampled; temp. 6°C |
| Aug 9/76 | 293.29 MP | 1546.3 | |
| Aug 30/76 | 293.58 MP | 1545.4 | |
| Sept 27/76 | 293.95 MP | 1544.1 | |
| Oct 25/76 | 294.27 MP | 1543.1 | |
| Nov 24/76 | 294.60 MP | 1542.0 | |
| Dec 21/76 | 294.86 MP | 1541.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/77 | 295.60 MP | 1538.7 | MP (2508.3) |
| Feb 14/77 | 295.32 MP | 1539.6 | |
| Mar 14/77 | | | Could not measure |
| Apr 12/77 | 295.75 MP | 1538.2 | |
| May 12/77 | 295.94 MP | 1537.6 | |
| June 8/77 | 296.11 MP | 1537.1 | |
| July 12/77 | 296.33 MP | 1536.3 | Sampled; temp. 7°C |
| Aug 2/77 | 296.90 MP | 1534.5 | |
| Sept 1/77 | 297.01 MP | 1534.1 | |
| Sept 29/77 | 296.96 MP | 1534.3 | |
| Oct 27/77 | 297.28 MP | 1533.2 | |
| Nov 24/77 | 297.40 MP | 1532.8 | |
| Dec 20/77 | 297.52 MP | 1532.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 297.64 MP | 1532.0 | MP (2508.3) |
| Feb 14/78 | 297.73 MP | 1531.7 | |
| Mar 15/78 | 297.84 MP | 1531.4 | |
| Apr 10/78 | 297.94 MP | 1531.1 | |
| May 8/78 | 298.05 MP | 1530.7 | |
| June 5/78 | 298.14 MP | 1530.4 | |
| July 11/78 | 298.25 MP | 1530.0 | Sampled; temp. 13°C |
| July 31/78 | 298.80 MP | 1528.2 | |
| Aug 28/78 | 298.85 MP | 1528.1 | |
| Sept 28/78 | 298.90 MP | 1527.9 | |
| Oct 26/78 | 298.95 MP | 1527.7 | |
| Nov 20/78 | 299.00 MP | 1527.6 | |
| Dec 18/78 | 299.06 MP | 1527.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1215

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 299.10 MP | 1527.2 | MP (2508.3) |
| Feb 12/79 | 299.14 MP | 1527.1 | |
| Mar 13/79 | 299.18 MP | 1527.0 | |
| Apr 11/79 | 299.08 MP | 1527.3 | |
| May 7/79 | 299.26 MP | 1526.7 | |
| June 5/79 | 299.27 MP | 1526.7 | |
| July 11/79 | 299.30 MP | 1526.6 | Sample; temp. 7°C |
| July 30/79 | 299.78 MP | 1525.0 | |
| Aug 30/79 | 299.78 MP | 1525.0 | |
| Sept 24/79 | 299.79 MP | 1525.0 | |
| Oct 22/79 | 299.81 MP | 1524.9 | |
| Nov 19/79 | 299.84 MP | 1524.8 | |
| Dec 20/79 | 299.85 MP | 1524.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 10 - 1215

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 299.87 MP | 1524.7 | |
| Feb 11/80 | 299.89 MP | 1524.7 | |
| Mar 12/80 | 299.93 MP | 1524.5 | |
| Apr 8/80 | | | Could not measure |
| May 7/80 | 299.99 MP | 1524.3 | |
| June 5/80 | 300.02 MP | 1524.2 | |
| July 3/80 | 300.03 MP | 1524.2 | Temp. 8°C |
| July 28/80 | 300.53 MP | 1522.6 | |
| Aug 28/80 | 300.44 MP | 1522.9 | |
| Sept 22/80 | 300.54 MP | 1522.5 | |
| Oct 22/80 | 300.51 MP | 1522.6 | |
| Nov 20/80 | 300.86 MP | 1521.5 | |
| Dec 16/80 | 299.60 MP | 1525.6 | |
| Jan 13/81 | 300.58 MP | 1522.4 | |
| Feb 12/81 | 300.60 MP | 1522.3 | |
| Mar 11/81 | 300.59 MP | 1522.4 | |
| Apr 7/81 | 300.60 MP | 1522.3 | |
| May 6/81 | 300.60 MP | 1522.3 | |
| June 1/81 | 300.63 MP | 1522.2 | |
| July 2/81 | 300.64 MP | 1522.2 | |
| July 29/81 | 300.66 MP | 1522.1 | |
| Aug 27/81 | 300.66 MP | 1522.1 | |
| Sept 21/81 | 300.51 MP | 1522.6 | |
| Oct 22/81 | 300.52 MP | 1522.6 | |
| Nov 16/81 | 300.49 MP | 1522.7 | |
| Dec 17/81 | 300.45 MP | 1522.8 | |

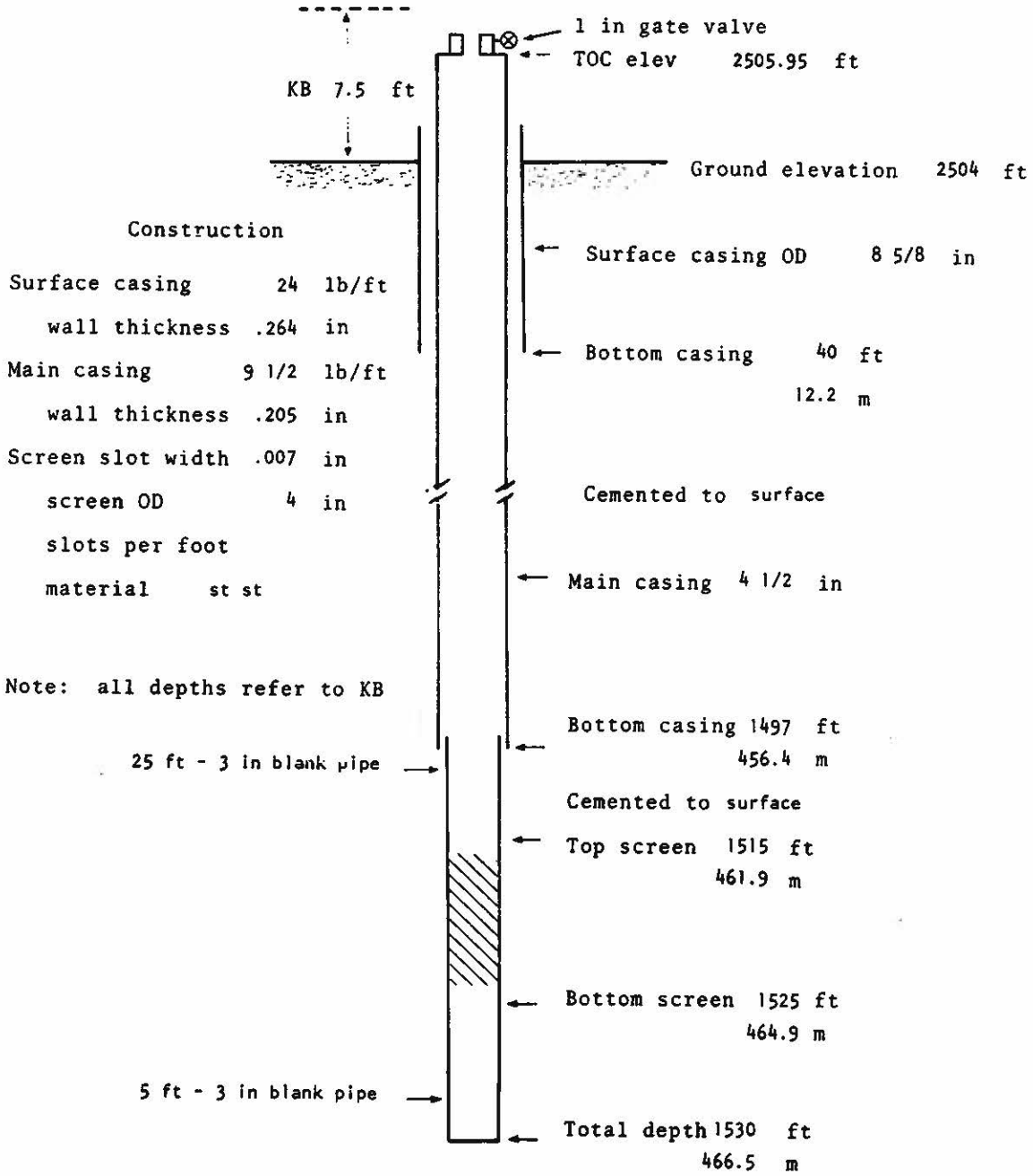
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Tp 85 R 9 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 9 1/2 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB

## DRILL STEM TEST

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Tp 85 R 9 W4th

Alberta Research Council

Elevation: gl 2504
KB 2512

Type of test Casing Positrieve

Date of test December 12, 1975

Testing company Johnston Testers

### TEST DATA

| | |
|---|---|
| Time started | 0830 hrs |
| Tool opened | 0951 hrs |
| First flow | 3 min |
| Initial shut in | 30 min |
| Second flow | 45 min |
| Final shut in | 90 min |
| Pulled loose at | 1245 hrs |
| Out of hole at | 1340 hrs |
| Wt on packers | 2000 lbs |

Description of blow Faint initial puff. Weak flow decreasing to faint and remaining throughout second flow period

Total water recovered 10 ft

Water sample No. DH 301

Gas blow -

Remarks -

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 3/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 29

Open or screened interval 1515-1525'

Formation tested Wabiskaw

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.30 | |
| D.P. Sub | 1.20 | |
| MFE Tool | 10.03 | |
| Positrieve Packer | 2.07 | 4 1/2" |
| Total | 14.60 | |
| Packer Stub | 3.53 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.93 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 97 | 90 |
| Capacity (psig) | | 1250 | 1250 |
| Instrument set at (ft) | | 1468 | 1476 |
| Initial hydrostatic | A | 104 | 102 |
| First flow | B | 77 | 76 |
| | B1 | 104 | 102 |
| Initial shut in | C | 108 | 107 |
| Second flow | D | 13 | 13 |
| | D1 | 12 | 12 |
| Final shut in | G | 90 | 88 |
| Final hydrostatic | H | 81 | 81 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

10-1530-D-77

OBSERVATION WELL NUMBER 10-1530

INTERVAL TESTED 1464-1530

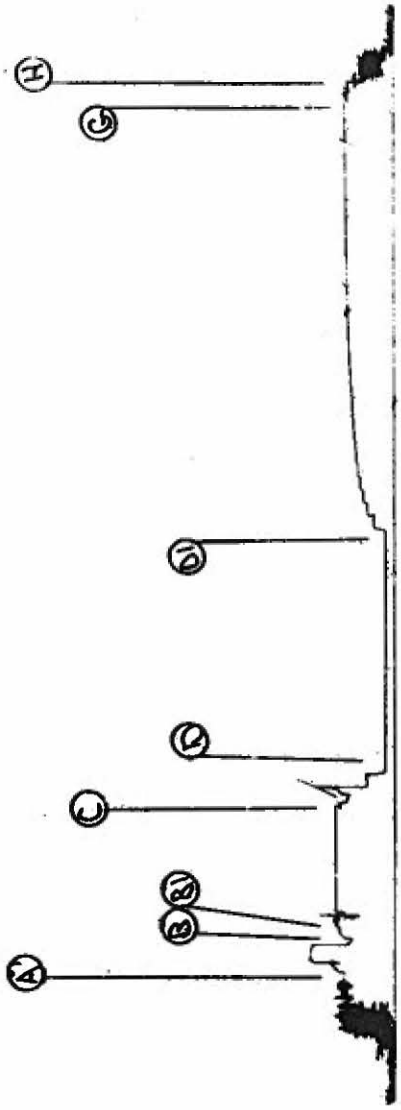
PRESSURE INCREMENTS

Recorder RPG-90

December 12, 1975

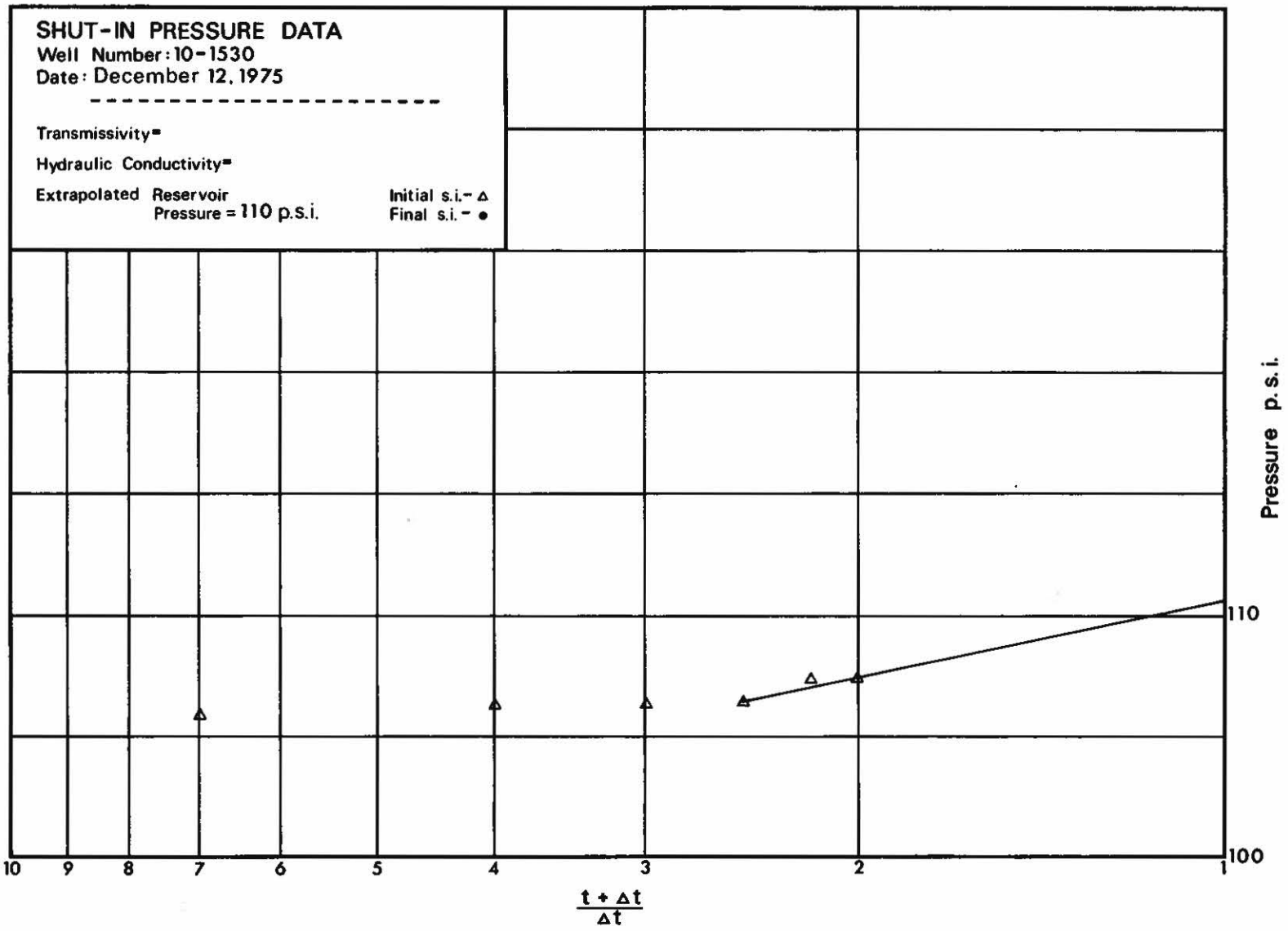
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 106.0 | 7.00 |
| 10 | 106.6 | 4.00 |
| 15 | 106.6 | 3.00 |
| 20 | 106.6 | 2.50 |
| 25 | 107.3 | 2.20 |
| 30 | 107.3 | 2.00 |

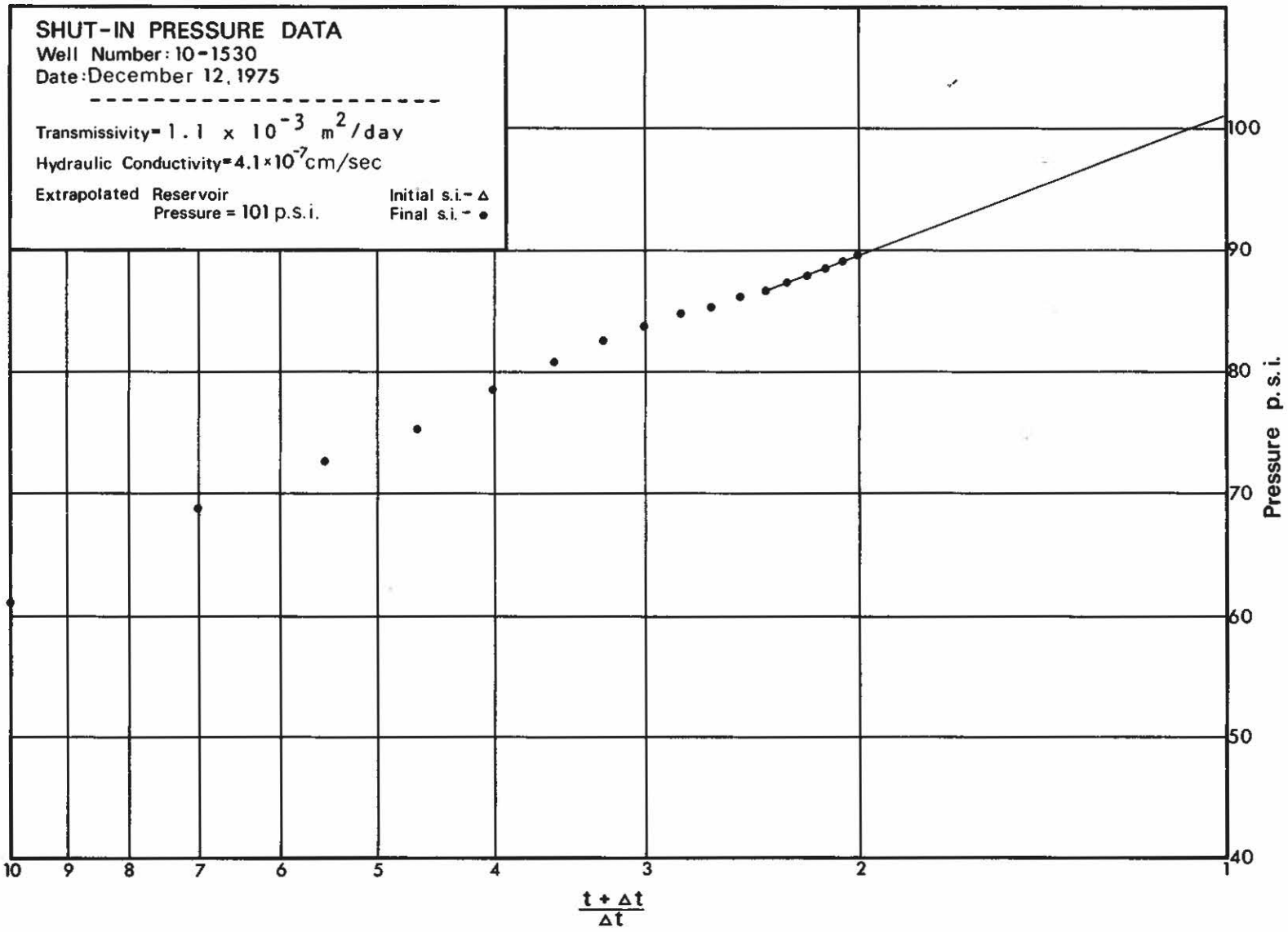



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 49.1 | 19.00 |
| 10 | 60.6 | 10.00 |
| 15 | 68.5 | 7.00 |
| 20 | 72.1 | 5.50 |
| 25 | 75.1 | 4.60 |
| 30 | 78.2 | 4.00 |
| 35 | 80.6 | 3.57 |
| 40 | 82.4 | 3.25 |
| 45 | 83.6 | 3.00 |
| 50 | 84.8 | 2.80 |
| 55 | 85.4 | 2.64 |
| 60 | 86.1 | 2.50 |
| 65 | 86.6 | 2.38 |
| 70 | 87.3 | 2.29 |
| 75 | 87.9 | 2.20 |
| 80 | 88.4 | 2.13 |
| 85 | 89.1 | 2.06 |
| 90 | 89.7 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 10-1530
Date: December 12, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 110 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
110
100
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

10-1530-D-77


SHUT-IN PRESSURE DATA
Well Number: 10-1530
Date: December 12, 1975
Transmissivity = 1.1 x 10^-3 m^2/day
Hydraulic Conductivity = 4.1 x 10^-7 cm/sec
Extrapolated Reservoir Pressure = 101 p.s.i.
Initial s.i. - Δ
Final s.i. - •
100
90
80
70
60
50
40
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
(t + Δt)/Δt

10-1530-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source DST on 10-1530

Date sampled December 12, 1975

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 750.0 | 37.43 | 58.8 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0.0 |
| Sodium ($Na^{+}$) | 390.0 | 16.96 | 26.6 |
| Potassium ($K^{+}$) | 363.0 | 9.29 | 14.6 |
| Carbonate ($CO_3^{=}$) | 86.6 | 2.87 | 4.1 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 3.4 | 0.07 | 0.1 |
| Chloride ($Cl^{-}$) | 878.0 | 24.76 | 35.6 |
| Nitrate ($NO_3^{=}$) | 1.8 | 0.03 | 0.0 |
| Silica ($SiO_2$) | 7.2 | | |
| Hydroxide ($OH^{-}$) | 713.0 | 41.92 | 60.2 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 5292.0 | | |
| Total Anions (epm) 69.6 | | Total Cations (epm) | 63.7 |

### Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | |
| pH | 12.6 | pH | 12.7 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | 78 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| | | Hydroxide ($OH^{-}$) | 834 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 210.0 | 10.48 | 32 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 331.0 | 14.40 | 44 |
| Potassium ($K^{+}$) | 321.0 | 8.21 | 25 |
| Carbonate ($CO_3^{=}$) | 24.4 | 0.81 | 4 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 5.1 | 0.11 | 1 |
| Chloride ($Cl^{-}$) | 680.0 | 19.18 | 95 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 225.5 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 1946 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 20.11 | Total Cations (epm) | 33.10 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 6000 | Temperature (C) | 8.0 | |
| pH | 12.2 | pH | 12.6 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | 39 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 257 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 210.0 | 10.48 | 32 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 331.0 | 14.40 | 44 |
| Potassium ($K^{+}$) | 321.0 | 8.21 | 25 |
| Carbonate ($CO_3^{=}$) | 24.4 | 0.81 | 2 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 5.1 | 0.11 | 0 |
| Chloride ($Cl^{-}$) | 680.0 | 19.18 | 55 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.8 | | |
| Hydroxide ($OH^{-}$) | 248.0 | 14.58 | 42 |
| Calcium (Acidified) | 225.5 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 1946 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 34.69 | Total Cations (epm) | 33.10 |

Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 6000 | |
| pH | 12.2 | |
| Fluoride ($F^{-}$) | 0.2 | Mg/L |

Field:

| | | |
|---|---|---|
| Temperature (C) | 8.0 | |
| pH | 12.6 | |
| Carbonate ($CO_3^{=}$) | 39 | Mg/L |
| Bicarbonate ($HCO_3^{-}$) | | |
| Hydroxide ($OH^{-}$) | 257 | Mg/L |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 12, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 455.0 | 22.70 | 53.0 |
| Magnesium ($Mg^{++}$) | 5.1 | 0.42 | 1.0 |
| Sodium ($Na^{+}$) | 326.0 | 14.18 | 33.1 |
| Potassium ($K^{+}$) | 217.0 | 5.55 | 13.0 |
| Carbonate ($CO_3^{=}$) | 19.2 | 0.64 | 1.4 |
| Bicarbonate ($HCO_3^{-}$) | 0.7 | 0.01 | 0.0 |
| Sulfate ($SO_4^{=}$) | 946.0 | 19.70 | 42.0 |
| Chloride ($Cl^{-}$) | 940.0 | 26.51 | 56.6 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 16.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 375.0 | | |
| Magnesium (Acidified) | 6.0 | | |
| Total dissolved solids | 3030.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 46.86 | Total Cations (epm) | 42.86 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 4200 | Temperature (C) | 10.0 |
| pH | 9.7 | pH | |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 19.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 24.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

10-1530-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 370.0 | 18.46 | 42.8 |
| Magnesium(Mg) | 35.0 | 2.88 | 6.7 |
| Sodium(Na) | 410.0 | 17.83 | 41.4 |
| Potassium(K) | 154.0 | 3.94 | 9.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 71.0 | 1.16 | 2.6 |
| Sulphate(SO4) | 810.0 | 16.86 | 37.8 |
| Chloride(Cl) | 940.0 | 26.51 | 59.4 |
| Nitrate(NO3) | 3.9 | 0.06 | 0.1 |
| Silica(SiO2) | 42.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 380.0 | | |
| Magnesium(Acidified) | 33.0 | | |
| TDS(mg/l) | 6668.0 | | |
| Total Anions(epm) | 44.60 | Total Cations(epm) | 43.12 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3910 | | Temperature(C) | 10.00 | |
| pH | 7.2 | | pH | 7.1 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 112 | mg/l |
| | | | Hydroxide(OH) | | |

10-1530-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 366.0 | 18.26 | 41.3 |
| Magnesium(Mg) | 41.0 | 3.37 | 7.6 |
| Sodium(Na) | 435.0 | 18.92 | 42.7 |
| Potassium(K) | 145.0 | 3.71 | 8.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 146.0 | 2.39 | 5.0 |
| Sulphate(SO4) | 754.0 | 15.70 | 33.1 |
| Chloride(Cl) | 1040.0 | 29.33 | 61.8 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 41.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 232.0 | | |
| Magnesium(Acidified) | 32.0 | | |
| TDS(mg/l) | 2870.0 | | |
| Total Anions(epm) | 47.42 | Total Cations(epm) | 44.27 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 4000 | | Temperature(C) | 9.00 | |
| pH | 7.8 | | pH | 6.8 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 336 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 10-1530-E-82

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 3, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 246.0 | 12.30 | 32.2 |
| Magnesium(Mg) | 31.0 | 2.58 | 6.8 |
| Sodium(Na) | 443.0 | 19.26 | 50.4 |
| Potassium(K) | 158.0 | 4.05 | 10.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 144.0 | 2.36 | 6.1 |
| Sulphate(SO4) | 380.0 | 7.92 | 20.6 |
| Chloride(Cl) | 1000.0 | 28.17 | 73.3 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 30.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 213.0 | | |
| Magnesium(Acidified) | 28.4 | | |
| TDS(mg/l) | 2636.0 | | |
| Total Anions(epm) | 38.45 | Total Cations(epm) | 38.20 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 3900 |
| pH | 7.7 |
| Fluoride | 0.4 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 12.50 | |
| pH | 7.3 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 736 | mg/l |
| Hydroxide(OH) | | |

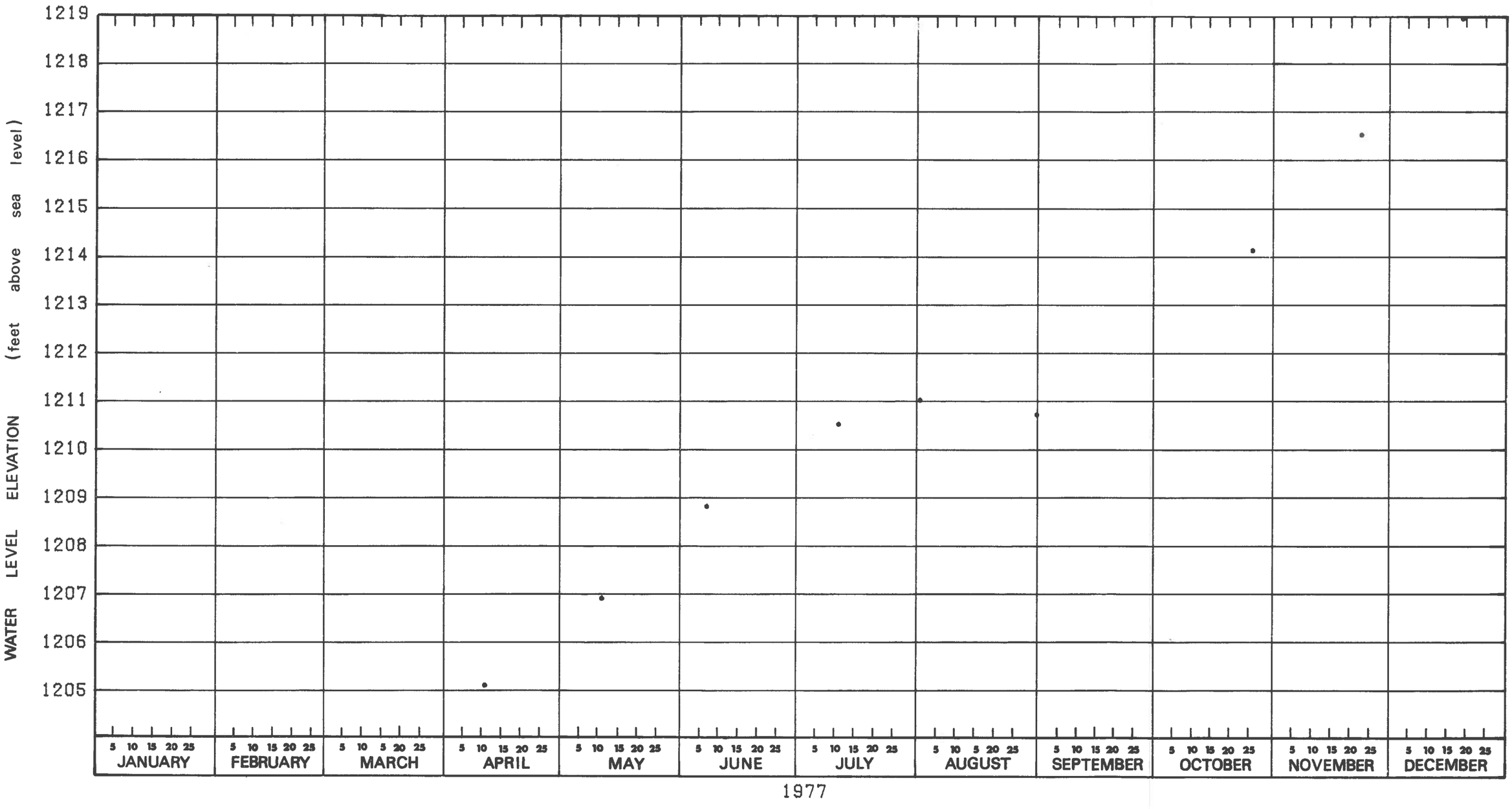
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1530

10-1530-H-78

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council




1977

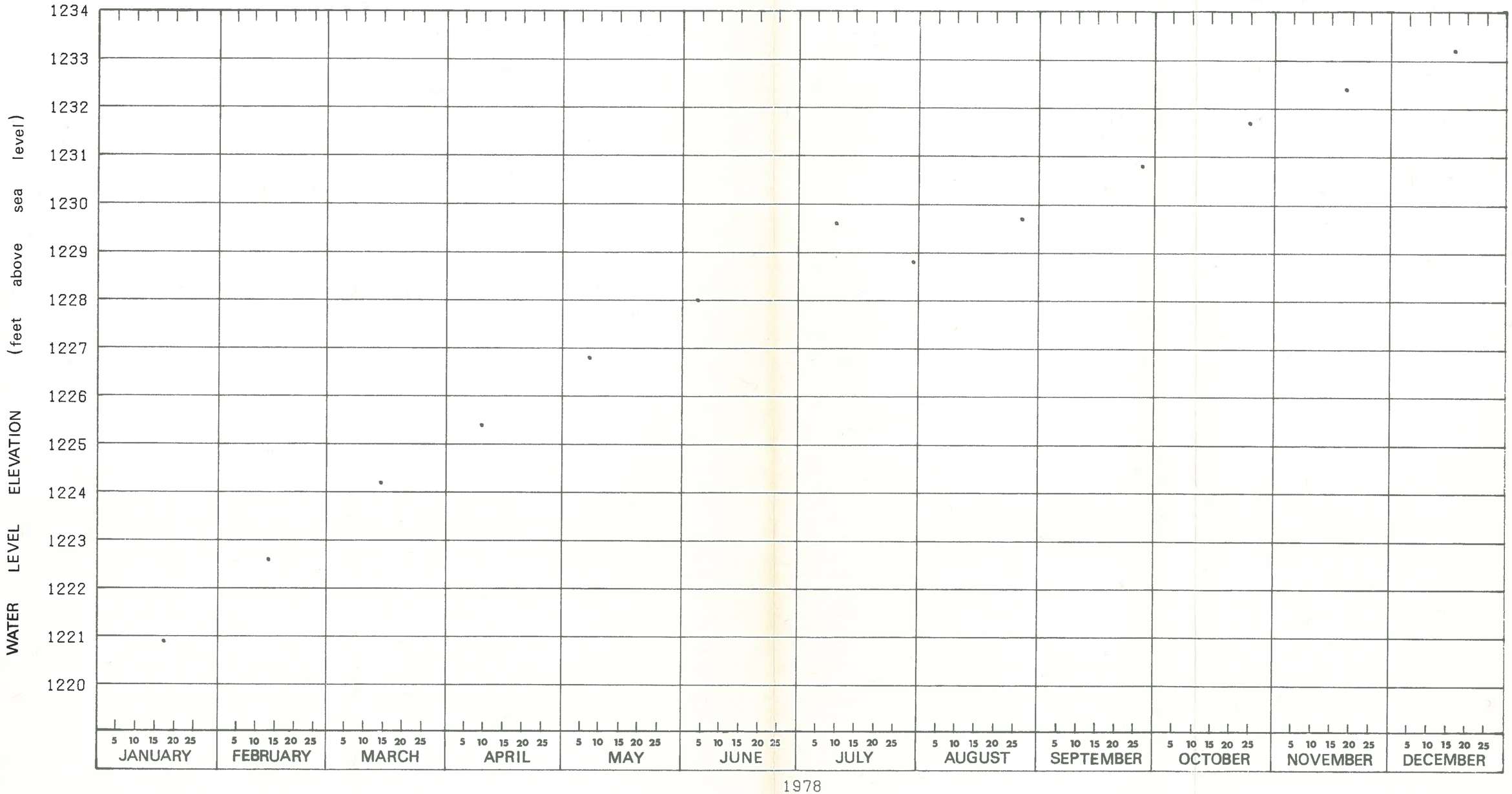
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1530

LSD 9 SEC 24 TWP 85 R 9 W4TH

10-1530-H-79

Alberta Research Council




1978

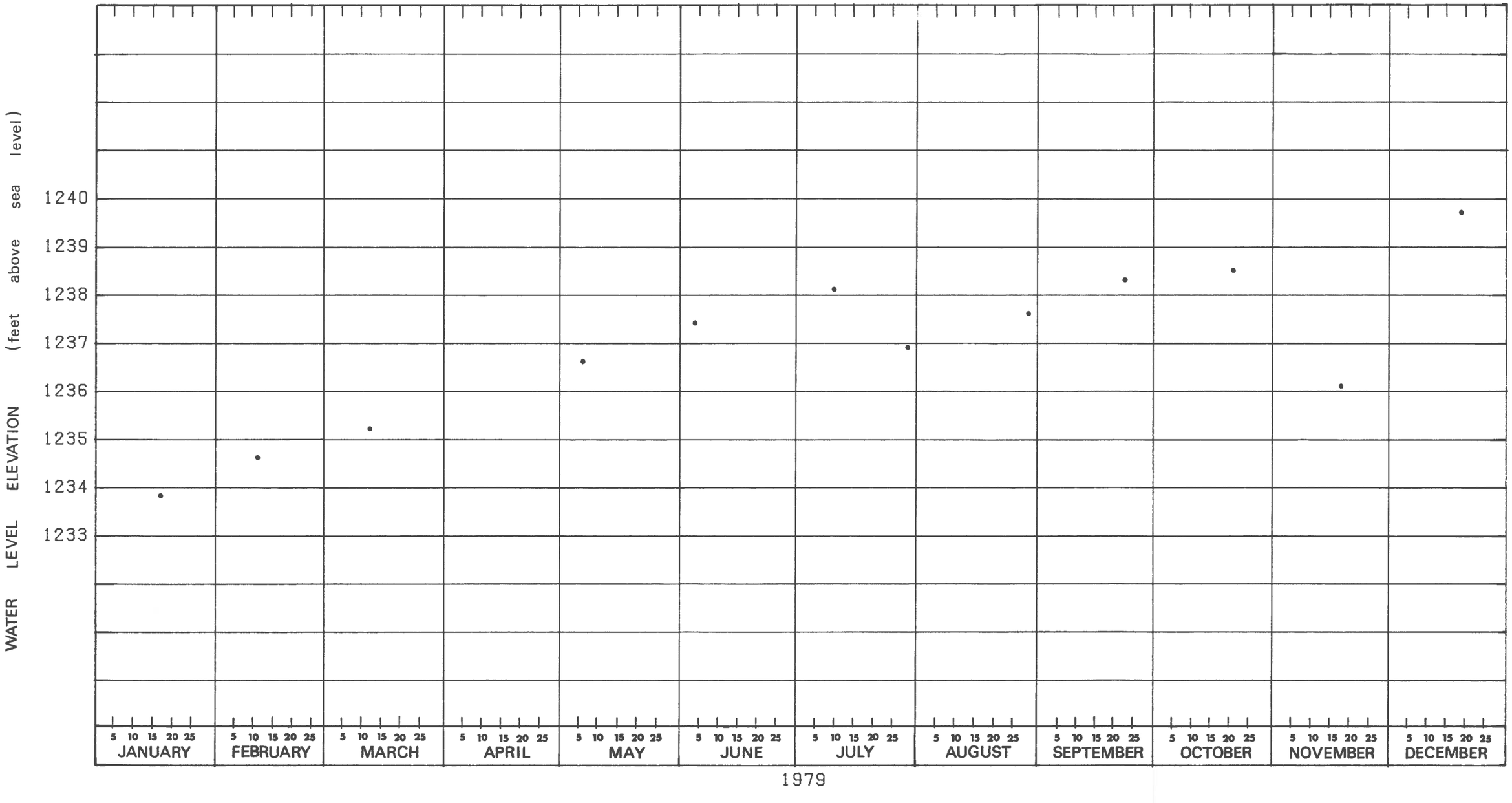
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1530

10-1530-H-80

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council



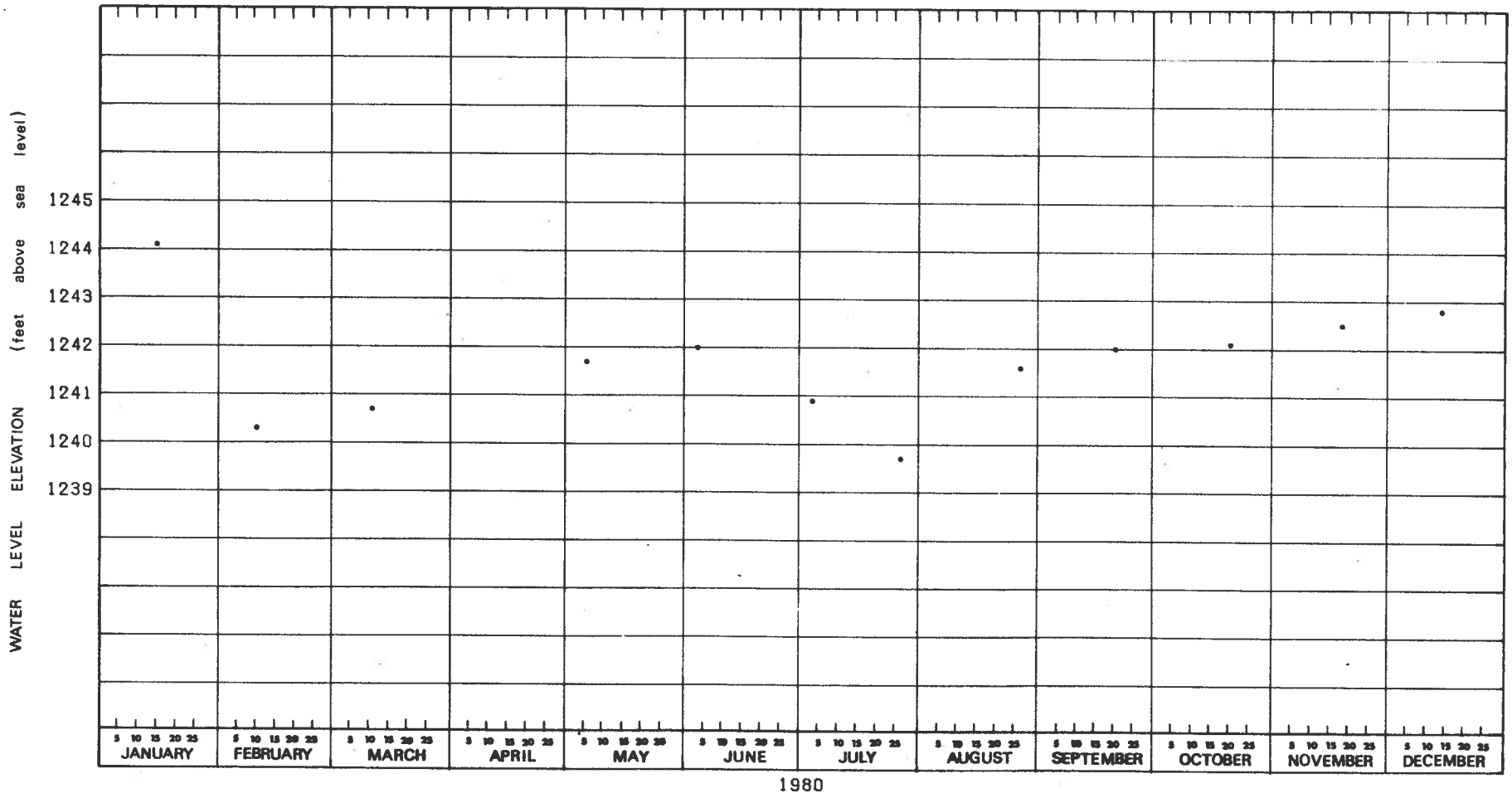
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-1530-H-81



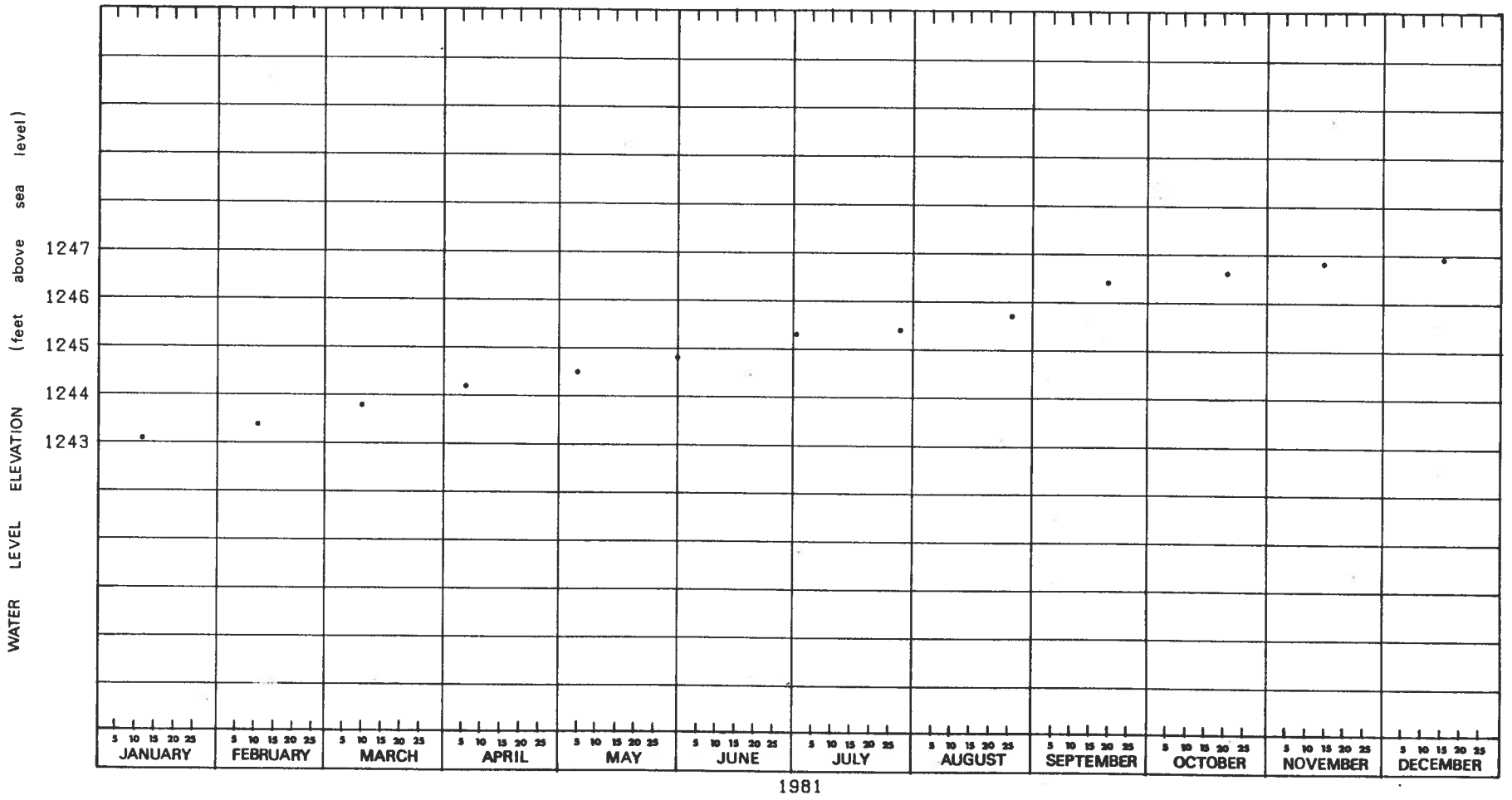
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-1530-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2505.95

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Nov 22/75 | | | Well completed; blow down with air; producing gas |
| Dec 1/75 | | | Unable to measure due to condensation on casing |
| Dec 12/75 | | | DST; FSI = 90# from 1468 ft, water sample |
| Dec 16/75 | | | Gas sample collected |
| Dec 18/75 | | | Install shelter; MP = 0.72 m TOC, (2508.3) |
| June 20/76 | | >1629 | Greater than 268 meters |
| July 20/76 | | 1193 approx. | Sampled; temp. 8°C |
| Aug 9/76 | | | Water level approx. 1315 ft |
| Aug 30/76 | | | Could not measure |
| Sept 27/76 | | | Could not measure |
| Oct 25/76 | 400.05 MP | 1196.1 | |
| Nov 24/76 | 399.89 MP | 1196.7 | |
| Dec 21/76 | 399.42 MP | 1198.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2505.95

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/77 | | | MP (2508.3); could not measure |
| Feb 14/77 | | | Could not measure |
| Mar 14/77 | | | Could not measure |
| Apr 12/77 | 397.31 MP | 1205.1 | Gas Pressure 3 PSIG |
| May 12/77 | 396.78 MP | 1206.9 | Gas pressure 3 PSIG |
| June 8/77 | 396.18 MP | 1208.8 | |
| July 12/77 | 395.68 MP | 1210.5 | Sampled; temp. 10°C; Gas pressure 3 PSIG |
| Aug 2/77 | 395.52 MP | 1211.0 | Gas pressure 3 PSIG |
| Sept 1/77 | 395.60 MP | 1210.7 | Gas pressure 3 PSIG |
| Sept 29/77 | | | Could not measure; Gas pressure 3 PSIG |
| Oct 27/77 | 394.57 MP | 1214.1 | Gas pressure 2.5 PSIG |
| Nov 24/77 | 393.84 MP | 1216.5 | Gas pressure 1.5 lb |
| Dec 20/77 | 393.11 MP | 1218.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2505.95

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 392.51 MP | 1220.9 | Gas pressure 1.5 PSIG MP (2508.3) |
| Feb 14/78 | 391.97 MP | 1222.6 | Gas pressure 1.8 PSIG |
| Mar 15/78 | 391.50 MP | 1224.2 | Gas pressure 2.0 PSIG |
| Apr 10/78 | 391.13 MP | 1225.4 | Gas pressure 2.25 PSIG |
| May 8/78 | 390.70 MP | 1226.8 | Gas pressure 2.75 PSIG |
| June 5/78 | 390.34 MP | 1228.0 | Gas pressure 2.75 PSIG |
| July 11/78 | 389.86 MP | 1229.6 | Sampled; temp. 10°C gas pressure 3.0 PSIG |
| July 31/78 | 390.08 MP | 1228.8 | Gas pressure 2.25 PSIG |
| Aug 28/78 | 389.82 MP | 1229.7 | Gas pressure 1.50 PSIG |
| Sept 28/78 | 389.46 MP | 1230.8 | |
| Oct 26/78 | 389.22 MP | 1231.7 | Gas pressure 2.0 PSIG |
| Nov 20/78 | 389.00 MP | 1232.4 | Gas pressure 0.75 PSIG |
| Dec 18/78 | 388.74 MP | 1233.2 | Gas pressure 0.75 PSIG |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1530

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2505.95

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 388.56 MP | 1233.8 | MP (2508.3) |
| | | | Gas pressure 0.75 PSIG |
| Feb 12/79 | 388.33 MP | 1234.6 | Gas pressure 0.75 PSIG |
| Mar 13/79 | 388.13 MP | 1235.2 | |
| Apr 11/79 | | | Could not measure |
| | | | Gas pressure 1.0 PSIG |
| May 7/79 | 387.71 MP | 1236.6 | Gas pressure 1.75 PSIG |
| June 5/79 | 387.47 MP | 1237.4 | Gas pressure 4.0 PSIG |
| July 11/79 | 387.25 MP | 1238.1 | Gas pressure 4.0 PSIG |
| | | | Sampled; temp. 9°C |
| July 30/79 | 387.61 MP | 1236.9 | Gas pressure 4.0 PSIG |
| Aug 30/79 | 387.42 MP | 1237.6 | Gas pressure 2.5 PSIG |
| Sept 24/79 | 387.18 MP | 1238.3 | Gas pressure 2.0 PSIG |
| Oct 22/79 | 387.12 MP | 1238.5 | |
| Nov 19/79 | 387.87 MP | 1236.1 | Gas pressure 2.25 PSIG |
| Dec 20/79 | 386.77 MP | 1239.7 | Gas pressure 8.0 PSIG |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10 - 1530

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2505.95

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 385.42 MP | 1244.1 | Gas Pressure 3.0 lbs. |
| Feb 11/80 | 386.59 MP | 1240.3 | Gas Pressure 3.0 lbs. |
| Mar 12/80 | 386.46 MP | 1240.7 | Gas Pressure 2.5 lbs. |
| Apr 8/80 | | | Could not measure |
| May 7/80 | 386.17 MP | 1241.7 | Gas Pressure 7.5 lbs. |
| June 5/80 | 386.08 MP | 1242.0 | Gas Pressure 8.0 lbs. |
| | | | New MP 0.32 m TOC (2507.0) |
| July 5/80 | 385.99 MP | 1240.9 | Gas Pressure 10.0 lbs. Temp. 12.5°C |
| July 28/80 | 386.37 MP | 1239.7 | Gas Pressure 10.5 lbs. |
| Aug 28/80 | 386.18 MP | 1241.6 | Gas Pressure 7.5 lbs. |
| Sept 22/80 | 386.06 MP | 1242.0 | Gas Pressure 5.0 lbs. |
| Oct 22/80 | 386.05 MP | 1242.1 | Gas Pressure 5.5 lbs. |
| Nov 20/80 | 385.92 MP | 1242.5 | Gas Pressure 4.0 lbs. |
| Dec 16/80 | 385.82 MP | 1242.8 | Gas Pressure 3.0 lbs. |
| Jan 13/81 | 385.74 MP | 1243.1 | Gas Pressure 3.5 lbs. |
| Feb 12/81 | 385.63 MP | 1243.4 | Gas Pressure 2.0 lbs. |
| Mar 11/81 | 385.51 MP | 1243.8 | Gas Pressure 5.5 lbs. |
| Apr 7/81 | 385.40 MP | 1244.2 | Gas Pressure 4.5 lbs. |
| May 6/81 | 385.31 MP | 1244.5 | Gas Pressure 6.5 lbs. |
| June 1/81 | 385.22 MP | 1244.8 | |
| July 2/81 | 385.06 MP | 1245.3 | Gas Pressure 9.5 lbs. |
| July 29/81 | 385.03 MP | 1245.4 | Gas Pressure 10.0 lbs. |
| Aug 27/81 | 384.95 MP | 1245.7 | |
| Sept 21/81 | 384.74 MP | 1246.4 | Gas Pressure 7.0 lbs. |
| Oct 22/81 | 384.68 MP | 1246.6 | Gas Pressure 2.0 lbs. |
| Nov 16/81 | 384.60 MP | 1246.8 | Gas Pressure 3.0 lbs. |
| Dec 17/81 | 384.56 MP | 1246.9 | Gas Pressure 2.5 lbs. |

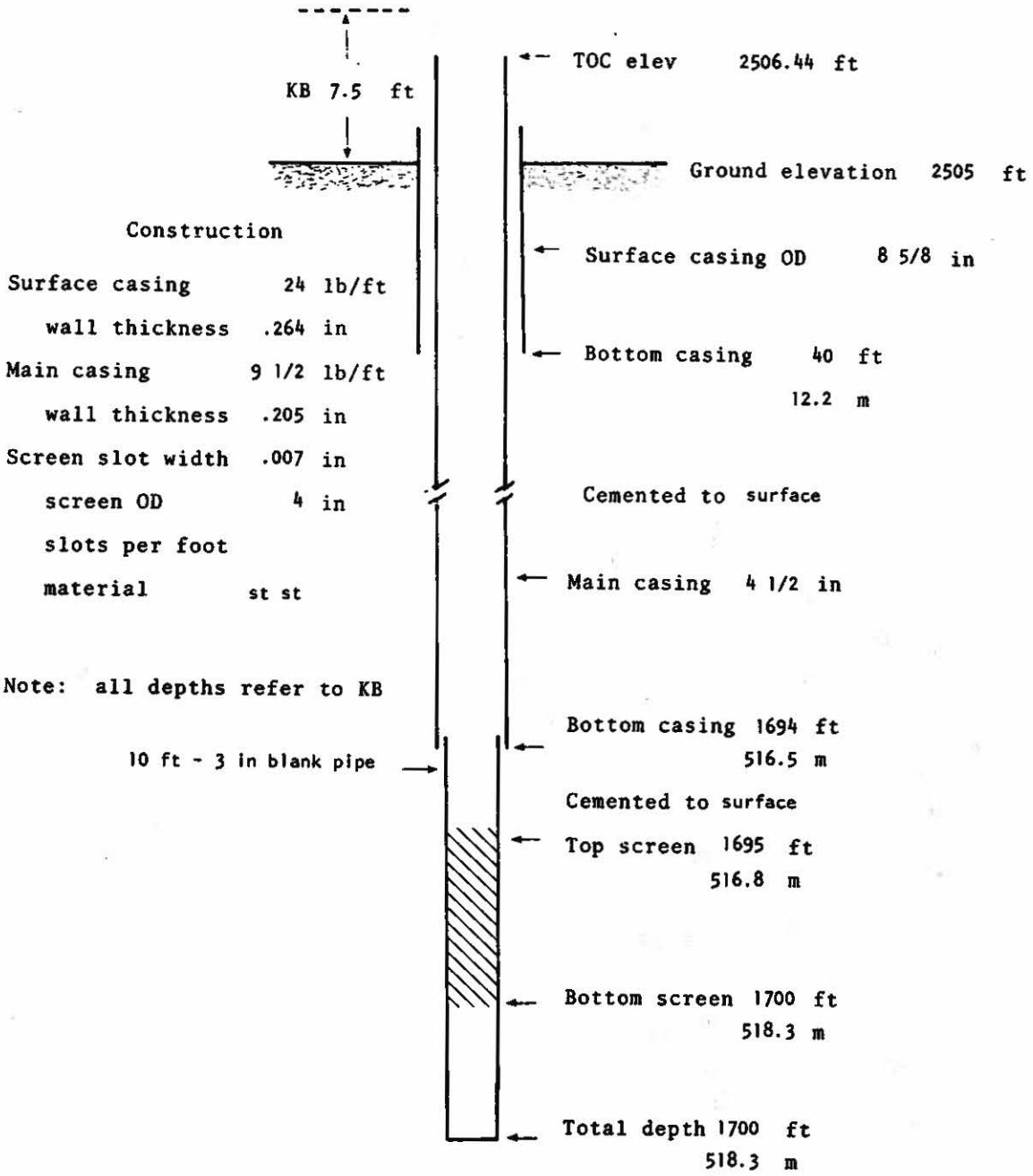
MP - Depth from measuring point
TOC - Depth from top of casing

**WELL CONSTRUCTION.**

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Tp 85 R 9 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 9 1/2 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB

## DRILL STEM TEST

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Tp 85 R 9 W4th

Alberta Research Council

Elevation: gl 2505
KB 2513

Type of test Casing Positrieve

Date of test December 10, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1100 | hrs |
| Tool opened | 1419 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1625 | hrs |
| Out of hole at | | hrs |
| Wt on packers | 8000 | lbs |

Description of blow Faint initial puff. Weak air blow; dead in 20 minutes on second opening.

Total water recovered nil ft

Water sample No. -

Gas blow -

Remarks -

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 3/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 59

Open or screened interval 1665-1700'

Formation tested McMurray

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.30 | |
| D.P. Sub | 1.20 | |
| MFE Tool | 10.03 | |
| Positrieve Packer | 2.07 | 4 1/2" |
| Total | 14.60 | |
| Packer Stub | 3.53 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.93 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 97 | 90 |
| Capacity (psig) | | 1250 | 1250 |
| Instrument set at (ft) | | 1666 | 1674 |
| Initial hydrostatic | A | - | - |
| First flow | B | - | - |
| | B1 | - | - |
| Initial shut in | C | 30 | 35 |
| Second flow | D | 16 | 19 |
| | D1 | 16 | 19 |
| Final shut in | G | 35 | 37 |
| Final hydrostatic | H | 123 | 122 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 10-1700

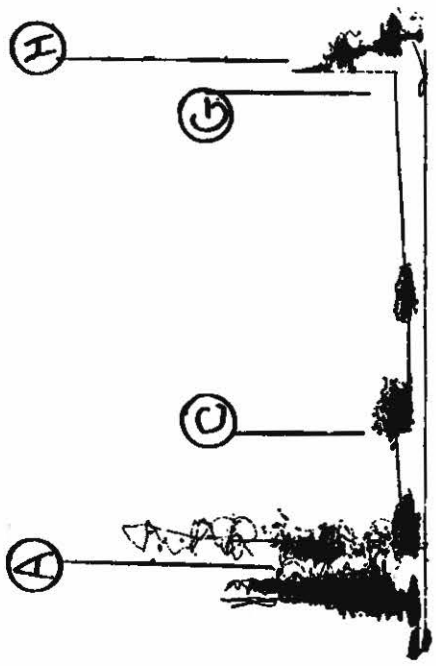
INTERVAL TESTED 1662-1700

PRESSURE INCREMENTS
Recorder RPG-90

December 10, 1975

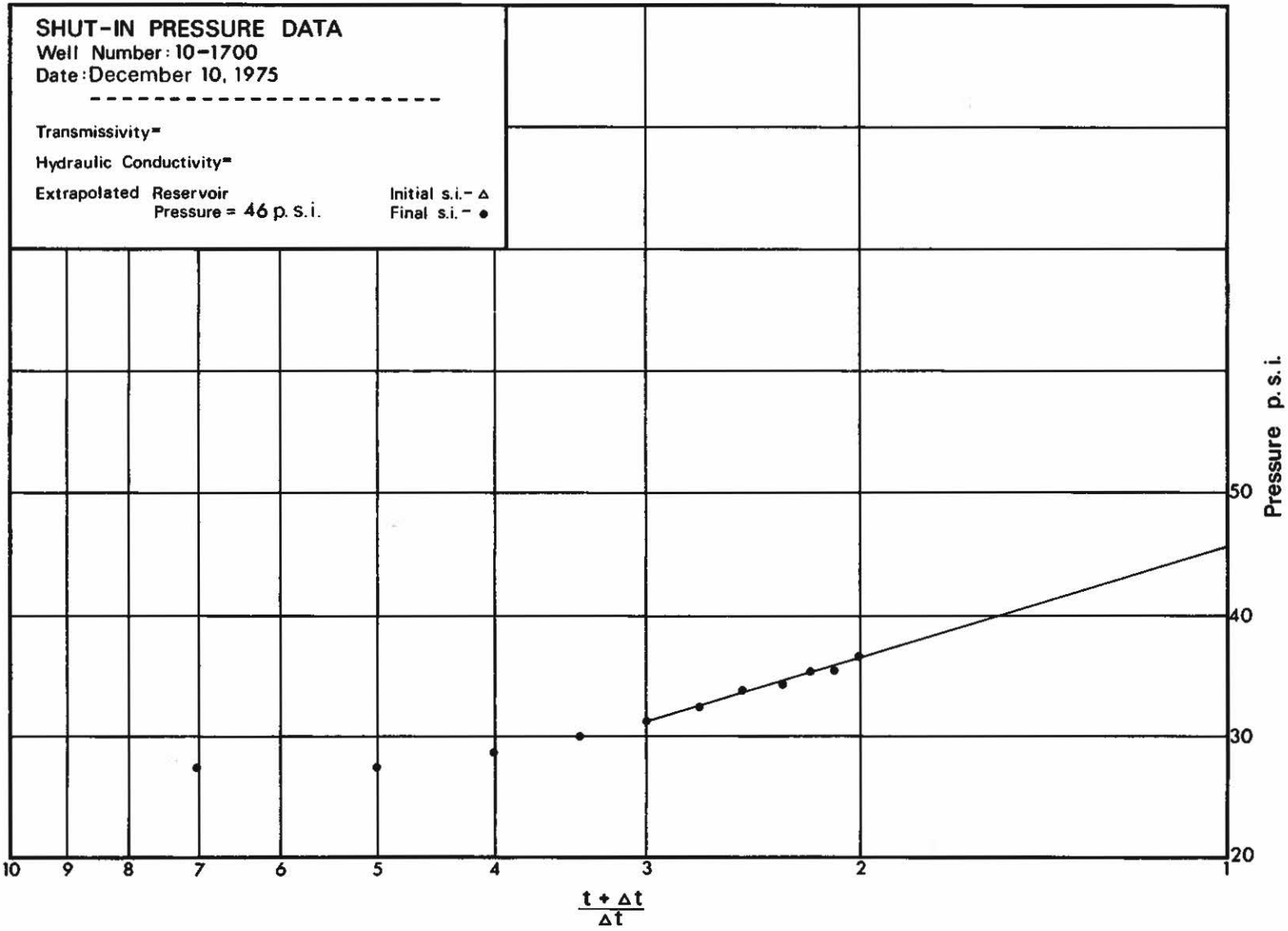
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| | Unreadable | |




Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 26.2 | 13.00 |
| 10 | 27.5 | 7.00 |
| 15 | 27.5 | 5.00 |
| 20 | 28.7 | 4.00 |
| 25 | 30.0 | 3.40 |
| 30 | 31.2 | 3.00 |
| 35 | 32.5 | 2.71 |
| 40 | 33.7 | 2.50 |
| 50 | 35.6 | 2.20 |
| 55 | 35.6 | 2.09 |
| 60 | 36.9 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 10-1700
Date: December 10, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 46 p. s. i.
Initial s.i.- Δ
Final s.i. - •
Pressure p. s. i.
50
40
30
20
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

10-1700-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Tp 85 R 9 W4th

Alberta Research Council

Elevation: gl 2505
KB 2513
Type of test Casing Positrieve
Date of test December 11, 1975
Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1115 | hrs |
| Tool opened | 1319 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1545 | hrs |
| Out of hole at | 1730 | hrs |
| Wt on packers | 2000 | lbs |

Description of blow Weak initial puff. Weak on final - dead in 20 minutes

Total water recovered 15 ft

Water sample No. DH 300

Gas blow -

Remarks

### HOLE DATA

Contractor Tri City Drilling
Drill pipe size (OD) 2 3/8" IF
Drill collar size (ID) 2"
Drill collar length (ft) 30
Open or screened interval 1695-1700'
Formation tested McMurray

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | 1.30 | |
| D.P. Sub | 1.20 | |
| MFE Tool | 10.03 | |
| Positrieve Packer | 2.07 | 4 1/2" |
| Total | 14.60 | |
| Packer Stub | 3.53 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.93 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 990 | 197 |
| Capacity (psig) | | 1250 | 1250 |
| Instrument set at (ft) | | 1674 | 1666 |
| Initial hydrostatic | A | 141 | 141 |
| First flow | B | 14 | 14 |
| | B1 | 14 | 14 |
| Initial shut in | C | 50 | 49 |
| Second flow | D | 17 | 15 |
| | D1 | 14 | 17 |
| Final shut in | G | 33 | 31 |
| Final hydrostatic | H | 115 | - |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

10-1700-D-77

OBSERVATION WELL NUMBER 10-1700

INTERVAL TESTED 1662-1700

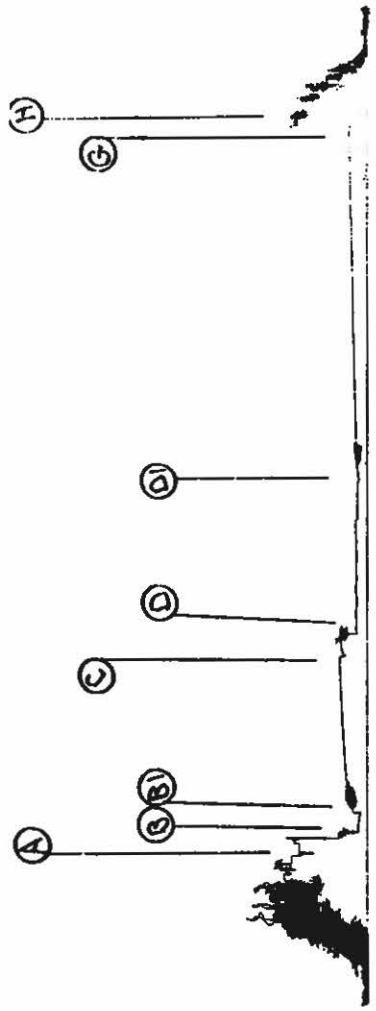
PRESSURE INCREMENTS

Recorder RPG-90

December 11, 1975

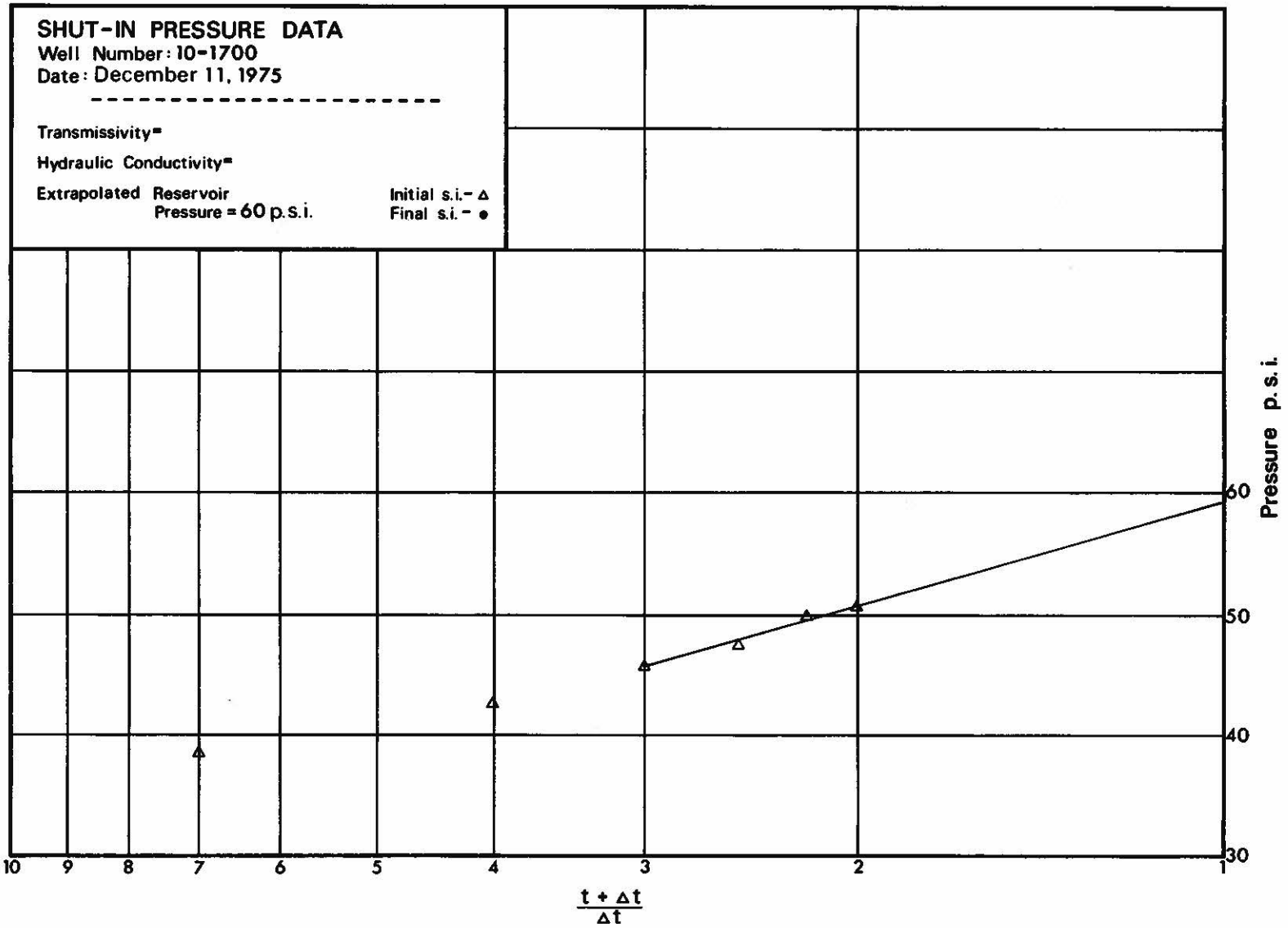
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 38.7 | 7.00 |
| 10 | 42.5 | 4.00 |
| 15 | 45.6 | 3.00 |
| 20 | 47.5 | 2.50 |
| 25 | 50.0 | 2.20 |
| 30 | 50.6 | 2.00 |

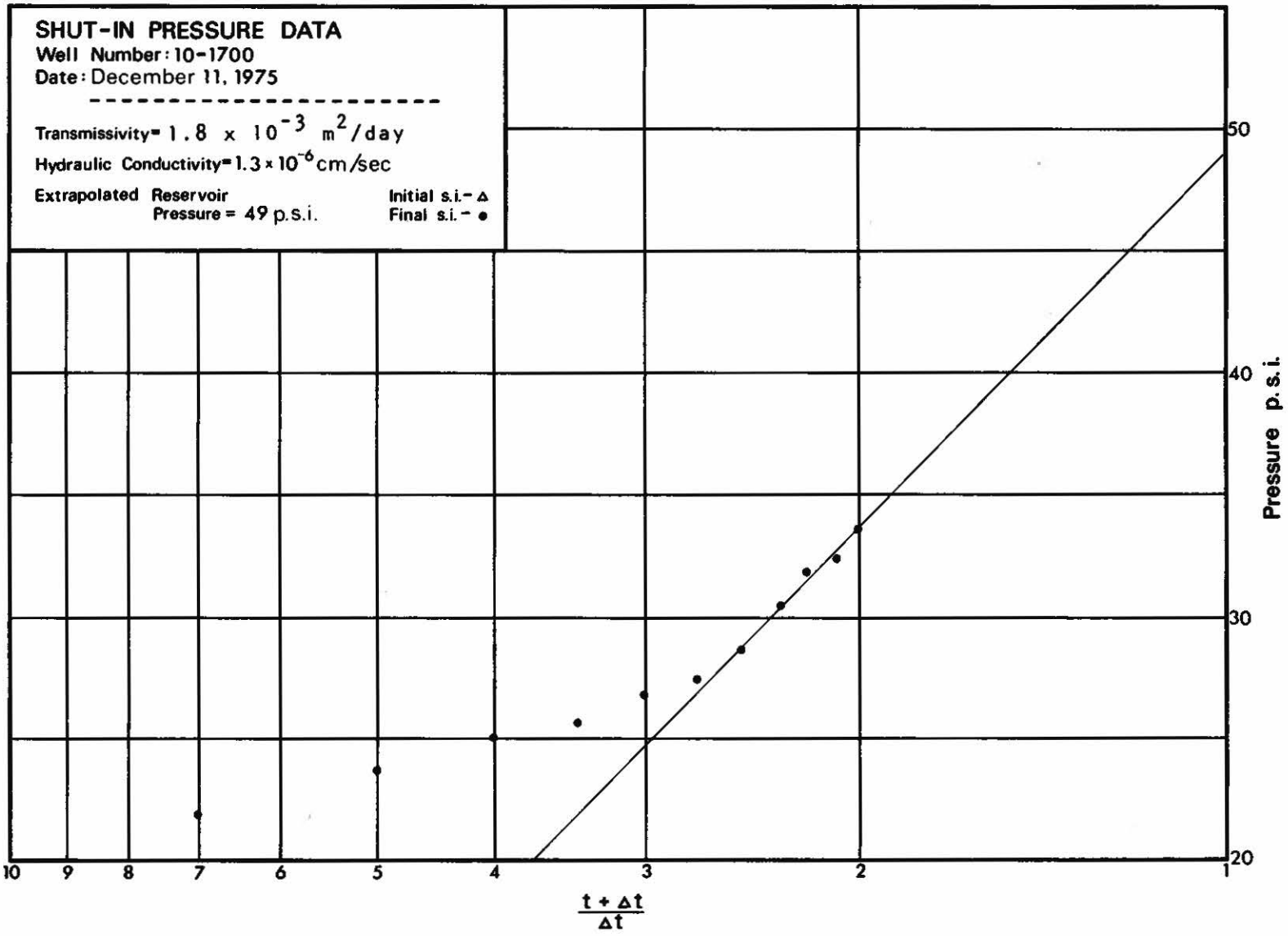



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 18.7 | 13.00 |
| 10 | 21.9 | 7.00 |
| 15 | 23.7 | 5.00 |
| 20 | 25.0 | 4.00 |
| 25 | 25.6 | 3.40 |
| 30 | 26.9 | 3.00 |
| 35 | 27.5 | 2.71 |
| 40 | 28.7 | 2.50 |
| 45 | 30.6 | 2.33 |
| 50 | 31.9 | 2.20 |
| 55 | 32.5 | 2.09 |
| 60 | 33.7 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 10-1700
Date: December 11, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 60 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
60
50
40
30
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

10-1700-D-77


SHUT-IN PRESSURE DATA
Well Number: 10-1700
Date: December 11, 1975
Transmissivity = 1.8 x 10^-3 m^2/day
Hydraulic Conductivity = 1.3 x 10^-6 cm/sec
Extrapolated Reservoir Pressure = 49 p.s.i.
Initial s.i. - Δ
Final s.i. - •
50
40
30
20
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

10-1700-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 810.0 | 40.42 | 22 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 3138.0 | 136.49 | 75.5 |
| Potassium ($K^{+}$) | 154.0 | 3.94 | 2 |
| Carbonate ($CO_3^{=}$) | 40.8 | 1.36 | 1 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 2.0 | 0.04 | 0 |
| Chloride ($Cl^{-}$) | 4600.0 | 129.72 | 99 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 988.9 | | |
| Magnesium (Acidified) | 0.4 | | |
| Total dissolved solids | 9980 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 131.14 | Total Cations (epm) | 180.86 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 8.5 | |
| pH | 12.7 | pH | 13.1 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | 50 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 1129 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source DST on 10-1700

Date sampled December 11, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 980.0 | 48.90 | 46.0 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0.0 |
| Sodium ($Na^{+}$) | 1150.0 | 50.02 | 47.0 |
| Potassium ($K^{+}$) | 292.0 | 7.47 | 7.0 |
| Carbonate ($CO_3^{=}$) | 62.0 | 2.07 | 1.7 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 2.0 | 0.04 | 0.0 |
| Chloride ($Cl^{-}$) | 2556.0 | 72.08 | 60.4 |
| Nitrate ($NO_3^{=}$) | 6.3 | 0.10 | 0.1 |
| Silica ($SiO_2$) | 3.3 | | |
| Hydroxide ($OH^{-}$) | 766.0 | 45.03 | 37.7 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 5692.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 119.3 | Total Cations (epm) | 106.4 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | |
| pH | 12.6 | pH | 12.9 |
| Fluoride ($F^{-}$) | 0.3 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 138 ppm |
| | | Hydroxide ($OH^{-}$) | 1095 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 810.0 | 40.42 | 22 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 3138.0 | 136.49 | 75.5 |
| Potassium ($K^{+}$) | 154.0 | 3.94 | 2 |
| Carbonate ($CO_3^{=}$) | 40.8 | 1.36 | 1 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 2.0 | 0.04 | 0 |
| Chloride ($Cl^{-}$) | 4600.0 | 129.72 | 69 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.6 | | |
| Hydroxide ($OH^{-}$) | 987.0 | 58.02 | 31 |
| Calcium (Acidified) | 988.9 | | |
| Magnesium (Acidified) | 0.4 | | |
| Total dissolved solids | 9980 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 189.16 | Total Cations (epm) | 180.86 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 8.5 | |
| pH | 12.7 | pH | 13.1 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | 50 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 1129 | Mg/L |
| | | Conductivity | | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 830.0 | 41.42 | 21.3 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.0 |
| Sodium(Na) | 3463.0 | 150.63 | 77.3 |
| Potassium(K) | 108.0 | 2.76 | 1.4 |
| Carbonate(CO3) | 72.0 | 2.40 | 1.2 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 3.5 | 0.07 | 0.0 |
| Chloride(Cl) | 5140.0 | 144.95 | 69.7 |
| Nitrate(NO3) | 13.5 | 0.22 | 0.1 |
| Silica(SiO2) | 0.9 | | |
| Hydroxide(OH) | 1028.0 | 60.44 | 29.0 |
| Calcium(Acidified) | 770.0 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 10750.0 | | |
| Total Anions(epm) | 208.08 | Total Cations(epm) | 194.82 |

## Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 22700 | |
| pH | 12.7 | |
| Fluoride(F) | 0.4 | mg/l |

Field:

| | | |
|---|---|---|
| Temperature(C) | 12.00 | |
| pH | 12.6 | |
| Carbonate(CO3) | 50 | mg/l |
| Bicarbonate(HCO3) | | |
| Hydroxide(OH) | 1040 | mg/l |

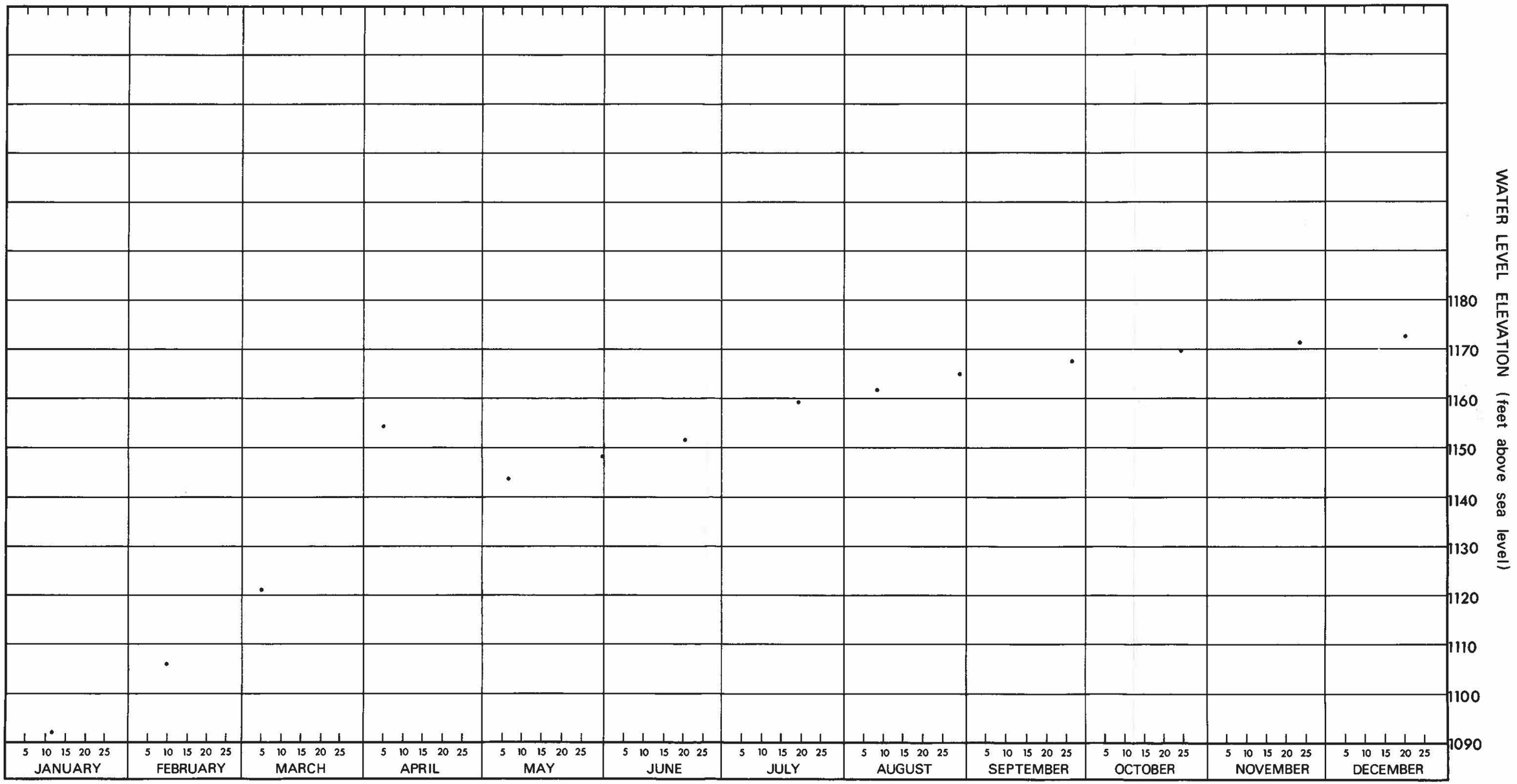
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

10 - 1700 - H - 77




1976

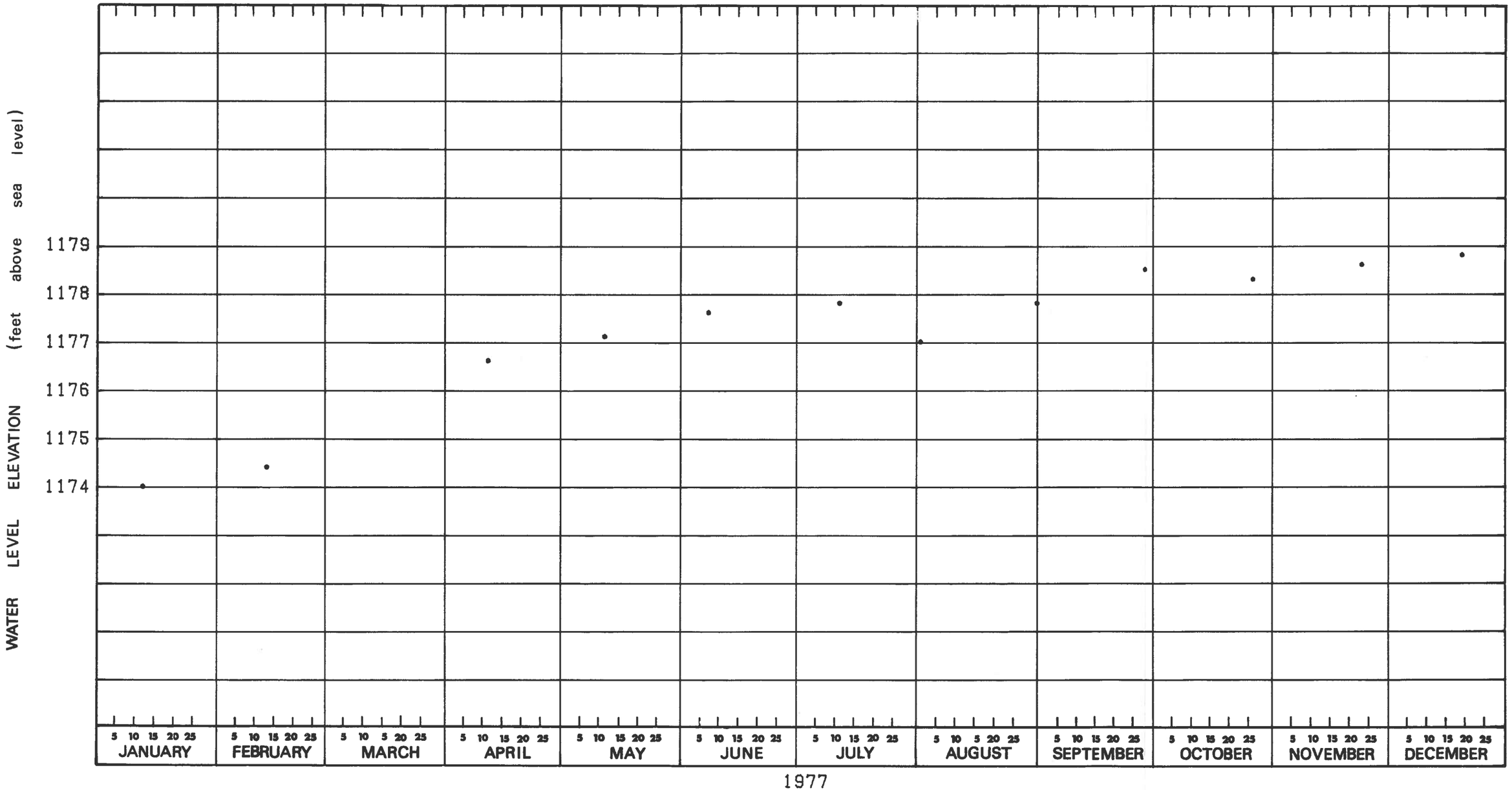
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1700

10-1700-H-78

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council




1977

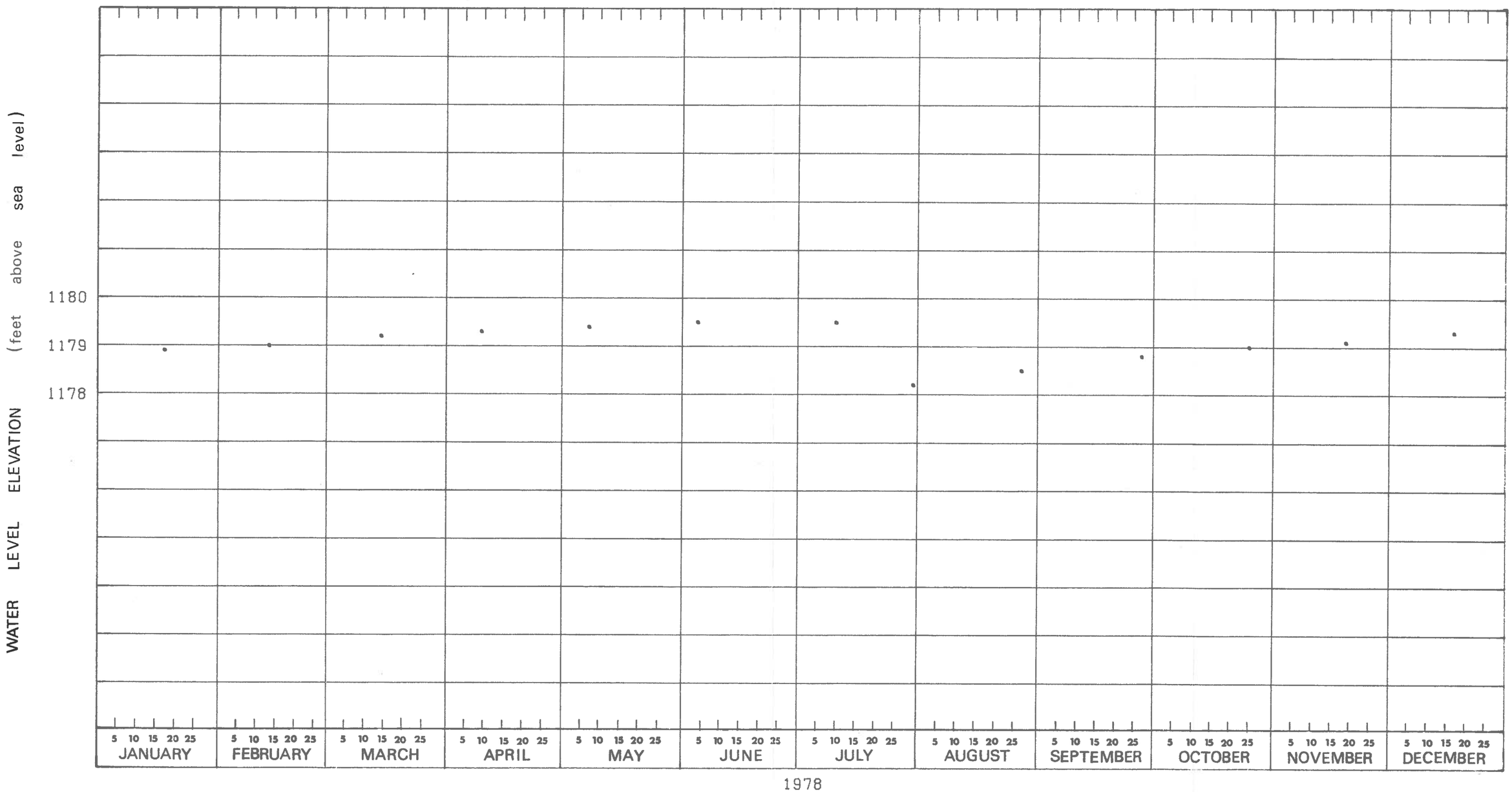
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1700

LSD 9 SEC 24 TWP 85 R 9 W4TH

10-1700-H-79

Alberta Research Council



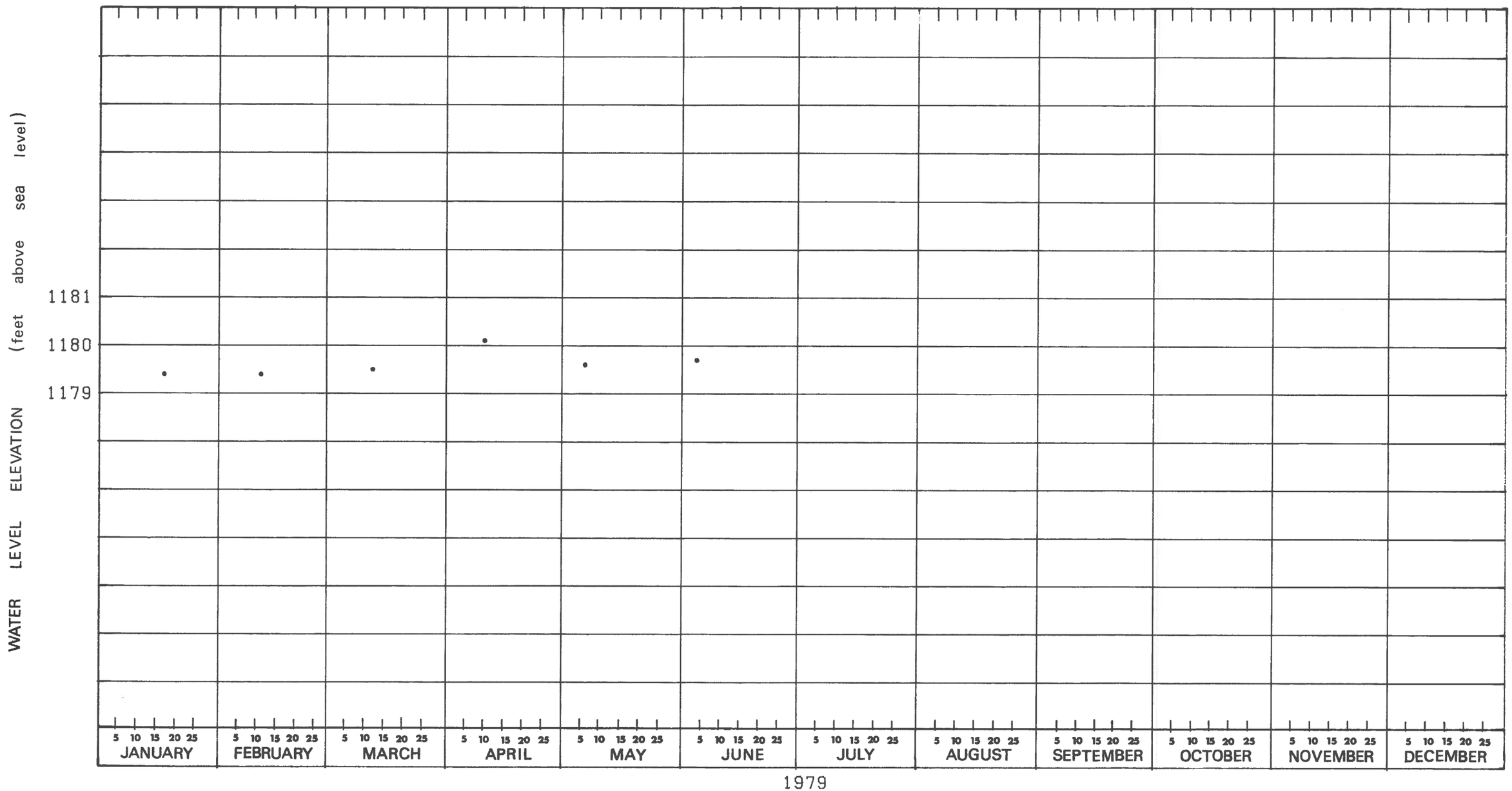
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1700

10-1700-H-80

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Nov 17/75 | | | Well completed, blow down with air |
| Nov 29/75 | 454.85 TOC | 1014.5 | |
| Dec 1/75 | 453.10 TOC | 1020.2 | |
| Dec 3/75 | 455.35 TOC | 1012.8 | |
| Dec 8/75 | 447.68 TOC | 1038.0 | |
| Dec 10/75 | | | DST; FSI = 35# from 1666 ft |
| Dec 11/75 | | | DST; FSI = 31# from 1666 ft<br>Water sample |
| Dec 18/75 | 440.77 MP | 1063.2 | Install shelter;<br>MP = 0.76 m TOC, (2508.9) |
| Jan 12/76 | 431.90 MP | 1092.3 | |
| Feb 10/76 | 427.68 MP | 1106.1 | |
| Mar 5/76 | 423.06 MP | 1121.3 | |
| Apr 5/76 | 412.90 MP | 1154.6 | |
| May 7/76 | 416.14 MP | 1143.9 | New MP = 0.71 m TOC (2508.8) |
| May 31/76 | 414.80 MP | 1148.3 | |
| June 21/76 | 413.69 MP | 1151.9 | |
| July 20/76 | 411.43 MP | 1159.3 | Sampled; temp. 8.5°C |
| Aug 9/76 | 410.52 MP | 1162.3 | |
| Aug 30/76 | 409.67 MP | 1165.1 | |
| Sept 27/76 | 408.77 MP | 1168.0 | |
| Oct 25/76 | 408.14 MP | 1170.1 | |
| Nov 24/76 | 407.62 MP | 1171.8 | |
| Dec 21/76 | 407.26 MP | 1173.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/77 | 406.94 MP | 1174.0 | MP (2508.8) |
| Feb 14/77 | 406.82 MP | 1174.4 | |
| Mar 14/77 | | | Could not measure |
| Apr 12/77 | 406.17 MP | 1176.6 | |
| May 12/77 | 405.99 MP | 1177.1 | |
| June 8/77 | 405.85 MP | 1177.6 | |
| July 12/77 | 405.80 MP | 1177.8 | Sampled; temp. 11°C |
| Aug 2/77 | 406.05 MP | 1177.0 | |
| Sept 1/77 | 405.78 MP | 1177.8 | |
| Sept 29/77 | 405.57 MP | 1178.5 | |
| Oct 27/77 | 405.65 MP | 1178.3 | |
| Nov 24/77 | 405.56 MP | 1178.6 | |
| Dec 20/77 | 405.48 MP | 1178.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 405.45 MP | 1178.9 | MP (2508.8) |
| Feb 14/78 | 405.41 MP | 1179.0 | |
| Mar 15/78 | 405.36 MP | 1179.2 | |
| Apr 10/78 | 405.33 MP | 1179.3 | |
| May 8/78 | 405.30 MP | 1179.4 | |
| June 5/78 | 405.28 MP | 1179.5 | |
| July 11/78 | 405.26 MP | 1179.5 | Sample; temp. 12°C |
| July 31/78 | 405.66 MP | 1178.2 | |
| Aug 28/78 | 405.57 MP | 1178.5 | |
| Sept 28/78 | 405.48 MP | 1178.8 | |
| Oct 26/78 | 405.42 MP | 1179.0 | |
| Nov 20/78 | 405.38 MP | 1179.1 | |
| Dec 18/78 | 405.32 MP | 1179.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1700

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2506.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 405.31 MP | 1179.4 | MP (2508.8) |
| Feb 12/79 | 405.29 MP | 1179.4 | |
| Mar 13/79 | 405.26 MP | 1179.5 | |
| Apr 11/79 | 405.10 MP | 1180.1 | |
| May 7/79 | 405.23 MP | 1179.6 | |
| June 5/79 | 405.20 MP | 1179.7 | |
| July 12/79 | | | Well was vadalized; obstruction at 19.37m |

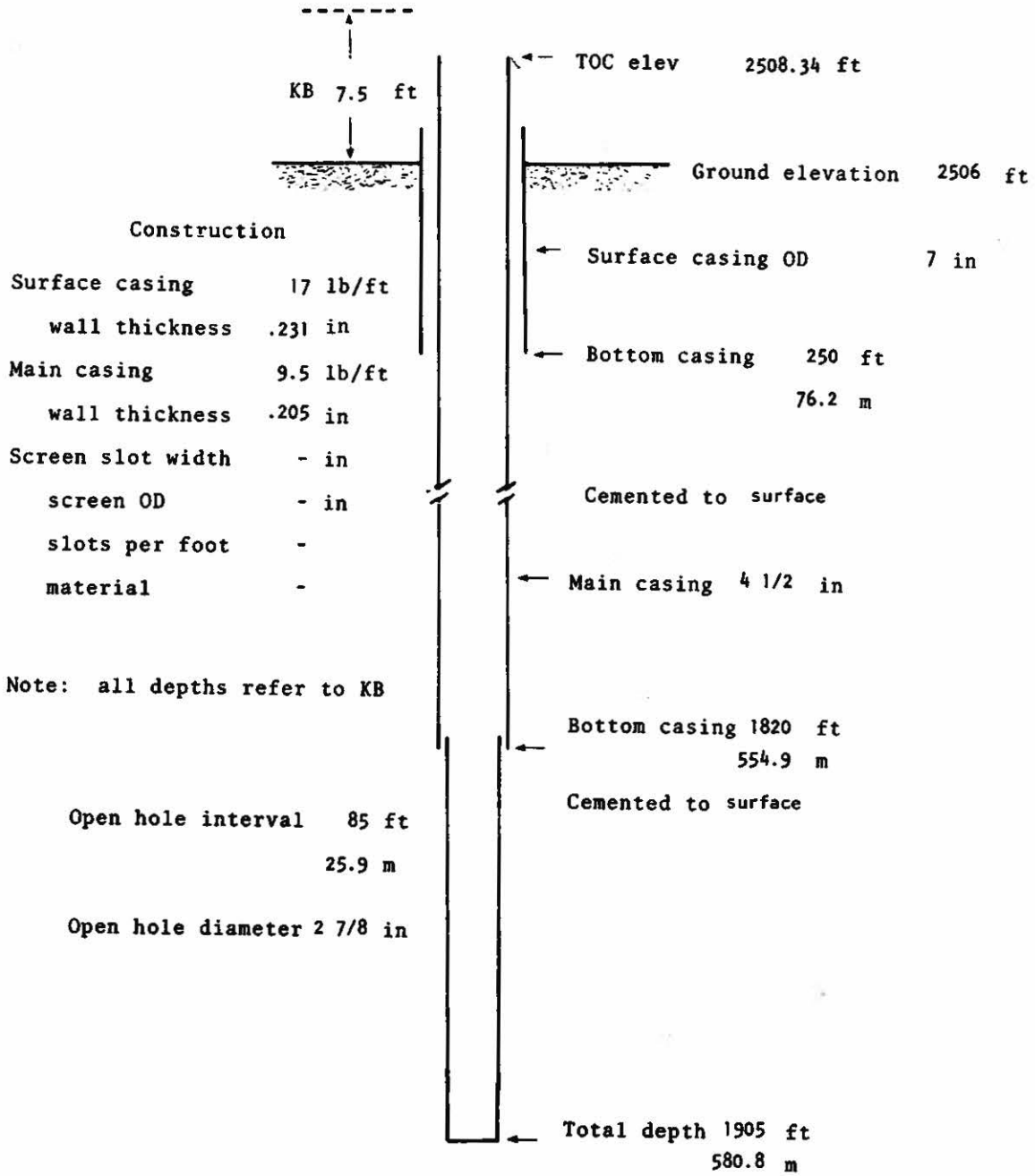
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Tp 85 R 9 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | - | in |
| screen OD | - | in |
| slots per foot | - | |
| material | - | |

Note: all depths refer to KB

Open hole interval 85 ft
25.9 m

Open hole diameter 2 7/8 in

## DRILL STEM TEST

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Tp 85 R 9 W4th

Alberta Research Council

Elevation: gl 2506
KB 2514

Type of test Open hole, Bottom hole

Date of test November 10, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0730 | hrs |
| Tool opened | 0957 | hrs |
| First flow | 3 | min |
| Initial shut in | 33 | min |
| Second flow | 30 | min |
| Final shut in | 30 | min |
| Pulled loose at | 1133 | hrs |
| Out of hole at | 1400 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff. Dead on second opening

Total water recovered 30 ft

Water sample No. - (drilling mud)

Gas blow -

Remarks

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 31

Open or screened interval 1708-1770'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Perfs | 11.00 | |
| Sub | 3.00 | |
| Drill Collar | 31.10 | |
| Sub | 1.30 | |
| Total Interval | 62.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 65 | 64 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 1714 | 1718 |
| Initial hydrostatic | A | 846 | 848 |
| First flow | B | 33 | 35 |
| | B1 | 33 | 35 |
| Initial shut in | C | 50 | 52 |
| Second flow | D | 35 | 37 |
| | D1 | 35 | 37 |
| Final shut in | G | 36 | 38 |
| Final hydrostatic | H | 849 | 850 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

10-1905-D-77

OBSERVATION WELL NUMBER 10-1905

INTERVAL TESTED 1708-1770

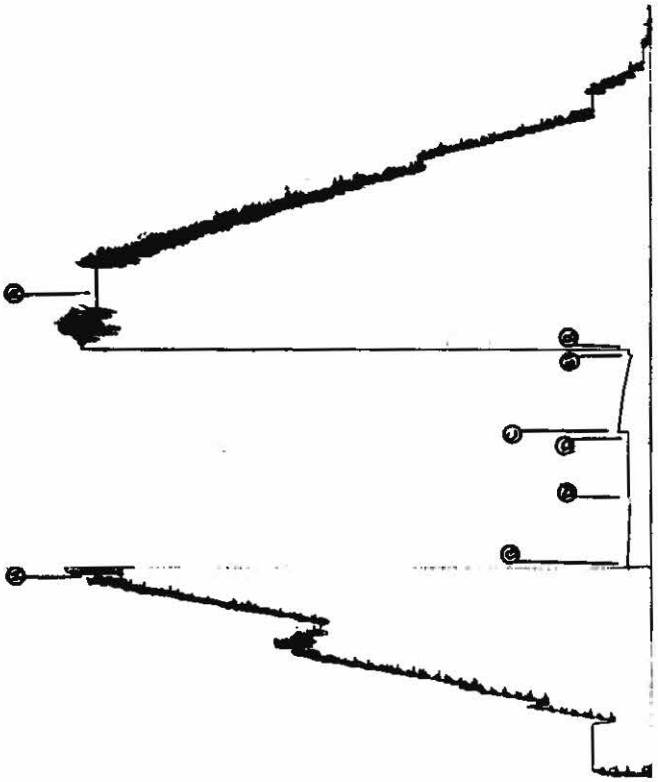
PRESSURE INCREMENTS

Recorder AK1-65

November 10, 1975

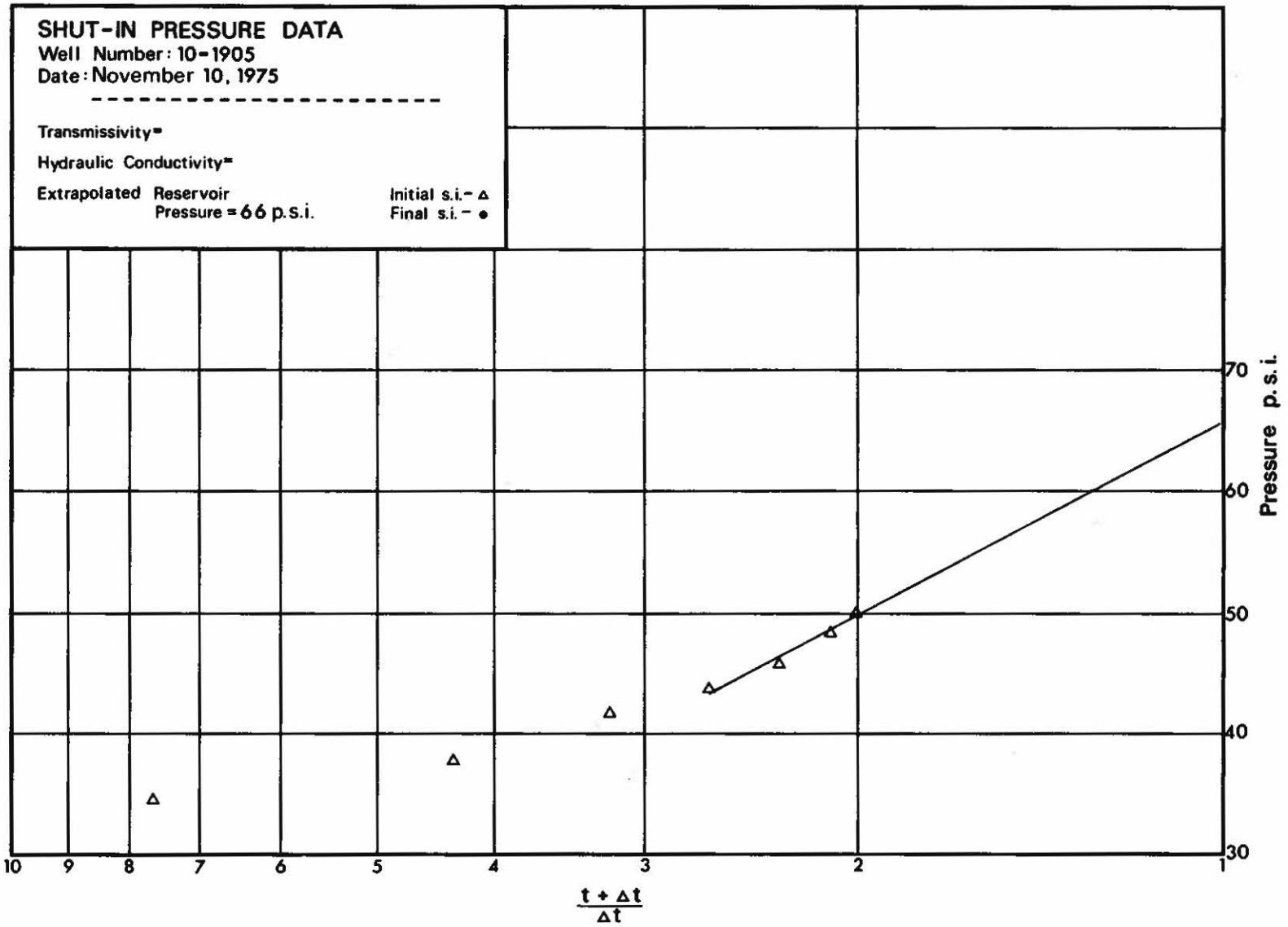
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 34.3 | 7.60 |
| 10 | 37.7 | 4.30 |
| 15 | 41.5 | 3.20 |
| 20 | 43.7 | 2.65 |
| 25 | 45.7 | 2.32 |
| 30 | 48.3 | 2.10 |
| 35 | 50.0 | 2.00 |

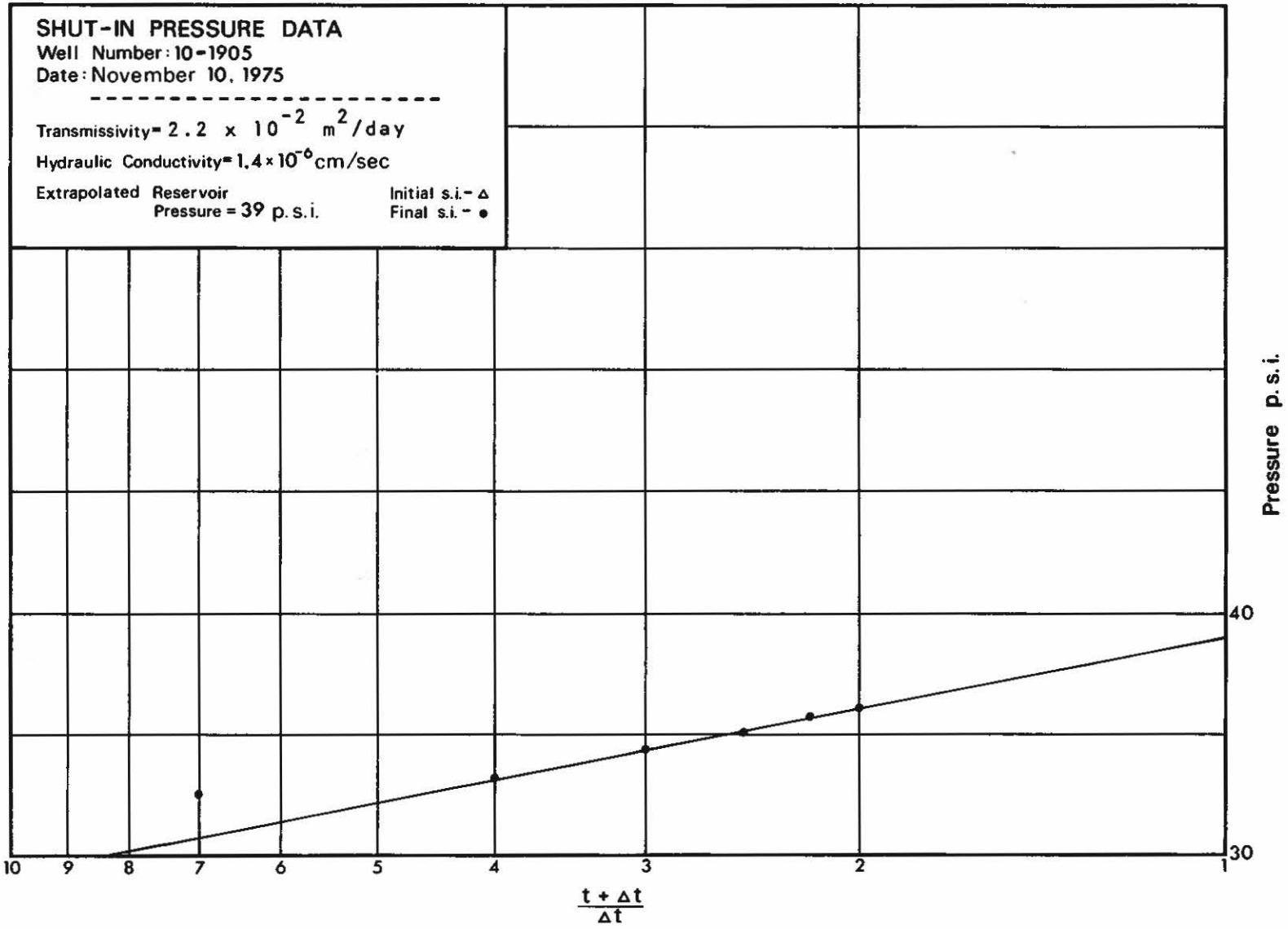


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 32.5 | 7.00 |
| 10 | 33.3 | 4.00 |
| 15 | 34.3 | 3.00 |
| 20 | 35.0 | 2.50 |
| 25 | 35.7 | 2.20 |
| 30 | 36.2 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 10-1905
Date: November 10, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 66 p.s.i.
Initial s.i.- Δ
Final s.i. - •
70
60
50
40
30
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

10-1905-B-77


SHUT-IN PRESSURE DATA
Well Number: 10-1905
Date: November 10, 1975
Transmissivity = 2.2 x 10^-2 m^2/day
Hydraulic Conductivity = 1.4 x 10^-6 cm/sec
Extrapolated Reservoir Pressure = 39 p.s.i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
40
30
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

10-1905-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Tp 85 R 9 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 2506 |
| | KB | 2514 |
| Type of test | | Open hole, Bottom hole |
| Date of test | | November 11, 1975 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 2300 | hrs |
| Tool opened | 0028 | hrs |
| First flow | 2 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 30 | min |
| Pulled loose at | 0145 | hrs |
| Out of hole at | 0330 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff on preflow. Faint air blow on final flow period

Total water recovered 30 ft

Water sample No. No

Gas blow Test satisfactory

Remarks The initial shut-in is false

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 31

Open or screened interval 1769-1820'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| Packer | 6.35 | 5 1/2" |
| Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 3.00 | |
| Drill Collar | 31.10 | |
| Sub | 1.30 | |
| Bull Nose | 1.00 | |
| Total Interval | 51.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 65 | 64 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 1775 | 1779 |
| Initial hydrostatic | A | 886 | 888 |
| First flow | B | 20 | 23 |
| | B1 | 19 | 22 |
| Initial shut in | C | 776 | 779 |
| Second flow | D | 22 | 25 |
| | D1 | 22 | 25 |
| Final shut in | G | 25 | 28 |
| Final hydrostatic | H | 878 | 880 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

10-1905-D-77

OBSERVATION WELL NUMBER 10-1905

INTERVAL TESTED 1769-1820

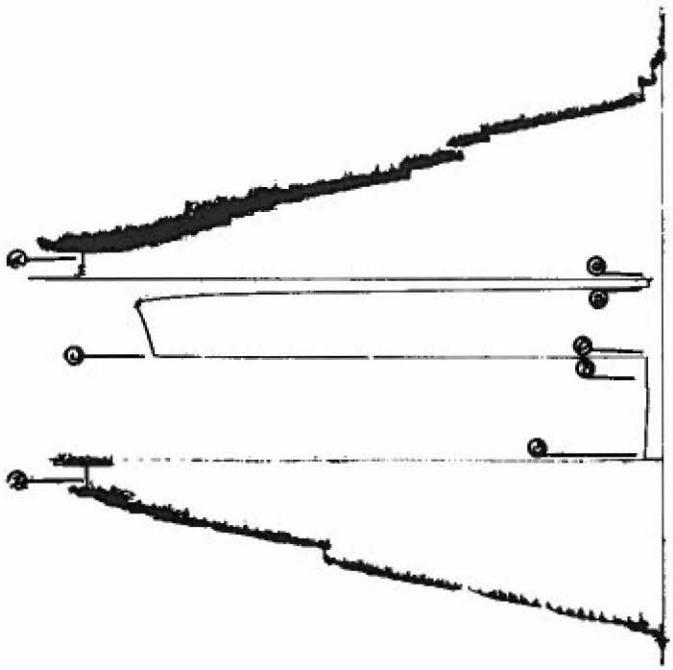
PRESSURE INCREMENTS

Recorder AK1-65

November 11, 1975

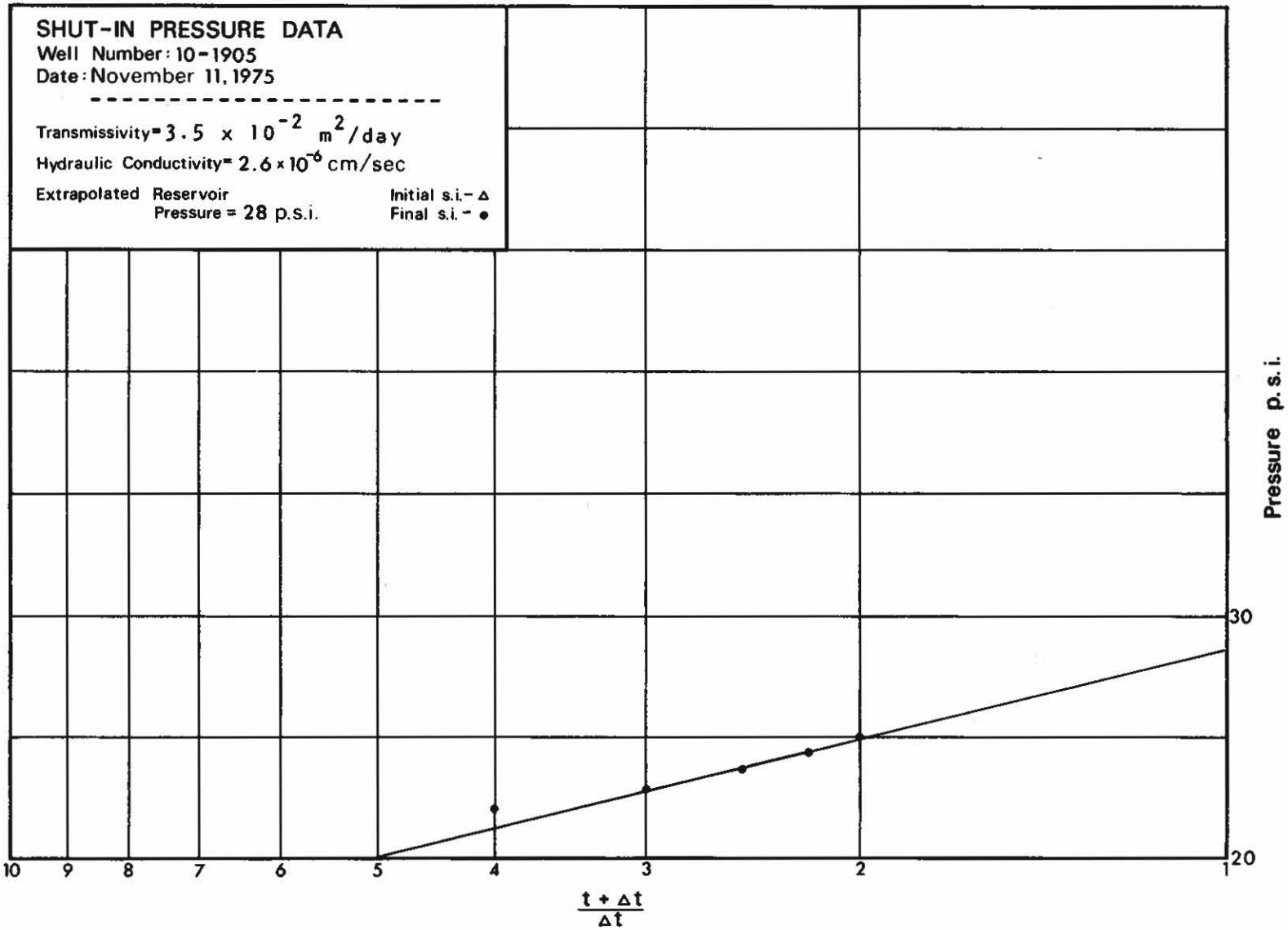
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 691.0 | 7.00 |
| 10 | 741.0 | 4.00 |
| 15 | 733.6 | 3.00 |
| 20 | 727.7 | 2.50 |
| 25 | 722.9 | 2.20 |
| 30 | 718.0 | 2.00 |



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 21.3 | 7.00 |
| 10 | 22.0 | 4.00 |
| 15 | 22.9 | 3.00 |
| 20 | 23.6 | 2.50 |
| 25 | 24.3 | 2.20 |
| 30 | 25.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 10-1905
Date: November 11, 1975
Transmissivity = 3.5 x 10^-2 m^2/day
Hydraulic Conductivity = 2.6 x 10^-6 cm/sec
Extrapolated Reservoir Pressure = 28 p.s.i.
Initial s.i. - Δ
Final s.i. - ●
Pressure p.s.i.
30
20
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

10-1905-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Tp 85 R 9 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 2506 |
| | KB | 2514 |
| Type of test | | Open hole, Bottom hole |
| Date of test | | November 12, 1975 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | | hrs |
| Tool opened | 0357 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 30 | min |
| Pulled loose at | 0530 | hrs |
| Out of hole at | 0830 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak air blow on preflow. Weak air blow on final flow period decreasing to nil in 15 minutes

Total water recovered 30 ft

Water sample No. - (drilling mud)

Gas blow No

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 31

Open or screened interval 1820-1870'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P.Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| Packer | 6.35 | 5 1/2" |
| Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 3.00 | |
| Drill Collar | 31.10 | |
| Sub | 1.30 | |
| Bull Nose | 1.00 | |
| Total Interval | 51.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 1827 | 1831 |
| Initial hydrostatic | A | 954 | 956 |
| First flow | B | 21 | 28 |
| | B1 | 21 | 28 |
| Initial shut in | C | 137 | 138 |
| Second flow | D | 23 | 25 |
| | D1 | 23 | 25 |
| Final shut in | G | 108 | 110 |
| Final hydrostatic | H | 944 | 947 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

10-1905-D-77

OBSERVATION WELL NUMBER 10-1905

INTERVAL TESTED 1820-1870

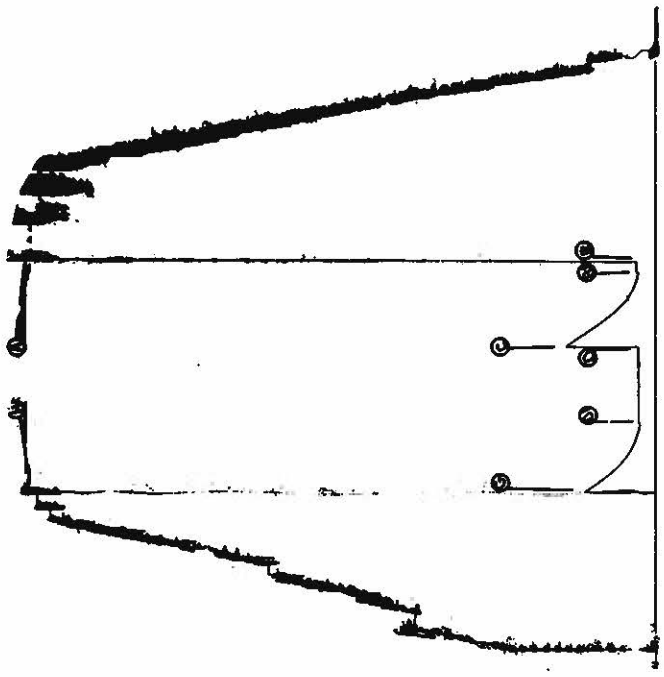
PRESSURE INCREMENTS

Recorder AKI-65

November 12, 1975

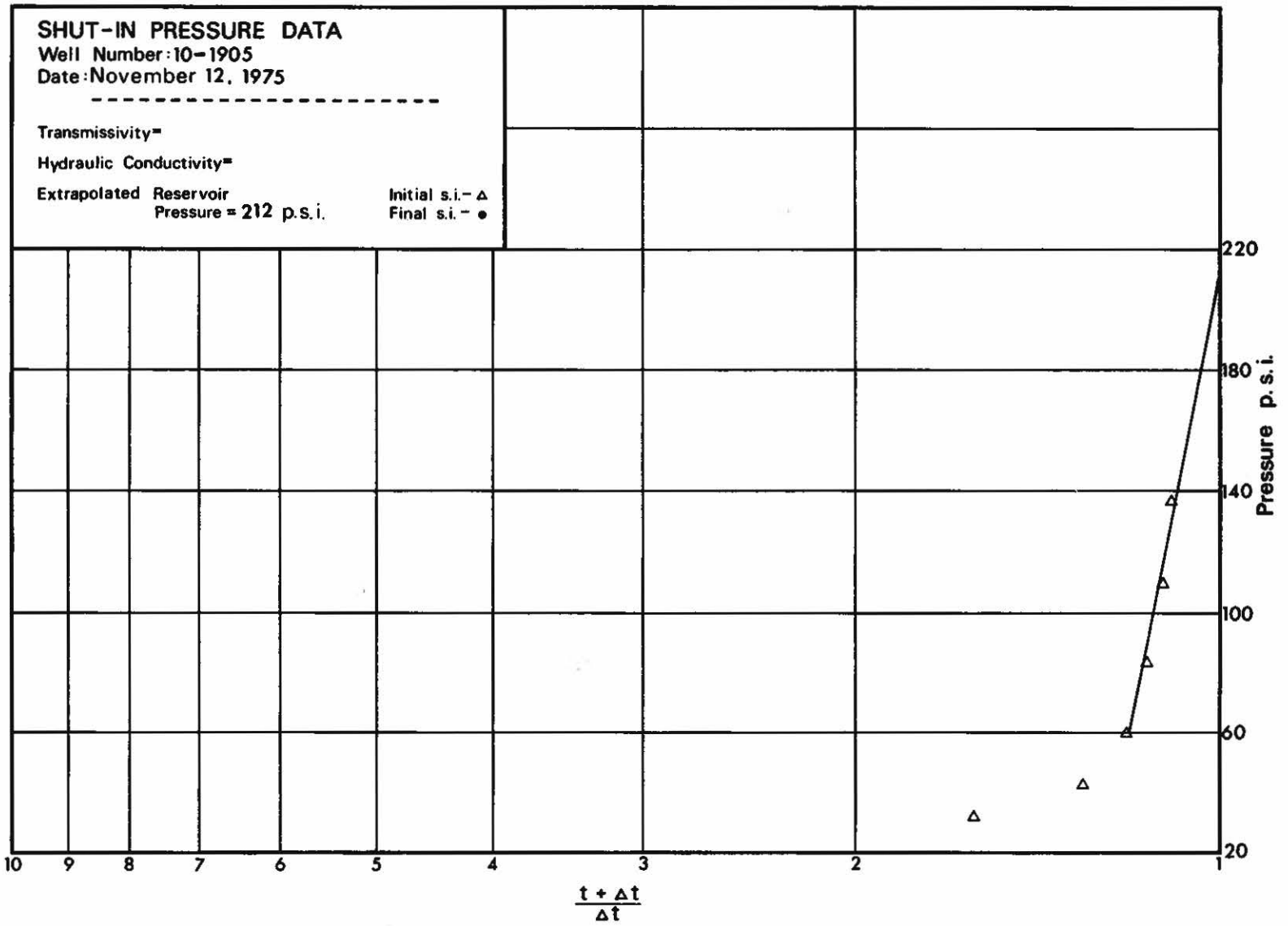
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 31.9 | 1.60 |
| 10 | 42.4 | 1.30 |
| 15 | 59.6 | 1.70 |
| 20 | 83.2 | 1.15 |
| 25 | 110.7 | 1.12 |
| 30 | 138.8 | 1.10 |

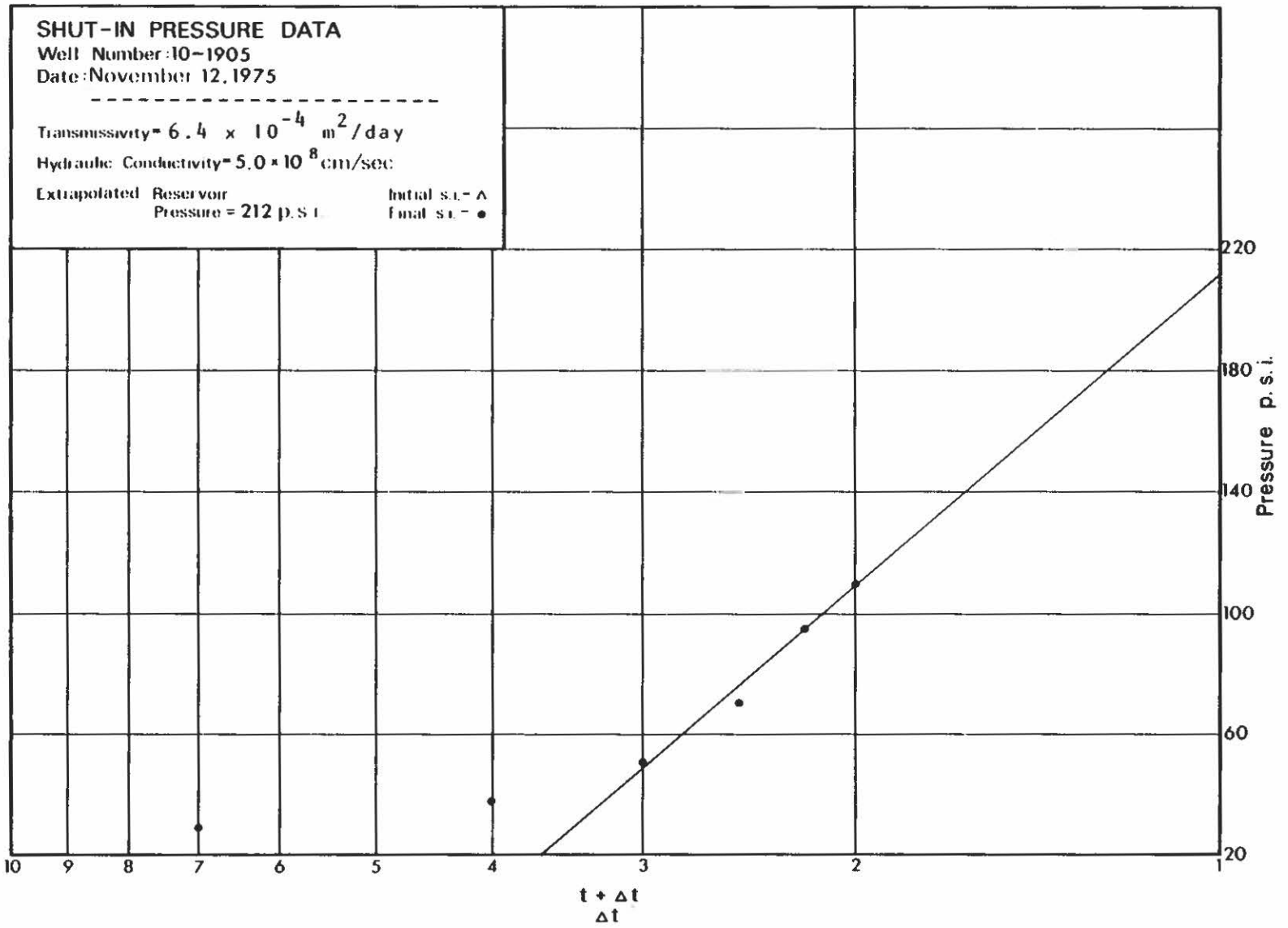


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 28.2 | 7.00 |
| 10 | 36.5 | 4.00 |
| 15 | 49.5 | 3.00 |
| 20 | 69.0 | 2.50 |
| 25 | 94.4 | 2.20 |
| 30 | 109.6 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 10-1905
Date: November 12, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 212 p.s.i.
Initial s.i.- Δ
Final s.i. - •
220
180
140
100
60
20
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

10-1905-D-77


SHUT-IN PRESSURE DATA
Well Number: 10-1905
Date: November 12, 1975
Transmissivity = 6.4 x 10^-4 m^2/day
Hydraulic Conductivity = 5.0 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 212 p.s.i.
Initial s.i. = Δ
Final s.i. = •
220
180
140
100
60
20
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

10-1905-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 192.0 | 9.58 | 4 |
| Magnesium ($Mg^{++}$) | 166.0 | 13.66 | 5 |
| Sodium ($Na^{+}$) | 5450.0 | 237.06 | 91 |
| Potassium ($K^{+}$) | 57.0 | 1.46 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 154.0 | 2.52 | 1 |
| Sulfate ($SO_4^{=}$) | 118.0 | 2.46 | 1 |
| Chloride ($Cl^{-}$) | 9198.0 | 259.39 | 98 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0 |
| Silica ($SiO_2$) | 12.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 205.7 | | |
| Magnesium (Acidified) | 169.4 | | |
| Total dissolved solids | 15554 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 264.39 | Total Cations (epm) | 261.76 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 10.0 | |
| pH | 8.0 | pH | 8.6 | |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 24 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 195 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 12, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 655.0 | 32.68 | 11.1 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.02 | 0.0 |
| Sodium ($Na^{+}$) | 6000.0 | 260.98 | 88.3 |
| Potassium ($K^{+}$) | 69.0 | 1.77 | 0.6 |
| Carbonate ($CO_3^{=}$) | 79.2 | 2.64 | 0.9 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 85.0 | 1.77 | 0.6 |
| Chloride ($Cl^{-}$) | 10180.0 | 287.08 | 95.8 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 58.0 | | |
| Hydroxide ($OH^{-}$) | 137.0 | 8.05 | 2.7 |
| Calcium (Acidified) | 590.0 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 17860.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 299.56 | Total Cations (epm) | 295.46 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 11.0 |
| pH | 11.7 | pH | 11.9 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 192.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 113.0 ppm |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Date sampled: July 20, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .028 |
| Au | <.003 | Mo | <.006 |
| Al | 0.44 | Na | 5126 |
| As | <.038 | Ni | <.010 |
| B | 2.44 | P | 1.21 |
| Ba | <.200 | Pb | <.088 |
| Be | .003 | Se | <.060 |
| Ca | 220 | Si | 5.65 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 7.88 |
| Cr | <.006 | Te | <.065 |
| Cu | .013 | Ti | .004 |
| Eu | <.015 | U | <.020 |
| Fe | .055 | V | .018 |
| K | 187 | W | <.078 |
| Mg | 176.6 | Zn | .132 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

10-1905-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Rge 9 Twp 85 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 130.0 | 6.49 | 1.1 |
| Magnesium(Mg) | 480.0 | 39.51 | 6.7 |
| Sodium(Na) | 12500.0 | 543.71 | 91.9 |
| Potassium(K) | 81.0 | 2.07 | 0.4 |
| Carbonate(CO3) | 40.8 | 1.36 | 0.2 |
| Bicarbonate(HCO3) | 268.0 | 4.39 | 0.7 |
| Sulphate(SO4) | 198.0 | 4.12 | 0.7 |
| Chloride(Cl) | 21700.0 | 611.96 | 98.4 |
| Nitrate(NO3) | 2.0 | 0.03 | 0.0 |
| Silica(SiO2) | 10.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 138.0 | | |
| Magnesium(Acidified) | 425.0 | | |
| TDS(mg/l) | 37720.0 | | |
| Total Anions(epm) | 621.86 | Total Cations(epm) | 591.78 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 48800 | | Temperature(C) | 12.00 | |
| pH | 8.9 | | pH | 8.7 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | 58 | mg/l |
| | | | Bicarbonate(HCO3) | 380 | mg/l |
| | | | Hydroxide(OH) | | |

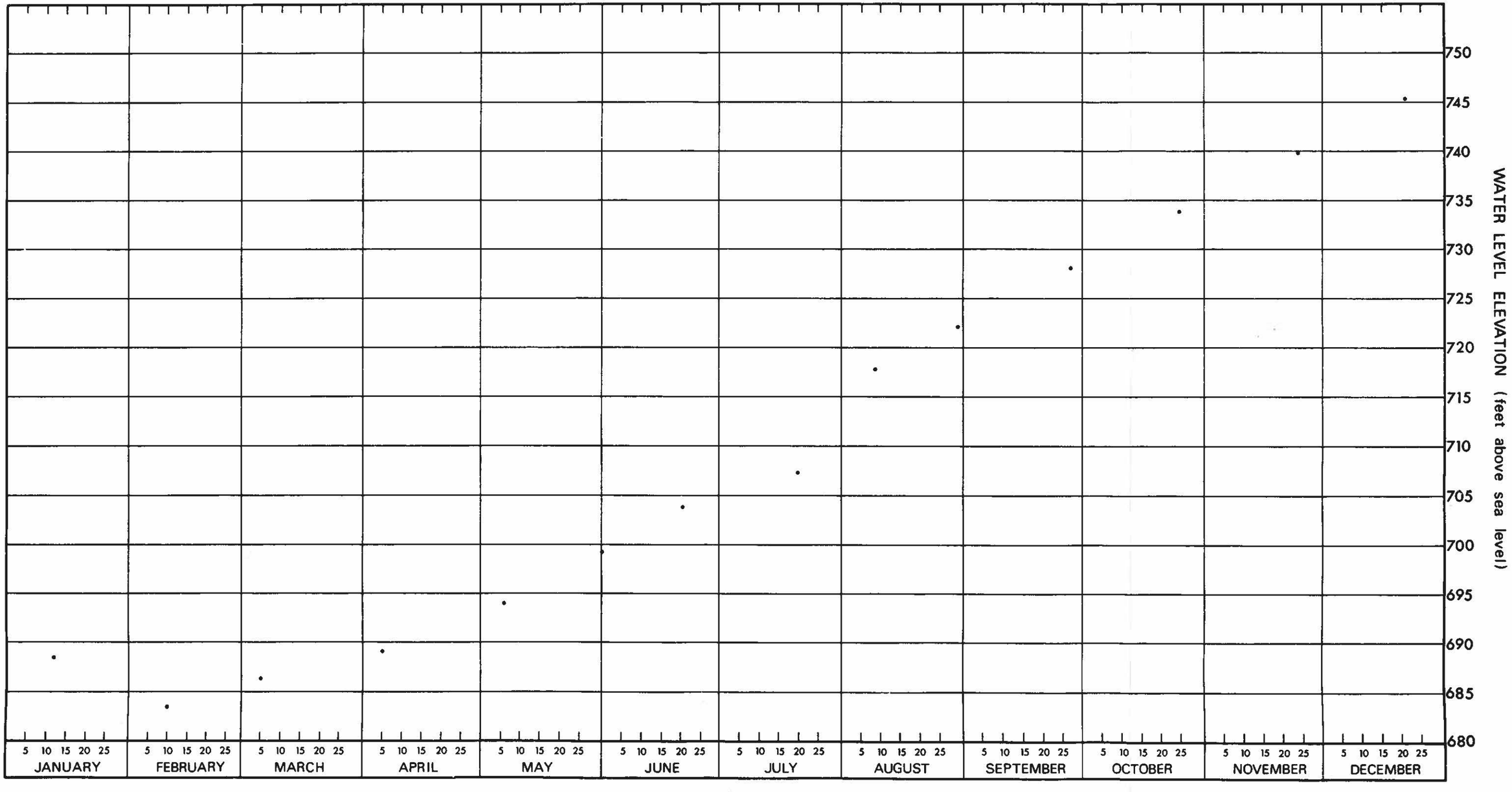
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1905

10 - 1905 - H - 77

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council




1976

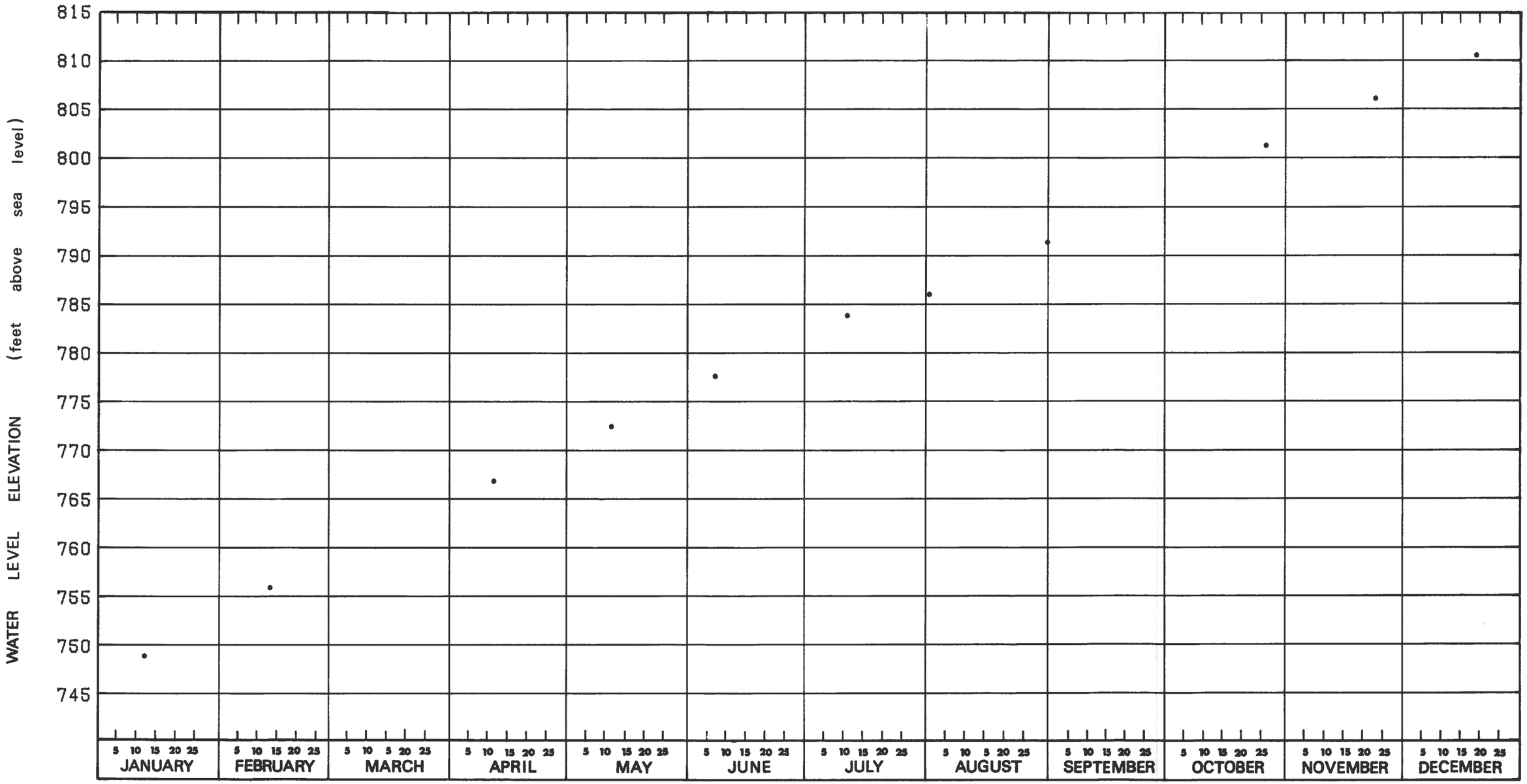
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-1905-H-78




1977

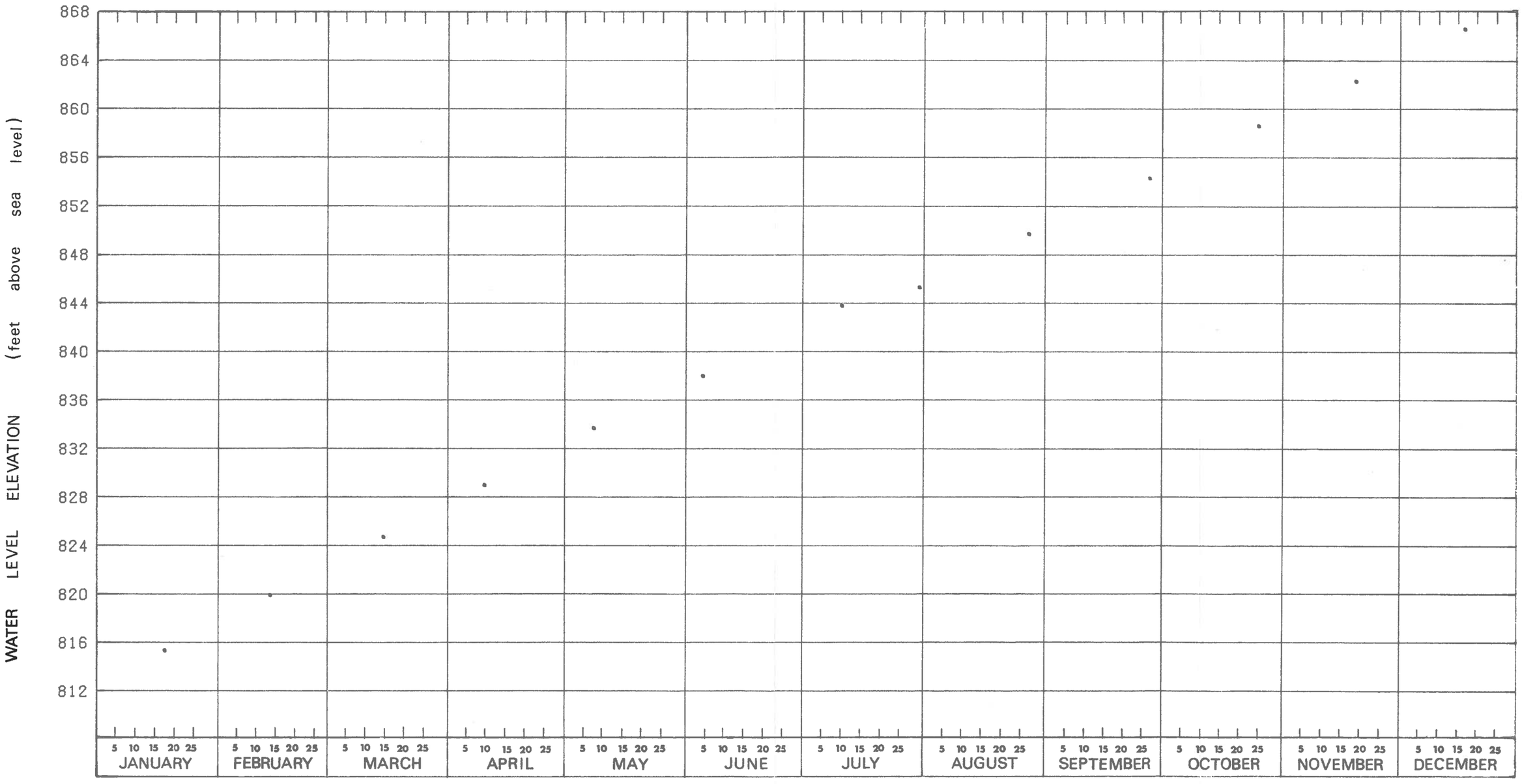
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1905

LSD 9 SEC 24 TWP 85 R 9 W4TH

10-1905-H-79

Alberta Research Council



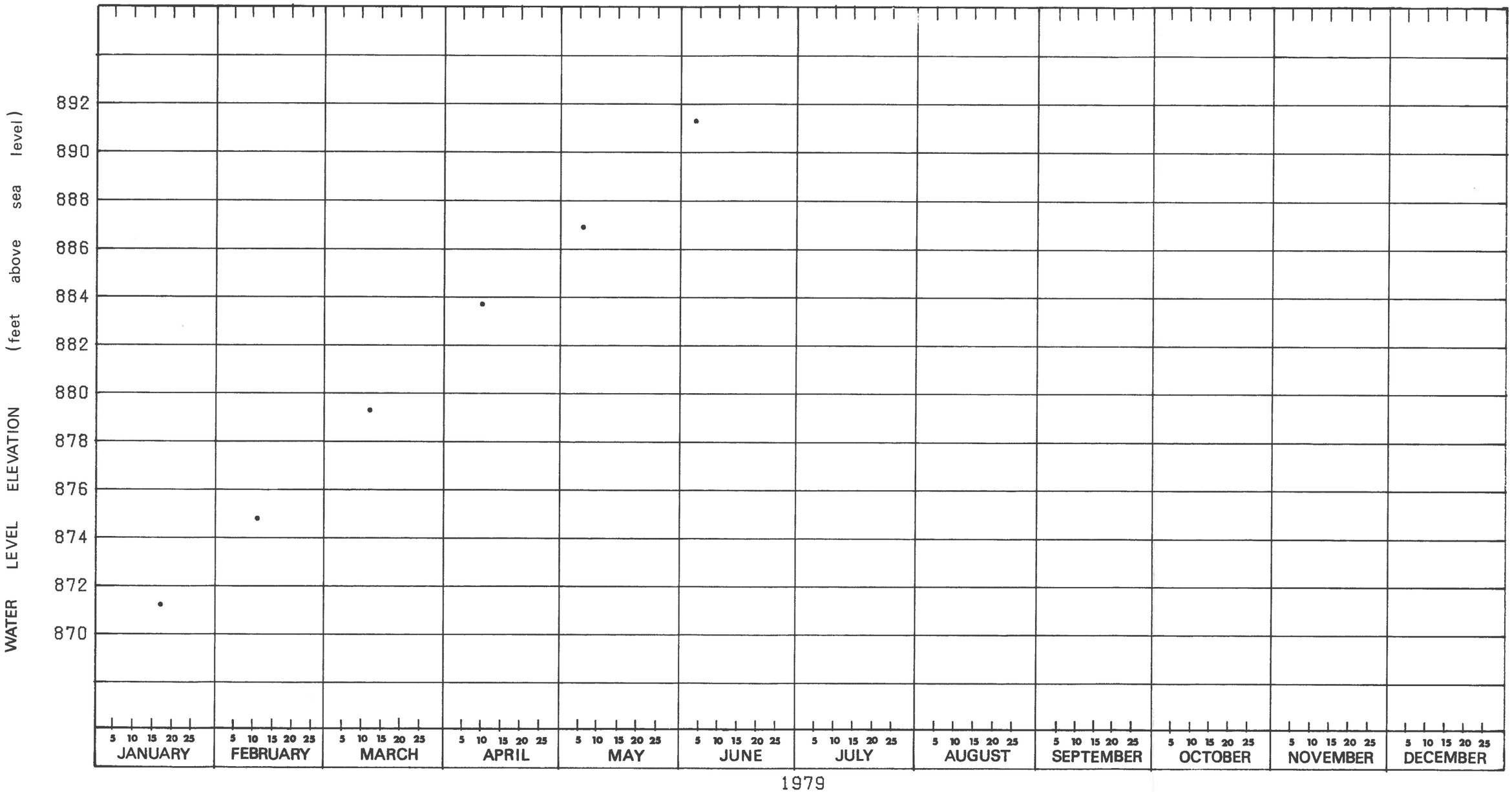
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Twp 85 R 9 W4 th

Alberta Research Council

10-1905-H-80




1979

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2508.34

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Nov 13/75 | | | Well completed; blown down with air |
| Dec 4/75 | 555.10 TOC | 687.6 | |
| Dec 8/75 | 554.90 TOC | 688.2 | |
| Dec 12/75 | 554.75 TOC | 688.7 | |
| Dec 18/75 | 554.76 MP | 689.7 | Install shelter; MP = 0.29 m TOC, (2509.3) |
| Jan 12/76 | 555.15 MP | 688.4 | |
| Feb 10/76 | 556.65 MP | 683.5 | |
| Mar 5/76 | 555.76 MP | 686.4 | |
| Apr 5/76 | 554.95 MP | 689.0 | New MP = 0.26 m TOC (2509.2) |
| May 7/76 | 553.38 MP | 694.1 | |
| May 31/76 | 551.81 MP | 699.3 | |
| June 21/76 | 550.41 MP | 703.8 | |
| July 20/76 | 549.35 MP | 707.3 | Sampled; temp. 10°C |
| Aug 9/76 | 546.16 MP | 717.8 | |
| Aug 30/76 | 544.81 MP | 722.2 | |
| Sept 27/76 | 543.00 MP | 728.2 | |
| Oct 25/76 | 541.27 MP | 733.8 | |
| Nov 24/76 | 539.45 MP | 739.8 | |
| Dec 21/76 | 537.81 MP | 745.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2508.34

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/77 | 536.66 MP | 749.0 | MP (2509.2) |
| Feb 14/77 | 534.50 MP | 756.0 | |
| Mar 14/77 | | | Could not measure |
| Apr 12/77 | 531.18 MP | 766.9 | |
| May 12/77 | 529.49 MP | 772.5 | |
| June 8/77 | 527.93 MP | 777.6 | |
| July 12/77 | 526.04 MP | 783.8 | Sampled; temp. 11°C |
| Aug 2/77 | 525.36 MP | 786.0 | |
| Sept 1/77 | 523.74 MP | 791.3 | |
| Sept 29/77 | | | Could not measure |
| Oct 27/77 | 520.74 MP | 801.2 | |
| Nov 24/77 | 519.27 MP | 806.0 | |
| Dec 20/77 | 517.91 MP | 810.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1905

Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2508.34

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 516.42 MP | 815.3 | MP (2509.2) |
| Feb 14/78 | 515.04 MP | 819.9 | |
| Mar 15/78 | 513.57 MP | 824.7 | |
| Apr 10/78 | 512.25 MP | 829.0 | |
| May 8/78 | 510.83 MP | 833.7 | |
| June 5/78 | 509.50 MP | 838.0 | |
| July 11/78 | 507.75 MP | 843.8 | Sampled; temp. 12°C |
| July 31/78 | 507.29 MP | 845.3 | |
| Aug 28/78 | 505.95 MP | 849.7 | |
| Sept 28/78 | 504.53 MP | 854.3 | |
| Oct 26/78 | 503.23 MP | 858.6 | |
| Nov 20/78 | 502.09 MP | 862.3 | |
| Dec 18/78 | 500.80 MP | 866.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 10-1905

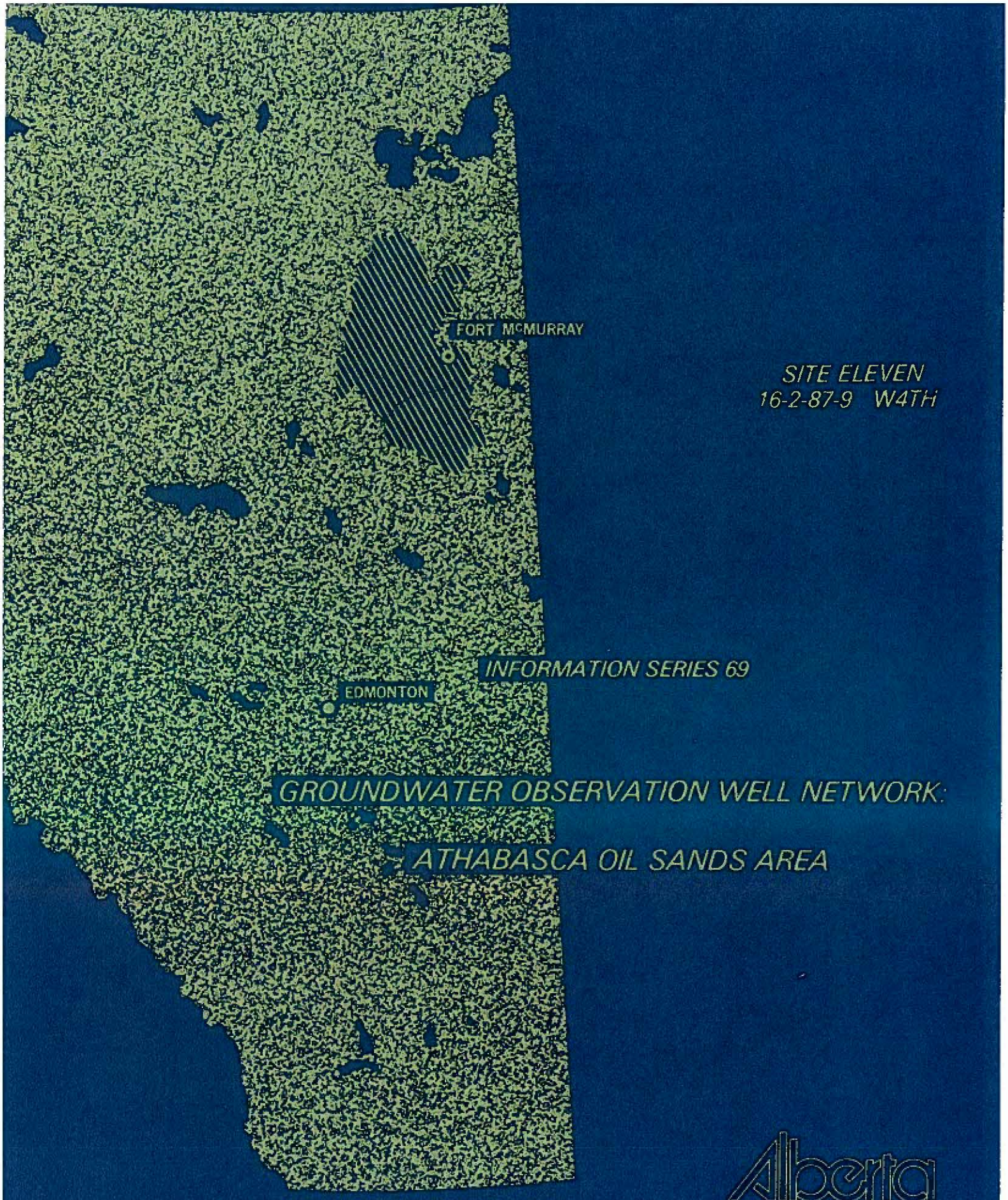
Lsd 9 Sec 24 Twp 85 R 9 W4th

Alberta Research Council

Elevation of top of casing 2508.34

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 499.40 MP | 871.2 | MP (2509.2) |
| Feb 12/79 | 498.29 MP | 874.8 | |
| Mar 13/79 | 496.92 MP | 879.3 | |
| Apr 11/79 | 495.59 MP | 883.7 | |
| May 7/79 | 494.60 MP | 886.9 | |
| June 5/79 | 493.27 MP | 891.3 | |
| July 12/79 | | | Well vandalized; filled with rocks and beer bottles |

MP - Depth from measuring point
TOC - Depth from top of casing




SITE ELEVEN
16-2-87-9 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites (numbers 1, 2, 3, 6, 7, 8 and 9), containing 36 individual wells, were instrumented in this manner during the winter of 1974-75. Eight sites (numbered 10, 11, 12, 13, 14, 15 16 and 17), containing 38 individual wells, were instrumented during the winter of 1975-76.

The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The page indexing system is also consistent with the updating process. All update volumes will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this Introduction and a Legend. There are 15 piezometer nests in the system and thus there are 15 separate

site publications in Information Series 69. Table 1 lists the location of wells in the system as of August 31, 1976. Figure 1 indicates the location of these wells. Publications are available as of the date of this document for all sites.

Five oil companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing.

## ACKNOWLEDGMENTS

The installation and monitoring of wells in this Program was funded by Alberta Energy and Natural Resources; Non-Renewable Resources Division.

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1976: BPOG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., Shell Canada Ltd. and Home Oil Company Ltd.

D. Hackbarth

EDMONTON

1977

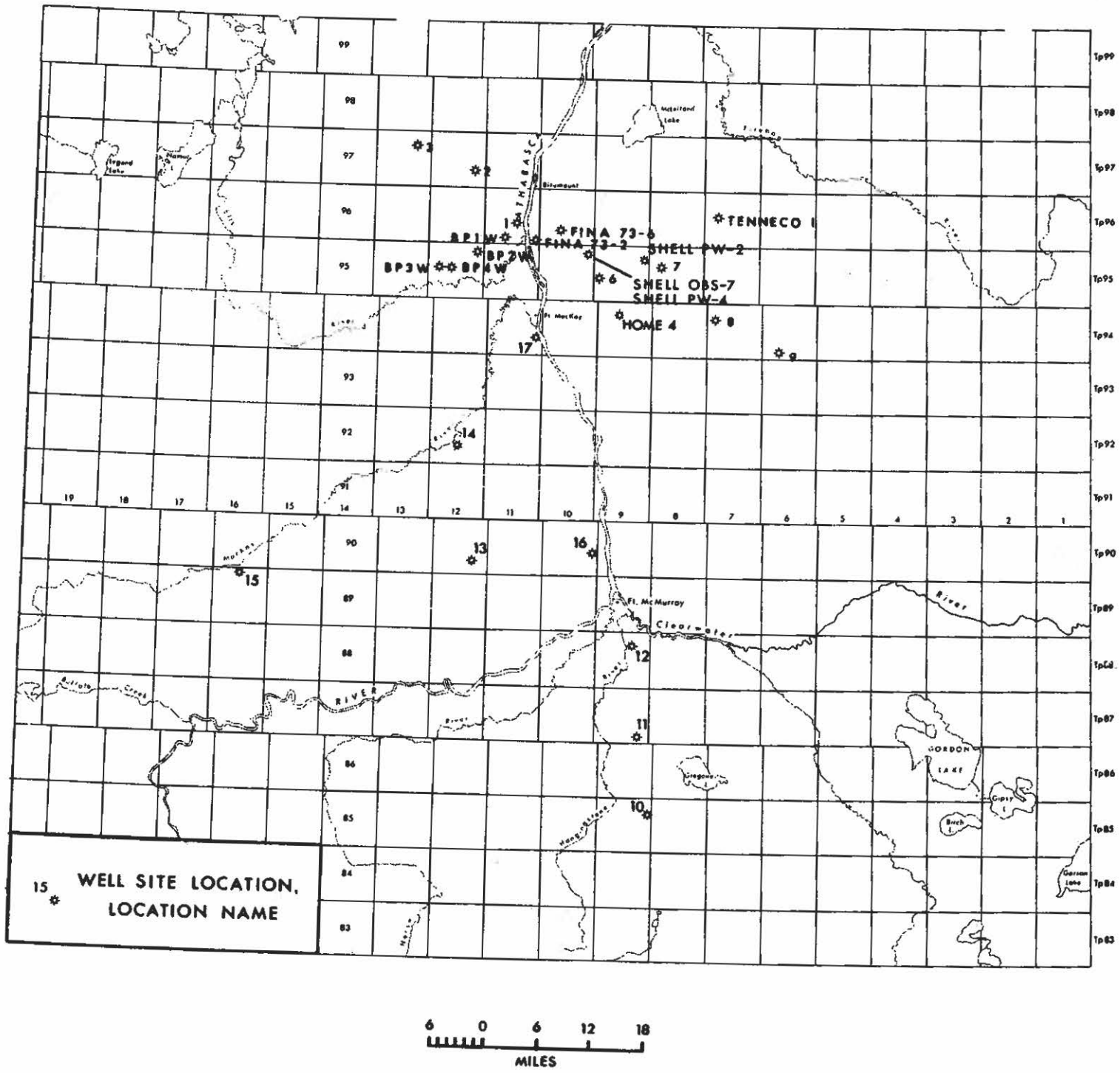



FIGURE 1. Athabasca Oil Sands observation well network, January 1977

Table 1

Athabasca Oil Sands Observation Wells

August 31, 1976

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 9-24-85-9 | 10 |
| Lsd 16-2-87-9 | 11 |
| Lsd 8-27-88-9 | 12 |
| Lsd 8-11-90-12 | 13 |
| Lsd 4-15-92-12 | 14 |
| Lsd 15-33-89-16 | 15 |
| Lsd 6-13-90-10 | 16 |
| Lsd 13-12-94-11 | 17 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |
| Lsd 3-28-94-9 | Home 4 |
| Lsd 10-25-95-10 | Shell PW-4 |
| Lsd 10-24-95-9 | Shell PW-2 |
| Lsd 10-25-95-10 | Shell Obs-7 |

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

| | | |
|---|---|---|
| Well Number | - | the name used for designating the well |
| Subject Code | - | as follows: |
| I | - | Introduction (no site number indicated) |
| L | - | Legend (no site number indicated) |
| G | - | General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents |
| C | - | Well construction details |
| D | - | Drill stem testing |
| A | - | Aquifer testing |
| E | - | Chemical analyses including multielement analyses and routine water analyses |
| H | - | Annual hydrograph |
| W | - | Well history |
| Year of Publication | - | the last two numerals of the year of publication. |

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within tha tabbed section for that particular well.

## GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
| | sandstone, arkosic |
| | silt |
| | siltstone |
| | siltstone & sandstone |
| | clay |
| | clay, sandy |
| | claystone, shale |
| | sandstone & shale |
| | oil sand |
| | limestone |
| | limestone, shaley |
| | dolomite |
| | dolomite, argillaceous |
| | rock salt |
| | gypsum & anhydrite |
| | coal |
| | igneous rock |

| Symbol | Stratigraphic Unit |
|---|---|
| | Pleistocene and Recent |
| Qd | Surface deposits |
| | Cretaceous |
| Ks | Smoky Group |
| Klb | La Biche Formation |
| Kd | Dunvegan Formation |
| Ksh | Shaftesbury Formation |
| Kpl | Pelican Formation |
| Kj | Joli Fou Formation |
| Kg | Grand Rapids Formation |
| Kc | Clearwater Formation |
| Kw | Wabiskaw Member |
| Km | McMurray Formation |
| | Devonian |
| Dwd | Woodbend Group |
| Dbl | Beaverhill Lake Formation |
| Dsw | Slave Point Formation & Fort Vermilion Formation & Watt Mountain Formation |
| Dmk | Muskeg Formation |
| Dpe | Prairie Evaporite Formation |
| Dm | Methy Formation (Keg River Formation equivalent) |
| Dmr | McLean River Formation (Chinchaga Formation equivalent) |
| Dl | La Loche Formation |
| | Precambrian |
| Pc | Undivided |

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

| Symbol | Units or Parameter |
|---|---|
| Sec. | section |
| ss | stainless steel |
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) or time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| WILL | Analysis done at Western Industrial Laboratories Ltd. |
| Wt | weight |

## GEOLOGICAL ABBREVIATIONS

| | |
|---|---|
| biocl | bioclast |
| brac | brachiopod |
| bry | bryozoan |
| calc | calcareous |
| carb | carbonaceous |
| cht | chert |
| fld | feldspar |
| glauc | glauconite, glauconitic |
| gvl | gravel |
| hvy | heavy |
| lt | light |
| mnrls | minerals |
| pbl | pebbles |
| qtz | quartz |
| strgr(s) | stringer(s) |
| stroms | stromotoporoids |
| subang | subangular |
| subrd | subrounded |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: a complete routine analysis and a multielement analysis (multielement radio frequency induction coupled plasma emission spectrometer). Some of the samples collected appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years. Results of analyses performed on samples obtained during July 1976 are included in this report.

Most routine water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source" and are limited to samples from wells contributed by oil companies. Spectral emission estimates were done at commercial laboratories.

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface
3. drill through the aquifer using very light mud
4. insert a screening device (if necessary)
5. develop the well with air.

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma, caliper and neutron were the logs run during the 1975-76 drilling. Results of the caliper logs are not presented. The geological log presented represents an interpretation based upon the sample

description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

4) A summary of contents page noting the number of pages in each of the subject areas that have been issued for that site. Pages which have been replaced because of errors are noted in the total.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells where the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, some wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the measuring tape sticking to the wet casing.

Drill stem testing equipment was utilized in two manners during the 1975-76 drilling program. Open hole - bottom hole drill stem tests

were conducted in the Devonian sediments to locate relatively productive zones for well completion. Casing tests were performed on completed wells at Site 10, 11 and 15 because of great depth to water or low permeability in the completion zone.

Information from these drill stem tests is presented under the heading "Drill Stem Testing". Results of open hole - bottom hole tests are presented in the section containing information about the deepest well at the Site as this is the hole in which the tests were conducted. An exception to this is at Site 14 where three tests were conducted on hole 14-699 and six tests performed in 14-1590.

A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day

V = volume of production into drill collars and stem

t = total flow time of test

T = transmissivity in millidarcy-feet

M = slope of final shut-in pressure plot

K = permeability in millidarcys (1 millidarcy = $10^{-6}$ cm/sec)

h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot. Calculations of transmissivity are according to the Modified Nonequilibrium Formula or the analogous Recovery Formula as follows:

$$T = \frac{0.92\ Q\ \log_{10}\ (t_2/t_1)}{d_2 - d_1} : \quad \text{(For pumping)}$$

or

$$T = \frac{0.92\ Q\ \log_{10}\ \left[\left(\frac{t + t'}{t'}\right)_2 - \left(\frac{t + t'}{t'}\right)_1\right]}{d_2 - d_1} : \quad \text{(For recovery)}$$

where:

$d_2$, $d_1$ = depth to water at corresponding subscripted time (meters) $d_2 > t_1$

$t_2$, $t_1$ = time since pumping started, $t_2 > t_1$

$t$ = length of time pumping

$t'$ = time since pumping stopped: $\left(\frac{t + t'}{t'}\right)_2 > \left(\frac{t + t'}{t'}\right)_1$

$T$ = transmissivity in sequence meters per day

$Q$ = pumping rate in imperial gallons per minute

That portion of the drawdown plot used to calculate the transmissivity is indicated on each drawing.

## SUMMARY OF CONTENTS

SITE NUMBER ELEVEN

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

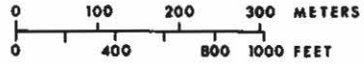
number of pages distributed for this site in 1977

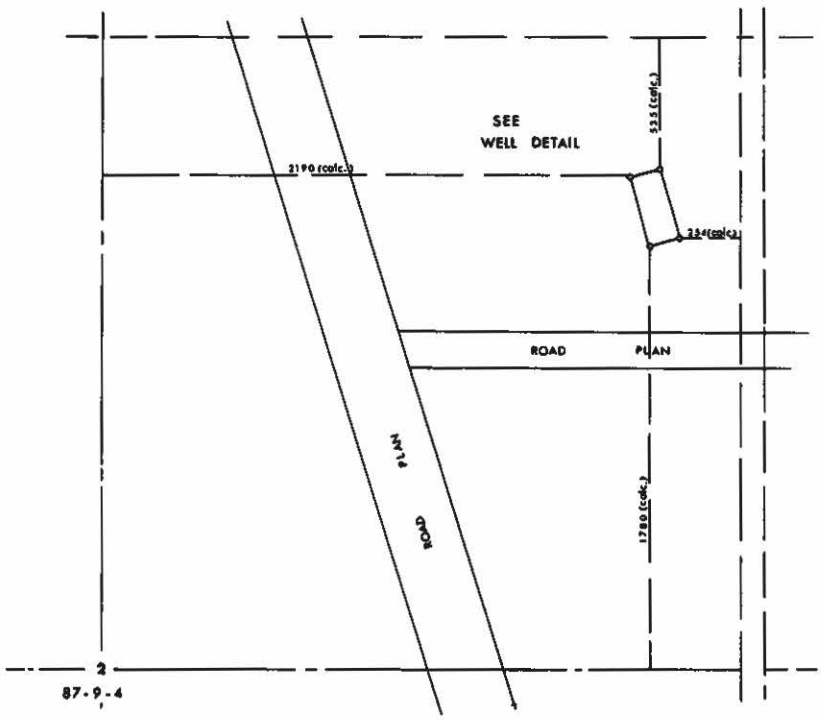
| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | site | 11-33 | 11-130 | 11-460 | 11-595 | 11-920 |
| Introduction | 4 | — | — | — | — | — |
| Legend | 9 | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — |
| Geological Sample Description | 3 | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 1 | 6 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 0 | 2 | 11 |
| Shut-In Pressure Data | — | 0 | 0 | 0 | 2 | 9 |
| Water Analysis | — | 2 | 2 | 0 | 2 | 2 |
| Water Level Hydrograph | — | 1 | 1 | 0 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 |

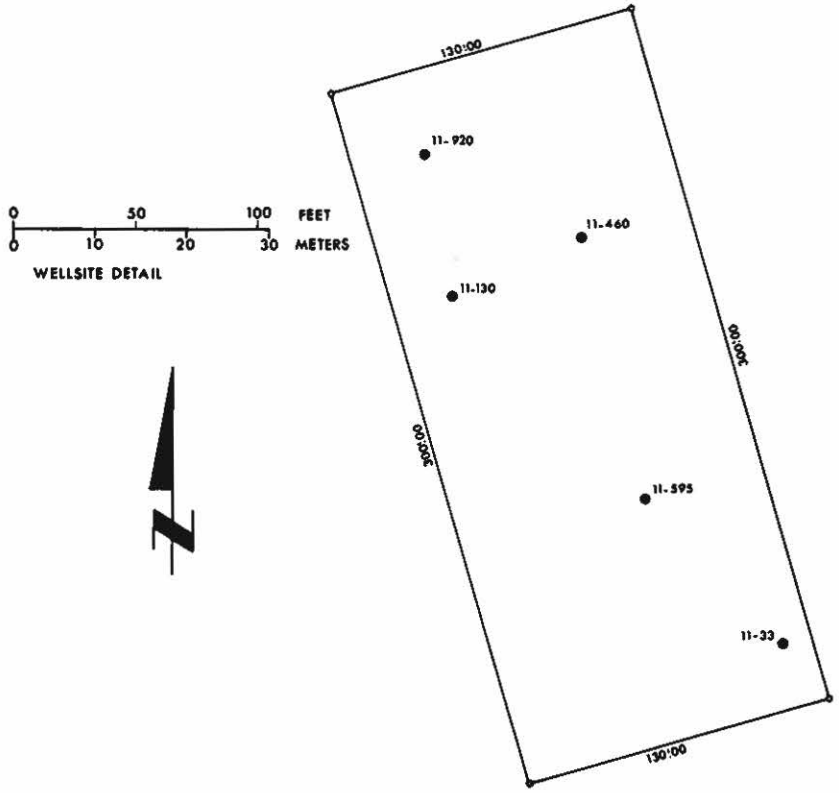
OBSERVATION WELL SITE 11

16-2-87-9 W 4th

ALBERTA RESEARCH COUNCIL



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Eleven

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Ground elevation 1409 Total depth 920 feet

KB elevation 1417

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 8 | 10 | Clay, brown, sandy, calc cement, some pebbles | Drift |
| 10 | 20 | Sand, white-grey, fine-coarse grained, subrounded, poorly sorted, excellent porosity, qtz, fld, lt cht, hvy mnrl, some pebbles | |
| 20 | 40 | Silt, medium grey, sandy, calc cement, some pebbles | |
| 40 | 80 | Clay, medium grey, silty, calc cement, mica, carbonaceous flakes, some pebbles | |
| 80 | 140 | Sandstone, light grey, fine grained, silty, calc cement, fair-good porosity, subangular, well sorted, qtz, lt cht, fld, mica, thin coal beds | Grand Rapids |
| 140 | 180 | Shale, medium grey, calc cement, mica | Clearwater |
| 180 | 190 | Shale, dark grey, silty, calc cement, thin coal beds | |
| 190 | 250 | Shale medium-dark grey, calc, silty strg | |
| 250 | 270 | Siltstone, lt grey, calc ferruginous, pyrite, thin sandy interbeds | |
| 270 | 280 | Sandstone, brown, fine grained, silty, fair porosity, poor sorting, calc, ferruginous, qtz, fld, shale, medium grey, silty interbedded | |
| 280 | 290 | Shale, medium grey, silty, calc, ferruginous, sandy strg | |
| 290 | 320 | Shale, medium grey, silty, dolomite cement, mica, silt, grey sandy strg | |
| 320 | 340 | Clay, medium grey and shale grey, silty, interbedded with thin, silty, grey sand strg | |
| 340 | 350 | Clay as above; reddish, silty sand, argillaceous strg | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Eleven (continued)

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 350 | 370 | Clay, medium grey and shale, medium grey, silty interbedded | |
| 370 | 400 | Shale, medium grey, calc, thin coal strg | |
| 400 | 420 | Shale, medium grey, silty, calc; sand, lt grey silty, qtz, glauc on the bottom | |
| 420 | 440 | Sandstone, lt grey, fine grained, silty fair porosity, subrounded, well sorted, qtz, glauc; thin shale, medium grey | McMurray |
| 440 | 450 | Sandstone, lt grey, fine grained, poor porosity, subrounded, well sorted, qtz, glauc, lightly oil impregnated | |
| 450 | 460 | Sandstone, as above, siltstone lenses | |
| 460 | 490 | Sandstone, lt grey, fine-medium grained, fair-good porosity, subrounded, well sorted, qtz, argillaceous, light oil stain; interbedded with dark shale | |
| 490 | 520 | Sandstone, lt brown, silty, fair-good porosity, subrounded, well sorted, partly oil stained, carbonaceous, argillaceous; dark grey clay interbeds | |
| 520 | 550 | Sandstone, lt grey, fine-medium grained, good porosity, subrounded, well sorted, oil stained, qtz, lt chert, glauc traces; interbedded with sandy siltstone | |
| 550 | 575 | Siltstone, medium grey; dark grey clay interbedded | |
| 575 | 595 | Sandstone, lt brown, fine-coarse grained, subrounded, good-excellent porosity, lightly oil stained, qtz, lt chert, hvy mnrl, carbonaceous, some dark shale strg | |
| 595 | 600 | Wheathered buff and lt grey argillaceous limestone, with dark grey calc shale, pyrite | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Eleven (continued)

Lsd 16 Sec 2 Twp 87 R 9 W4th

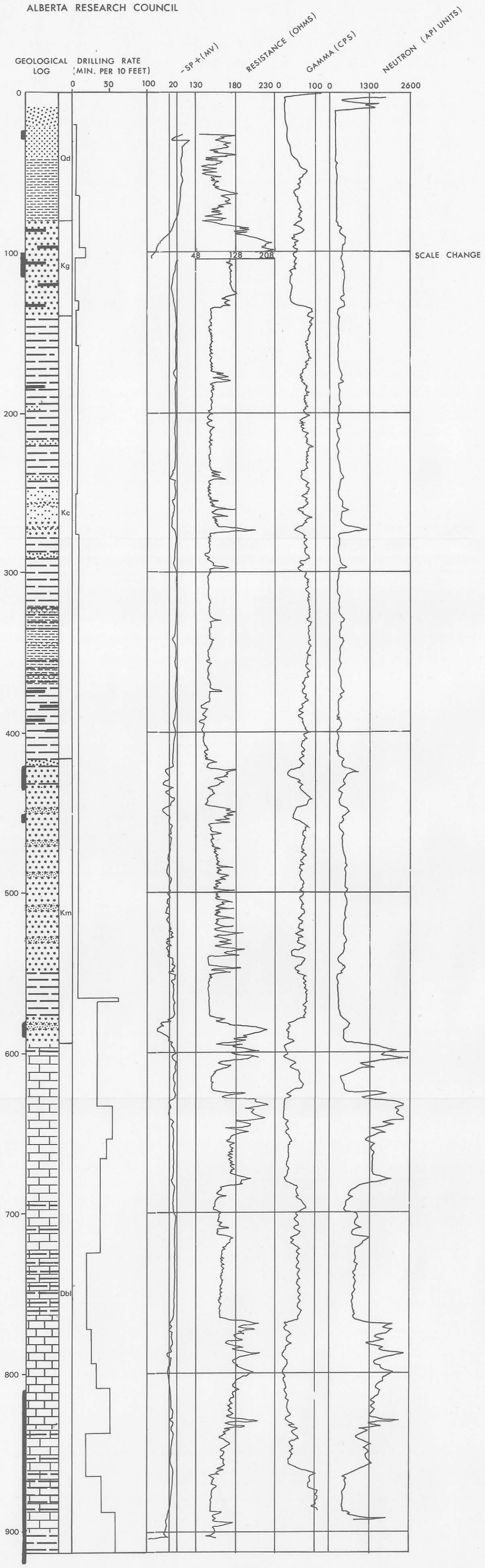
Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 600 | 630 | Limestone, buff-lt grey, argillaceous, fossiliferous (crinoids), pyrite | Beaverhill Lake |
| 630 | 660 | Limestone, lt grey, fossiliferous, dolomitic replacement, salt casts | |
| 660 | 680 | Limestone, buff, argillaceous, fossiliferous, pyrite, some dark grey, calc shale interbedded | |
| 680 | 770 | Shale, dark and medium grey, calc, pyrite; interbedded with limestone (20-30%), lt grey, argillaceous, fossiliferous, leaching, calcite recrystallization | |
| 770 | 810 | Limestone, buff-lt grey, argillaceous, fossiliferous, pyrite; dark calc shale strg | |
| 810 | 840 | Shale, dark grey (60-70%), calc, pyrite; limestone, buff, argillaceous (30-40%) | |
| 840 | 860 | Limestone, buff, argillaceous, pyrite; with interbedded shale, dark grey, dolomitic, ferruginous | |
| 860 | 890 | Marlstone, grey, silty, calc, argillaceous; interbedded with red-brown, calc, argillaceous siltstone and green calc shale | |
| 890 | 900 | Limestone, buff to lt grey, fossiliferous, argillaceous | |
| 900 | 910 | Shale, grey, calc, pyrite | |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 11
## 10-2-87-9 W4th
### ALBERTA RESEARCH COUNCIL

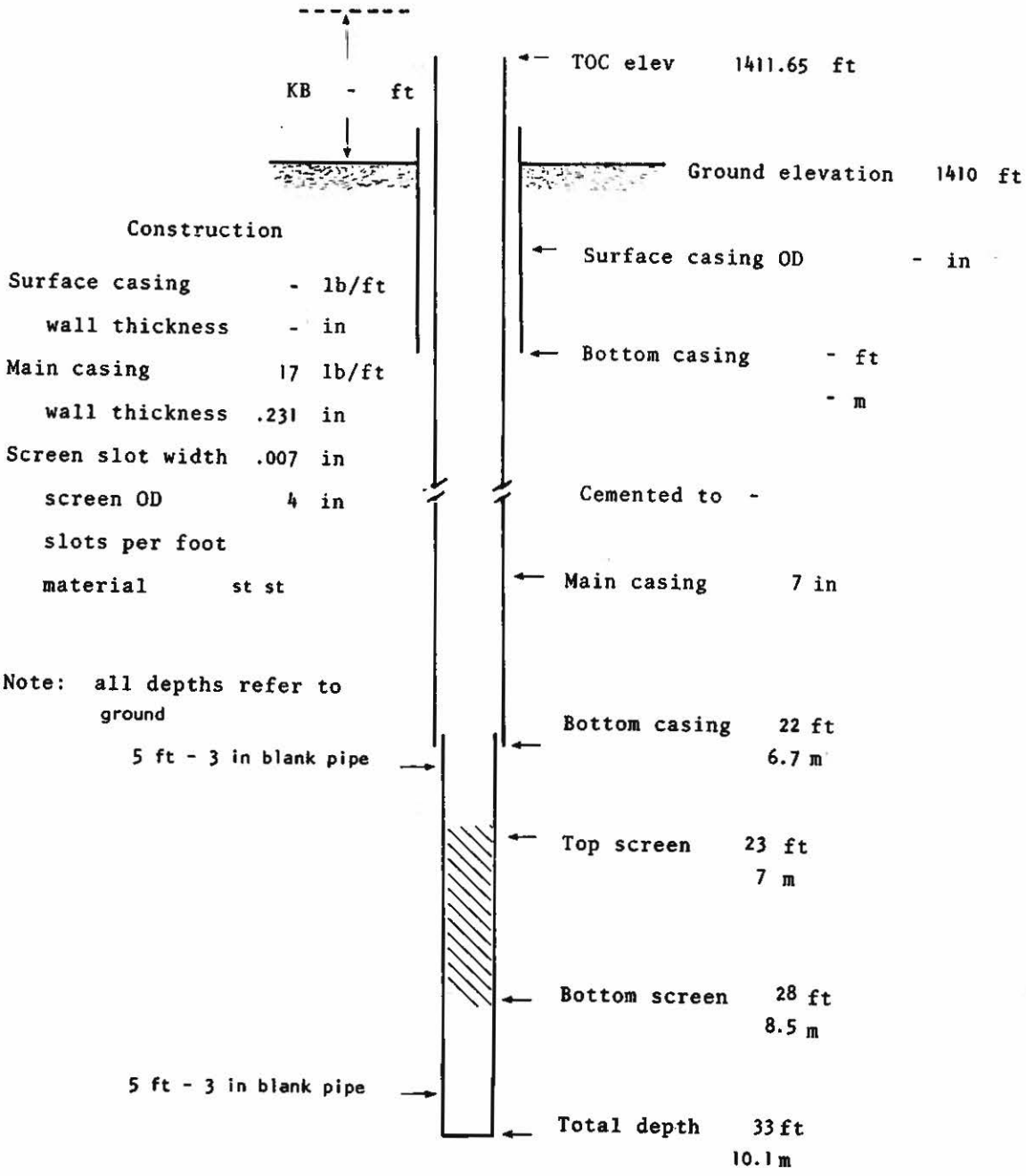


WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Tp 87 R 9 W 4th

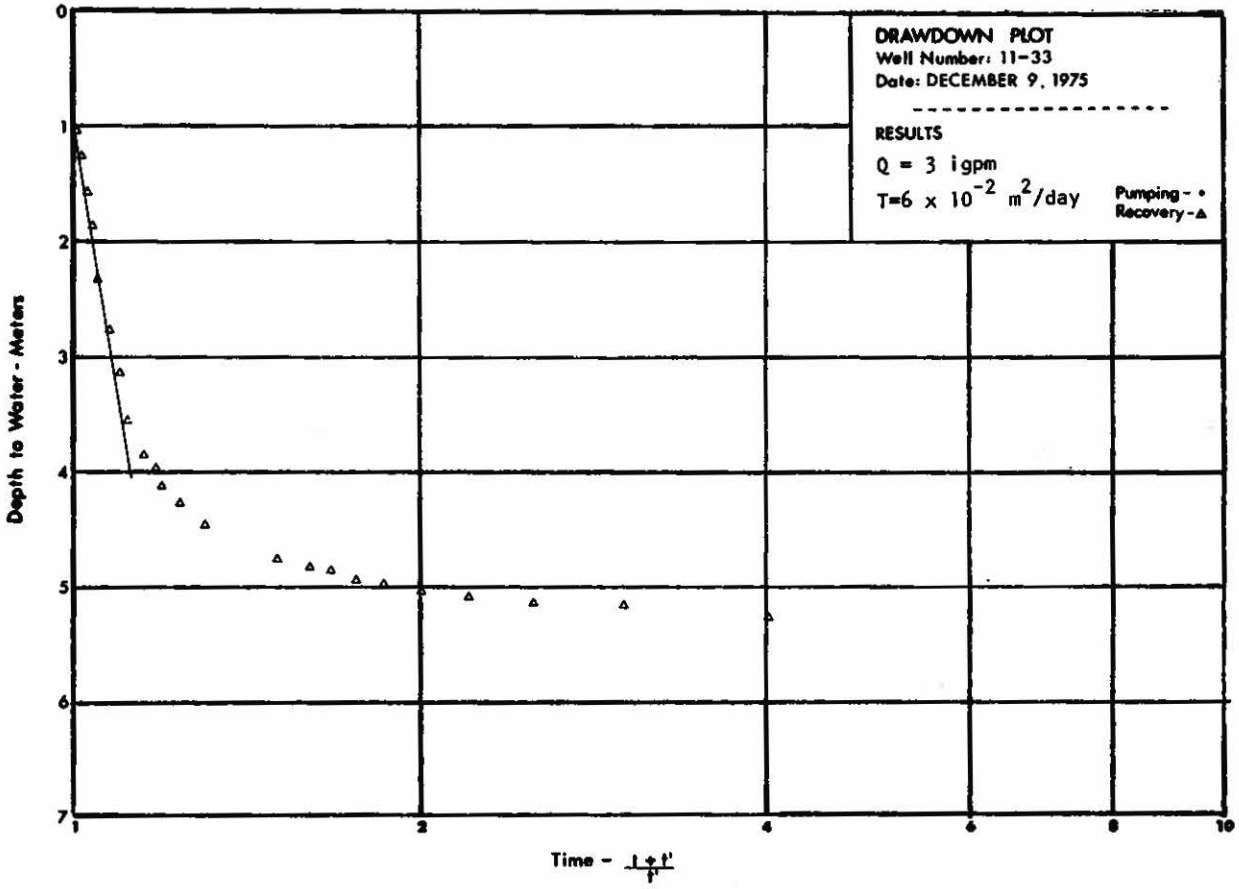
Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | in |
| Main casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to ground


DRAWDOWN PLOT
Well Number: 11-33
Date: DECEMBER 9, 1975
RESULTS
Q = 3 igpm
T=6 x 10^-2 m^2/day
Pumping - •
Recovery - △
Depth to Water - Meters
0
1
2
3
4
5
6
7
1
2
4
6
8
10
Time - t+t'/t'

11-33-A-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source Bailed from 11-33

Date sampled December 9, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 11.9 | 0.59 | 2.3 |
| Magnesium ($Mg^{++}$) | 3.9 | 0.32 | 1.3 |
| Sodium ($Na^{+}$) | 560.0 | 24.36 | 96.1 |
| Potassium ($K^{+}$) | 2.9 | 0.07 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1035.0 | 16.96 | 61.6 |
| Sulfate ($SO_4^{=}$) | 238.0 | 4.96 | 18.0 |
| Chloride ($Cl^{-}$) | 196.0 | 5.53 | 20.0 |
| Nitrate ($NO_3^{=}$) | 5.7 | 0.09 | 0.3 |
| Silica ($SiO_2$) | 10.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1512.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 27.5 | Total Cations (epm) | 25.3 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2800 | Temperature (C) | |
| pH | 8.0 | pH | 8.3 |
| Fluoride ($F^{-}$) | 1.6 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1088 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 7.2 | 0.36 | 2 |
| Magnesium ($Mg^{++}$) | 3.5 | 0.29 | 1 |
| Sodium ($Na^{+}$) | 550.0 | 23.92 | 97 |
| Potassium ($K^{+}$) | 2.5 | 0.06 | 0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1005.0 | 16.47 | 67 |
| Sulfate ($SO_4^{=}$) | 217.0 | 4.52 | 18 |
| Chloride ($Cl^{-}$) | 126.0 | 3.55 | 15 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 3.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 6.6 | | |
| Magnesium (Acidified) | 3.9 | | |
| Total dissolved solids | 1410 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 24.55 | Total Cations (epm) | 24.64 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2200 | Temperature (C) | 4.5 | |
| pH | 8.1 | pH | 8.7 | |
| Fluoride ($F^{-}$) | 1.1 Mg/L | Carbonate ($CO_3^{=}$) | 43 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 981 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 7.9 | 0.39 | 1.6 |
| Magnesium ($Mg^{++}$) | 3.2 | 0.26 | 1.0 |
| Sodium ($Na^{+}$) | 565.0 | 24.58 | 97.1 |
| Potassium ($K^{+}$) | 2.9 | 0.07 | 0.3 |
| Carbonate ($CO_3^{=}$) | 33.6 | 1.12 | 4.4 |
| Bicarbonate ($HCO_3^{-}$) | 988.0 | 16.19 | 63.2 |
| Sulfate ($SO_4^{=}$) | 214.0 | 4.46 | 17.4 |
| Chloride ($Cl^{-}$) | 136.0 | 3.84 | 15.0 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 4.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 7.5 | | |
| Magnesium (Acidified) | 3.5 | | |
| Total dissolved solids | 1410.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 25.61 | Total Cations (epm) | 25.31 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2400 |
| pH | 8.7 |
| Fluoride ($F^{-}$) | 1.9 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 6.0 |
| pH | 8.7 |
| Carbonate ($CO_3^{=}$) | 53.0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 956.0 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Date sampled: July 20, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .027 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 582 |
| As | <.038 | Ni | <.010 |
| B | 3.54 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 8.80 | Si | 1.96 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .219 |
| Cr | <.006 | Te | <.065 |
| Cu | .013 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .044 | V | <.0008 |
| K | <.150 | W | <.078 |
| Mg | 3.75 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

11-33-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 7.6 | 0.38 | 1.5 |
| Magnesium(Mg) | 5.3 | 0.44 | 1.7 |
| Sodium(Na) | 579.0 | 25.18 | 96.6 |
| Potassium(K) | 2.9 | 0.07 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1035.0 | 16.96 | 66.0 |
| Sulphate(SO4) | 199.0 | 4.14 | 16.1 |
| Chloride(Cl) | 160.0 | 4.51 | 17.6 |
| Nitrate(NO3) | 4.3 | 0.07 | 0.3 |
| Silica(SiO2) | 5.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 7.6 | | |
| Magnesium(Acidified) | 6.4 | | |
| TDS(mg/l) | 1416.0 | | |
| Total Anions(epm) | 25.69 | Total Cations(epm) | 26.07 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2110 | | Temperature(C) | 6.00 | |
| pH | 8.2 | | pH | 8.6 | |
| Fluoride(F) | 1.8 | mg/l | Carbonate(CC3) | 38 | mg/l |
| | | | Bicarbonate(HCO3) | 971 | mg/l |
| | | | Hydroxide(OH) | | |

11-33-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 12, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 7.7 | 0.38 | 1.5 |
| Magnesium(Mg) | 3.3 | 0.27 | 1.1 |
| Sodium(Na) | 568.0 | 24.71 | 96.4 |
| Potassium(K) | 10.0 | 0.26 | 1.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1044.0 | 17.11 | 67.6 |
| Sulphate(SO4) | 205.0 | 4.27 | 16.9 |
| Chloride(Cl) | 140.0 | 3.95 | 15.6 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 5.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 5.7 | | |
| Magnesium(Acidified) | 2.9 | | |
| TDS(mg/l) | 1320.0 | | |
| Total Anions(epm) | 25.33 | Total Cations(epm) | 25.62 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2100 | | Temperature(C) | 5.50 | |
| pH | 8.3 | | pH | 8.8 | |
| Fluoride(F) | 2.5 | mg/l | Carbonate(CO3) | 53 | mg/l |
| | | | Bicarbonate(HCO3) | 961 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 11-33-E-82

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 4, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 6.9 | 0.34 | 1.4 |
| Magnesium(Mg) | 3.0 | 0.25 | 1.0 |
| Sodium(Na) | 546.0 | 23.74 | 97.2 |
| Potassium(K) | 3.8 | 0.10 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 1030.0 | 16.89 | 70.3 |
| Sulphate(SO4) | 140.0 | 2.92 | 12.1 |
| Chloride(Cl) | 150.0 | 4.23 | 17.6 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 3.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 5.4 | | |
| Magnesium(Acidified) | 2.8 | | |
| TDS(mg/l) | 1449.0 | | |
| Total Anions(epm) | 24.03 | Total Cations(epm) | 24.43 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2200 | Temperature | 5.00 | |
| pH | 8.3 | pH | 8.9 | |
| Fluoride | 2.1 mg/l | Carbonate(CO3) | 77 | mg/l |
| | | Bicarbonate(HCO3) | 908 | mg/l |
| | | Hydroxide(OH) | | |

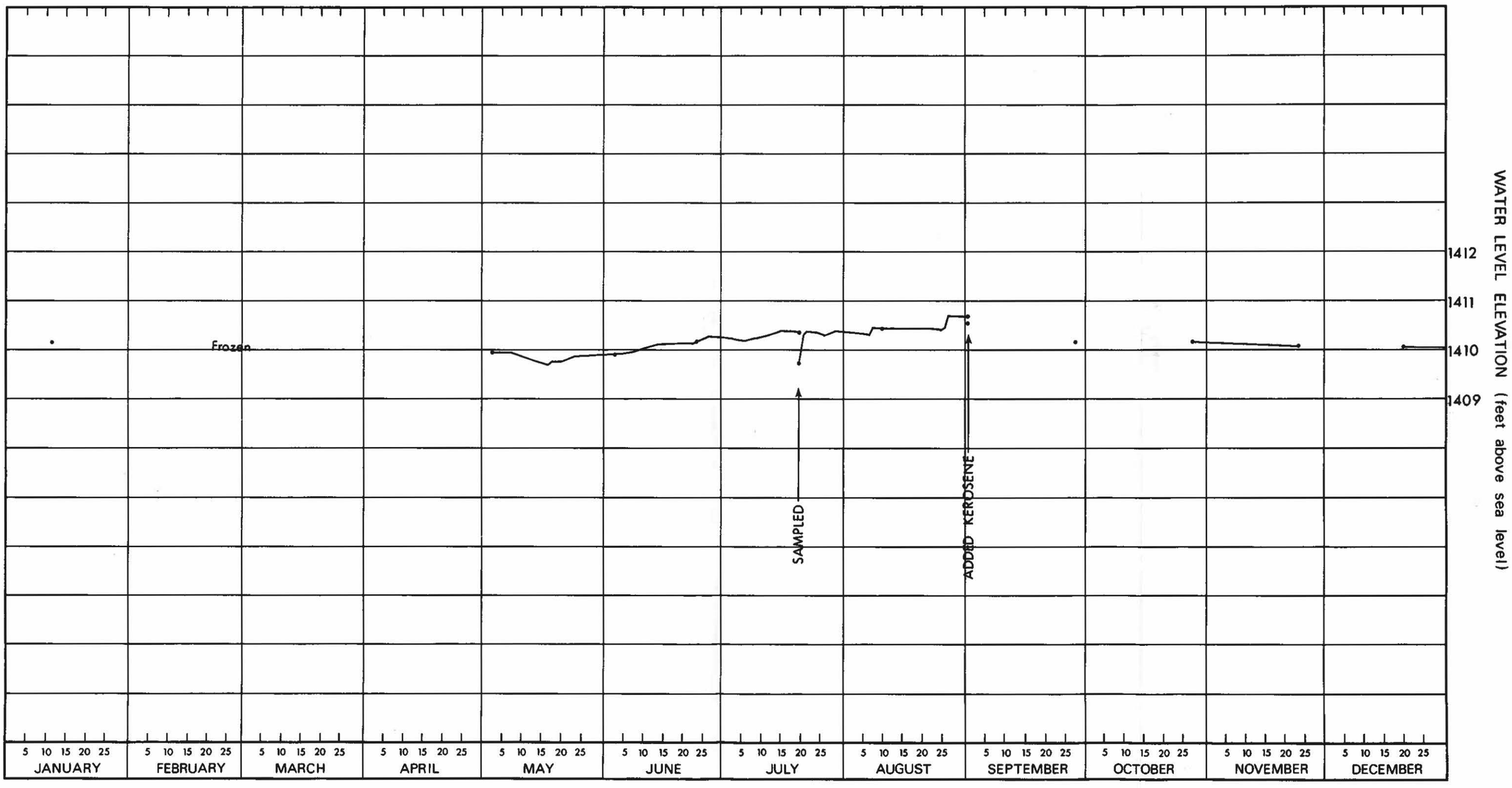
WATER LEVEL HYDROGRAPH

11 - 33 - H - 77

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council




1976

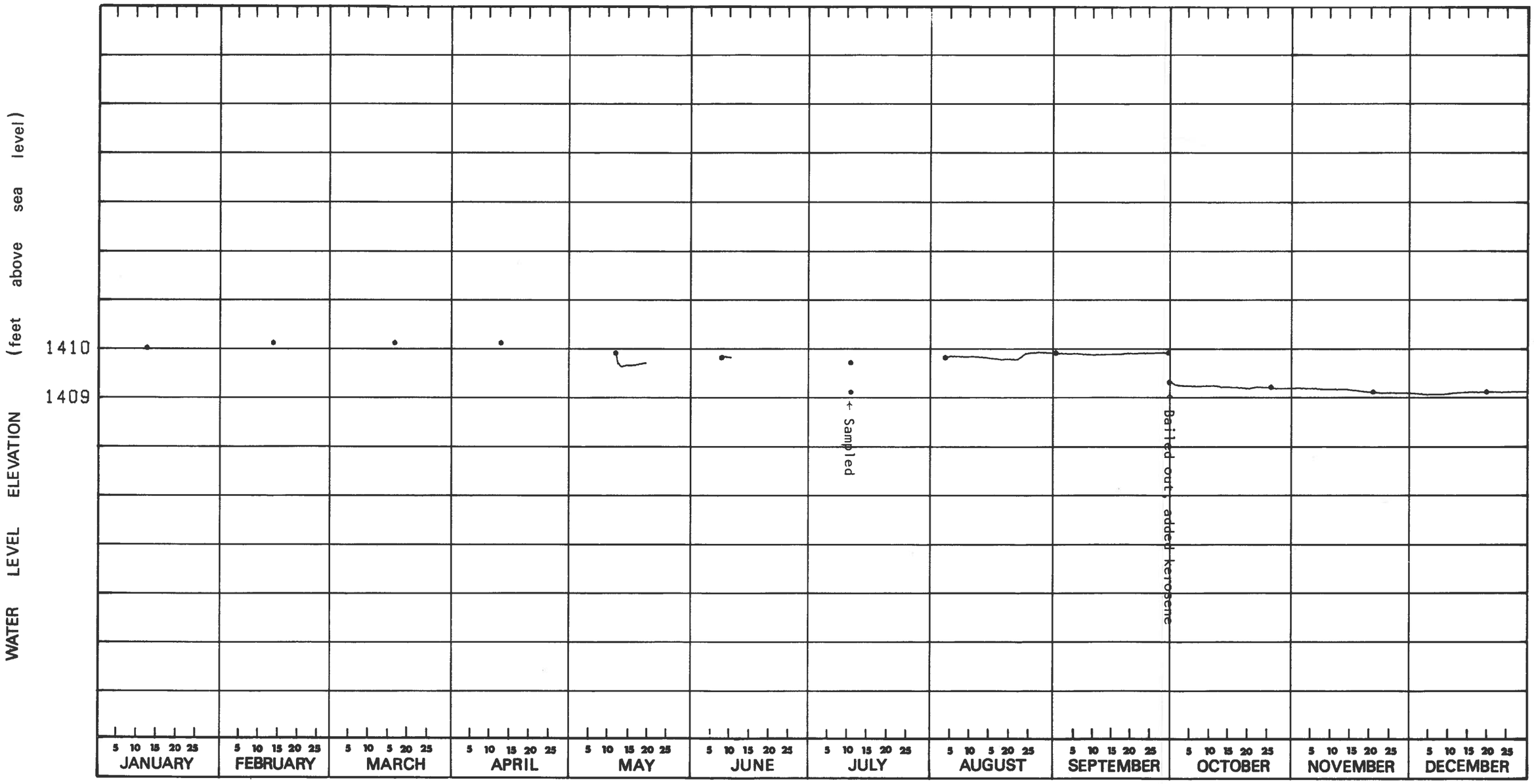
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-33

11-33-H-78

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council




1977

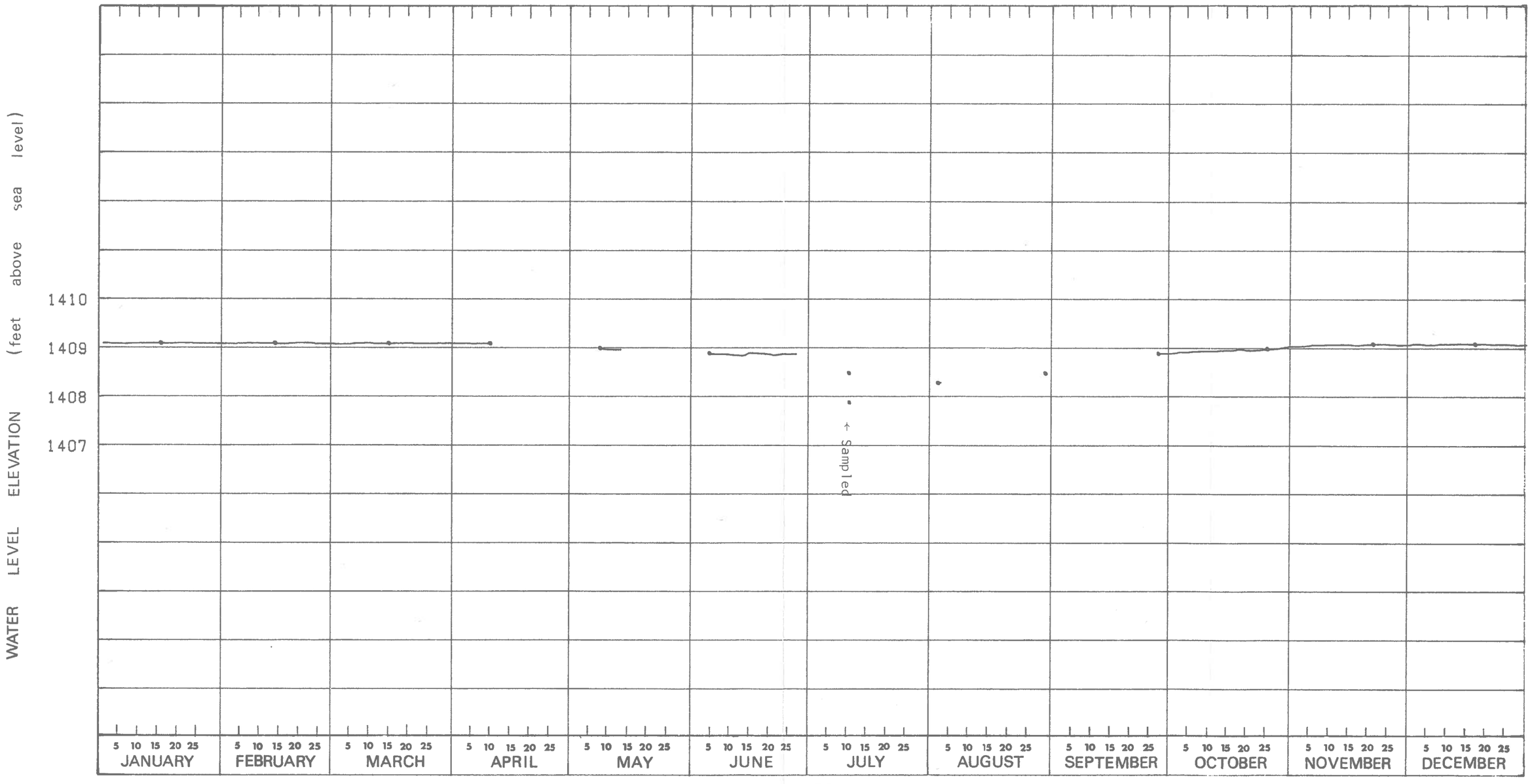
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-33

LSD 16 SEC 2 TWP 87 R 9 W4TH

11-33-H-79

Alberta Research Council



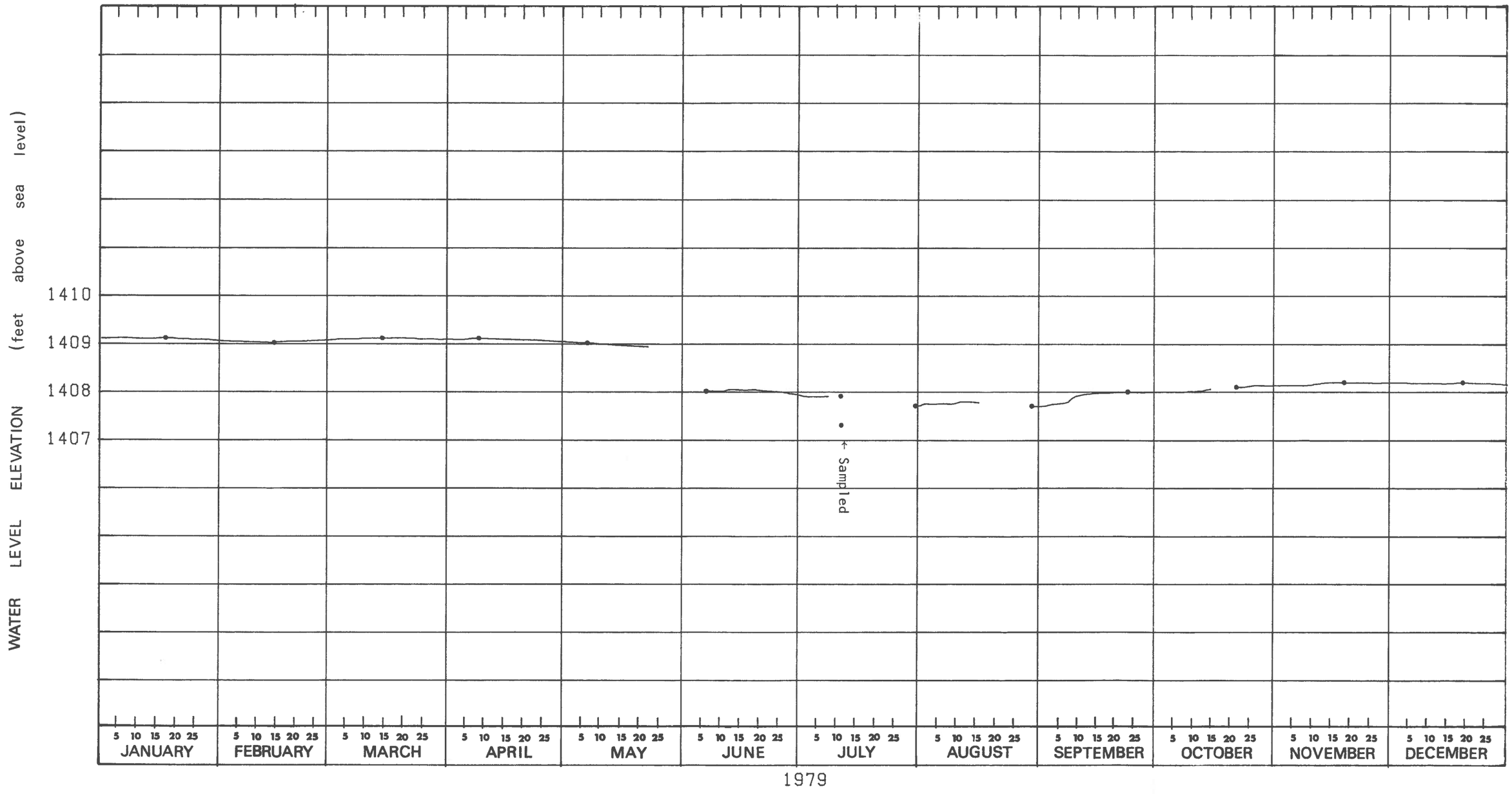
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-33

11-33-H-80

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council



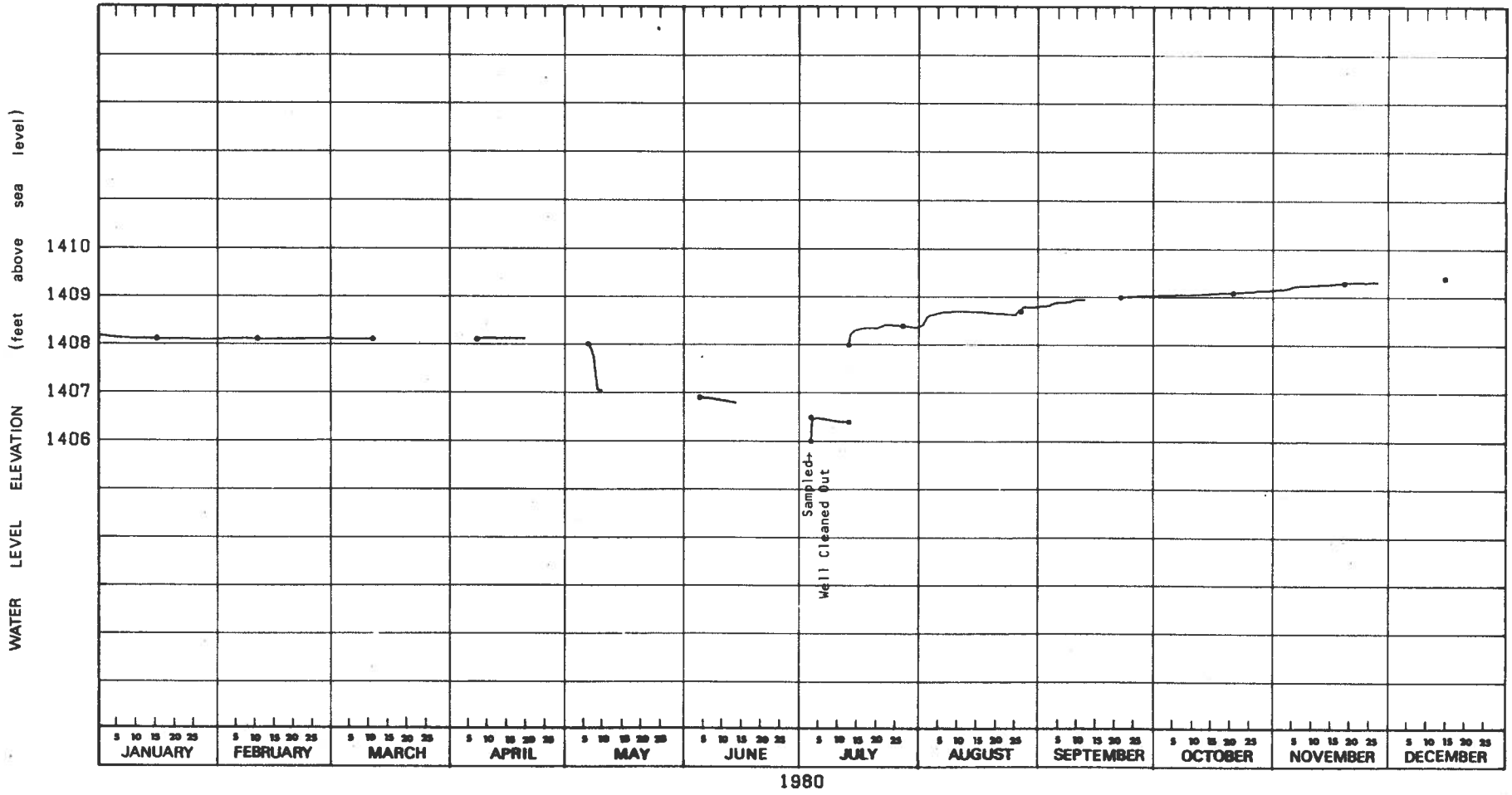
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-33-H-81



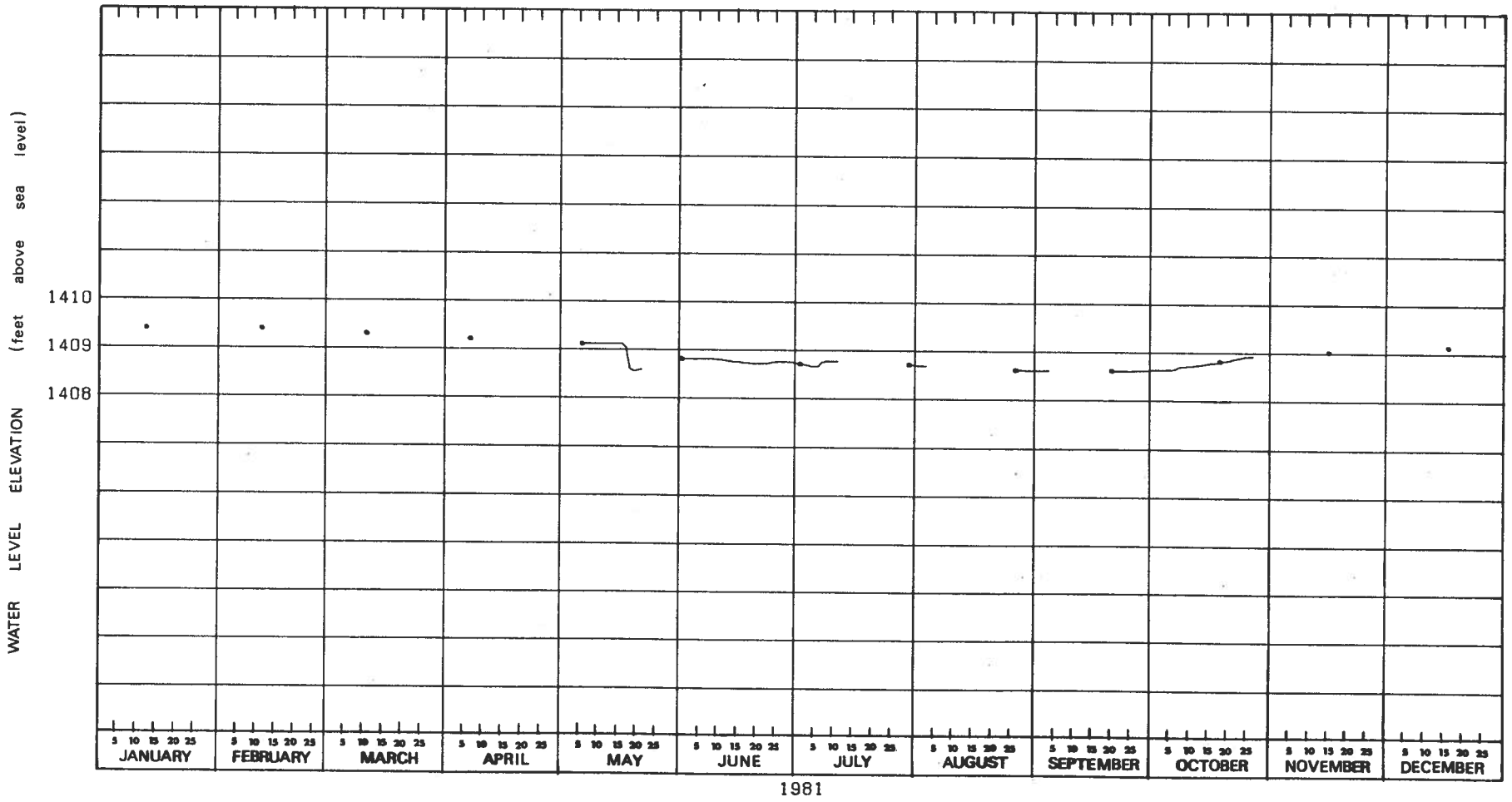
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-33

11-33-H-82

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1411.65 (Until October 28/76)
1412.14 (After October 28/76)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Nov 26/75 | | | Well completed |
| Dec 9/75 | 1.07 TOC | 1408.1 | Bail test; T = 5 IGPD/FT; Water sample |
| Dec 18/75 | | | Install shelter; MP = 0.74 m TOC, (1414.1) |
| Jan 12/76 | 1.20 MP | 1410.2 | |
| Jan 21/76 | | | Frozen |
| Mar 4/76 | 1.19 MP | 1410.2 | Frozen |
| Apr 5/76 | | | Frozen |
| May 3/76 | 1.26 MP | 1410.0 | |
| June 3/76 | 1.27 MP | 1409.9 | |
| June 24/76 | 1.18 MP | 1410.2 | |
| July 20/76 | 1.13 MP | 1410.4 | |
| | 1.31 MP | 1409.8 | After sample; temp. 4.5°C |
| Aug 11/76 | 1.11 MP | 1410.5 | |
| Sept 1/76 | 1.03 MP | 1410.7 | Bailed 5 gallons of water |
| | 1.07 MP | 1409.1 | Added 10 gallons of kerosene; water level elevation adjusted downward by 1.5 ft after this date |
| Sept 29/76 | TOC | 1410.2 | |
| Oct 28/76 | TOC | 1410.2 | Added 0.15 m of casing New MP = 0.59 m TOC, (1414.1) |
| Nov 24/76 | .75 MP | 1410.1 | |
| Dec 21/76 | .77 MP | 1410.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1411.65 before Oct. 28/76
1412.14 after Oct. 28/76

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan. 13/77 | 0.78 MP | 1410.0 | MP (1414.1) |
| Feb. 14/77 | 0.76 MP | 1410.1 | |
| Mar 17/77 | 0.76 MP | 1410.1 | Water frozen at 1.59 m |
| Apr 13/77 | 0.77 MP | 1410.1 | |
| May 12/77 | 0.82 MP | 1409.9 | |
| June 8/77 | 0.85 MP | 1409.8 | |
| July 11/77 | 0.88 MP | 1409.7 | |
| | 1.07 MP | 1409.1 | After sample; temp. 6°C |
| Aug. 4/77 | 0.86 MP | 1409.8 | |
| Sept. 1/77 | 0.83 MP | 1409.9 | |
| Sept.30/77 | 0.82 MP | 1409.9 | Bail out water; added 18 gal. |
| | 0.69 MP | 1409.3 | of kerosene; water level elevation adjusted downward by 2.5 ft. after the date |
| Oct. 26/77 | 0.72 MP | 1409.2 | |
| Nov. 21/77 | 0.75 MP | 1409.1 | |
| Dec. 20/77 | 0.75 MP | 1409.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1412.14

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/78 | 0.75 MP | 1409.1 | MP (1414.1) water level elevation adjusted downward by 2.5 ft to compensate for kerosene |
| Feb 14/78 | 0.76 MP | 1409.1 | |
| Mar 15/78 | 0.76 MP | 1409.1 | |
| Apr 10/78 | 0.76 MP | 1409.1 | |
| May 8/78 | 0.78 MP | 1409.0 | |
| June 5/78 | 0.83 MP | 1408.9 | |
| July 11/78 | 0.94 MP | 1408.5 | |
| | 1.12 MP | 1407.9 | After sample; temp. 6°C |
| Aug 3/78 | 1.00 MP | 1408.3 | |
| Aug 30/78 | 0.94 MP | 1408.5 | |
| Sept 28/78 | 0.82 MP | 1408.9 | |
| Oct 26/78 | 0.78 MP | 1409.0 | |
| Nov 22/78 | 0.76 MP | 1409.1 | |
| Dec 18/78 | 0.77 MP | 1409.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1412.14

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 0.77 MP | 1409.1 | MP (1414.1) Water level elevation adjusted downward by 2.5 ft to compensate for kerosene |
| Feb 15/79 | 0.78 MP | 1409.0 | |
| Mar 15/79 | 0.77 MP | 1409.1 | |
| Apr 9/79 | 0.77 MP | 1409.1 | |
| May 7/79 | 0.79 MP | 1409.0 | |
| June 7/79 | 1.09 MP | 1408.0 | |
| July 12/79 | 1.14 MP | 1407.9 | |
| | 1.31 MP | 1407.3 | After sample; temp. 5.5°C |
| July 31/79 | 1.20 MP | 1407.7 | |
| Aug 30/79 | 1.18 MP | 1407.7 | |
| Sept 24/79 | 1.11 MP | 1408.0 | |
| Oct 22/79 | 1.08 MP | 1408.1 | |
| Nov 19/79 | 1.05 MP | 1408.2 | |
| Dec 20/79 | 1.05 MP | 1408.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-33

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1412.14

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 1.06 MP | 1408.1 | |
| Feb 11/80 | 1.06 MP | 1408.1 | |
| Mar 12/80 | 1.06 MP | 1408.1 | |
| Apr 8/80 | 1.06 MP | 1408.1 | |
| May 7/80 | 1.10 MP | 1408.0 | |
| June 5/80 | 1.42 MP | 1406.9 | |
| July 4/80 | 1.55 MP | 1406.5 | Temp. 5°C |
| | 1.71 MP | 1406.0 | After Sample |
| July 13/80 | 1.58 MP | 1406.4 | Airlifted, Sampled t=10°C Cond. = 2000 |
| July 14/80 | 1.81 MP | 1408.0 | 24 cm. of Kerosene left in well |
| July 28/80 | 1.67 MP | 1408.4 | |
| Aug 28/80 | 1.57 MP | 1408.7 | |
| Sept 23/80 | 1.49 MP | 1409.0 | |
| Oct 22/80 | 1.45 MP | 1409.1 | |
| Nov 20/80 | 1.39 MP | 1409.3 | |
| Dec 16/80 | 1.38 MP | 1409.4 | |
| Jan 13/81 | 1.38 MP | 1409.4 | |
| Feb 12/81 | 1.38 MP | 1409.4 | |
| Mar 11/81 | 1.39 MP | 1409.3 | |
| Apr 7/81 | 1.43 MP | 1409.2 | |
| May 6/81 | 1.45 MP | 1409.1 | |
| June 1/81 | 1.55 MP | 1408.8 | |
| July 2/81 | 1.60 MP | 1408.7 | |
| July 30/81 | 1.55 MP | 1408.7 | |
| Aug 27/81 | 1.61 MP | 1408.6 | |
| Sept 21/81 | 1.62 MP | 1408.6 | |
| Oct 19/81 | 1.57 MP | 1408.8 | |
| Nov 16/81 | 1.48 MP | 1409.0 | |
| Dec 17/81 | 1.46 MP | 1409.1 | |

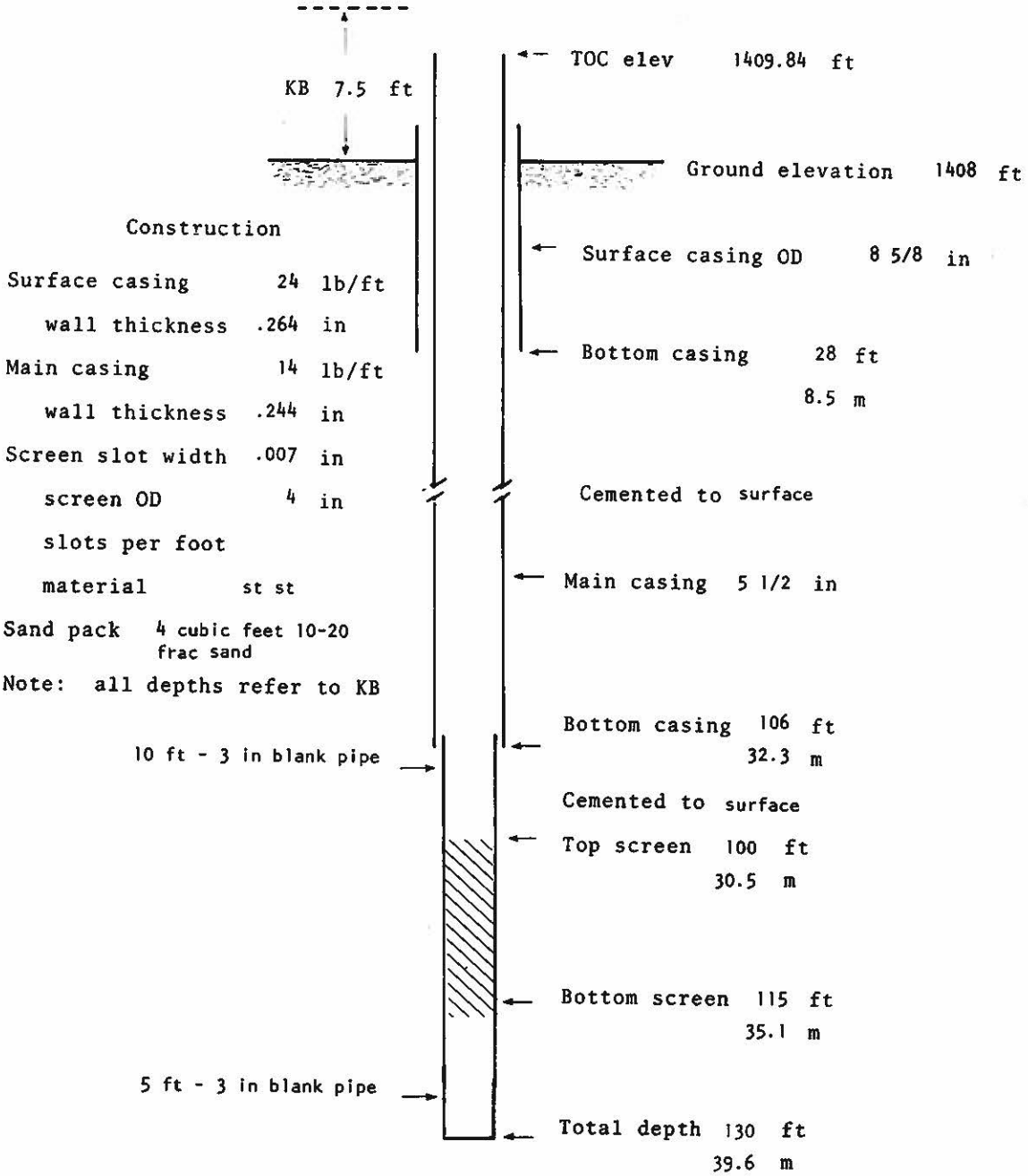
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Tp 87 R 9 W 4th

Alberta Research Council

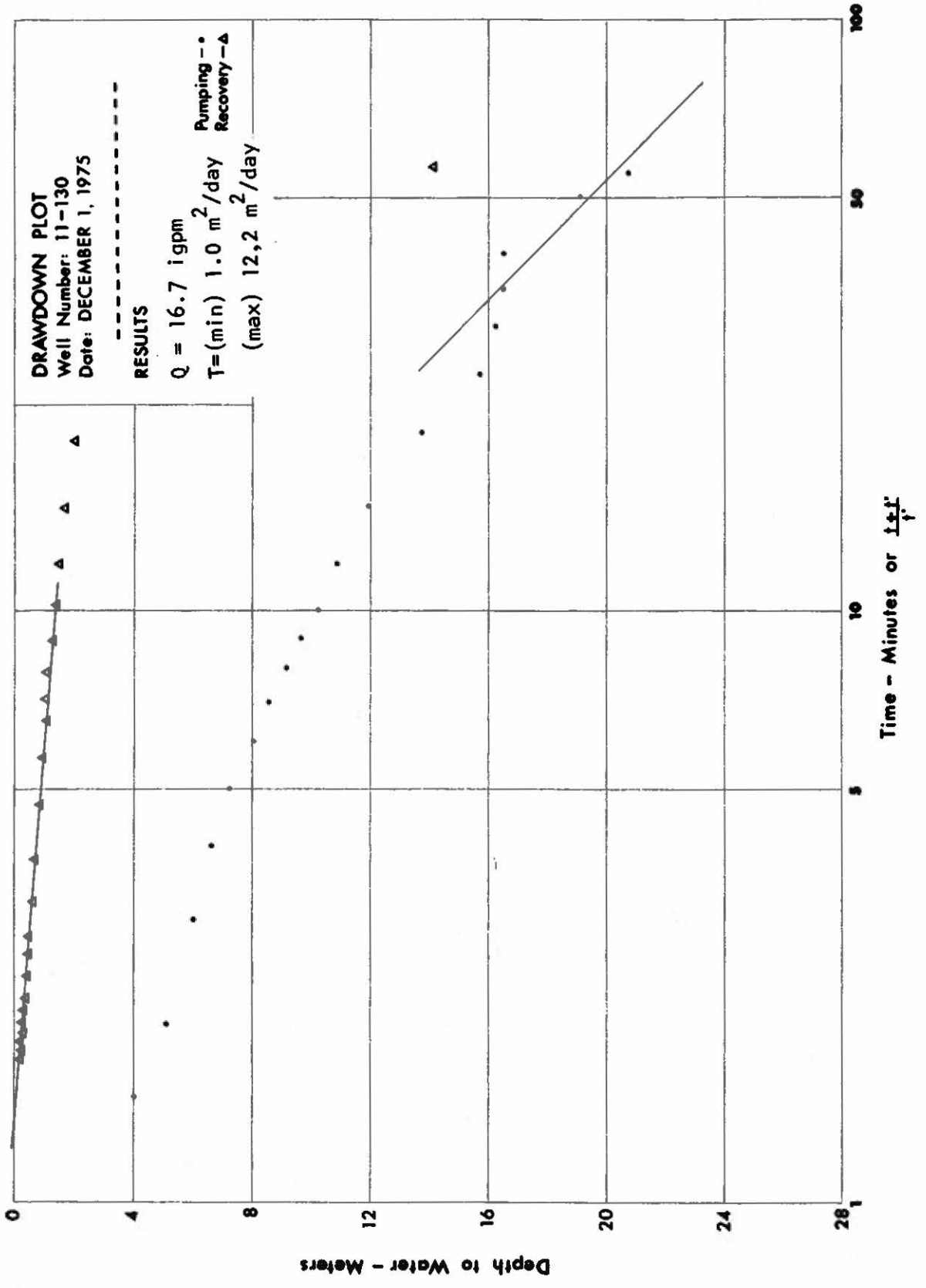


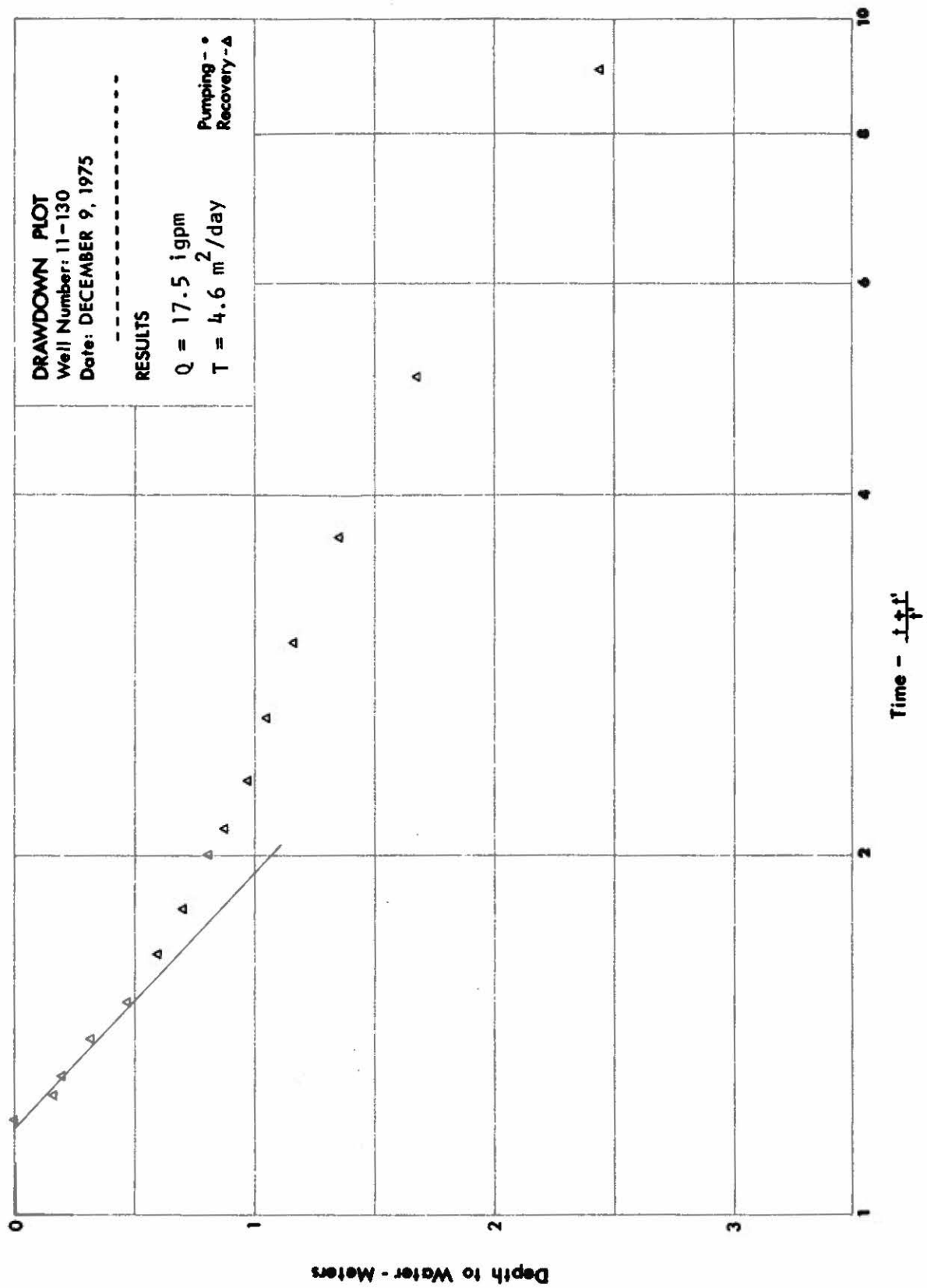

Construction

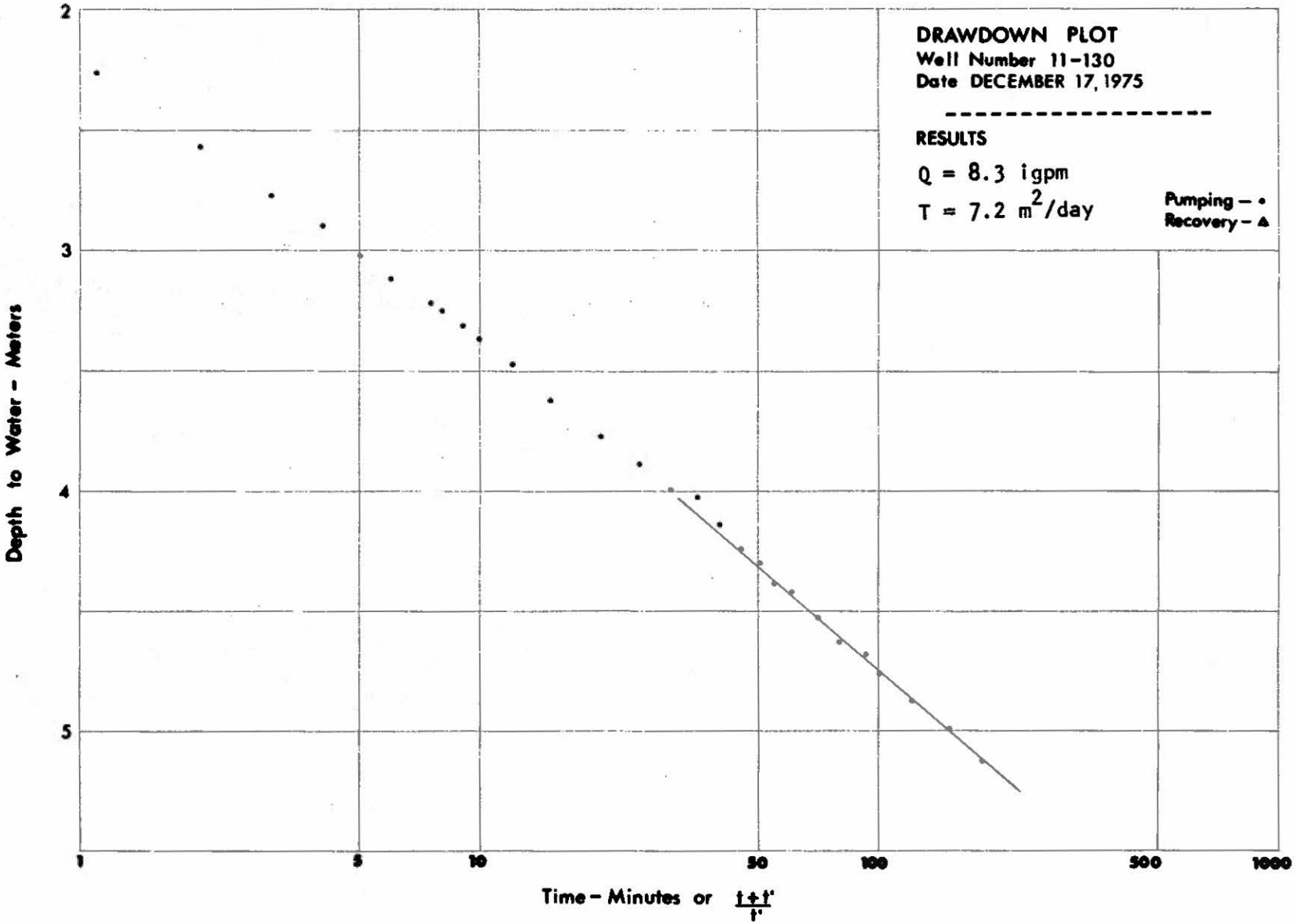
| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Sand pack 4 cubic feet 10-20 frac sand

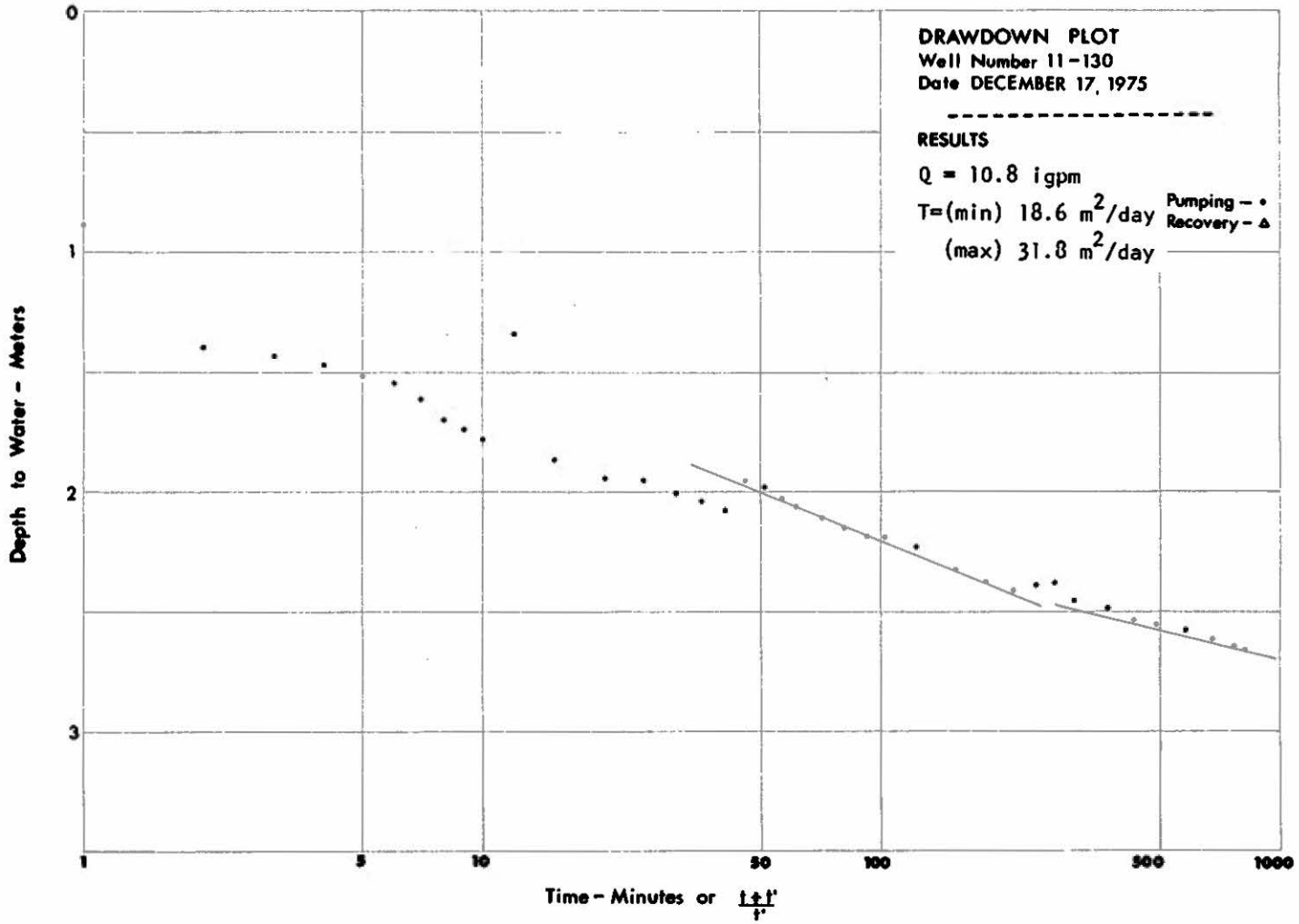
Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 11-130
Date: DECEMBER 1, 1975
RESULTS
Q = 16.7 igpm
T=(min) 1.0 m²/day
(max) 12,2 m²/day
Pumping —•
Recovery —▲
Depth to Water - Meters
0
4
8
12
16
20
24
28
1
5
10
50
100
Time - Minutes or t+t'/t'

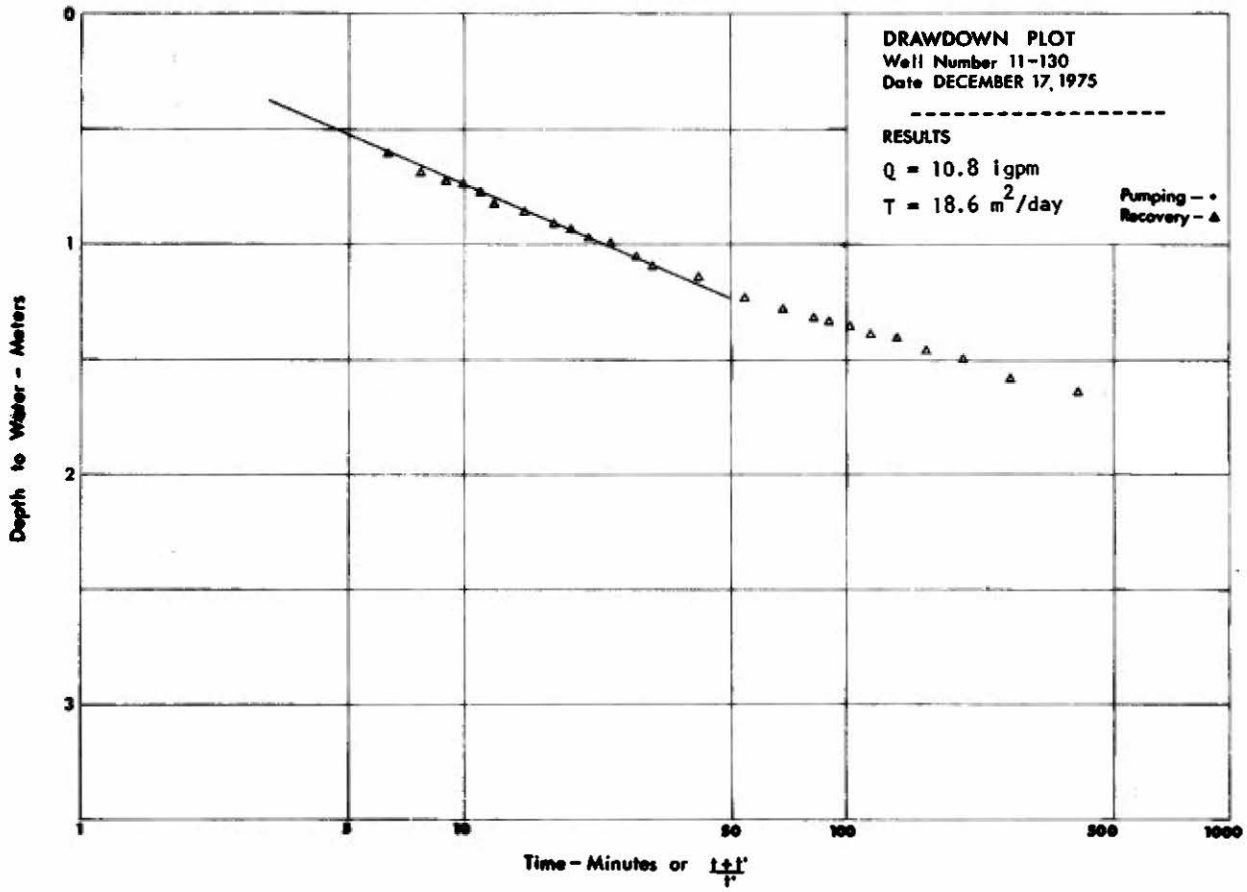

DRAWDOWN PLOT
Well Number: 11-130
Date: DECEMBER 9, 1975
RESULTS
Q = 17.5 igpm
T = 4.6 m²/day
Pumping - •
Recovery - Δ
Depth to Water - Meters
Time - t+t'/t'
0
1
2
3
1
2
4
6
8
10


DRAWDOWN PLOT
Well Number 11-130
Date DECEMBER 17, 1975
RESULTS
Q = 8.3 igpm
T = 7.2 m²/day
Pumping – •
Recovery – ▲
Depth to Water – Meters
2
3
4
5
1
5
10
50
100
500
1000
Time – Minutes or (t+t')/t'

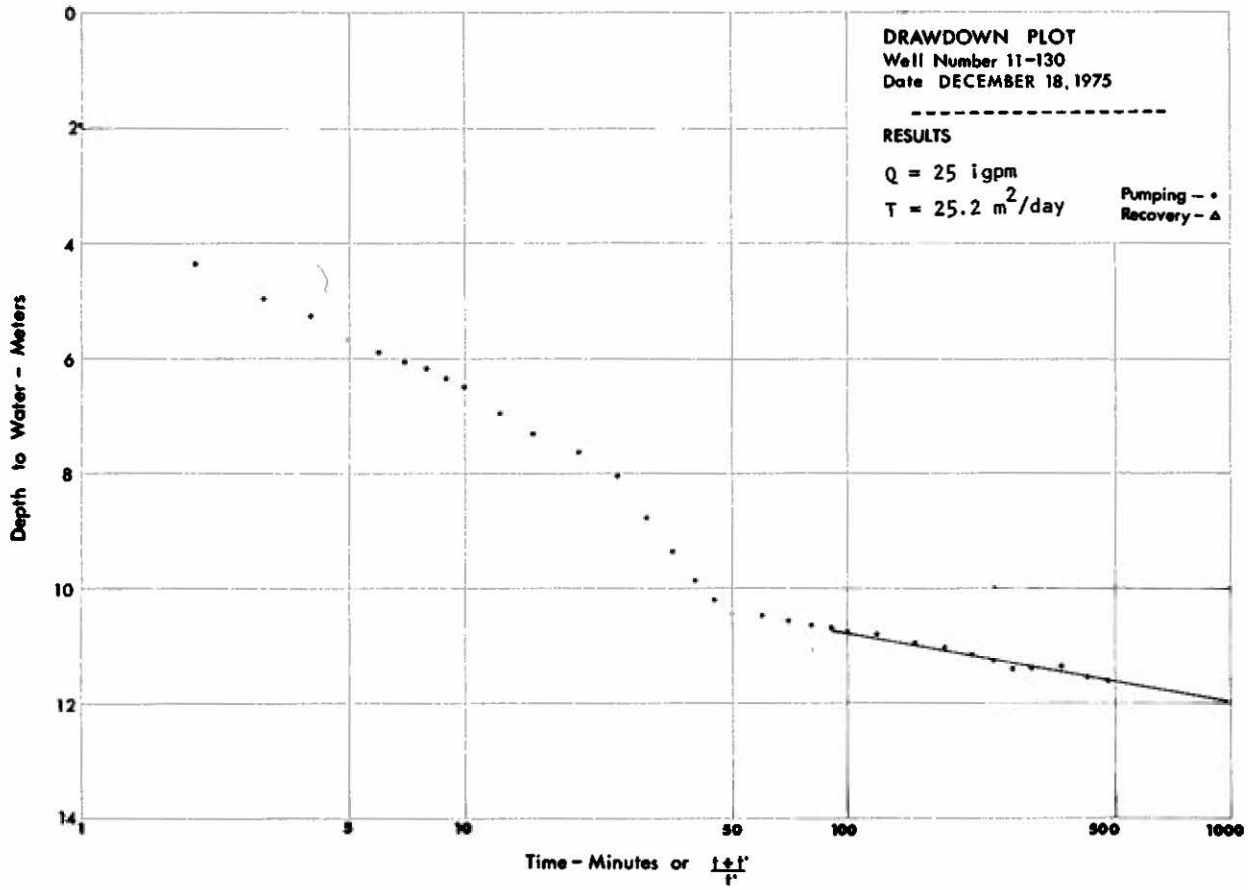
11-130-A-77


DRAWDOWN PLOT
Well Number 11-130
Date DECEMBER 17, 1975
RESULTS
Q = 10.8 igpm
T=(min) 18.6 m²/day
(max) 31.8 m²/day
Pumping - •
Recovery - Δ
Depth to Water - Meters
0
1
2
3
1
5
10
50
100
500
1000
Time - Minutes or t+t'/t'

11-130-A-77


DRAWDOWN PLOT
Well Number 11-130
Date DECEMBER 17, 1975
RESULTS
Q = 10.8 igpm
T = 18.6 m²/day
Pumping – •
Recovery – △
Depth to Water - Meters
0
1
2
3
1
5
10
50
100
500
1000
Time - Minutes or t+t'/t'

11-130-A-77


DRAWDOWN PLOT
Well Number 11-130
Date DECEMBER 18, 1975
RESULTS
Q = 25 igpm
T = 25.2 m²/day
Pumping – •
Recovery – △
Depth to Water – Meters
Time – Minutes or (t+t')/t'
0
2
4
6
8
10
12
14
1
5
10
50
100
500
1000

11-130-A-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source Pump Test

Date sampled December 18, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 69.0 | 3.44 | 1.1 |
| Magnesium ($Mg^{++}$) | 191.0 | 15.72 | 4.8 |
| Sodium ($Na^{+}$) | 7000.0 | 304.48 | 93.8 |
| Potassium ($K^{+}$) | 41.2 | 1.05 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1069.0 | 17.52 | 4.9 |
| Sulfate ($SO_4^{=}$) | 14.5 | 0.30 | 0.1 |
| Chloride ($Cl^{-}$) | 11996.0 | 338.30 | 95.0 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 15.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 19008.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 356.1 | Total Cations (epm) | 324.6 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | |
| pH | 8.1 | pH | 7.2 |
| Fluoride ($F^{-}$) | 0.7 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 586 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 53.0 | 2.64 | 24 |
| Magnesium ($Mg^{++}$) | 22.0 | 1.81 | 17 |
| Sodium ($Na^{+}$) | 146.0 | 6.35 | 58 |
| Potassium ($K^{+}$) | 4.6 | 0.12 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 539.0 | 8.83 | 82 |
| Sulfate ($SO_4^{=}$) | 19.7 | 0.41 | 4 |
| Chloride ($Cl^{-}$) | 56.0 | 1.58 | 15 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 10.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 55.0 | | |
| Magnesium (Acidified) | 26.4 | | |
| Total dissolved solids | 556 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 10.83 | Total Cations (epm) | 10.92 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 960 | Temperature (C) | 8.0 |
| pH | 7.4 | pH | 7.1 |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 561 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 12, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 53.0 | 2.64 | 26.3 |
| Magnesium ($Mg^{++}$) | 9.8 | 0.81 | 8.0 |
| Sodium ($Na^{+}$) | 150.0 | 6.52 | 64.8 |
| Potassium ($K^{+}$) | 3.8 | 0.10 | 1.0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 568.0 | 9.31 | 83.8 |
| Sulfate ($SO_4^{=}$) | 10.8 | 0.22 | 2.0 |
| Chloride ($Cl^{-}$) | 56.0 | 1.58 | 14.2 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 5.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 49.0 | | |
| Magnesium (Acidified) | 20.9 | | |
| Total dissolved solids | 514.0 | | |
| Total Anions (epm) | 11.11 | Total Cations (epm) | 10.07 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1020 | Temperature (C) | 5.0 |
| pH | 7.6 | pH | 7.4 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 566.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Date sampled: July 20, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .190 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 143 |
| As | <.038 | Ni | <.010 |
| B | .797 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 59.3 | Si | 5.30 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .728 |
| Cr | <.006 | Te | <.065 |
| Cu | .014 | Ti | .003 |
| Eu | <.015 | U | <.020 |
| Fe | .033 | V | .009 |
| K | 66 | W | <.078 |
| Mg | 21.3 | Zn | .25 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 54.0 | 2.69 | 24.9 |
| Magnesium(Mg) | 23.0 | 1.89 | 17.5 |
| Sodium(Na) | 141.0 | 6.13 | 56.8 |
| Potassium(K) | 3.3 | 0.08 | 0.8 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 559.0 | 9.16 | 84.6 |
| Sulphate(SO4) | 6.3 | 0.13 | 1.2 |
| Chloride(Cl) | 52.0 | 1.47 | 13.5 |
| Nitrate(NO3) | 4.5 | 0.07 | 0.7 |
| Silica(SiO2) | 7.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 53.0 | | |
| Magnesium(Acidified) | 18.0 | | |
| TDS(mg/l) | 640.0 | | |
| Total Anions(epm) | 10.83 | Total Cations(epm) | 10.81 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 870 | | Temperature(C) | 10.00 | |
| pH | 7.0 | | pH | 7.5 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 571 | mg/l |
| | | | Hydroxide(OH) | | |

11-130-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 12, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 47.0 | 2.35 | 23.6 |
| Magnesium(Mg) | 17.0 | 1.40 | 14.1 |
| Sodium(Na) | 140.0 | 6.09 | 61.2 |
| Potassium(K) | 4.6 | 0.12 | 1.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 525.0 | 8.61 | 83.9 |
| Sulphate(SO4) | 6.2 | 0.13 | 1.3 |
| Chloride(Cl) | 54.0 | 1.52 | 14.8 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 4.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 38.0 | | |
| Magnesium(Acidified) | 15.0 | | |
| TDS(mg/l) | 496.0 | | |
| Total Anions(epm) | 10.26 | Total Cations(epm) | 9.95 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 825 | Temperature(C) | 8.00 | |
| pH | 7.7 | pH | 8.3 | |
| Fluoride(F) | 0.5 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 517 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 11-130-E-82

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 3, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 28.6 | 1.43 | 16.6 |
| Magnesium(Mg) | 17.3 | 1.44 | 16.7 |
| Sodium(Na) | 130.0 | 5.65 | 65.7 |
| Potassium(K) | 3.3 | 0.08 | 1.0 |
| Carbonate(CO3) | 9.6 | 0.32 | 3.9 |
| Bicarbonate(HCO3) | 403.0 | 6.61 | 79.7 |
| Sulphate(SO4) | 6.0 | 0.13 | 1.5 |
| Chloride(Cl) | 44.0 | 1.24 | 14.9 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 2.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 20.5 | | |
| Magnesium(Acidified) | 15.5 | | |
| TDS(mg/l) | 417.0 | | |
| Total Anions(epm) | 8.29 | Total Cations(epm) | 8.61 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 730 | Temperature | 5.00 | |
| pH | 8.5 | pH | 8.4 | |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | 19 | mg/l |
| | | Bicarbonate(HCO3) | 371 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 11-130 0X-E-82

OBSERVATION WELL NUMBER 11-130 0X

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 51.0 | 2.55 | 24.0 |
| Magnesium(Mg) | 19.2 | 1.60 | 15.0 |
| Sodium(Na) | 147.0 | 6.39 | 60.1 |
| Potassium(K) | 3.9 | 0.10 | 0.9 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 555.0 | 9.10 | 85.1 |
| Sulphate(SO4) | 3.3 | 0.07 | 0.6 |
| Chloride(Cl) | 54.0 | 1.52 | 14.2 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 7.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 59.0 | | |
| Magnesium(Acidified) | 19.4 | | |
| TDS(mg/l) | 550.0 | | |
| Total Anions(epm) | 10.69 | Total Cations(epm) | 10.64 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 920 |
| pH | 7.8 |
| Fluoride | 0.3 mg/l |

Field:

| | |
|---|---|
| Temperature | 0.0 |
| pH | 0.0 |
| Carbonate(CO3) | |
| Bicarbonate(HCO3) | |
| Hydroxide(OH) | |

WATER ANALYSIS 11-130 1X-E-82

OBSERVATION WELL NUMBER 11-130 1X

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 42.2 | 2.11 | 16.1 |
| Magnesium(Mg) | 15.4 | 1.28 | 9.8 |
| Sodium(Na) | 221.0 | 9.61 | 73.4 |
| Potassium(K) | 3.4 | 0.09 | 0.7 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 575.0 | 9.43 | 77.1 |
| Sulphate(SO4) | 31.7 | 0.66 | 5.4 |
| Chloride(Cl) | 76.0 | 2.14 | 17.5 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 11.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 42.3 | | |
| Magnesium(Acidified) | 15.2 | | |
| TDS(mg/l) | 668.0 | | |
| Total Anions(epm) | 12.23 | Total Cations(epm) | 13.09 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1110 | Temperature | 0.0 |
| pH | 8.0 | pH | 0.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 11-130 2X-E-82

OBSERVATION WELL NUMBER 11-130 2X

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 43.6 | 2.18 | 16.5 |
| Magnesium(Mg) | 15.6 | 1.30 | 9.9 |
| Sodium(Na) | 221.0 | 9.61 | 72.9 |
| Potassium(K) | 3.3 | 0.08 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 565.0 | 9.26 | 76.4 |
| Sulphate(SO4) | 31.5 | 0.66 | 5.4 |
| Chloride(Cl) | 78.0 | 2.20 | 18.1 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 11.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 42.3 | | |
| Magnesium(Acidified) | 15.3 | | |
| TDS(mg/l) | 657.0 | | |
| Total Anions(epm) | 12.12 | Total Cations(epm) | 13.17 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1120 | Temperature | 0.0 |
| pH | 7.7 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 11-130 3X-E-82

OBSERVATION WELL NUMBER 11-130 3X

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 43.3 | 2.16 | 16.5 |
| Magnesium(Mg) | 15.4 | 1.28 | 9.8 |
| Sodium(Na) | 221.0 | 9.61 | 73.1 |
| Potassium(K) | 3.3 | 0.08 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 569.0 | 9.33 | 76.6 |
| Sulphate(SO4) | 31.6 | 0.66 | 5.4 |
| Chloride(Cl) | 78.0 | 2.20 | 18.0 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 11.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 41.2 | | |
| Magnesium(Acidified) | 15.1 | | |
| TDS(mg/l) | 684.0 | | |
| Total Anions(epm) | 12.18 | Total Cations(epm) | 13.14 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1110 | Temperature | 0.0 |
| pH | 7.7 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 11-130 4X-E-82

OBSERVATION WELL NUMBER 11-130 4X

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 43.7 | 2.18 | 16.5 |
| Magnesium(Mg) | 15.5 | 1.29 | 9.7 |
| Sodium(Na) | 223.0 | 9.70 | 73.1 |
| Potassium(K) | 3.3 | 0.08 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 587.0 | 9.62 | 80.3 |
| Sulphate(SO4) | 31.8 | 0.66 | 5.5 |
| Chloride(Cl) | 60.0 | 1.69 | 14.1 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 11.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 42.0 | | |
| Magnesium(Acidified) | 15.5 | | |
| TDS(mg/l) | 665.0 | | |
| Total Anions(epm) | 11.98 | Total Cations(epm) | 13.26 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1130 | Temperature | 0.0 |
| pH | 7.5 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 11-130 5X-E-82

OBSERVATION WELL NUMBER 11-130 5X

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 43.1 | 2.15 | 16.4 |
| Magnesium(Mg) | 15.4 | 1.28 | 9.7 |
| Sodium(Na) | 222.0 | 9.65 | 73.3 |
| Potassium(K) | 3.3 | 0.08 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 592.0 | 9.70 | 80.5 |
| Sulphate(SO4) | 31.6 | 0.66 | 5.5 |
| Chloride(Cl) | 60.0 | 1.69 | 14.0 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 11.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 41.4 | | |
| Magnesium(Acidified) | 15.1 | | |
| TDS(mg/l) | 702.0 | | |
| Total Anions(epm) | 12.06 | Total Cations(epm) | 13.18 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1120 | Temperature | 0.0 |
| pH | 7.4 | pH | 0.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 11-130 6X-E-82

OBSERVATION WELL NUMBER 11-130 6X

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 43.7 | 2.18 | 16.5 |
| Magnesium(Mg) | 15.5 | 1.29 | 9.7 |
| Sodium(Na) | 223.0 | 9.70 | 73.1 |
| Potassium(K) | 3.3 | 0.08 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 595.0 | 9.75 | 81.3 |
| Sulphate(SO4) | 32.0 | 0.67 | 5.6 |
| Chloride(Cl) | 56.0 | 1.58 | 13.1 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 11.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 41.4 | | |
| Magnesium(Acidified) | 15.1 | | |
| TDS(mg/l) | 686.0 | | |
| Total Anions(epm) | 12.00 | Total Cations(epm) | 13.26 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1120 | Temperature | 0.0 |
| pH | 7.5 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 11-130 7X-E-82

OBSERVATION WELL NUMBER 11-130 7X

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 43.2 | 2.16 | 16.3 |
| Magnesium(Mg) | 15.5 | 1.29 | 9.8 |
| Sodium(Na) | 223.0 | 9.70 | 73.3 |
| Potassium(K) | 3.3 | 0.08 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 591.0 | 9.69 | 82.7 |
| Sulphate(SO4) | 32.1 | 0.67 | 5.7 |
| Chloride(Cl) | 48.0 | 1.35 | 11.5 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 11.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 41.3 | | |
| Magnesium(Acidified) | 15.0 | | |
| TDS(mg/l) | 687.0 | | |
| Total Anions(epm) | 11.71 | Total Cations(epm) | 13.23 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1120 | Temperature | 0.0 |
| pH | 7.4 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 11-130 8X-E-82

OBSERVATION WELL NUMBER 11-130 8X

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 43.9 | 2.19 | 16.5 |
| Magnesium(Mg) | 15.5 | 1.29 | 9.7 |
| Sodium(Na) | 223.0 | 9.70 | 73.1 |
| Potassium(K) | 3.3 | 0.08 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 599.0 | 9.82 | 82.9 |
| Sulphate(SO4) | 32.3 | 0.67 | 5.7 |
| Chloride(Cl) | 48.0 | 1.35 | 11.4 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 11.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 42.3 | | |
| Magnesium(Acidified) | 15.0 | | |
| TDS(mg/l) | 680.0 | | |
| Total Anions(epm) | 11.85 | Total Cations(epm) | 13.27 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1120 |
| pH | 7.8 |
| Fluoride | 0.4 mg/l |

Field:

| | |
|---|---|
| Temperature | 0.0 |
| pH | 0.0 |
| Carbonate(CO3) | |
| Bicarbonate(HCO3) | |
| Hydroxide(OH) | |

WATER ANALYSIS 11-130 9X-E-82

OBSERVATION WELL NUMBER 11-130 9X

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 43.2 | 2.16 | 16.3 |
| Magnesium(Mg) | 15.5 | 1.29 | 9.7 |
| Sodium(Na) | 224.0 | 9.74 | 73.4 |
| Potassium(K) | 3.3 | 0.08 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 595.0 | 9.75 | 79.7 |
| Sulphate(SO4) | 32.2 | 0.67 | 5.5 |
| Chloride(Cl) | 64.0 | 1.80 | 14.7 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 11.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 40.8 | | |
| Magnesium(Acidified) | 14.8 | | |
| TDS(mg/l) | 691.0 | | |
| Total Anions(epm) | 12.23 | Total Cations(epm) | 13.28 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1130 | Temperature | 0.0 |
| pH | 7.9 | pH | 0.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 11-130 10X-E-82

OBSERVATION WELL NUMBER 11-130 10X

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 44.3 | 2.22 | 16.4 |
| Magnesium(Mg) | 15.7 | 1.31 | 9.7 |
| Sodium(Na) | 227.0 | 9.87 | 73.2 |
| Potassium(K) | 3.3 | 0.08 | 0.6 |
| Carbonate(CO3) | 8.4 | 0.28 | 2.3 |
| Bicarbonate(HCO3) | 576.0 | 9.44 | 79.2 |
| Sulphate(SO4) | 32.2 | 0.67 | 5.6 |
| Chloride(Cl) | 54.0 | 1.52 | 12.8 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 11.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 42.0 | | |
| Magnesium(Acidified) | 15.0 | | |
| TDS(mg/l) | 686.0 | | |
| Total Anions(epm) | 11.92 | Total Cations(epm) | 13.48 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1060 |
| pH | 8.4 |
| Fluoride | 0.4 mg/l |

Field:

| | |
|---|---|
| Temperature | 0.0 |
| pH | 0.0 |
| Carbonate(CO3) | |
| Bicarbonate(HCO3) | |
| Hydroxide(OH) | |

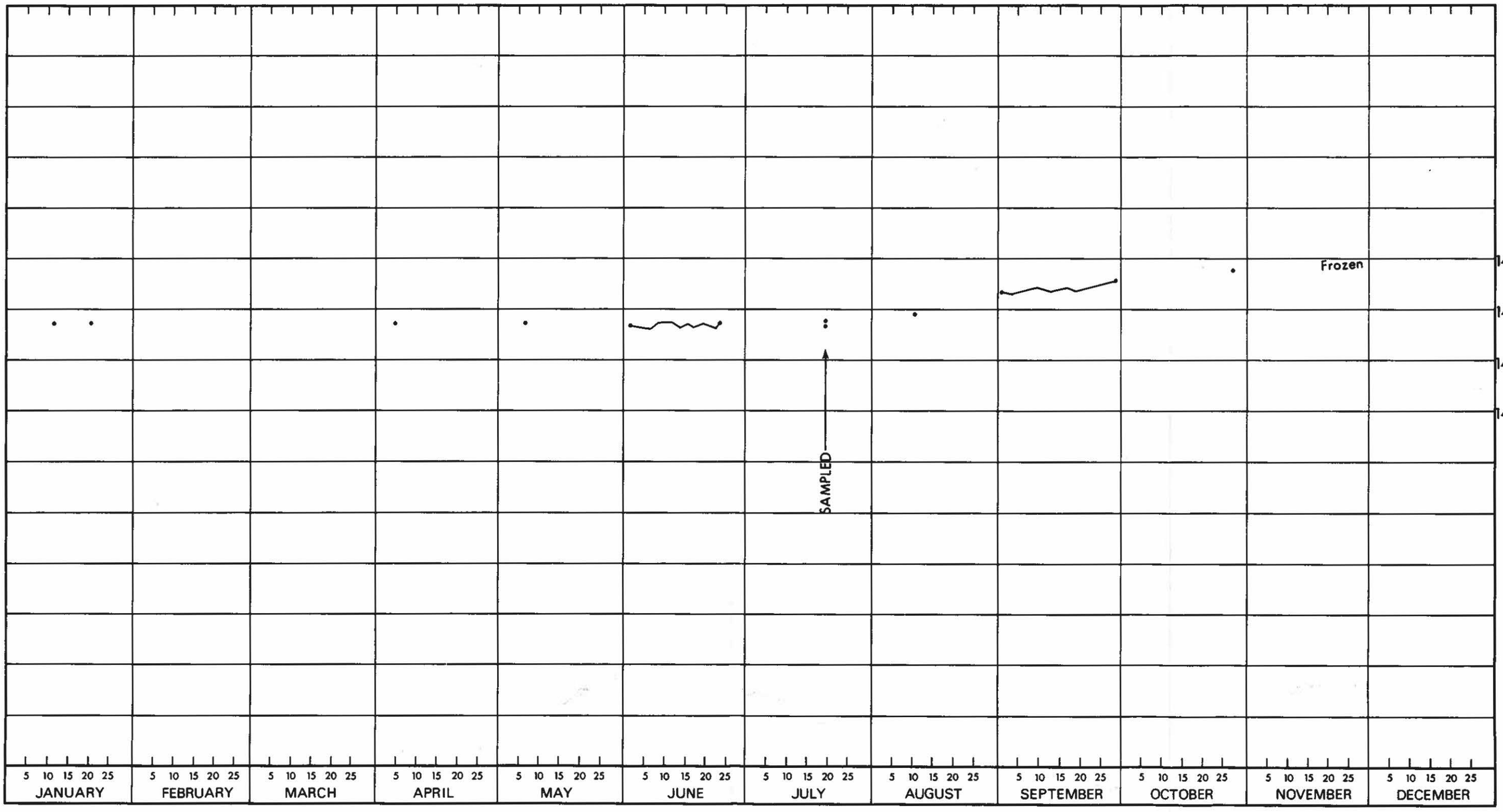
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-130

11 - 130 - H - 77

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council




1976

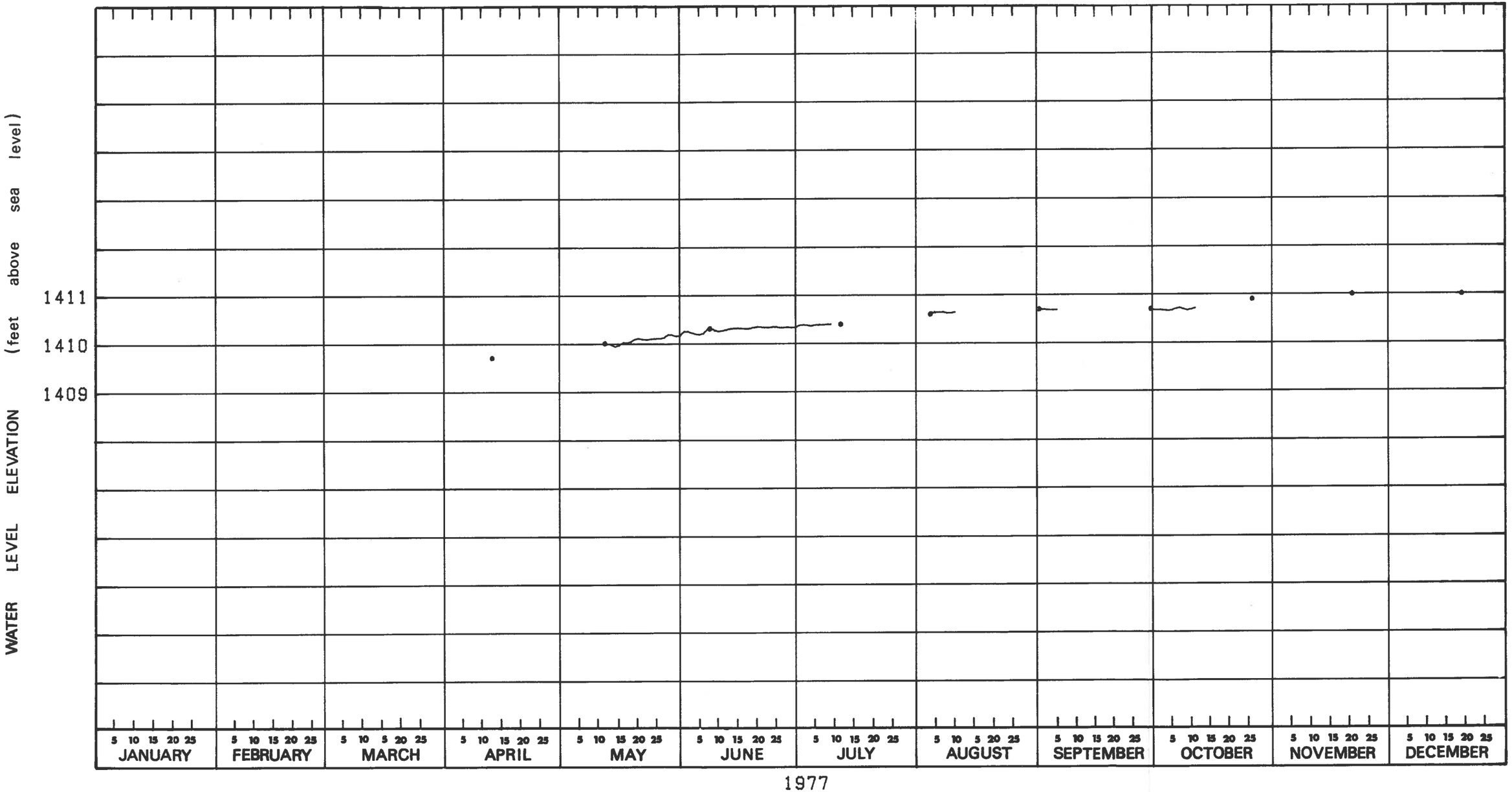
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-130-H-78



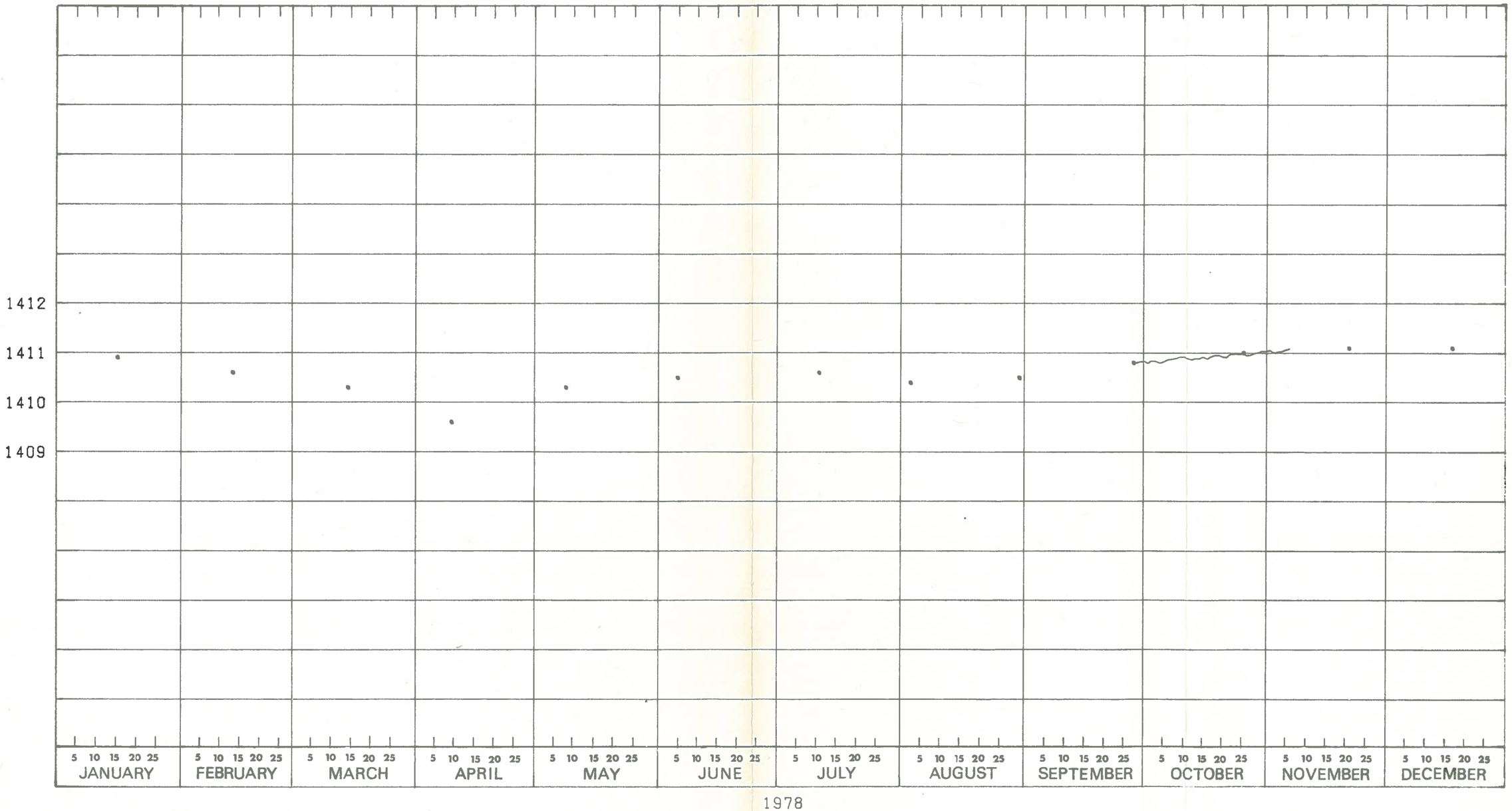
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-130

LSD 16 SEC 2 TWP 87 R 9 W4TH

11-130-H-79

Alberta Research Council




1978

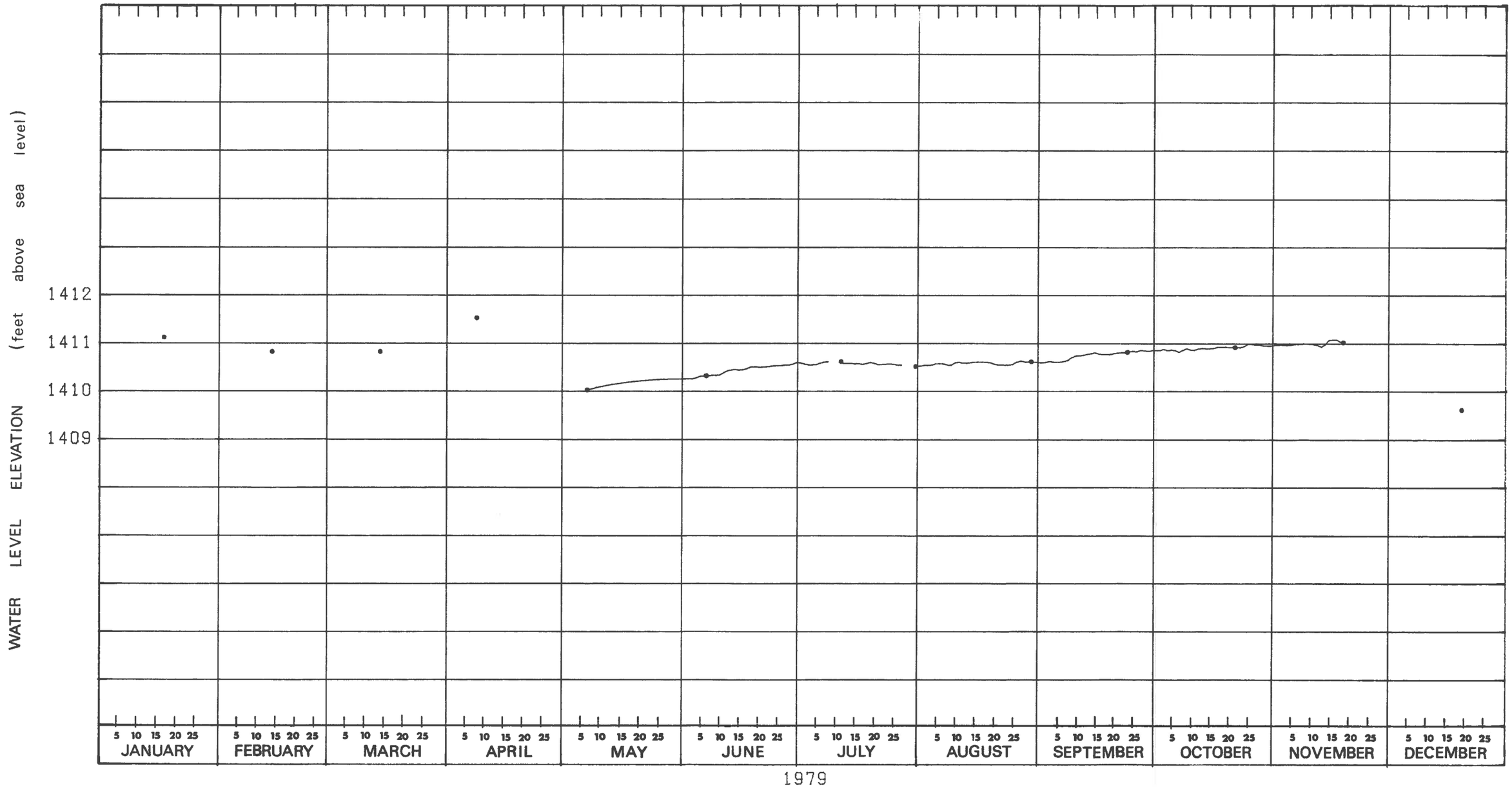
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-130

11-130-H-80

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council



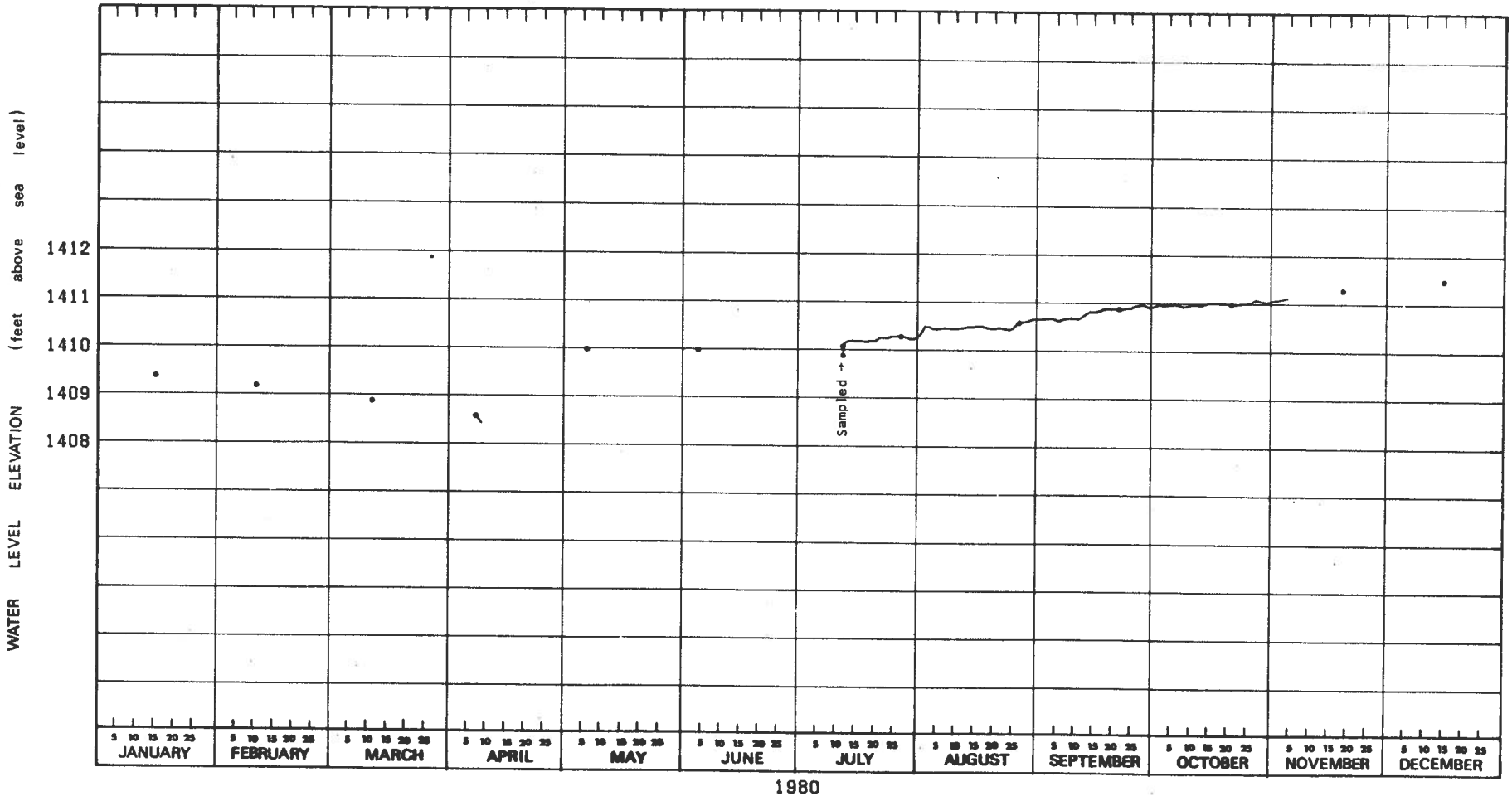
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-130-H-81



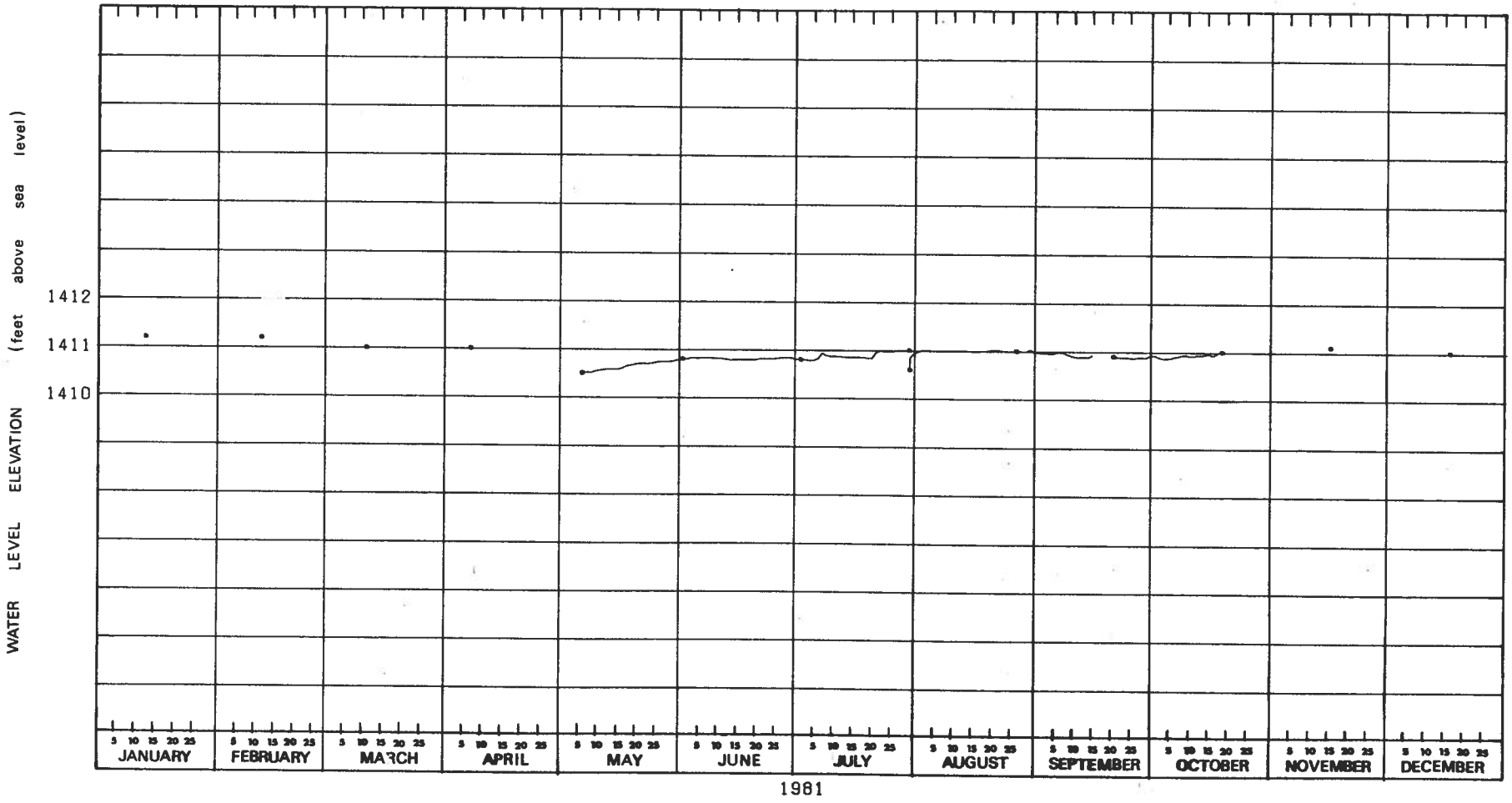
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-130-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1409.84 (Until May 7/76)
1411.41 (After May 7/76)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Dec 4/75 | | | Well completed; Well blown down with air |
| Dec 9/75 | TOC | 1409.8 | Bail test; T = 282 IGPD/FT |
| Dec 13/75 | | | Bail 500 IGal., blow with air for 7 hours |
| Dec 17/75 | | | Pump test; Q = 8 IGPM, T = 581 IGPD/FT |
| Dec 19/75 | | | Install shelter |
| Jan 12/76 | TOC | 1409.8 | |
| Jan 21/76 | TOC | 1409.8 | |
| Mar 4/76 | | | Could not measure |
| Apr 5/76 | TOC | 1409.8 | |
| May 7/76 | TOC | 1409.8 | Added 0.46 m of casing |
| June 2/76 | 0.50 TOC | 1409.8 | |
| June 24/76 | 0.91 MP | 1409.8 | MP = 0.42 m TOC, (1412.7) |
| July 20/76 | 0.92 MP | 1409.8 | |
| | 0.89 MP | 1409.9 | After sample; temp. 8°C |
| Aug 11/76 | 0.84 MP | 1410.0 | |
| Sept 1/76 | 0.72 MP | 1410.4 | |
| Sept 29/76 | 0.65 MP | 1410.7 | |
| Oct 28/76 | 0.57 MP | 1410.9 | |
| Nov 24/76 | | | Frozen |
| Dec 21/76 | | | Frozen |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1411.39 before October 26/77
1411.68 after October 26/77

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/77 | | | Frozen |
| Feb 14/77 | | | Frozen |
| Mar 17/77 | | | Frozen |
| Apr 13/77 | 0.91 MP | 1409.7 | Counter weight still frozen |
| May 12/77 | 0.83 MP | 1410.0 | |
| June 8/77 | 0.73 MP | 1410.3 | |
| July 12/77 | 0.70 MP | 1410.4 | |
| | 0.70 MP | 1410.4 | After sample; temp. 5°C |
| Aug 4/77 | 0.65 MP | 1410.6 | |
| Sept 1/77 | 0.61 MP | 1410.7 | |
| Sept 30/77 | 0.60 MP | 1410.7 | |
| Oct 26/77 | 0.54 MP | 1410.9 | Added 10 cm of casing; installed pitless adopter; pump kerosene inside 21 ft of 3/4 in pipe |
| | | 1411.0 | 55 in of water pressure in pipe New MP 0.32 m TOC, (1412.7) |
| Nov 21/77 | | 1411.0 | 54.5 in of water pressure |
| Dec 20/77 | | 1410.9 | 55.5 in of water pressure |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1411.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/78 | | 1410.9 | MP (1412.7)<br>53.5 in. of water pressure |
| Feb 14/78 | | 1410.6 | 50.5 in. of water pressure |
| Mar 15/78 | | 1410.3 | 46.5 in. of water pressure |
| Apr 10/78 | | 1409.6 | 37.5 in. of water pressure |
| May 8/78 | 0.74 MP | 1410.3 | 30 in. of water pressure |
| June 5/78 | 0.67 MP | 1410.5 | 34 in. of water pressure |
| July 11/78 | 0.63 MP | 1410.6 | 35.5 in. of water pressure |
| | 0.64 MP | 1410.6 | After sample; temp. 10°C |
| Aug 3/78 | 0.69 MP | 1410.4 | 34.0 in. of water pressure |
| Aug 30/78 | 0.67 MP | 1410.5 | 35.0 in. of water pressure |
| Sept 28/78 | 0.59 MP | 1410.8 | 36.5 in. of water pressure |
| Oct 26/78 | 0.53 MP | 1411.0 | 39 in. of water pressure |
| Nov 22/78 | | | Added 900 ml of kerosene to pipe to bring the kerosene level back to original level<br>Previous pressure reading are in error |
| | | 1411.1 | 56.0 in. of water pressure |
| Dec 18/78 | | 1411.1 | 56.5 in. of water pressure |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-130

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1411.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | | 1411.1 | MP (1412.7) |
| | | | 56.0in of water pressure |
| Feb 15/79 | | 1410.8 | 52.0in of water pressure |
| Mar 15/79 | | 1410.8 | 52.5in of water pressure |
| Apr 9/79 | | 1411.5 | 48.5in of water pressure |
| May 7/79 | 0.81 MP | 1410.0 | 44 in of water pressure |
| June 7/79 | 0.73 MP | 1410.3 | 43.5in of water pressure |
| July 12/79 | 0.65 MP | 1410.6 | 44 in of water pressure |
| | 0.65 MP | 1410.6 | After sample; temp. 8°C |
| July 31/79 | 0.66 MP | 1410.5 | 41 in of water pressure |
| Aug 30/79 | 0.64 MP | 1410.6 | 39 in of water pressure |
| Sept 24/79 | 0.59 MP | 1410.8 | 38 in of water pressure |
| Oct 22/79 | 0.54 MP | 1410.9 | 38 in of water pressure |
| Nov 19/79 | 0.52 MP | 1411.0 | 38 in of water pressure |
| Dec 20/79 | | 1409.6 | 38 in of water pressure |

MP - Depth from measuring point
TOC - Depth from top of casing.

WELL HISTORY

OBSERVATION WELL NUMBER 11 - 130

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1411.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | | 1409.4 | 36 in. of Water Pressure |
| Feb 11/80 | | 1409.2 | 33.5 in. of Water Pressure |
| Mar 12/80 | | 1408.9 | 30.0 in. of Water Pressure |
| Apr 8/80 | | 1408.6 | 26.5 in. of Water Pressure |
| May 7/80 | 0.83 MP | 1410.0 | 22.0 in. of Water Pressure |
| June 5/80 | 0.90 MP | 1410.0 | New MP 0.39 m TOC (1413.0) |
| July 3/80 | 0.91 MP | 1410.1 | |
| July 12/80 | | | Airlift for 15 min. @ 7 gal/min. |
| July 13/80 | | | Airlift for 1 hour @ 7 gal/min. Sampled t=5°C, Cond.=1000 |
| July 13/80 | 1.03 MP | 1409.9 | New MP 0.49 m TOC (1413.3) |
| July 28/80 | 0.91 MP | 1410.3 | |
| Aug 28/80 | 0.74 MP | 1410.6 | |
| Sept 23/80 | 0.65 MP | 1410.9 | |
| Oct 22/80 | 0.61 MP | 1411.0 | |
| Nov 20/80 | 0.51 MP | 1411.3 | |
| Dec 16/80 | 0.45 MP | 1411.5 | |
| Jan 13/81 | 0.54 MP | 1411.2 | |
| Feb 12/81 | 0.54 MP | 1411.2 | |
| Mar 11/81 | 0.62 MP | 1411.0 | |
| Apr 7/81 | 0.71 MP | 1411.0 | |
| May 6/81 | 0.86 MP | 1410.5 | |
| June 1/81 | 0.77 MP | 1410.8 | |
| July 2/81 | 0.77 MP | 1410.8 | |
| July 30/81 | 0.71 MP | 1411.0 | |
| | 0.81 MP | 1410.6 | Pumped 1100 gal (US) of H20, sampling at regular intervals. |
| Aug 27/81 | 0.69 MP | 1411.0 | |
| Sept 21/81 | 0.72 MP | 1410.9 | |
| Oct 19/81 | 0.71 MP | 1411.0 | |
| Nov 16/81 | 0.68 MP | 1411.1 | |
| Dec 17/81 | 0.69 MP | 1411.0 | |

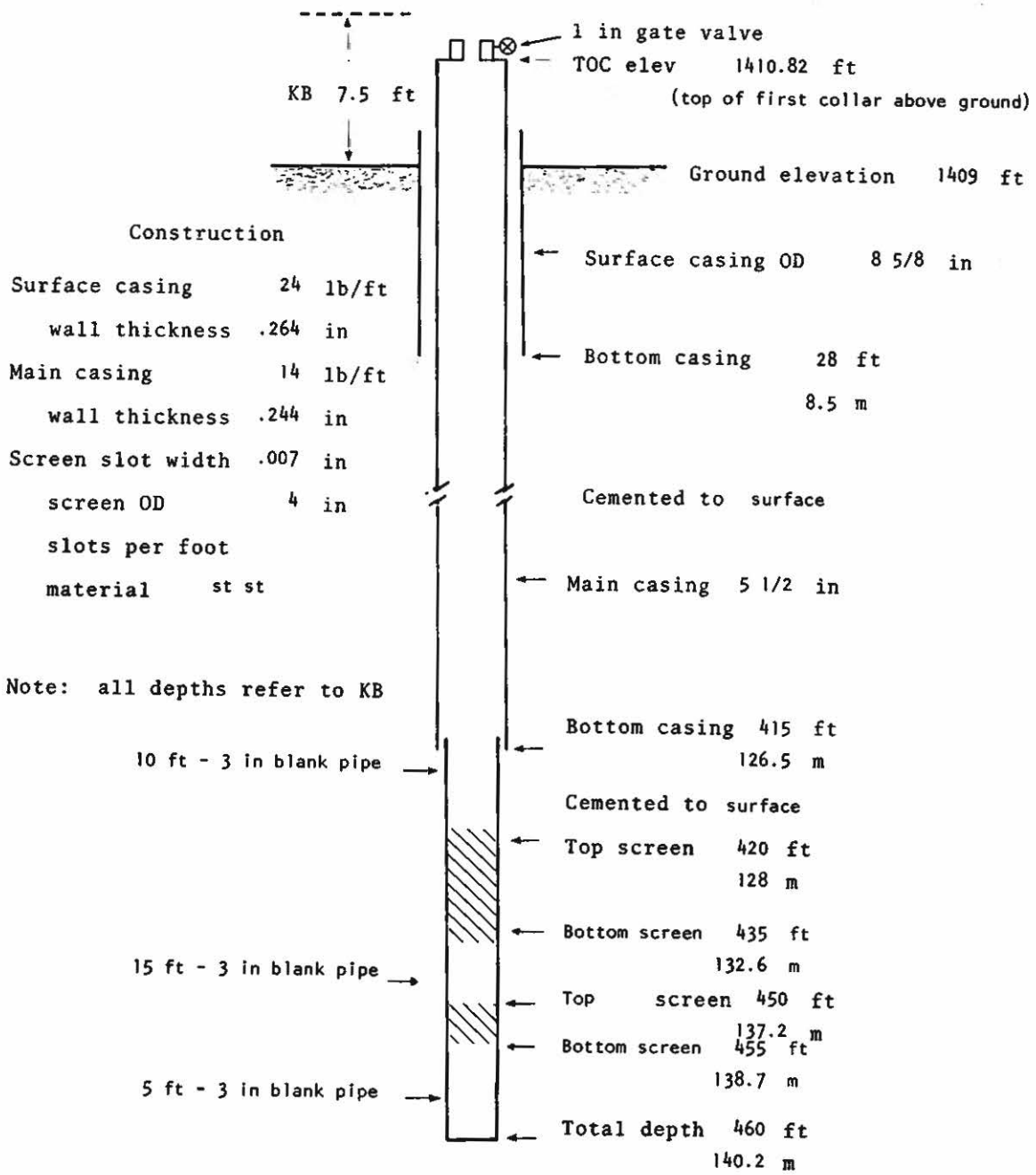
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 11-460

Lsd 16 Sec 2 Tp 87 R 9 W 4th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 11-460

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1410.82

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Dec 7/75 | | | Well completed; Blown down with air |
| Dec 8/75 | 122.24 TOC | 1009.8 | Well producing gas |
| Dec 9/75 | 122.16 TOC | 1010.1 | |
| Dec 19/75 | | | Sample gas; install shelter MP = 0.47 m TOC, (1412.4) |
| Jan 12/76 | 134.36 MP | 971.7 | Install casing flange and gate value to stop gas flow |
| Feb 11/76 | 128.82 MP | 989.9 | |
| Mar 4/76 | Dry | | Producing gas |
| Apr 5/76 | Dry | | " |
| May 3/76 | Dry | | MP = 0.66 m TOC, (1413.0) |
| June 3/76 | Dry | | |
| June 24/76 | Dry | | |
| July 20/76 | Dry | | Could not sample |
| Aug 11/76 | Dry | | |
| Sept 1/76 | Dry | | |
| Sept 29/76 | Dry | | |
| Oct 28/76 | Dry | | Gas pressure 9# |
| Nov 25/76 | Dry | | Gas pressure 8# |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-460

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1410.82

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/77 | Dry | | Gas pressure 8 PSIG |
| Feb 14/77 | Dry | | Gas pressure 8 PSIG |
| Mar 17/77 | Dry | | Gas pressure 7 PSIG |
| Apr 13/77 | Dry | | Gas pressure 8 PSIG |
| May 12/77 | Dry | | Gas pressure 8 PSIG |
| June 8/77 | Dry | | Gas pressure 7 PSIG |
| July 12/77 | Dry | | Gas pressure 7 PSIG |
| Aug 4/77 | Dry | | Gas pressure 7 PSIG |
| Sept 1/77 | Dry | | Gas pressure 7 PSIG |
| Sept 30/77 | Dry | | Gas pressure 7 PSIG |
| Oct 26/77 | Dry | | Gas pressure 8 PSIG |
| Nov 21/77 | Dry | | Gas pressure 8 PSIG |
| Dec 20/77 | Dry | | Gas pressure 8 PSIG |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-460

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1410.82

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/78 | Dry | | Gas pressure 7.8 PSIG; MP (1413.0) |
| Feb 14/78 | Dry | | Gas pressure 7.6 PSIG |
| Mar 15/78 | Dry | | Gas pressure 7.8 PSIG |
| Apr 10/78 | Dry | | Gas pressure 7.8 PSIG |
| May 8/78 | Dry | | Gas pressure 7.5 PSIG |
| June 5/78 | Dry | | Gas pressure 7.75 PSIG |
| July 11/78 | Dry | | Gas pressure 7.5 PSIG |
| Aug 3/78 | Dry | | Gas pressure 7.5 PSIG |
| Aug 30/78 | Dry | | Gas pressure 7.25 PSIG |
| Sept 28/78 | Dry | | Gas pressure 7.5 PSIG |
| Oct 26/78 | Dry | | Gas pressure 9.0 PSIG |
| Nov 22/78 | Dry | | Gas pressure 9.0 PSIG |
| Dec 18/78 | Dry | | Gas pressure 9.0 PSIG |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-460

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1410.82

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | Dry | | MP (1413.0) Gas pressure 9.0 PSIG |
| Feb 15/79 | Dry | | Gas pressure 8.5 PSIG |
| Mar 15/79 | Dry | | Gas pressure 9.0 PSIG |
| Apr 9/79 | Dry | | Gas pressure 9.25 PSIG |
| May 7/79 | Dry | | Gas pressure 9.0 PSIG |
| June 7/79 | Dry | | Gas pressure 9.0 PSIG |
| July 12/79 | Dry | | Gas pressure 9.0 PSIG |
| July 31/79 | Dry | | Gas pressure 9.0 PSIG |
| Aug 30/79 | Dry | | Gas pressure 9.0 PSIG |
| Sept 24/79 | Dry | | Gas pressure 7.5 PSIG |
| Oct 22/79 | Dry | | Gas pressure 7.0 PSIG |
| Nov 19/79 | Dry | | Gas pressure 9.0 PSIG |
| Dec 20/79 | Dry | | Gas pressure 9.25 PSIG |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 11 - 460

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1410.82

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | DRY | | Gas Pressure 9.0 lbs. |
| Feb 11/80 | DRY | | Gas Pressure 9.0 lbs. |
| Mar 12/80 | DRY | | Gas Pressure 9.0 lbs. |
| Apr 8/80 | | | Could not measure |
| May 7/80 | DRY | | Gas Pressure 9.75 lbs. |
| June 5/80 | DRY | | Gas Pressure 10 lbs. |
| July 4/80 | DRY | | Gas Pressure 9.75 lbs. |
| July 28/80 | DRY | | Gas Pressure 10.0 lbs. |
| Aug 28/80 | DRY | | Gas Pressure 9.75 lbs. |
| Sept 23/80 | DRY | | Gas Pressure 9.50 lbs. |
| Oct 22/80 | DRY | | Gas Pressure 9.50 lbs. |
| Nov 20/80 | DRY | | Gas Pressure 9.50 lbs. |
| Dec 16/80 | DRY | | Gas Pressure 9.75 lbs. |
| Jan 13/81 | DRY | | Gas Pressure 9.50 lbs. |
| Feb 12/81 | DRY | | Gas Pressure 9.50 lbs. |
| Mar 11/81 | DRY | | Gas Pressure 9.50 lbs. |
| Apr 7/81 | DRY | | Gas Pressure 9.75 lbs. |
| May 6/81 | DRY | | Gas Pressure 9.58 lbs. |
| June 1/81 | DRY | | Gas Pressure 10.0 lbs. |
| July 2/81 | DRY | | Gas Pressure 10.0 lbs. |
| July 30/81 | DRY | | Gas Pressure 10.0 lbs. |
| Aug 27/81 | DRY | | Gas Pressure 10.0 lbs. |
| Sept 21/81 | DRY | | Gas Pressure 9.75 lbs. |
| Oct 19/81 | DRY | | Gas Pressure 9.5 lbs. |
| Nov 16/81 | DRY | | Gas Pressure 9.5 lbs. |
| Dec 17/81 | DRY | | Gas Pressure 9.5 lbs. |

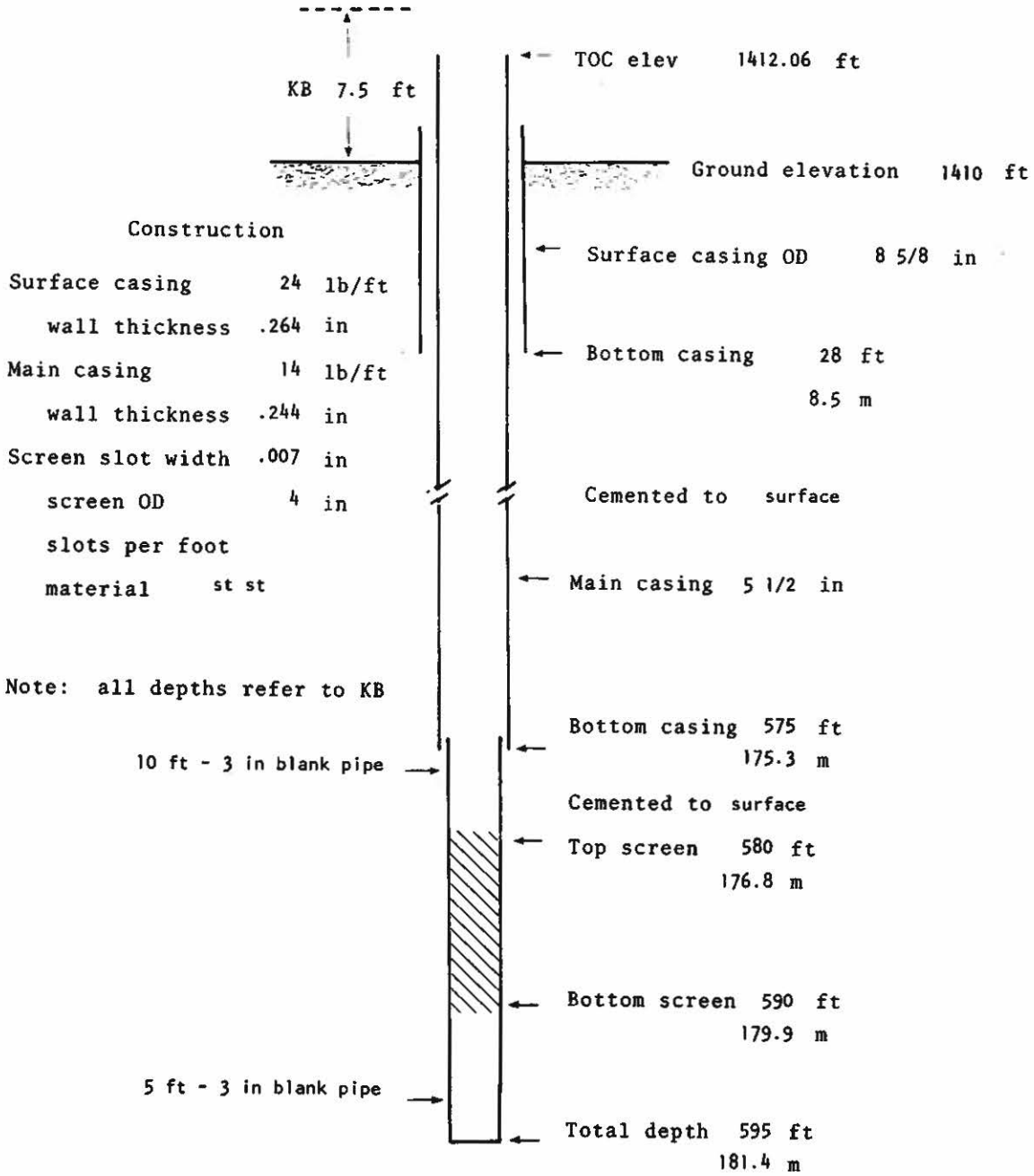
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Tp 87 R 9 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB

## DRILL STEM TEST

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Tp 87 R 9 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1410 |
| | KB | 1418 |
| Type of test | | Casing Positrieve |
| Date of test | | December 14, 1975 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 1445 | hrs |
| Tool opened | 1517 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1730 | hrs |
| Out of hole at | 1800 | hrs |
| Wt on packers | 1000 | lbs |

Description of blow Good initial puff. Good air blow through entire second opening

Total water recovered 75 ft

Water sample No. DH 303

Gas blow -

Remarks -

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 3/8" EVE tubing

Drill collar size (ID) -

Drill collar length (ft) -

Open or screened interval 580-590'

Formation tested McMurray

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | .43 | |
| MFE Tool | 10.03 | |
| Positrieve Packer | 2.64 | 5 1/2" |
| Total | 13.10 | |
| Packer Stub | 3.53 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.93 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 97 | 50 |
| Capacity (psig) | | 1250 | 1250 |
| Instrument set at (ft) | | 552 | 560 |
| Initial hydrostatic | A | 47 | 45 |
| First flow | B | 45 | 40 |
| | B1 | 45 | 40 |
| Initial shut in | C | 45 | 45 |
| Second flow | D | 17 | 17 |
| | D1 | 43 | 44 |
| Final shut in | G | 45 | 45 |
| Final hydrostatic | H | 41 | 41 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

11-595-D-77

OBSERVATION WELL NUMBER 11-595

INTERVAL TESTED 548-595

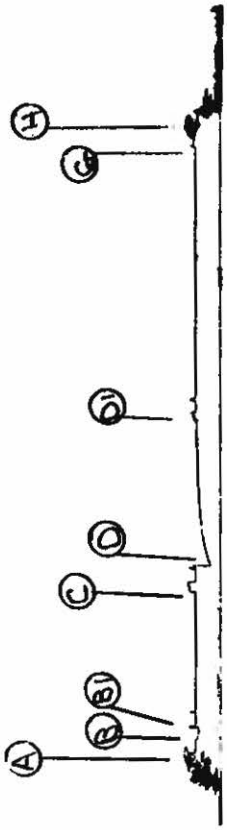
PRESSURE INCREMENTS

Recorder RPG-90

December 14, 1975

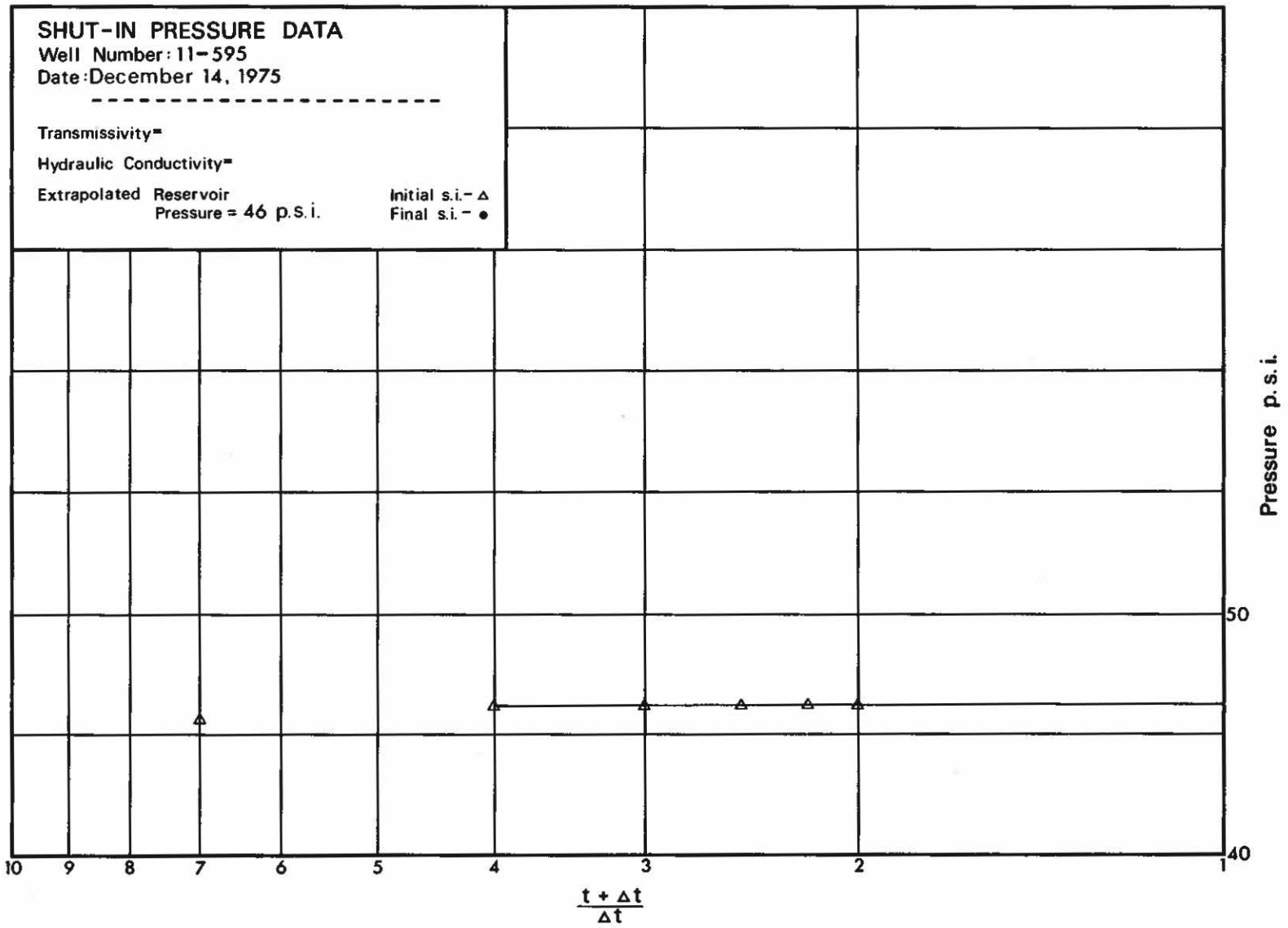
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 45.6 | 7.00 |
| 10 | 46.2 | 4.00 |
| 15 | 46.2 | 3.00 |
| 20 | 46.2 | 2.50 |
| 25 | 46.2 | 2.20 |
| 30 | 46.2 | 2.00 |

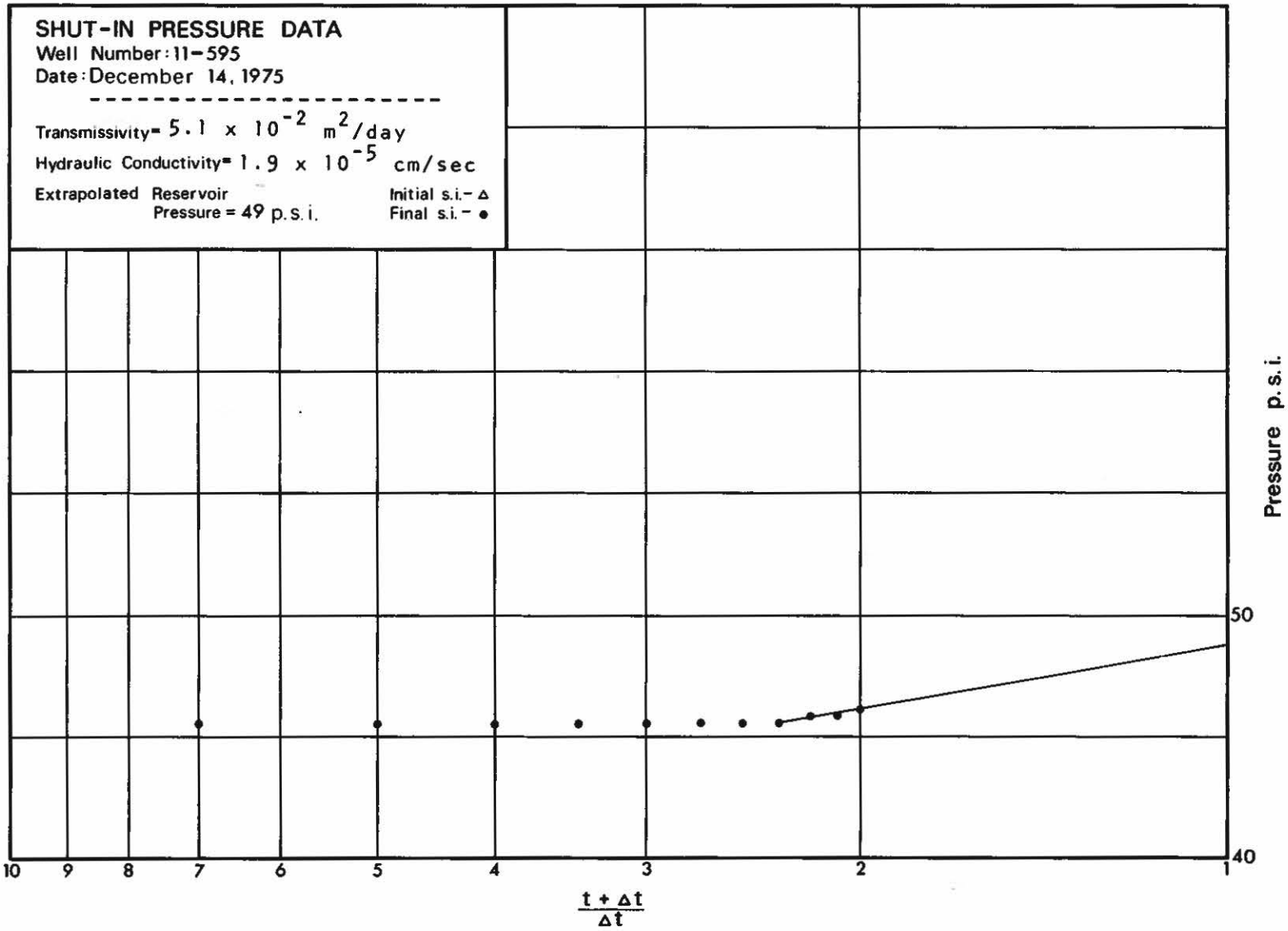



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 46.2 | 13.00 |
| 10 | 45.6 | 7.00 |
| 15 | 45.6 | 5.00 |
| 20 | 45.6 | 4.00 |
| 25 | 45.6 | 3.40 |
| 30 | 45.6 | 3.00 |
| 35 | 45.6 | 2.71 |
| 40 | 45.6 | 2.50 |
| 45 | 45.6 | 2.33 |
| 50 | 45.9 | 2.20 |
| 55 | 45.9 | 2.09 |
| 60 | 46.2 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 11-595
Date: December 14, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 46 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
50
40
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

11-595-0-77


SHUT-IN PRESSURE DATA
Well Number: 11-595
Date: December 14, 1975
Transmissivity= 5.1 x 10^-2 m^2/day
Hydraulic Conductivity= 1.9 x 10^-5 cm/sec
Extrapolated Reservoir Pressure = 49 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
50
40
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

11-595-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source DST on 11-595

Date sampled December 14, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 32.0 | 1.60 | 19.2 |
| Magnesium ($Mg^{++}$) | 0.6 | 0.05 | 0.6 |
| Sodium ($Na^{+}$) | 152.0 | 6.61 | 79.4 |
| Potassium ($K^{+}$) | 2.9 | 0.07 | 0.9 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 483.0 | 7.92 | 78.6 |
| Sulfate ($SO_4^{=}$) | 25.0 | 0.52 | 5.2 |
| Chloride ($Cl^{-}$) | 56.0 | 1.58 | 15.7 |
| Nitrate ($NO_3^{=}$) | 3.3 | 0.05 | 0.5 |
| Silica ($SiO_2$) | 1.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 526.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 10.0 | Total Cations (epm) | 8.3 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 970 | Temperature (C) | | |
| pH | 8.0 | pH | 8.4 | |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | 96 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 878 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |
| | | Sulfide | 0.14 | ppm |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled November 11, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 35.0 | 1.75 | 1 |
| Magnesium ($Mg^{++}$) | 81.0 | 6.67 | 3 |
| Sodium ($Na^{+}$) | 4313.0 | 187.60 | 95 |
| Potassium ($K^{+}$) | 35.8 | 0.92 | 1 |
| Carbonate ($CO_3^{=}$) | 31.2 | 1.04 | 1 |
| Bicarbonate ($HCO_3^{-}$) | 237.0 | 3.88 | 3 |
| Sulfate ($SO_4^{=}$) | 29.5 | 0.61 | 1 |
| Chloride ($Cl^{-}$) | 3800.0 | 107.16 | 95 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 1.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 8444 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 112.70 | Total Cations (epm) | 196.93 |

Other Constituents

| Lab: | | | Field: |
|---|---|---|---|
| Conductivity | 78,000 | | Temperature (C) |
| pH | 8.8 | | pH |
| Fluoride ($F^{-}$) | 0.3 | mg/l | Carbonate ($CO_3^{=}$) |
| | | | Bicarbonate ($HCO_3^{-}$) |
| | | | Hydroxide ($OH^{-}$) |
| | | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 12, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 17.7 | 0.88 | 0.3 |
| Magnesium ($Mg^{++}$) | 118.0 | 9.71 | 3.7 |
| Sodium ($Na^{+}$) | 5800.0 | 252.28 | 95.6 |
| Potassium ($K^{+}$) | 42.1 | 1.08 | 0.4 |
| Carbonate ($CO_3^{=}$) | 77.0 | 2.57 | 0.9 |
| Bicarbonate ($HCO_3^{-}$) | 354.0 | 5.80 | 2.0 |
| Sulfate ($SO_4^{=}$) | 26.2 | 0.55 | 0.2 |
| Chloride ($Cl^{-}$) | 9800.0 | 276.37 | 96.9 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 1.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 20.8 | | |
| Magnesium (Acidified) | 134.0 | | |
| Total dissolved solids | 15588.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 285.28 | Total Cations (epm) | 263.96 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 7.0 |
| pH | 9.0 | pH | 9.2 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | 106.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 293.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Date sampled: November 11, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .014 |
| Au | <.003 | Mo | <.006 |
| Al | 0.33 | Na | 4136 |
| As | <.038 | Ni | <.010 |
| B | 1.47 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 54.5 | Si | 0.80 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 3.03 |
| Cr | <.006 | Te | <.065 |
| Cu | .264 | Ti | .004 |
| Eu | <.015 | U | <.020 |
| Fe | 0.11 | V | .010 |
| K | 110 | W | <.078 |
| Mg | 63.7 | Zn | .088 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

11-595-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 22.0 | 1.10 | 0.4 |
| Magnesium(Mg) | 149.0 | 12.26 | 4.0 |
| Sodium(Na) | 6688.0 | 290.91 | 95.2 |
| Potassium(K) | 48.3 | 1.24 | 0.4 |
| Carbonate(CO3) | 65.0 | 2.17 | 0.7 |
| Bicarbonate(HCO3) | 556.0 | 9.11 | 2.8 |
| Sulphate(SO4) | 9.5 | 0.20 | 0.1 |
| Chloride(Cl) | 11200.0 | 315.85 | 96.5 |
| Nitrate(NO3) | 3.1 | 0.05 | 0.0 |
| Silica(SiO2) | 1.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 20.0 | | |
| Magnesium(Acidified) | 129.0 | | |
| TDS(mg/l) | 18136.0 | | |
| Total Anions(epm) | 327.38 | Total Cations(epm) | 305.51 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 26700 | | Temperature(C) | 7.00 | |
| pH | 8.9 | | pH | 8.9 | |
| Fluoride(F) | 0.3 | mg/l | Carbonate(CO3) | 101 | mg/l |
| | | | Bicarbonate(HCO3) | 468 | mg/l |
| | | | Hydroxide(OH) | | |

11-595-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 12, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 46.0 | 2.30 | 0.7 |
| Magnesium(Mg) | 138.0 | 11.36 | 3.4 |
| Sodium(Na) | 7250.0 | 315.35 | 95.5 |
| Potassium(K) | 47.1 | 1.20 | 0.4 |
| Carbonate(CO3) | 12.0 | 0.40 | 0.1 |
| Bicarbonate(HCO3) | 564.0 | 9.24 | 2.6 |
| Sulphate(SO4) | 9.1 | 0.19 | 0.1 |
| Chloride(Cl) | 12400.0 | 349.69 | 97.3 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 2.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 25.0 | | |
| Magnesium(Acidified) | 124.0 | | |
| TDS(mg/l) | 18060.0 | | |
| Total Anions(epm) | 359.53 | Total Cations(epm) | 330.21 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 27000 | Temperature(C) | 7.00 | |
| pH | 8.4 | pH | 9.0 | |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) | 82 | mg/l |
| | | Bicarbonate(HCO3) | 395 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 11-595-E-82

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 4, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 23.4 | 1.17 | 0.3 |
| Magnesium(Mg) | 124.0 | 10.33 | 2.8 |
| Sodium(Na) | 8063.0 | 350.57 | 96.5 |
| Potassium(K) | 47.0 | 1.21 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 593.0 | 9.72 | 2.8 |
| Sulphate(SO4) | 7.0 | 0.15 | 0.0 |
| Chloride(Cl) | 12000.0 | 338.03 | 97.2 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 0.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 19.7 | | |
| Magnesium(Acidified) | 113.0 | | |
| TDS(mg/l) | 18835.0 | | |
| Total Anions(epm) | 347.90 | Total Cations(epm) | 363.27 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 29399 | Temperature | 8.00 | |
| pH | 8.2 | pH | 8.9 | |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | 72 | mg/l |
| | | Bicarbonate(HCO3) | 395 | mg/l |
| | | Hydroxide(OH) | | |

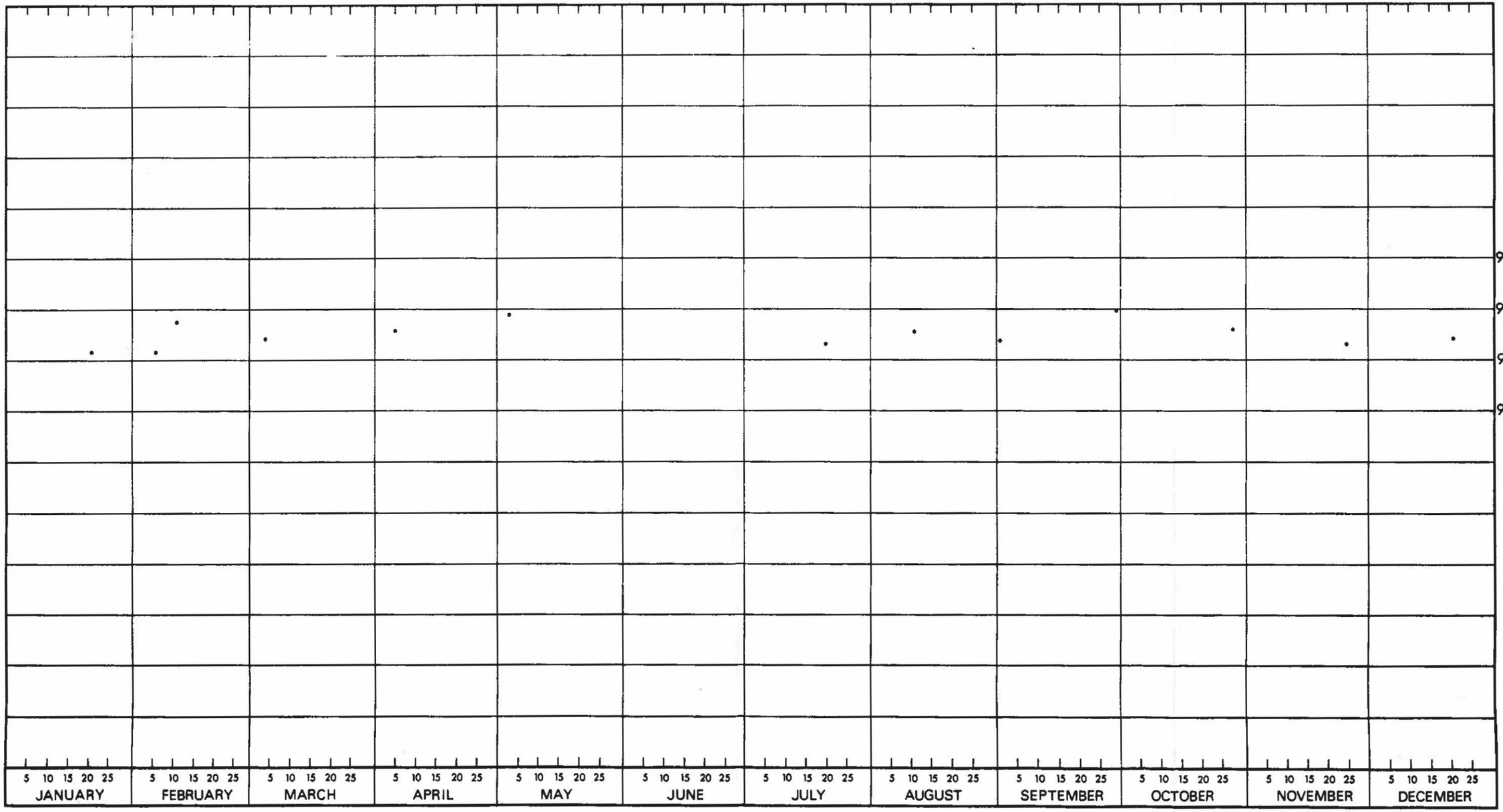
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **11-595**

Lsd **16** Sec **2** Twp **87** R **9** W4th

Alberta Research Council

11 - 595 - H - 77




1976

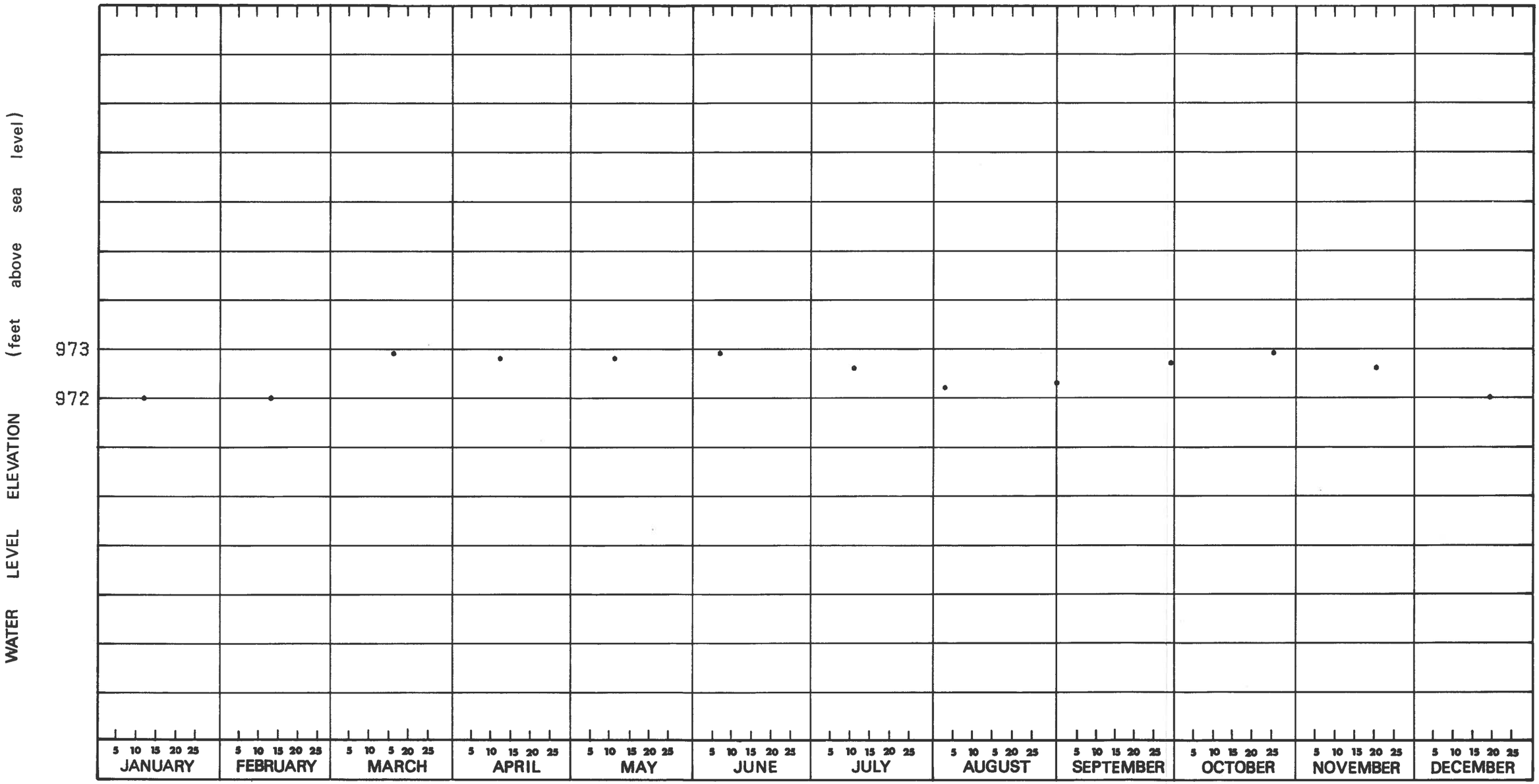
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-595-H-78




1977

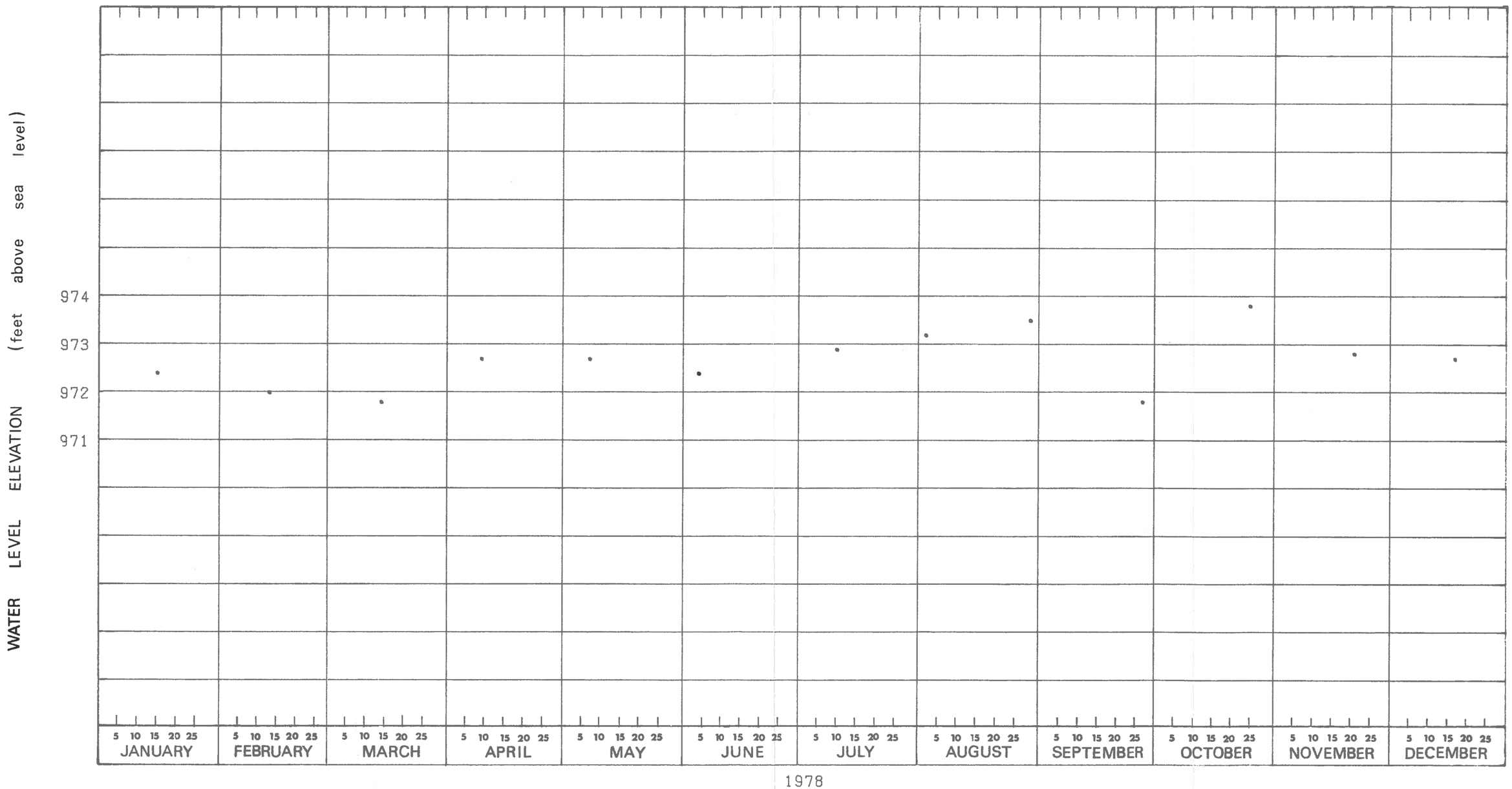
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-595

LSD 16 SEC 2 TWP 87 R 9 W4TH

11-595-H-79

Alberta Research Council




1978

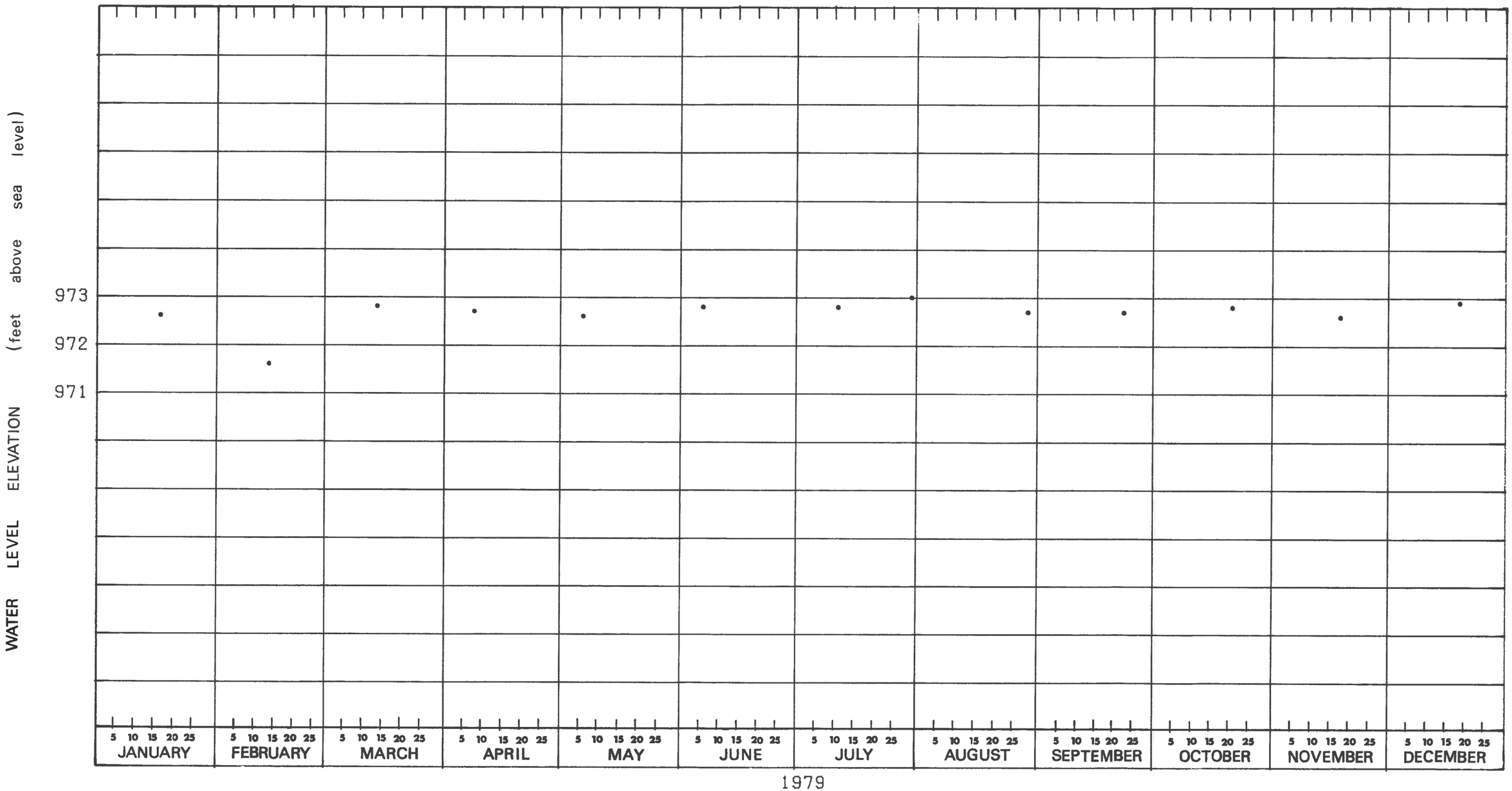
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-595-H-80



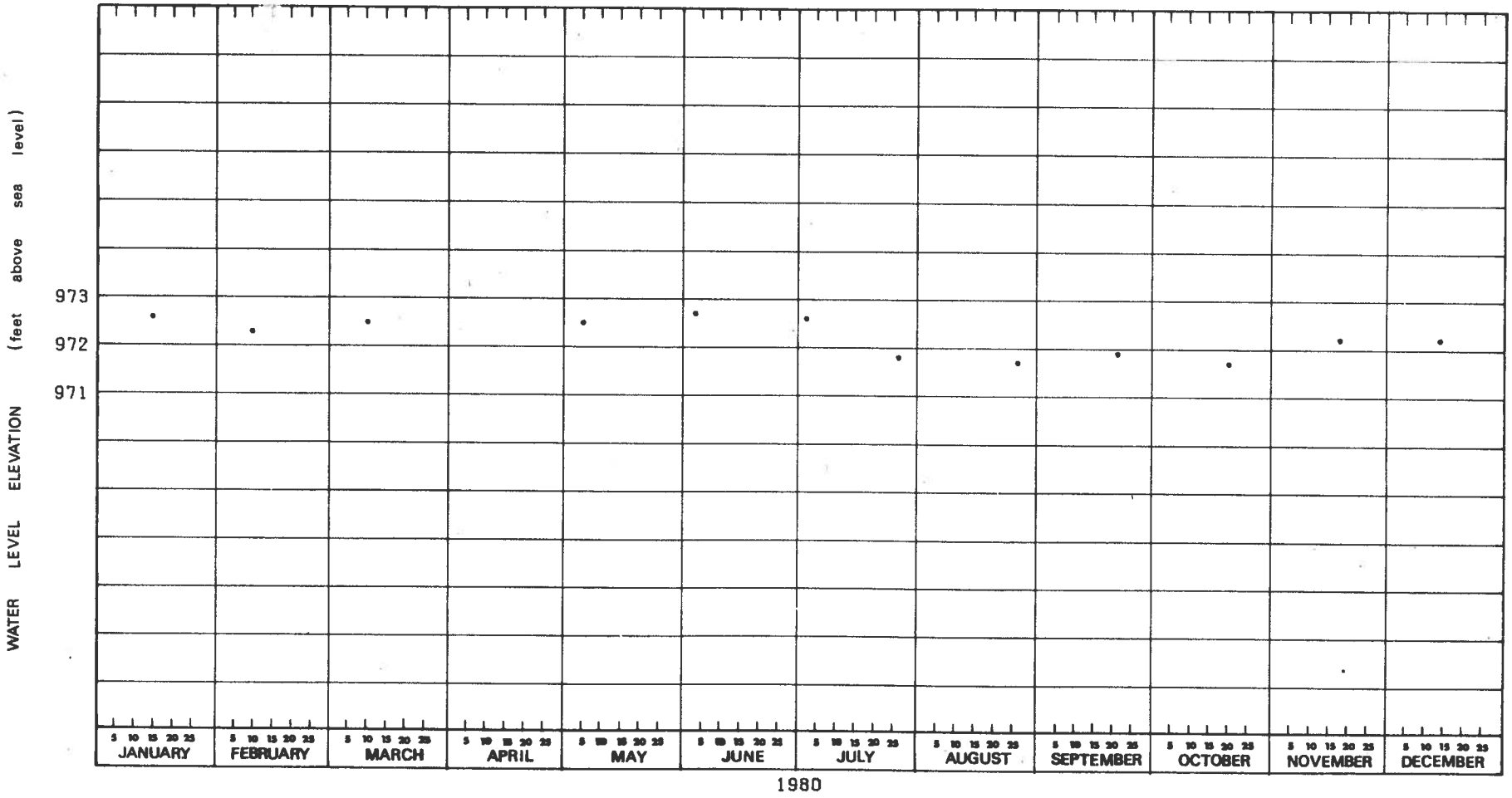
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-595-H-81



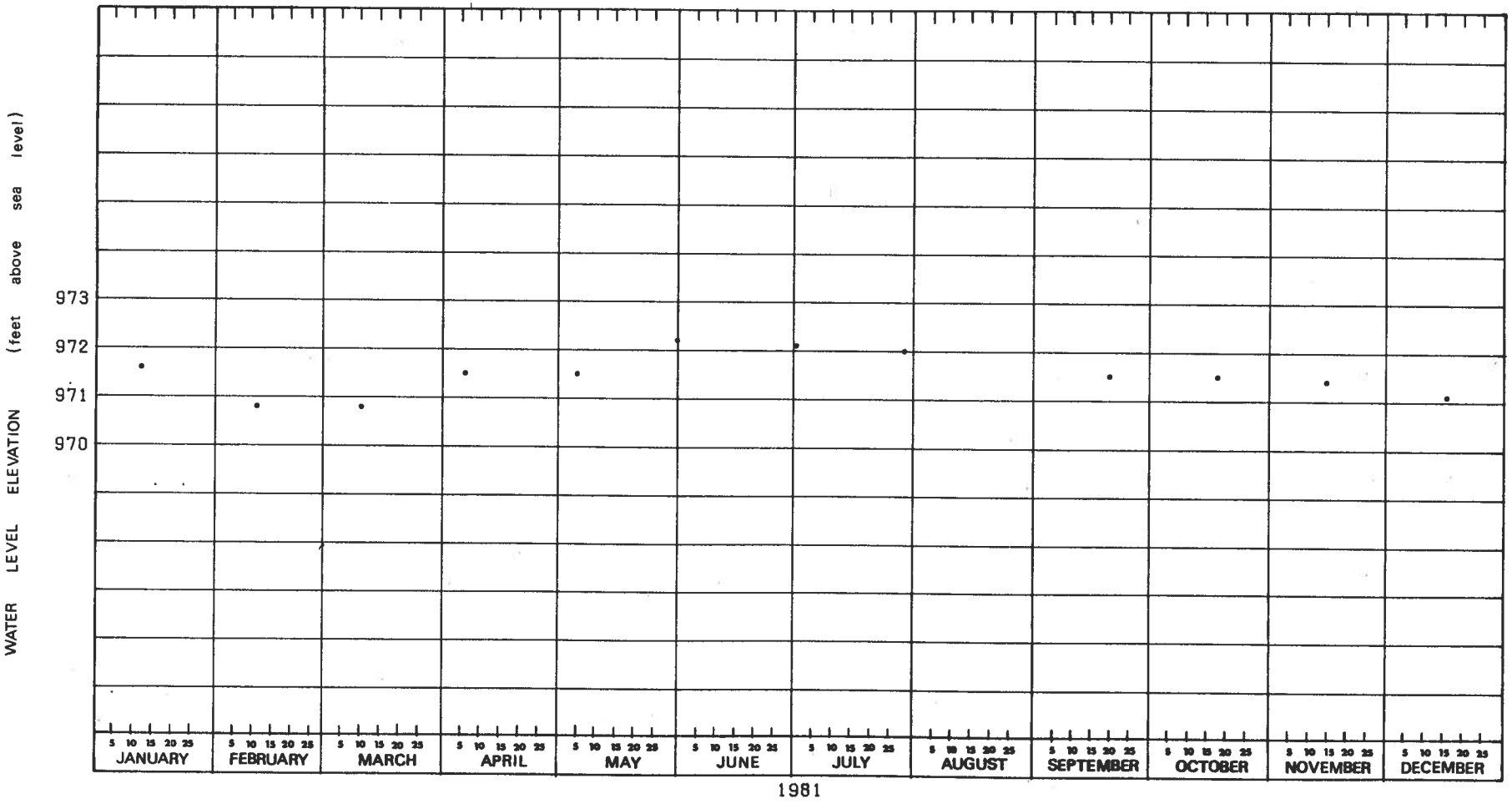
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-595-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1412.06

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Dec 6/75 | | | Well completed; blown down with air |
| Dec 8/75 | 133.83 TOC | 973.1 | |
| Dec 9/75 | 133.98 TOC | 972.6 | |
| Dec 14/75 | | | DST; FSI = 45# from 552 ft., water sample |
| Dec 18/75 | 136.18 TOC | 965.4 | |
| Dec 19/75 | | | Install shelter, MP = 0.41 m TOC, (1413.4) |
| Jan 12/76 | 129.40 MP | 989.0 | |
| Jan 21/76 | 134.53 MP | 972.1 | |
| Feb 6/76 | 134.53 MP | 972.1 | |
| Feb 11/76 | 134.35 MP | 972.7 | |
| Mar 4/76 | 134.45 MP | 972.4 | |
| Apr 5/76 | 134.41 MP | 972.5 | |
| May 3/76 | 134.31 MP | 972.9 | Dropped float in well |
| July 20/76 | 134.48 MP | 972.3 | Could not sample; could not get Bailer Past 430 ft |
| Aug 11/76 | 134.41 MP | 972.5 | |
| Sept 1/76 | 134.46 MP | 972.4 | |
| Sept 29/76 | 134.28 MP | 973.0 | |
| Oct 28/76 | 134.40 MP | 972.6 | |
| Nov 11/76 | | | Sampled; tried to fish float out |
| Nov 25/76 | 134.42 MP | 972.3 | New MP = 0.35 m TOC, (1413.2) |
| Dec 21/76 | 134.39 MP | 972.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1412.06

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/77 | 134.50 MP | 972.0 | MP (1413.2) |
| Feb 14/77 | 134.50 MP | 972.0 | |
| Mar 17/77 | 134.25 MP | 972.9 | |
| Apr 13/77 | 134.27 MP | 972.8 | |
| May 12/77 | 134.28 MP | 972.8 | |
| June 8/77 | 134.24 MP | 972.9 | |
| July 12/77 | 134.33 MP | 972.6 | Sampled; temp. 7°C |
| Aug 4/77 | 134.46 MP | 972.2 | |
| Sept 1/77 | 134.42 MP | 972.3 | |
| Sept 30/77 | 134.29 MP | 972.7 | |
| Oct 26/77 | 134.25 MP | 972.9 | |
| Nov 21/77 | 134.32 MP | 972.6 | |
| Dec 20/77 | 134.51 MP | 972.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1412.06

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/78 | 134.40 MP | 972.4 | MP (1413.2) |
| Feb 14/78 | 134.50 MP | 972.0 | |
| Mar 15/78 | 134.56 MP | 971.8 | |
| Apr 10/78 | 134.30 MP | 972.7 | |
| May 8/78 | 134.30 MP | 972.7 | |
| June 5/78 | 134.38 MP | 972.4 | |
| July 11/78 | 134.24 MP | 972.9 | Sampled; temp. 7°C |
| Aug 3/78 | 134.13 MP | 973.2 | |
| Aug 30/78 | 134.04 MP | 973.5 | |
| Sept 28/78 | 134.56 MP | 971.8 | |
| Oct 26/78 | 133.95 MP | 973.8 | |
| Nov 22/78 | 134.27 MP | 972.8 | |
| Dec 18/78 | 134.31 MP | 972.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-595

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1412.06

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 134.32 MP | 972.6 | MP (1413.2) |
| Feb 15/79 | 134.64 MP | 971.6 | |
| Mar 15/79 | 134.28 MP | 972.8 | |
| Apr 9/79 | 134.30 MP | 972.7 | |
| May 7/79 | 134.33 MP | 972.6 | |
| June 7/79 | 134.27 MP | 972.8 | New MP 0.35m TOC (1413.2) |
| July 12/79 | 134.28 MP | 972.8 | Sampled; temp. 7°C |
| July 31/79 | 134.21 MP | 973.0 | |
| Aug 30/79 | 134.31 MP | 972.7 | |
| Sept 24/79 | 134.29 MP | 972.7 | |
| Oct 22/79 | 134.26 MP | 972.8 | |
| Nov 19/79 | 134.32 MP | 972.6 | |
| Dec 20/79 | 134.23 MP | 972.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 11 - 595

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1412.06

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 134.33 MP | 972.6 | |
| Feb 11/80 | 134.42 MP | 972.3 | |
| Mar 12/80 | 134.36 MP | 972.5 | |
| Apr 8/80 | | | Could not measure |
| May 7/80 | 134.36 MP | 972.5 | |
| June 5/80 | 134.26 MP | 972.7 | |
| July 4/80 | 134.30 MP | 972.6 | New MP 0.32 m TOC (1413.1) Temp. 8°C |
| July 13/80 | | | Bailed 300 gals to clean<br>Sampled t=9°C Cond. > 20000 |
| July 28/80 | 134.55 MP | 971.8 | |
| Aug 28/80 | 134.58 MP | 971.7 | |
| Sept 23/80 | 134.51 MP | 971.9 | |
| Oct 22/80 | 134.58 MP | 971.7 | |
| Nov 20/80 | 134.42 MP | 972.2 | |
| Dec 16/80 | 134.43 MP | 972.2 | |
| Jan 13/81 | 134.61 MP | 971.6 | |
| Feb 12/81 | 134.86 MP | 970.8 | |
| Mar 11/81 | 134.85 MP | 970.8 | |
| Apr 7/81 | 134.62 MP | 971.5 | |
| May 6/81 | 134.63 MP | 971.5 | |
| June 1/81 | 134.42 MP | 972.2 | |
| July 2/81 | 134.46 MP | 972.1 | |
| July 30/81 | 134.48 MP | 972.0 | |
| Aug 27/81 | | | Could not measure |
| Sept 21/81 | 134.63 MP | 971.5 | |
| Oct 19/81 | 134.64 MP | 971.5 | |
| Nov 16/81 | 134.68 MP | 971.4 | |
| Dec 17/81 | 134.77 MP | 971.1 | |

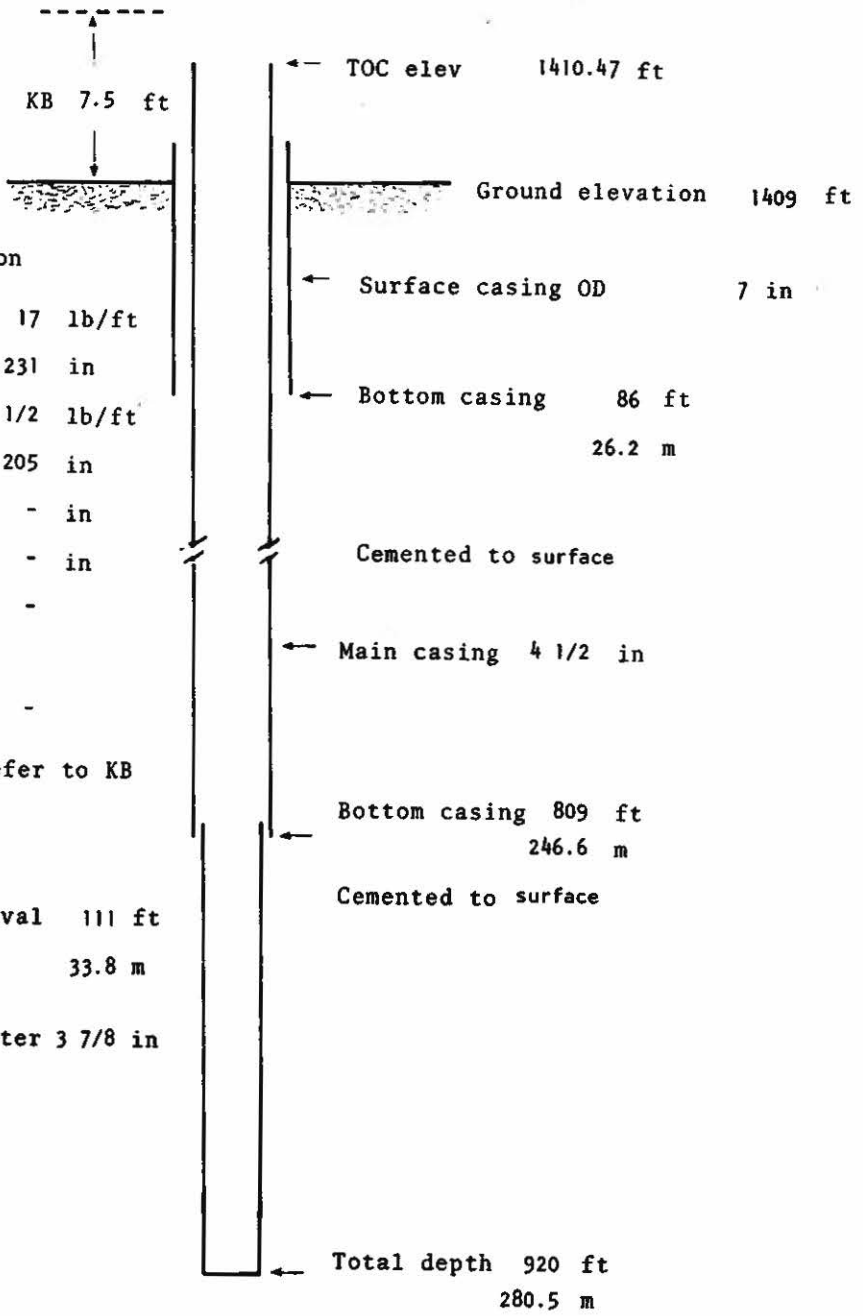
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Tp 87 R 9 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Main casing | 9 1/2 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | - | in |
| screen OD | - | in |
| slots per foot | - | |
| material | | |
| Sand pack | - | |

Note: all depths refer to KB

Open hole interval 111 ft
33.8 m

Open hole diameter 3 7/8 in

N.B. - 34 ft of 10 3/4 in conductor pipe at surface

## DRILL STEM TEST

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Tp 87 R 9 W4th

Alberta Research Council

Elevation: gl 1409

KB 1417

Type of test Open hole, Bottom hole

Date of test November 30, 1975 I

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0100 | hrs |
| Tool opened | 0312 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 30 | min |
| Pulled loose at | 0430 | hrs |
| Out of hole at | 0600 | hrs |
| Wt on packers | 15,000 | lbs |

Description of blow Weak initial puff. Faint blow-dead in 10 minutes on second opening.

Total water recovered 2 ft

Water sample No. - (drilling mud)

Gas blow -

Remarks

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 605-655'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Collar | 31.10 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 50.35 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 611 | 616 |
| Initial hydrostatic | A | 285 | 283 |
| First flow | B | 14 | 12 |
| | B1 | 14 | 12 |
| Initial shut in | C | 18 | 16 |
| Second flow | D | 15 | 13 |
| | D1 | 16 | 14 |
| Final shut in | G | 33 | 31 |
| Final hydrostatic | H | 282 | 280 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

11-920-D-77

OBSERVATION WELL NUMBER 11-920

INTERVAL TESTED AK1-65

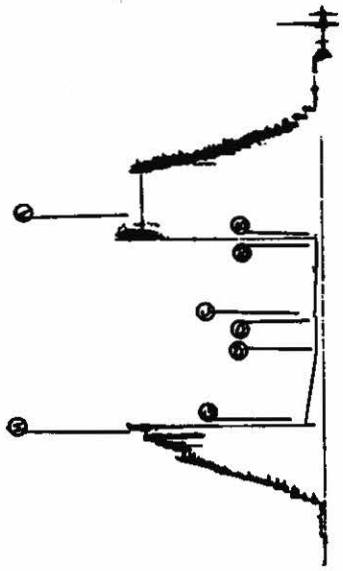
PRESSURE INCREMENTS

Recorder 605-655

November 30, 1975

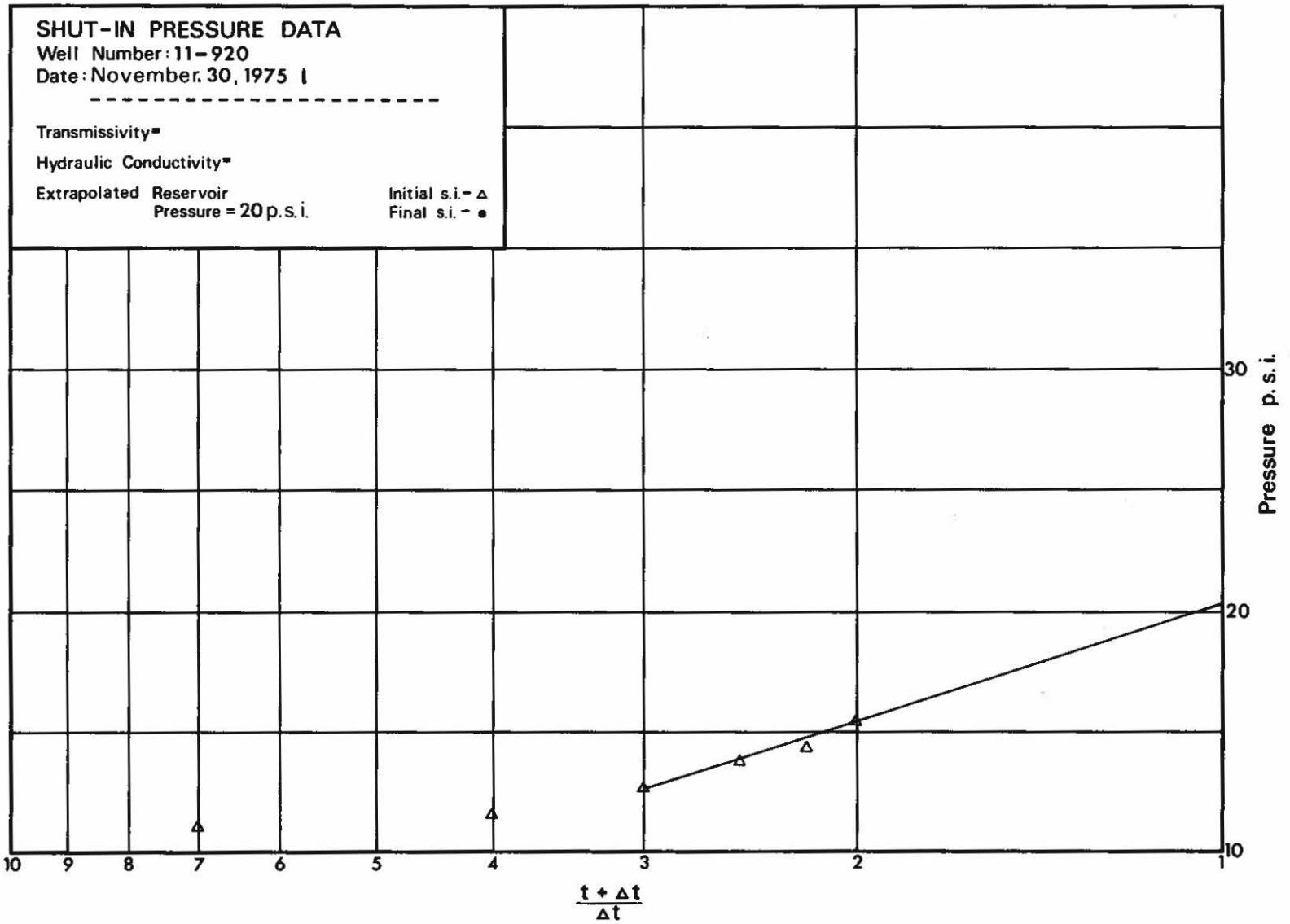
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 11.1 | 7.00 |
| 10 | 11.6 | 4.00 |
| 15 | 12.7 | 3.00 |
| 20 | 13.8 | 2.50 |
| 25 | 14.4 | 2.20 |
| 30 | 15.5 | 2.00 |

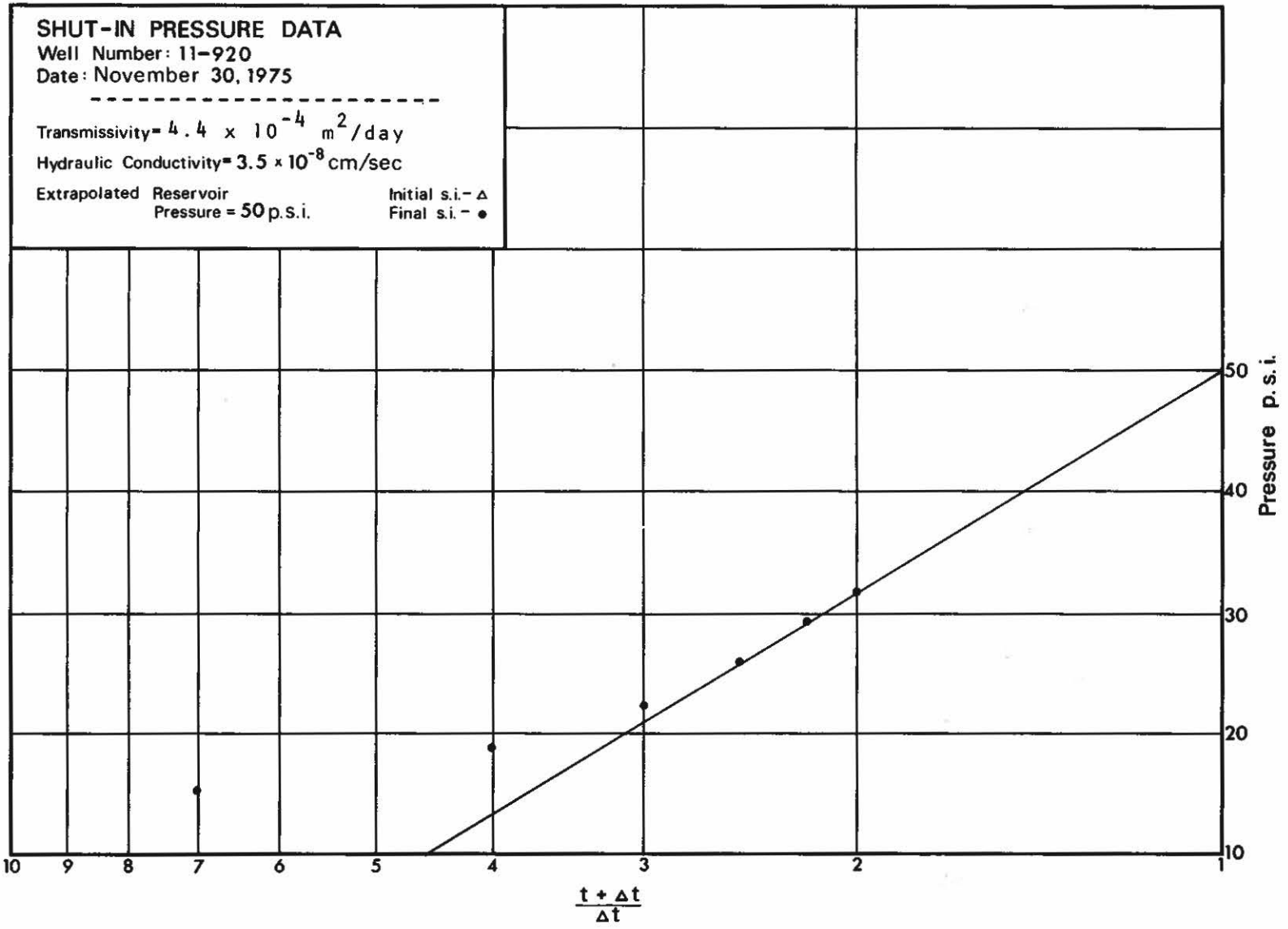


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 15.0 | 7.00 |
| 10 | 18.6 | 4.00 |
| 15 | 22.2 | 3.00 |
| 20 | 25.8 | 2.50 |
| 25 | 29.2 | 2.20 |
| 30 | 31.9 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 11-920
Date: November. 30, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 20 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
30
20
10
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

11-920-D-77


SHUT-IN PRESSURE DATA
Well Number: 11-920
Date: November 30, 1975
Transmissivity = 4.4 x 10^-4 m^2/day
Hydraulic Conductivity = 3.5 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 50 p.s.i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
50
40
30
20
10
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

11-920-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Tp 87 R 9 W4th

Alberta Research Council

Elevation: gl 1409
KB 1417

Type of test Open hole, Bottom hole

Date of test November 30, 1975 11

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1315 | hrs |
| Tool opened | 1427 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | | hrs |
| Out of hole at | | hrs |
| Wt on packers | | lbs |

Description of blow Weak initial puff. Poor flow, dead in 5 minutes on second flow.

Total water recovered 30 ft

Water sample No. - (drilling mud)

Gas blow -

Remarks

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 655-705'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P.Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Collar | 31.10 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 50.35 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 661 | 666 |
| Initial hydrostatic | A | 306 | 309 |
| First flow | B | 33 | 34 |
| | B1 | 32 | 34 |
| Initial shut in | C | 37 | 39 |
| Second flow | D | 33 | 35 |
| | D1 | 33 | 35 |
| Final shut in | G | 32 | 34 |
| Final hydrostatic | H | 299 | 303 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

11-920-D-77

OBSERVATION WELL NUMBER 11-920

INTERVAL TESTED 655-705

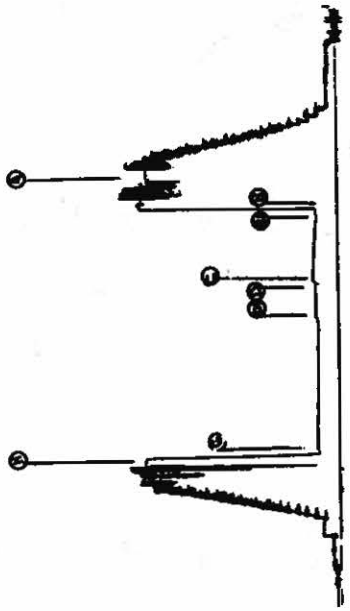
PRESSURE INCREMENTS

Recorder AK1-65

November 30, 1975 ||

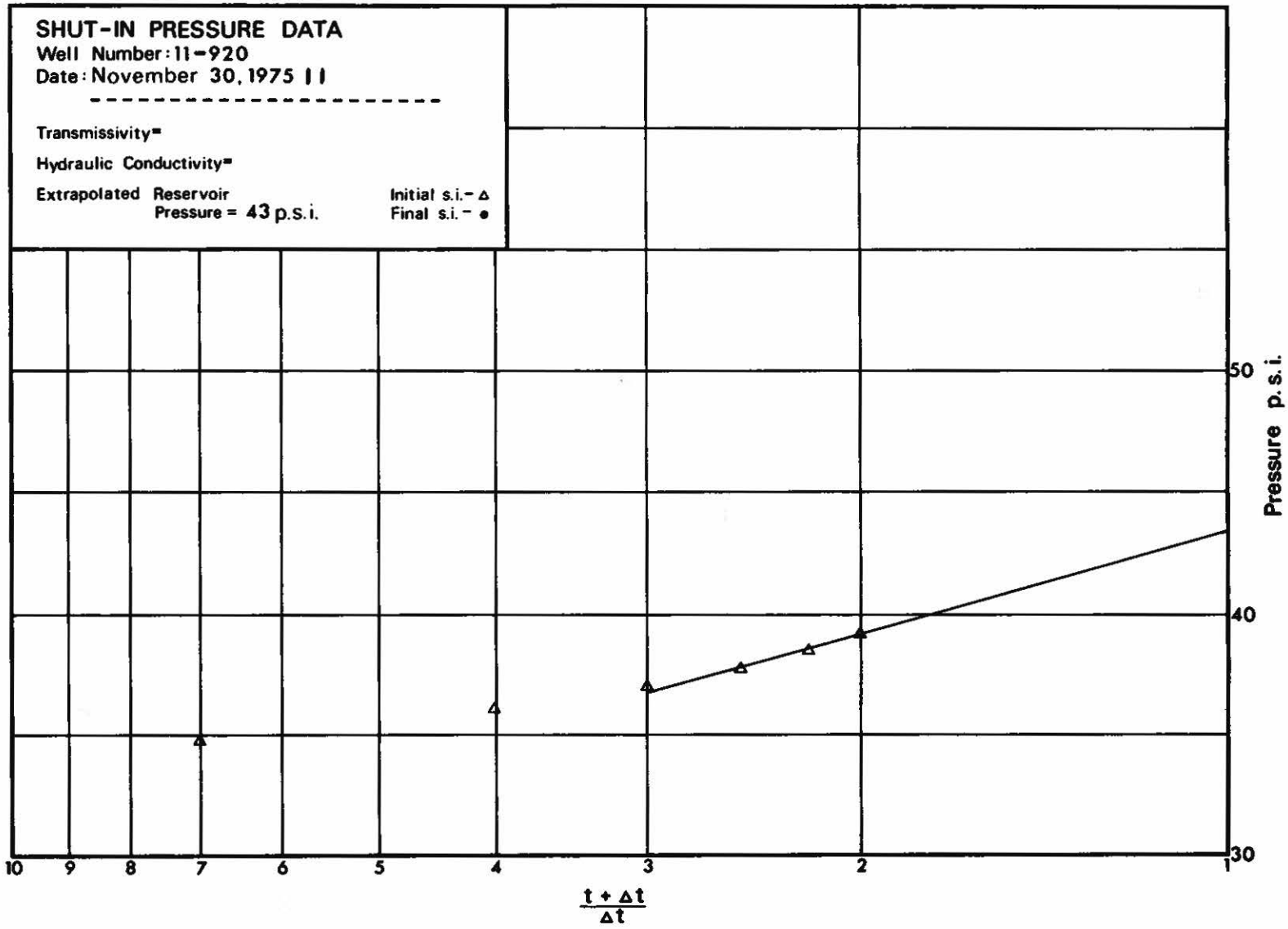
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 34.8 | 7.00 |
| 10 | 36.0 | 4.00 |
| 15 | 37.1 | 3.00 |
| 20 | 37.8 | 2.50 |
| 25 | 38.6 | 2.20 |
| 30 | 39.3 | 2.00 |

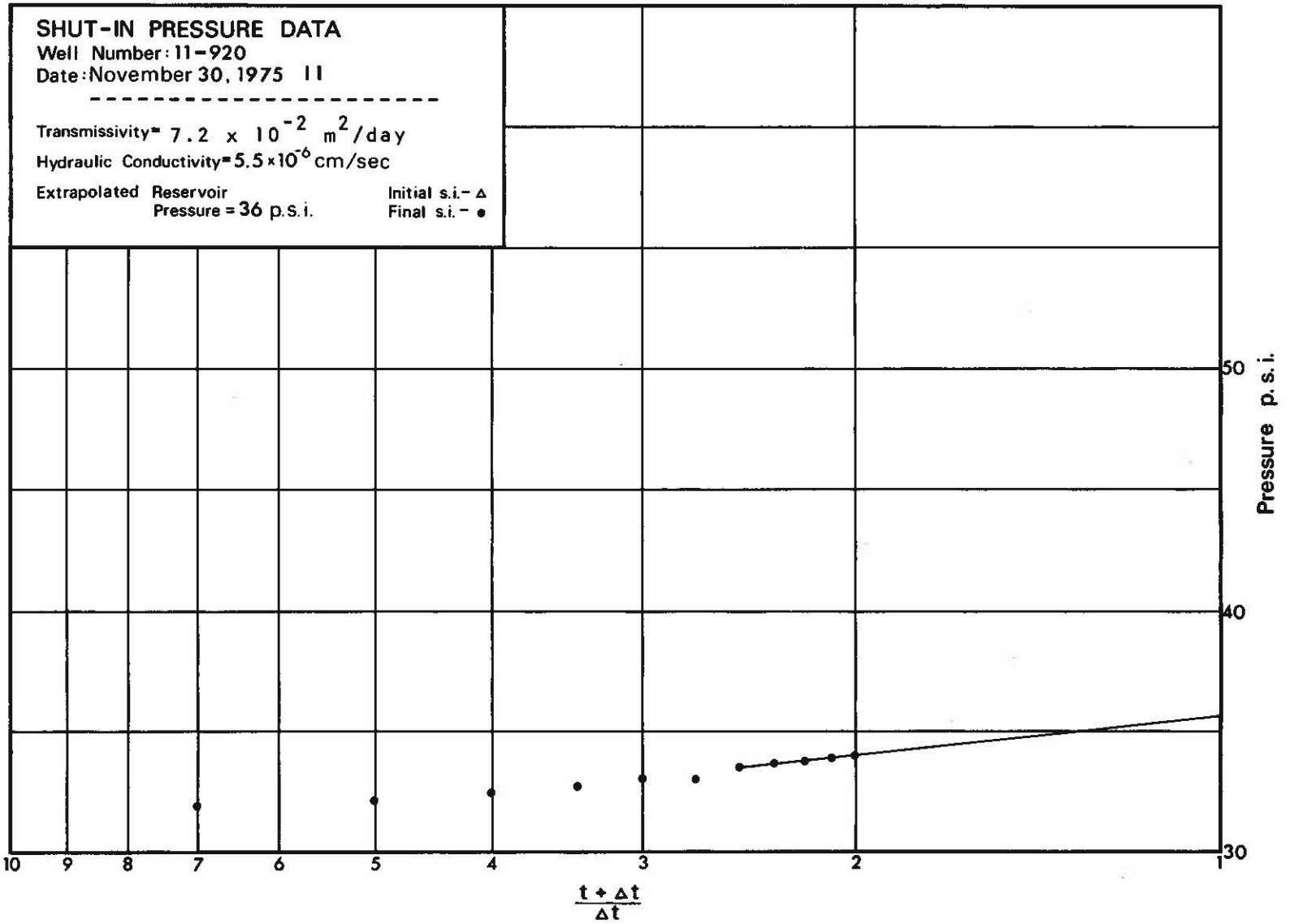


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 31.7 | 13.00 |
| 10 | 31.9 | 7.00 |
| 15 | 32.2 | 5.00 |
| 20 | 32.5 | 4.00 |
| 25 | 32.7 | 3.40 |
| 30 | 33.0 | 3.00 |
| 35 | 33.0 | 2.71 |
| 40 | 33.5 | 2.50 |
| 45 | 33.7 | 2.33 |
| 50 | 33.7 | 2.20 |
| 55 | 33.8 | 2.09 |
| 60 | 34.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 11-920
Date: November 30, 1975 11
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 43 p.s.i.
Initial s.i.- Δ
Final s.i. - •
50
40
30
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

11-920-D-77


SHUT-IN PRESSURE DATA
Well Number: 11-920
Date: November 30, 1975 11
Transmissivity = 7.2 x 10^-2 m^2/day
Hydraulic Conductivity = 5.5 x 10^-6 cm/sec
Extrapolated Reservoir Pressure = 36 p.s.i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
50
40
30
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

11-920-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Tp 87 R 9 W4th

Alberta Research Council

Elevation: gl 1409
KB 1417

Type of test Open hole, Bottom hole

Date of test December 1, 1975 1

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 2300 | hrs |
| Tool opened | 2342 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0130 | hrs |
| Out of hole at | 0245 | hrs |
| Wt on packers | 15,000 | lbs |

Description of blow Weak initial puff. Faint blow on second opening.

Total water recovered 30 ft

Water sample No. - (drilling mud)

Gas blow -

Remarks

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 705-755'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Collar | 31.10 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 50.35 | |

### PRESSURE DATA (psi)

| Instrument No. | | 64 | 65 |
|---|---|---|---|
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 711 | 716 |
| Initial hydrostatic | A | 328 | 332 |
| First flow | B | 15 | 16 |
| | B1 | 21 | 23 |
| Initial shut in | C | 324 | 327 |
| Second flow | D | 24 | 25 |
| | D1 | 30 | 31 |
| Final shut in | G | 73 | 75 |
| Final hydrostatic | H | 310 | 313 |

B1, D1, etc. Initial Hyd. Pressure

11-920-D-77

DRILL STEM TEST

OBSERVATION WELL NUMBER 11-920

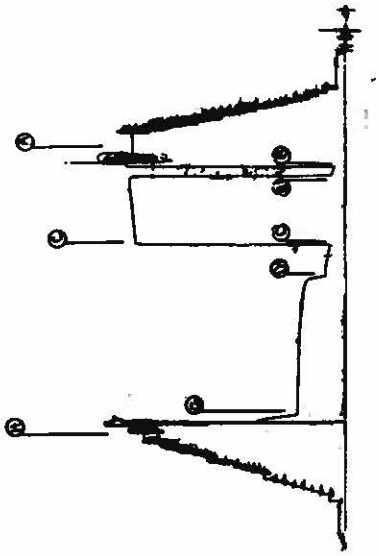
INTERVAL TESTED 705-755

PRESSURE INCREMENTS
Recorder AK1-65

December 1, 1975 |

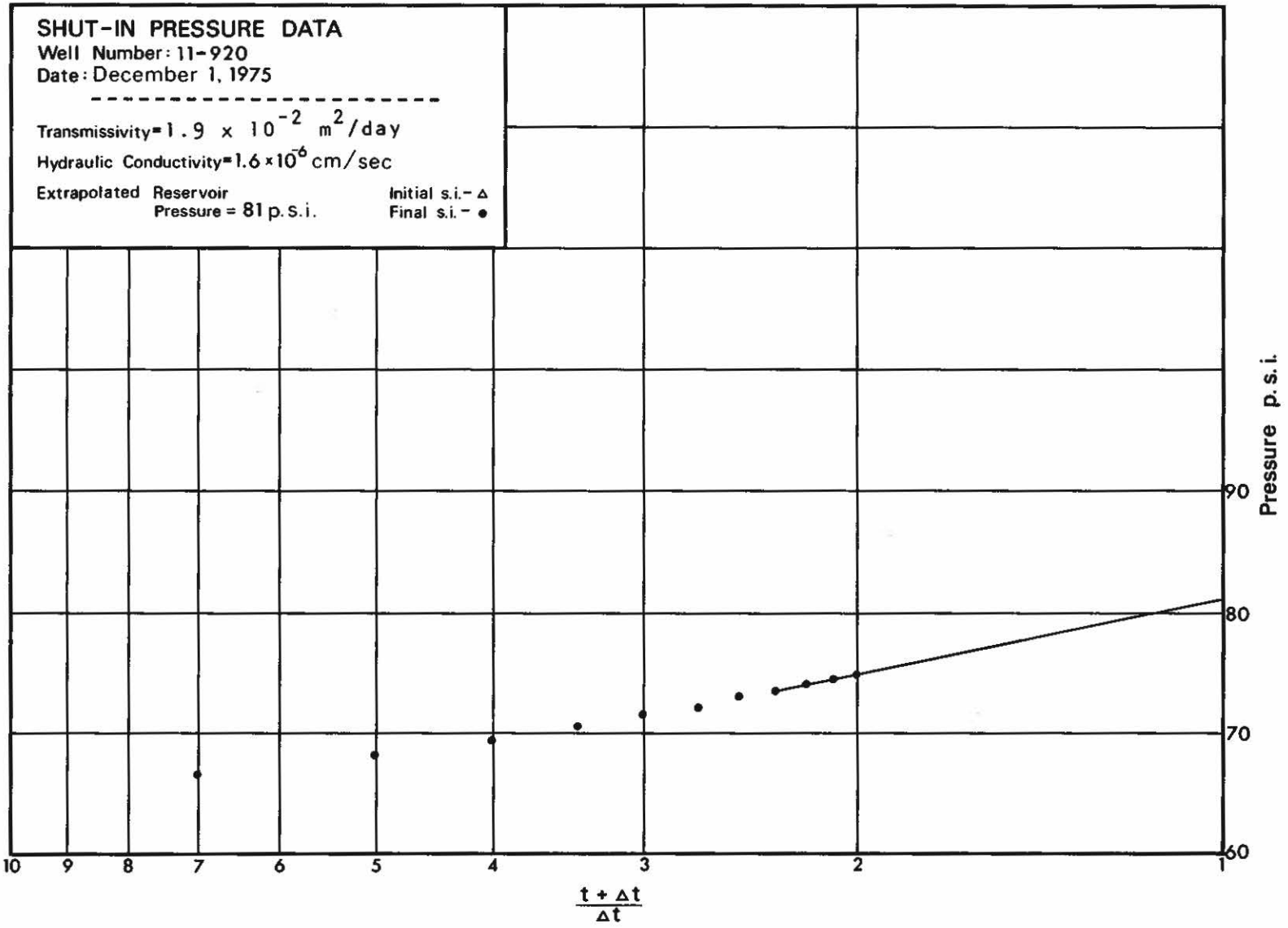
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 335.8 | 7.00 |
| 10 | 334.1 | 4.00 |
| 15 | 332.1 | 3.00 |
| 20 | 330.3 | 2.50 |
| 25 | 328.5 | 2.20 |
| 30 | 327.0 | 2.00 |



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 64.4 | 13.00 |
| 10 | 66.6 | 7.00 |
| 15 | 68.2 | 5.00 |
| 20 | 69.4 | 4.00 |
| 25 | 70.4 | 3.40 |
| 30 | 71.5 | 3.00 |
| 35 | 72.2 | 2.71 |
| 40 | 73.0 | 2.50 |
| 45 | 73.5 | 2.33 |
| 50 | 74.0 | 2.20 |
| 55 | 74.5 | 2.09 |
| 60 | 74.7 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 11-920
Date: December 1, 1975
Transmissivity = 1.9 x 10^-2 m^2/day
Hydraulic Conductivity = 1.6 x 10^-6 cm/sec
Extrapolated Reservoir Pressure = 81 p.s.i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
90
80
70
60
10
9
8
7
6
5
4
3
2
1
(t + Δt)/Δt

11-920-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Tp 87 R 9 W4th

Alberta Research Council

Elevation: gl 1409
KB 1417

Type of test Open hole, Bottom hole

Date of test December 1, 1975 11

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1100 | hrs |
| Tool opened | 1157 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1345 | hrs |
| Out of hole at | 1500 | hrs |
| Wt on packers | 15,000 | lbs |

Description of blow Weak initial puff. Faint blow on second flow.

Total water recovered 2 ft

Water sample No. - (drilling mud)

Gas blow -

Remarks

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 755-805'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Collar | 31.10 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 50.35 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 65 | 64 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 762 | 766 |
| Initial hydrostatic | A | 361 | 356 |
| First flow | B | 16 | 14 |
| | B1 | 16 | 14 |
| Initial shut in | C | 30 | 27 |
| Second flow | D | 18 | 16 |
| | D1 | 17 | 16 |
| Final shut in | G | 25 | 24 |
| Final hydrostatic | H | 356 | 353 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 11-920

INTERVAL TESTED 755-805

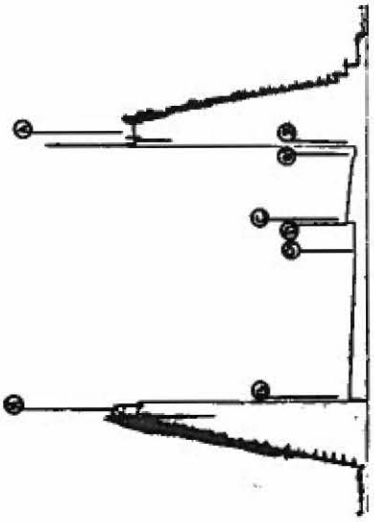
PRESSURE INCREMENTS

Recorder AK1-65

December 1, 1975 ||

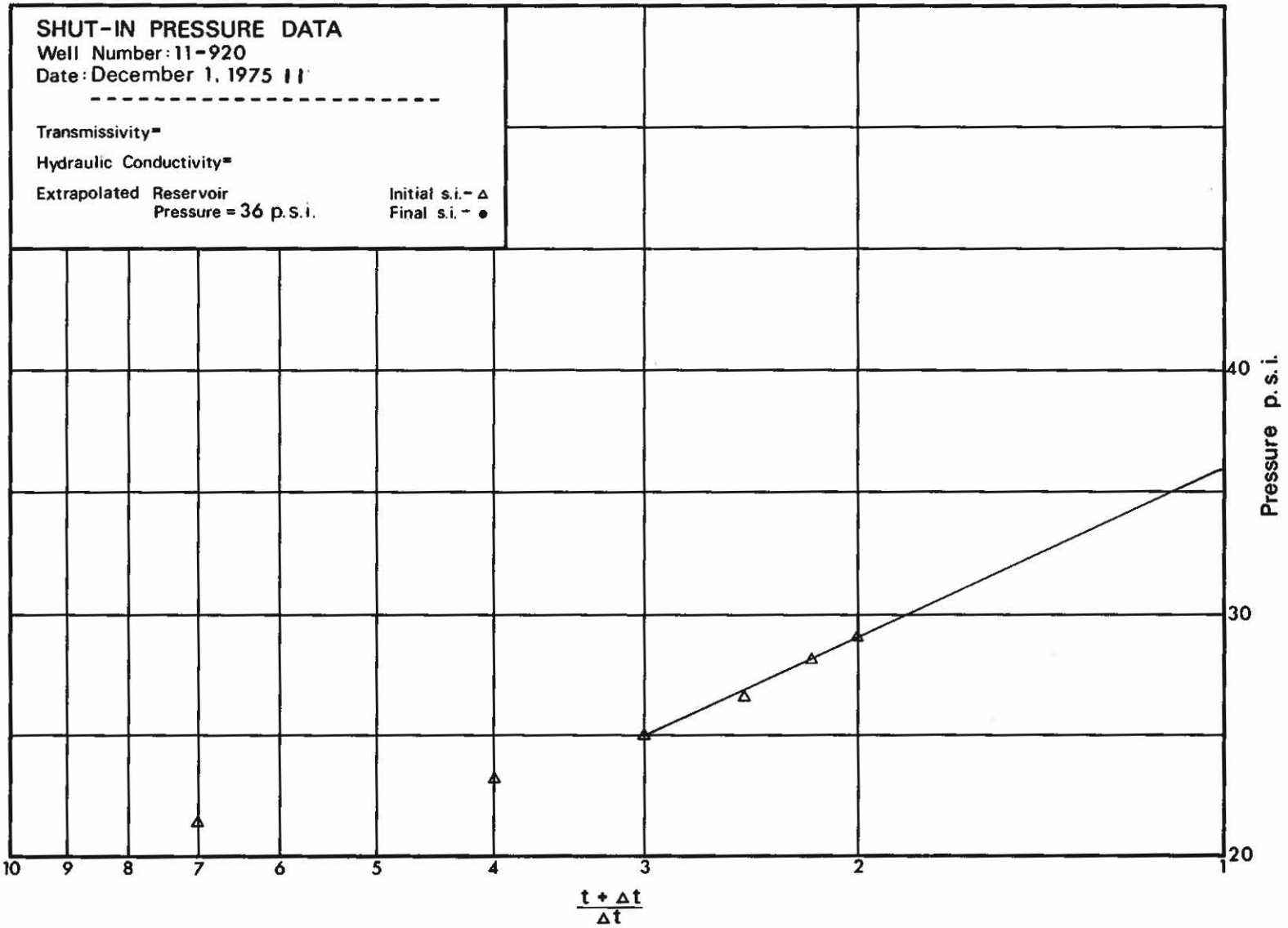
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 21.4 | 7.00 |
| 10 | 23.2 | 4.00 |
| 15 | 25.0 | 3.00 |
| 20 | 26.6 | 2.50 |
| 25 | 28.2 | 2.20 |
| 30 | 29.1 | 2.00 |

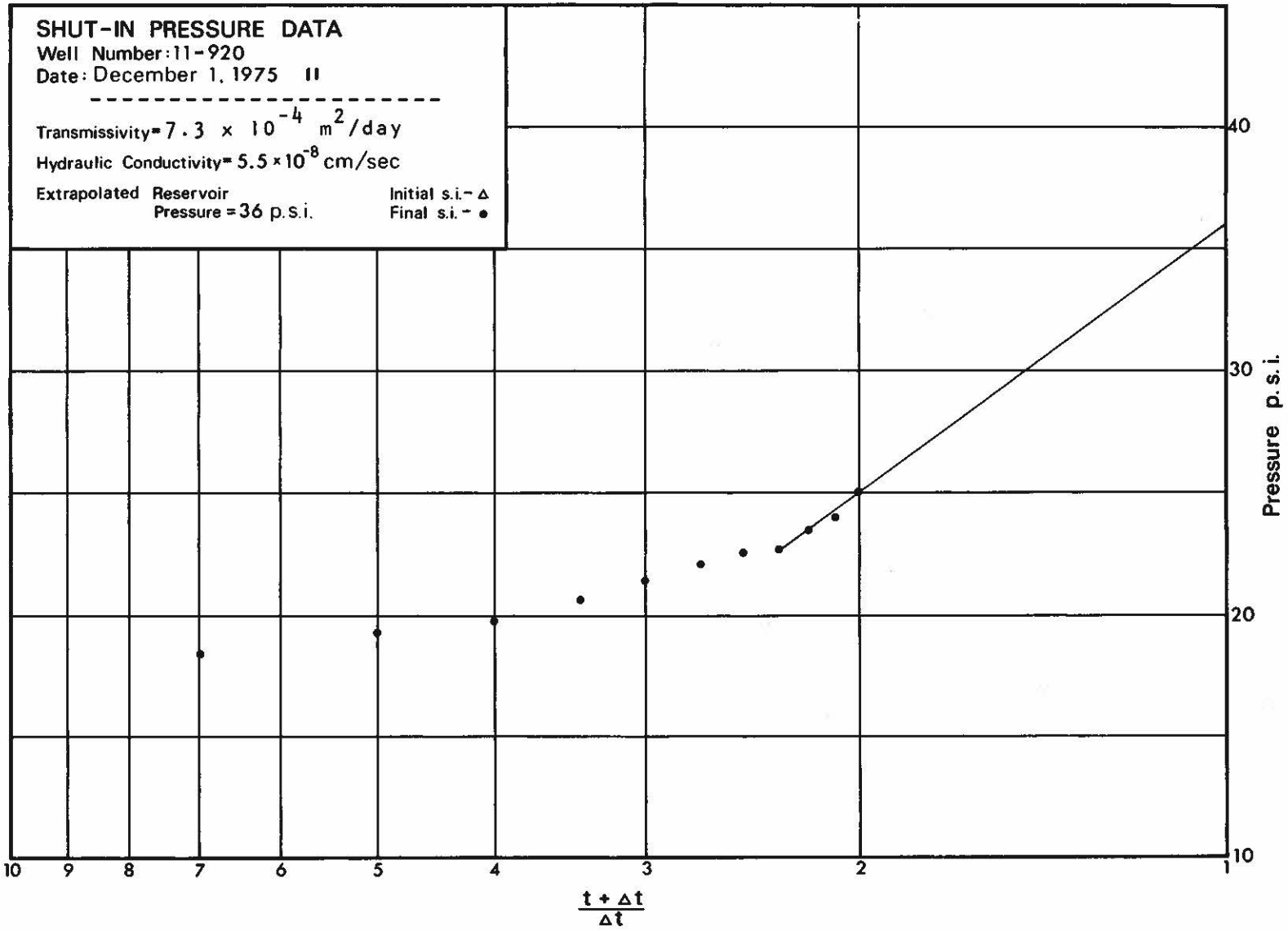


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 17.9 | 13.00 |
| 10 | 18.4 | 7.00 |
| 15 | 19.3 | 5.00 |
| 20 | 19.8 | 4.00 |
| 25 | 20.4 | 3.40 |
| 30 | 21.1 | 3.00 |
| 35 | 21.8 | 2.71 |
| 40 | 22.3 | 2.50 |
| 45 | 22.5 | 2.33 |
| 50 | 23.4 | 2.20 |
| 55 | 23.8 | 2.09 |
| 60 | 25.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 11-920
Date: December 1, 1975 11
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 36 p.s.i.
Initial s.i.- Δ
Final s.i. - •
40
30
20
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

11-920-D-77


SHUT-IN PRESSURE DATA
Well Number: 11-920
Date: December 1, 1975 II
Transmissivity = 7.3 x 10^-4 m^2/day
Hydraulic Conductivity = 5.5 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 36 p.s.i.
Initial s.i. - Δ
Final s.i. - •
40
30
20
10
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

11-920-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Tp 87 R 9 W4th

Alberta Research Council

Elevation: gl 1409
KB 1417

Type of test Open hole, Bottom hole

Date of test December 2, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0330 | hrs |
| Tool opened | 0428 | hrs |
| First flow | 2 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0615 | hrs |
| Out of hole at | 0800 | hrs |
| Wt on packers | 15,000 | lbs |

Description of blow Weak initial puff. Faint blow, dead in 2 minutes on second flow.

Total water recovered 90 ft

Water sample No. - (drilling mud)

Gas blow -

Remarks

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 805-917'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-in Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| Instrument No. | | 65 | 64 |
|---|---|---|---|
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 811 | 816 |
| Initial hydrostatic | A | 365 | 366 |
| First flow | B | 57 | 59 |
| | B1 | 57 | 59 |
| Initial shut in | C | 72 | 73 |
| Second flow | D | 59 | 61 |
| | D1 | 60 | 62 |
| Final shut in | G | 142 | 143 |
| Final hydrostatic | H | 362 | 362 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

11-920-D-77

OBSERVATION WELL NUMBER 11-920

INTERVAL TESTED 805-917

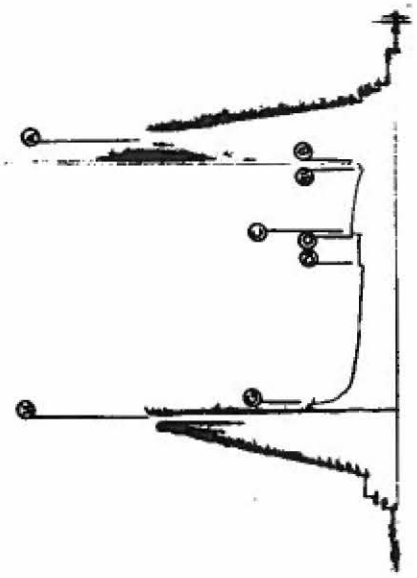
PRESSURE INCREMENTS

Recorder AK1-65

December 2, 1975

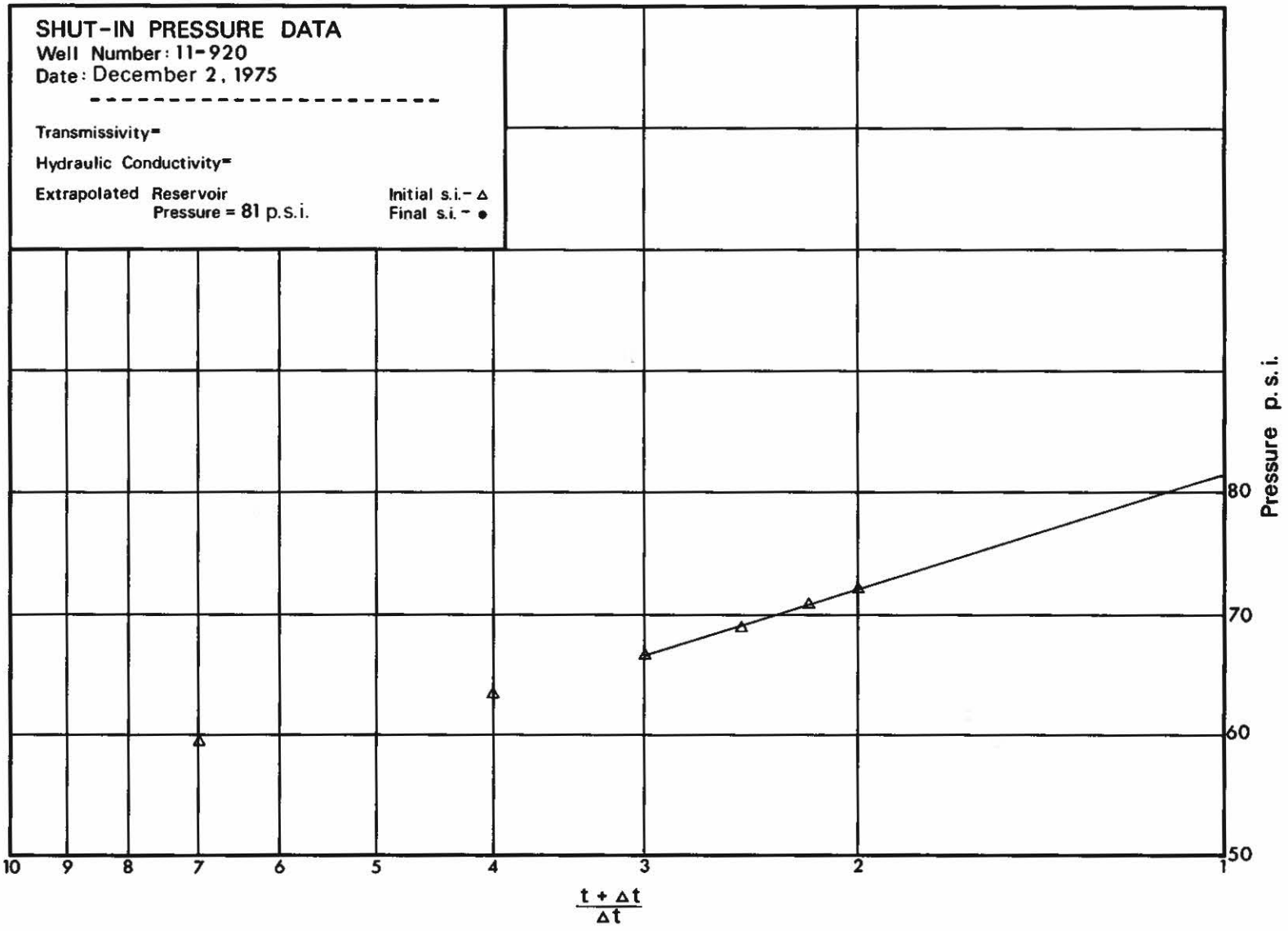
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 59.2 | 7.00 |
| 10 | 63.3 | 4.00 |
| 15 | 66.4 | 3.00 |
| 20 | 68.7 | 2.50 |
| 25 | 70.8 | 2.20 |
| 30 | 72.0 | 2.00 |

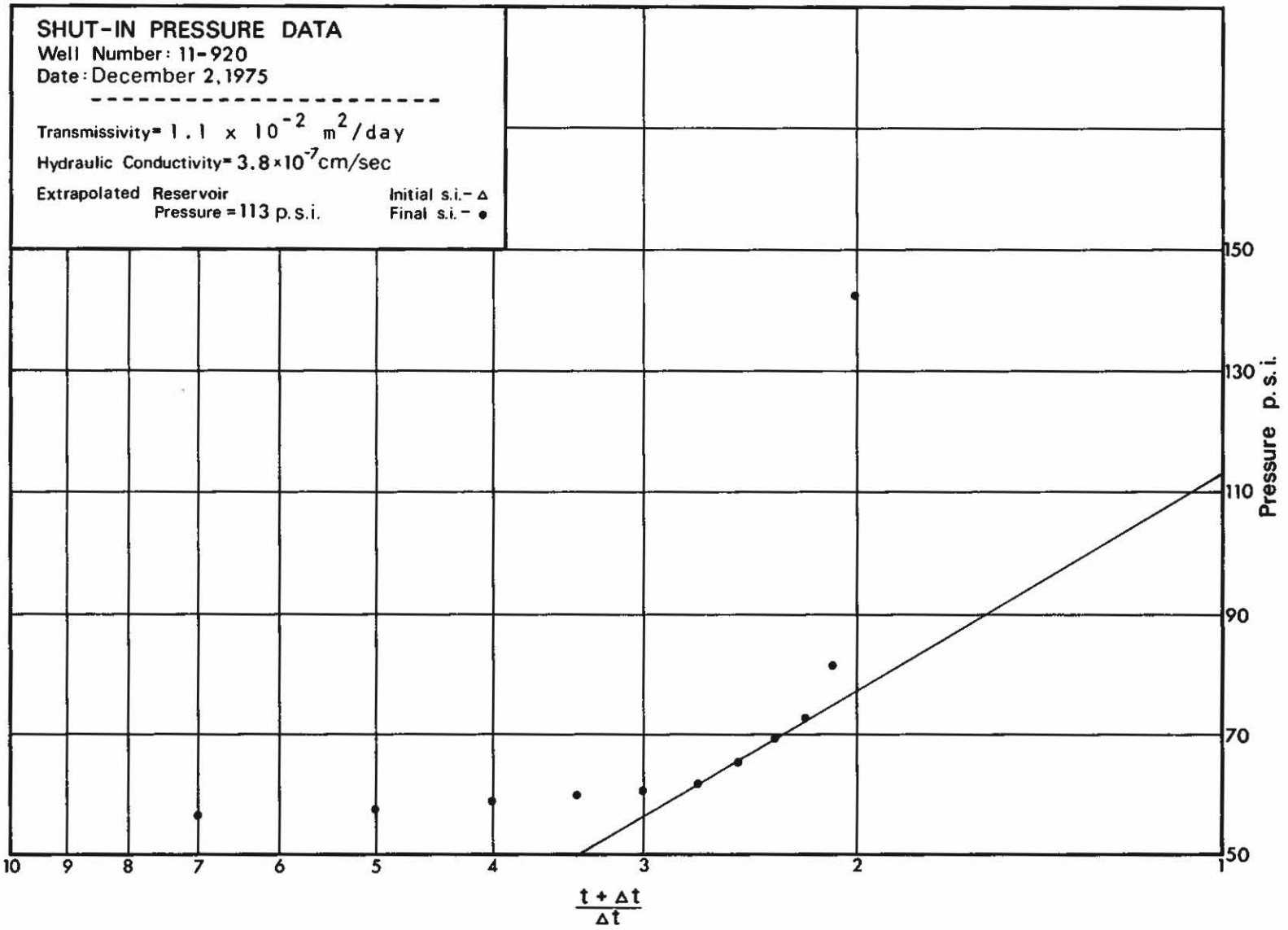


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 54.9 | 13.00 |
| 10 | 56.1 | 7.00 |
| 15 | 57.4 | 5.00 |
| 20 | 58.5 | 4.00 |
| 25 | 59.5 | 3.40 |
| 30 | 60.5 | 3.00 |
| 35 | 61.8 | 2.71 |
| 40 | 65.1 | 2.50 |
| 45 | 68.5 | 2.33 |
| 50 | 72.5 | 2.20 |
| 55 | 81.3 | 2.09 |
| 60 | 143.1 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 11-920
Date: December 2, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 81 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
80
70
60
50
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

11-920-D-77


SHUT-IN PRESSURE DATA
Well Number: 11-920
Date: December 2, 1975
Transmissivity= 1.1 x 10^-2 m^2/day
Hydraulic Conductivity= 3.8×10^-7 cm/sec
Extrapolated Reservoir Pressure = 113 p.s.i.
Initial s.i.- Δ
Final s.i. - •
150
130
110
90
70
50
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

11-920-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Tp 87 R 9 W4th

Alberta Research Council

Elevation: gl 1409
KB 1417

Type of test Casing Positrieve

Date of test December 14, 1975

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0850 | hrs |
| Tool opened | 1019 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 30 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1225 | hrs |
| Out of hole at | 1250 | hrs |
| Wt on packers | 1500 | lbs |

Description of blow Faint initial puff. Faint blow, dead in 20 minutes on second opening.

Total water recovered 15 ft

Water sample No. -

Gas blow -

Remarks Misrun, fluid level below packer; recovery due to ice tubing

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 3/8" EVE tubing

Drill collar size (ID) -

Drill collar length (ft) -

Open or screened interval 809-920'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| Sub | .43 | |
| MFE Tool | 10.03 | |
| Positrieve Packer | 2.07 | 4 1/2" |
| Total | 12.53 | |
| Packer Stub | 3.53 | |
| Recorder | 7.70 | |
| Recorder | 7.70 | |
| Total Interval | 18.93 | |

### PRESSURE DATA (psi)

| | |
|---|---|
| Instrument No. | |
| Capacity (psig) | |
| Instrument set at (ft) | |
| Initial hydrostatic | A |
| First flow | B |
| | B1 |
| Initial shut in | C |
| Second flow | D |
| | D1 |
| Final shut in | G |
| Final hydrostatic | H |

B1, D1, etc. Initial Hyd. Pressure

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source Bailed from 11-920

Date sampled February 22, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 44.0 | 2.20 | 2.5 |
| Magnesium ($Mg^{++}$) | 10.0 | 0.82 | 1.0 |
| Sodium ($Na^{+}$) | 1912.0 | 83.17 | 96.1 |
| Potassium ($K^{+}$) | 12.5 | 0.32 | 0.4 |
| Carbonate ($CO_3^{=}$) | 12.0 | 0.40 | 0.4 |
| Bicarbonate ($HCO_3^{-}$) | 39.0 | 0.64 | 0.7 |
| Sulfate ($SO_4^{=}$) | 380.0 | 7.91 | 8.9 |
| Chloride ($Cl^{-}$) | 2840.0 | 80.09 | 89.9 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 6.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 5420.0 | | |
| Total Anions (epm) | 89.0 | Total Cations (epm) | 86.5 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | |
| pH | 8.7 | pH | 10.1 |
| Fluoride ($F^{-}$) | 1.1 ppm | Carbonate ($CO_3^{=}$) | 33.8 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 5.4 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 70.0 | 3.49 | 2 |
| Magnesium ($Mg^{++}$) | 52.0 | 4.28 | 3 |
| Sodium ($Na^{+}$) | 3100.0 | 134.84 | 94 |
| Potassium ($K^{+}$) | 18.8 | 0.48 | 0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 107.0 | 1.75 | 1 |
| Sulfate ($SO_4^{=}$) | 765.0 | 15.93 | 11 |
| Chloride ($Cl^{-}$) | 4600.0 | 129.72 | 88 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 62.7 | | |
| Magnesium (Acidified) | 52.8 | | |
| Total dissolved solids | 8364 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 147.42 | Total Cations (epm) | 143.10 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 11.0 | |
| pH | 7.5 | pH | 7.7 | |
| Fluoride ($F^{-}$) | 0.9 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 93 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 12, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 76.0 | 3.79 | 1.9 |
| Magnesium ($Mg^{++}$) | 87.0 | 7.16 | 3.5 |
| Sodium ($Na^{+}$) | 4388.0 | 190.87 | 94.3 |
| Potassium ($K^{+}$) | 22.9 | 0.59 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 210.0 | 3.44 | 1.6 |
| Sulfate ($SO_4^{=}$) | 1155.0 | 24.05 | 11.5 |
| Chloride ($Cl^{-}$) | 6460.0 | 182.18 | 86.9 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 4.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 70.0 | | |
| Magnesium (Acidified) | 89.0 | | |
| Total dissolved solids | 12350.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 209.67 | Total Cations (epm) | 202.40 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 10.0 |
| pH | 7.8 | pH | 8.0 |
| Fluoride ($F^{-}$) | 0.9 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 190.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Date sampled: July 20, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .107 |
| Au | <.003 | Mo | <.006 |
| Al | 0.11 | Na | 3014 |
| As | <.038 | Ni | <.010 |
| B | 2.24 | P | 0.99 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 56.5 | Si | 1.38 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 2.18 |
| Cr | <.006 | Te | <.065 |
| Cu | .012 | Ti | .003 |
| Eu | <.015 | U | <.020 |
| Fe | .033 | V | .009 |
| K | 99 | W | <.078 |
| Mg | 44.0 | Zn | .044 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 83.0 | 4.14 | 1.8 |
| Magnesium(Mg) | 110.0 | 9.05 | 3.9 |
| Sodium(Na) | 5075.0 | 220.75 | 94.1 |
| Potassium(K) | 25.4 | 0.65 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 310.0 | 5.08 | 2.2 |
| Sulphate(SO4) | 1088.0 | 22.65 | 9.8 |
| Chloride(Cl) | 7220.0 | 203.61 | 88.0 |
| Nitrate(NO3) | 2.6 | 0.04 | 0.0 |
| Silica(SiO2) | 4.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 81.0 | | |
| Magnesium(Acidified) | 105.0 | | |
| TDS(mg/l) | 14112.0 | | |
| Total Anions(epm) | 231.39 | Total Cations(epm) | 234.59 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 20200 | | Temperature(C) | 10.00 | |
| pH | 7.6 | | pH | 7.6 | |
| Fluoride(F) | 0.7 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 258 | mg/l |
| | | | Hydroxide(OH) | | |

11-920-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 12, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 82.0 | 4.09 | 1.6 |
| Magnesium(Mg) | 122.0 | 10.04 | 3.9 |
| Sodium(Na) | 5525.0 | 240.32 | 94.2 |
| Potassium(K) | 26.7 | 0.68 | 0.3 |
| Carbonate(CO3) | 9.6 | 0.32 | 0.1 |
| Bicarbonate(HCO3) | 266.0 | 4.36 | 1.6 |
| Sulphate(SO4) | 1106.0 | 23.03 | 8.5 |
| Chloride(Cl) | 8600.0 | 242.53 | 89.7 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 3.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 88.0 | | |
| Magnesium(Acidified) | 110.0 | | |
| TDS(mg/l) | 15016.0 | | |
| Total Anions(epm) | 270.24 | Total Cations(epm) | 255.14 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 22000 | Temperature(C) | 9.50 | |
| pH | 8.4 | pH | 7.9 | |
| Fluoride(F) | 1.1 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 220 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 11-920-E-82

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Rge 9 Twp 87 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 4, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 104.0 | 5.20 | 2.0 |
| Magnesium(Mg) | 128.0 | 10.67 | 4.0 |
| Sodium(Na) | 5700.0 | 247.83 | 93.7 |
| Potassium(K) | 26.0 | 0.67 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 322.0 | 5.28 | 1.9 |
| Sulphate(SO4) | 510.0 | 10.63 | 3.8 |
| Chloride(Cl) | 9400.0 | 264.79 | 94.3 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 3.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 83.0 | | |
| Magnesium(Acidified) | 107.0 | | |
| TDS(mg/l) | 16576.0 | | |
| Total Anions(epm) | 280.69 | Total Cations(epm) | 264.36 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 25000 | Temperature | 13.00 | |
| pH | 8.2 | pH | 7.9 | |
| Fluoride | 0.7 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 322 | mg/l |
| | | Hydroxide(OH) | | |

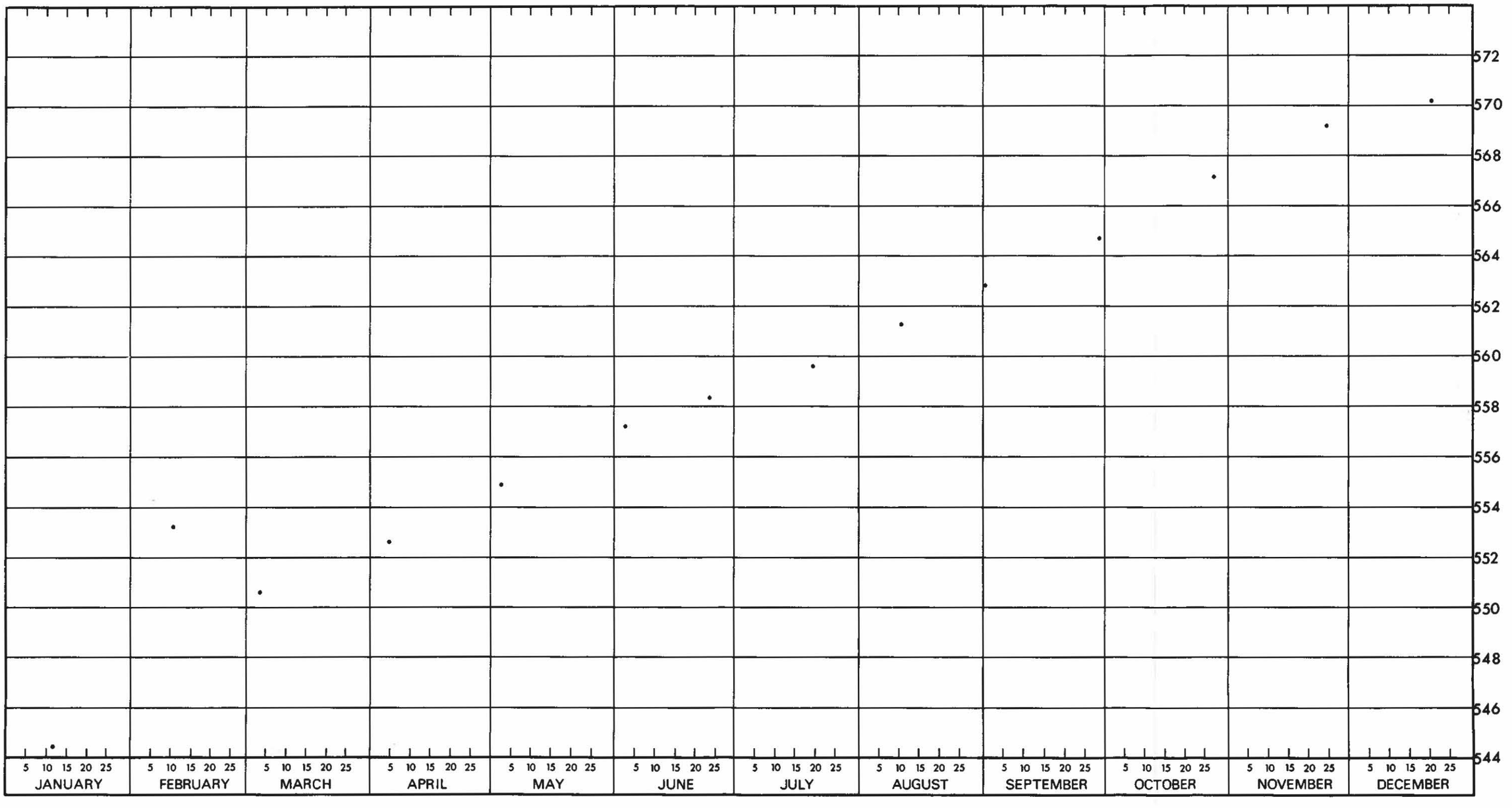
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

11 - 920 - H - 77




1976

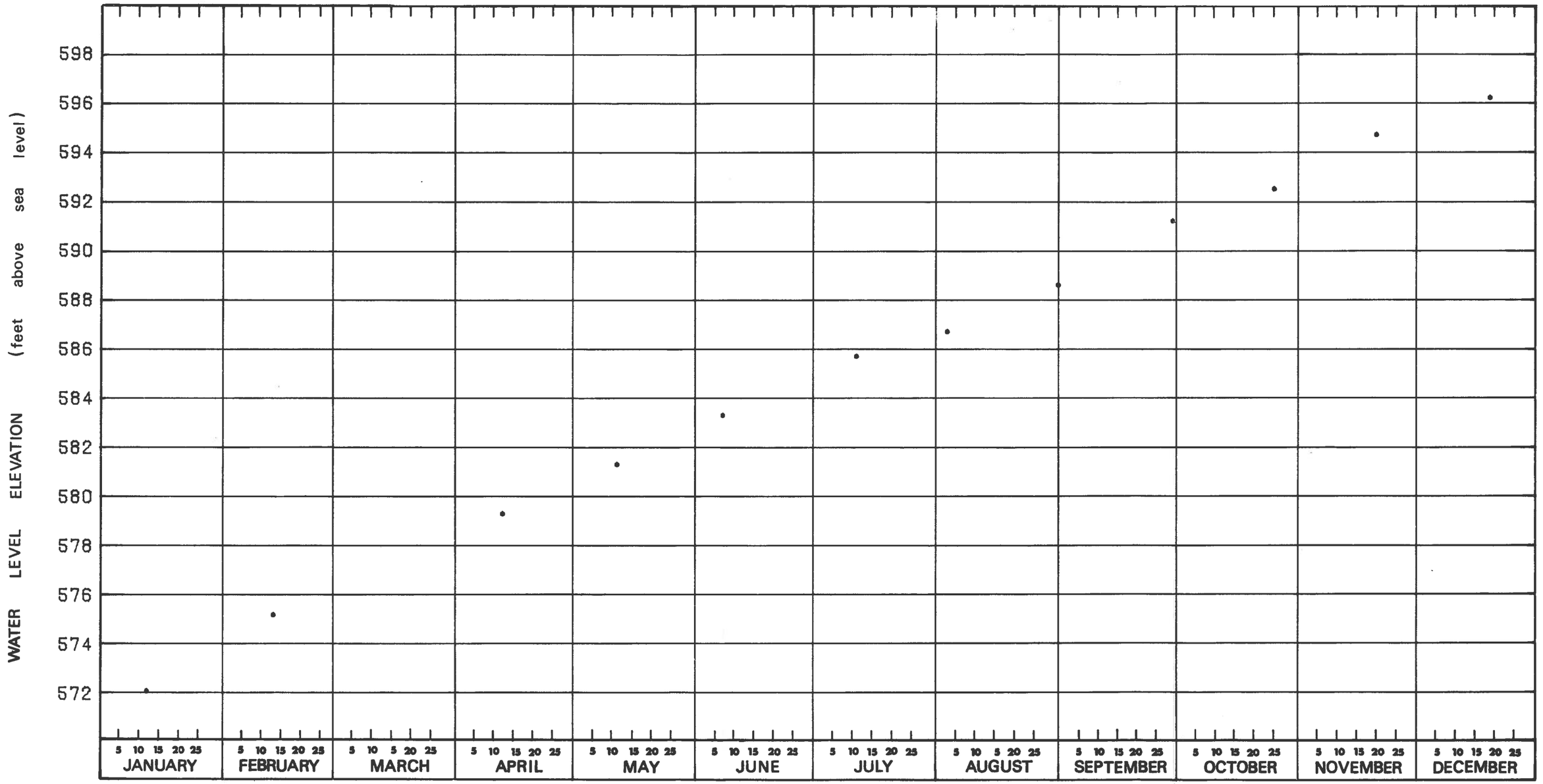
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-920-H-78




1977

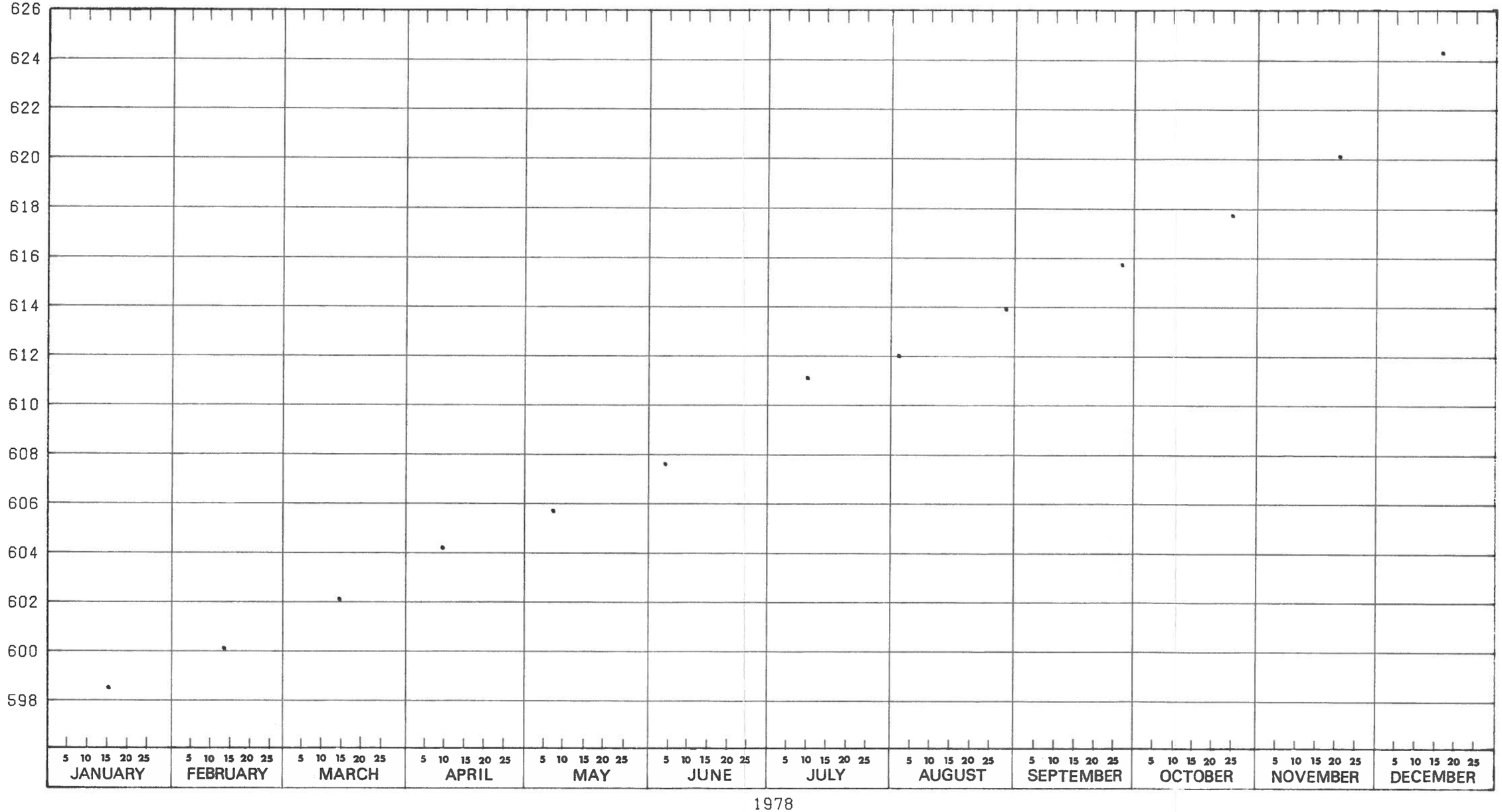
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-920

LSD 16 SEC 2 TWP 87 R 9 W4TH

11-920-H-79

Alberta Research Council




1978

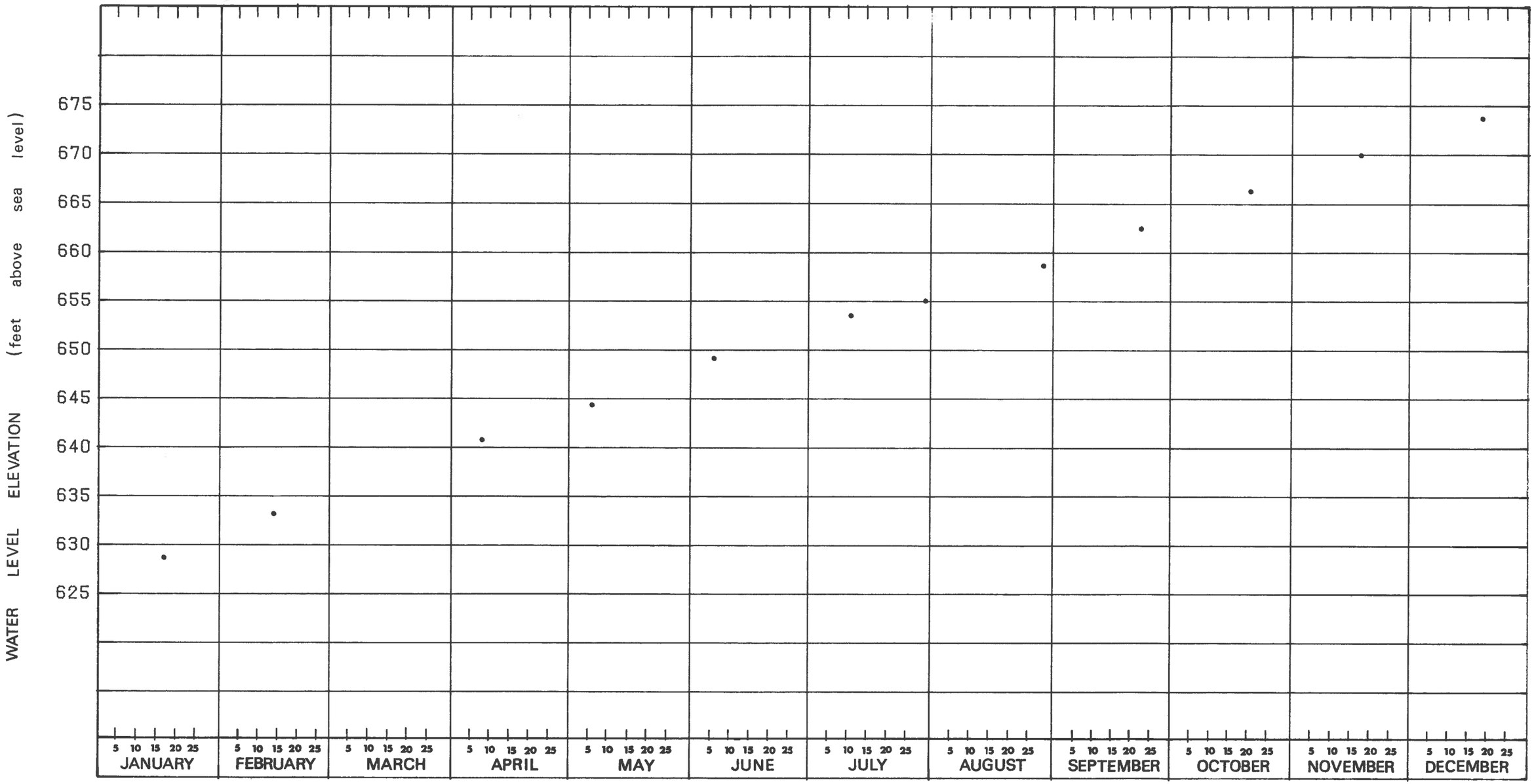
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-920-H-80



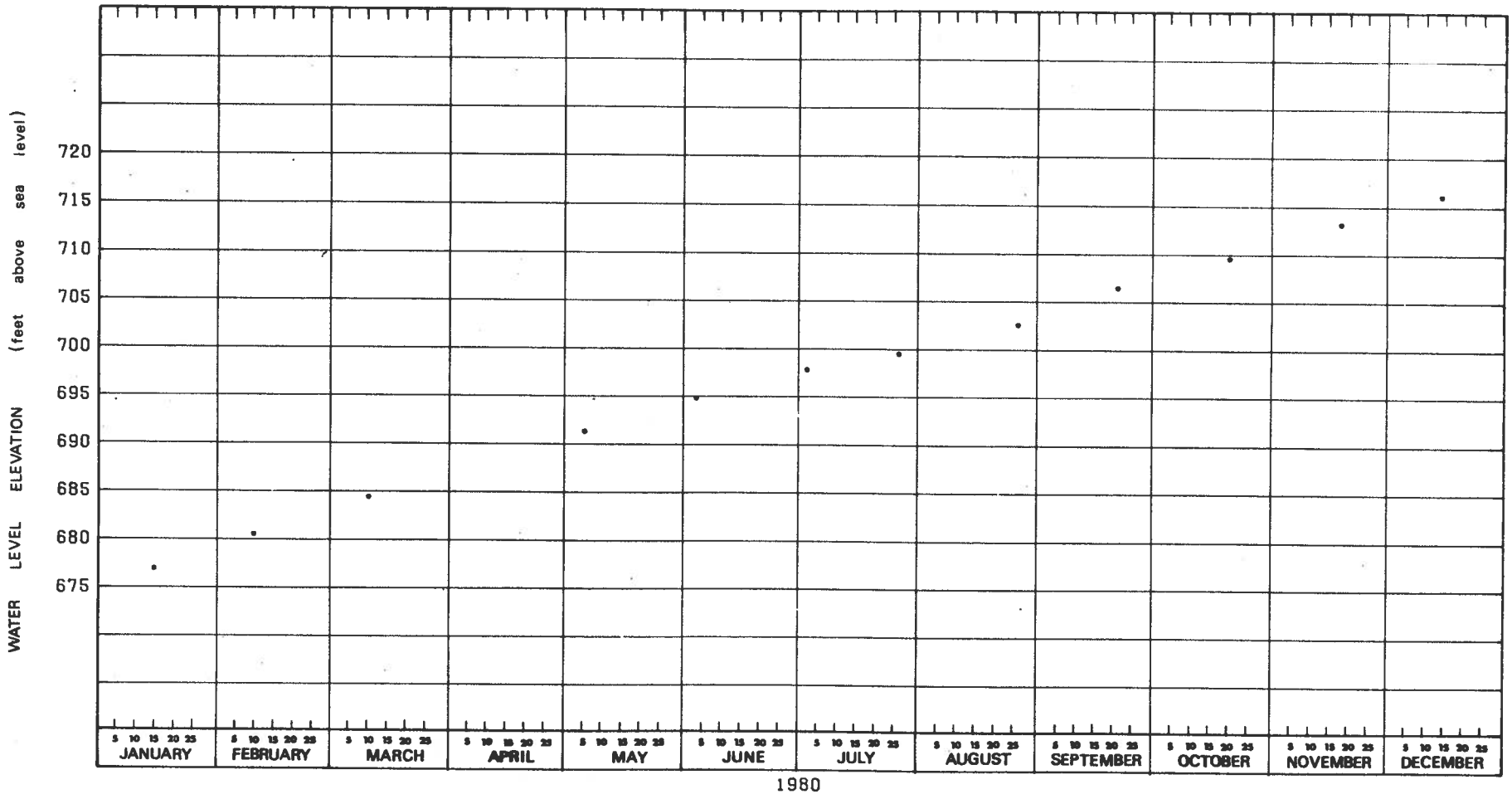
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-920-H-81



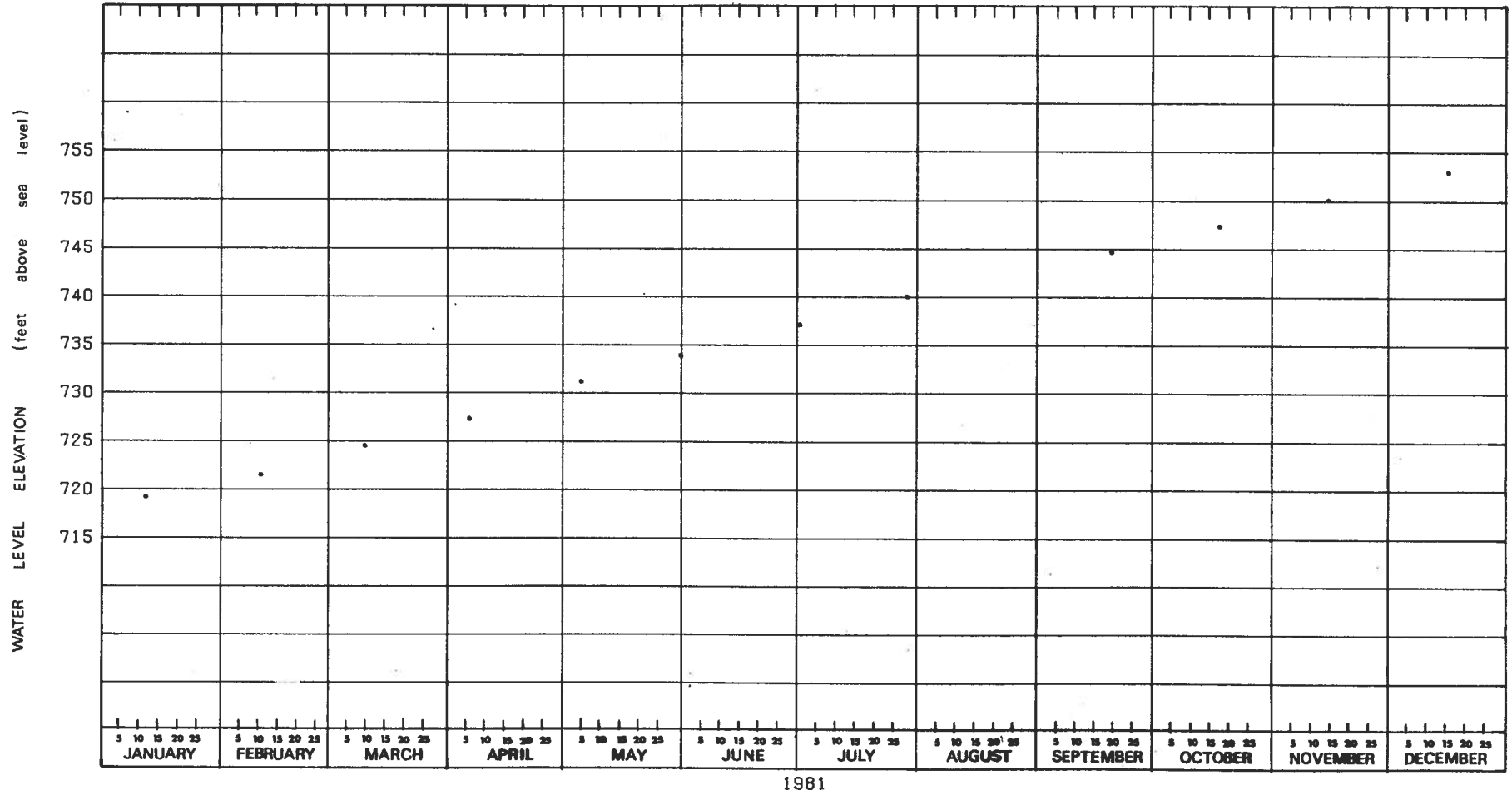
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4 th

Alberta Research Council

11-920-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1410.47

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Dec 3/75 | | | Well completed; blown down with air |
| Dec 4/75 | 264.90 TOC | 541.6 | |
| Dec 18/75 | 262.62 TOC | 549.1 | |
| Dec 19/75 | | | Install shelter; MP = 0.85 m TOC, (1413.3) |
| Jan 12/76 | 264.90 MP | 544.4 | |
| Feb 11/76 | 262.20 MP | 553.3 | |
| Mar 4/76 | 263.01 MP | 550.6 | |
| Apr 5/76 | 262.40 MP | 552.6 | |
| May 3/76 | 261.70 MP | 554.9 | |
| June 3/76 | 260.99 MP | 557.2 | |
| June 24/76 | 260.66 MP | 558.3 | |
| July 20/76 | 260.26 MP | 559.6 | Sampled; temp. 11°C |
| Aug 11/76 | 259.75 MP | 561.3 | |
| Sept 1/76 | 259.27 MP | 562.9 | |
| Sept 29/76 | 258.71 MP | 564.7 | |
| Oct 28/76 | 257.96 MP | 567.2 | |
| Nov 25/76 | 257.34 MP | 569.2 | |
| Dec 21/76 | 256.75 MP | 571.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1410.47

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 13/77 | 256.46 MP | 572.1 | MP (1413.3) |
| Feb 14/77 | 255.52 MP | 575.2 | |
| Mar 17/77 | | | >200 m |
| Apr 13/77 | 254.26 MP | 579.3 | |
| May 12/77 | 253.65 MP | 581.3 | |
| June 8/77 | 253.05 MP | 583.3 | |
| July 12/77 | 252.32 MP | 585.7 | Sampled; temp. 10°C |
| Aug 4/77 | 252.01 MP | 586.7 | |
| Sept 1/77 | 251.43 MP | 588.6 | |
| Sept 30/77 | 250.64 MP | 591.2 | |
| Oct 26/77 | 250.25 MP | 592.5 | |
| Nov 21/77 | 249.57 MP | 594.7 | |
| Dec 20/77 | 249.10 MP | 596.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1410.47

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/78 | 248.42 MP | 598.5 | MP (1413.3) |
| Feb 14/78 | 247.93 MP | 600.1 | |
| Mar 15/78 | 247.33 MP | 602.1 | |
| Apr 10/78 | 246.67 MP | 604.2 | |
| May 8/78 | 246.21 MP | 605.7 | |
| June 5/78 | 245.65 MP | 607.6 | |
| July 11/78 | 244.56 MP | 611.1 | Sampled; temp. 10°C |
| Aug 3/78 | 244.29 MP | 612.0 | |
| Aug 30/78 | 243.73 MP | 613.9 | |
| Sept 28/78 | 243.17 MP | 615.7 | |
| Oct 26/78 | 242.56 MP | 617.7 | |
| Nov 22/78 | 241.84 MP | 620.1 | |
| Dec 18/78 | 240.55 MP | 624.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 11-920

Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1410.47

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 239.25 MP | 628.6 | MP (1413.3) |
| Feb 15/79 | 237.86 MP | 633.1 | |
| Mar 15/79 | | | Could not measure |
| Apr 9/79 | 235.56 MP | 640.7 | |
| May 7/79 | 234.44 MP | 644.3 | |
| June 7/79 | 232.98 MP | 649.1 | |
| July 12/79 | 231.65 MP | 653.5 | Sampled; temp. 9.5°C |
| July 31/79 | 231.18 MP | 655.0 | |
| Aug 30/79 | 230.08 MP | 658.6 | |
| Sept 24/79 | 228.92 MP | 662.4 | |
| Oct 22/79 | 227.77 MP | 666.2 | |
| Nov 19/79 | 226.64 MP | 669.9 | |
| Dec 20/79 | 225.48 MP | 673.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 11 - 920

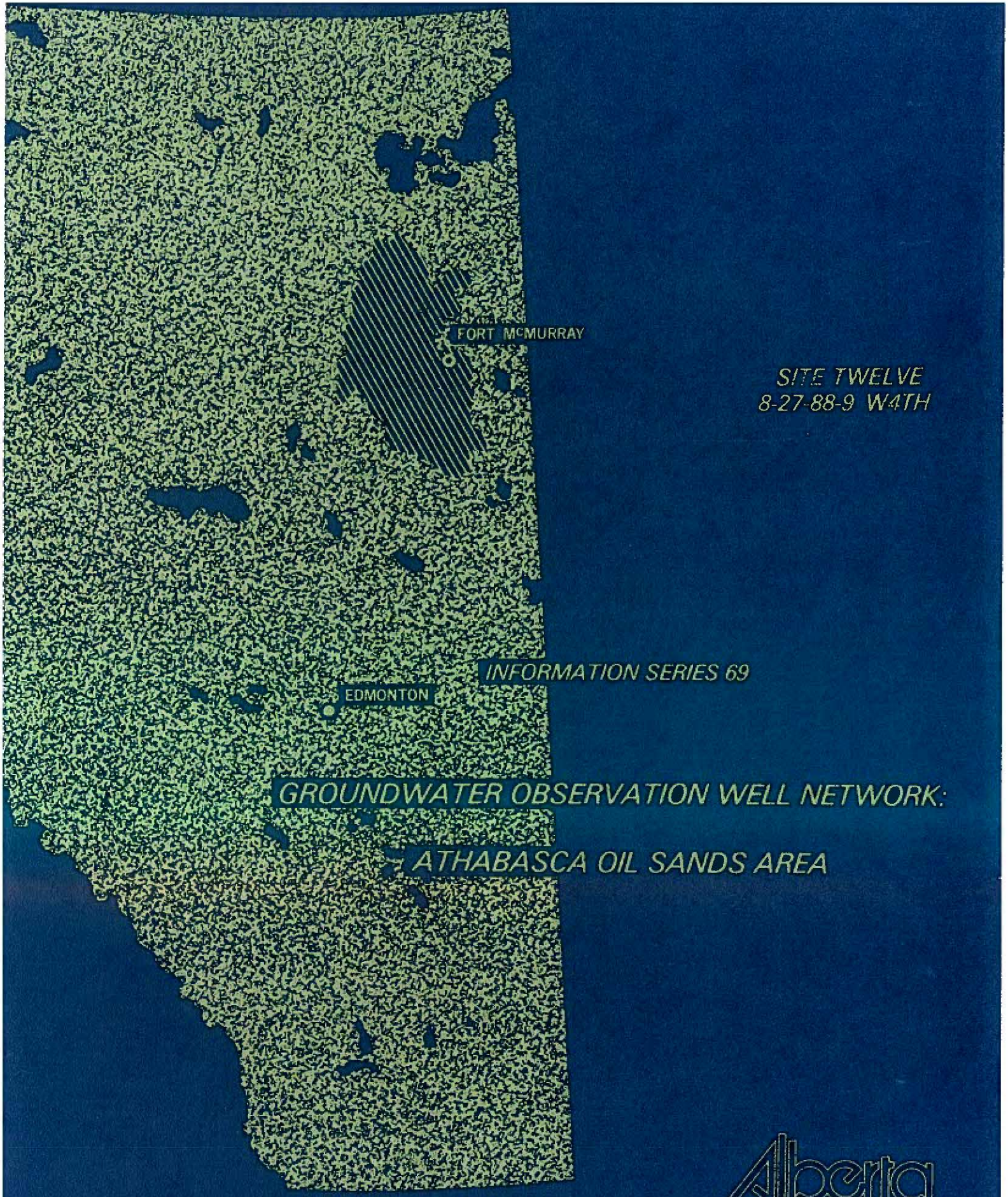
Lsd 16 Sec 2 Twp 87 R 9 W4th

Alberta Research Council

Elevation of top of casing 1410.47

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 224.52 MP | 676.9 | |
| Feb 11/80 | 223.42 MP | 680.5 | |
| Mar 12/80 | 222.23 MP | 684.4 | |
| Apr 8/80 | | | Could not measure |
| May 7/80 | 220.11 MP | 691.3 | |
| June 5/80 | 219.05 MP | 694.8 | |
| July 4/80 | 218.15 MP | 697.8 | Temp. 13°C |
| July 28/80 | 217.63 MP | 699.5 | |
| Aug 28/80 | 216.66 MP | 702.6 | |
| Sept 23/80 | 215.50 MP | 706.5 | |
| Oct 22/80 | 214.55 MP | 709.6 | |
| Nov 20/80 | 213.46 MP | 713.2 | |
| Dec 16/80 | 212.56 MP | 716.1 | |
| Jan 13/81 | 211.63 MP | 719.2 | |
| Feb 12/81 | 210.92 MP | 721.5 | |
| Mar 11/81 | 210.01 MP | 724.5 | |
| Apr 7/81 | 209.14 MP | 727.3 | |
| May 6/81 | 207.95 MP | 731.2 | |
| June 1/81 | 207.13 MP | 733.9 | |
| July 2/81 | 206.15 MP | 737.1 | |
| July 30/81 | 205.27 MP | 740.0 | |
| Sept 21/81 | 203.83 MP | 744.7 | |
| Oct 19/81 | 203.02 MP | 747.4 | |
| Nov 16/81 | 202.20 MP | 750.1 | |
| Dec 17/81 | 201.30 MP | 753.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing




SITE TWELVE
8-27-88-9 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

## ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

## INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites (numbers 1, 2, 3, 6, 7, 8 and 9), containing 36 individual wells, were instrumented in this manner during the winter of 1974-75. Eight sites (numbered 10, 11, 12, 13, 14, 15 16 and 17), containing 38 individual wells, were instrumented during the winter of 1975-76.

The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The page indexing system is also consistent with the updating process. All update volumes will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this Introduction and a Legend. There are 15 piezometer nests in the system and thus there are 15 separate

site publications in Information Series 69. Table 1 lists the location of wells in the system as of August 31, 1976. Figure 1 indicates the location of these wells. Publications are available as of the date of this document for all sites.

Five oil companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing.

## ACKNOWLEDGMENTS

The installation and monitoring of wells in this Program was funded by Alberta Energy and Natural Resources; Non-Renewable Resources Division.

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1976: BPOG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., Shell Canada Ltd. and Home Oil Company Ltd.

D. Hackbarth

EDMONTON

1977

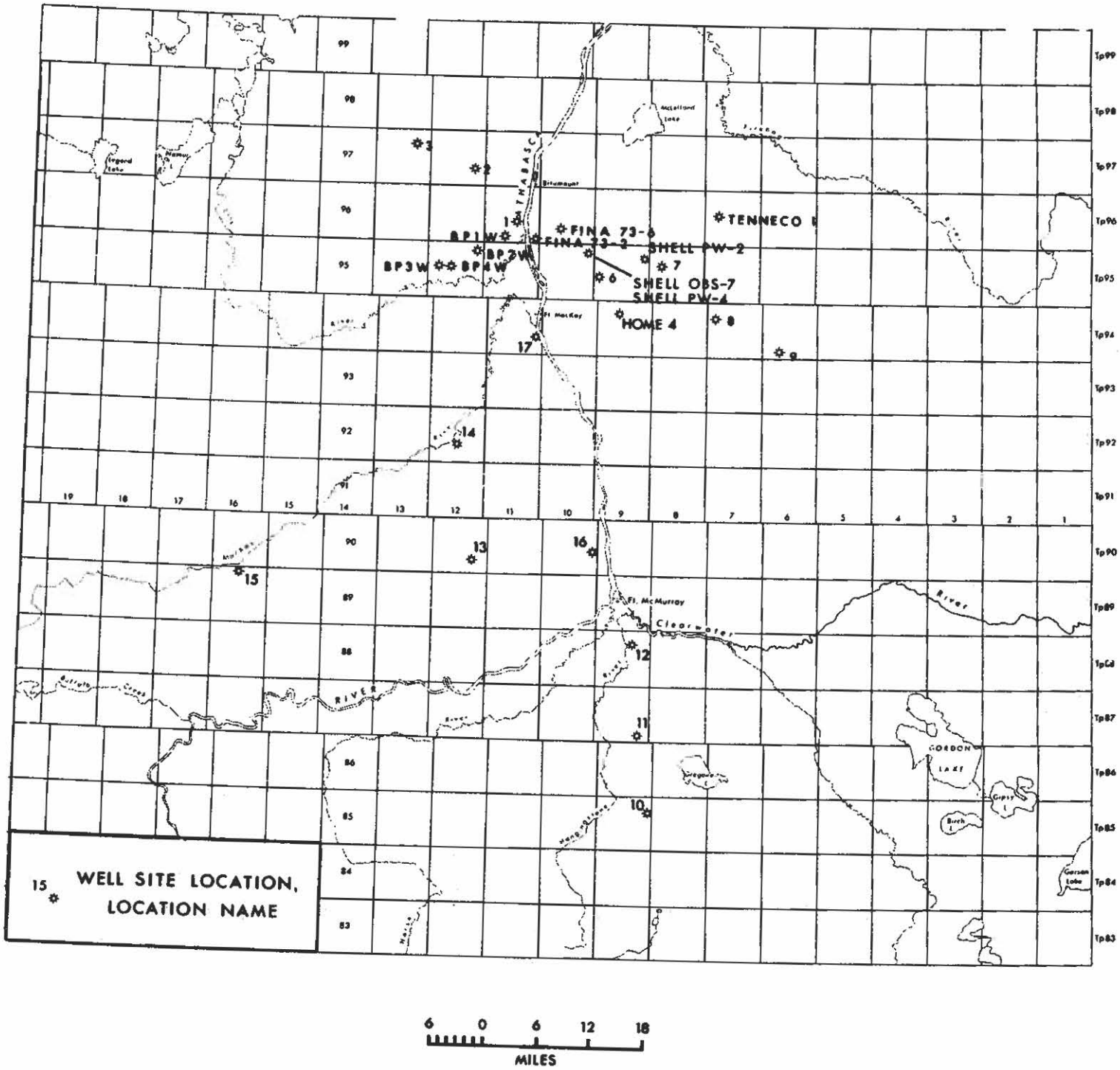



FIGURE 1. Athabasca Oil Sands observation well network, January 1977

Table 1

Athabasca Oil Sands Observation Wells

August 31, 1976

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 9-24-85-9 | 10 |
| Lsd 16-2-87-9 | 11 |
| Lsd 8-27-88-9 | 12 |
| Lsd 8-11-90-12 | 13 |
| Lsd 4-15-92-12 | 14 |
| Lsd 15-33-89-16 | 15 |
| Lsd 6-13-90-10 | 16 |
| Lsd 13-12-94-11 | 17 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |
| Lsd 3-28-94-9 | Home 4 |
| Lsd 10-25-95-10 | Shell PW-4 |
| Lsd 10-24-95-9 | Shell PW-2 |
| Lsd 10-25-95-10 | Shell Obs-7 |

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

| | | |
|---|---|---|
| Well Number | - | the name used for designating the well |
| Subject Code | - | as follows: |
| I | - | Introduction (no site number indicated) |
| L | - | Legend (no site number indicated) |
| G | - | General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents |
| C | - | Well construction details |
| D | - | Drill stem testing |
| A | - | Aquifer testing |
| E | - | Chemical analyses including multielement analyses and routine water analyses |
| H | - | Annual hydrograph |
| W | - | Well history |
| Year of Publication | - | the last two numerals of the year of publication. |

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within tha tabbed section for that particular well.

GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
| | sandstone, arkosic |
| | silt |
| | siltstone |
| | siltstone & sandstone |
| | clay |
| | clay, sandy |
| | claystone, shale |
| | sandstone & shale |
| | oil sand |
| | limestone |
| | limestone, shaley |
| | dolomite |
| | dolomite, argillaceous |
| | rock salt |
| | gypsum & anhydrite |
| | coal |
| | igneous rock |

| Symbol | Stratigraphic Unit |
|---|---|
| | Pleistocene and Recent |
| Qd | Surface deposits |
| | Cretaceous |
| Ks | Smoky Group |
| Klb | La Biche Formation |
| Kd | Dunvegan Formation |
| Ksh | Shaftesbury Formation |
| Kpl | Pelican Formation |
| Kj | Joli Fou Formation |
| Kg | Grand Rapids Formation |
| Kc | Clearwater Formation |
| Kw | Wabiskaw Member |
| Km | McMurray Formation |
| | Devonian |
| Dwd | Woodbend Group |
| Dbl | Beaverhill Lake Formation |
| Dsw | Slave Point Formation & Fort Vermilion Formation & Watt Mountain Formation |
| Dmk | Muskeg Formation |
| Dpe | Prairie Evaporite Formation |
| Dm | Methy Formation (Keg River Formation equivalent) |
| Dmr | McLean River Formation (Chinchaga Formation equivalent) |
| Dl | La Loche Formation |
| | Precambrian |
| Pe | Undivided |

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

1. drill to about 5 feet above the zone
2. land casing and cement to surface
3. drill through the aquifer using very light mud
4. insert a screening device (if necessary)
5. develop the well with air.

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma, caliper and neutron were the logs run during the 1975-76 drilling. Results of the caliper logs are not presented. The geological log presented represents an interpretation based upon the sample

description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

4) A summary of contents page noting the number of pages in each of the subject areas that have been issued for that site. Pages which have been replaced because of errors are noted in the total.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells where the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, some wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the measuring tape sticking to the wet casing.

Drill stem testing equipment was utilized in two manners during the 1975-76 drilling program. Open hole - bottom hole drill stem tests

were conducted in the Devonian sediments to locate relatively productive zones for well completion. Casing tests were performed on completed wells at Site 10, 11 and 15 because of great depth to water or low permeability in the completion zone.

Information from these drill stem tests is presented under the heading "Drill Stem Testing". Results of open hole - bottom hole tests are presented in the section containing information about the deepest well at the Site as this is the hole in which the tests were conducted. An exception to this is at Site 14 where three tests were conducted on hole 14-699 and six tests performed in 14-1590.

A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day

V = volume of production into drill collars and stem

t = total flow time of test

T = transmissivity in millidarcy-feet

M = slope of final shut-in pressure plot

K = permeability in millidarcys (1 millidarcy = $10^{-6}$ cm/sec)

h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot. Calculations of transmissivity are according to the Modified Nonequilibrium Formula or the analogous Recovery Formula as follows:

$$T = \frac{0.92\ Q\ \log_{10}\ (t_2/t_1)}{d_2 - d_1} : \quad \text{(For pumping)}$$

or

$$T = \frac{0.92\ Q\ \log_{10}\ \left[\left(\frac{t + t'}{t'}\right)_2 - \left(\frac{t + t'}{t'}\right)_1\right]}{d_2 - d_1} : \quad \text{(For recovery)}$$

where:

$d_2$, $d_1$ = depth to water at corresponding subscripted time (meters) $d_2 > t_1$

$t_2$, $t_1$ = time since pumping started, $t_2 > t_1$

$t$ = length of time pumping

$t'$ = time since pumping stopped: $\left(\frac{t + t'}{t'}\right)_2 > \left(\frac{t + t'}{t'}\right)_1$

$T$ = transmissivity in sequence meters per day

$Q$ = pumping rate in imperial gallons per minute

That portion of the drawdown plot used to calculate the transmissivity is indicated on each drawing.

## SUMMARY OF CONTENTS

SITE NUMBER TWELVE

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

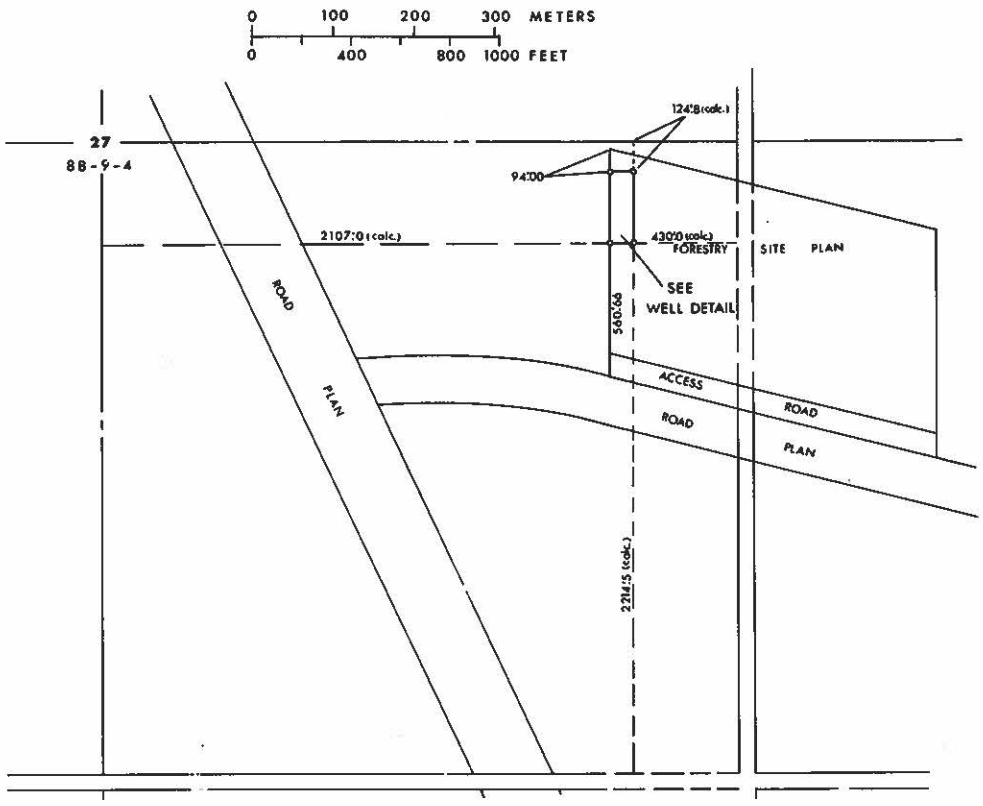
number of pages distributed for this site in 1977

| page title | well name | | | | |
|---|---|---|---|---|---|
| | site | 12-115 | 12-270 | 12-460 | 12-1092 |
| Introduction | 4 | — | — | — | — |
| Legend | 9 | — | — | — | — |
| Site Plan | 1 | — | — | — | — |
| Geological Sample Description | 4 | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 0 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 0 | 11 |
| Shut-In Pressure Data | — | 0 | 0 | 0 | 7 |
| Water Analysis | — | 0 | 0 | 2 | 2 |
| Water Level Hydrograph | — | 1 | 0 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 |

OBSERVATION WELL SITE 12

8-27-88-9 W 4th

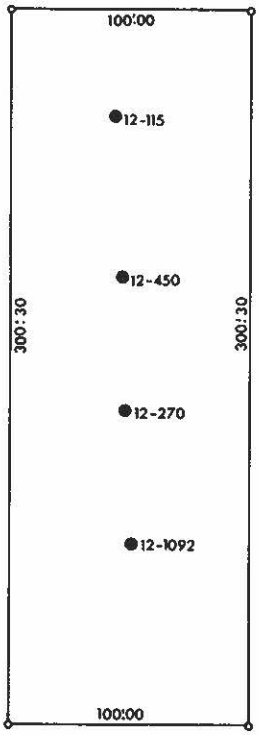
ALBERTA RESEARCH COUNCIL




WELLSITE DETAIL

0 10 20 30 METERS

0 40 80 100 FEET



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Twelve

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Ground elevation 1221 Total depth 1092 feet

KB elevation 1229

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 8 | 30 | Sand, lt grey, medium-coarse grained, angular, poorly sorted, excellent porosity, qtz, fld, lt chert, argillaceous, calc, boulderchips | Drift |
| 30 | 40 | Silt, grey, sandy, argillaceous, qtz, fld, calc, boulderchips | |
| 40 | 50 | Silt, brown, sandy, qtz, fld, argillaceous, ferruginous, calc | |
| 50 | 60 | Sand, brown, silty-coarse grained, angular, poorly sorted, good-excellent porosity, qtz, fld, pebbles of qtz and fld, boulderchips | |
| 60 | 70 | Sand, as above, argillaceous | |
| 70 | 100 | Sand, grey and brown, silty-coarse grained, angular, poorly sorted, excellent porosity, qtz, lt chert, fld, hvy mnrl, argillaceous, some pebbles and boulderchips | |
| 100 | 110 | Sand, lt grey, medium-coarse grained, angular, poorly sorted, excellent porosity, some pebbles, qtz, lt chert, fld, hvy mnrl | |
| 110 | 120 | Sand, lt grey, silty, argillaceous, qtz, with medium grey shale strgrs | |
| 120 | 130 | Siltstone, medium grey, sandy, argillaceous, calc cement, shale, medium grey, interbedded in the bottom | Clearwater |
| 130 | 150 | Shale, medium grey, calc cement, carbonaceous in bottom, siltstone strgrs | |
| 150 | 170 | Siltstone, medium grey, sandy, calc cement | |
| 170 | 180 | Clay, medium grey, silty | |
| 180 | 220 | Sandstone, lt-medium grey, fine grained, silty, fair-good porosity, qtz, fld, glauc, pyrite, medium grey clay strgrs | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Twelve (continued)

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 220 | 235 | Clay, medium grey, silty, calc, pyrite | |
| 235 | 240 | Siltstone, medium grey, sandy, calc, pyrite | |
| 240 | 270 | Sandstone, green-grey, fine-medium grained, silty, subangular, medium sorted, fair-good porosity, glauc, qtz, fld, pyrite, ferruginous strgrs, slightly oil stained in bottom. Laminated grey siltstone | McMurray |
| 270 | 280 | Sandstone, lt grey, fine-medium grained, subang-subrnd, well sorted, fair-good porosity, qtz, oil stained | |
| 280 | 310 | Sandstone as above, heavily oil saturated, lt grey clay interbedded | |
| 310 | 320 | Clay, medium grey, silty, mica, sandy strgrs | |
| 320 | 330 | Sandstone, lt-medium-grey, fine-medium grained, subang-subrnd, good porosity, qtz, lt cht, heavily oil saturated | |
| 330 | 340 | Shale, dark grey, calc, sandstone, lt grey, oil stained, interbedded | |
| 340 | 400 | Sandstone, lt green, fine-medium grained, subrnd, well sorted, good porosity, qtz, lt cht, oil saturated in strgrs. Thin dark grey shale and lt grey siltstone strgrs | |
| 400 | 410 | Sandstone as above, interbedded dark grey shale (30-40%) | |
| 410 | 430 | Sandstone as above, heavily oil saturated and lt cht pebbles | |
| 430 | 460 | Sandstone, lt brown, fine grained, silty, subrnd, well sorted, fair-good porosity, slightly oil stained. Silty clay strgrs | |
| 460 | 470 | Sandstone as above, dark grey clay interbedded (30-40%) | |
| 470 | 490 | Shale, medium grey, silty, calc, plant remains, thin coal strgrs, bituminous | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Twelve (continued)

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 965 | 1010 | Anhydrite, white nodular, compact thin beds of buff, microcrystalline dolomite and light grey, ferruginous claystone. Replacement, recrystallization | |
| 1010 | 1035 | Rock salt, smoky grey with white-grey nodular anhydrite | |
| 1035 | 1055 | Anhydrite, white-grey, crystalline; buff-brown anhydritic dolomite, fair vuggy porosity, leaching, recrystallization. Colorless and reddish rock salt interbedded | |
| 1055 | 1070 | Rock salt interbedded with white, nodular anhydrite | |
| 1070 | 1090 | Anhydrite white-grey, nodular, dolomitic; dolomite buff-brown, microcrystalline, good-excellent vuggy porosity | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Twelve (continued)

Lsd 8 Sec 27 Twp 88 R 9 W4th

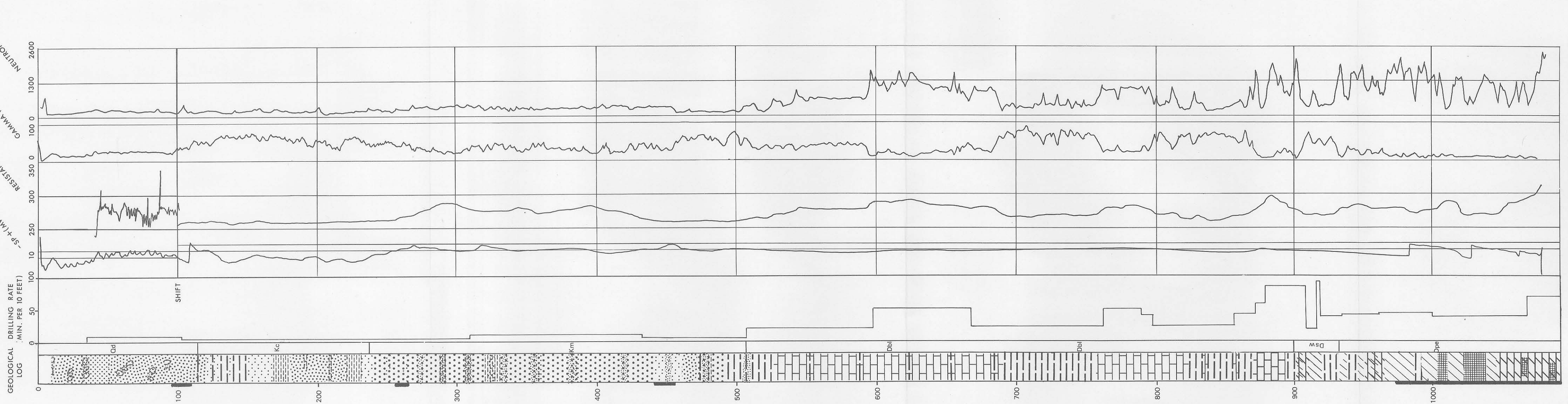
Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 490 | 505 | Sandstone, lt grey, fine grained, silty, fair porosity interbedded with shale, silty, carbonaceous | |
| 505 | 540 | Weathered limestone. Limestone, medium grey, argillaceous, fossiliferous and shale, medium grey, calc, carbonaceous | Beaverhill Lake |
| 540 | 600 | Limestone, lt-medium grey, compact, argillaceous, fossiliferous; interbedded with shale (30-40%), medium grey, calc, pyrite | |
| 600 | 690 | Limestone, buff, compact, fossiliferous, pyrite. Limestone, lt grey, argillaceous, compact, fossiliferous; thin, dark, calc shale strgrs | |
| 690 | 760 | Shale, dark grey, calc, mica, bituminous; limestone, lt grey, argillaceous, compact, fossiliferous, interbedded with clay, medium grey, calc, ferruginous | |
| 760 | 820 | Limestone, buff, compact, fossiliferous; limestone, lt grey, compact, argillaceous; shale dark grey, calc, pyrite, bituminous (10-20%) | |
| 820 | 865 | Shale, dark grey (40-60%), calc, pyrite; interbedded with limestone, lt grey, argillaceous, fossiliferous | |
| 865 | 900 | Limestone, buff-brown, microgranular, fossiliferous; interbedded with dark grey dolomitic and carbonaceous shale | Slave Point and Watt Mountain |
| 900 | 910 | Limestone, buff, dolomitic, microgranular, fossiliferous with anhydrite traces | |
| 910 | 930 | Shale, medium grey, dolomitic, ferruginous traces; anhydrite and dolomite stringers in the upper part | |
| 910 | 930 | Shale, medium grey, dolomitic, ferruginous traces; anhydrite and dolomite stringers in the upper part | |
| 930 | 950 | Dolomite, buff, microcrystalline, anhydritic; grey anhydrite, white nodular gypsum and dark grey dolomitic shale in stringers. Salt infill in shale | Prairie Evaporite |
| 950 | 965 | Shale, medium grey, dolomitic, ferruginous, bituminous; dolomitic claystone, rock salt, gypsum and anhydrite in stringers | |

GEOPHYSICAL AND GEOLOGICAL LOGS
OBSERVATION WELL SITE 12
8-27-88-9 W4th
ALBERTA RESEARCH COUNCIL

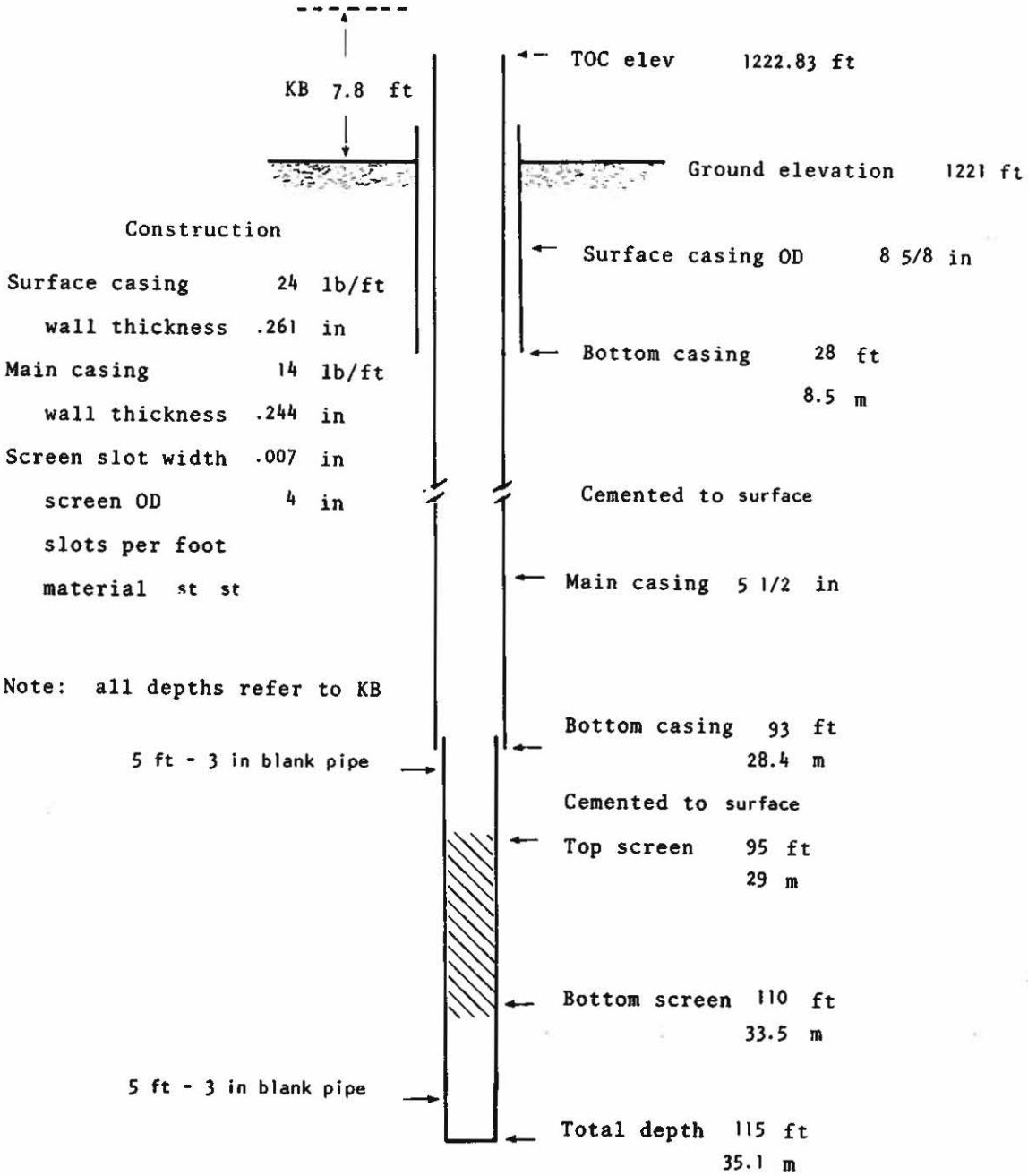


WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 12-115

Lsd 8 Sec 27 Tp 88 R 9 W 4th

Alberta Research Council



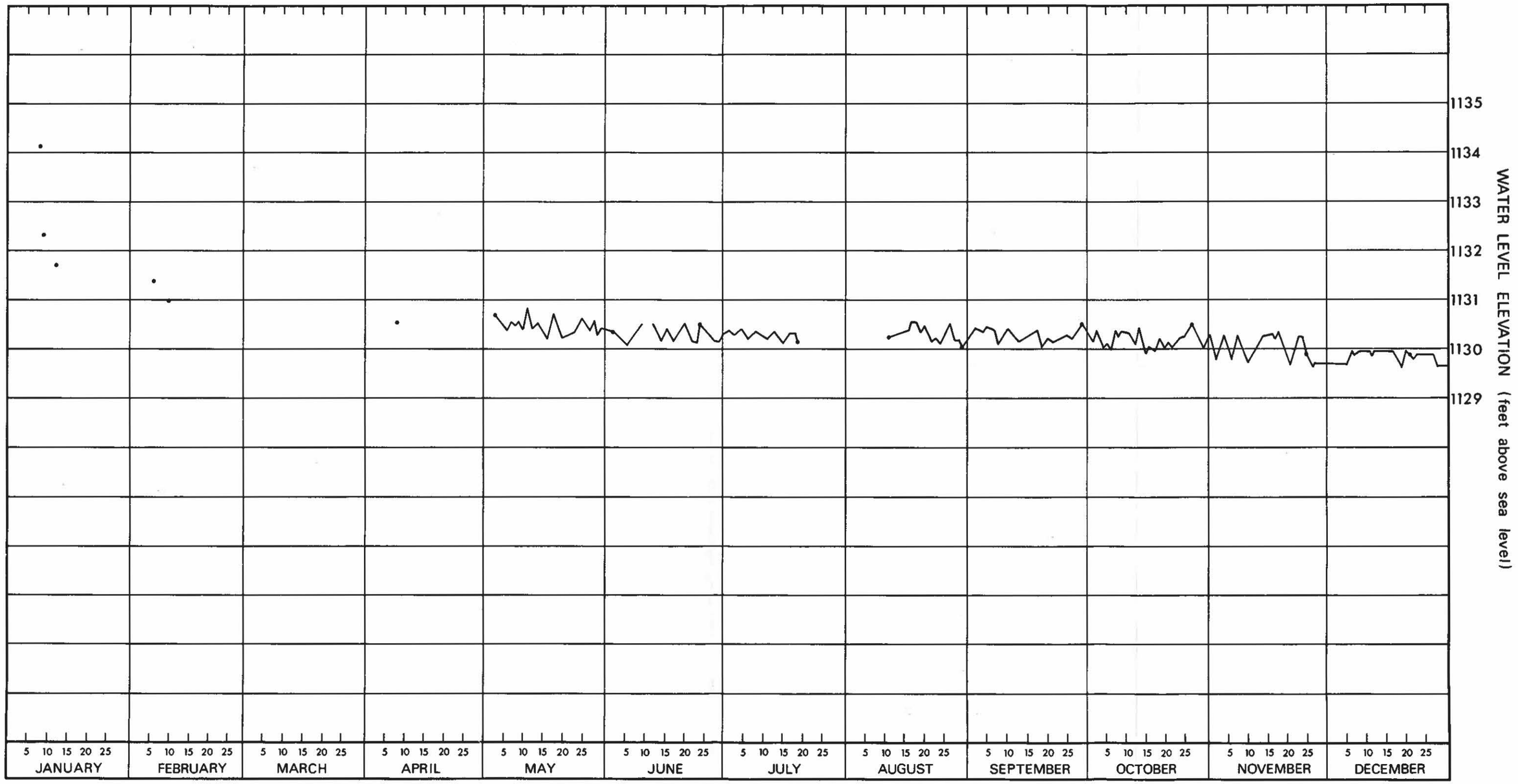
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-115

12 - 115 - H - 77

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council




1976

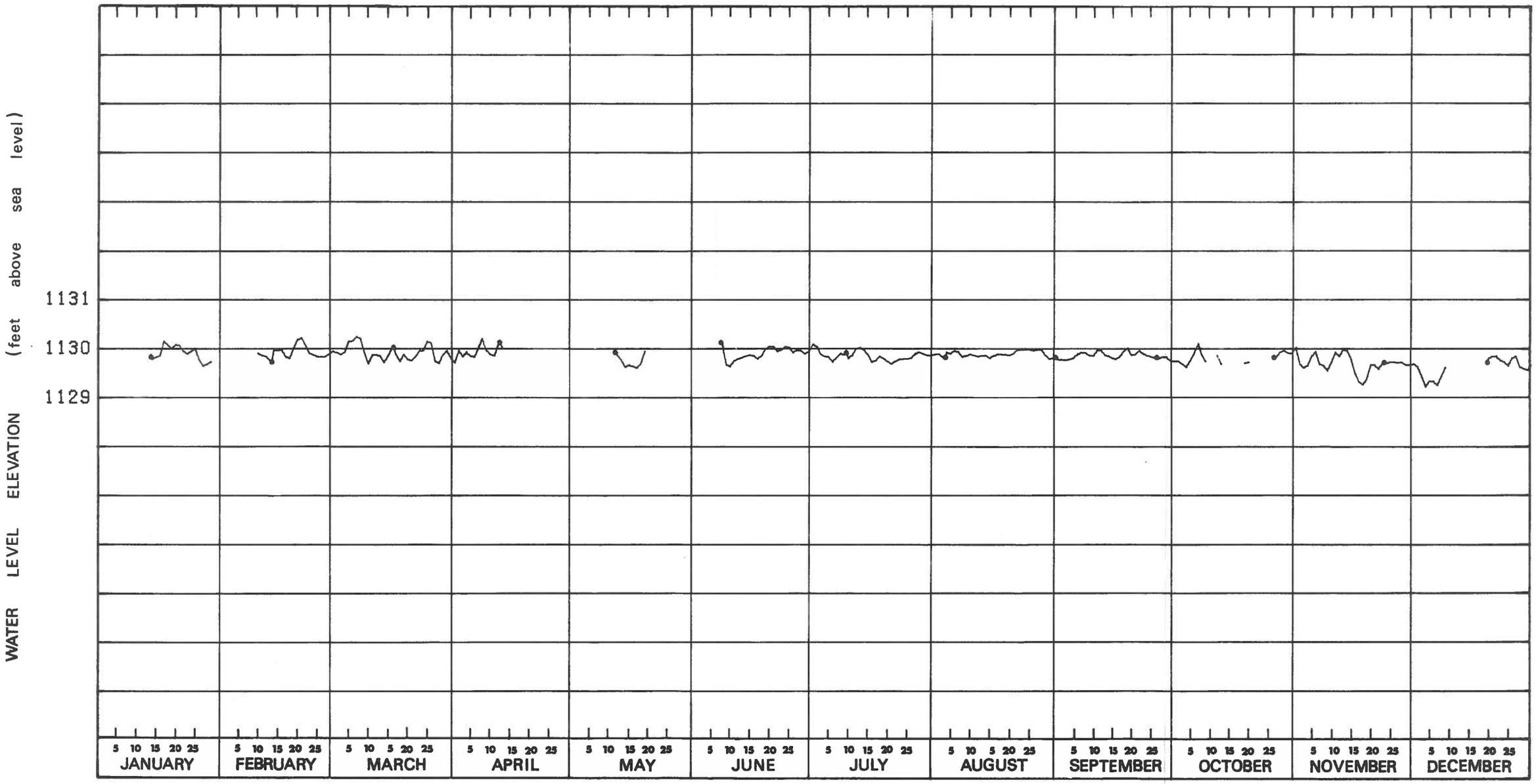
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-115

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta Research Council

12-115-H-78




1977

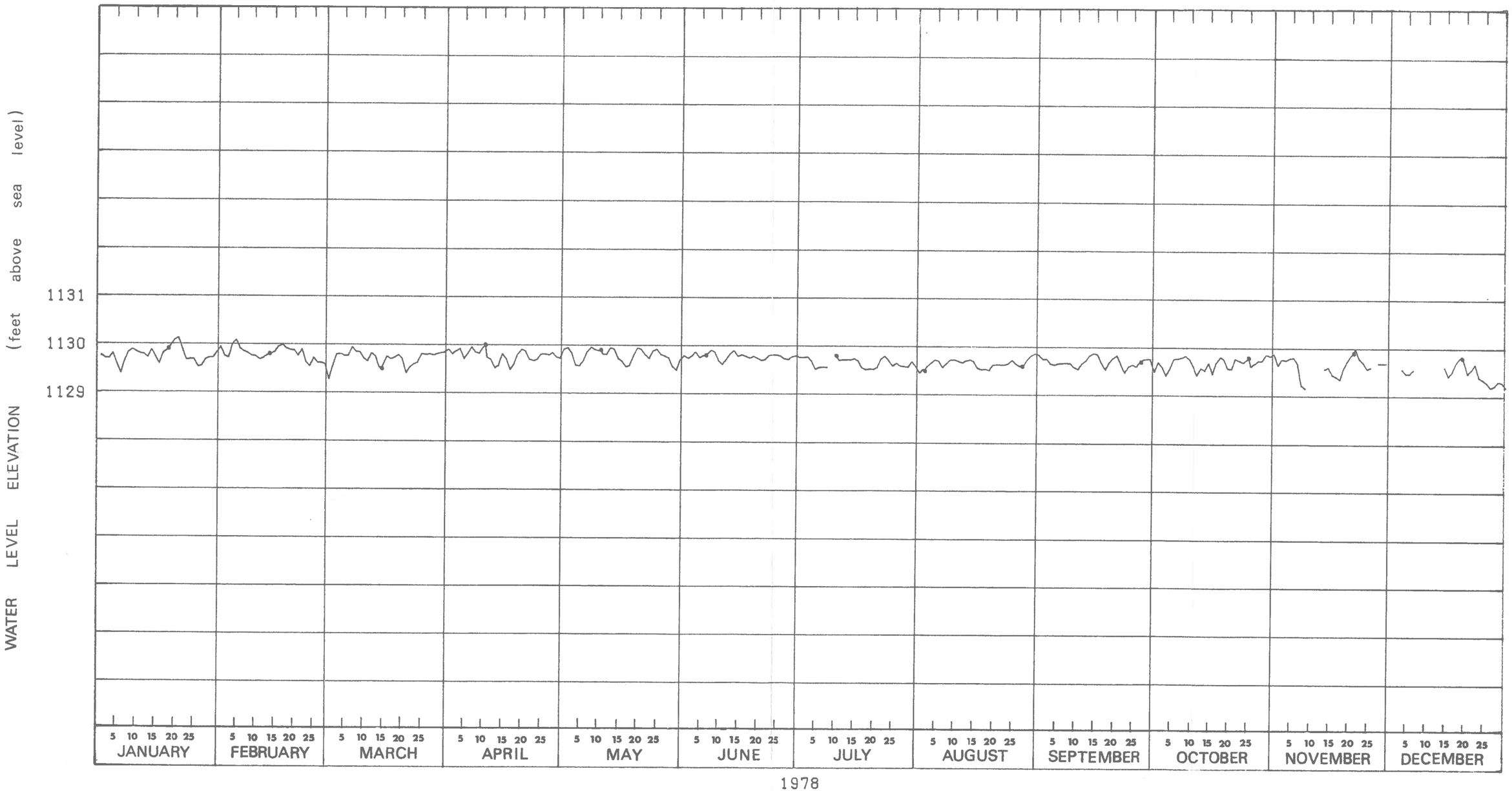
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-115

LSD 8 SEC 27 TWP 88 R 9 W4TH

12-115-H-79

Alberta Research Council




1978

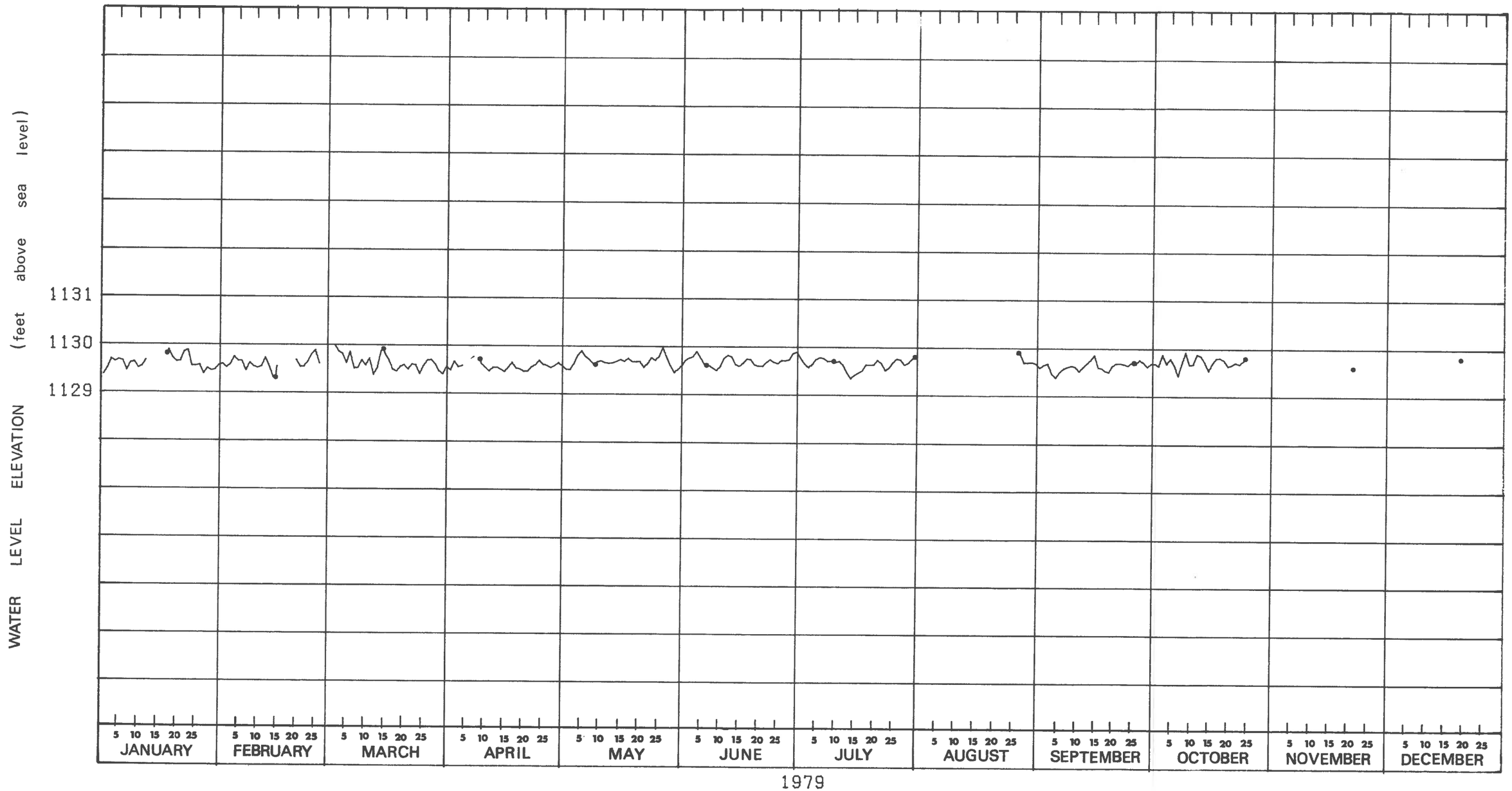
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-115

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta Research Council

12-115-H-80



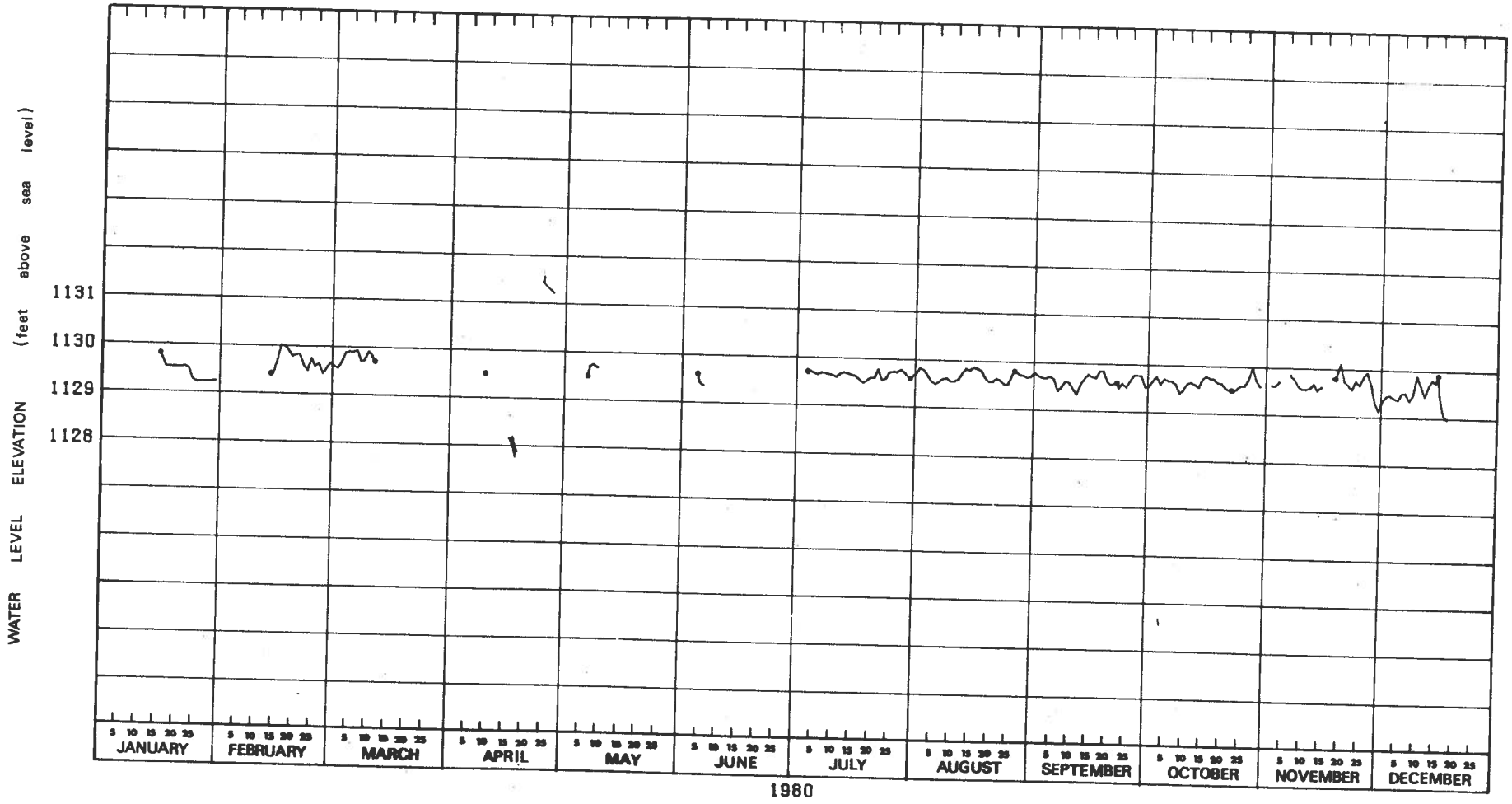
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-115

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta Research Council

12-115-H-81



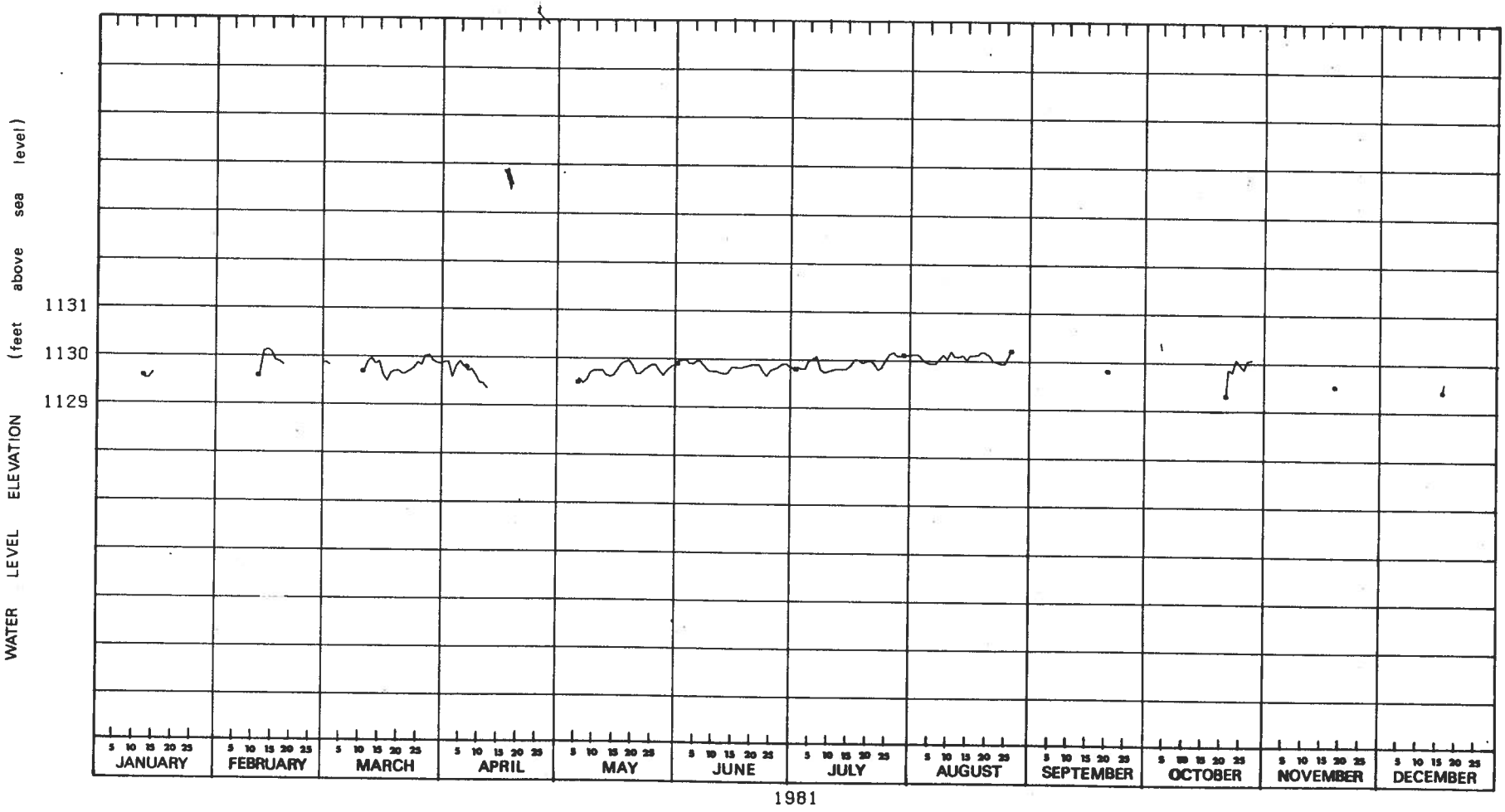
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-115

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta Research Council

12-115-H-82



WELL HISTORY

OBSERVATION WELL NUMBER 12-115

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1222.83

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Dec 19/75 | | | Well completed |
| Jan 8/76 | 27.75 MP | 1134.1 | MP = 0.70 m TOC, (1225.1) |
| Jan 9/76 | 28.30 MP | 1132.3 | |
| Jan 12/76 | 28.49 MP | 1131.6 | |
| Feb 6/76 | 28.58 MP | 1131.4 | |
| Feb 10/76 | 28.71 MP | 1130.9 | |
| Mar 4/76 | 25.77 MP | 1140.6 | Measurement questionable |
| Apr 8/76 | 28.84 MP | 1130.5 | |
| May 3/76 | 28.80 MP | 1130.6 | |
| June 2/76 | 28.90 MP | 1130.3 | |
| June 24/76 | 28.85 MP | 1130.5 | |
| July 19/76 | 28.95 MP | 1130.1 | Could not sample only 6" of water |
| Aug 11/76 | 28.92 MP | 1130.2 | |
| Aug 30/76 | 28.98 MP | 1130.0 | |
| Sept 29/76 | 28.85 MP | 1130.5 | |
| Oct 27/76 | 28.83 MP | 1130.5 | |
| Nov 25/76 | 29.01 MP | 1129.9 | |
| Dec 21/76 | 29.01 MP | 1129.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-115

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1222.83

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 29.04 MP | 1129.8 | MP (1225.1) |
| Feb 14/77 | 29.07 MP | 1129.7 | |
| Mar 17/77 | 28.99 MP | 1130.0 | |
| Apr 13/77 | 28.95 MP | 1130.1 | |
| May 12/77 | 29.01 MP | 1129.9 | |
| June 8/77 | 28.95 MP | 1130.1 | |
| July 12/77 | 29.02 MP | 1129.9 | Not enough water to sample |
| Aug 4/77 | 29.37 MP | 1128.8 | |
| Sept 1/77 | 29.06 MP | 1129.8 | |
| Sept 27/77 | 29.05 MP | 1129.8 | |
| Oct 27/77 | 29.06 MP | 1129.8 | |
| Nov 24/77 | 29.09 MP | 1129.7 | |
| Dec 20/77 | 29.08 MP | 1129.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-115

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1222.83

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 19/78 | 29.02 MP | 1129.9 | MP (1225.1) |
| Feb 14/78 | 29.05 MP | 1129.8 | |
| Mar 15/78 | 29.15 MP | 1129.5 | |
| Apr 11/78 | 29.00 MP | 1130.0 | |
| May 11/78 | 29.03 MP | 1129.9 | |
| June 7/78 | 29.07 MP | 1129.8 | |
| July 11/78 | 29.05 MP | 1129.8 | Not enough water to sample |
| Aug 3/78 | 29.13 MP | 1129.5 | |
| Aug 28/78 | 29.12 MP | 1129.6 | |
| Sept 28/78 | 29.09 MP | 1129.7 | |
| Oct 26/78 | 29.05 MP | 1129.8 | |
| Nov 22/78 | 29.03 MP | 1129.9 | |
| Dec 20/78 | 29.04 MP | 1129.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-115

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1222.83

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 29.04 MP | 1129.8 | MP (1225.1) |
| Feb 15/79 | 29.20 MP | 1129.3 | |
| Mar 15/79 | 29.01 MP | 1129.9 | |
| Apr 9/79 | 29.07 MP | 1129.7 | |
| May 9/79 | 29.11 MP | 1129.6 | |
| June 7/79 | 29.11 MP | 1129.6 | |
| July 10/79 | 29.09 MP | 1129.7 | Not enough water to sample |
| July 31/79 | 29.06 MP | 1129.8 | |
| Aug 27/79 | 29.01 MP | 1129.9 | |
| Sept 26/79 | 29.08 MP | 1129.7 | |
| Oct 25/79 | 29.06 MP | 1129.8 | |
| Nov 22/79 | 29.10 MP | 1129.6 | |
| Dec 20/79 | 29.04 MP | 1129.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 12 - 115

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1222.83

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 29.06 MP | 1129.8 | |
| Feb 14/80 | 29.18 MP | 1129.4 | |
| Mar 12/80 | 29.09 MP | 1129.7 | |
| Apr 10/80 | 29.14 MP | 1129.5 | |
| May 7/80 | 29.14 MP | 1129.5 | |
| June 5/80 | 29.10 MP | 1129.6 | |
| July 4/80 | 29.08 MP | 1129.7 | |
| July 31/80 | 29.11 MP | 1129.6 | |
| Aug 27/80 | 29.05 MP | 1129.8 | |
| Sept 23/80 | 29.10 MP | 1129.6 | |
| Oct 23/80 | 29.13 MP | 1129.5 | |
| Nov 19/80 | 29.07 MP | 1129.8 | |
| Dec 16/80 | 29.02 MP | 1129.9 | |
| Jan 13/81 | 29.11 MP | 1129.6 | |
| Feb 12/81 | 29.11 MP | 1129.6 | |
| Mar 11/81 | 29.10 MP | 1129.7 | |
| Apr 7/81 | 29.06 MP | 1129.8 | |
| May 6/81 | 29.14 MP | 1129.5 | |
| June 1/81 | 29.03 MP | 1129.9 | |
| July 2/81 | 29.07 MP | 1129.8 | |
| July 30/81 | 28.95 MP | 1130.1 | |
| Aug 27/81 | 28.93 MP | 1130.2 | |
| Sept 21/81 | 29.05 MP | 1129.8 | |
| Oct 22/81 | 29.20 MP | 1129.3 | |
| Nov 19/81 | 29.14 MP | 1129.5 | |
| Dec 17/81 | 29.17 MP | 1129.4 | |

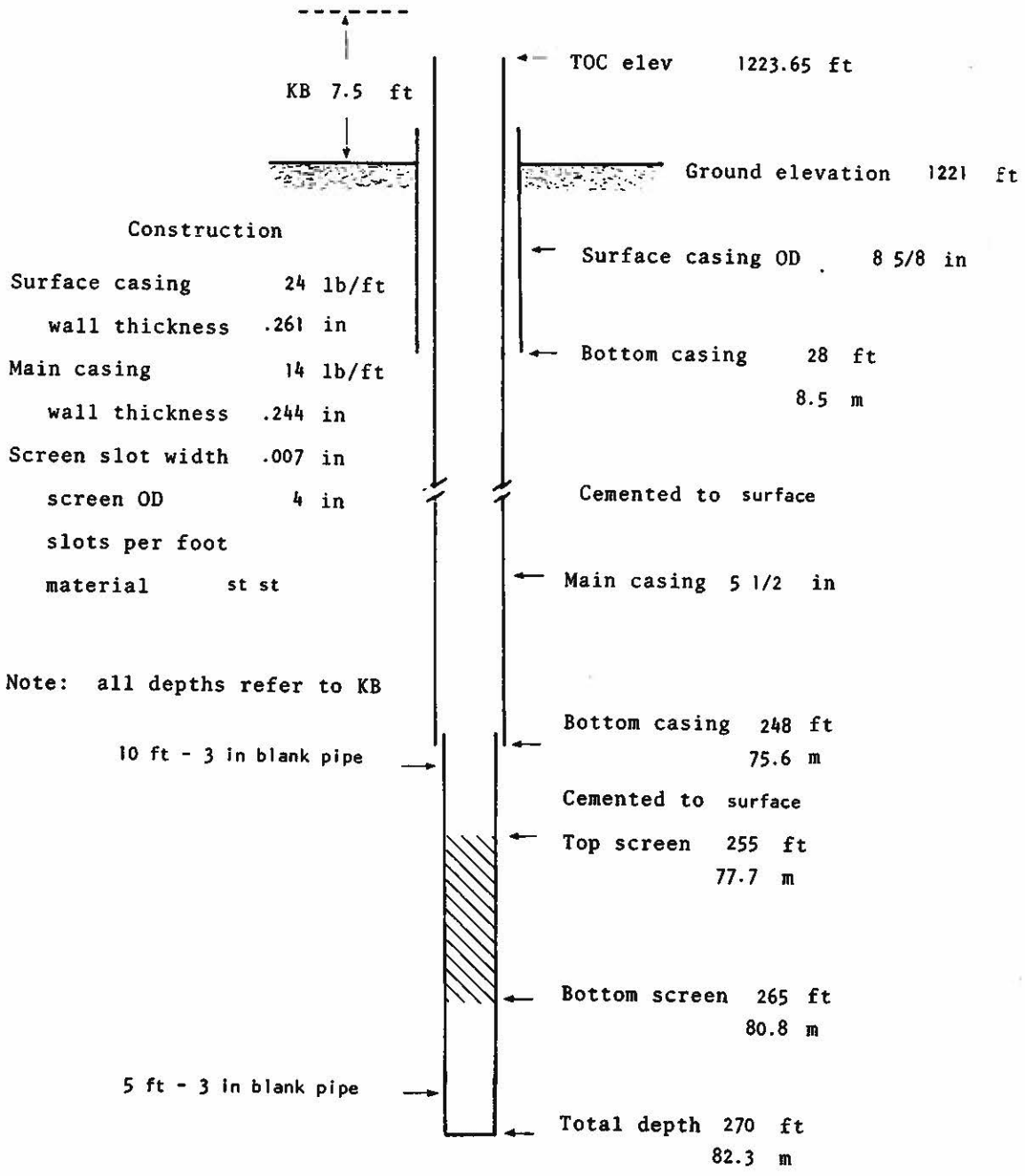
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 12-270

Lsd 8 Sec 27 Tp 88 R 9 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .261 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB

## WELL HISTORY

OBSERVATION WELL NUMBER 12-270

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1223.65

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Dec 16/75 | | | Well completed |
| Dec 18/75 | Dry | | MP = 0.68 m TOC, (1225.9) |
| Jan 8/76 | 78.93 MP | 967.0 | |
| Jan 9/76 | 79.63 MP | 964.7 | |
| Jan 12/76 | 79.38 MP | 965.5 | |
| Feb 6/76 | 79.63 MP | 964.7 | |
| Feb 10/76 | 79.09 MP | 966.5 | |
| Mar 4/76 | Dry | | |
| Apr 8/76 | 79.77 MP | 964.2 | |
| May 3/76 | Dry | | |
| June 2/76 | Dry | | |
| June 24/76 | Dry | | |
| July 19/76 | Dry | | Could not sample |
| Aug 11/76 | Dry | | |
| Aug 30/76 | Dry | | |
| Sept 29/76 | Dry | | |
| Oct 27/76 | Dry | | |
| Nov 25/76 | Dry | | |
| Dec 21/76 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-270

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1223.65

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | Dry | | MP (1225.9) |
| Feb 14/77 | Dry | | |
| Mar 17/77 | Dry | | |
| Apr 13/77 | Dry | | |
| May 12/77 | Dry | | |
| June 8/77 | Dry | | |
| July 12/77 | Dry | | |
| Aug 4/77 | Dry | | |
| Sept 1/77 | Dry | | |
| Sept 27/77 | Dry | | |
| Oct 27/77 | Dry | | |
| Nov 24/77 | Dry | | |
| Dec 20/77 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-270

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1223.65

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 19/78 | Dry | | |
| Feb 14/78 | Dry | | |
| Mar 15/78 | Dry | | |
| Apr 11/78 | Dry | | |
| May 11/78 | Dry | | |
| June 7/78 | Dry | | |
| July 11/78 | Dry | | |
| Aug 3/78 | Dry | | |
| Aug 28/78 | Dry | | |
| Sept 28/78 | Dry | | |
| Oct 26/78 | Dry | | |
| Nov 22/78 | Dry | | |
| Dec 20/78 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-270

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1223.65

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | Dry | | MP (1225.9) |
| Feb 15/79 | Dry | | |
| Mar 15/79 | Dry | | |
| Apr 9/79 | Dry | | |
| May 9/79 | Dry | | |
| June 7/79 | Dry | | |
| July 10/79 | Dry | | |
| July 31/79 | Dry | | |
| Aug 27/79 | Dry | | |
| Sept 26/79 | Dry | | |
| Oct 25/79 | Dry | | |
| Nov 22/79 | Dry | | |
| Dec 20/79 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12 - 270

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1223.65

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | DRY | | |
| Feb 14/80 | DRY | | |
| Mar 12/80 | DRY | | |
| Apr 10/80 | DRY | | |
| May 7/80 | DRY | | |
| June 5/80 | DRY | | |
| July 4/80 | DRY | | |
| July 31/80 | DRY | | |
| Aug 27/80 | DRY | | |
| Sept 23/80 | DRY | | |
| Oct 23/80 | DRY | | |
| Nov 19/80 | DRY | | |
| Dec 16/80 | DRY | | |
| Jan 13/81 | DRY | | |
| Feb 12/81 | DRY | | |
| Mar 11/81 | DRY | | |
| Apr 7/81 | DRY | | |
| May 6/81 | DRY | | |
| June 1/81 | DRY | | |
| July 2/81 | DRY | | |
| July 30/81 | DRY | | |
| Aug 27/81 | DRY | | |
| Sept 21/81 | DRY | | |
| Oct 22/81 | DRY | | |
| Nov 19/81 | DRY | | |
| Dec 17/81 | DRY | | |

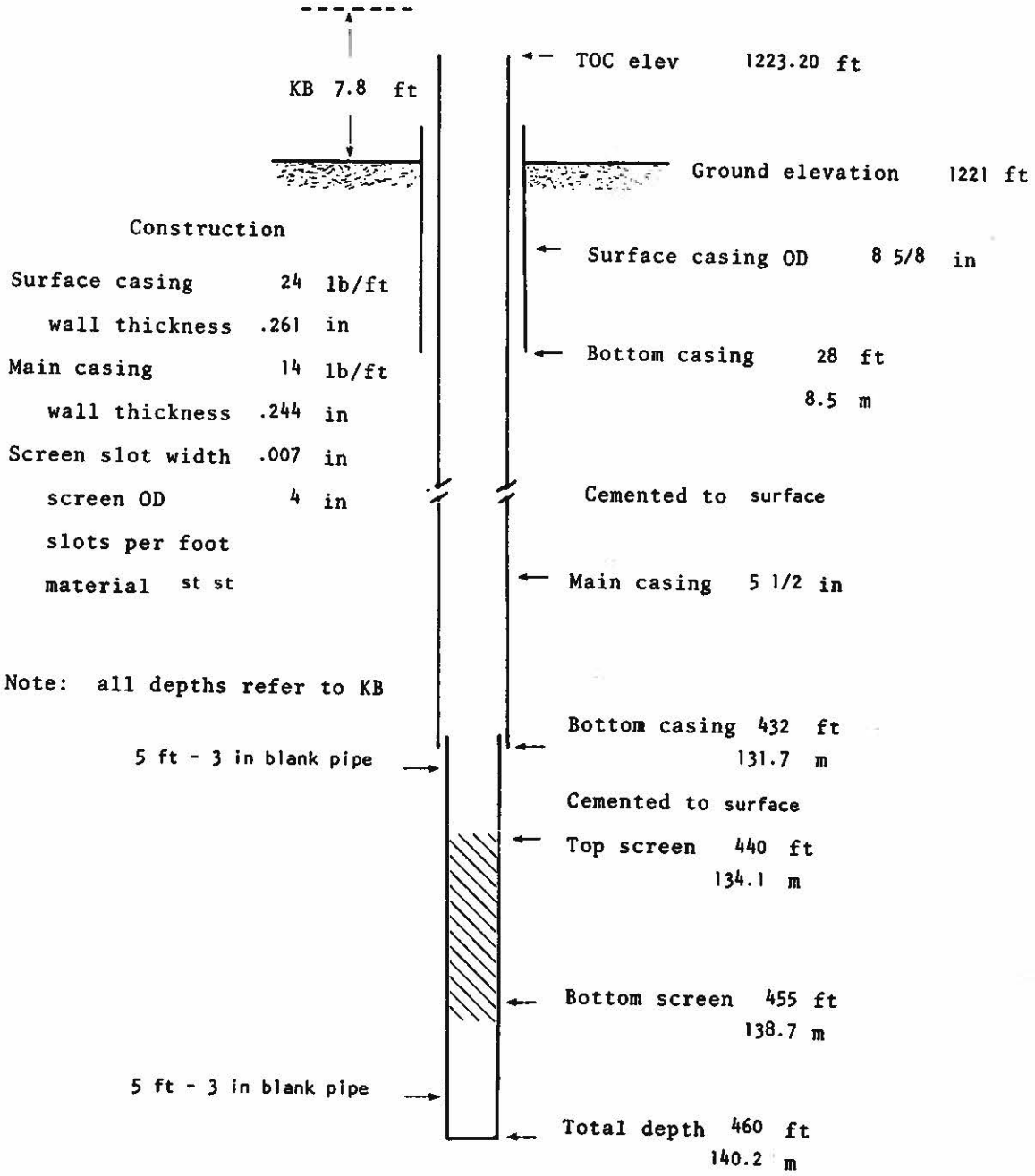
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Tp 88 R 9 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .261 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB

## WATER ANALYSIS

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Sample source Bailed from 12-460

Date sampled February 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 51.0 | 2.54 | 34.8 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.02 | 0.3 |
| Sodium ($Na^{+}$) | 103.0 | 4.48 | 61.3 |
| Potassium ($K^{+}$) | 10.0 | 0.26 | 3.5 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 9.1 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 22.3 | 0.46 | 5.3 |
| Chloride ($Cl^{-}$) | 186.0 | 5.25 | 59.7 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 17.2 | | |
| Hydroxide ($OH^{-}$) | 38.7 | 2.27 | 25.9 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 424.0 | | |
| Total Anions (epm) 8.7 | | Total Cations (epm) | 7.3 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1120 | Temperature (C) | |
| pH | 10.8 | pH | 11.3 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | 24.3 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 27.2 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 43.0 | 2.15 | 32 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 100.0 | 4.35 | 64 |
| Potassium ($K^{+}$) | 11.7 | 0.30 | 4 |
| Carbonate ($CO_3^{=}$) | 19.2 | 0.64 | 8 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 25.0 | 0.52 | 7 |
| Chloride ($Cl^{-}$) | 184.0 | 5.19 | 67 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 14.4 | | |
| Hydroxide ($OH^{-}$) | 22.9 | 1.35 | 18 |
| Calcium (Acidified) | 50.6 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 416 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 7.71 | Total Cations (epm) | 6.80 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 900 | Temperature (C) | 6.0 |
| pH | 10.8 | pH | 12.4 |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 53 Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 16 Mg/L |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Sample source Bailed from 12-460

Date sampled February 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 51.0 | 2.54 | 34.8 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.02 | 0.3 |
| Sodium ($Na^{+}$) | 103.0 | 4.48 | 61.3 |
| Potassium ($K^{+}$) | 10.0 | 0.26 | 3.5 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 10.0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 22.3 | 0.46 | 6.0 |
| Chloride ($Cl^{-}$) | 186.0 | 5.25 | 66.0 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 17.2 | | |
| Hydroxide ($OH^{-}$) | 25.0 | 1.47 | 18.0 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 424.0 | | |
| Total Anions (epm) 7.98 | | Total Cations (epm) | 7.3 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1120 | Temperature (C) | |
| pH | 10.8 | pH | 11.3 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | 24.3 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 27.2 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 43.0 | 2.15 | 32 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 100.0 | 4.35 | 64 |
| Potassium ($K^{+}$) | 11.7 | 0.30 | 4 |
| Carbonate ($CO_3^{=}$) | 19.2 | 0.64 | 9 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 25.0 | 0.52 | 7 |
| Chloride ($Cl^{-}$) | 184.0 | 5.19 | 71 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 14.4 | | |
| Hydroxide ($OH^{-}$) | 17.0 | 1.00 | 14 |
| Calcium (Acidified) | 50.6 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 416 | | |
| Total Anions (epm) | 7.36 | Total Cations (epm) | 6.80 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 900 | Temperature (C) | 6.0 |
| pH | 10.8 | pH | 12.4 |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 53 Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 16 Mg/L |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 12, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 34.0 | 1.70 | 1.8 |
| Magnesium ($Mg^{++}$) | 46.0 | 3.79 | 3.9 |
| Sodium ($Na^{+}$) | 2075.0 | 90.26 | 93.8 |
| Potassium ($K^{+}$) | 18.8 | 0.48 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 383.0 | 6.28 | 6.5 |
| Sulfate ($SO_4^{=}$) | 52.0 | 1.08 | 1.1 |
| Chloride ($Cl^{-}$) | 3180.0 | 89.68 | 92.4 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 42.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 38.0 | | |
| Magnesium (Acidified) | 39.0 | | |
| Total dissolved solids | 5434.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 97.05 | Total Cations (epm) | 96.22 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 6.0 |
| pH | 8.3 | pH | 8.7 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | 38.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 317.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

12-460-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Rge 9 Twp 88 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 10.3 | 0.51 | 0.4 |
| Magnesium(Mg) | 66.0 | 5.43 | 3.7 |
| Sodium(Na) | 3200.0 | 139.19 | 95.4 |
| Potassium(K) | 29.2 | 0.75 | 0.5 |
| Carbonate(CO3) | 26.4 | 0.88 | 0.6 |
| Bicarbonate(HCO3) | 695.0 | 11.39 | 7.6 |
| Sulphate(SO4) | 24.0 | 0.50 | 0.3 |
| Chloride(Cl) | 4860.0 | 137.06 | 91.4 |
| Nitrate(NO3) | 3.3 | 0.05 | 0.0 |
| Silica(SiO2) | 3.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 32.0 | | |
| Magnesium(Acidified) | 59.0 | | |
| TDS(mg/l) | 8562.0 | | |
| Total Anions(epm) | 149.88 | Total Cations(epm) | 145.88 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 13350 | | Temperature(C) | 6.50 | |
| pH | 8.6 | | pH | 8.8 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | 77 | mg/l |
| | | | Bicarbonate(HCO3) | 654 | mg/l |
| | | | Hydroxide(OH) | | |

12-460-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Rge 9 Twp 88 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.7 | 0.13 | 0.2 |
| Magnesium(Mg) | 11.0 | 0.91 | 1.3 |
| Sodium(Na) | 1613.0 | 70.16 | 97.8 |
| Potassium(K) | 20.4 | 0.52 | 0.7 |
| Carbonate(CO3) | 118.0 | 3.93 | 5.1 |
| Bicarbonate(HCO3) | 81.0 | 1.33 | 1.7 |
| Sulphate(SO4) | 29.7 | 0.62 | 0.8 |
| Chloride(Cl) | 2540.0 | 71.63 | 92.4 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 3.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 9.0 | | |
| Magnesium(Acidified) | 12.9 | | |
| TDS(mg/l) | 4298.0 | | |
| Total Anions(epm) | 77.51 | Total Cations(epm) | 71.72 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 7000 | | Temperature(C) | 6.50 | |
| pH | 9.7 | | pH | 10.0 | |
| Fluoride(F) | 0.3 | mg/l | Carbonate(CO3) | 134 | mg/l |
| | | | Bicarbonate(HCO3) | 88 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 12-460-E-82

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Rge 9 Twp 88 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 4, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 66.0 | 3.30 | 1.3 |
| Magnesium(Mg) | 139.0 | 11.58 | 4.7 |
| Sodium(Na) | 5325.0 | 231.52 | 93.6 |
| Potassium(K) | 36.0 | 0.92 | 0.4 |
| Carbonate(CO3) | 108.0 | 3.60 | 1.4 |
| Bicarbonate(HCO3) | 1025.0 | 16.80 | 6.4 |
| Sulphate(SO4) | 22.0 | 0.46 | 0.2 |
| Chloride(Cl) | 8600.0 | 242.25 | 92.1 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 3.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 86.0 | | |
| Magnesium(Acidified) | 110.0 | | |
| TDS(mg/l) | 14396.0 | | |
| Total Anions(epm) | 263.11 | Total Cations(epm) | 247.33 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 22799 | Temperature | 10.00 | |
| pH | 8.8 | pH | 7.9 | |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 1537 | mg/l |
| | | Hydroxide(OH) | | |

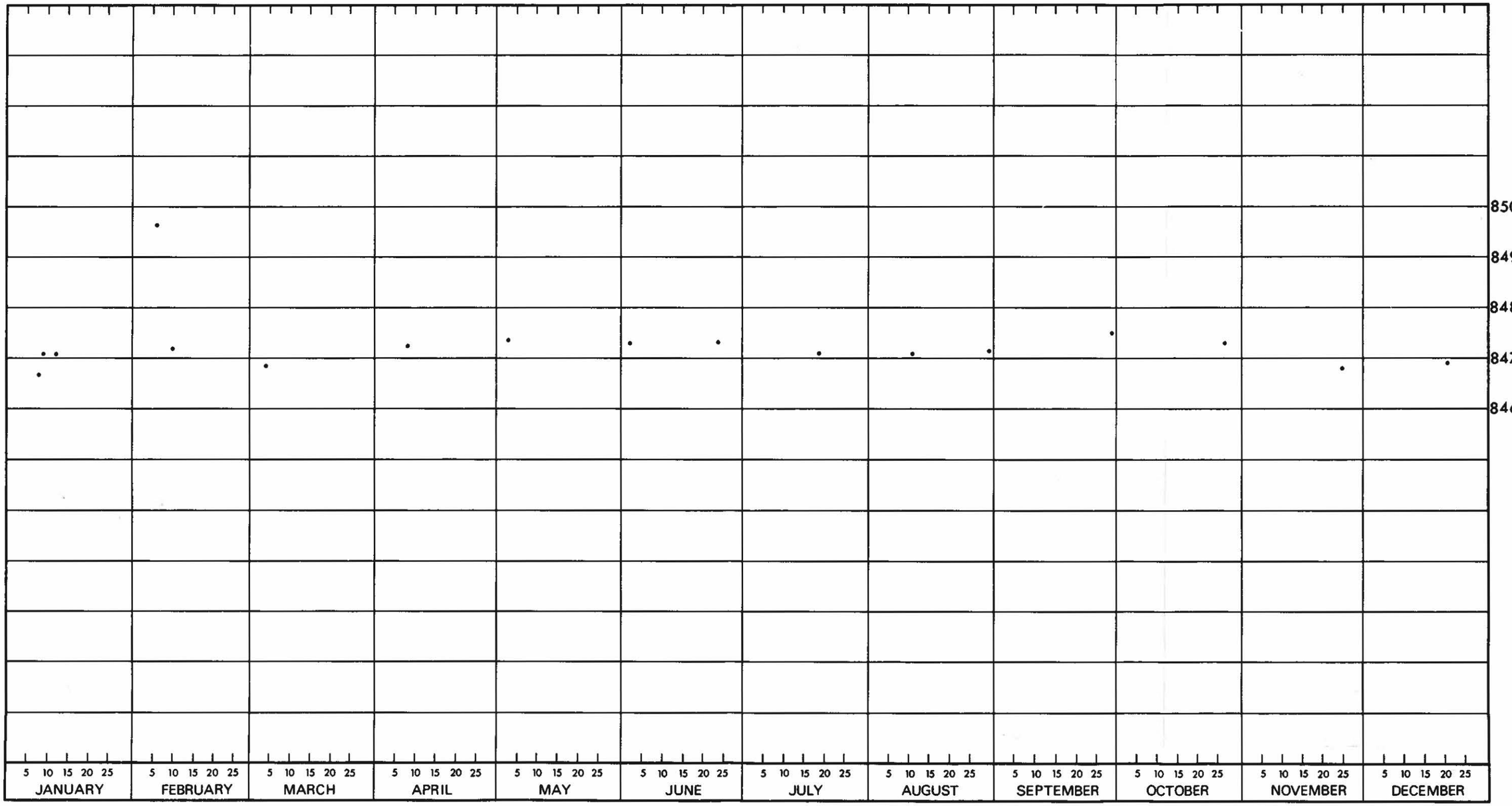
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

12 - 460 - H - 77




1976

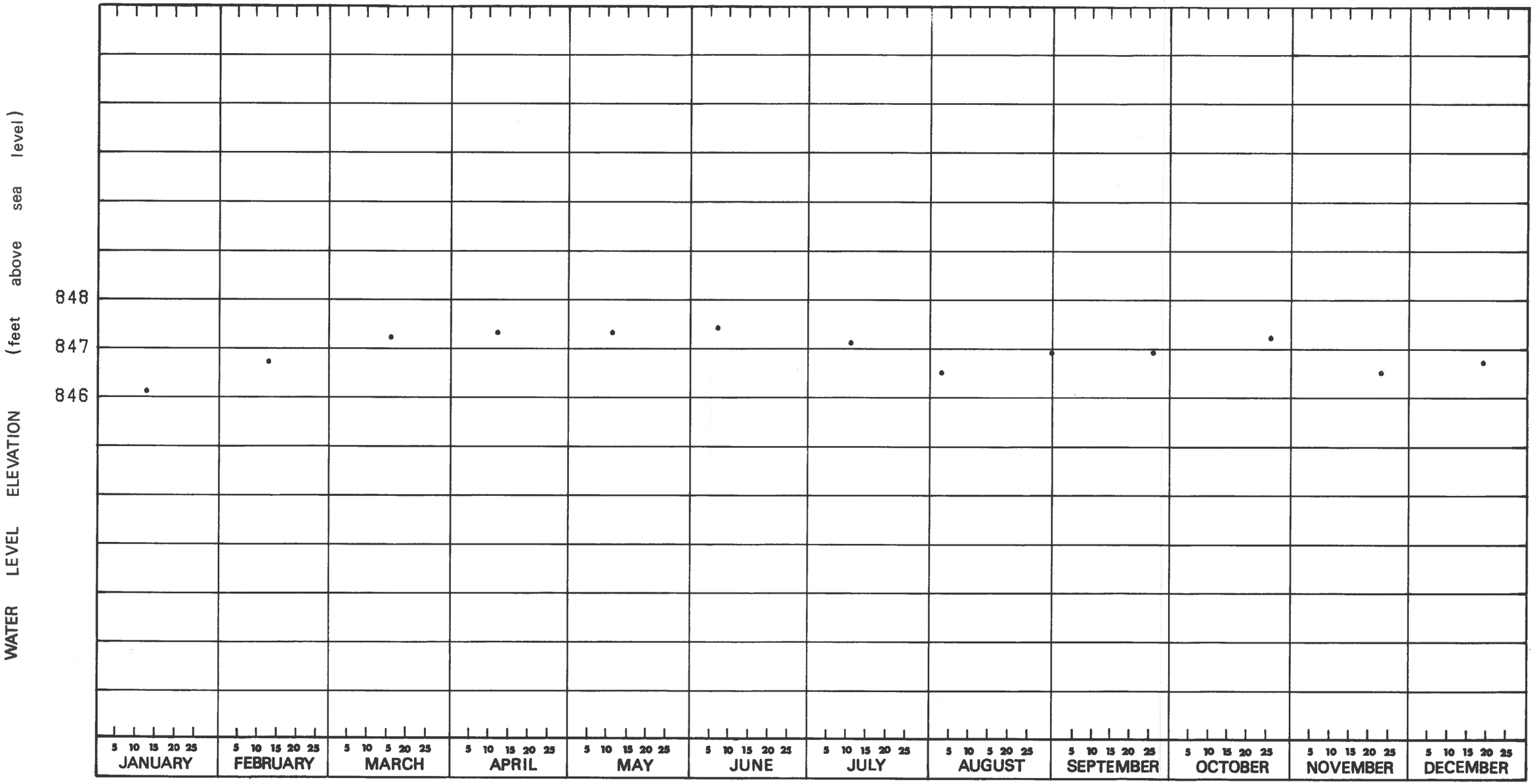
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta Research Council

12-460-H-78




1977

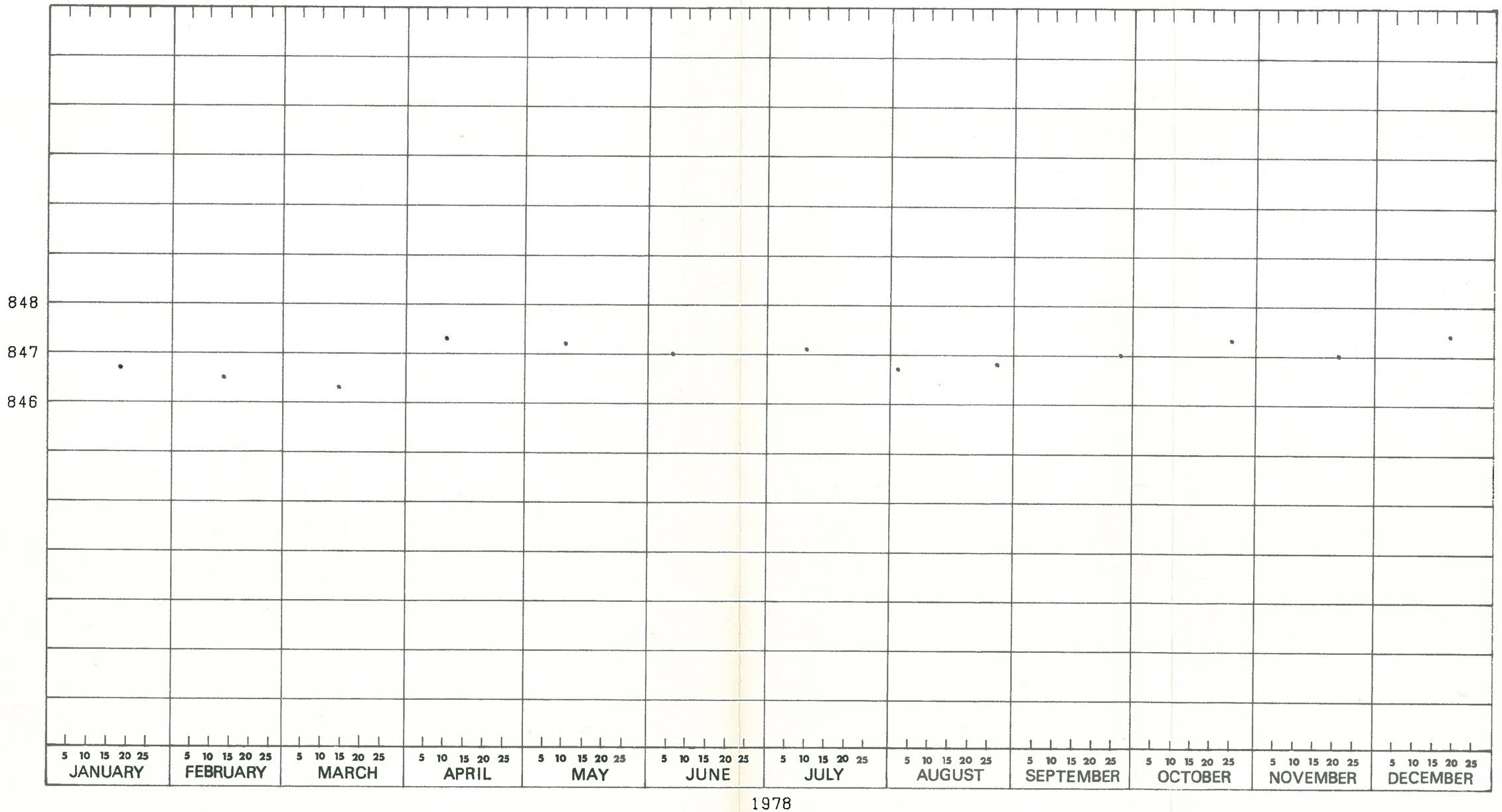
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-460

LSD 8 SEC 27 TWP 88 R 9 W4TH

Alberta Research Council

12-460-H-79




1978

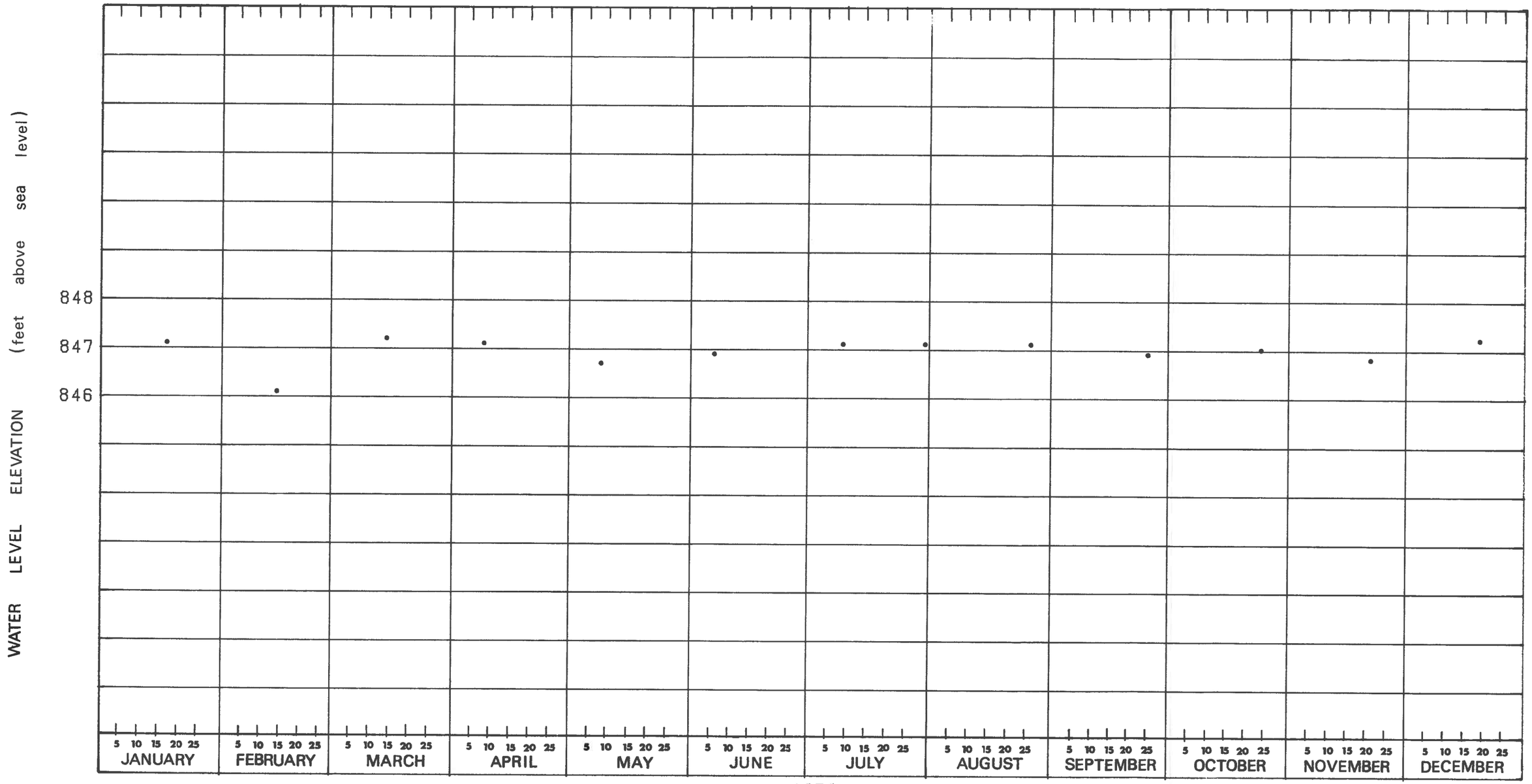
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta Research Council

12-460-H-80



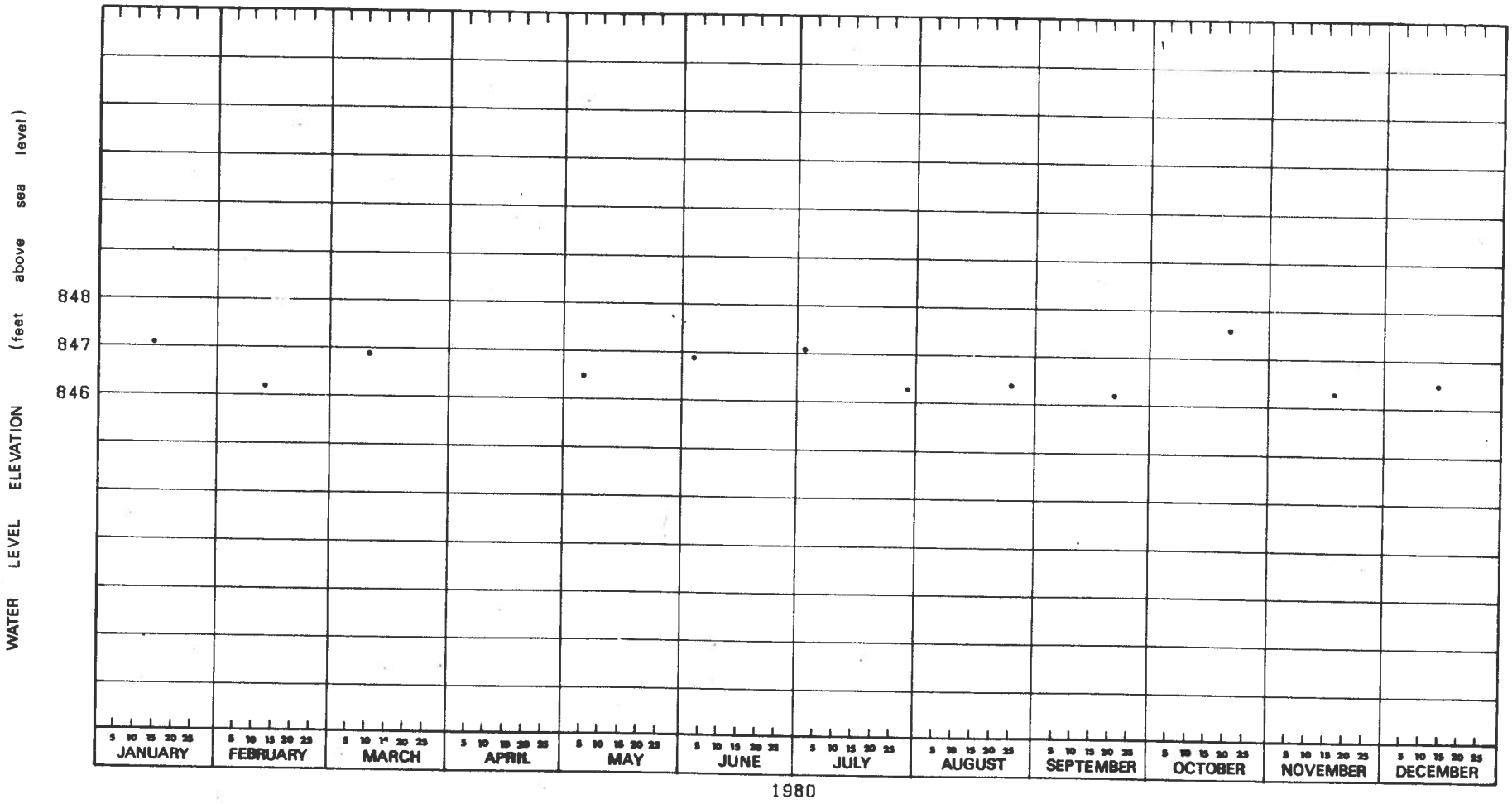
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta Research Council

12-460-H-81



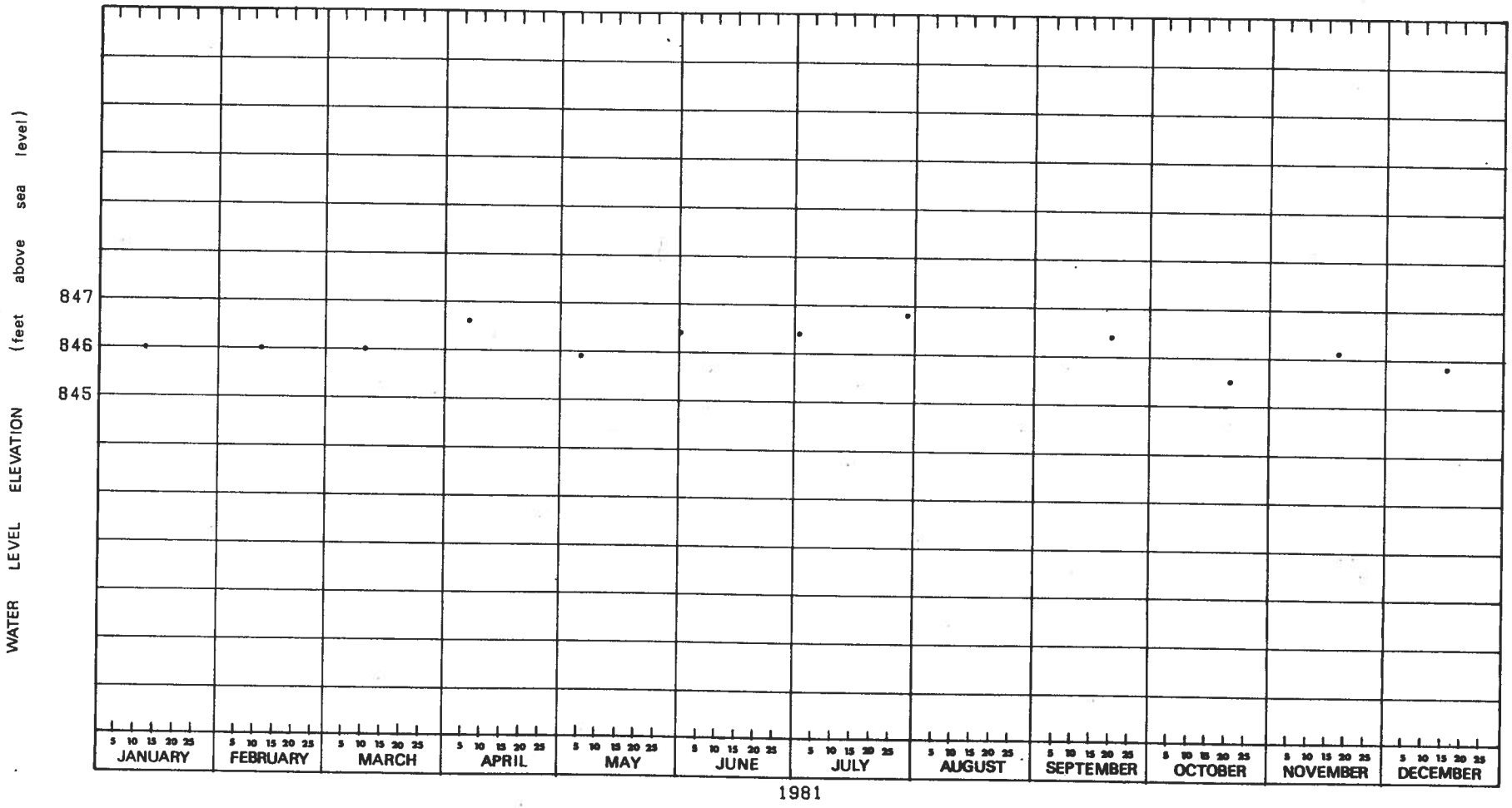
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta · Research Council

12-460-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1223.20

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Dec 17/75 | | | Well completed |
| Dec 18/75 | 114.62 TOC | 847.2 | MP = 0.78 m TOC, (1225.8) |
| Jan 8/76 | 114.80 TOC | 846.7 | |
| Jan 9/76 | 114.67 TOC | 847.1 | |
| Jan 12/76 | 115.45 MP | 847.1 | |
| Feb 6/76 | 114.67 MP | 849.7 | |
| Feb 10/76 | 115.42 MP | 847.2 | |
| Mar 4/76 | 115.52 MP | 846.9 | |
| Apr 8/76 | 115.42 MP | 847.1 | New MP = 0.77 m TOC, (1225.7) |
| May 3/76 | 115.39 MP | 847.2 | |
| June 2/76 | 115.41 MP | 847.1 | |
| June 24/76 | 115.40 MP | 847.2 | |
| July 19/76 | 115.46 MP | 847.0 | After sample; temp. 6°C |
| Aug 11/76 | 115.47 MP | 847.0 | |
| Aug 30/76 | 115.45 MP | 847.0 | |
| Sept 29/76 | 115.35 MP | 847.3 | |
| Oct 27/76 | 115.35 MP | 847.3 | |
| Nov 25/76 | 115.52 MP | 846.8 | |
| Dec 21/76 | 115.48 MP | 846.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1223.20

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 115.72 MP | 846.1 | MP (1225.7) |
| Feb 14/77 | 115.55 MP | 846.7 | |
| Mar 17/77 | 115.40 MP | 847.2 | |
| Apr 13/77 | 115.35 MP | 847.3 | |
| May 12/77 | 115.35 MP | 847.3 | |
| June 8/77 | 115.34 MP | 847.4 | |
| July 12/77 | 115.44 MP | 847.1 | Sampled; temp. 6°C |
| Aug 4/77 | 115.62 MP | 846.5 | |
| Sept 1/77 | 115.49 MP | 846.9 | |
| Sept 27/77 | 115.50 MP | 846.9 | |
| Oct 27/77 | 115.40 MP | 847.2 | |
| Nov 24/77 | 115.60 MP | 846.5 | |
| Dec 20/77 | 115.56 MP | 846.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1223.20

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 19/78 | 115.56 MP | 846.7 | MP (1225.7) |
| Feb 14/78 | 115.60 MP | 846.5 | |
| Mar 15/78 | 115.66 MP | 846.3 | |
| Apr 11/78 | 115.35 MP | 847.3 | |
| May 11/78 | 115.41 MP | 847.2 | |
| June 7/78 | 115.46 MP | 847.0 | |
| July 11/78 | 115.42 MP | 847.1 | Sampled; temp. 6.5°C |
| Aug 3/78 | 115.53 MP | 846.7 | |
| Aug 28/78 | 115.51 MP | 846.8 | |
| Sept 28/78 | 115.47 MP | 847.0 | |
| Oct 26/78 | 115.37 MP | 847.3 | |
| Nov 22/78 | 115.46 MP | 847.0 | |
| Dec 20/78 | 115.32 MP | 847.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1223.20

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 115.42 MP | 847.1 | MP (1225.7) |
| Feb 15/79 | 115.73 MP | 846.1 | |
| Mar 15/79 | 115.38 MP | 847.2 | |
| Apr 9/79 | 115.41 MP | 847.1 | |
| May 9/79 | 115.55 MP | 846.7 | |
| June 7/79 | 115.49 MP | 846.9 | |
| July 10/79 | 115.43 MP | 847.1 | Sampled; temp. 6.5°C |
| July 31/79 | 115.41 MP | 847.1 | |
| Aug 27/79 | 115.41 MP | 847.1 | |
| Sept 26/79 | 115.49 MP | 846.9 | |
| Oct 25/79 | 115.45 MP | 847.0 | |
| Nov 22/79 | 115.51 MP | 846.8 | |
| Dec 20/79 | 115.39 MP | 847.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

12 - 460 - W - 82

## WELL HISTORY

OBSERVATION WELL NUMBER 12-460

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1223.20

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 115.44 MP | 847.1 | |
| Feb 14/80 | 115.71 MP | 846.2 | |
| Mar 12/80 | 115.48 MP | 846.9 | |
| Apr 10/80 | | | Could not measure |
| May 7/80 | 115.60 MP | 846.5 | |
| June 5/80 | 115.48 MP | 846.9 | |
| July 4/80 | 115.41 MP | 847.1 | Temp. 10°C |
| July 10/80 | | | Bailed 200 gals to clean out |
| July 31/80 | 115.68 MP | 846.3 | |
| Aug 27/80 | 115.64 MP | 846.4 | |
| Sept 23/80 | 115.70 MP | 846.2 | |
| Oct 23/80 | 115.27 MP | 847.6 | |
| Nov 19/80 | 115.67 MP | 846.3 | |
| Dec 16/80 | 115.62 MP | 846.5 | |
| Jan 13/81 | 115.76 MP | 846.0 | |
| Feb 12/81 | 115.77 MP | 846.0 | |
| Mar 11/81 | 115.76 MP | 846.0 | |
| Apr 7/81 | 115.59 MP | 846.6 | |
| May 6/81 | 115.78 MP | 845.9 | |
| June 1/81 | 115.64 MP | 846.4 | |
| July 2/81 | 115.64 MP | 846.4 | |
| July 30/81 | 115.51 MP | 846.8 | |
| Aug 27/81 | | | Could not measure |
| Sept 21/81 | 115.65 MP | 846.4 | |
| Oct 22/81 | 115.90 MP | 845.5 | |
| Nov 19/81 | 115.73 MP | 846.1 | |
| Dec 17/81 | 115.81 MP | 845.8 | |

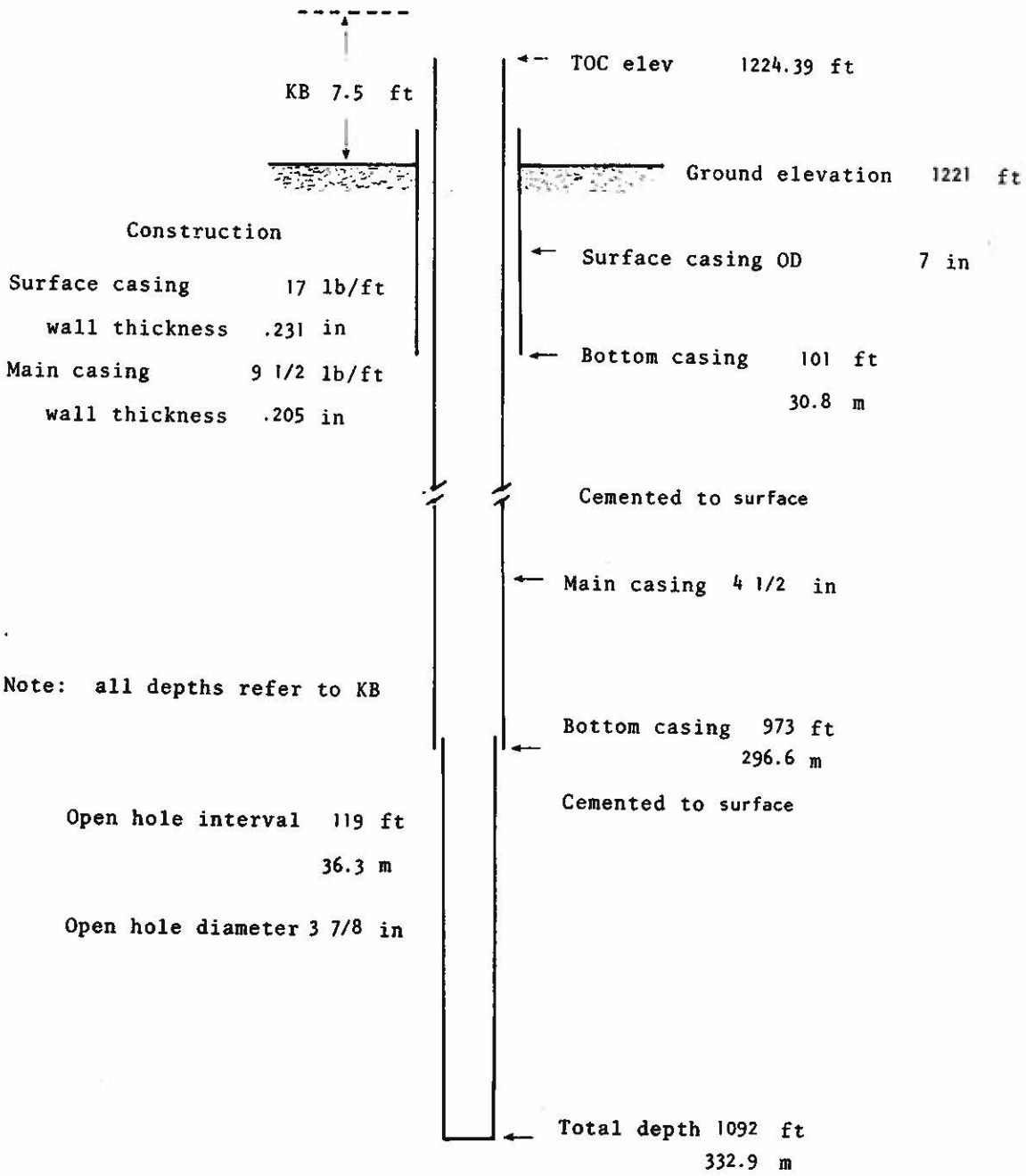
MP - Depth from measuring point
TOC - Depth from top of casing

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Tp 88 R 9 W 4th

Alberta Research Council




N.B. - 32 ft of 10 3/4 in conductor pipe at surface.

# DRILL STEM TEST

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Tp 88 R 9 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1222 |
| | KB | 1230 |
| Type of test | | Open hole, Bottom hole |
| Date of test | | December 10, 1975 |
| Testing company | | Johnston Testers |

## TEST DATA

| | | |
|---|---|---|
| Time started | 0930 | hrs |
| Tool opened | 1042 | hrs |
| First flow | 3 | min |
| Initial shut in | 33 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1233 | hrs |
| Out of hole at | | hrs |
| Wt on packers | 10,000 | lbs |
| Description of blow | Weak initial puff, dead in 2 minutes. Faint blow, dead in 1 minute on second opening | |
| Total water recovered | - | ft |
| Water sample No. | - | |
| Gas blow | - | |
| Remarks | | |

## HOLE DATA

| | |
|---|---|
| Contractor | Tri City Drilling |
| Drill pipe size (OD) | 2 7/8" IF |
| Drill collar size (ID) | 2" |
| Drill collar length (ft) | 60 |
| Open or screened interval | 553-665' |
| Formation tested | Beaverhill Lake |

## TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

## PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 560 | 560 |
| Initial hydrostatic | A | 244 | 246 |
| First flow | B | 20 | 21 |
| | B1 | 19 | 20 |
| Initial shut in | C | 24 | 25 |
| Second flow | D | 20 | 21 |
| | D1 | 20 | 21 |
| Final shut in | G | 20 | 21 |
| Final hydrostatic | H | 225 | 227 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST 12-1092-D-77

OBSERVATION WELL NUMBER 12-1092

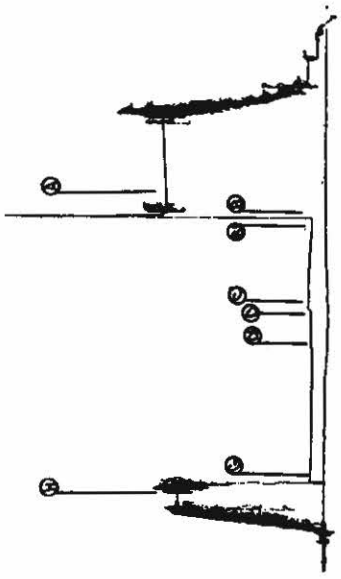
INTERVAL TESTED 553-665

PRESSURE INCREMENTS

Recorder AK1-65
December 10, 1975

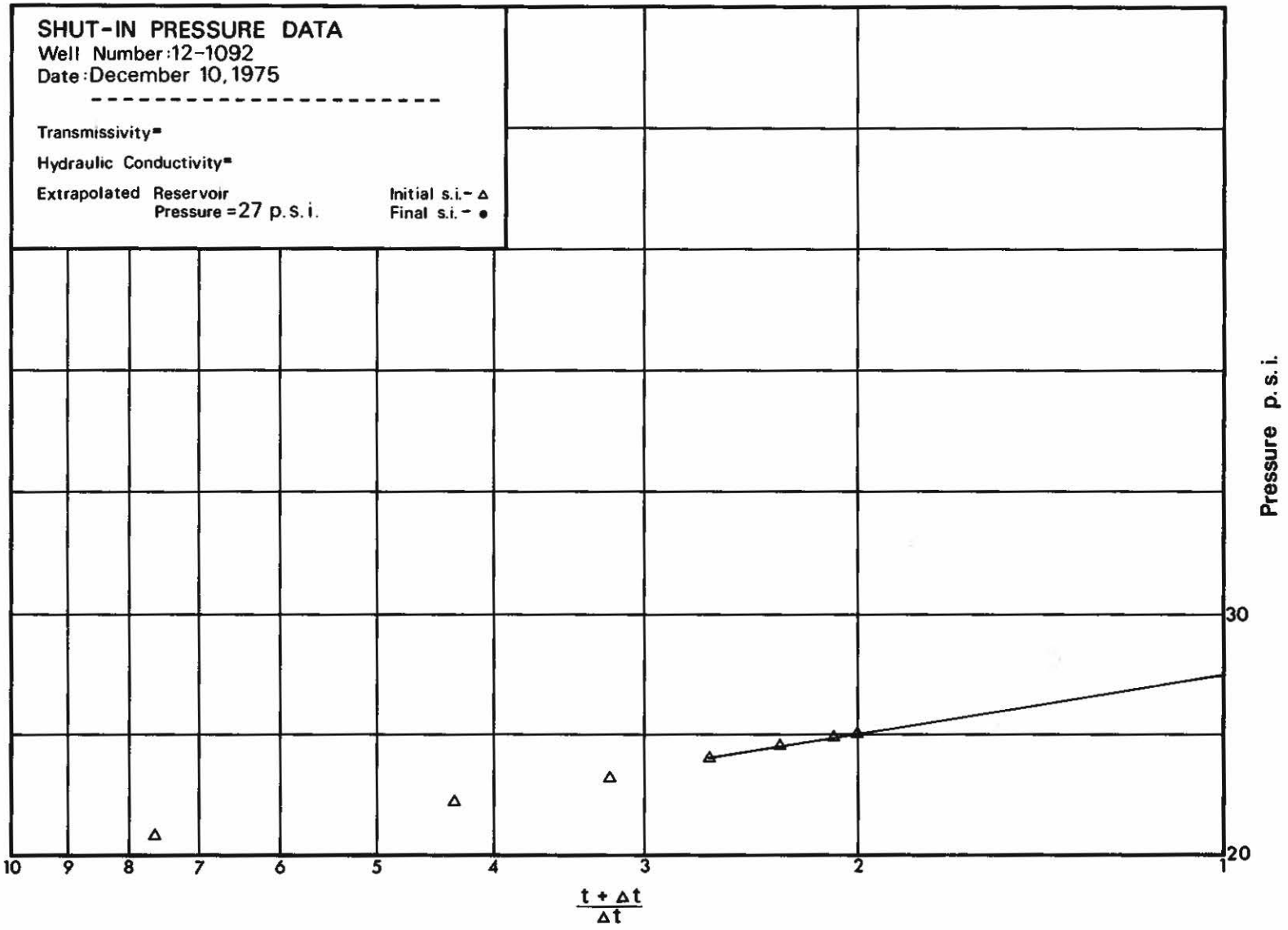
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 20.7 | 7.60 |
| 10 | 22.2 | 4.30 |
| 15 | 23.2 | 3.20 |
| 20 | 24.1 | 2.65 |
| 25 | 24.6 | 2.32 |
| 30 | 24.9 | 2.10 |
| 35 | 25.1 | 2.00 |

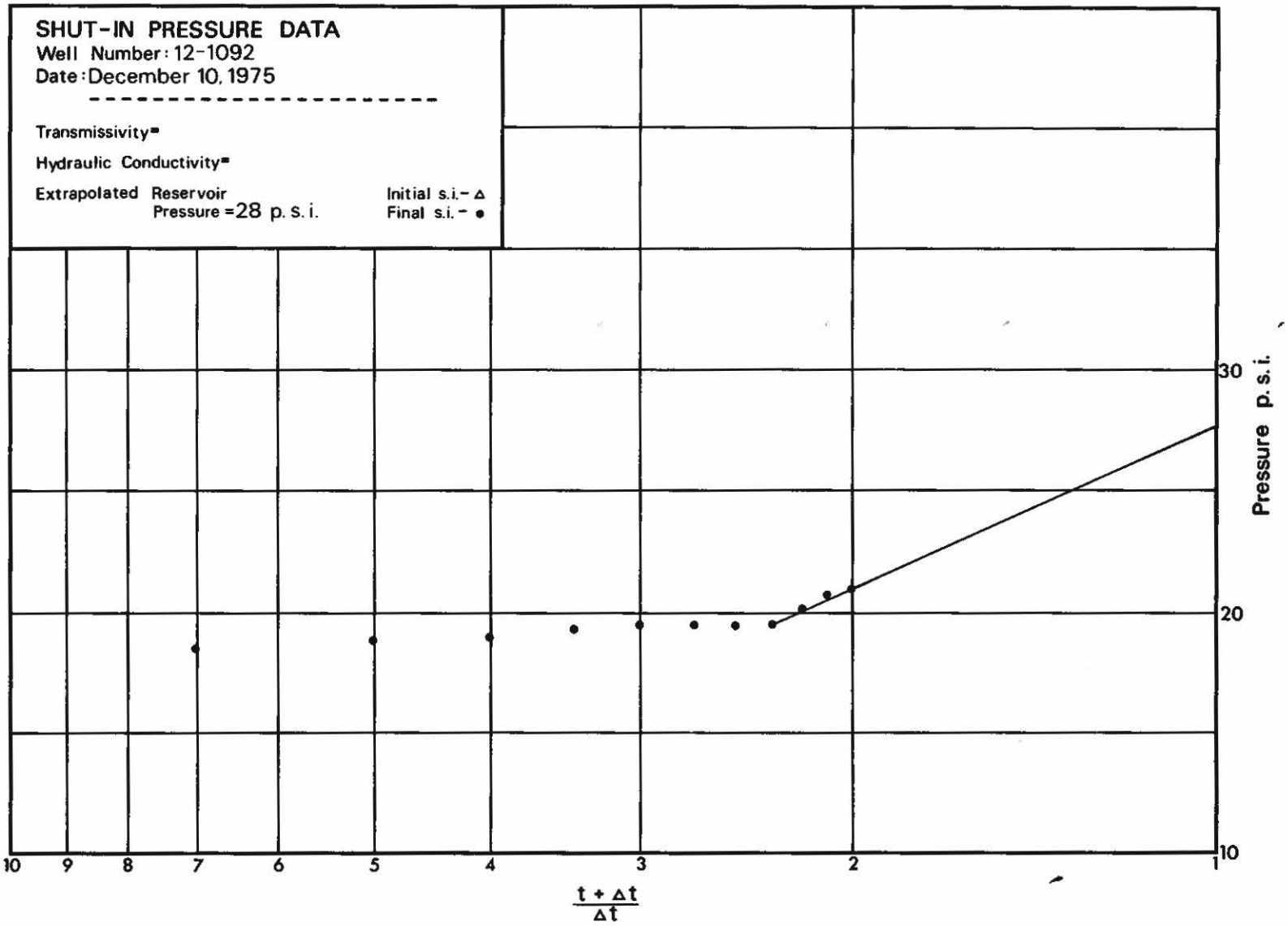


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 18.5 | 13.00 |
| 10 | 18.5 | 7.00 |
| 15 | 18.8 | 5.00 |
| 20 | 19.0 | 4.00 |
| 25 | 19.3 | 3.40 |
| 30 | 19.5 | 3.00 |
| 35 | 19.5 | 2.71 |
| 40 | 19.5 | 2.50 |
| 45 | 19.5 | 2.33 |
| 50 | 20.2 | 2.20 |
| 55 | 20.7 | 2.09 |
| 60 | 21.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 12-1092
Date: December 10, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 27 p.s.i.
Initial s.i.- Δ
Final s.i.- •
Pressure p.s.i.
30
20
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

12-1092-D-77


SHUT-IN PRESSURE DATA
Well Number: 12-1092
Date: December 10, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure =28 p. s. i.
Initial s.i.- Δ
Final s.i. - •
30
20
10
Pressure p. s. i.
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

12-1092-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Tp 88 R 9 W4th

Alberta Research Council

Elevation: gl 1222
KB 1230

Type of test Open hole, Bottom hole

Date of test December 11, 1975 I

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 2330 | hrs |
| Tool opened | 0057 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0245 | hrs |
| Out of hole at | 0430 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff - dead in 1 minute. Faint blow on second opening

Total water recovered 15 ft

Water sample No. - (drilling mud)

Gas blow -

Remarks -

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 675-787'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 681 | 685 |
| Initial hydrostatic | A | 312 | 315 |
| First flow | B | | |
| | B1 | | |
| Initial shut in | C | | |
| Second flow | D | 32 | 36 |
| | D1 | | |
| Final shut in | G | 53 | 56 |
| Final hydrostatic | H | 289 | 292 |

B1, D1, etc. Initial Hyd. Pressure

12-1092-D-77

DRILL STEM TEST

OBSERVATION WELL NUMBER 12-1092

INTERVAL TESTED 675-787

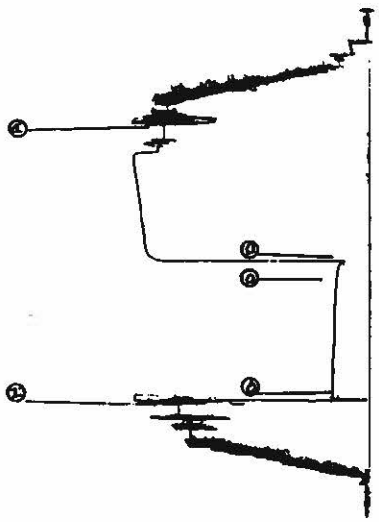
PRESSURE INCREMENTS

Recorder AK1-65
December 11, 1975

Initial Shut In

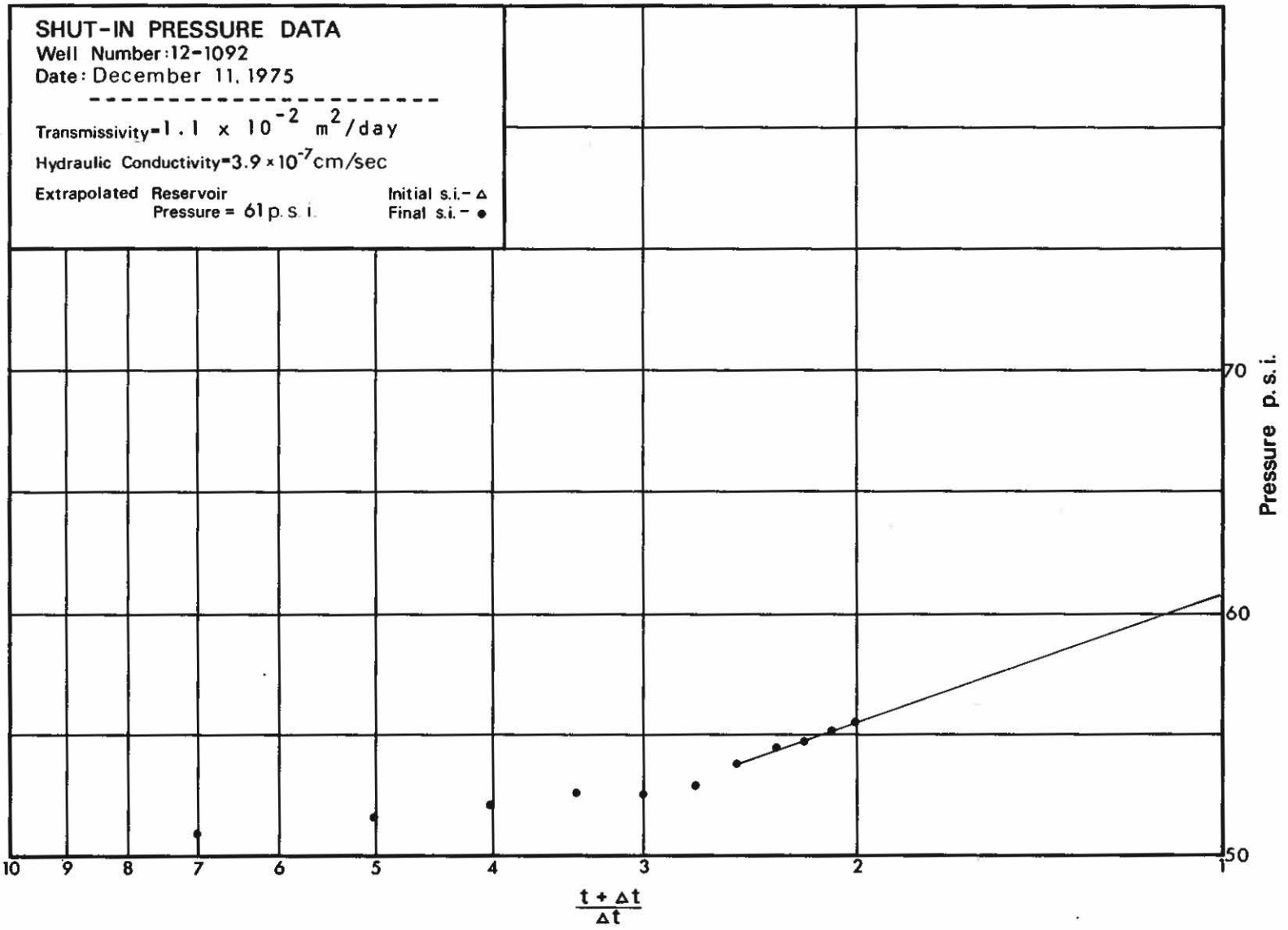
| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|

UNREADABLE



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 50.0 | 13.00 |
| 10 | 50.9 | 7.00 |
| 15 | 51.6 | 5.00 |
| 20 | 52.1 | 4.00 |
| 25 | 52.6 | 3.40 |
| 30 | 52.6 | 3.00 |
| 35 | 52.9 | 2.71 |
| 40 | 53.8 | 2.50 |
| 45 | 54.5 | 2.33 |
| 50 | 54.7 | 2.20 |
| 55 | 55.2 | 2.09 |
| 60 | 55.5 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 12-1092
Date: December 11, 1975
Transmissivity = 1.1 x 10^-2 m^2/day
Hydraulic Conductivity = 3.9 x 10^-7 cm/sec
Extrapolated Reservoir Pressure = 61 p.s.i.
Initial s.i. - Δ
Final s.i. - •
70
60
50
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
(t + Δt)/Δt

12-1092-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Tp 88 R 9 W4th

Alberta Research Council

Elevation: gl 1222
KB 1230

Type of test Open hole, Bottom hole

Date of test December 11, 1975 11

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1300 | hrs |
| Tool opened | 1427 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1615 | hrs |
| Out of hole at | 1730 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff. Faint blow on second opening.

Total water recovered 15 ft

Water sample No. - (drilling mud)

Gas blow -

Remarks -

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 692-867'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 155.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 174.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 698 | 702 |
| Initial hydrostatic | A | 331 | 334 |
| First flow | B | 15 | 18 |
| | B1 | 15 | 18 |
| Initial shut in | C | 43 | 46 |
| Second flow | D | 16 | 19 |
| | D1 | 16 | 19 |
| Final shut in | G | 25 | 28 |
| Final hydrostatic | H | - | - |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

12-1092-D-77

OBSERVATION WELL NUMBER 12-1092

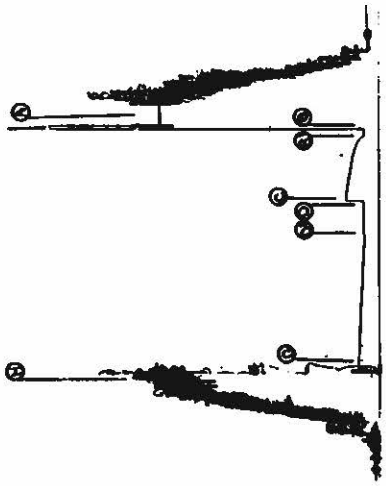
INTERVAL TESTED 692-867

PRESSURE INCREMENTS

Recorder AK1-65
December 11, 1975 ||

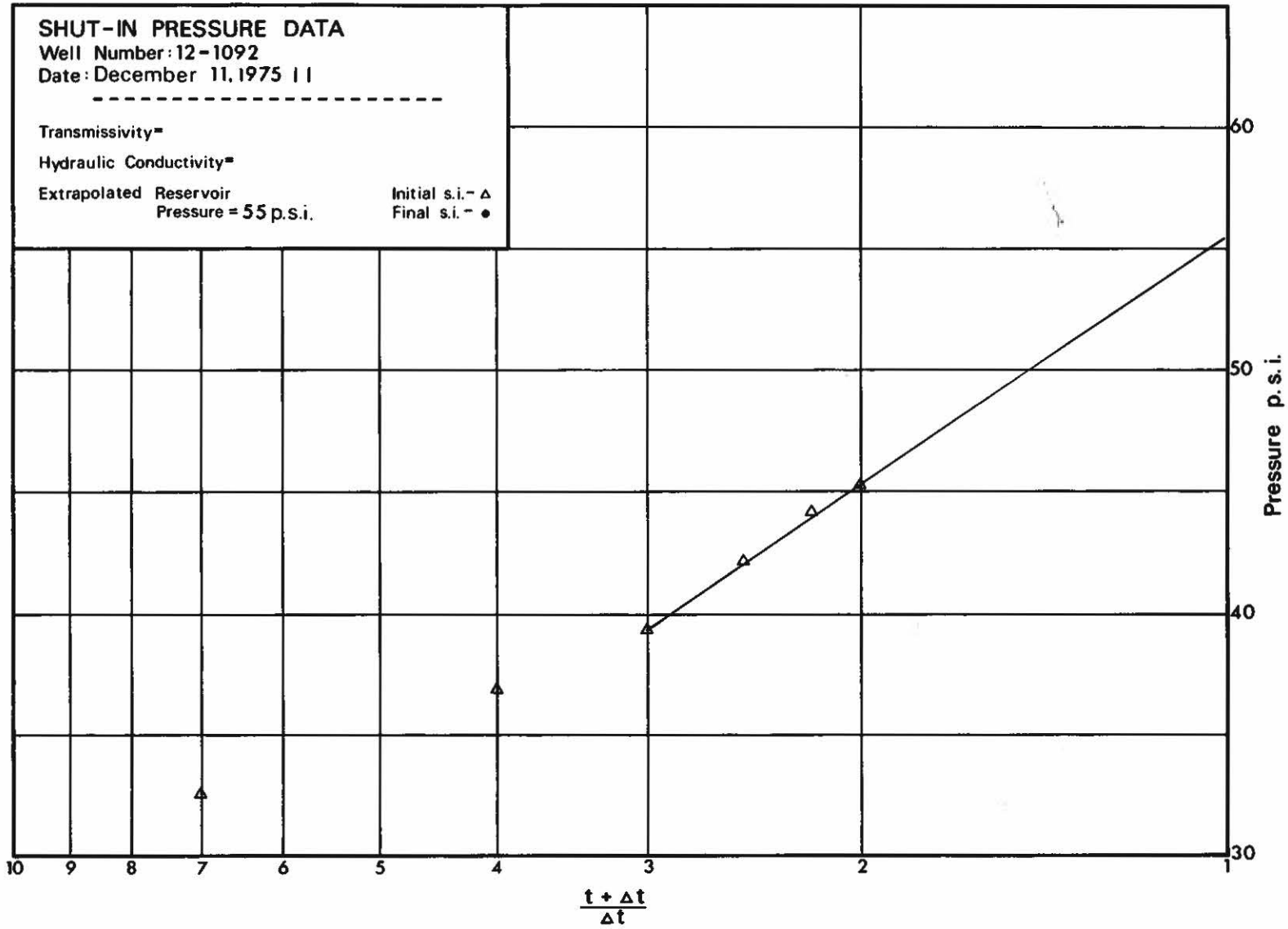
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 32.2 | 7.00 |
| 10 | 36.6 | 4.00 |
| 15 | 39.1 | 3.00 |
| 20 | 42.0 | 2.50 |
| 25 | 44.0 | 2.20 |
| 30 | 45.1 | 2.00 |

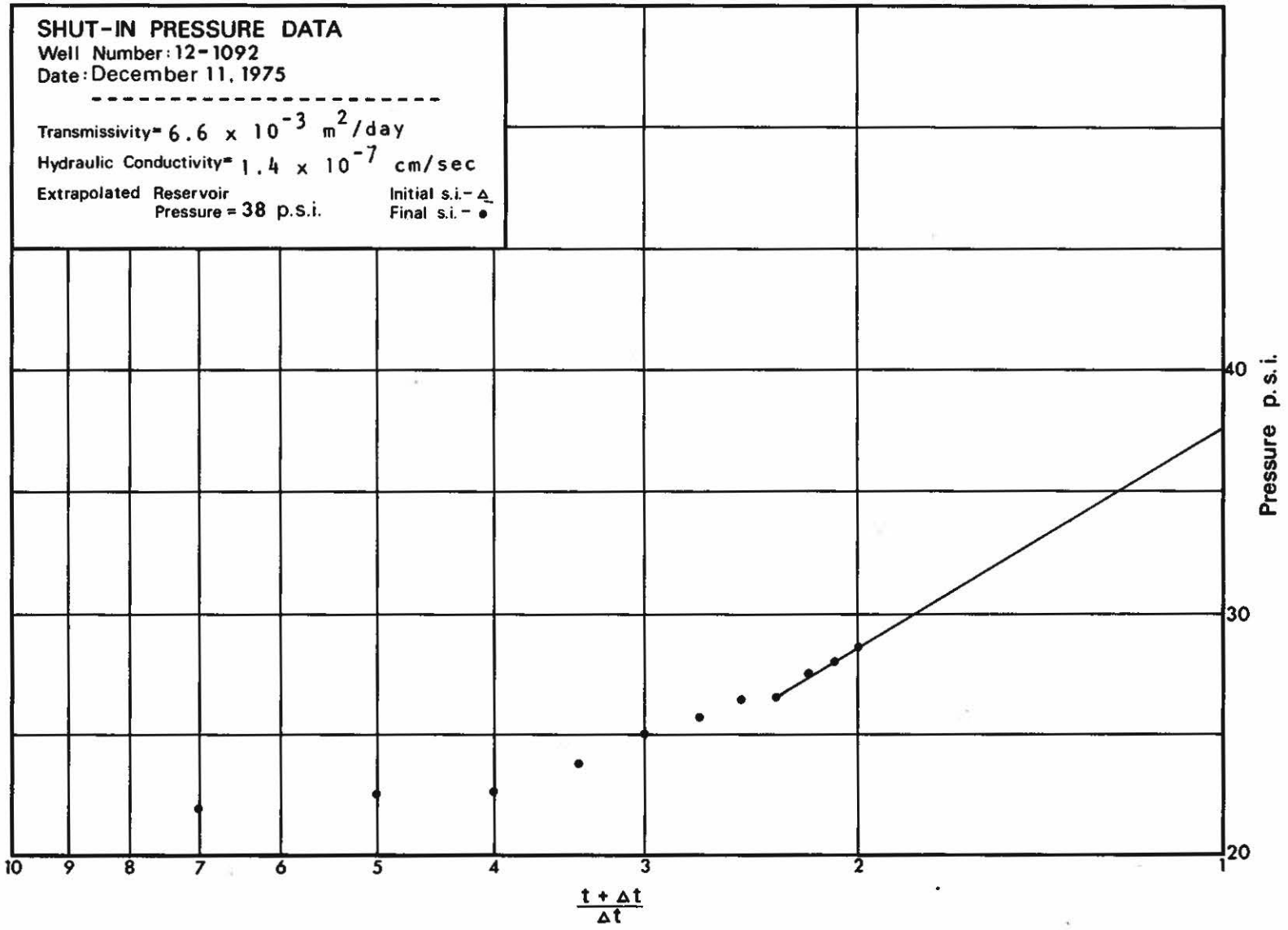


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 20.4 | 13.00 |
| 10 | 21.7 | 7.00 |
| 15 | 22.4 | 5.00 |
| 20 | 22.6 | 4.00 |
| 25 | 23.7 | 3.40 |
| 30 | 24.9 | 3.00 |
| 35 | 25.7 | 2.71 |
| 40 | 26.4 | 2.50 |
| 45 | 26.6 | 2.33 |
| 50 | 27.5 | 2.20 |
| 55 | 28.0 | 2.09 |
| 60 | 28.6 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 12-1092
Date: December 11, 1975 11
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 55 p.s.i.
Initial s.i.- Δ
Final s.i. - •
60
50
40
30
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

12-1092-D-77


SHUT-IN PRESSURE DATA
Well Number: 12-1092
Date: December 11, 1975
Transmissivity = 6.6 x 10^-3 m^2/day
Hydraulic Conductivity = 1.4 x 10^-7 cm/sec
Extrapolated Reservoir Pressure = 38 p.s.i.
Initial s.i. - Δ
Final s.i. - •
40
30
20
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

12-1092-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Tp 88 R 9 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1222 |
| | KB | 1230 |
| Type of test | | Open hole, Bottom hole |
| Date of test | | December 12, 1975 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 1130 | hrs |
| Tool opened | 1257 | hrs |
| First flow | 3 | min |
| Initial shut in | 20 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1445 | hrs |
| Out of hole at | 1600 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff. Faint blow on second opening

Total water recovered 15 ft

Water sample No. -

Gas blow -

Remarks -

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 867-980'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 873 | 877 |
| Initial hydrostatic | A | - | - |
| First flow | B | 19 | 22 |
| | B1 | 18 | 22 |
| Initial shut in | C | 219 | 222 |
| Second flow | D | 20 | 24 |
| | D1 | 20 | 24 |
| Final shut in | G | 204 | 207 |
| Final hydrostatic | H | - | 380 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

12-1092-D-77

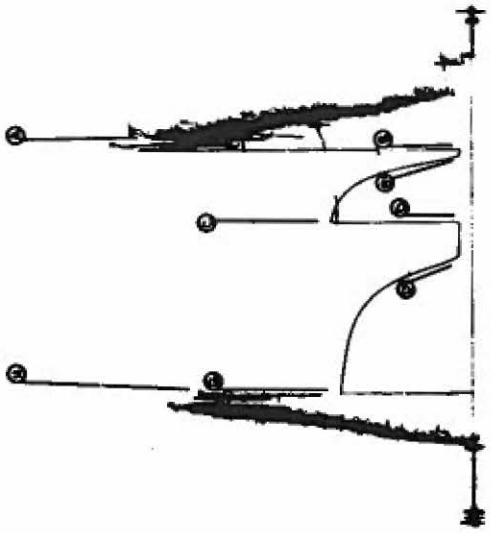
OBSERVATION WELL NUMBER 12-1092

INTERVAL TESTED 867-980

PRESSURE INCREMENTS
Recorder AKI-65
December 12, 1975

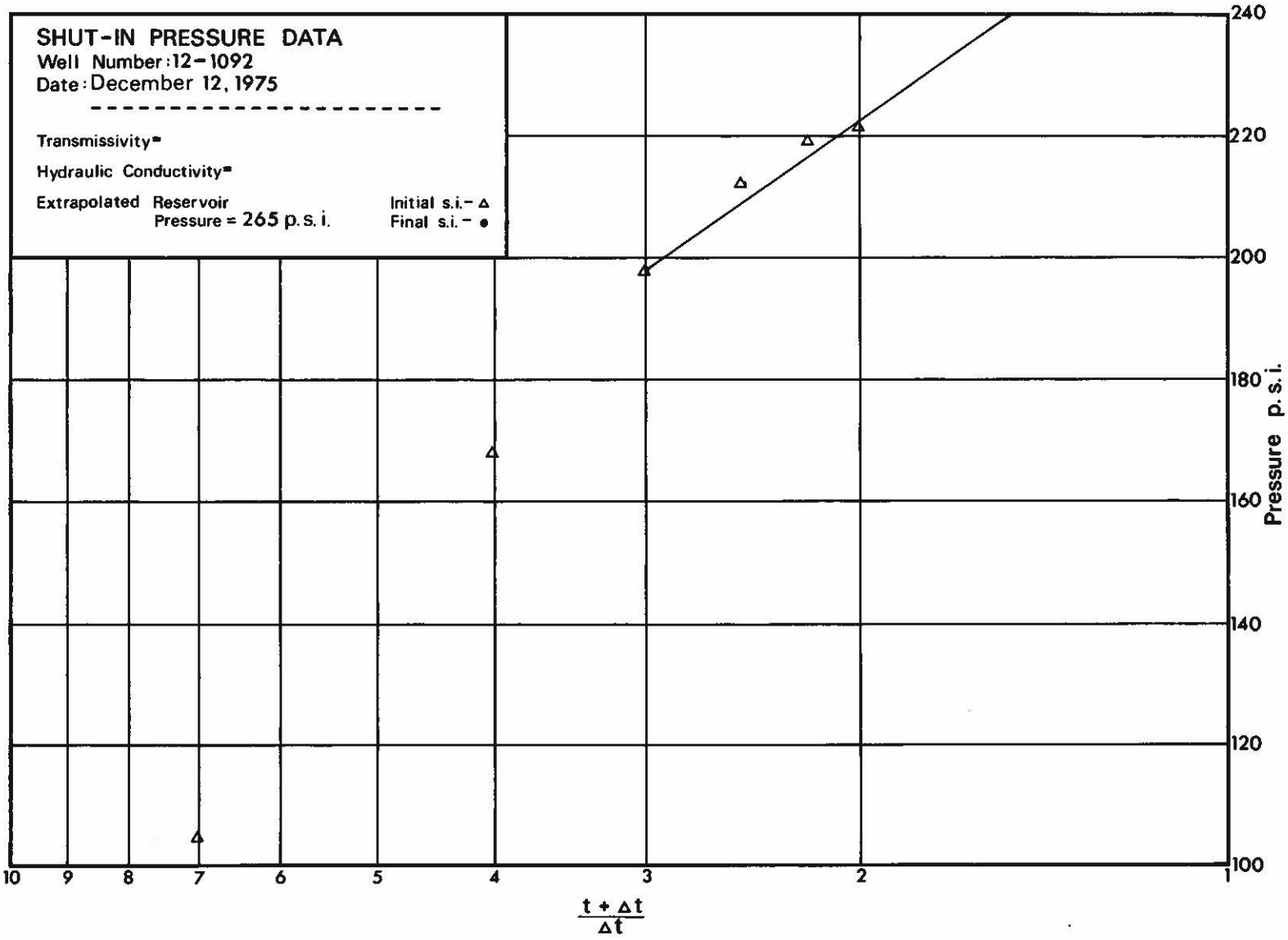
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 103.3 | 7.00 |
| 10 | 167.8 | 4.00 |
| 15 | 197.7 | 3.00 |
| 20 | 212.1 | 2.50 |
| 25 | 219.5 | 2.20 |
| 30 | 221.5 | 2.00 |

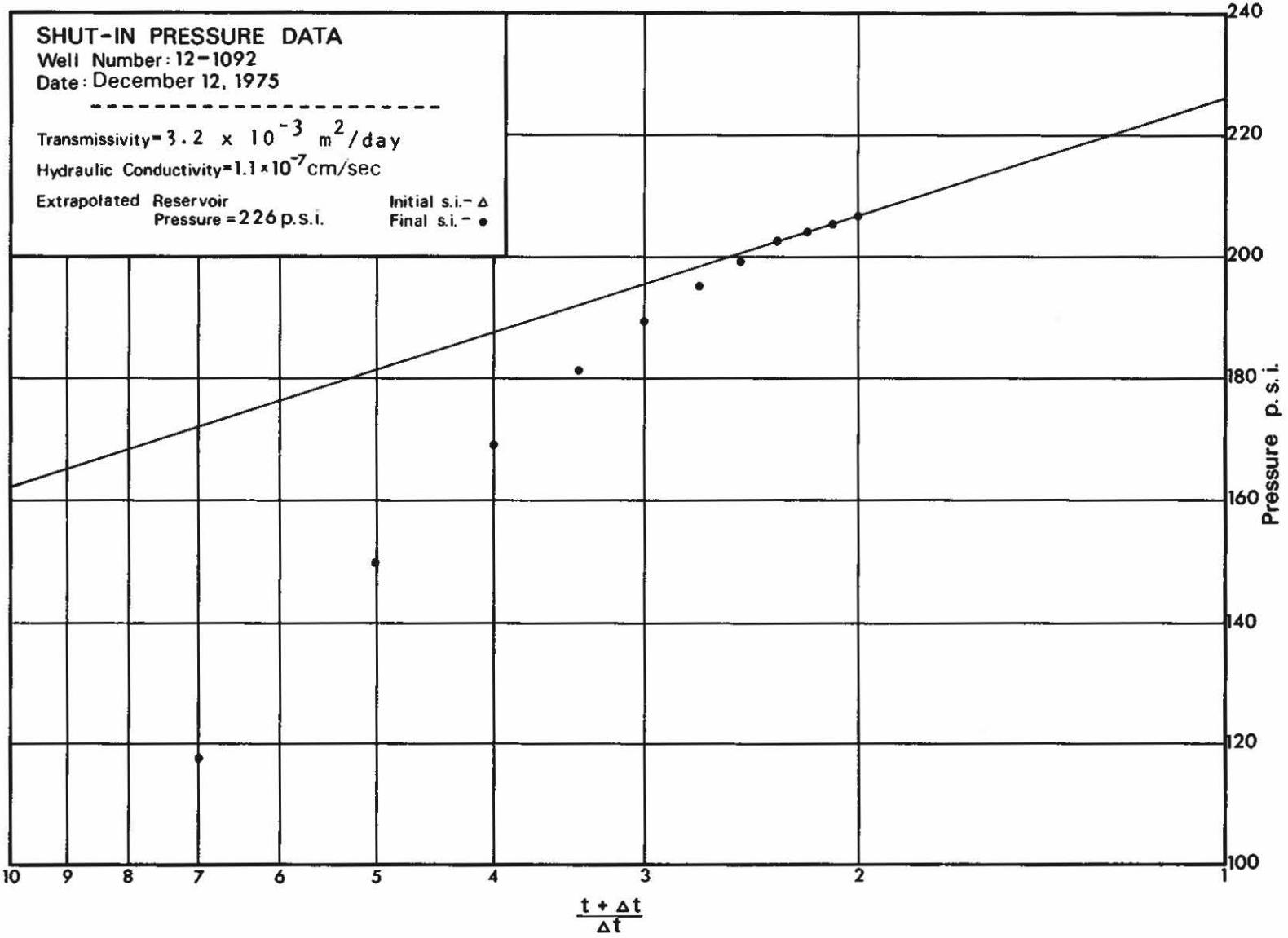


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 65.6 | 13.00 |
| 10 | 116.5 | 7.00 |
| 15 | 149.1 | 5.00 |
| 20 | 168.3 | 4.00 |
| 25 | 180.7 | 3.40 |
| 30 | 189.1 | 3.00 |
| 35 | 194.9 | 2.71 |
| 40 | 198.7 | 2.50 |
| 45 | 202.3 | 2.33 |
| 50 | 203.8 | 2.20 |
| 55 | 205.1 | 2.09 |
| 60 | 206.6 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 12-1092
Date: December 12, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 265 p.s.i.
Initial s.i.- Δ
Final s.i. - •
240
220
200
180
160
140
120
100
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

12-1092-D-77


SHUT-IN PRESSURE DATA
Well Number: 12-1092
Date: December 12, 1975
Transmissivity = 3.2 x 10^-3 m^2/day
Hydraulic Conductivity = 1.1 x 10^-7 cm/sec
Extrapolated Reservoir Pressure = 226 p.s.i.
Initial s.i. - Δ
Final s.i. - •
240
220
200
180
160
140
120
100
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

12-1092-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Tp 88 R 9 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1222 |
| | KB | 1230 |
| Type of test | | Open hole, Bottom hole |
| Date of test | | December 13, 1975 I |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 0900 | hrs |
| Tool opened | 1042 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1230 | hrs |
| Out of hole at | 1500 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Strong initial puff on preflow. Fair air blow on final flow period

Total water recovered 120 ft

Water sample No. - (Salty drilling mud)

Gas blow No

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 980-1092'

Formation tested Prairie Evaporite

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 988 | 992 |
| Initial hydrostatic | A | 490 | 488 |
| First flow | B | 75 | 74 |
| | B1 | 75 | 74 |
| Initial shut in | C | 481 | 479 |
| Second flow | D | 83 | 81 |
| | D1 | 85 | 83 |
| Final shut in | G | 112 | 110 |
| Final hydrostatic | H | 450 | 448 |

B1, D1, etc. Initial Hyd. Pressure

## DRILL STEM TEST

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Tp 88 R 9 W4th

Alberta Research Council

Elevation: gl 1222
KB 1230

Type of test Open hole, Bottom hole

Date of test December 13, 1975 11

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0500 | hrs |
| Tool opened | | hrs |
| First flow | | min |
| Initial shut in | | min |
| Second flow | | min |
| Final shut in | | min |
| Pulled loose at | | hrs |
| Out of hole at | 0800 | hrs |
| Wt on packers | 10,000 | lbs |
| Description of blow | Nil | |

Total water recovered Nil ft

Water sample No. - (drilling mud)

Gas blow

Remarks Misrun, poor packer seat

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 980-1092'

Formation tested Beaverhill Lake and Prairie Evaporite

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 988 | 992 |
| Initial hydrostatic | A | 495 | 499 |
| First flow | B | 487 | 490 |
| | B1 | | |
| Initial shut in | C | | |
| Second flow | D | | |
| | D1 | | |
| Final shut in | G | | |
| Final hydrostatic | H | | |

B1, D1, etc. Initial Hyd. Pressure

## WATER ANALYSIS

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Sample source Bailed from 12-1092

Date sampled February 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1740.0 | 86.83 | 1.7 |
| Magnesium ($Mg^{++}$) | 0.2 | 0.02 | 0.0 |
| Sodium ($Na^{+}$) | 118750.0 | 5165.29 | 98.3 |
| Potassium ($K^{+}$) | 28.3 | 0.72 | 0.0 |
| Carbonate ($CO_3^{=}$) | 14.0 | 0.47 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 2640.0 | 54.97 | 1.0 |
| Chloride ($Cl^{-}$) | 193200.0 | 5448.39 | 99.0 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 2.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 322540.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5503.836 | Total Cations (epm) | 5252.856 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | |
| pH | 11.2 | pH | 11.5 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| | | Hydroxide ($OH^{-}$) | 61.2 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1700.0 | 84.83 | 2 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 119500.0 | 5197.91 | 98 |
| Potassium ($K^{+}$) | 43.3 | 1.11 | 0 |
| Carbonate ($CO_3^{=}$) | 12.0 | 0.40 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 4025.0 | 83.80 | 2 |
| Chloride ($Cl^{-}$) | 186400.0 | 5256.63 | 98 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0 |
| Silica ($SiO_2$) | 0.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1738.0 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 309300 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5340.83 | Total Cations (epm) | 5283.85 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 11.0 | |
| pH | 11.3 | pH | 12.5 | |
| Fluoride ($F^{-}$) | 0.1 Mg/L | Carbonate ($CO_3^{=}$) | 24 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 44 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Sample source Bailed from 12-1092

Date sampled February 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1740.0 | 86.83 | 1.7 |
| Magnesium ($Mg^{++}$) | 0.2 | 0.02 | 0.0 |
| Sodium ($Na^{+}$) | 118750.0 | 5165.29 | 98.3 |
| Potassium ($K^{+}$) | 28.3 | 0.72 | 0.0 |
| Carbonate ($CO_3^{=}$) | 14.0 | 0.47 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 2640.0 | 54.97 | 1.0 |
| Chloride ($Cl^{-}$) | 193200.0 | 5448.39 | 99.0 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 2.2 | | |
| Hydroxide ($OH^{-}$) | 48.0 | 2.82 | 0.0 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 322540.0 | | |
| Total Anions (epm) | 5506.66 | Total Cations (epm) | 5252.86 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | |
| pH | 11.2 | pH | 11.5 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| | | Hydroxide ($OH^{-}$) | 61.2 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1700.0 | 84.83 | 2 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 119500.0 | 5197.91 | 98 |
| Potassium ($K^{+}$) | 43.3 | 1.11 | 0 |
| Carbonate ($CO_3^{=}$) | 12.0 | 0.40 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 4025.0 | 83.80 | 2 |
| Chloride ($Cl^{-}$) | 186400.0 | 5256.63 | 98 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0 |
| Silica ($SiO_2$) | 0.8 | | |
| Hydroxide ($OH^{-}$) | 42.8 | 2.52 | 0 |
| Calcium (Acidified) | 1738.0 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 309300 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5343.35 | Total Cations (epm) | 5283.85 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 11.0 | |
| pH | 11.3 | pH | 12.5 | |
| Fluoride ($F^{-}$) | 0.1 Mg/L | Carbonate ($CO_3^{=}$) | 24 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 44 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 12, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1840.0 | 91.82 | 1.7 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.02 | 0.0 |
| Sodium ($Na^{+}$) | 119000.0 | 5176.16 | 98.2 |
| Potassium ($K^{+}$) | 22.1 | 0.57 | 0.0 |
| Carbonate ($CO_3^{=}$) | 14.4 | 0.48 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 4200.0 | 87.45 | 1.6 |
| Chloride ($Cl^{-}$) | 196000.0 | 5527.35 | 98.4 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 1.5 | | |
| Hydroxide ($OH^{-}$) | 34.7 | 2.04 | 0.0 |
| Calcium (Acidified) | 1680.0 | | |
| Magnesium (Acidified) | 0.5 | | |
| Total dissolved solids | 314460.0 | | |
| Total Anions (epm) | 5617.33 | Total Cations (epm) | 5268.57 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 11.0 |
| pH | 10.8 | pH | 10.9 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | 14.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 35.0 ppm |
| | | Conductivity | |

12-1092-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Rge 9 Twp 88 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 11, 1978

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1520.0 | 75.85 | 1.5 |
| Magnesium(Mg) | 0.0 | 0.00 | 0.0 |
| Sodium(Na) | 118250.0 | 5143.54 | 98.5 |
| Potassium(K) | 53.0 | 1.36 | 0.0 |
| Carbonate(CO3) | 24.0 | 0.80 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 3660.0 | 76.20 | 1.4 |
| Chloride(Cl) | 184400.0 | 5200.23 | 98.5 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 0.3 | | |
| Hydroxide(OH) | 19.0 | 1.12 | 0.0 |
| Calcium(Acidified) | 1520.0 | | |
| Magnesium(Acidified) | 0.4 | | |
| TDS(mg/l) | 298900.0 | | |
| Total Anions(epm) | 5278.34 | Total Cations(epm) | 5220.74 |

## Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 79999 | | Temperature(C) | 11.00 | |
| pH | 11.4 | | pH | 10.7 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | 19 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 19 | mg/l |

12-1092-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Rge 9 Twp 88 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1470.0 | 73.35 | 1.3 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.0 |
| Sodium(Na) | 125000.0 | 5437.15 | 98.6 |
| Potassium(K) | 55.0 | 1.41 | 0.0 |
| Carbonate(CO3) | 16.8 | 0.56 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 3290.0 | 68.50 | 1.3 |
| Chloride(Cl) | 185000.0 | 5217.15 | 98.7 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 1.7 | | |
| Hydroxide(OH) | 3.4 | 0.20 | 0.0 |
| Calcium(Acidified) | 1425.0 | | |
| Magnesium(Acidified) | 0.4 | | |
| TDS(mg/l) | 314700.0 | | |
| Total Anions(epm) | 5286.40 | Total Cations(epm) | 5511.95 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 20000 | Temperature(C) | 15.00 | |
| pH | 10.0 | pH | 10.5 | |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) | 19 | mg/l |
| | | Bicarbonate(HCO3) | | |
| | | Hydroxide(OH) | 14 | mg/l |

WATER ANALYSIS 12-1092-E-82

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Rge 9 Twp 88 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 4, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1670.0 | 83.50 | 1.7 |
| Magnesium(Mg) | 0.2 | 0.02 | 0.0 |
| Sodium(Na) | 114250.0 | 4967.39 | 98.3 |
| Potassium(K) | 50.0 | 1.28 | 0.0 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 19.5 | 0.32 | 0.0 |
| Sulphate(SO4) | 3600.0 | 75.00 | 1.4 |
| Chloride(Cl) | 190000.0 | 5352.11 | 98.6 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 2.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1490.0 | | |
| Magnesium(Acidified) | 0.9 | | |
| TDS(mg/l) | 317685.0 | | |
| Total Anions(epm) | 5427.43 | Total Cations(epm) | 5052.19 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 219999 |
| pH | 7.2 |
| Fluoride | 0.1 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 12.00 | |
| pH | 10.3 | |
| Carbonate(CO3) | 29 | mg/l |
| Bicarbonate(HCO3) | 0 | mg/l |
| Hydroxide(OH) | 5 | mg/l |

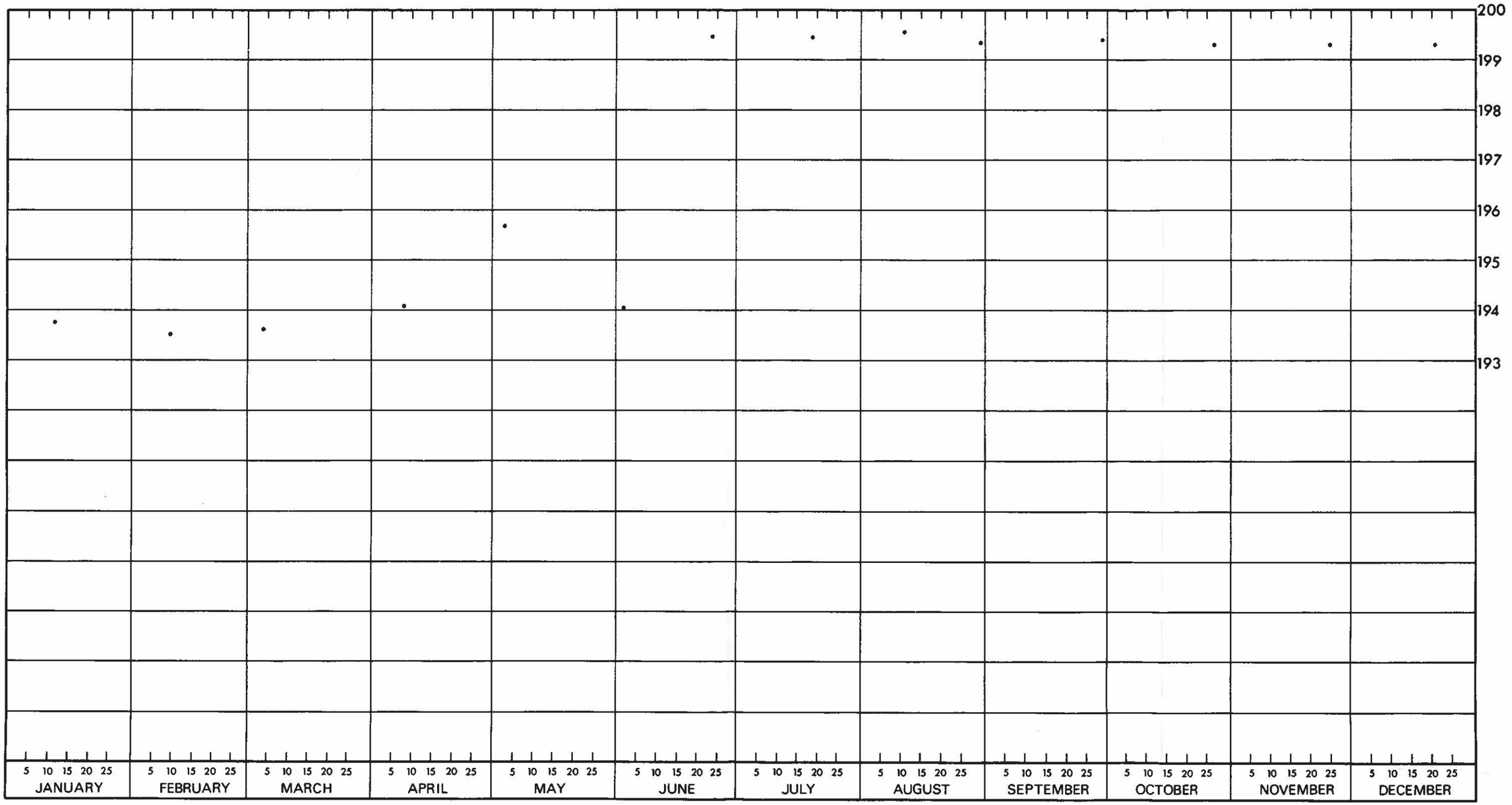
WATER LEVEL HYDROGRAPH

12 - 1092 - H - 77

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council




1976

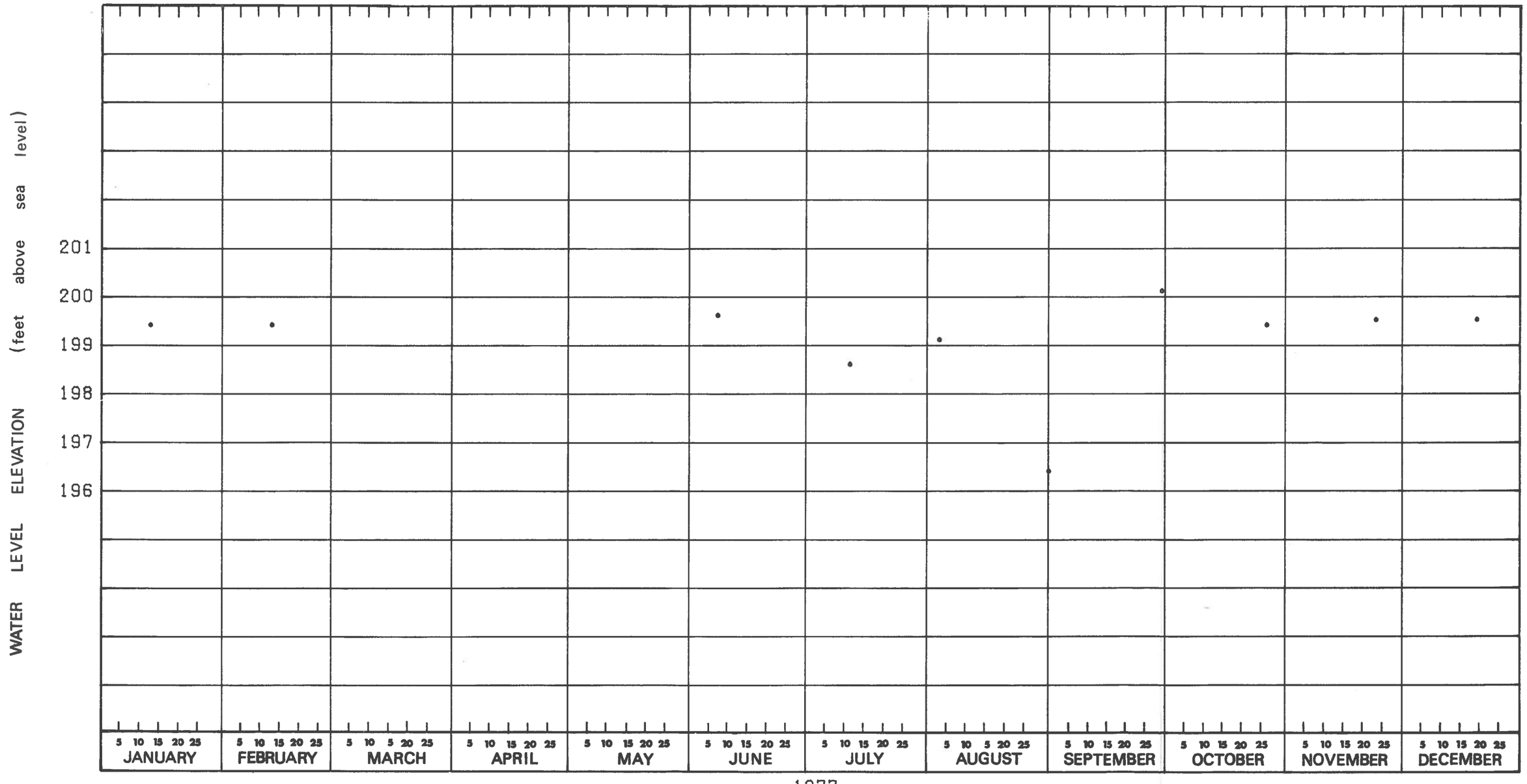
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta Research Council

12-1092-H-78




1977

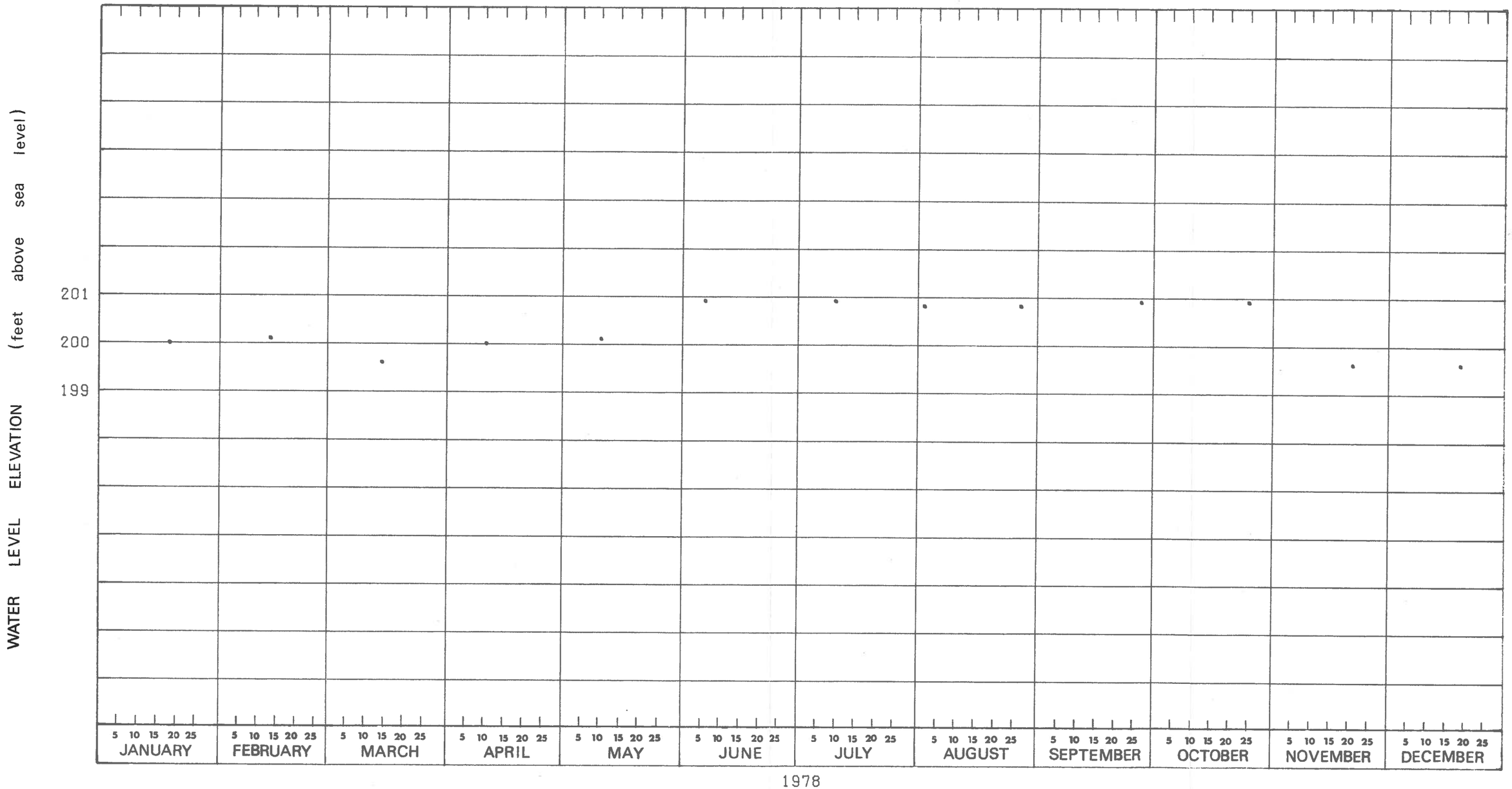
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-1092

LSD 8 SEC 27 TWP 88 R 9 W4TH

12-1092-H-79

Alberta Research Council



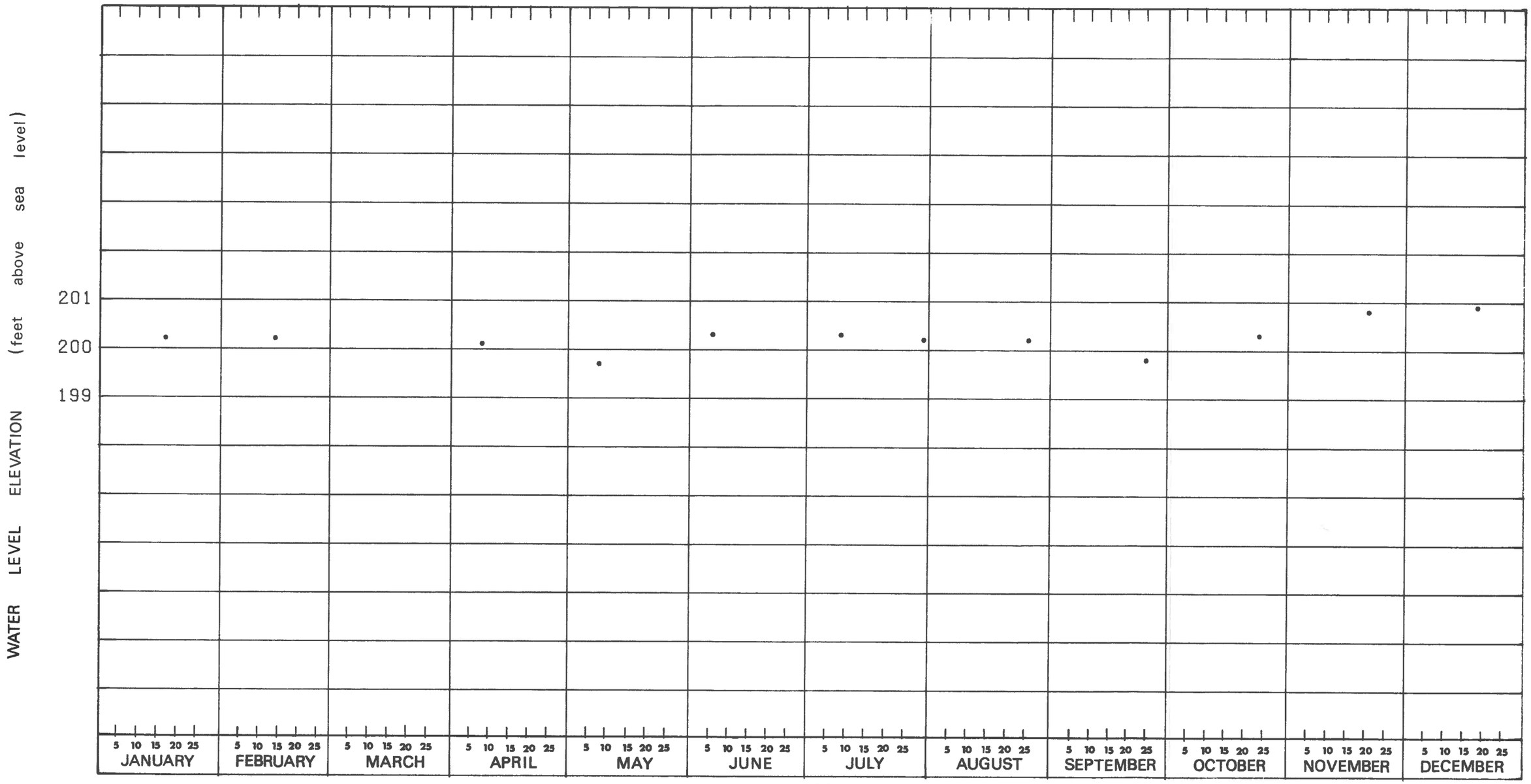
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta Research Council

12-1092-H-80



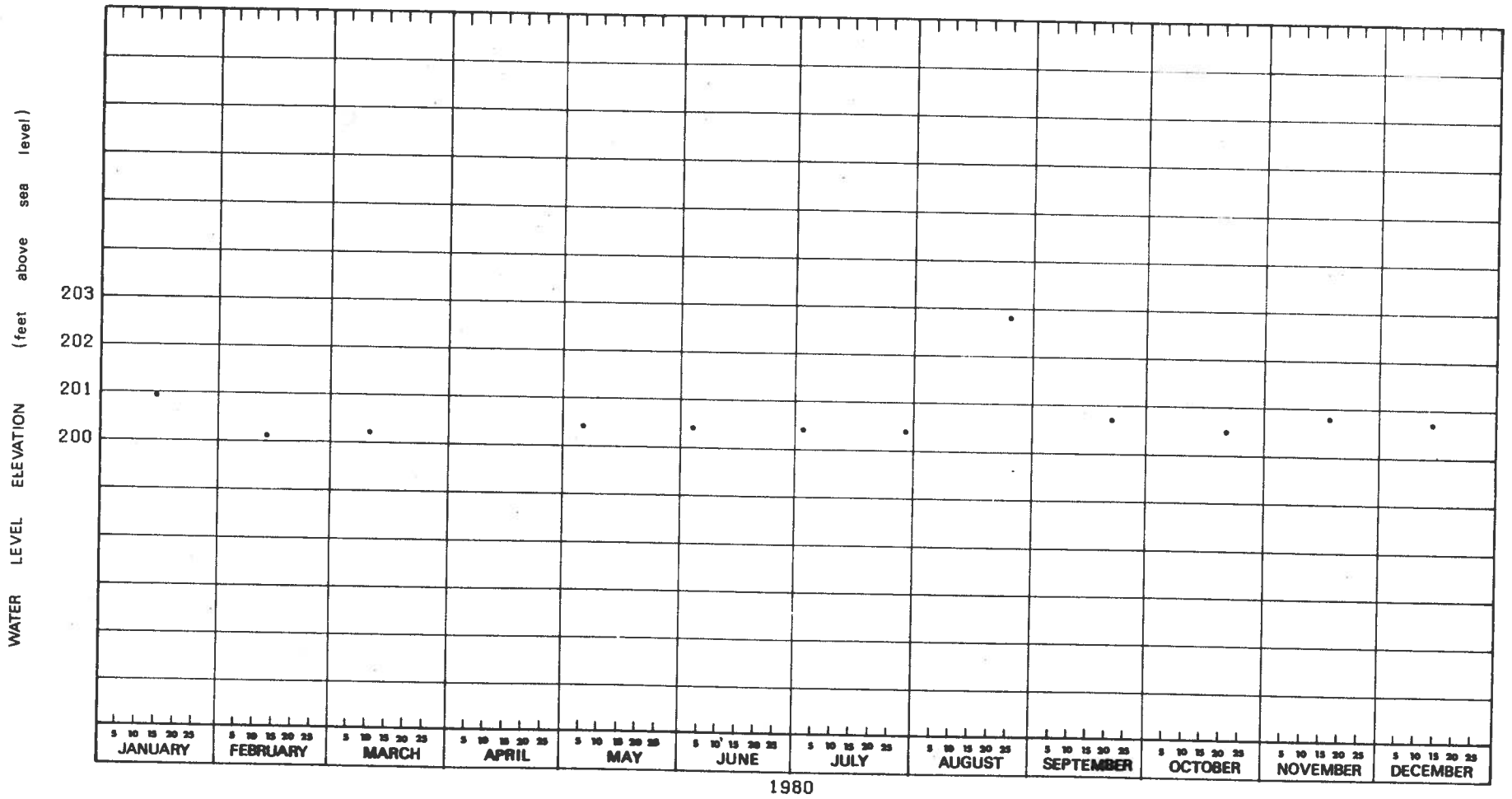
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta Research Council

12-1092-H-81



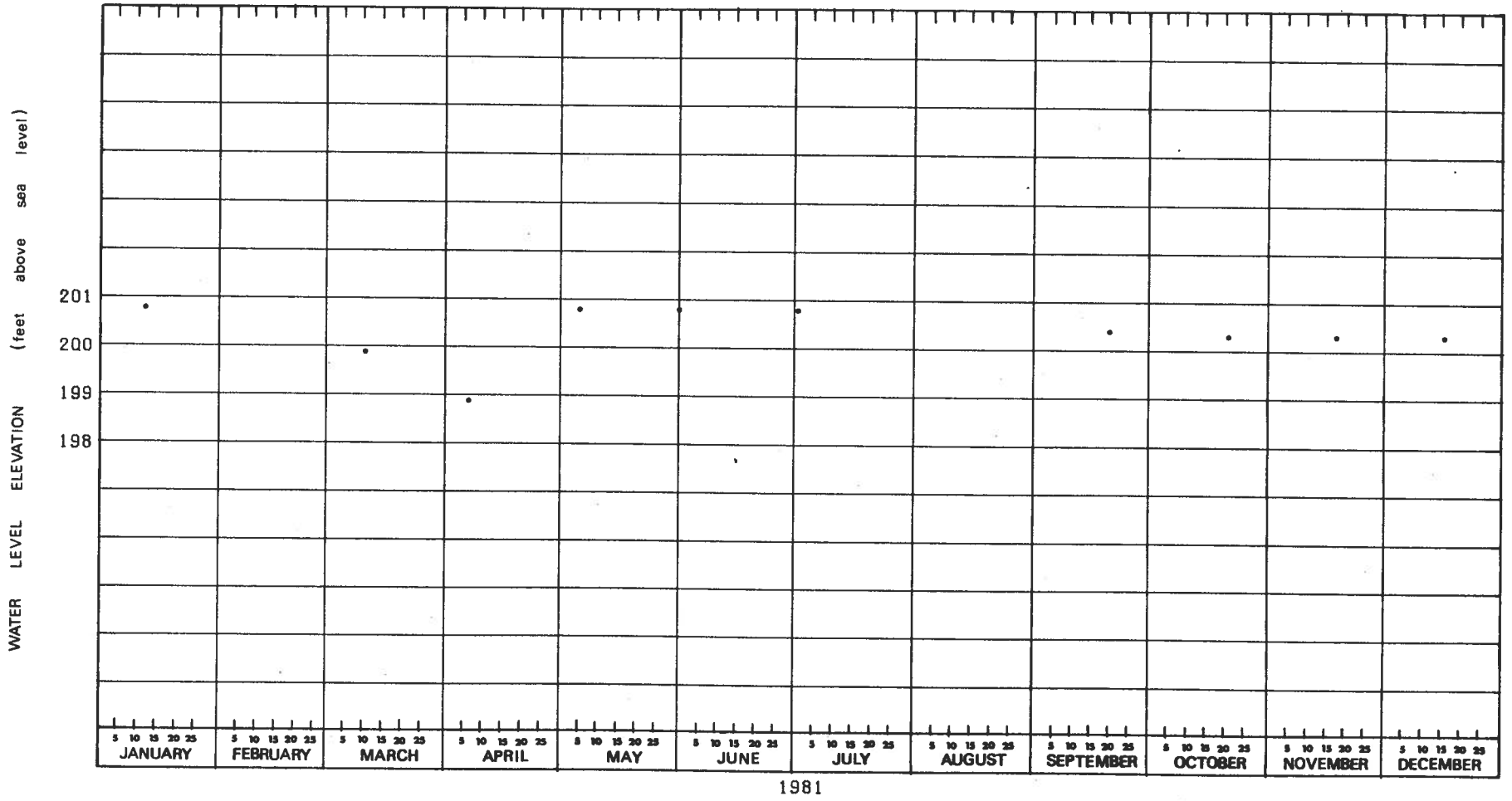
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4 th

Alberta Research Council

12-1092-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1224.39

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Dec 14/75 | | | Well completed |
| Dec 18/75 | 312.21 TOC | 200.3 | |
| Jan 12/76 | 314.77 MP | 193.7 | MP = 0.55 m TOC, (1226.2) |
| Feb 10/76 | 314.84 MP | 193.5 | |
| Mar 4/76 | 314.81 MP | 193.6 | |
| Apr 8/76 | 314.39 MP | 194.1 | New MP = 0.27 m TOC, (1225.3) |
| May 3/76 | 313.90 MP | 195.7 | |
| June 2/76 | 314.40 MP | 194.1 | |
| June 24/76 | 312.75 MP | 199.5 | |
| July 19/76 | 312.75 MP | 199.5 | Sampled; temp. 11°C |
| Aug 11/76 | 312.72 MP | 199.6 | |
| Aug 30/76 | 312.78 MP | 199.4 | |
| Sept 29/76 | 312.77 MP | 199.4 | |
| Oct 27/76 | 312.79 MP | 199.3 | |
| Nov 25/76 | 312.79 MP | 199.3 | |
| Dec 21/76 | 312.80 MP | 199.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1224.39

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 312.78 MP | 199.4 | MP (1225.3) |
| Feb 14/77 | 312.77 MP | 199.4 | |
| Mar 17/77 | | | >200 m |
| Apr 13/77 | Dry | | |
| May 12/77 | Dry | | |
| June 8/77 | 312.70 MP | 199.6 | |
| July 12/77 | 313.01 MP | 198.6 | Sampled; temp. 11°C |
| Aug 4/77 | 312.86 MP | 199.1 | |
| Sept 1/77 | 313.70 MP | 196.4 | |
| Sept 30/77 | 312.55 MP | 200.1 | |
| Oct 27/77 | 312.77 MP | 199.4 | |
| Nov 24/77 | 312.75 MP | 199.5 | |
| Dec 20/77 | 312.75 MP | 199.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1224.39

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 19/78 | 312.60 MP | 200.0 | MP (1225.3) |
| Feb 14/78 | 312.55 MP | 200.1 | |
| Mar 15/78 | 312.71 MP | 199.6 | |
| Apr 11/78 | 312.58 MP | 200.0 | |
| May 11/78 | 312.55 MP | 200.1 | |
| June 7/78 | 312.32 MP | 200.9 | |
| July 11/78 | 312.33 MP | 200.9 | Sampled; temp. 11°C |
| Aug 3/78 | 312.34 MP | 200.8 | |
| Aug 28/78 | 312.34 MP | 200.8 | |
| Sept 28/78 | 312.33 MP | 200.9 | |
| Oct 26/78 | 312.32 MP | 200.9 | |
| Nov 22/78 | 312.71 MP | 199.6 | |
| Dec 20/78 | 312.71 MP | 199.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12-1092

Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1224.39 before Aug 27/79
1222.92 after Aug 27/79

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 312.53 MP | 200.2 | MP (1225.3) |
| Feb 15/79 | 312.54 MP | 200.2 | |
| Mar 15/79 | | | Could not measure |
| Apr 9/79 | 312.57 MP | 200.1 | |
| May 9/79 | 312.68 MP | 199.7 | |
| June 7/79 | 312.50 MP | 200.3 | |
| July 10/79 | 312.51 MP | 200.3 | Sampled; temp. 15°C |
| July 31/79 | 312.53 MP | 200.2 | |
| Aug 27/79 | 312.54 MP | 200.2 | New MP 0.36m TOC (1224.1) |
| Sept 26/79 | 312.28 MP | 199.8 | |
| Oct 25/79 | 312.12 MP | 200.3 | |
| Nov 22/79 | 311.99 MP | 200.8 | |
| Dec 20/79 | 311.94 MP | 200.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 12 - 1092

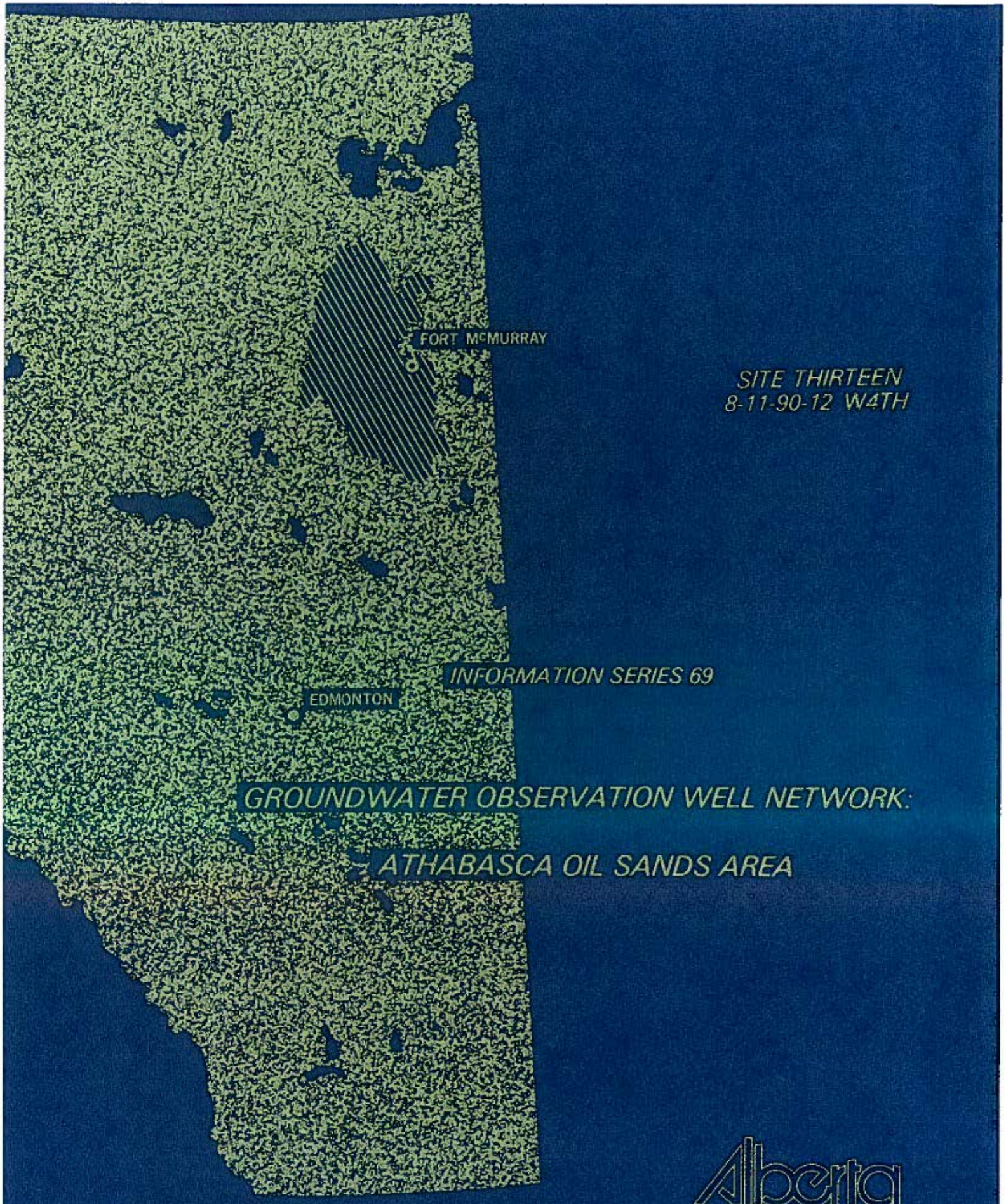
Lsd 8 Sec 27 Twp 88 R 9 W4th

Alberta Research Council

Elevation of top of casing 1222.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 311.96 MP | 200.9 | |
| Feb 14/80 | 312.19 MP | 200.1 | |
| Mar 12/80 | 312.15 MP | 200.2 | |
| Apr 10/80 | | | Could not measure |
| May 7/80 | 312.10 MP | 200.4 | |
| June 5/80 | 312.09 MP | 200.4 | |
| July 4/80 | 312.09 MP | 200.4 | Temp. 12°C |
| July 31/80 | 312.10 MP | 200.4 | |
| Aug 27/80 | 311.37 MP | 202.8 | |
| Sept 23/80 | 312.00 MP | 200.7 | |
| Oct 23/80 | 312.06 MP | 200.5 | |
| Nov 19/80 | 311.97 MP | 200.8 | |
| Dec 16/80 | 312.01 MP | 200.7 | |
| Jan 13/81 | 311.99 MP | 200.8 | |
| Feb 12/81 | | | Could not measure |
| Mar 11/81 | 312.25 MP | 199.9 | |
| Apr 7/81 | 312.55 MP | 198.9 | |
| May 6/81 | 311.97 MP | 200.8 | |
| June 1/81 | 311.98 MP | 200.8 | |
| July 2/81 | 311.97 MP | 200.8 | |
| July 30/81 | | | Could not measure |
| Aug 27/81 | | | Could not measure |
| Sept 21/81 | 312.11 MP | 200.4 | |
| Oct 22/81 | 312.12 MP | 200.3 | |
| Nov 19/81 | 312.14 MP | 200.3 | |
| Dec 17/81 | 312.12 MP | 200.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing




SITE THIRTEEN
8-11-90-12 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

## INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites (numbers 1, 2, 3, 6, 7, 8 and 9), containing 36 individual wells, were instrumented in this manner during the winter of 1974-75. Eight sites (numbered 10, 11, 12, 13, 14, 15 16 and 17), containing 38 individual wells, were instrumented during the winter of 1975-76.

The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The page indexing system is also consistent with the updating process. All update volumes will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this Introduction and a Legend. There are 15 piezometer nests in the system and thus there are 15 separate

site publications in Information Series 69. Table 1 lists the location of wells in the system as of August 31, 1976. Figure 1 indicates the location of these wells. Publications are available as of the date of this document for all sites.

Five oil companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing.

## ACKNOWLEDGMENTS

The installation and monitoring of wells in this Program was funded by Alberta Energy and Natural Resources; Non-Renewable Resources Division.

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1976: BPOG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., Shell Canada Ltd. and Home Oil Company Ltd.

D. Hackbarth

EDMONTON

1977

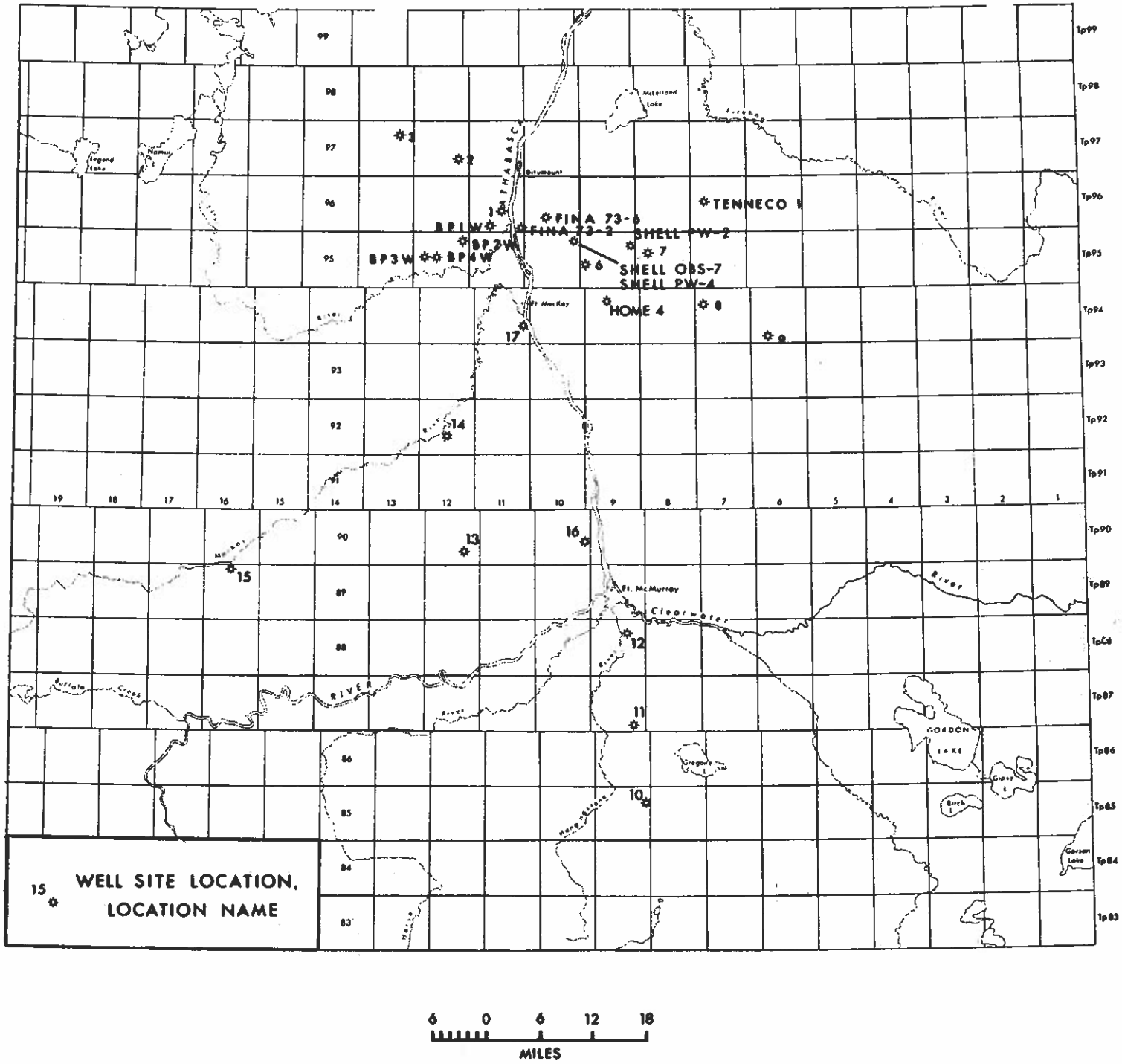



FIGURE 1. Athabasca Oil Sands observation well network, January 1977

Table 1

Athabasca Oil Sands Observation Wells

August 31, 1976

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 9-24-85-9 | 10 |
| Lsd 16-2-87-9 | 11 |
| Lsd 8-27-88-9 | 12 |
| Lsd 8-11-90-12 | 13 |
| Lsd 4-15-92-12 | 14 |
| Lsd 15-33-89-16 | 15 |
| Lsd 6-13-90-10 | 16 |
| Lsd 13-12-94-11 | 17 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |
| Lsd 3-28-94-9 | Home 4 |
| Lsd 10-25-95-10 | Shell PW-4 |
| Lsd 10-24-95-9 | Shell PW-2 |
| Lsd 10-25-95-10 | Shell Obs-7 |

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

| | | |
|---|---|---|
| Well Number | - | the name used for designating the well |
| Subject Code | - | as follows: |
| I | - | Introduction (no site number indicated) |
| L | - | Legend (no site number indicated) |
| G | - | General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents |
| C | - | Well construction details |
| D | - | Drill stem testing |
| A | - | Aquifer testing |
| E | - | Chemical analyses including multielement analyses and routine water analyses |
| H | - | Annual hydrograph |
| W | - | Well history |
| Year of Publication | - | the last two numerals of the year of publication. |

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within tha tabbed section for that particular well.

# GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
|  | sandstone, arkosic |
| | silt |
| | siltstone |
| | siltstone & sandstone |
| | clay |
| | clay, sandy |
| | claystone, shale |
| | sandstone & shale |
| | oil sand |
| | limestone |
| | limestone, shaley |
| | dolomite |
| | dolomite, argillaceous |
| | rock salt |
| | gypsum & anhydrite |
| | coal |
| | igneous rock |

| Symbol | Stratigraphic Unit |
|---|---|
| | **Pleistocene and Recent** |
| Qd | Surface deposits |
| | **Cretaceous** |
| Ks | Smoky Group |
| Klb | La Biche Formation |
| Kd | Dunvegan Formation |
| Ksh | Shaftesbury Formation |
| Kpl | Pelican Formation |
| Kj | Joli Fou Formation |
| Kg | Grand Rapids Formation |
| Kc | Clearwater Formation |
| Kw | Wabiskaw Member |
| Km | McMurray Formation |
| | **Devonian** |
| Dwd | Woodbend Group |
| Dbl | Beaverhill Lake Formation |
| Dsw | Slave Point Formation & Fort Vermilion Formation & Watt Mountain Formation |
| Dmk | Muskeg Formation |
| Dpe | Prairie Evaporite Formation |
| Dm | Methy Formation (Keg River Formation equivalent) |
| Dmr | McLean River Formation (Chinchaga Formation equivalent) |
| Dl | La Loche Formation |
| | **Precambrian** |
| Pc | Undivided |

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

| Symbol | Units or Parameter |
|---|---|
| Sec. | section |
| ss | stainless steel |
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) or time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| WILL | Analysis done at Western Industrial Laboratories Ltd. |
| Wt | weight |

## GEOLOGICAL ABBREVIATIONS

| | |
|---|---|
| biocl | bioclast |
| brac | brachiopod |
| bry | bryozoan |
| calc | calcareous |
| carb | carbonaceous |
| cht | chert |
| fld | feldspar |
| glauc | glauconite, glauconitic |
| gvl | gravel |
| hvy | heavy |
| lt | light |
| mnrls | minerals |
| pbl | pebbles |
| qtz | quartz |
| strgr(s) | stringer(s) |
| stroms | stromotoporoids |
| subang | subangular |
| subrd | subrounded |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: a complete routine analysis and a multielement analysis (multielement radio frequency induction coupled plasma emission spectrometer). Some of the samples collected appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years. Results of analyses performed on samples obtained during July 1976 are included in this report.

Most routine water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source" and are limited to samples from wells contributed by oil companies. Spectral emission estimates were done at commercial laboratories.

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface
3. drill through the aquifer using very light mud
4. insert a screening device (if necessary)
5. develop the well with air.

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma, caliper and neutron were the logs run during the 1975-76 drilling. Results of the caliper logs are not presented. The geological log presented represents an interpretation based upon the sample

description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

4) A summary of contents page noting the number of pages in each of the subject areas that have been issued for that site. Pages which have been replaced because of errors are noted in the total.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells where the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, some wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the measuring tape sticking to the wet casing.

Drill stem testing equipment was utilized in two manners during the 1975-76 drilling program. Open hole - bottom hole drill stem tests

were conducted in the Devonian sediments to locate relatively productive zones for well completion. Casing tests were performed on completed wells at Site 10, 11 and 15 because of great depth to water or low permeability in the completion zone.

Information from these drill stem tests is presented under the heading "Drill Stem Testing". Results of open hole - bottom hole tests are presented in the section containing information about the deepest well at the Site as this is the hole in which the tests were conducted. An exception to this is at Site 14 where three tests were conducted on hole 14-699 and six tests performed in 14-1590.

A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day

V = volume of production into drill collars and stem

t = total flow time of test

T = transmissivity in millidarcy-feet

M = slope of final shut-in pressure plot

K = permeability in millidarcys (1 millidarcy = $10^{-6}$ cm/sec)

h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot. Calculations of transmissivity are according to the Modified Nonequilibrium Formula or the analogous Recovery Formula as follows:

$$T = \frac{0.92\ Q \log_{10} (t_2/t_1)}{d_2 - d_1} : \quad \text{(For pumping)}$$

or

$$T = \frac{0.92\ Q \log_{10} \left[\left(\frac{t + t'}{t'}\right)_2 - \left(\frac{t + t'}{t'}\right)_1\right]}{d_2 - d_1} : \quad \text{(For recovery)}$$

where:

$d_2$, $d_1$ = depth to water at corresponding subscripted time (meters) $d_2 > t_1$

$t_2$, $t_1$ = time since pumping started, $t_2 > t_1$

$t$ = length of time pumping

$t'$ = time since pumping stopped: $\left(\frac{t + t'}{t'}\right)_2 > \left(\frac{t + t'}{t'}\right)_1$

$T$ = transmissivity in sequence meters per day

$Q$ = pumping rate in imperial gallons per minute

That portion of the drawdown plot used to calculate the transmissivity is indicated on each drawing.

## SUMMARY OF CONTENTS

SITE NUMBER THIRTEEN

sd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

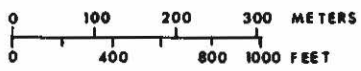
number of pages distributed for this site in 1977

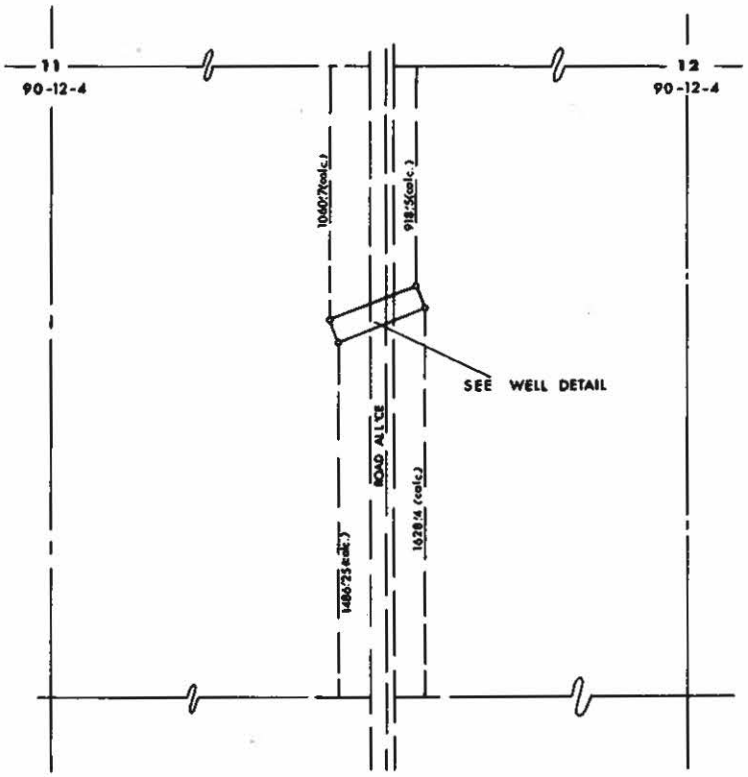
| page title | well name | | | | | | |
|---|---|---|---|---|---|---|---|
| | site | 13-70 | 13-230 | 13-460 | 13-770 | 13-872 | 13-1230 |
| Introduction | 4 | — | — | — | — | — | — |
| Legend | 9 | — | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — | — |
| Geological Sample Description | 4 | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 0 | 1 | 7 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 0 | 0 | 0 | 6 |
| Shut-In Pressure Data | — | 0 | 0 | 0 | 0 | 0 | 5 |
| Water Analysis | — | 2 | 2 | 4 | 2 | 2 | 2 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 |

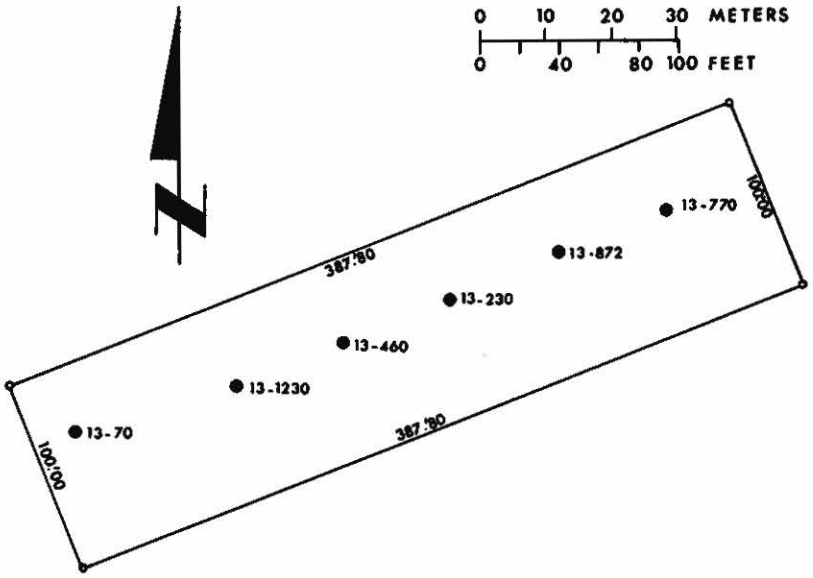
OBSERVATION WELL SITE 13

8-11-90-12 W 4th

ALBERTA RESEARCH COUNCIL



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Thirteen

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Ground elevation 1749 Total depth 1230 feet

KB elevation 1757

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 8 | 35 | Sand, lt brown, fine grained, silty, subangular, medium sorted, good-excellent porosity, qtz, fld, calc; clay, medium grey, silty, interbedded | Drift |
| 35 | 50 | Sand, brown, coarse grained; subangular, poorly sorted, excellent permeability, qtz, fld, siderite; pebbles of dark and light cht; silty, grey clay strgrs, kaolinization | |
| 50 | 60 | Silt, grey, clayey, kaolin, ferruginous, thin coal beds, interbedded with sand, lt brown fine-coarse grained, subangular-subrounded, poorly sorted, excellent intergranular porosity, qtz, fld, hvy mnrls (tourmaline, garnet, zircon) light and dark cht, carb flakes, siderite, kaolin | |
| 60 | 160 | Unsorted drift; silt, sand, gravel, boulderchips, angular-subangular, poor sorting excellent intergranular porosity, qtz, fld, cht, ferruginous, kaolin | |
| 160 | 220 | Sand, lt brown, coarse grained, subang-subrd, poorly sorted, excellent porosity, qtz, fld, hvy mnrls (tourmaline, garnet, zircon), lt and dark cht, ferruginous (siderite), carbonaceous flakes, kaolin, pebbles, boulderchips | |
| 220 | 230 | Gravel, lt brown, angular-subangular, poorly sorted, excellent porosity, qtz, fld, hvy mnrls, ferruginous (siderite); boulderchips of igneous, metamorphic and sedimentary (sandstone and limestone) rocks | |
| 230 | 240 | Siltstone, medium grey, sandy, kaolinization, boulderchips | |
| 240 | 250 | Gravel, lt brown, subangular, poorly sorted, excellent porosity, qtz, fld, lt cht, boulderchips of igneous, metamorphic and sedimentary rocks | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Thirteen (continued)

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 250 | 270 | Siltstone, medium grey, clayey, kaolin, boulderchips, fair permeability | Drift |
| 270 | 280 | Clay, medium grey, silty, kaolinization, slightly calc | |
| 280 | 300 | Siltstone, medium grey, sandy in the bottom, calc, kaolin | Grand Rapids |
| 300 | 310 | Siltstone, medium grey, sandy, argillaceous, calc, silty grey clay and coal, thin beds | |
| 310 | 350 | Siltstone, medium grey, sandy, calc, qtz, glauc traces; clay grey and coal interbedded | |
| 350 | 390 | Siltstone, lt grey, sandy, qtz, fld, glauc traces, carb flakes; sand, lt grey, fine-medium, interbedded | |
| 390 | 400 | Sandstone, lt grey, fine-grained, subangular, well sorted, good porosity, qtz, fld, interbedded with shale, medium grey and coal thin strgrs | |
| 400 | 460 | Sandstone, salt and pepper, fine grained, subangular-subrounded, well sorted, good-excellent porosity, calc cement on the bottom, qtz, hvy dark mnrls, fld, carb flakes | |
| 460 | 470 | Sandstone as above, calc cement, shale interbedded | |
| 470 | 500 | Clay, medium grey, silty, calc; coal, thin beds | Clearwater |
| 500 | 530 | Clay red-brown, silty, calc cement | |
| 530 | 585 | Shale, medium grey, calc cement, carb flakes; siltstone, medium grey, sandy, glauc traces, interbedded on the bottom | |
| 585 | 600 | Sandstone, lt grey, fine, silty, subrounded, well sorted, fair porosity, qtz, glauc. Shale medium grey, hard, calc, pyrite on the bottom | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Thirteen (continued)

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 600 | 670 | Shale, medium grey, silty, calc, ferruginous, carb flakes, plant remains; two sandy interbeds at 610 and 650 feet | Clearwater |
| 670 | 700 | Siltstone, medium grey, sandy, argillaceous, calc, qtz, glauc traces, interbedded with shale medium grey, calc, carb flakes | |
| 700 | 720 | Sandstone, lt grey, fine grained, silty, calc cement, qtz, glauc traces, interbedded with shale, medium grey, calc and siltstone,medium grey, sandy | |
| 720 | 745 | Siltstone, grey, sandy, argillaceous, calc cement; shale,medium grey, calc, carb flakes interbedded | |
| 745 | 760 | Sandstone lt grey, fine grained, silty, subrounded, well sorted, fair-good porosity, glauc, qtz; thin beds of medium grey calc shale | McMurray |
| 760 | 780 | Sandstone, brown, fine-medium grained, subrounded medium sorted, fair porosity, calc cement, qtz, fld, pyrite, ferruginous, slightly oil stained; thin beds of medium grey shale | |
| 780 | 815 | Sandstone, brown, fine-medium grained, subangular, well sorted, fair porosity, qtz, fld, ferruginous, pyrite, heavily oil saturated | |
| 815 | 830 | Sandstone as above interbedded with shale, medium grey, bituminous | |
| 830 | 870 | Sandstone, lt brown, fine-medium grained, medium sorted, fair porosity, calc and silica cement, qtz, fld; slightly oil stained, interbedded with thin layers of shale, dark grey, calc, pyrite | |
| 870 | 885 | Sandstone as above, heavily oil saturated, interbedded with shale, dark grey, calc, pyrite | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Thirteen (continued)

Lsd 8 Sec 11 Twp 90 R 12 W4th

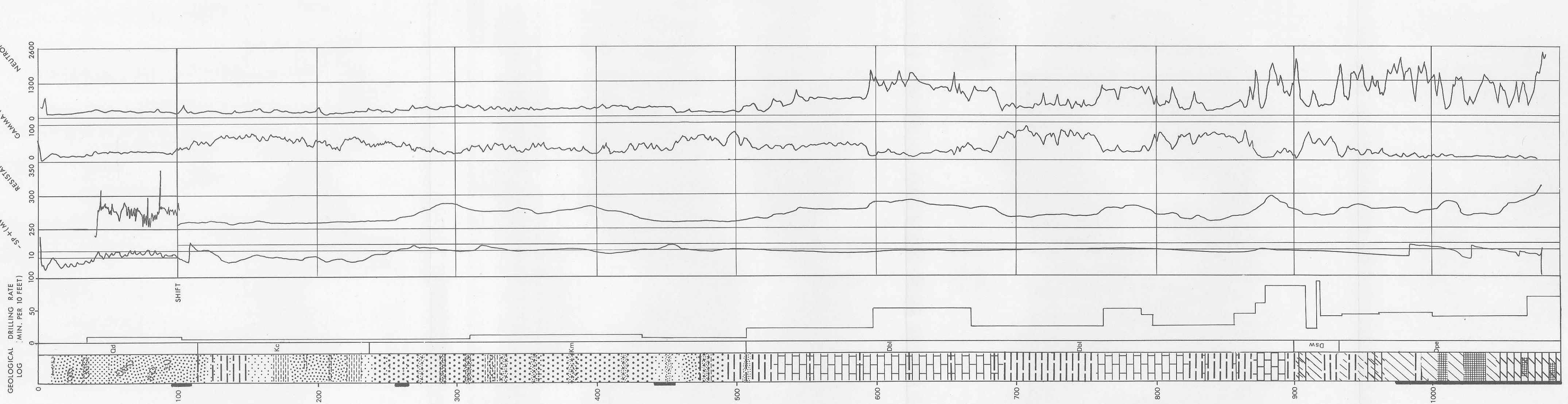
Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 885 | 900 | Limestone, buff-lt grey, compact, mud supported, argillaceous, fossils (biocl), pyrite, thin medium grey calc shale strgrs | Beaverhill Lake |
| 900 | 920 | Shale (70%), medium grey, hard, calc, pyrite. Limestone, lt grey, argillaceous, fossils, compact (30%) | |
| 920 | 1010 | Limestone (15-20%), white-buff, microcrystalline, fossils (stroms, pelecypods, brac, bry), replacement, calcite recrystallization, poor vuggy porosity, pyrite. Limestone (50-60%), lt grey, mud supported, argillaceous, fossils, pyrite, chalcopyrite, shale, dark grey, calc (10-15%) | |
| 1010 | 1050 | Limestone (30-40%), lt grey, compact, argillaceous, fossils, pyrite interbedded with shale, dark grey, carbonaceous (60-70%) | |
| 1050 | 1150 | Limestone, buff (20-25%), microcrystalline, fossils (brac, bry, bioclast), replacement, calcite recrystallization, dolomitization traces, pyrite; limestone, lt grey (50-70%), argillaceous, fossils, pyrite, thin bedded dark grey, carb shale | |
| 1150 | 1230 | Limestone, lt grey (40-50%), argillaceous, fossils, pyrite, chalcopyrite, interbedded with shale lt grey, calc and dark grey, shale carbonaceous | |

GEOPHYSICAL AND GEOLOGICAL LOGS
OBSERVATION WELL SITE 12
8-27-88-9 W4th
ALBERTA RESEARCH COUNCIL

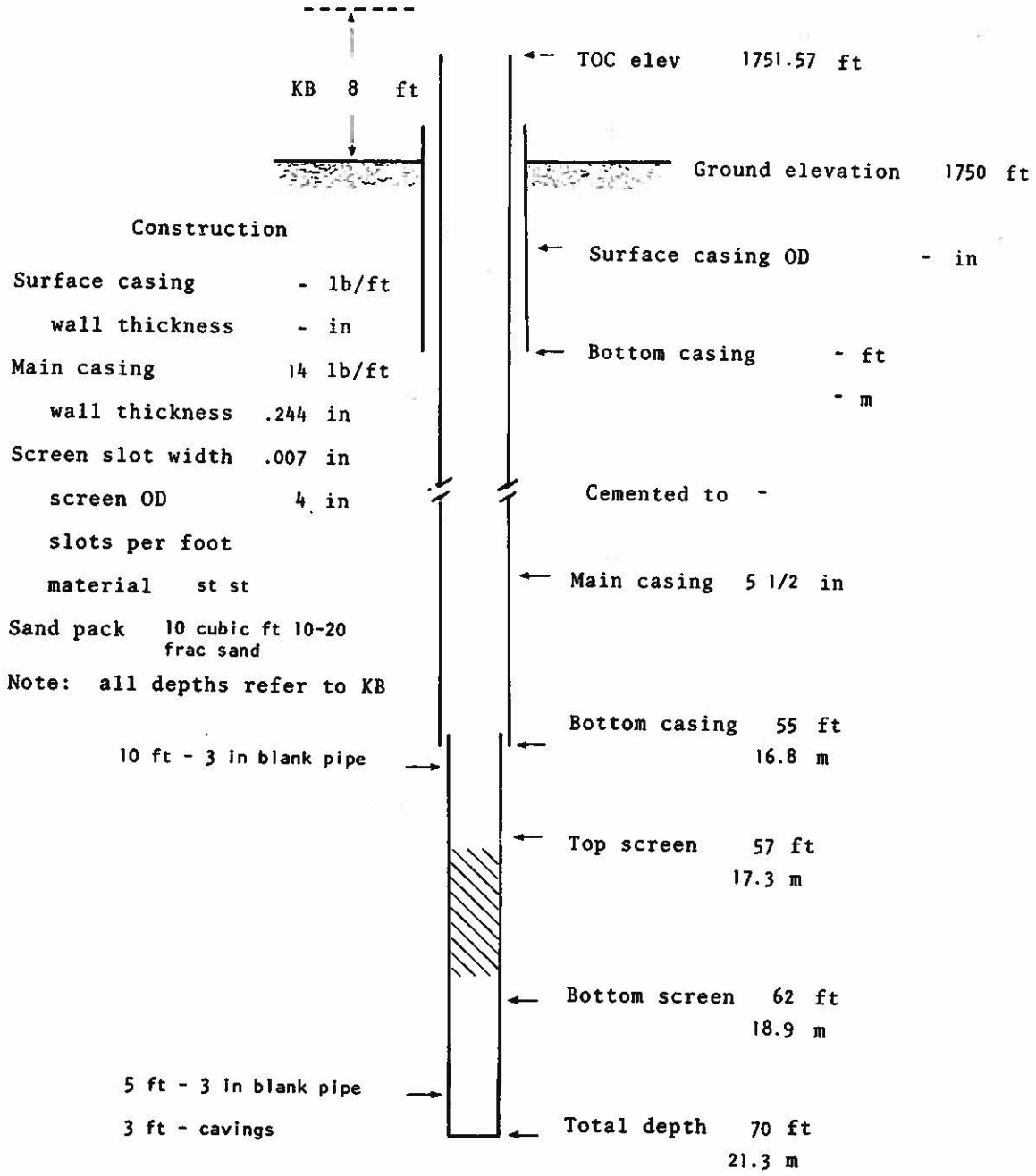


WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Tp 90 R 12 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Sand pack 10 cubic ft 10-20 frac sand

Note: all depths refer to KB

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed from 13-70

Date sampled February 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 45.0 | 2.25 | 49.8 |
| Magnesium ($Mg^{++}$) | 12.3 | 1.01 | 22.5 |
| Sodium ($Na^{+}$) | 27.5 | 1.20 | 26.5 |
| Potassium ($K^{+}$) | 2.1 | 0.05 | 1.2 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 234.0 | 3.84 | 88.2 |
| Sulfate ($SO_4^{=}$) | 10.0 | 0.21 | 4.8 |
| Chloride ($Cl^{-}$) | 10.0 | 0.28 | 6.5 |
| Nitrate ($NO_3^{=}$) | 1.3 | 0.02 | 0.5 |
| Silica ($SiO_2$) | 4.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 258.0 | | |
| Total Anions (epm) | 4.3 | Total Cations (epm) | 4.5 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | |
| pH | 7.1 | pH | 7.3 |
| Fluoride ($F^{-}$) | 0.3 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 254 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 61.0 | 3.04 | 53 |
| Magnesium ($Mg^{++}$) | 16.1 | 1.33 | 23 |
| Sodium ($Na^{+}$) | 30.0 | 1.30 | 23 |
| Potassium ($K^{+}$) | 2.1 | 0.05 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 305.0 | 5.00 | 94 |
| Sulfate ($SO_4^{=}$) | 1.3 | 0.03 | 1 |
| Chloride ($Cl^{-}$) | 10.0 | 0.28 | 5 |
| Nitrate ($NO_3^{-}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 8.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 64.9 | | |
| Magnesium (Acidified) | 16.1 | | |
| Total dissolved solids | 308 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5.32 | Total Cations (epm) | 5.73 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 500 | Temperature (C) | 4.0 | |
| pH | 7.4 | pH | 8.1 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 424 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 37.0 | 1.85 | 44.1 |
| Magnesium ($Mg^{++}$) | 13.0 | 1.07 | 25.6 |
| Sodium ($Na^{+}$) | 27.5 | 1.20 | 28.6 |
| Potassium ($K^{+}$) | 2.9 | 0.07 | 1.8 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 232.0 | 3.80 | 83.3 |
| Sulfate ($SO_4^{=}$) | 6.7 | 0.14 | 3.1 |
| Chloride ($Cl^{-}$) | 22.0 | 0.62 | 13.6 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0.00 | 0.1 |
| Silica ($SiO_2$) | 1.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 31.0 | | |
| Magnesium (Acidified) | 13.9 | | |
| Total dissolved solids | 216.0 | | |
| Total Anions (epm) 4.57 | | Total Cations (epm) | 4.19 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 410 | Temperature (C) | 6.0 |
| pH | 7.3 | pH | 7.1 |
| Fluoride ($F^{-}$) | 13.0 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 205.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Date sampled: July 19, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | 1.63 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 490 |
| As | <.038 | Ni | <.010 |
| B | .131 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 66.0 | Si | 2.42 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .260 |
| Cr | <.006 | Te | <.065 |
| Cu | .012 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 0.39 | V | .009 |
| K | 55 | W | <.078 |
| Mg | 14.6 | Zn | .044 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

13-70-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 32.0 | 1.60 | 41.2 |
| Magnesium(Mg) | 10.8 | 0.89 | 22.9 |
| Sodium(Na) | 30.0 | 1.30 | 33.7 |
| Potassium(K) | 3.3 | 0.08 | 2.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 200.0 | 3.28 | 80.8 |
| Sulphate(SO4) | 4.9 | 0.10 | 2.5 |
| Chloride(Cl) | 22.0 | 0.62 | 15.3 |
| Nitrate(NO3) | 3.5 | 0.06 | 1.4 |
| Silica(SiO2) | 0.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 23.0 | | |
| Magnesium(Acidified) | 10.2 | | |
| TDS(mg/l) | 242.0 | | |
| Total Anions(epm) | 4.06 | Total Cations(epm) | 3.88 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 336 | | Temperature(C) | 10.00 | |
| pH | 6.4 | | pH | 6.7 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 170 | mg/l |
| | | | Hydroxide(OH) | | |

13-70-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 40.0 | 2.00 | 44.0 |
| Magnesium(Mg) | 7.6 | 0.63 | 13.8 |
| Sodium(Na) | 43.8 | 1.91 | 42.0 |
| Potassium(K) | 0.4 | 0.01 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 195.0 | 3.20 | 67.1 |
| Sulphate(SO4) | 12.7 | 0.26 | 5.6 |
| Chloride(Cl) | 46.0 | 1.30 | 27.2 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.1 |
| Silica(SiO2) | 1.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 29.0 | | |
| Magnesium(Acidified) | 8.3 | | |
| TDS(mg/l) | 238.0 | | |
| Total Anions(epm) | 4.76 | Total Cations(epm) | 4.54 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 398 | Temperature(C) | 7.50 | |
| pH | 8.3 | pH | 7.2 | |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 166 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 13-70-E-82

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 7, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 19.5 | 0.97 | 30.2 |
| Magnesium(Mg) | 9.1 | 0.76 | 23.5 |
| Sodium(Na) | 33.0 | 1.43 | 44.4 |
| Potassium(K) | 2.5 | 0.06 | 2.0 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 137.0 | 2.25 | 82.3 |
| Sulphate(SO4) | 7.0 | 0.15 | 5.3 |
| Chloride(Cl) | 12.0 | 0.34 | 12.4 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 0.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 16.4 | | |
| Magnesium(Acidified) | 8.6 | | |
| TDS(mg/l) | 138.0 | | |
| Total Anions(epm) | 2.73 | Total Cations(epm) | 3.23 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 250 | Temperature | 5.50 | |
| pH | 8.2 | pH | 6.8 | |
| Fluoride | 0.0 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 122 | mg/l |
| | | Hydroxide(OH) | | |

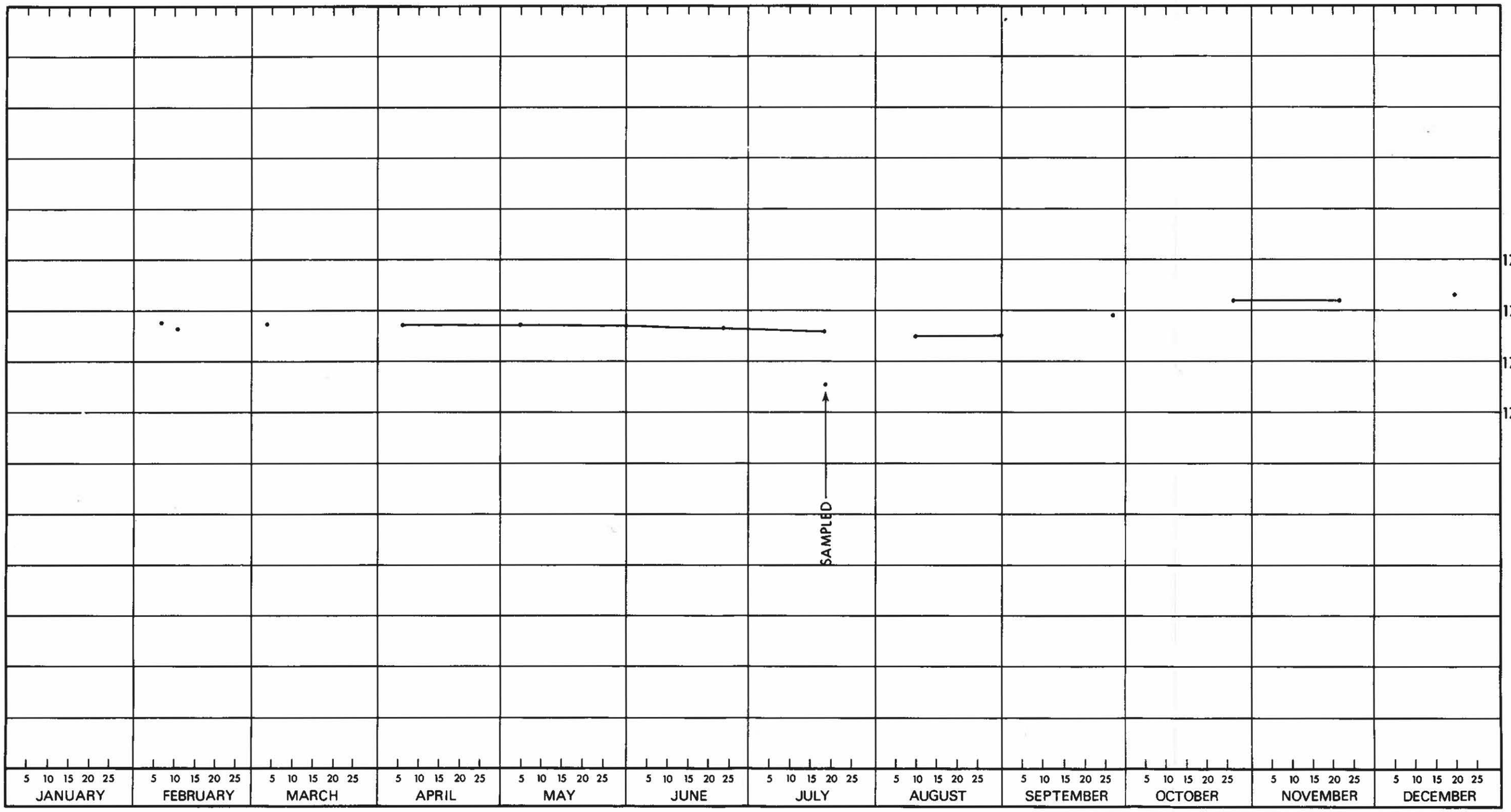
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

13 - 70 - H - 77




1976

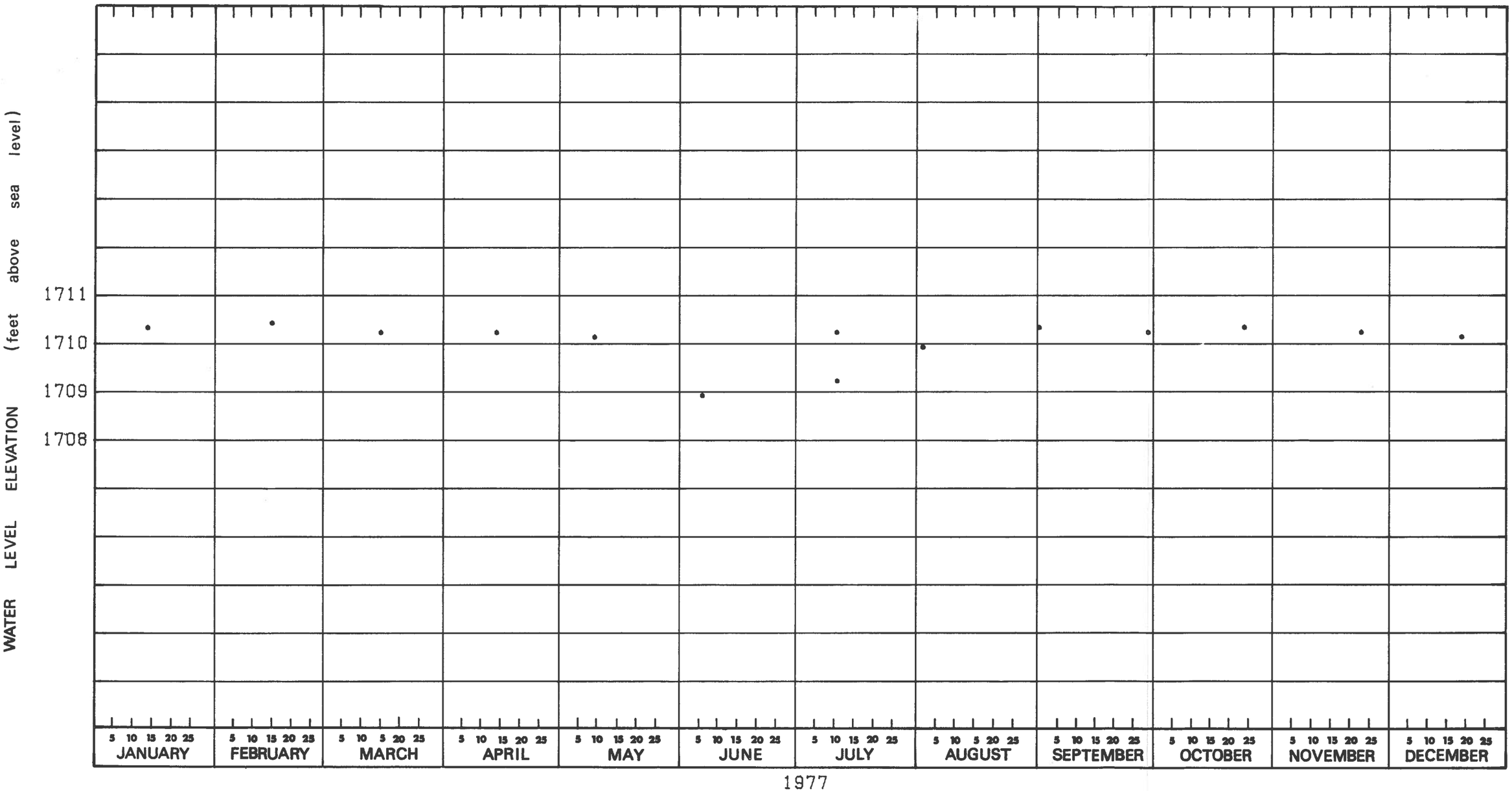
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-70

13-70-H-78

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council




1977

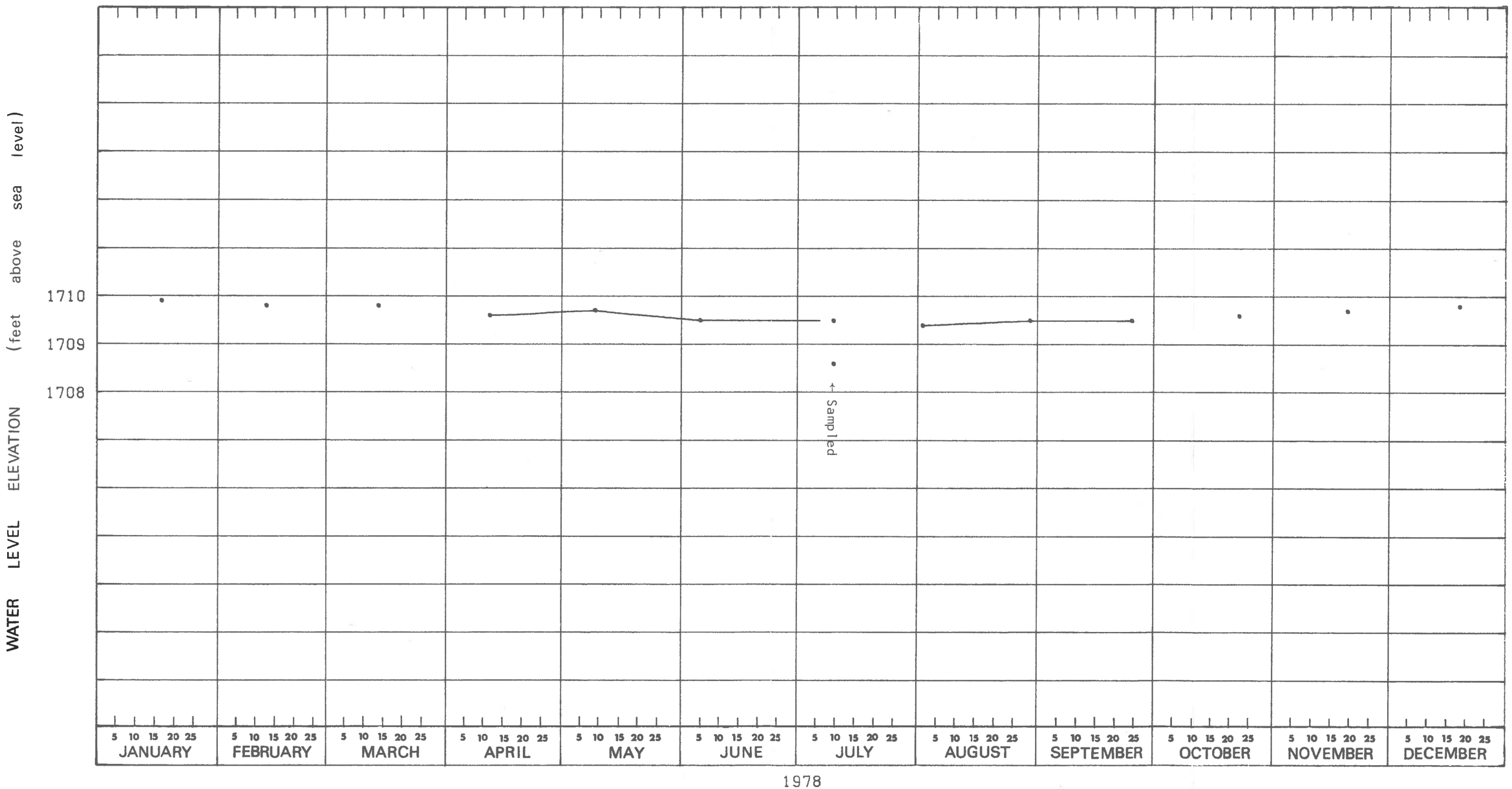
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-70

LSD 8 SEC 11 TWP 90 R 12 W4TH

13-70-H-79

Alberta Research Council



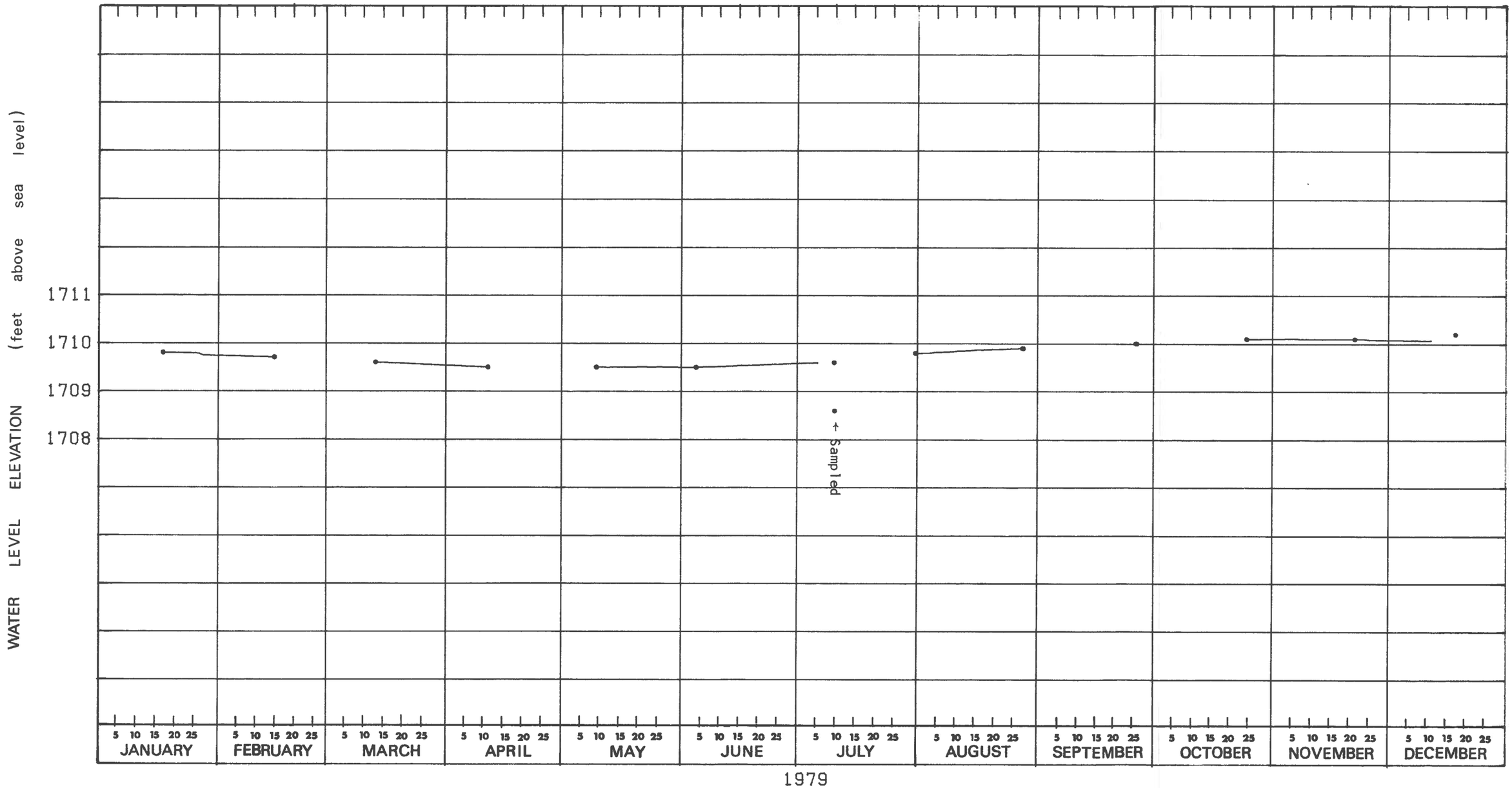
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-70

13-70-H-80

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council



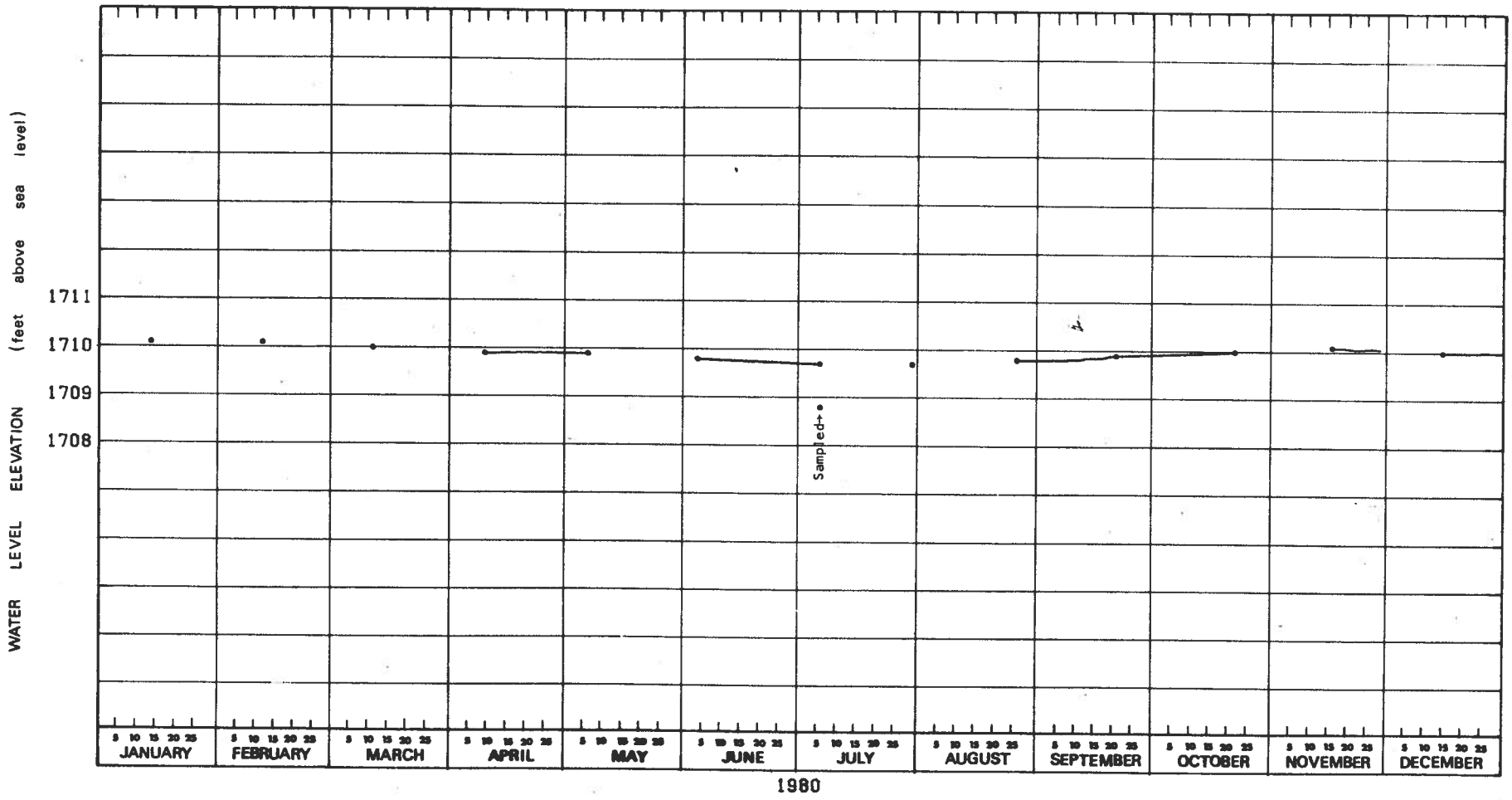
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-70-H-81



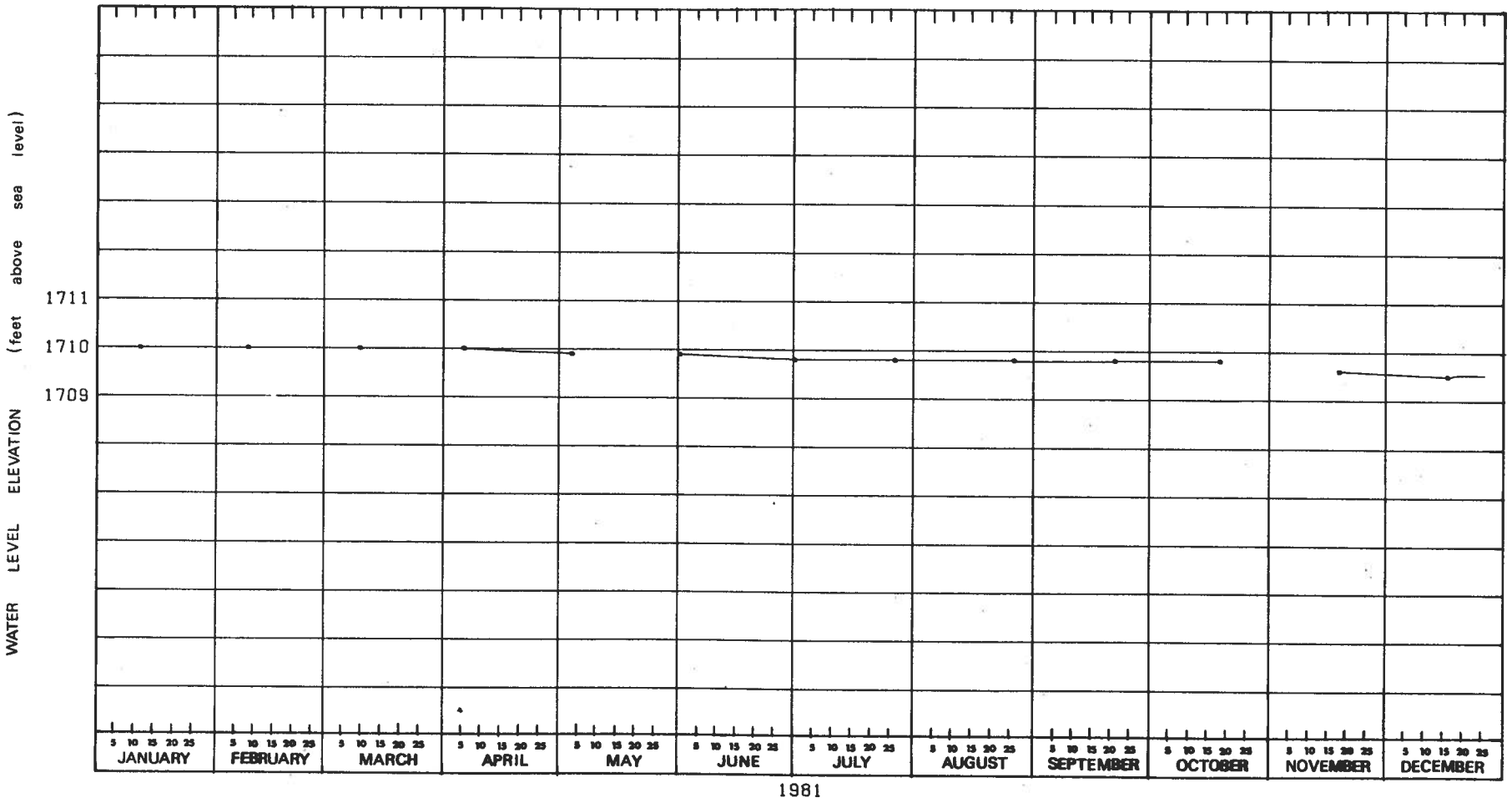
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-70

13-70-H-82

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1751.57

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/76 | | | Well completed |
| Feb 7/76 | 13.32 MP | 1709.8 | MP = 0.58 m TOC, (1753.5) |
| Feb 11/76 | 13.36 MP | 1709.7 | |
| Feb 20/76 | | | Water sample |
| Mar 4/76 | 13.33 MP | 1709.8 | |
| Apr 6/76 | 13.34 MP | 1709.7 | |
| May 5/76 | 13.34 MP | 1709.7 | |
| May 31/76 | 13.35 MP | 1709.7 | |
| June 24/76 | 13.36 MP | 1709.7 | |
| July 19/76 | 13.38 MP | 1709.6 | |
| | 13.70 MP | 1708.6 | After sample; temp. 4°C |
| Aug 10/76 | 13.41 MP | 1709.5 | |
| Aug 31/76 | 13.40 MP | 1709.5 | |
| Sept 27/76 | 13.28 MP | 1709.9 | |
| Oct 27/76 | 13.21 MP | 1710.2 | |
| Nov 22/76 | 13.21 MP | 1710.2 | |
| Dec 20/76 | 13.17 MP | 1710.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1751.57

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 13.16 MP | 1710.3 | MP (1753.5) |
| Feb 15/77 | 13.15 MP | 1710.4 | |
| Mar 16/77 | 13.19 MP | 1710.2 | |
| Apr 14/77 | 13.20 MP | 1710.2 | |
| May 9/77 | 13.22 MP | 1710.1 | |
| June 6/77 | 13.53 MP | 1708.9 | |
| July 11/77 | 13.20 MP | 1710.2 | |
| | 13.50 MP | 1709.2 | After sample; temp. 6°C |
| Aug 2/77 | 13.28 MP | 1709.9 | |
| Sept 1/77 | 13.17 MP | 1710.3 | |
| Sept 29/77 | 13.20 MP | 1710.2 | |
| Oct 24/77 | 13.17 MP | 1710.3 | |
| Nov 23/77 | 13.21 MP | 1710.2 | |
| Dec 19/77 | 13.24 MP | 1710.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1751.57

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 13.28 MP | 1709.9 | MP (1753.5) |
| Feb 13/78 | 13.31 MP | 1709.8 | |
| Mar 14/78 | 13.33 MP | 1709.8 | |
| Apr 12/78 | 13.38 MP | 1709.6 | |
| May 9/78 | 13.36 MP | 1709.7 | |
| June 5/78 | 13.40 MP | 1709.5 | |
| July 10/78 | 13.41 MP | 1709.5 | |
| | 13.70 MP | 1708.6 | After sample; temp, 10°C |
| Aug 2/78 | 13.43 MP | 1709.4 | |
| Aug 30/78 | 13.42 MP | 1709.5 | |
| Sept 25/78 | 13.42 MP | 1709.5 | |
| Oct 23/78 | 13.38 MP | 1709.6 | |
| Nov 20/78 | 13.35 MP | 1709.7 | |
| Dec 19/78 | 13.32 MP | 1709.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-70

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1751.57

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 13.32 MP | 1709.8 | MP (1753.5) |
| Feb 15/79 | 13.35 MP | 1709.7 | |
| Mar 13/79 | 13.37 MP | 1709.6 | |
| Apr 11/79 | 13.41 MP | 1709.5 | |
| May 9/79 | 13.41 MP | 1709.5 | |
| June 4/79 | 13.41 MP | 1709.5 | |
| July 10/79 | 13.39 MP | 1709.6 | |
| | 13.69 MP | 1708.6 | After sample; temp. 7.5°C |
| July 31/79 | 13.33 MP | 1709.8 | |
| Aug 28/79 | 13.29 MP | 1709.9 | |
| Sept 26/79 | 13.26 MP | 1710.0 | |
| Oct 25/79 | 13.22 MP | 1710.1 | |
| Nov 22/79 | 13.22 MP | 1710.1 | |
| Dec 18/79 | 13.21 MP | 1710.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 13 - 70

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1751.57

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/80 | 13.22 MP | 1710.1 | |
| Feb 12/80 | 13.23 MP | 1710.1 | |
| Mar 12/80 | 13.25 MP | 1710.0 | |
| Apr 10/80 | 13.28 MP | 1709.9 | |
| May 7/80 | 13.28 MP | 1709.9 | |
| June 5/80 | 13.32 MP | 1709.8 | |
| July 7/80 | 13.34 MP | 1709.7 | Temp. 5.5°C |
| | 13.62 MP | 1708.8 | After Sample |
| July 11/80 | | | Airlift 45 mins. @ 0.5 l/min |
| | | | Sampled t=11°C, cond.=375 |
| July 31/80 | 13.36 MP | 1709.7 | |
| Aug 27/80 | 13.32 MP | 1709.8 | |
| Sept 22/80 | 13.28 MP | 1709.9 | |
| Oct 23/80 | 13.25 MP | 1710.0 | |
| Nov 17/80 | 13.22 MP | 1710.1 | |
| Dec 16/80 | 13.26 MP | 1710.0 | |
| Jan 12/81 | 13.27 MP | 1710.0 | |
| Feb 9/81 | 13.26 MP | 1710.0 | |
| Mar 10/81 | 13.26 MP | 1710.0 | |
| Apr 6/81 | 13.26 MP | 1710.0 | |
| May 4/81 | 13.28 MP | 1709.9 | |
| June 1/81 | 13.30 MP | 1709.9 | |
| July 1/81 | 13.31 MP | 1709.8 | |
| July 27/81 | 13.31 MP | 1709.8 | |
| Aug 27/81 | 13.31 MP | 1709.8 | |
| Sept 22/81 | 13.31 MP | 1709.8 | |
| Oct 19/81 | 13.31 MP | 1709.8 | |
| Nov 19/81 | 13.39 MP | 1709.6 | |
| Dec 17/81 | 13.40 MP | 1709.5 | |

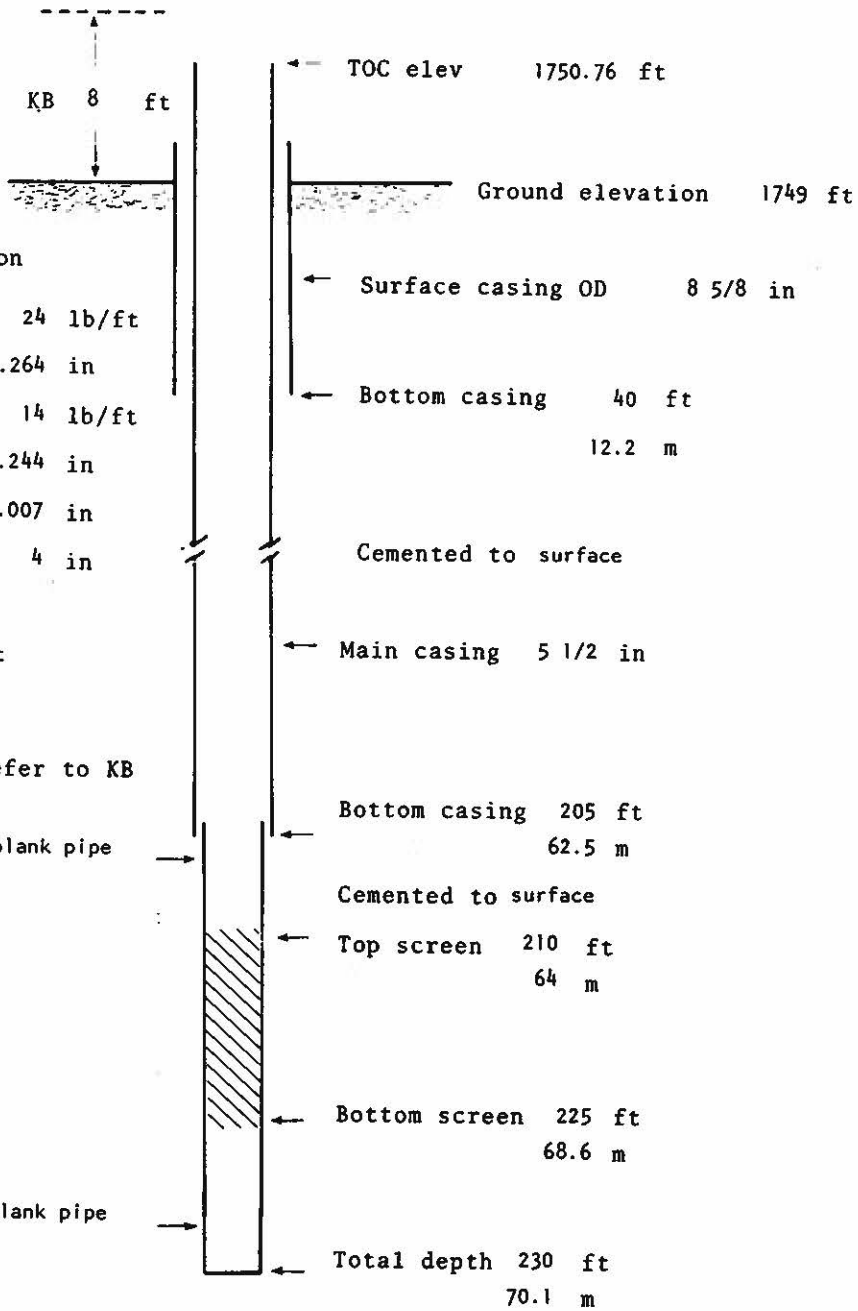
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Tp 90 R 12 W 4th

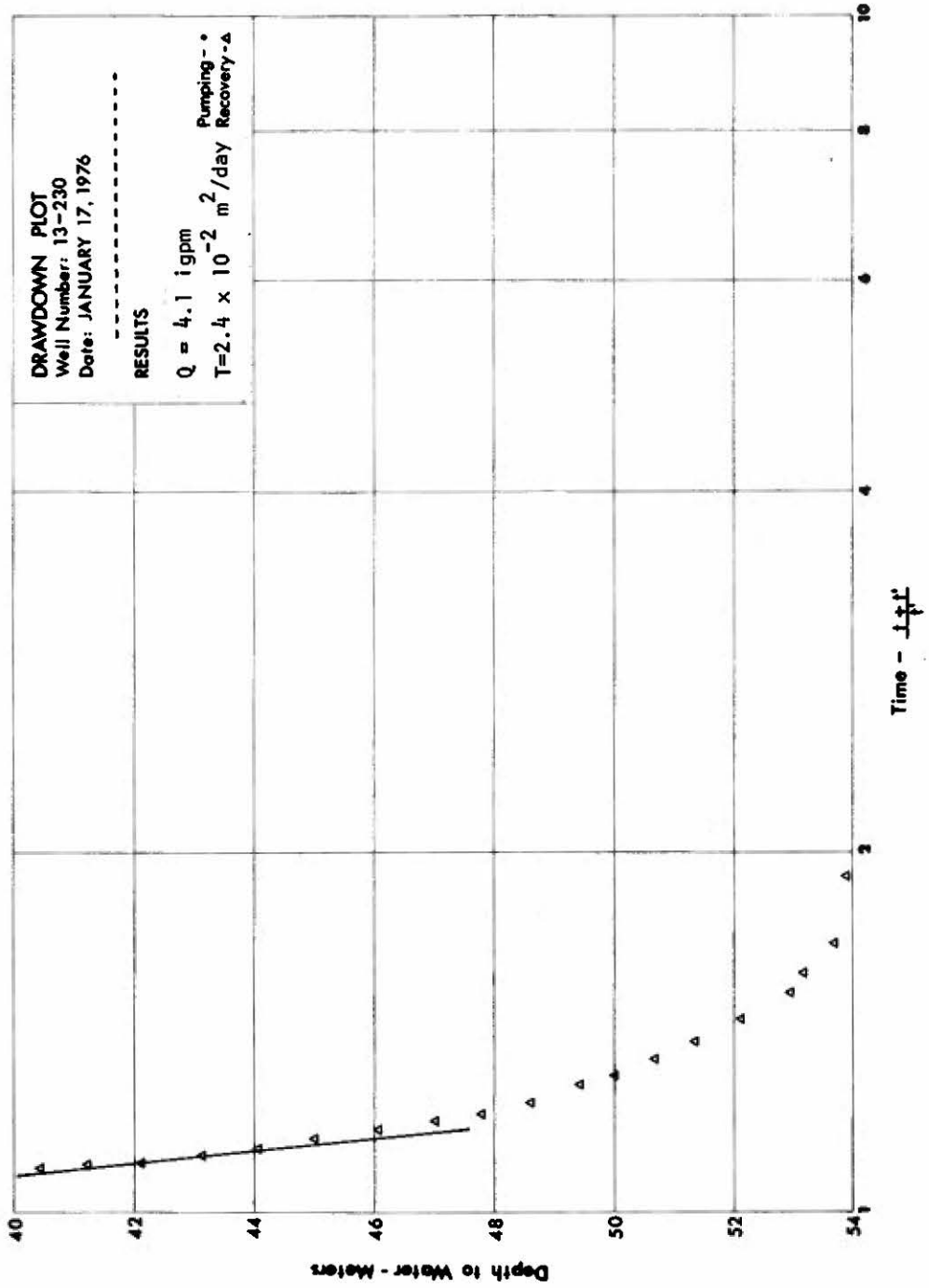
Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 13-230
Date: JANUARY 17, 1976
RESULTS
Q = 4.1 igpm
T=2.4 x 10⁻² m²/day
Pumping - •
Recovery - △
Depth to Water - Meters
40
42
44
46
48
50
52
54
Time - t/t'
1
2
4
6
8
10

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed from 13-230

Date sampled January 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.0 | 0.15 | 1.5 |
| Magnesium ($Mg^{++}$) | 1.5 | 0.12 | 1.2 |
| Sodium ($Na^{+}$) | 220.0 | 9.57 | 94.1 |
| Potassium ($K^{+}$) | 12.9 | 0.33 | 3.2 |
| Carbonate ($CO_3^{=}$) | 14.4 | 0.48 | 4.4 |
| Bicarbonate ($HCO_3^{-}$) | 244.0 | 4.00 | 36.4 |
| Sulfate ($SO_4^{=}$) | 60.0 | 1.25 | 11.4 |
| Chloride ($Cl^{-}$) | 186.0 | 5.25 | 47.8 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 1.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 952.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 11.0 | Total Cations (epm) | 10.2 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1220 | Temperature (C) | | |
| pH | 9.3 | pH | 10.3 | |
| Fluoride ($F^{-}$) | 0.3 ppm | Carbonate ($CO_3^{=}$) | 154 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 37 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.2 | 0.11 | 1 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 198.0 | 8.61 | 96 |
| Potassium ($K^{+}$) | 10.0 | 0.26 | 3 |
| Carbonate ($CO_3^{=}$) | 130.0 | 4.33 | 47 |
| Bicarbonate ($HCO_3^{-}$) | 39.0 | 0.64 | 7 |
| Sulfate ($SO_4^{=}$) | 43.0 | 0.90 | 10 |
| Chloride ($Cl^{-}$) | 120.0 | 3.38 | 37 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 6.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 2.9 | | |
| Magnesium (Acidified) | 0.1 | | |
| Total dissolved solids | 508 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 9.27 | Total Cations (epm) | 8.98 |

Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 1000 | |
| pH | 10.1 | |
| Fluoride ($F^{-}$) | 0.2 | Mg/L |

Field:

| | | |
|---|---|---|
| Temperature (C) | 4.0 | |
| pH | 12.0 | |
| Carbonate ($CO_3^{=}$) | 168 | Mg/L |
| Bicarbonate ($HCO_3^{-}$) | | |
| Hydroxide ($OH^{-}$) | 16 | Mg/L |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled January 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 64.0 | 3.19 | 14.8 |
| Magnesium ($Mg^{++}$) | 22.8 | 1.88 | 8.7 |
| Sodium ($Na^{+}$) | 373.0 | 16.22 | 75.1 |
| Potassium ($K^{+}$) | 12.1 | 0.31 | 1.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 68.0 | 1.11 | 16.1 |
| Sulfate ($SO_4^{=}$) | 73.0 | 1.52 | 22.0 |
| Chloride ($Cl^{-}$) | 152.0 | 4.29 | 61.9 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 15.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 4098.0 | | |
| Total Anions (epm) | 6.92 | Total Cations (epm) | 21.60 |

Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 3400 | |
| pH | 5.9 | |
| Fluoride ($F^{-}$) | 0.5 | ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 7.1 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 135.0 | 6.74 | 22.3 |
| Magnesium ($Mg^{++}$) | 45.0 | 3.70 | 12.3 |
| Sodium ($Na^{+}$) | 446.0 | 19.40 | 64.3 |
| Potassium ($K^{+}$) | 12.1 | 0.31 | 1.0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 161.0 | 2.64 | 17.8 |
| Sulfate ($SO_4^{=}$) | 70.3 | 1.46 | 9.9 |
| Chloride ($Cl^{-}$) | 380.0 | 10.72 | 72.2 |
| Nitrate ($NO_3^{=}$) | 1.7 | 0.03 | 0.2 |
| Silica ($SiO_2$) | 16.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 121.0 | | |
| Magnesium (Acidified) | 48.0 | | |
| Total dissolved solids | 5334.0 | | |
| Total Anions (epm) | 14.85 | Total Cations (epm) | 30.15 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 5000 |
| pH | 6.0 |
| Fluoride ($F^{-}$) | 0.6 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 4.0 |
| pH | 6.1 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | 332.0 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

13-230-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 93.0 | 4.64 | 20.6 |
| Magnesium(Mg) | 30.0 | 2.47 | 10.9 |
| Sodium(Na) | 350.0 | 15.22 | 67.4 |
| Potassium(K) | 9.6 | 0.25 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 71.0 | 1.16 | 16.0 |
| Sulphate(SO4) | 50.2 | 1.05 | 14.3 |
| Chloride(Cl) | 180.0 | 5.08 | 69.6 |
| Nitrate(NO3) | 0.6 | 0.01 | 0.1 |
| Silica(SiO2) | 16.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 80.0 | | |
| Magnesium(Acidified) | 27.0 | | |
| TDS(mg/l) | 3284.0 | | |
| Total Anions(epm) | 7.29 | Total Cations(epm) | 22.58 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2490 | | Temperature(C) | 5.50 | |
| pH | 5.5 | | pH | 6.3 | |
| Fluoride(F) | 0.5 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 395 | mg/l |
| | | | Hydroxide(OH) | | |

13-230-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 82.0 | 4.09 | 19.5 |
| Magnesium(Mg) | 25.0 | 2.06 | 9.8 |
| Sodium(Na) | 336.0 | 14.62 | 69.7 |
| Potassium(K) | 7.9 | 0.20 | 1.0 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 28.9 | 0.60 | 12.3 |
| Chloride(Cl) | 152.0 | 4.29 | 87.3 |
| Nitrate(NO3) | 1.2 | 0.02 | 0.4 |
| Silica(SiO2) | 14.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 70.0 | | |
| Magnesium(Acidified) | 22.0 | | |
| TDS(mg/l) | 2442.0 | | |
| Total Anions(epm) | 4.91 | Total Cations(epm) | 20.97 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1888 | | Temperature(C) | 5.50 | |
| pH | 4.3 | | pH | 6.3 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 288 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 13-230-E-82

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 7, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 77.0 | 3.85 | 20.2 |
| Magnesium(Mg) | 23.1 | 1.93 | 10.1 |
| Sodium(Na) | 301.0 | 13.09 | 68.6 |
| Potassium(K) | 7.9 | 0.20 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 85.0 | 1.39 | 25.7 |
| Sulphate(SO4) | 31.0 | 0.65 | 11.9 |
| Chloride(Cl) | 120.0 | 3.38 | 62.4 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 9.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 60.0 | | |
| Magnesium(Acidified) | 19.0 | | |
| TDS(mg/l) | 2096.0 | | |
| Total Anions(epm) | 5.42 | Total Cations(epm) | 19.06 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1870 | Temperature | 3.00 | |
| pH | 7.0 | pH | 6.5 | |
| Fluoride | 0.7 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 332 | mg/l |
| | | Hydroxide(OH) | | |

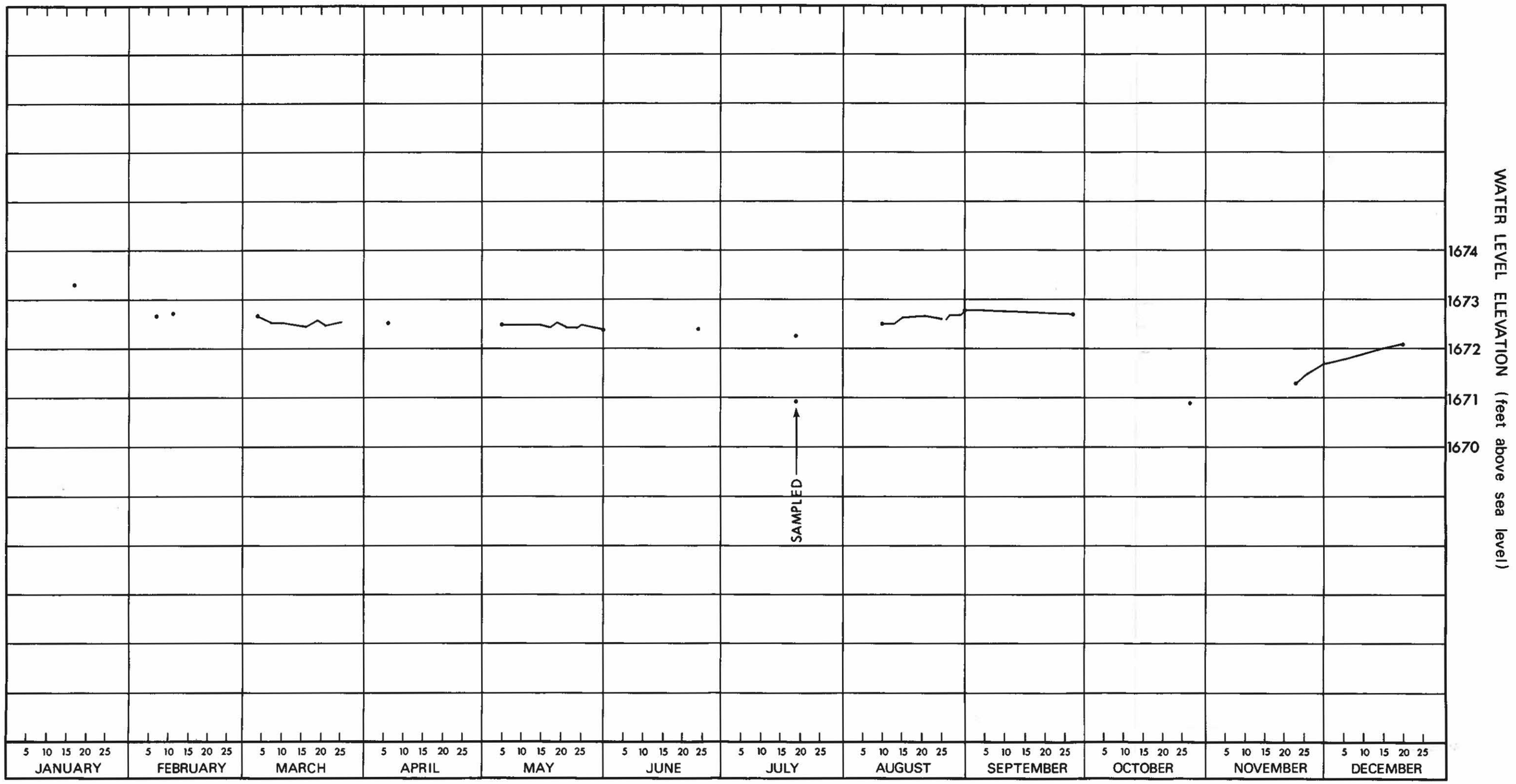
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

13 - 230 - H - 77




1976

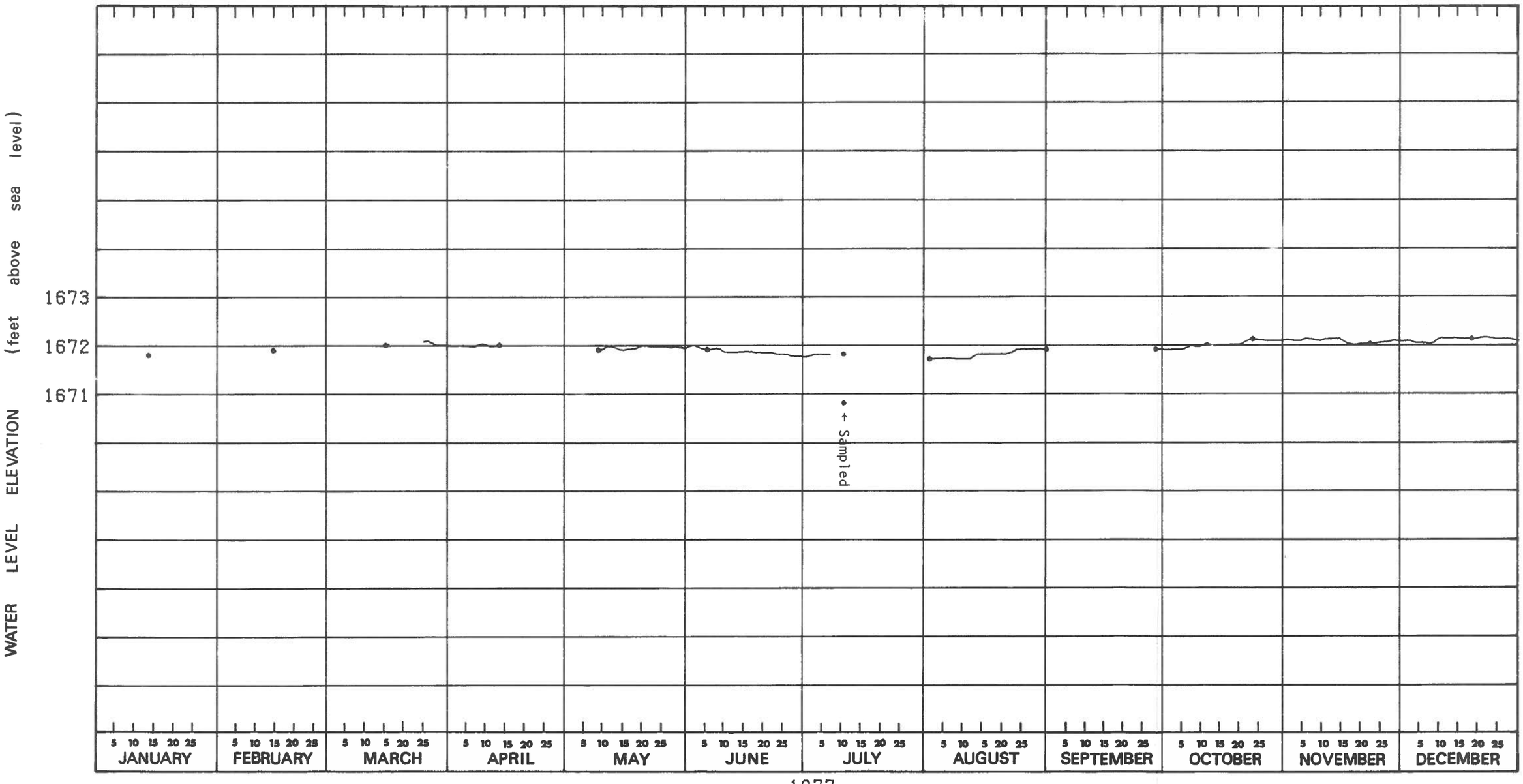
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-230-H-78



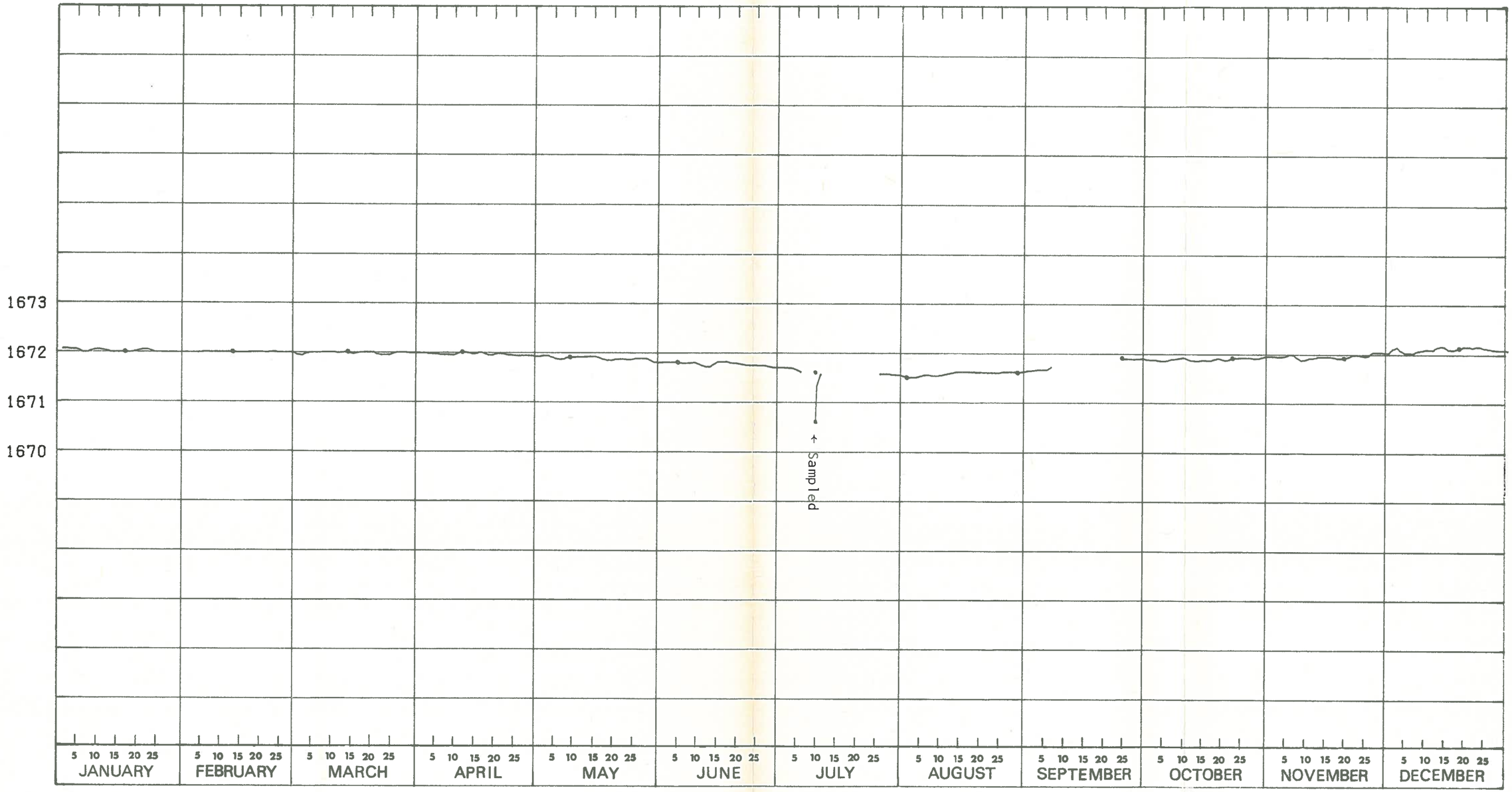
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-230

LSD 8 SEC 11 TWP 90 R 12 W4TH

13-230-H-79

Alberta Research Council




1978

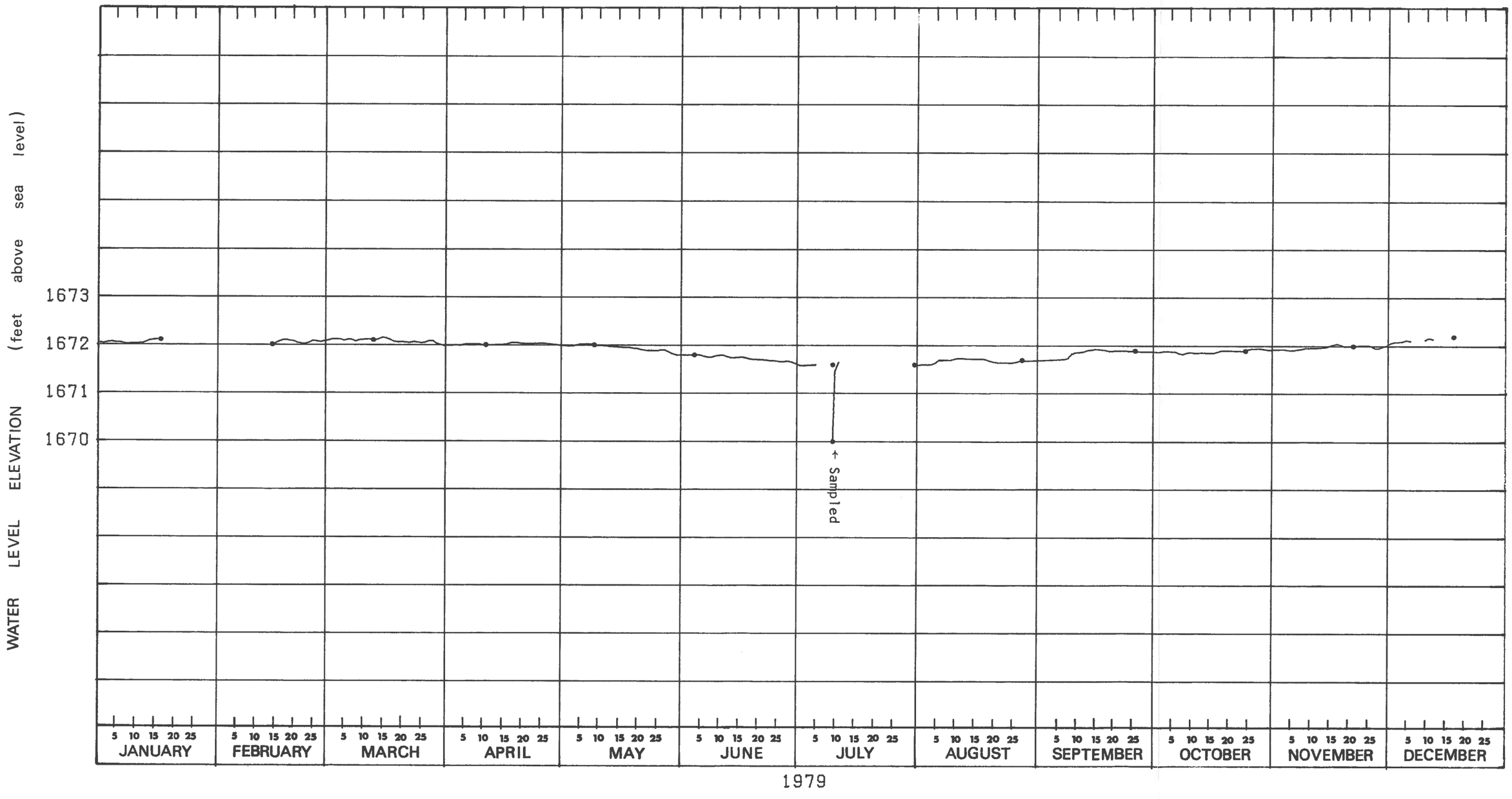
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-230

13-230-H-80

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council



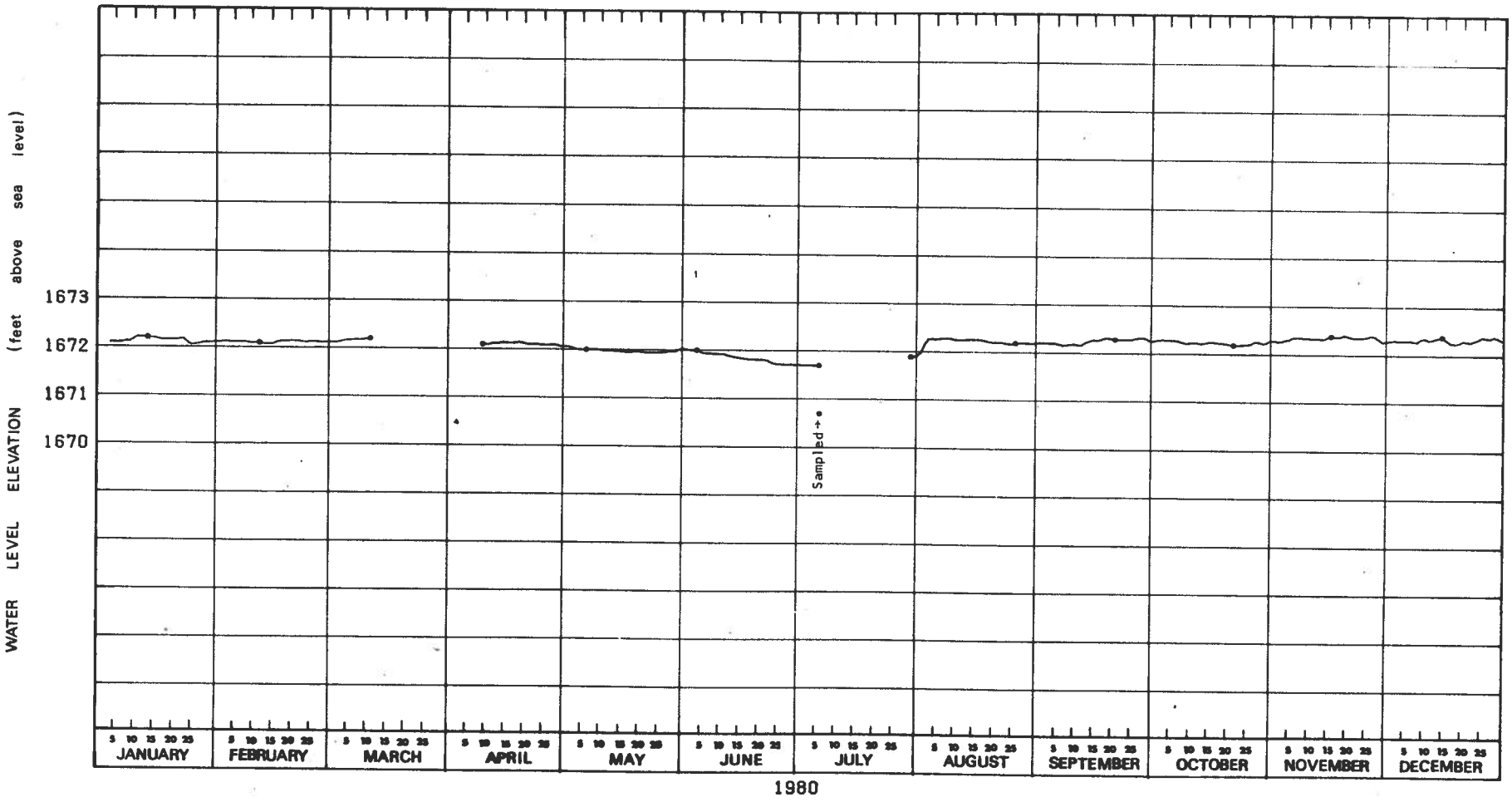
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-230-H-81



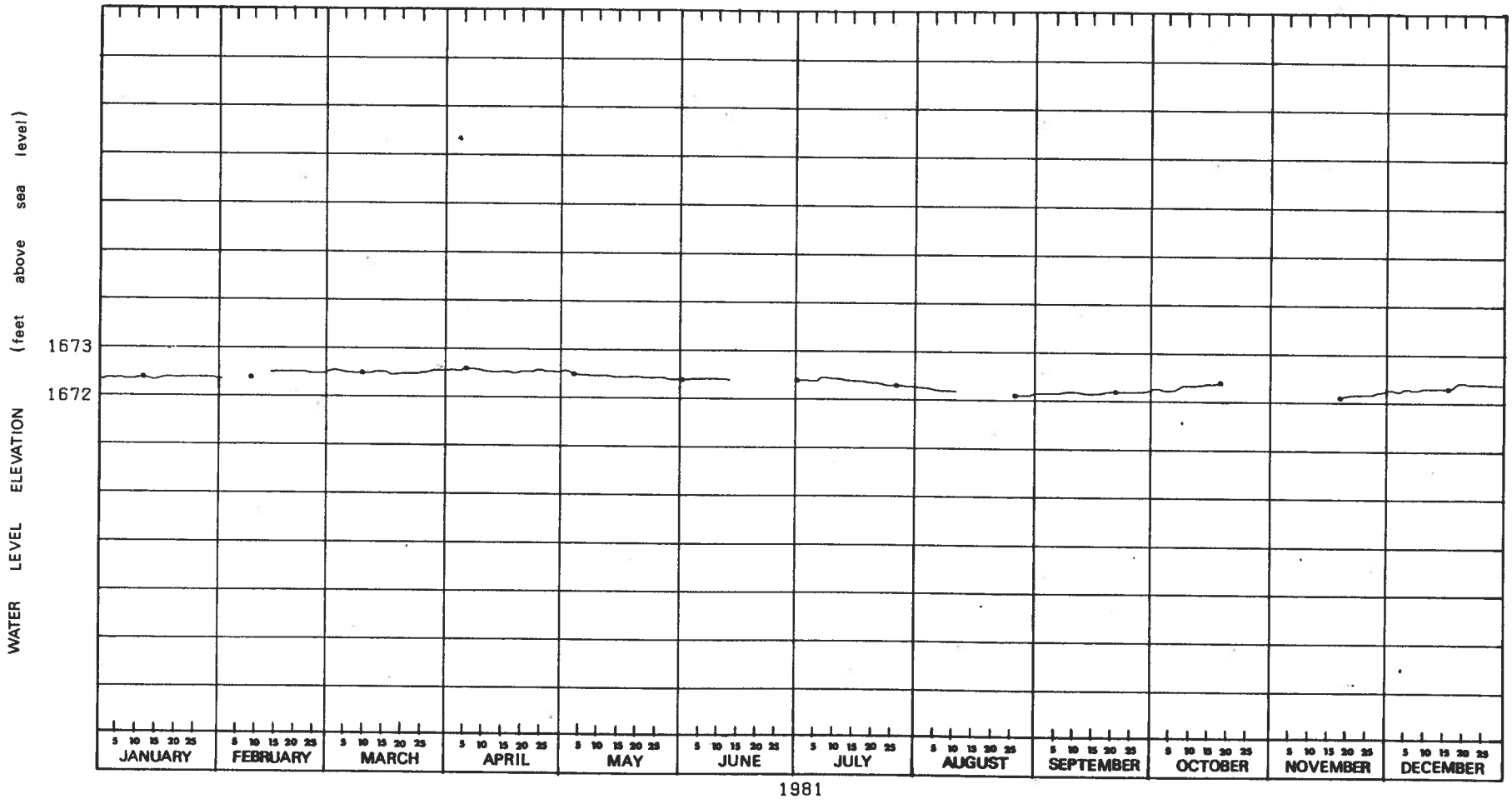
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-230-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1750.76

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 12/76 | | | Well completed |
| Jan 17/76 | 23.62 TOC | 1673.3 | Bail test, Q = 4 IGPM, T = 0.8 IGPD/FT |
| Jan 18/76 | | | Water sample, shelter installed |
| Feb 7/76 | 24.52 MP | 1672.7 | MP = 0.70 m TOC, (1753.1) |
| Feb 11/76 | 24.50 MP | 1672.7 | |
| Mar 4/76 | 24.52 MP | 1672.7 | |
| Apr 6/76 | 24.56 MP | 1672.5 | |
| May 5/76 | 24.57 MP | 1672.5 | |
| May 31/76 | 24.60 MP | 1672.4 | |
| June 24/76 | 24.60 MP | 1672.4 | |
| July 19/76 | 24.64 MP | 1672.3 | |
| | 25.05 MP | 1670.9 | After sample; temp. 4°C |
| Aug 10/76 | 24.56 MP | 1672.5 | |
| Aug 31/76 | 24.49 MP | 1672.8 | |
| Sept 27/76 | 24.50 MP | 1672.7 | |
| Oct 18/76 | | | Treated with 70# NU-Well acid well conditioner |
| Oct 27/76 | 24.37 TOC | 1670.9 | |
| Nov 8/76 | | | Well blown down with air to clean out acid |
| Nov 22/76 | 24.88 MP | 1671.3 | MP = 0.66 m TOC, (1752.9) |
| Dec 20/76 | 24.70 MP | 1672.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1750.76

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 24.72 MP | 1671.8 | MP (1752.9) |
| Feb 15/77 | 24.68 MP | 1671.9 | |
| Mar 16/77 | 24.67 MP | 1672.0 | |
| Apr 14/77 | 24.66 MP | 1672.0 | |
| May 9/77 | 24.69 MP | 1671.9 | |
| June 6/77 | 25.00 MP | 1670.9 | Measurement probably incorrect recorder shows water level elevation of 1671.9 |
| July 11/77 | 24.73 MP | 1671.8 | |
| | 25.02 MP | 1670.8 | After sample; temp. 4°C |
| Aug 2/77 | 24.75 MP | 1671.7 | |
| Sept 1/77 | 24.69 MP | 1671.9 | |
| Sept 29/77 | 24.70 MP | 1671.9 | |
| Oct 24/77 | 24.62 MP | 1672.1 | |
| Nov 23/77 | 24.67 MP | 1672.0 | |
| Dec 19/77 | 24.62 MP | 1672.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1750.76

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 24.65 MP | 1672.0 | MP (1752.9) |
| Feb 13/78 | 24.67 MP | 1672.0 | |
| Mar 14/78 | 24.66 MP | 1672.0 | |
| Apr 12/78 | 24.65 MP | 1672.0 | |
| May 9/78 | 24.69 MP | 1671.9 | |
| June 5/78 | 24.74 MP | 1671.8 | |
| July 10/78 | 24.78 MP | 1671.6 | |
| | 25.10 MP | 1670.6 | After sample; temp. 5.5°C |
| Aug 2/78 | 24.81 MP | 1671.5 | |
| Aug 30/78 | 24.77 MP | 1671.6 | |
| Sept 25/78 | 24.68 MP | 1671.9 | |
| Oct 23/78 | 24.68 MP | 1671.9 | |
| Nov 20/78 | 24.70 MP | 1671.9 | |
| Dec 19/78 | 24.63 MP | 1672.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1750.76

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 24.64 MP | 1672.1 | MP (1752.9) |
| Feb 15/79 | 24.66 MP | 1672.0 | |
| Mar 13/79 | 24.64 MP | 1672.1 | |
| Apr 11/79 | 24.67 MP | 1672.0 | |
| May 9/79 | 24.67 MP | 1672.0 | |
| June 4/79 | 24.71 MP | 1671.8 | |
| July 10/79 | 24.78 MP | 1671.6 | |
| | 25.28 MP | 1670.0 | After sample; temp. 5.5°C |
| July 31/79 | 24.79 MP | 1671.6 | |
| Aug 28/79 | 24.74 MP | 1671.7 | |
| Sept 26/79 | 24.70 MP | 1671.9 | |
| Oct 25/79 | 24.68 MP | 1671.9 | |
| Nov 22/79 | 24.66 MP | 1672.0 | |
| Dec 18/79 | 24.61 MP | 1672.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

13 - 230 - W - 82

WELL HISTORY

OBSERVATION WELL NUMBER 13-230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1750.76

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/80 | 24.59 MP | 1672.2 | |
| Feb 12/80 | 24.62 MP | 1672.1 | |
| Mar 12/80 | 24.61 MP | 1672.2 | |
| Apr 10/80 | 24.63 MP | 1672.1 | |
| May 7/80 | 24.67 MP | 1672.0 | |
| June 5/80 | 24.67 MP | 1672.0 | |
| July 7/80 | 24.74 MP | 1671.7 | Temp. 3°C |
| | 25.05 MP | 1670.7 | After Sample |
| July 11/80 | | | Bailed 90 gals - Dry, recovered and bailed 90 gals - dry. Sampled t=5°C, cond. = 2500 |
| July 14/80 | 26.10 MP | 1662.3 | |
| July 31/80 | 24.69 MP | 1671.9 | |
| Aug 27/80 | 24.61 MP | 1672.2 | |
| Sept 22/80 | 24.57 MP | 1672.3 | |
| Oct 23/80 | 24.59 MP | 1672.2 | |
| Nov 17/80 | 24.53 MP | 1672.4 | |
| Dec 16/80 | 24.53 MP | 1672.4 | |
| Jan 12/81 | 24.53 MP | 1672.4 | |
| Feb 9/81 | 24.53 MP | 1672.4 | |
| Mar 10/81 | 24.50 MP | 1672.5 | |
| Apr 6/81 | 24.49 MP | 1672.6 | |
| May 4/81 | 24.50 MP | 1672.5 | |
| June 1/81 | 24.55 MP | 1672.4 | |
| July 1/81 | 24.55 MP | 1672.4 | |
| July 27/81 | 24.56 MP | 1672.3 | |
| Aug 27/81 | 24.64 MP | 1672.1 | |
| Sept 22/81 | 24.61 MP | 1672.2 | |
| Oct 19/81 | 24.54 MP | 1672.4 | |
| Nov 19/81 | 24.62 MP | 1672.1 | |
| Dec 17/81 | 24.57 MP | 1672.3 | |

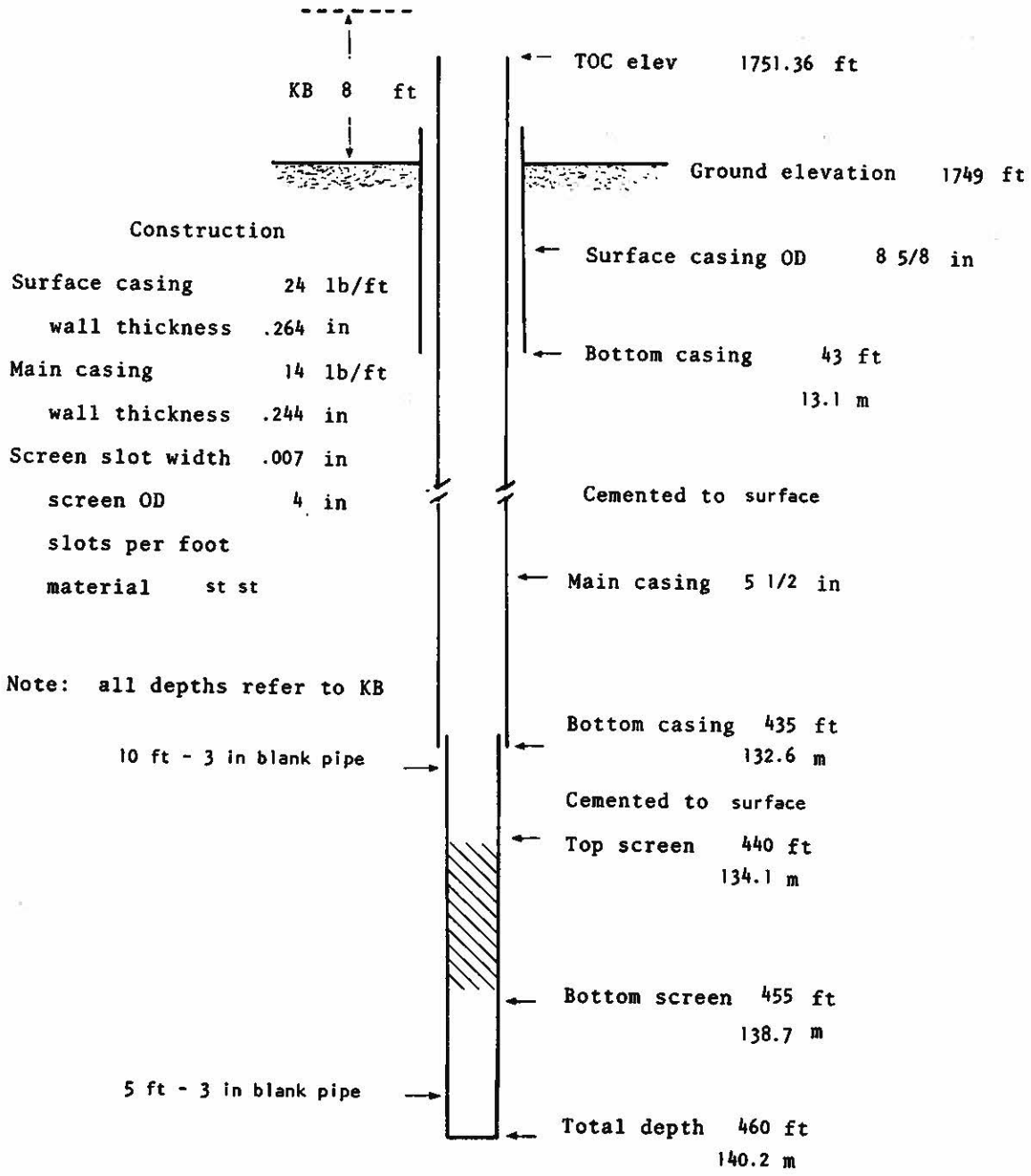
MP - Depth from measuring point
TOC - Depth from top of casing

**WELL CONSTRUCTION.**

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Tp 90 R 12 W 4th

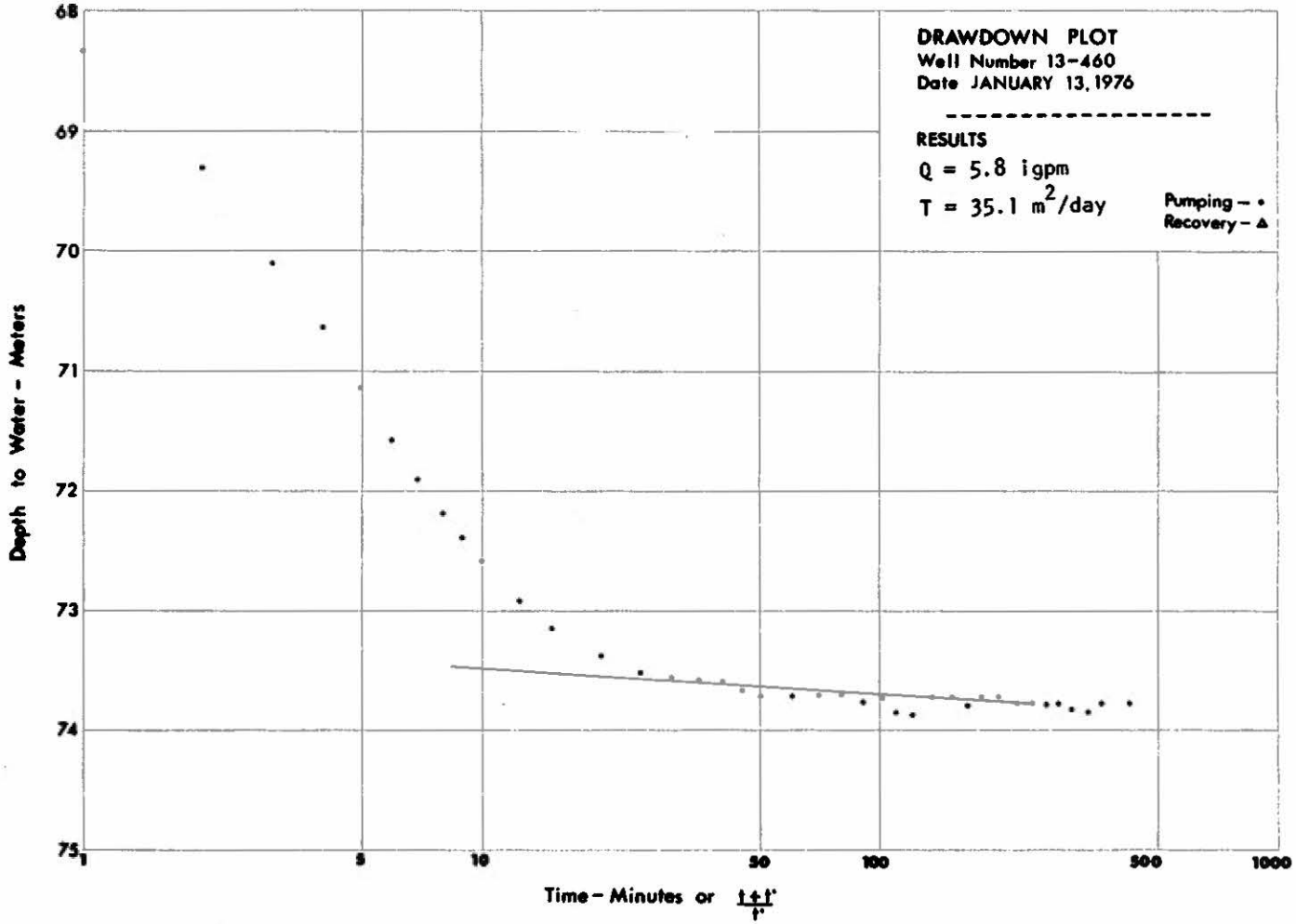
Alberta Research Council



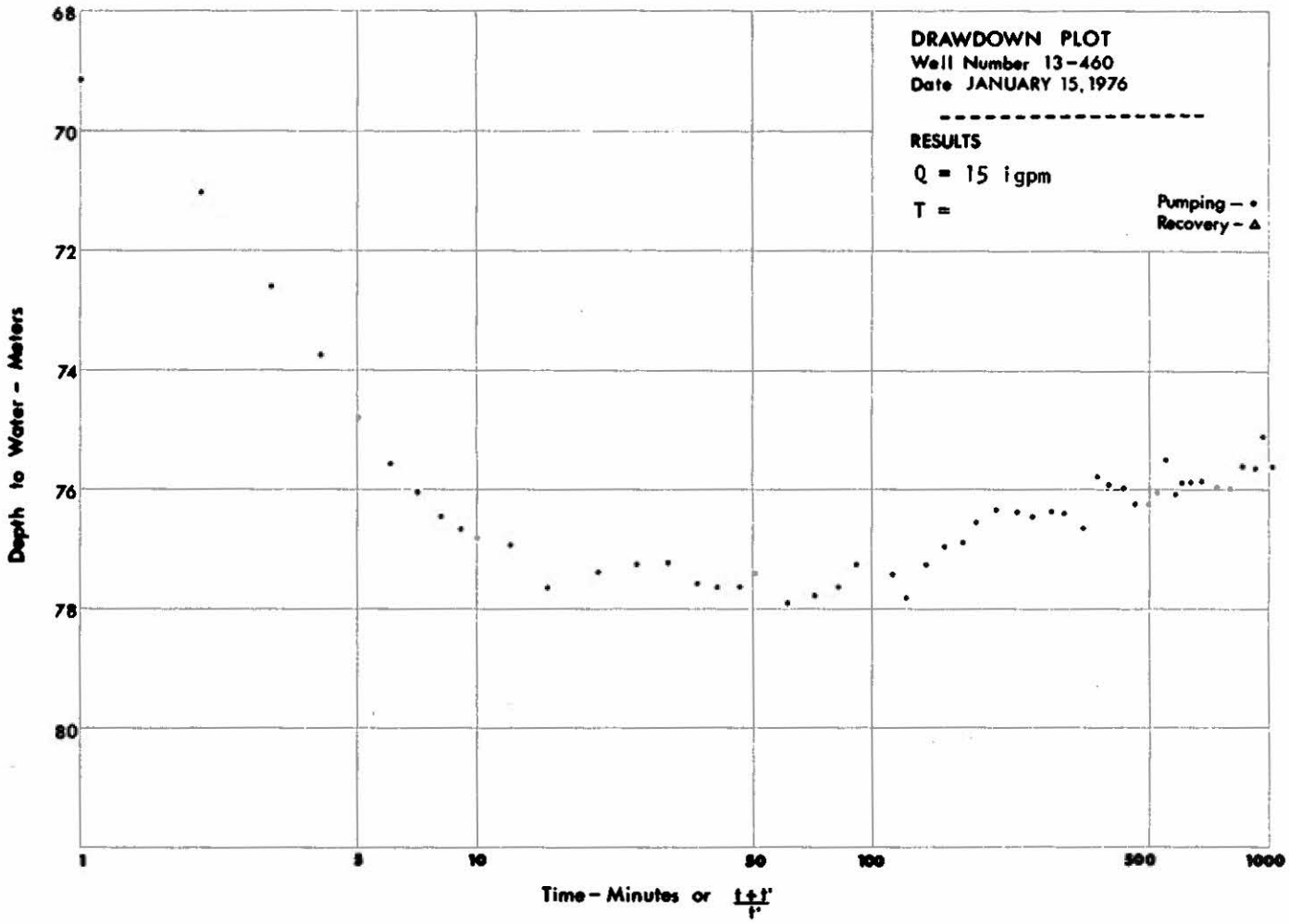

Construction

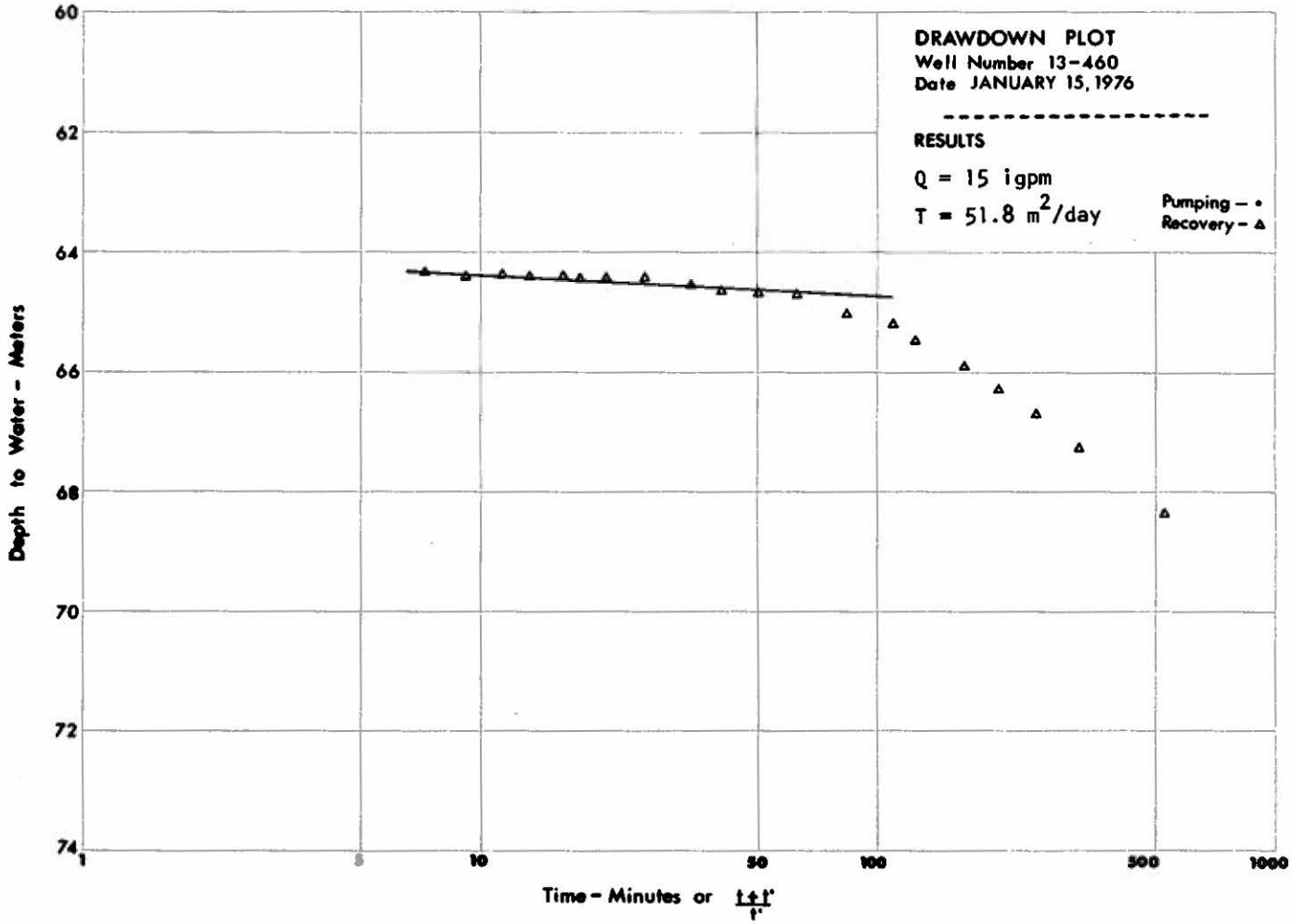
| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB

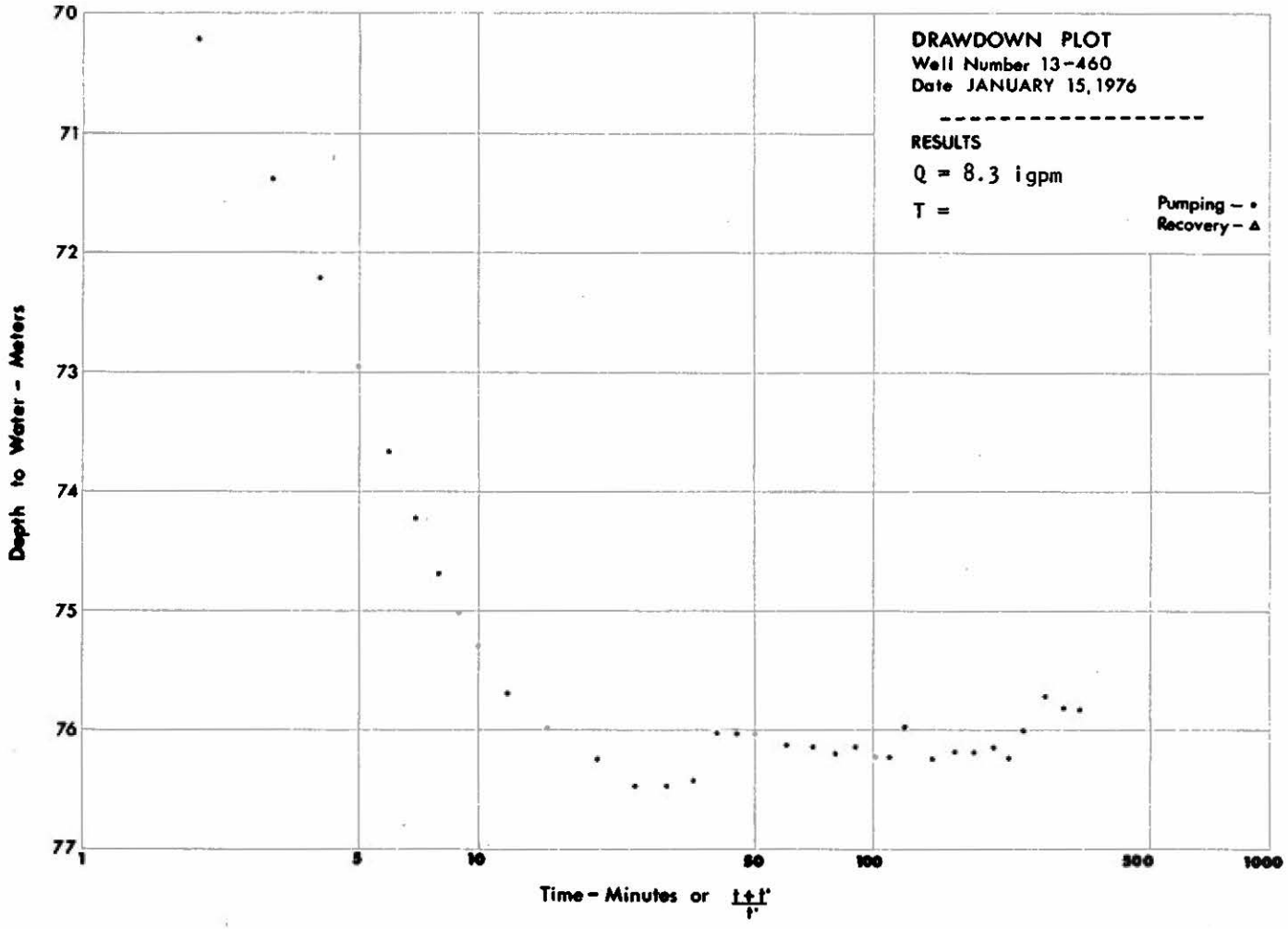

DRAWDOWN PLOT
Well Number 13-460
Date JANUARY 13, 1976
RESULTS
Q = 5.8 igpm
T = 35.1 m²/day
Pumping – •
Recovery – △
Depth to Water – Meters
68
69
70
71
72
73
74
75
1
5
10
50
100
500
1000
Time – Minutes or (t+t')/t'

13-460-A-77

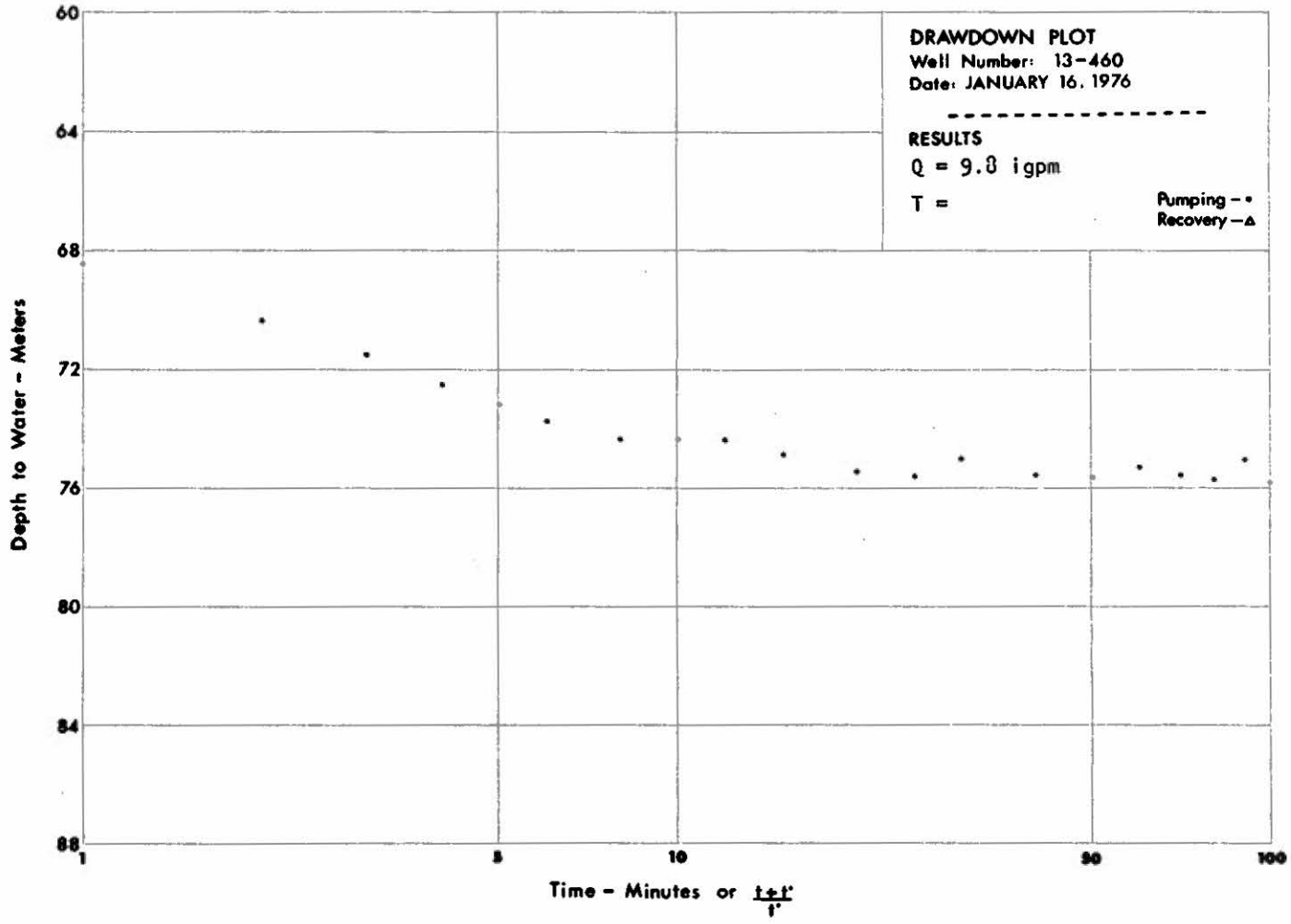

DRAWDOWN PLOT
Well Number 13-460
Date JANUARY 15, 1976
RESULTS
Q = 15 igpm
T =
Pumping – •
Recovery – △
Depth to Water – Meters
68
70
72
74
76
78
80
1
5
10
50
100
500
1000
Time – Minutes or $\frac{t+t'}{t'}$


DRAWDOWN PLOT
Well Number 13-460
Date JANUARY 15, 1976
RESULTS
Q = 15 igpm
T = 51.8 m²/day
Pumping – •
Recovery – △
Depth to Water – Meters
60
62
64
66
68
70
72
74
1
10
50
100
500
1000
Time – Minutes or (t+t')/t'

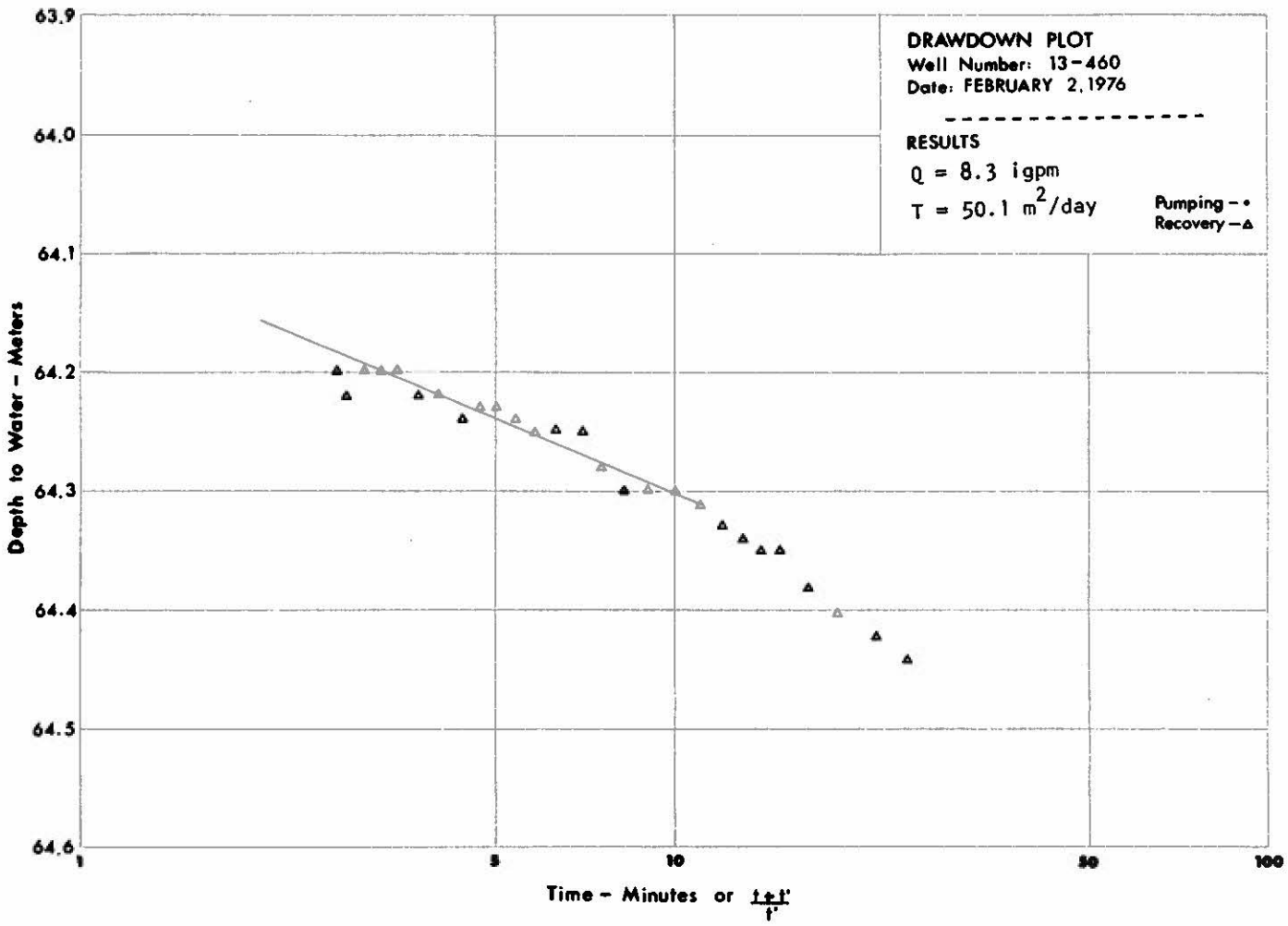
13-460-A-77


DRAWDOWN PLOT
Well Number 13-460
Date JANUARY 15, 1976
RESULTS
Q = 8.3 igpm
T =
Pumping – •
Recovery – Δ
Depth to Water - Meters
70
71
72
73
74
75
76
77
1
5
10
50
100
500
1000
Time - Minutes or t+t'/t'

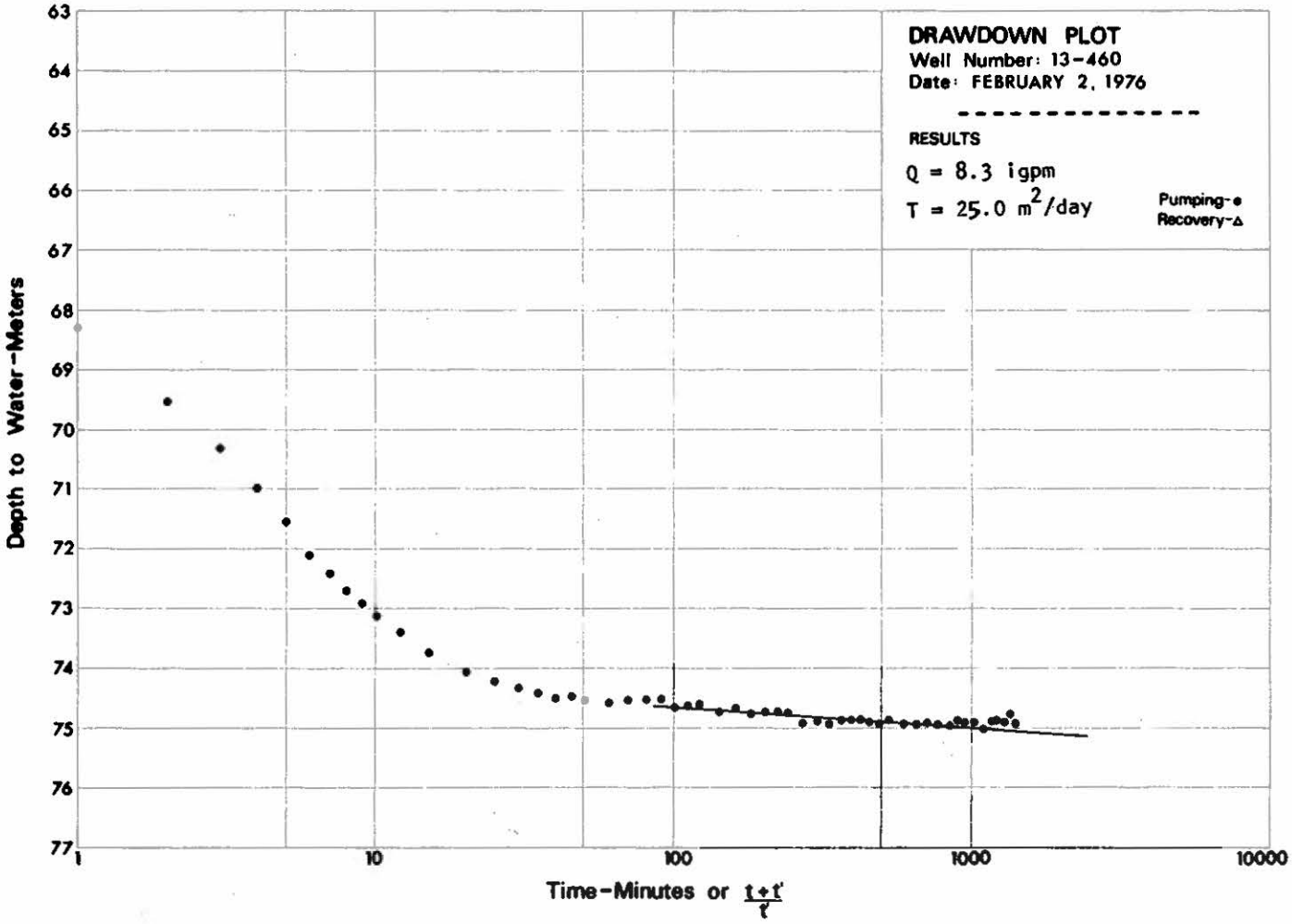
13-460-A-77


DRAWDOWN PLOT
Well Number: 13-460
Date: JANUARY 16, 1976
RESULTS
Q = 9.8 igpm
T =
Pumping - •
Recovery - △
Depth to Water - Meters
60
64
68
72
76
80
84
88
1
5
10
50
100
Time - Minutes or t+t'/t'

13-460-A-77


DRAWDOWN PLOT
Well Number: 13-460
Date: FEBRUARY 2, 1976
RESULTS
Q = 8.3 igpm
T = 50.1 m²/day
Pumping - •
Recovery - △
Depth to Water - Meters
63.9
64.0
64.1
64.2
64.3
64.4
64.5
64.6
1
5
10
50
100
Time - Minutes or (t+t')/t'

13-460-A-77


DRAWDOWN PLOT
Well Number: 13-460
Date: FEBRUARY 2, 1976
RESULTS
Q = 8.3 igpm
T = 25.0 m²/day
Pumping-•
Recovery-△
Depth to Water-Meters
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
1
10
100
1000
10000
Time-Minutes or (t+t')/t'

13-460-A-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Pump test on 13-460

Date sampled January 15, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1.3 | 0.06 | 0.4 |
| Magnesium ($Mg^{++}$) | 0.6 | 0.05 | 0.3 |
| Sodium ($Na^{+}$) | 371.0 | 16.14 | 99.2 |
| Potassium ($K^{+}$) | 0.8 | 0.02 | 0.1 |
| Carbonate ($CO_3^{=}$) | 62.0 | 2.07 | 12.5 |
| Bicarbonate ($HCO_3^{-}$) | 686.0 | 11.24 | 67.9 |
| Sulfate ($SO_4^{=}$) | 135.0 | 2.81 | 17.0 |
| Chloride ($Cl^{-}$) | 15.0 | 0.42 | 2.6 |
| Nitrate ($NO_3^{=}$) | 1.7 | 0.03 | 0.2 |
| Silica ($SiO_2$) | 0.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 940.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 16.6 | Total Cations (epm) | 16.3 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | | Temperature (C) | | |
| pH | 8.8 | pH | 9.2 | |
| Fluoride ($F^{-}$) | 0.7 ppm | Carbonate ($CO_3^{=}$) | 86 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 771 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

### Major Constituents

| | Mg/L | Mcq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1.3 | 0.06 | 0 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.02 | 0 |
| Sodium ($Na^{+}$) | 395.0 | 17.18 | 99 |
| Potassium ($K^{+}$) | 2.5 | 0.06 | 0 |
| Carbonate ($CO_3^{=}$) | 79.0 | 2.63 | 16 |
| Bicarbonate ($HCO_3^{-}$) | 688.0 | 11.28 | 68 |
| Sulfate ($SO_4^{=}$) | 114.0 | 2.37 | 14 |
| Chloride ($Cl^{-}$) | 14.0 | 0.39 | 2 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1.5 | | |
| Magnesium (Acidified) | 0.7 | | |
| Total dissolved solids | 940 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 16.69 | Total Cations (epm) | 17.34 |

### Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1500 | | Temperature (C) | 4.0 | |
| pH | 9.0 | | pH | 10.6 | |
| Fluoride ($F^{-}$) | 0.4 | Mg/L | Carbonate ($CO_3^{=}$) | 350 | Mg/L |
| | | | Bicarbonate ($HCO_3^{-}$) | 229 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled November 11, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.0 | 0.15 | 1 |
| Magnesium ($Mg^{++}$) | 2.0 | 0.16 | 1 |
| Sodium ($Na^{+}$) | 422.0 | 18.36 | 98 |
| Potassium ($K^{+}$) | 2.1 | 0.05 | 0 |
| Carbonate ($CO_3^{=}$) | 16.8 | 0.56 | 4 |
| Bicarbonate ($HCO_3^{-}$) | 769.0 | 12.60 | 78 |
| Sulfate ($SO_4^{=}$) | 98.0 | 2.04 | 13 |
| Chloride ($Cl^{-}$) | 32.0 | 0.90 | 6 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0 | 0 |
| Silica ($SiO_2$) | 3.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1130 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 16.11 | Total Cations (epm) | 18.72 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1750 | Temperature (C) | |
| pH | 8.6 | pH | 9 |
| Fluoride ($F^{-}$) | 0.4 mg/l | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled January 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.4 | 0.12 | 0.7 |
| Magnesium ($Mg^{++}$) | 1.5 | 0.12 | 0.7 |
| Sodium ($Na^{+}$) | 396.0 | 17.22 | 98.4 |
| Potassium ($K^{+}$) | 1.7 | 0.04 | 0.2 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 795.0 | 13.03 | 81.3 |
| Sulfate ($SO_4^{=}$) | 117.0 | 2.44 | 15.2 |
| Chloride ($Cl^{-}$) | 20.0 | 0.56 | 3.5 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 5.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1044.0 | | |
| Total Anions (epm) | 16.03 | Total Cations (epm) | 17.51 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1530 | Temperature (C) | |
| pH | 8.3 | pH | 8.5 |
| Fluoride ($F^{-}$) | 0.7 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1.0 | 0.05 | 0.3 |
| Magnesium ($Mg^{++}$) | 0.5 | 0.04 | 0.2 |
| Sodium ($Na^{+}$) | 398.0 | 17.31 | 99.2 |
| Potassium ($K^{+}$) | 2.1 | 0.05 | 0.3 |
| Carbonate ($CO_3^{=}$) | 43.2 | 1.44 | 9.3 |
| Bicarbonate ($HCO_3^{-}$) | 776.0 | 12.72 | 82.3 |
| Sulfate ($SO_4^{=}$) | 31.5 | 0.66 | 4.2 |
| Chloride ($Cl^{-}$) | 22.0 | 0.62 | 4.0 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0.1 |
| Silica ($SiO_2$) | 2.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1.0 | | |
| Magnesium (Acidified) | 0.9 | | |
| Total dissolved solids | 952.0 | | |
| Total Anions (epm) | 15.46 | Total Cations (epm) | 17.46 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1600 |
| pH | 8.8 |
| Fluoride ($F^{-}$) | 0.8 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 5.0 |
| pH | 8.9 |
| Carbonate ($CO_3^{=}$) | 62.0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 737.0 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Date sampled: November 11, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .084 |
| Au | <.003 | Mo | <.006 |
| Al | 0.33 | Na | 442 |
| As | <.038 | Ni | <.010 |
| B | 2.39 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 6.03 | Si | 2.25 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 0.11 |
| Cr | <.006 | Te | <.065 |
| Cu | .012 | Ti | .006 |
| Eu | <.015 | U | <.020 |
| Fe | 0.792 | V | <.0008 |
| K | <.150 | W | <.078 |
| Mg | 3.43 | Zn | 0.11 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.5 | 0.07 | 0.4 |
| Magnesium(Mg) | 0.4 | 0.03 | 0.2 |
| Sodium(Na) | 386.0 | 16.79 | 99.1 |
| Potassium(K) | 1.7 | 0.04 | 0.3 |
| Carbonate(CO3) | 45.6 | 1.52 | 9.0 |
| Bicarbonate(HCO3) | 776.0 | 12.72 | 75.4 |
| Sulphate(SO4) | 99.0 | 2.06 | 12.2 |
| Chloride(Cl) | 18.0 | 0.51 | 3.0 |
| Nitrate(NO3) | 3.3 | 0.05 | 0.3 |
| Silica(SiO2) | 2.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.8 | | |
| Magnesium(Acidified) | 0.6 | | |
| TDS(mg/l) | 948.0 | | |
| Total Anions(epm) | 16.86 | Total Cations(epm) | 16.94 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1370 | | Temperature(C) | 5.00 | |
| pH | 8.7 | | pH | 9.0 | |
| Fluoride(F) | 0.6 | mg/l | Carbonate(CO3) | 77 | mg/l |
| | | | Bicarbonate(HCO3) | 717 | mg/l |
| | | | Hydroxide(OH) | | |

13-460-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.0 | 0.05 | 0.3 |
| Magnesium(Mg) | 0.4 | 0.03 | 0.2 |
| Sodium(Na) | 386.0 | 16.79 | 99.3 |
| Potassium(K) | 1.3 | 0.03 | 0.2 |
| Carbonate(CO3) | 98.0 | 3.27 | 20.1 |
| Bicarbonate(HCO3) | 678.0 | 11.11 | 68.3 |
| Sulphate(SO4) | 80.0 | 1.67 | 10.2 |
| Chloride(Cl) | 8.0 | 0.23 | 1.4 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 1.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.1 | | |
| Magnesium(Acidified) | 0.6 | | |
| TDS(mg/l) | 926.0 | | |
| Total Anions(epm) | 16.27 | Total Cations(epm) | 16.91 |

Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 1320 | |
| pH | 9.2 | |
| Fluoride(F) | 0.6 | mg/l |

Field:

| | | |
|---|---|---|
| Temperature(C) | 5.00 | |
| pH | 9.3 | |
| Carbonate(CO3) | 105 | mg/l |
| Bicarbonate(HCO3) | 678 | mg/l |
| Hydroxide(OH) | | |

WATER ANALYSIS 13-460-E-82

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 7, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.3 | 0.06 | 0.4 |
| Magnesium(Mg) | 0.6 | 0.05 | 0.3 |
| Sodium(Na) | 353.0 | 15.35 | 98.7 |
| Potassium(K) | 3.3 | 0.08 | 0.5 |
| Carbonate(CO3) | 79.0 | 2.63 | 15.9 |
| Bicarbonate(HCO3) | 727.0 | 11.92 | 71.9 |
| Sulphate(SO4) | 82.0 | 1.71 | 10.3 |
| Chloride(Cl) | 11.0 | 0.31 | 1.9 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 1.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.4 | | |
| Magnesium(Acidified) | 0.7 | | |
| TDS(mg/l) | 1008.0 | | |
| Total Anions(epm) | 16.57 | Total Cations(epm) | 15.55 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1510 | Temperature | 5.00 | |
| pH | 9.1 | pH | 9.3 | |
| Fluoride | 0.8 mg/l | Carbonate(CO3) | 110 | mg/l |
| | | Bicarbonate(HCO3) | 664 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 13-460 0X-E-82

OBSERVATION WELL NUMBER 13-460 0X

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 0.9 | 0.04 | 0.2 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.2 |
| Sodium(Na) | 416.0 | 18.09 | 99.3 |
| Potassium(K) | 1.5 | 0.04 | 0.2 |
| Carbonate(CO3) | 94.0 | 3.13 | 18.9 |
| Bicarbonate(HCO3) | 673.0 | 11.03 | 66.7 |
| Sulphate(SO4) | 106.0 | 2.21 | 13.3 |
| Chloride(Cl) | 6.0 | 0.17 | 1.0 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 0.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.2 | | |
| Magnesium(Acidified) | 0.5 | | |
| TDS(mg/l) | 919.0 | | |
| Total Anions(epm) | 16.55 | Total Cations(epm) | 18.21 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1390 | Temperature | 0.0 |
| pH | 9.1 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 13-460 1X-E-82

OBSERVATION WELL NUMBER 13-460 1X

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.0 | 0.05 | 0.3 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.2 |
| Sodium(Na) | 418.0 | 18.17 | 99.2 |
| Potassium(K) | 1.8 | 0.05 | 0.3 |
| Carbonate(CO3) | 74.0 | 2.47 | 14.8 |
| Bicarbonate(HCO3) | 708.0 | 11.61 | 69.7 |
| Sulphate(SO4) | 115.0 | 2.40 | 14.4 |
| Chloride(Cl) | 6.0 | 0.17 | 1.0 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 5.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.2 | | |
| Magnesium(Acidified) | 0.5 | | |
| TDS(mg/l) | 977.0 | | |
| Total Anions(epm) | 16.64 | Total Cations(epm) | 18.31 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1410 | Temperature | 0.0 |
| pH | 8.9 | pH | 0.0 |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 13-460 2X-E-82

OBSERVATION WELL NUMBER 13-460 2X

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 0.9 | 0.04 | 0.2 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.2 |
| Sodium(Na) | 412.0 | 17.91 | 99.3 |
| Potassium(K) | 1.5 | 0.04 | 0.2 |
| Carbonate(CO3) | 67.0 | 2.23 | 13.6 |
| Bicarbonate(HCO3) | 717.0 | 11.75 | 71.8 |
| Sulphate(SO4) | 112.0 | 2.33 | 14.2 |
| Chloride(Cl) | 2.0 | 0.06 | 0.3 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 6.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.0 | | |
| Magnesium(Acidified) | 0.5 | | |
| TDS(mg/l) | 966.0 | | |
| Total Anions(epm) | 16.38 | Total Cations(epm) | 18.04 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1400 | Temperature | 0.0 |
| pH | 8.9 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 13-460 3X-E-82

OBSERVATION WELL NUMBER 13-460 3X

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 0.9 | 0.04 | 0.2 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.2 |
| Sodium(Na) | 414.0 | 18.00 | 99.3 |
| Potassium(K) | 1.5 | 0.04 | 0.2 |
| Carbonate(CO3) | 67.0 | 2.23 | 13.5 |
| Bicarbonate(HCO3) | 724.0 | 11.87 | 71.7 |
| Sulphate(SO4) | 112.0 | 2.33 | 14.1 |
| Chloride(Cl) | 4.0 | 0.11 | 0.7 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 6.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.0 | | |
| Magnesium(Acidified) | 0.5 | | |
| TDS(mg/l) | 917.0 | | |
| Total Anions(epm) | 16.55 | Total Cations(epm) | 18.13 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1400 | Temperature | 0.0 |
| pH | 9.1 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 13-460 4X-E-82

OBSERVATION WELL NUMBER 13-460 4X

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

## Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 0.9 | 0.04 | 0.2 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.2 |
| Sodium(Na) | 413.0 | 17.96 | 99.3 |
| Potassium(K) | 1.5 | 0.04 | 0.2 |
| Carbonate(CO3) | 72.0 | 2.40 | 14.4 |
| Bicarbonate(HCO3) | 720.0 | 11.80 | 70.9 |
| Sulphate(SO4) | 112.0 | 2.33 | 14.0 |
| Chloride(Cl) | 4.0 | 0.11 | 0.7 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 5.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.1 | | |
| Magnesium(Acidified) | 0.5 | | |
| TDS(mg/l) | 921.0 | | |
| Total Anions(epm) | 16.65 | Total Cations(epm) | 18.08 |

## Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1400 |
| pH | 9.0 |
| Fluoride | 0.4 mg/l |

Field:

| | |
|---|---|
| Temperature | 0.0 |
| pH | 0.0 |
| Carbonate(CO3) | |
| Bicarbonate(HCO3) | |
| Hydroxide(OH) | |

WATER ANALYSIS 13-460 5X-E-82

OBSERVATION WELL NUMBER 13-460 5X

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 0.9 | 0.04 | 0.2 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.2 |
| Sodium(Na) | 416.0 | 18.09 | 99.3 |
| Potassium(K) | 1.5 | 0.04 | 0.2 |
| Carbonate(CO3) | 62.0 | 2.07 | 12.6 |
| Bicarbonate(HCO3) | 722.0 | 11.84 | 72.4 |
| Sulphate(SO4) | 112.0 | 2.33 | 14.3 |
| Chloride(Cl) | 4.0 | 0.11 | 0.7 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 6.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.0 | | |
| Magnesium(Acidified) | 0.6 | | |
| TDS(mg/l) | 920.0 | | |
| Total Anions(epm) | 16.35 | Total Cations(epm) | 18.21 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1400 | Temperature | 0.0 |
| pH | 8.8 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 13-460 6X-E-82

OBSERVATION WELL NUMBER 13-460 6X

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 0.9 | 0.04 | 0.2 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.2 |
| Sodium(Na) | 412.0 | 17.91 | 99.3 |
| Potassium(K) | 1.4 | 0.04 | 0.2 |
| Carbonate(CO3) | 74.0 | 2.47 | 15.0 |
| Bicarbonate(HCO3) | 700.0 | 11.48 | 70.0 |
| Sulphate(SO4) | 112.0 | 2.33 | 14.2 |
| Chloride(Cl) | 4.0 | 0.11 | 0.7 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 5.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.0 | | |
| Magnesium(Acidified) | 0.5 | | |
| TDS(mg/l) | 914.0 | | |
| Total Anions(epm) | 16.39 | Total Cations(epm) | 18.04 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1400 | Temperature | 0.0 |
| pH | 8.9 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 13-460 7X-E-82

OBSERVATION WELL NUMBER 13-460 7X

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 0.9 | 0.04 | 0.2 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.2 |
| Sodium(Na) | 413.0 | 17.96 | 99.3 |
| Potassium(K) | 1.5 | 0.04 | 0.2 |
| Carbonate(CO3) | 99.0 | 3.30 | 19.0 |
| Bicarbonate(HCO3) | 712.0 | 11.67 | 67.1 |
| Sulphate(SO4) | 111.0 | 2.31 | 13.3 |
| Chloride(Cl) | 4.0 | 0.11 | 0.6 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 5.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.0 | | |
| Magnesium(Acidified) | 0.6 | | |
| TDS(mg/l) | 920.0 | | |
| Total Anions(epm) | 17.40 | Total Cations(epm) | 18.08 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1400 | Temperature | 0.0 |
| pH | 8.9 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 13-460 8X-E-82

OBSERVATION WELL NUMBER 13-460 8X

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 0.9 | 0.04 | 0.2 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.2 |
| Sodium(Na) | 412.0 | 17.91 | 99.3 |
| Potassium(K) | 1.5 | 0.04 | 0.2 |
| Carbonate(CO3) | 74.0 | 2.47 | 14.9 |
| Bicarbonate(HCO3) | 708.0 | 11.61 | 70.3 |
| Sulphate(SO4) | 111.0 | 2.31 | 14.0 |
| Chloride(Cl) | 4.0 | 0.11 | 0.7 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 5.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.0 | | |
| Magnesium(Acidified) | 0.5 | | |
| TDS(mg/l) | 966.0 | | |
| Total Anions(epm) | 16.50 | Total Cations(epm) | 18.04 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1400 | Temperature | 0.0 |
| pH | 9.0 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 13-460 9X-E-82

OBSERVATION WELL NUMBER 13-460 9X

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 0.9 | 0.04 | 0.2 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.2 |
| Sodium(Na) | 413.0 | 17.96 | 99.3 |
| Potassium(K) | 1.5 | 0.04 | 0.2 |
| Carbonate(CO3) | 67.0 | 2.23 | 13.6 |
| Bicarbonate(HCO3) | 716.0 | 11.74 | 71.6 |
| Sulphate(SO4) | 111.0 | 2.31 | 14.1 |
| Chloride(Cl) | 4.0 | 0.11 | 0.7 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 5.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.0 | | |
| Magnesium(Acidified) | 0.5 | | |
| TDS(mg/l) | 930.0 | | |
| Total Anions(epm) | 16.40 | Total Cations(epm) | 18.08 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1400 | Temperature | 0.0 |
| pH | 8.9 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS 13-460 10X-E-82

OBSERVATION WELL NUMBER 13-460 10X

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 30, 1981

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 0.9 | 0.04 | 0.2 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.2 |
| Sodium(Na) | 417.0 | 18.13 | 99.3 |
| Potassium(K) | 1.5 | 0.04 | 0.2 |
| Carbonate(CO3) | 66.0 | 2.20 | 13.5 |
| Bicarbonate(HCO3) | 715.0 | 11.72 | 71.7 |
| Sulphate(SO4) | 111.0 | 2.31 | 14.1 |
| Chloride(Cl) | 4.0 | 0.11 | 0.7 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 5.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.0 | | |
| Magnesium(Acidified) | 0.6 | | |
| TDS(mg/l) | 925.0 | | |
| Total Anions(epm) | 16.35 | Total Cations(epm) | 18.26 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1390 | Temperature | 0.0 |
| pH | 8.9 | pH | 0.0 |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

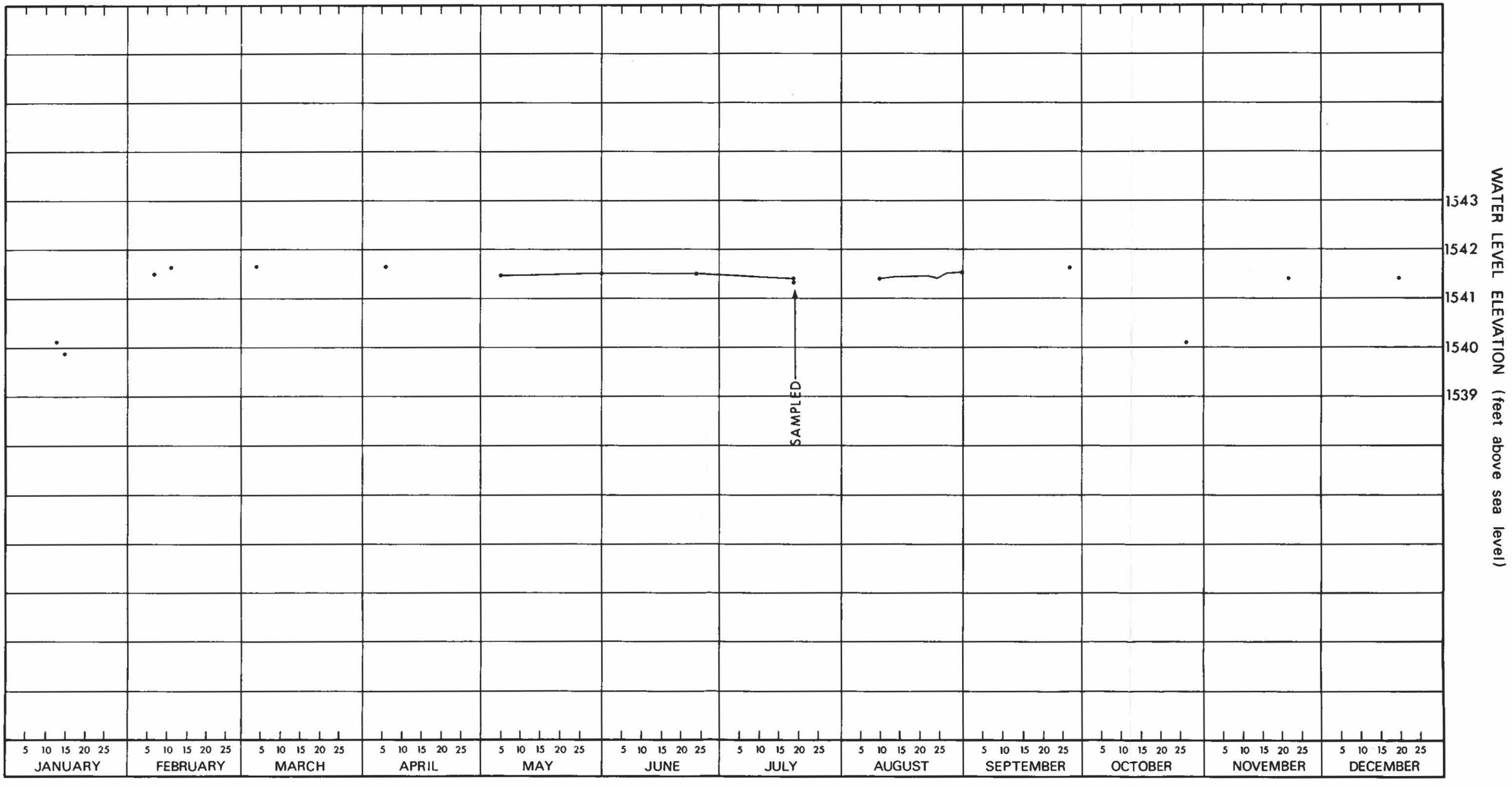
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

13 - 460 - H - 77




1976

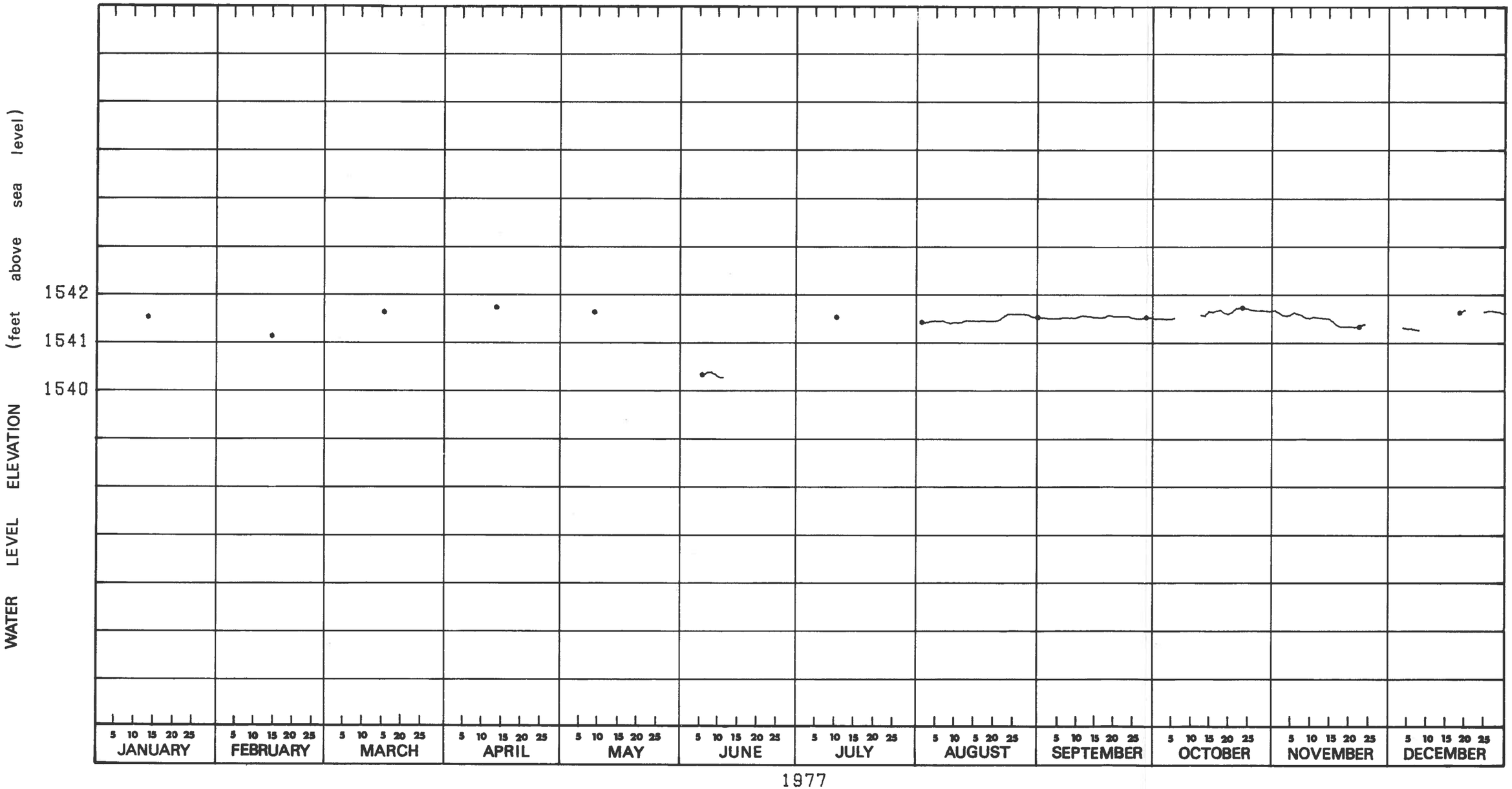
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-460-H-78



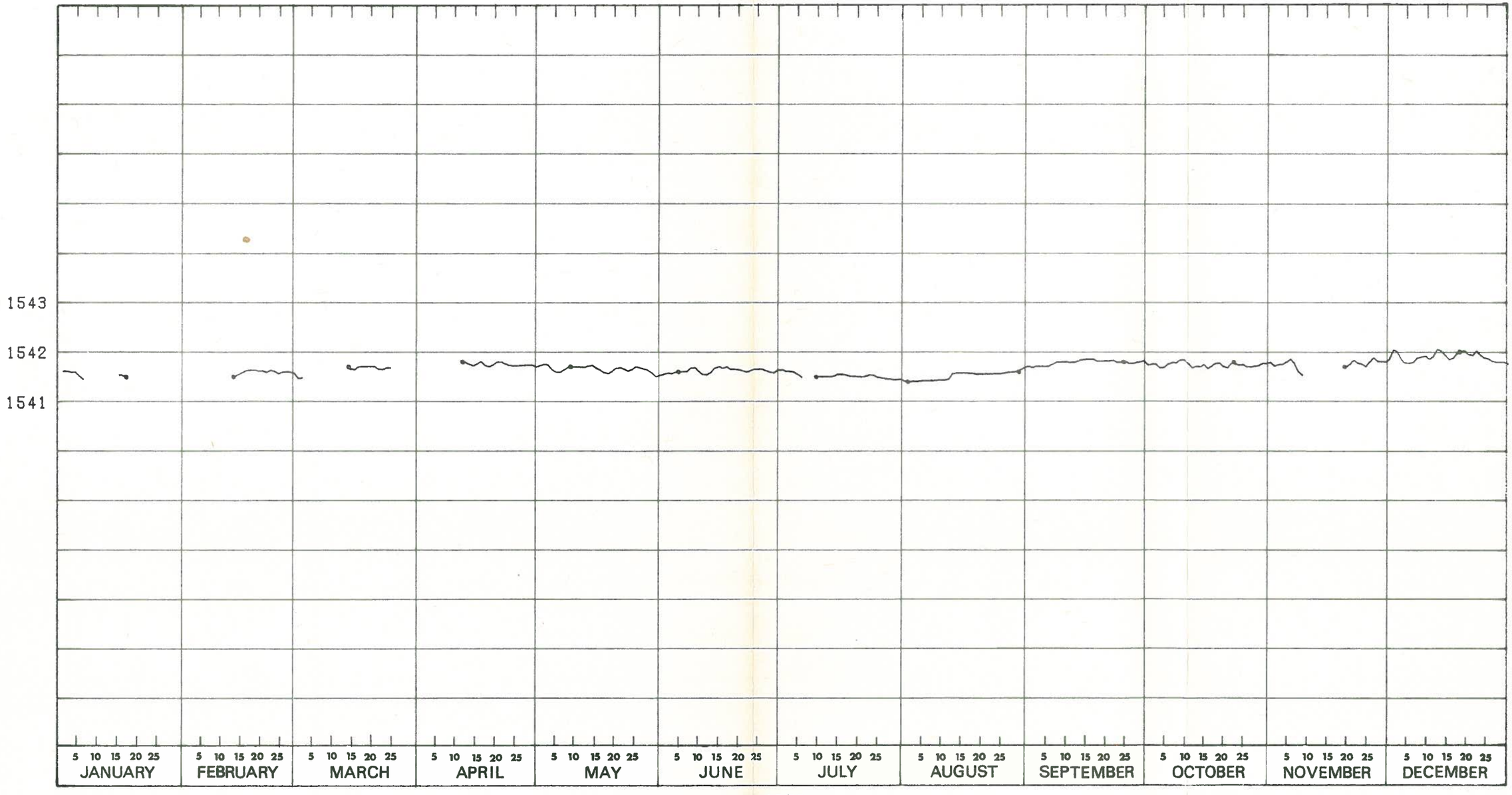
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-460

LSD 8 SEC 11 TWP 90 R 12 W4TH

Alberta Research Council

13-460-H-79



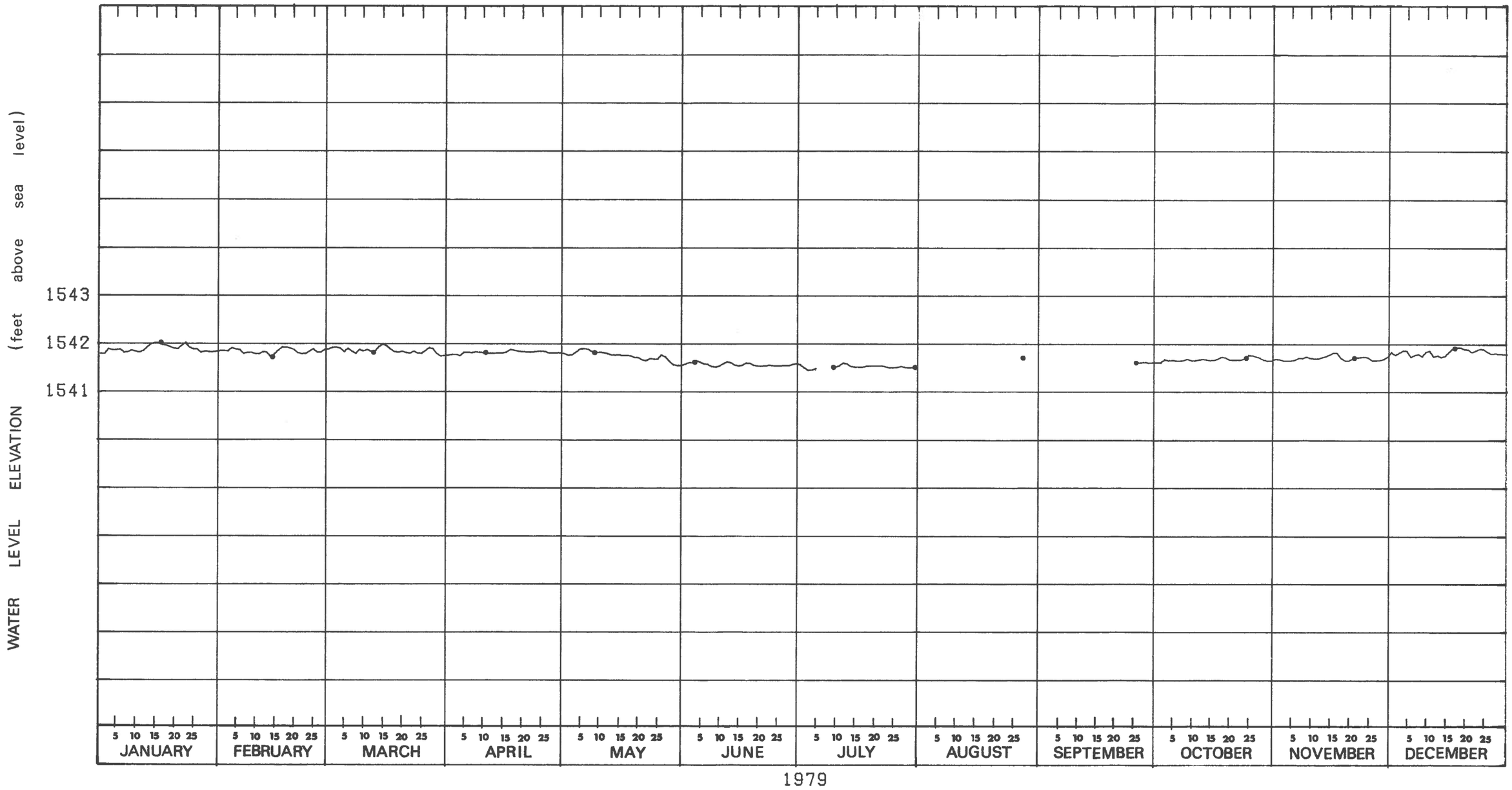
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-460-H-80



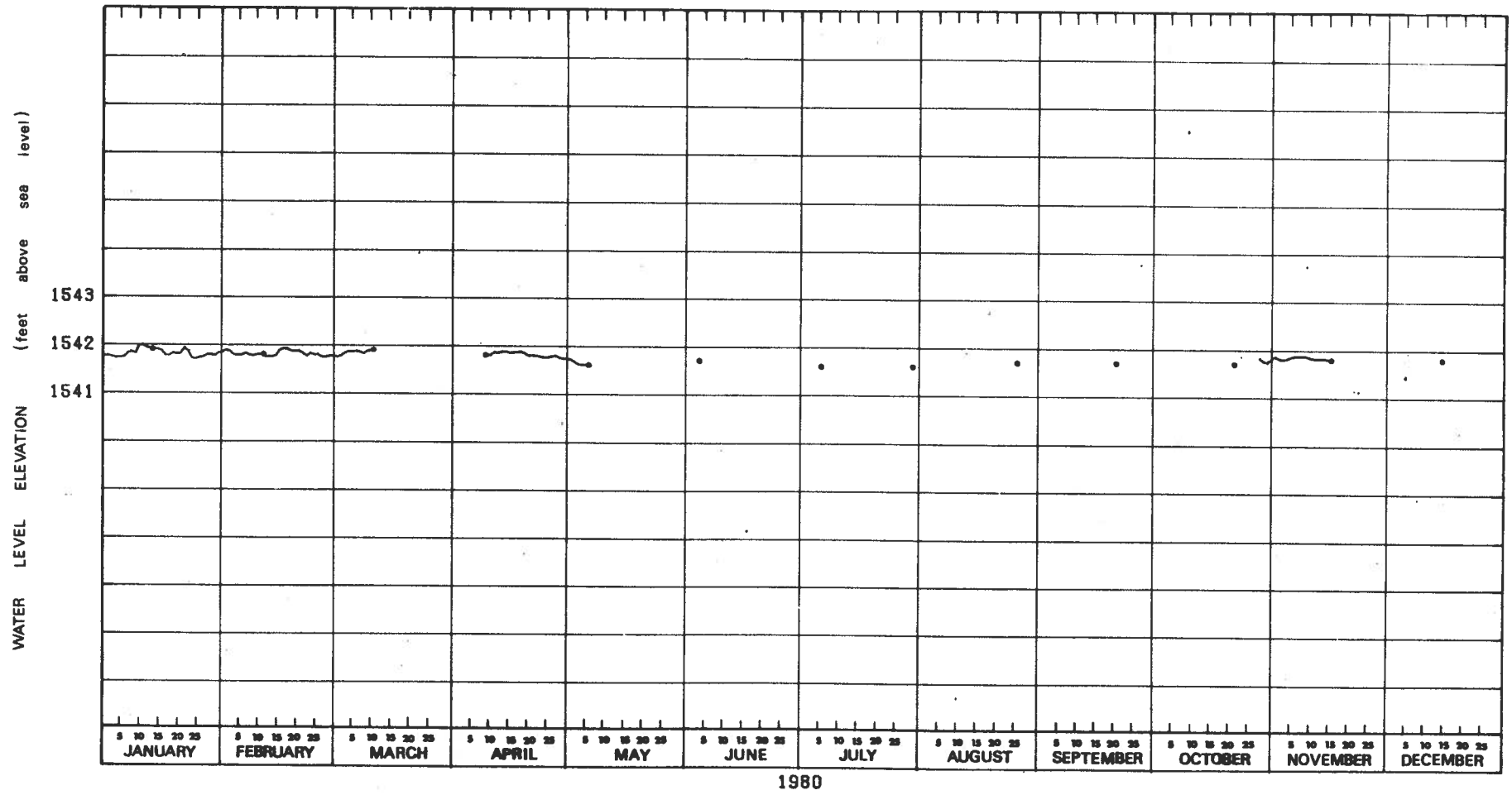
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta . Research Council

13-460-H-81



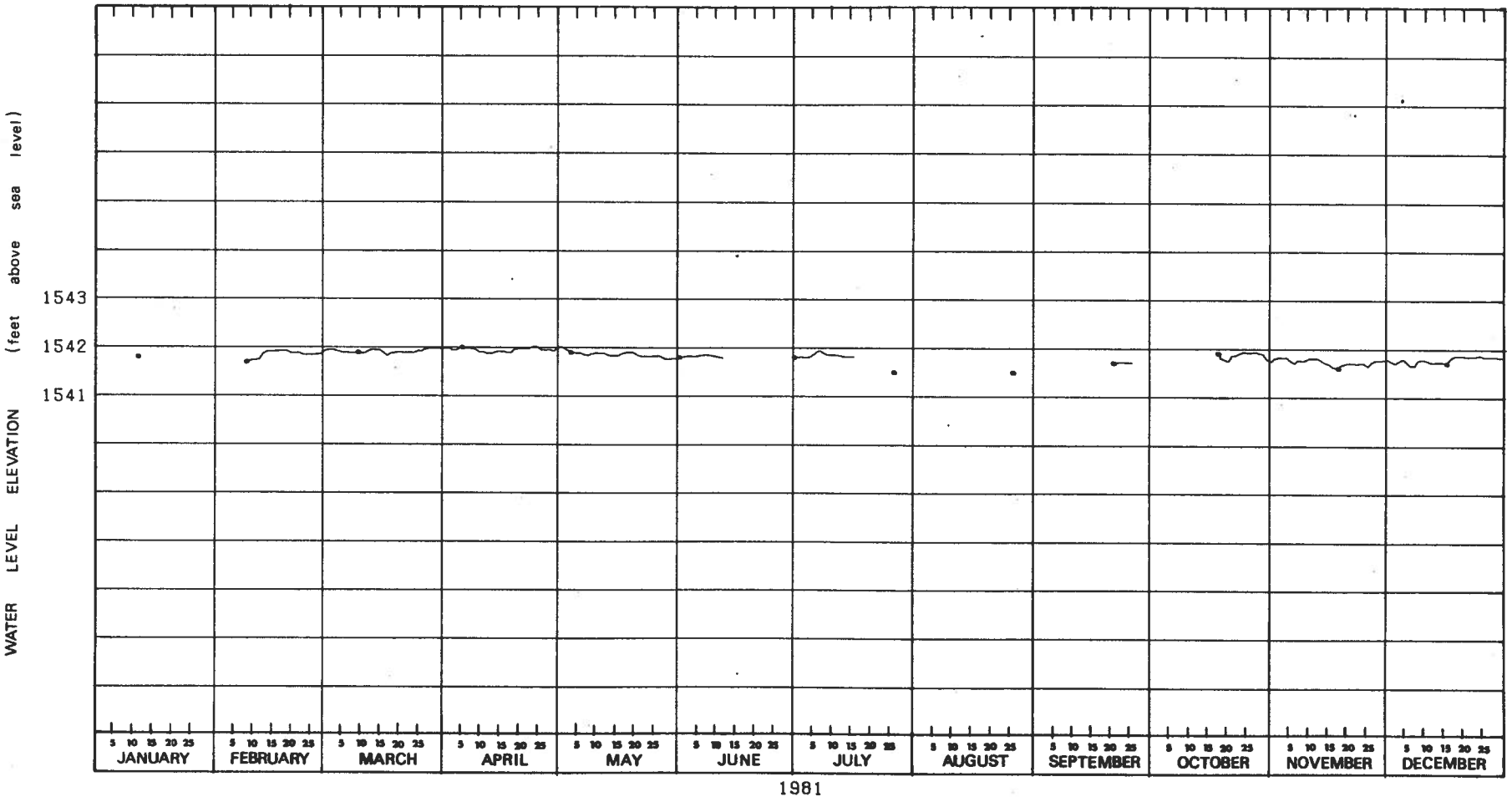
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-460-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1751.36

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 10/76 | | | Well completed |
| Jan 13/76 | 64.41 TOC | 1540.1 | Pump test, Q = 5.8 IGPM, 450 minutes; T = 2640 IGPD/FT |
| Jan 15/76 | 64.48 TOC | 1539.9 | Pump test, Q = 8.3 IGPM, 330 minutes |
| | 64.30 TOC | 1540.5 | Pump test, Q = 14.4 IGPM, 1000 minutes, T = 3450 IGPD/FT |
| Jan 16/76 | | | Water sample; shelter installed |
| Feb 1/76 | | | Pump test, Q = 8.3 IGPM, 1380 minutes, T = 1686 IGPD/FT |
| Feb 7/76 | 64.75 MP | 1541.4 | MP = 0.76 m TOC, 1753.8 |
| Feb 11/76 | 64.70 MP | 1541.6 | |
| Mar 4/76 | 64.72 MP | 1541.5 | |
| Apr 6/76 | 64.70 MP | 1541.6 | |
| May 5/76 | 64.75 MP | 1541.4 | |
| May 31/76 | 64.74 MP | 1541.4 | |
| June 24/76 | 64.74 MP | 1541.4 | |
| July 19/76 | 64.77 MP | 1541.3 | |
| | 64.78 MP | 1541.3 | After sample; temp. 4°C |
| Aug 10/76 | 64.77 MP | 1541.3 | |
| Aug 31/76 | 64.73 MP | 1541.5 | |
| Sept 27/76 | 64.70 MP | 1541.6 | |
| Oct 18/76 | | | Treated with 70# NU-Well acid well conditioner |
| Oct 27/76 | 64.42 TOC | 1540.1 | |
| Nov 9/76 | | | Blown with air; clean out acid |
| Nov 22/76 | 64.68 MP | 1541.4 | MP = 0.70 m TOC, (1753.6) |
| Dec 20/76 | 64.68 MP | 1541.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1751.36

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 64.66 MP | 1541.5 | MP (1753.6) |
| Feb 15/77 | 64.77 MP | 1541.1 | |
| Mar 16/77 | 64.64 MP | 1541.6 | |
| Apr 14/77 | 64.59 MP | 1541.7 | |
| May 9/77 | 64.62 MP | 1541.6 | |
| June 6/77 | 65.03 MP | 1540.3 | |
| July 11/77 | 64.66 MP | 1541.5 | |
| | 64.67 MP | 1541.5 | After sample; temp. 5°C |
| Aug 2/77 | 64.68 MP | 1541.4 | |
| Sept 1/77 | 64.67 MP | 1541.5 | |
| Sept 29/77 | 64.66 MP | 1541.5 | |
| Oct 24/77 | 64.60 MP | 1541.7 | |
| Nov 23/77 | 64.73 MP | 1541.3 | |
| Dec 19/77 | 64.62 MP | 1541.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1751.36

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 64.65 MP | 1541.5 | MP (1753.6) |
| Feb 13/78 | 64.66 MP | 1541.5 | |
| Mar 14/78 | 64.61 MP | 1541.7 | |
| Apr 12/78 | 64.58 MP | 1541.8 | |
| May 9/78 | 64.59 MP | 1541.7 | |
| June 5/78 | 64.64 MP | 1541.6 | |
| July 10/78 | 64.65 MP | 1541.5 | |
| | 64.67 MP | 1541.5 | After sample; temp. 5°C |
| Aug 2/78 | 64.69 MP | 1541.4 | |
| Aug 30/78 | 64.62 MP | 1541.6 | |
| Sept 25/78 | 64.58 MP | 1541.8 | |
| Oct 23/78 | 64.56 MP | 1541.8 | |
| Nov 20/78 | 64.60 MP | 1541.7 | |
| Dec 19/78 | 64.51 MP | 1542.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-460

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1751.36

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 64.52 MP | 1542.0 | MP (1753.6) |
| Feb 15/79 | 64.61 MP | 1541.7 | |
| Mar 13/79 | 64.56 MP | 1541.8 | |
| Apr 11/79 | 64.58 MP | 1541.8 | |
| May 9/79 | 64.58 MP | 1541.8 | |
| June 4/79 | 64.62 MP | 1541.6 | |
| July 10/79 | 64.66 MP | 1541.5 | |
| | 64.66 MP | 1541.5 | After sample; temp. 5°C |
| July 31/79 | 64.65 MP | 1541.5 | |
| Aug 28/79 | 64.61 MP | 1541.7 | |
| Sept 26/79 | 64.63 MP | 1541.6 | |
| Oct 25/79 | 64.60 MP | 1541.7 | |
| Nov 22/79 | 64.60 MP | 1541.7 | |
| Dec 18/79 | 64.54 MP | 1541.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13 - 460

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1751.36

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/80 | 64.55 MP | 1541.9 | |
| Feb 12/80 | 64.58 MP | 1541.8 | |
| Mar 12/80 | 64.55 MP | 1541.9 | |
| Apr 10/80 | 64.58 MP | 1541.8 | |
| May 7/80 | 64.62 MP | 1541.6 | |
| June 5/80 | 64.60 MP | 1541.7 | |
| July 7/80 | 64.62 MP | 1541.6 | Temp. 5°C |
| | 64.62 MP | 1541.6 | After Sample |
| July 11/80 | | | Bailed 400 gals. |
| July 12/80 | | | Bailed 200 gals, sampled t = 6°C, cond. = 1200 |
| July 31/80 | 64.63 MP | 1541.6 | |
| Aug 27/80 | 64.59 MP | 1541.7 | |
| Sept 22/80 | 64.59 MP | 1541.7 | |
| Oct 23/80 | 64.61 MP | 1541.7 | |
| Nov 17/80 | 64.56 MP | 1541.8 | |
| Dec 16/80 | 64.56 MP | 1541.8 | |
| Jan 12/81 | 64.58 MP | 1541.8 | |
| Feb 9/81 | 64.59 MP | 1541.7 | |
| Mar 10/81 | 64.55 MP | 1541.9 | |
| Apr 6/81 | 64.52 MP | 1542.0 | |
| May 4/81 | 64.55 MP | 1541.9 | |
| June 1/81 | 64.56 MP | 1541.8 | |
| July 1/81 | 64.57 MP | 1541.8 | |
| July 30/81 | 64.67 MP | 1541.5 | Pumped 2200 gals (U.S) of H20 sampling at regular intervals. |
| Aug 27/81 | 64.66 MP | 1541.5 | |
| Sept 22/81 | 64.60 MP | 1541.7 | |
| Oct 19/81 | 64.55 MP | 1541.9 | |
| Nov 19/81 | 64.62 MP | 1541.6 | |
| Dec 17/81 | 64.59 MP | 1541.7 | |

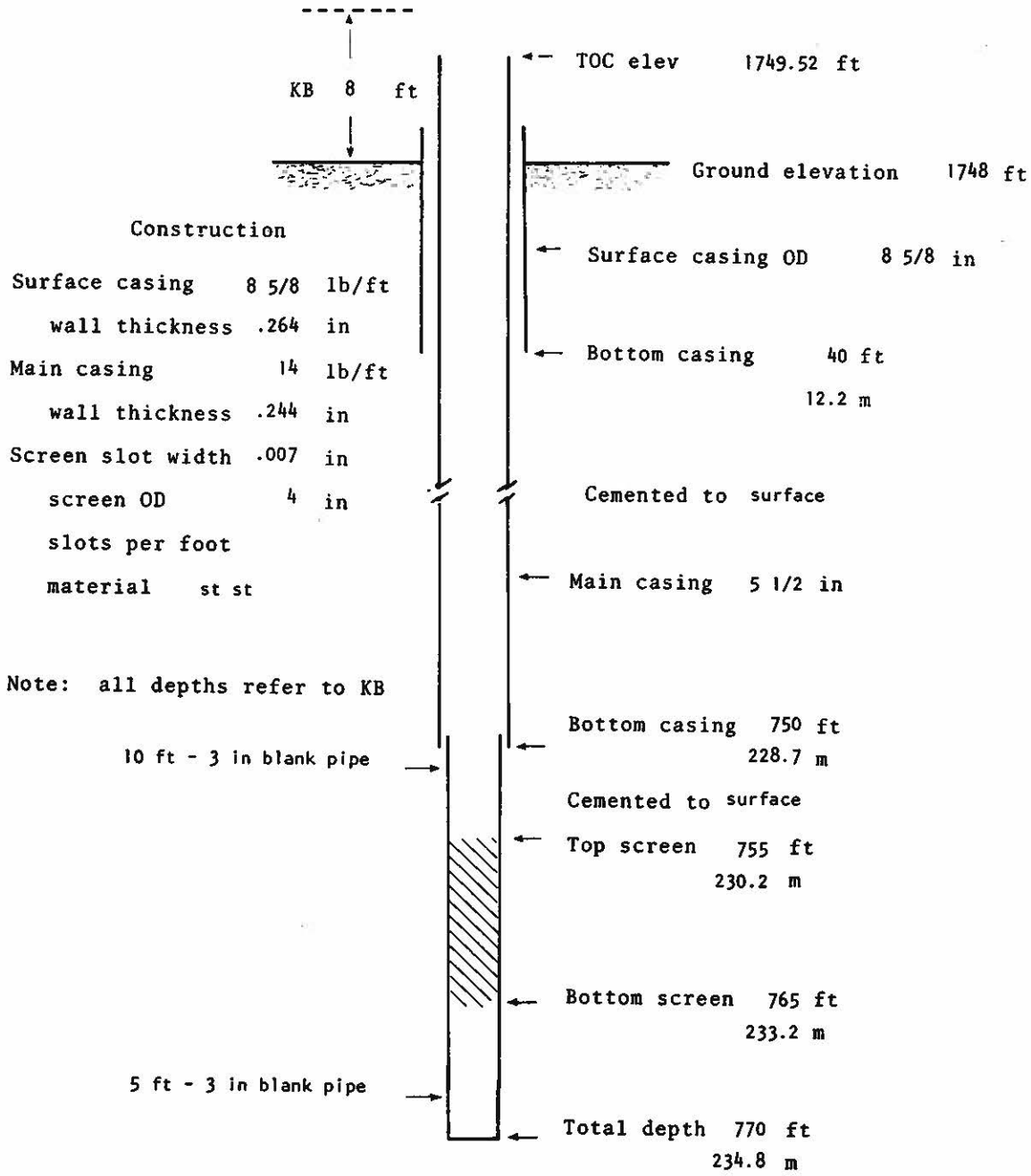
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Tp 90 R 12 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 8 5/8 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed from 13-770

Date sampled February 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 63.0 | 3.14 | 31.2 |
| Magnesium ($Mg^{++}$) | 0.7 | 0.06 | 0.6 |
| Sodium ($Na^{+}$) | 150.0 | 6.52 | 64.7 |
| Potassium ($K^{+}$) | 14.2 | 0.36 | 3.6 |
| Carbonate ($CO_3^{=}$) | 8.6 | 0.29 | 3.9 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 33.4 | 0.70 | 9.5 |
| Chloride ($Cl^{-}$) | 224.0 | 6.32 | 86.0 |
| Nitrate ($NO_3^{=}$) | 3.0 | 0.05 | 0.7 |
| Silica ($SiO_2$) | 11.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 596.0 | | |
| Total Anions (epm) 7.3 | | Total Cations (epm) | 10.1 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | |
| pH | 11.2 | pH | 11.8 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | 25 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 68 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 81.0 | 4.04 | 11 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 725.0 | 31.54 | 88 |
| Potassium ($K^{+}$) | 14.6 | 0.37 | 1 |
| Carbonate ($CO_3^{=}$) | 33.6 | 1.12 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 91.0 | 1.89 | 6 |
| Chloride ($Cl^{-}$) | 1118.0 | 31.53 | 99 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0 |
| Silica ($SiO_2$) | 8.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 89.1 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 2100 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 34.56 | Total Cations (epm) | 35.95 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 4200 | | Temperature (C) | 9.0 | |
| pH | 11.3 | | pH | 13.0 | |
| Fluoride ($F^{-}$) | 0.5 | Mg/L | Carbonate ($CO_3^{=}$) | 82 | Mg/L |
| | | | Bicarbonate ($HCO_3^{-}$) | | |
| | | | Hydroxide ($OH^{-}$) | 42 | Mg/L |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed from 13-770

Date sampled February 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 63.0 | 3.14 | 31.2 |
| Magnesium ($Mg^{++}$) | 0.7 | 0.06 | 0.6 |
| Sodium ($Na^{+}$) | 150.0 | 6.52 | 64.7 |
| Potassium ($K^{+}$) | 14.2 | 0.36 | 3.6 |
| Carbonate ($CO_3^{=}$) | 8.6 | 0.29 | 3.0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 33.4 | 0.70 | 7.0 |
| Chloride ($Cl^{-}$) | 224.0 | 6.32 | 62.0 |
| Nitrate ($NO_3^{=}$) | 3.0 | 0.05 | 1.0 |
| Silica ($SiO_2$) | 11.6 | | |
| Hydroxide ($OH^{-}$) | 49.0 | 2.88 | 28.0 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 596.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 10.23 | Total Cations (epm) | 10.1 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | |
| pH | 11.2 | pH | 11.8 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | 25 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 68 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 81.0 | 4.04 | 11 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 725.0 | 31.54 | 88 |
| Potassium ($K^{+}$) | 14.6 | 0.37 | 1 |
| Carbonate ($CO_3^{=}$) | 33.6 | 1.12 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 91.0 | 1.89 | 5 |
| Chloride ($Cl^{-}$) | 1118.0 | 31.53 | 85 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0 |
| Silica ($SiO_2$) | 8.6 | | |
| Hydroxide ($OH^{-}$) | 40.0 | 2.35 | 6 |
| Calcium (Acidified) | 89.1 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 2100 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 36.91 | Total Cations (epm) | 35.95 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4200 | Temperature (C) | 9.0 | |
| pH | 11.3 | pH | 13.0 | |
| Fluoride ($F^{-}$) | 0.5 Mg/L | Carbonate ($CO_3^{=}$) | 82 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 42 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 65.0 | 3.24 | 26.6 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0.0 |
| Sodium ($Na^{+}$) | 198.0 | 8.61 | 70.6 |
| Potassium ($K^{+}$) | 13.3 | 0.34 | 2.8 |
| Carbonate ($CO_3^{=}$) | 45.6 | 1.52 | 11.7 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 69.0 | 1.44 | 11.1 |
| Chloride ($Cl^{-}$) | 268.0 | 7.56 | 58.3 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 6.5 | | |
| Hydroxide ($OH^{-}$) | 41.5 | 2.44 | 18.8 |
| Calcium (Acidified) | 68.0 | | |
| Magnesium (Acidified) | 0.2 | | |
| Total dissolved solids | 704.0 | | |
| Total Anions (epm) | 12.97 | Total Cations (epm) | 12.20 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1730 | Temperature (C) | 9.0 |
| pH | 11.3 | pH | 11.6 |
| Fluoride ($F^{-}$) | 1.0 ppm | Carbonate ($CO_3^{=}$) | 43.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 24.0 ppm |
| | | Conductivity | |

13-770-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 49.0 | 2.45 | 20.1 |
| Magnesium(Mg) | 0.0 | 0.00 | 0.0 |
| Sodium(Na) | 216.0 | 9.40 | 77.1 |
| Potassium(K) | 13.3 | 0.34 | 2.8 |
| Carbonate(CO3) | 52.8 | 1.76 | 13.5 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 54.0 | 1.12 | 8.6 |
| Chloride(Cl) | 296.0 | 8.35 | 63.9 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 6.0 | | |
| Hydroxide(OH) | 31.3 | 1.84 | 14.1 |
| Calcium(Acidified) | 62.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 776.0 | | |
| Total Anions(epm) | 13.07 | Total Cations(epm) | 12.18 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1445 | | Temperature(C) | 8.00 | |
| pH | 11.1 | | pH | 11.5 | |
| Fluoride(F) | 0.8 | mg/l | Carbonate(CO3) | 53 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 48 | mg/l |

13-770-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 9, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 13.4 | 0.67 | 5.1 |
| Magnesium(Mg) | 0.3 | 0.02 | 0.2 |
| Sodium(Na) | 275.0 | 11.96 | 91.7 |
| Potassium(K) | 15.0 | 0.38 | 2.9 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 146.0 | 2.39 | 16.7 |
| Sulphate(SO4) | 57.0 | 1.19 | 8.3 |
| Chloride(Cl) | 382.0 | 10.77 | 75.0 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 5.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 50.0 | | |
| Magnesium(Acidified) | 0.2 | | |
| TDS(mg/l) | 852.0 | | |
| Total Anions(epm) | 14.36 | Total Cations(epm) | 13.04 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1370 | | Temperature(C) | 9.00 | |
| pH | 8.3 | | pH | 11.2 | |
| Fluoride(F) | 0.8 | mg/l | Carbonate(CO3) | 86 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 24 | mg/l |

WATER ANALYSIS 13-770-E-82

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 7, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 10.7 | 0.53 | 3.3 |
| Magnesium(Mg) | 0.5 | 0.04 | 0.3 |
| Sodium(Na) | 305.0 | 13.26 | 82.8 |
| Potassium(K) | 85.0 | 2.18 | 13.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 178.0 | 2.92 | 18.3 |
| Sulphate(SO4) | 56.0 | 1.17 | 7.3 |
| Chloride(Cl) | 420.0 | 11.83 | 74.3 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 14.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 34.0 | | |
| Magnesium(Acidified) | 0.2 | | |
| TDS(mg/l) | 984.0 | | |
| Total Anions(epm) | 15.92 | Total Cations(epm) | 16.02 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1800 |
| pH | 8.2 |
| Fluoride | 1.0 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 0.0 | |
| pH | 11.1 | |
| Carbonate(CO3) | 62 | mg/l |
| Bicarbonate(HCO3) | 0 | mg/l |
| Hydroxide(OH) | 22 | mg/l |

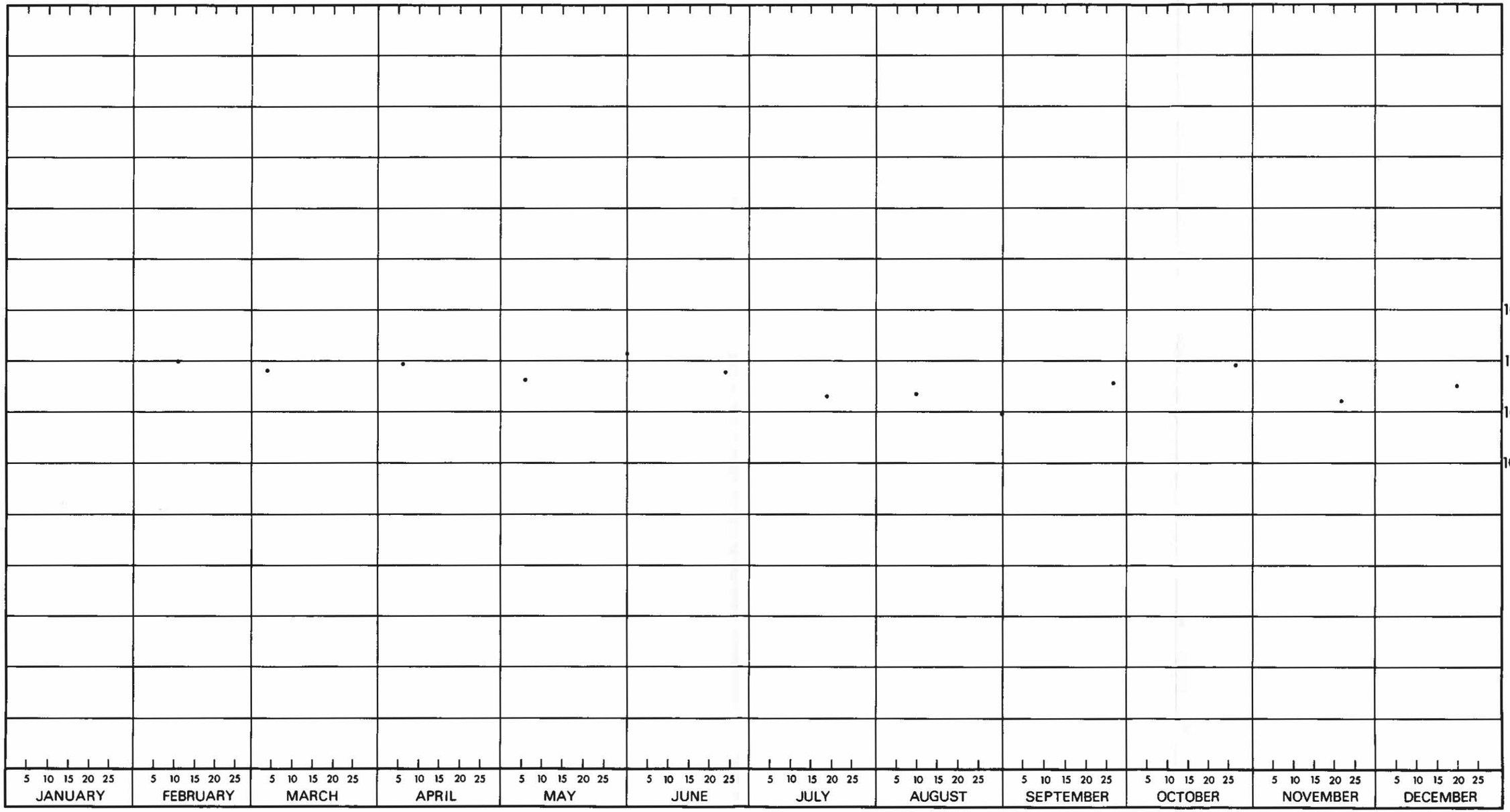
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

13 - 770 - H - 77




1976

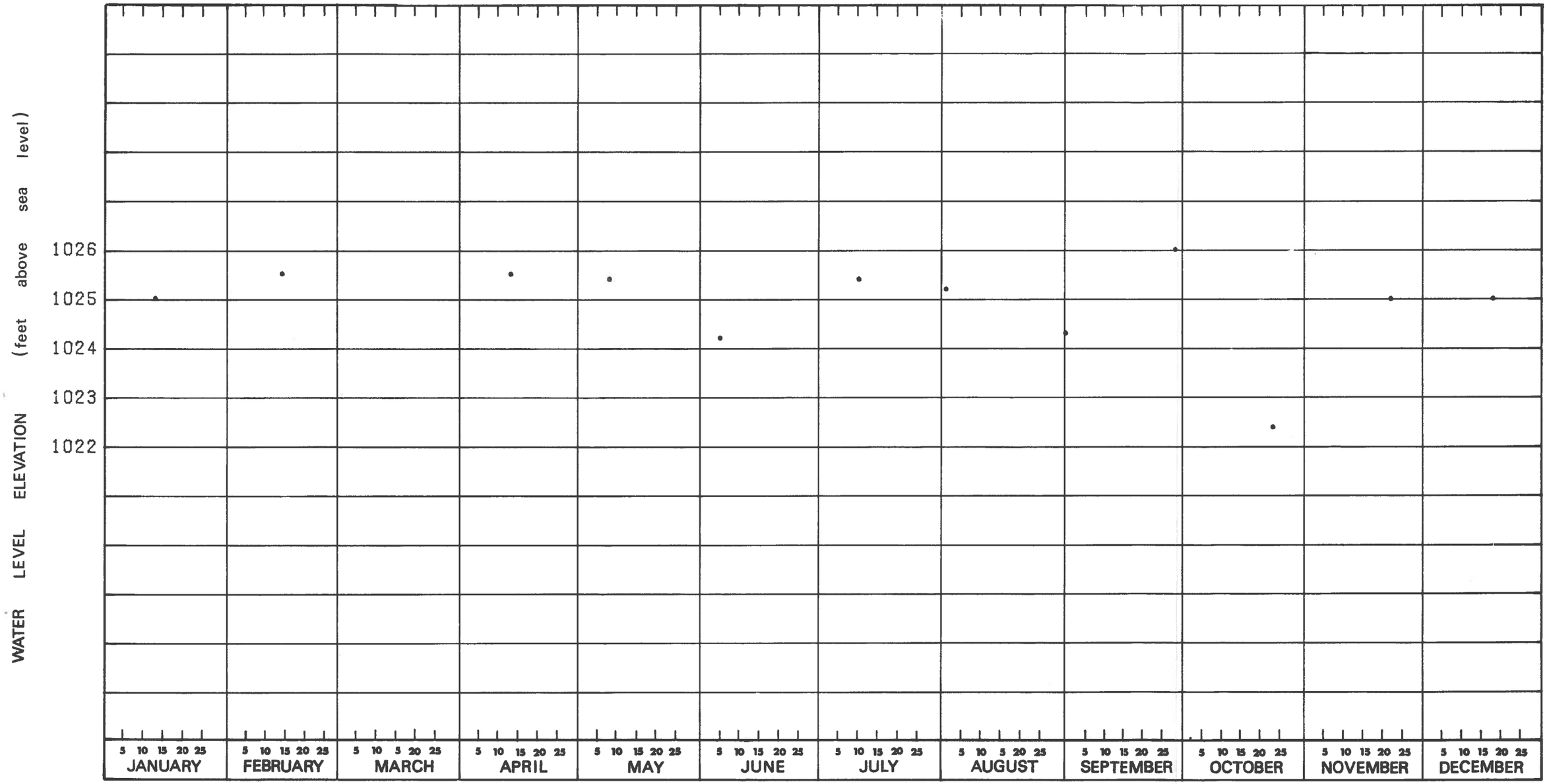
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-770

13-770-H-78

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council




1977

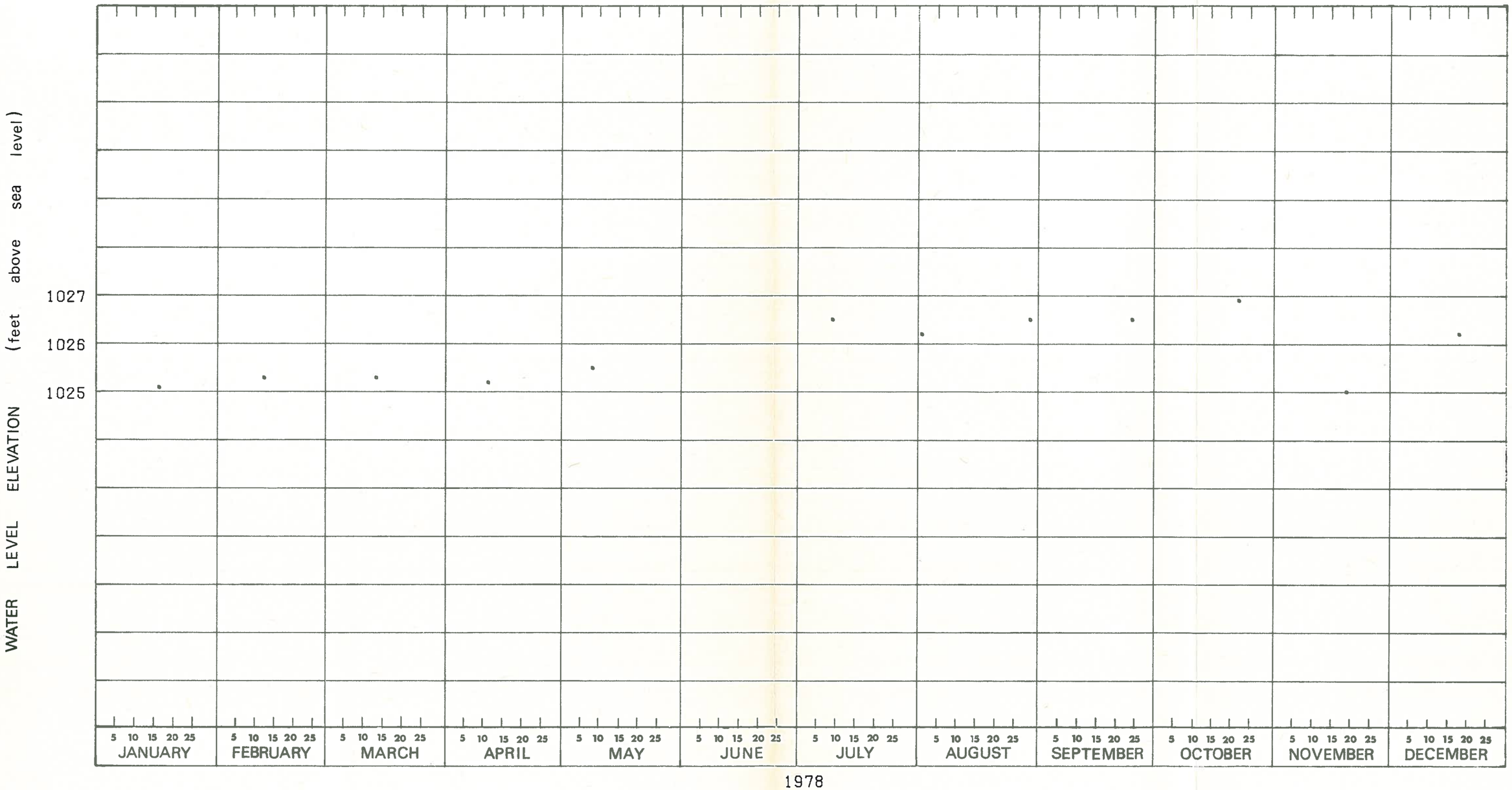
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-770

LSD 8 SEC 11 TWP 90 R 12 W4TH

13-770-H-79

Alberta Research Council




1978

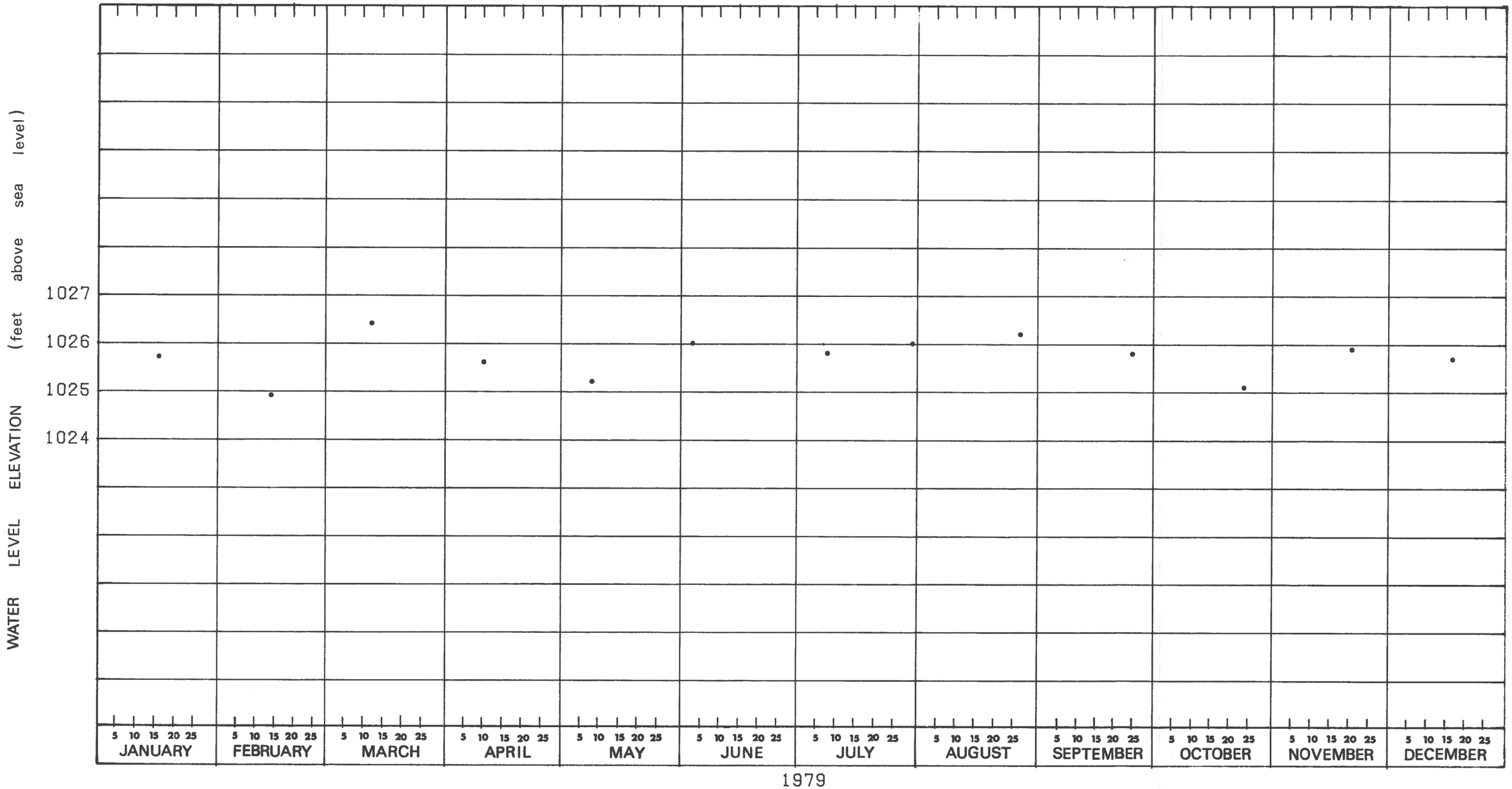
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-770-H-80



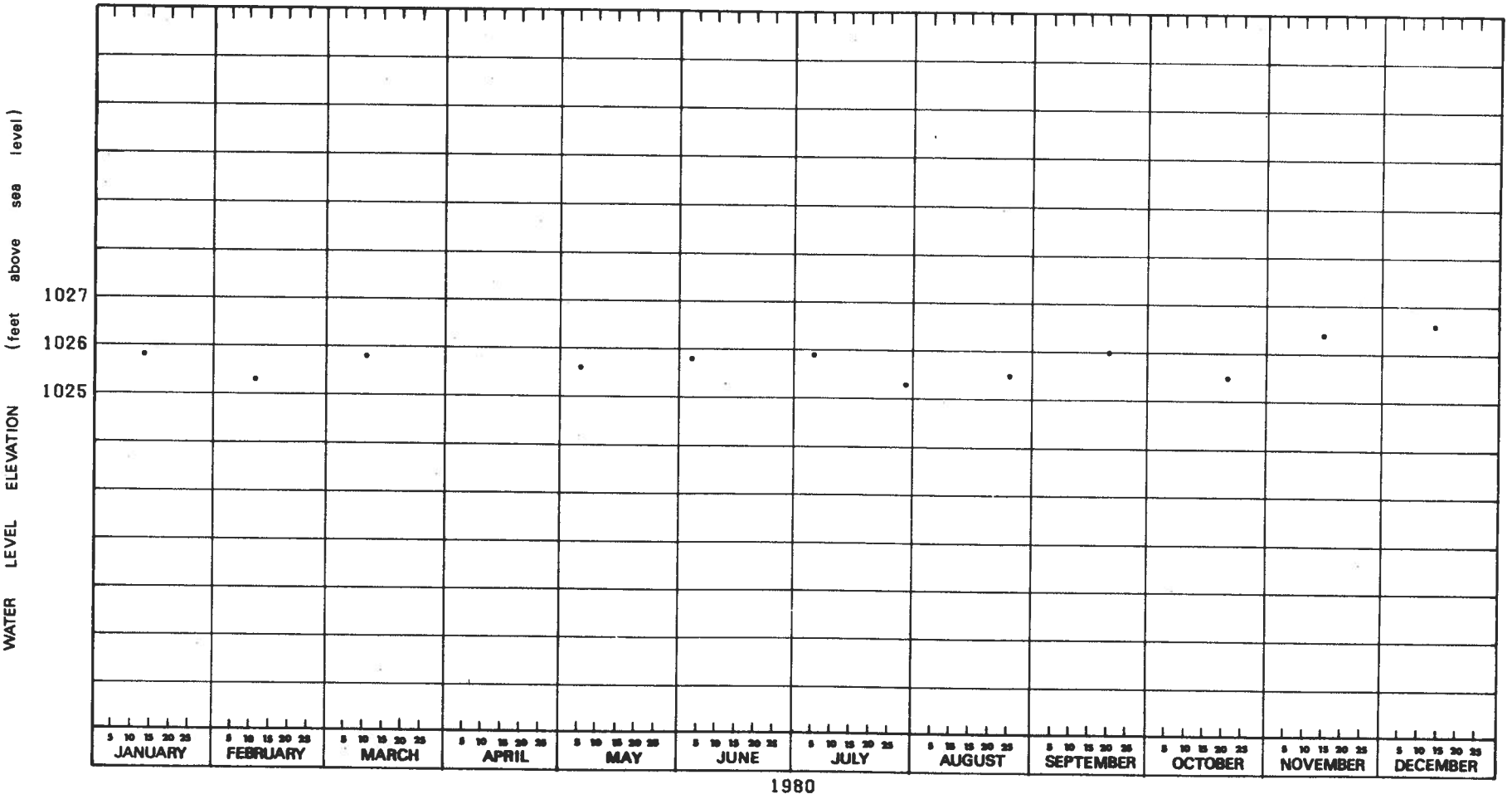
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-770-H-81



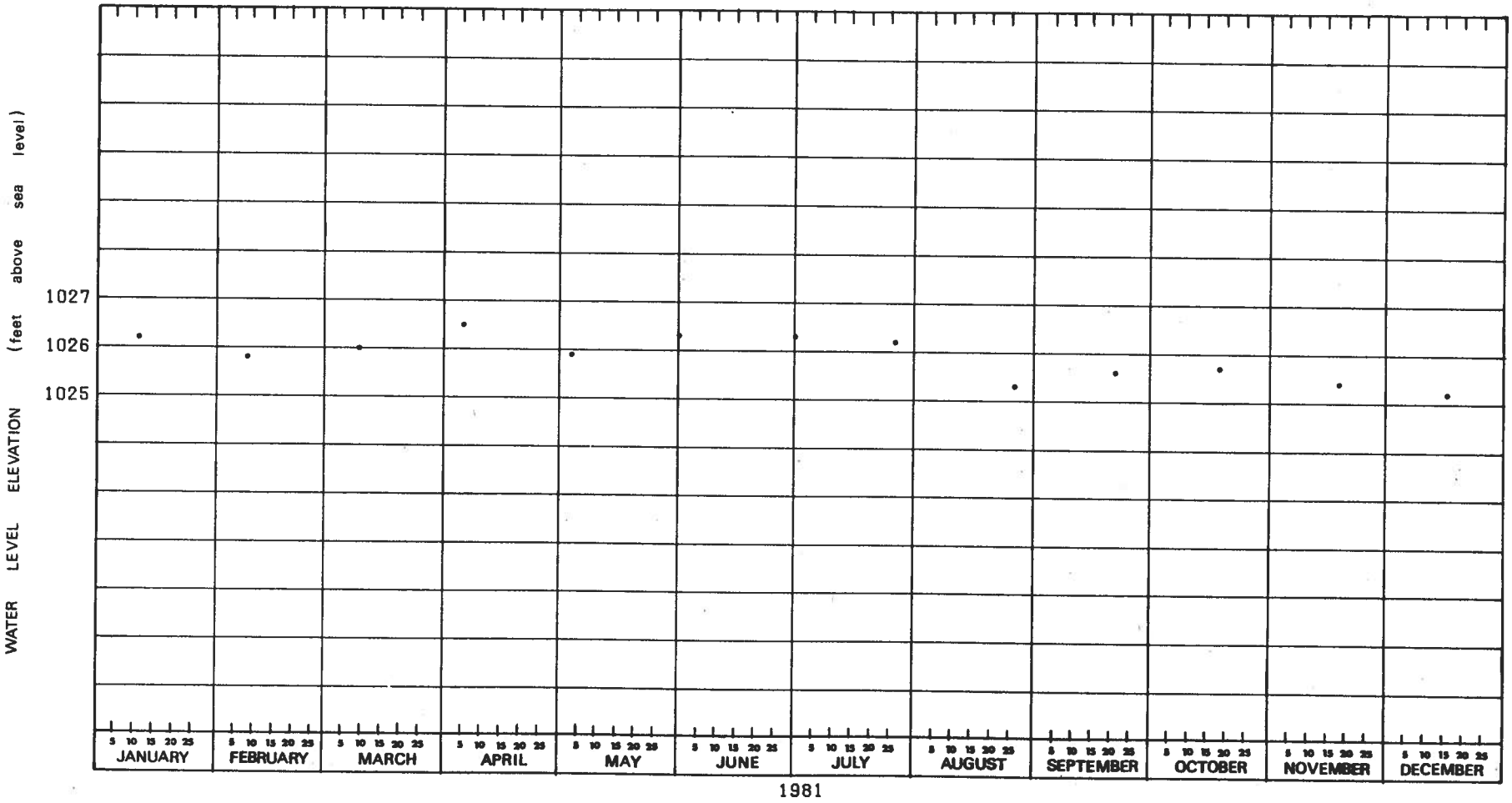
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-770-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1749.52

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/76 | | | Well completed |
| Feb 11/76 | 221.25 MP | 1026.0 | MP = 0.67 m TOC, (1751.7) |
| Feb 20/76 | | | Water sample |
| Mar 4/76 | 221.31 MP | 1025.8 | |
| Apr 6/76 | 221.27 MP | 1025.9 | |
| May 6/76 | 221.37 MP | 1025.6 | |
| May 31/76 | 221.21 MP | 1026.1 | |
| June 24/76 | 221.32 MP | 1025.8 | |
| July 19/76 | 221.46 MP | 1025.3 | Sampled; temp. 9°C |
| Aug 10/76 | 221.45 MP | 1025.3 | |
| Aug 31/76 | 221.57 MP | 1024.9 | |
| Sept 27/76 | 221.39 MP | 1025.5 | |
| Oct 27/76 | 221.28 MP | 1025.9 | |
| Nov 22/76 | 221.50 MP | 1025.2 | |
| Dec 20/76 | 221.39 MP | 1025.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1749.52

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 221.55 MP | 1025.0 | MP (1751.7) |
| Feb 15/77 | 221.40 MP | 1025.5 | |
| Mar 16/77 | | | >200 m |
| Apr 14/77 | 221.39 MP | 1025.5 | |
| May 9/77 | 221.44 MP | 1025.4 | |
| June 6/77 | 221.79 MP | 1024.2 | |
| July 11/77 | 221.42 MP | 1025.4 | Sampled; temp. 9°C |
| Aug 2/77 | 221.50 MP | 1025.2 | |
| Sept 1/77 | 221.77 MP | 1024.3 | |
| Sept 29/77 | 221.26 MP | 1026.0 | |
| Oct 24/77 | 222.34 MP | 1022.4 | |
| Nov 23/77 | 221.55 MP | 1025.0 | |
| Dec 19/77 | 221.55 MP | 1025.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1749.52

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 221.53 MP | 1025.1 | MP (1751.7) |
| Feb 13/78 | 221.47 MP | 1025.3 | |
| Mar 14/78 | 221.47 MP | 1025.3 | |
| Apr 12/78 | 221.48 MP | 1025.2 | |
| May 9/78 | 221.39 MP | 1025.5 | |
| June 5/78 | Dry | | |
| July 10/78 | 221.10 MP | 1026.5 | Sampled; temp, 8°C |
| Aug 2/78 | 221.18 MP | 1026.2 | |
| Aug 30/78 | 221.08 MP | 1026.5 | |
| Sept 25/78 | 221.11 MP | 1026.5 | |
| Oct 23/78 | 220.96 MP | 1026.9 | |
| Nov 20/78 | 221.56 MP | 1025.0 | |
| Dec 19/78 | 221.19 MP | 1026.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-770

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1749.52

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 221.33 MP | 1025.7 | MP (1751.7) |
| Feb 15/79 | 221.58 MP | 1024.9 | |
| Mar 13/79 | 221.14 MP | 1026.4 | |
| Apr 11/79 | 221.36 MP | 1025.6 | |
| May 9/79 | 221.50 MP | 1025.2 | |
| June 4/79 | 221.25 MP | 1026.0 | |
| July 9/79 | 221.31 MP | 1025.8 | Sampled; temp. 9°C |
| July 31/79 | 221.26 MP | 1026.0 | |
| Aug 28/79 | 221.20 MP | 1026.2 | |
| Sept 26/79 | 221.30 MP | 1025.8 | |
| Oct 25/79 | 221.52 MP | 1025.1 | |
| Nov 22/79 | 221.28 MP | 1025.9 | |
| Dec 18/79 | 221.34 MP | 1025.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

13 - 770 - W - 82

## WELL HISTORY

OBSERVATION WELL NUMBER 13 - 770

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1749.52

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/80 | 221.30 MP | 1025.8 | |
| Feb 12/80 | 221.45 MP | 1025.3 | |
| Mar 12/80 | 221.30 MP | 1025.8 | |
| Apr 10/80 | | | Could not measure |
| May 7/80 | 221.38 MP | 1025.6 | |
| June 5/80 | 221.30 MP | 1025.8 | |
| July 7/80 | 221.27 MP | 1025.9 | |
| July 31/80 | 221.46 MP | 1025.3 | |
| Aug 27/80 | 221.41 MP | 1025.5 | |
| Sept 22/80 | 221.25 MP | 1026.0 | |
| Oct 23/80 | 221.39 MP | 1025.5 | |
| Nov 17/80 | 221.12 MP | 1026.4 | |
| Dec 16/80 | 221.06 MP | 1026.6 | |
| Jan 12/81 | 221.20 MP | 1026.2 | |
| Feb 9/81 | 221.31 MP | 1025.8 | |
| Mar 10/81 | 221.26 MP | 1026.0 | |
| Apr 6/81 | 221.11 MP | 1026.5 | |
| May 4/81 | 221.27 MP | 1025.9 | |
| June 1/81 | 221.15 MP | 1026.3 | |
| July 1/81 | 221.16 MP | 1026.3 | |
| July 27/81 | 221.18 MP | 1026.2 | |
| Aug 27/81 | 221.46 MP | 1025.3 | |
| Sept 22/81 | 221.38 MP | 1025.6 | |
| Oct 19/81 | 221.35 MP | 1025.7 | |
| Nov 19/81 | 221.43 MP | 1025.4 | |
| Dec 17/81 | 221.50 MP | 1025.2 | |

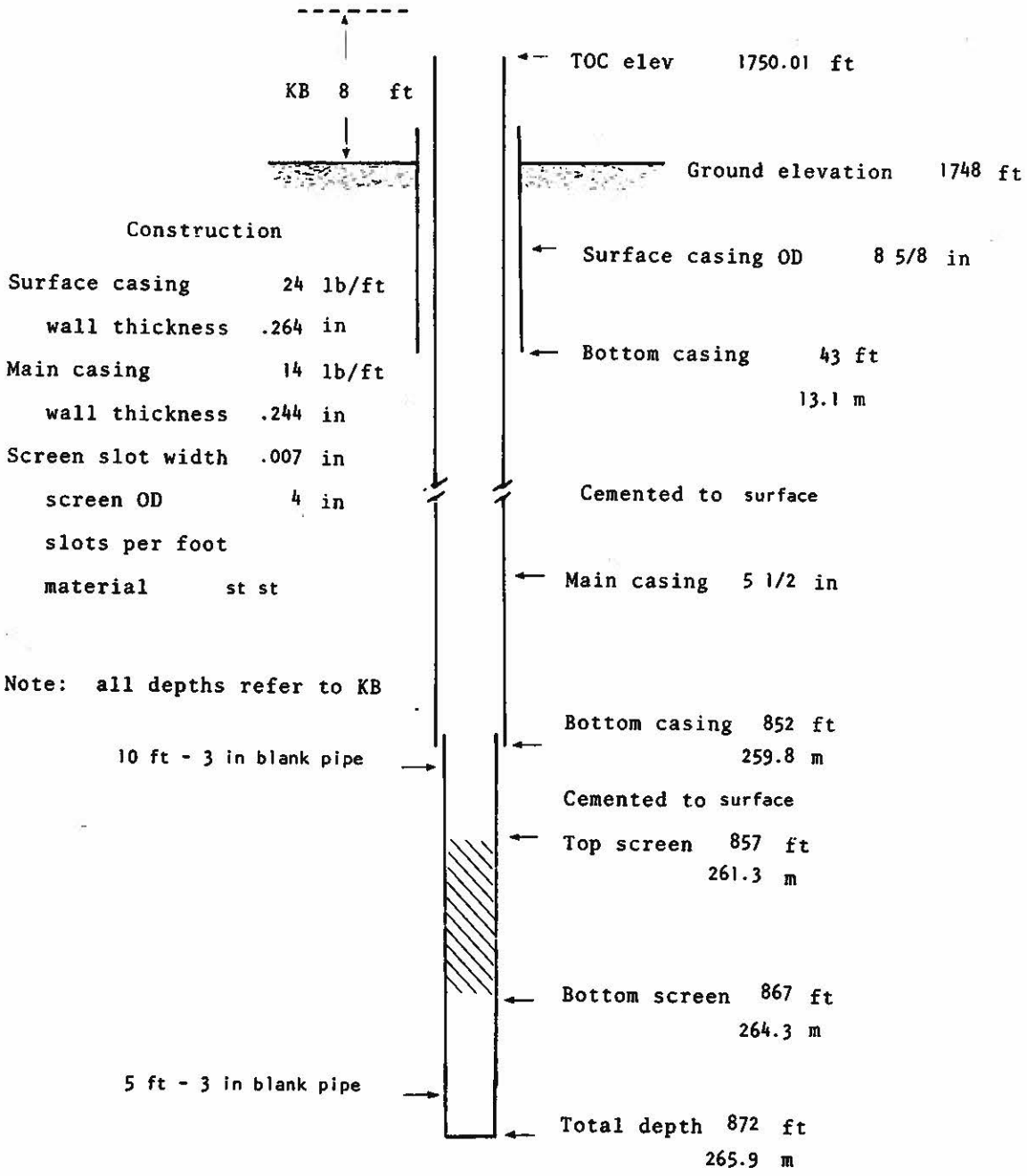
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Tp 90 R 12 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed from 13-872

Date sampled February 20, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 66.0 | 3.29 | 6.5 |
| Magnesium ($Mg^{++}$) | 0.8 | 0.07 | 0.1 |
| Sodium ($Na^{+}$) | 1062.0 | 46.19 | 91.9 |
| Potassium ($K^{+}$) | 28.7 | 0.73 | 1.5 |
| Carbonate ($CO_3^{=}$) | 23.6 | 0.79 | 1.4 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 52.0 | 1.08 | 1.9 |
| Chloride ($Cl^{-}$) | 2000.0 | 56.40 | 96.8 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 52.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 3470.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 58.3 | Total Cations (epm) | 50.3 |

### Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 8000 | Temperature (C) | |
| pH | 11.7 | pH | 12.2 |
| Fluoride ($F^{-}$) | 1.0 ppm | Carbonate ($CO_3^{=}$) | 61 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 153 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 154.0 | 7.68 | 20 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 713.0 | 31.01 | 79 |
| Potassium ($K^{+}$) | 25.8 | 0.66 | 2 |
| Carbonate ($CO_3^{=}$) | 33.6 | 1.12 | 4 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 55.0 | 1.15 | 4 |
| Chloride ($Cl^{-}$) | 1008.0 | 28.43 | 93 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 15.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 133.0 | | |
| Magnesium (Acidified) | 0.2 | | |
| Total dissolved solids | 2120 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 30.70 | Total Cations (epm) | 39.36 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 5400 | Temperature (C) | 7.0 | |
| pH | 12.0 | pH | 13.6 | |
| Fluoride ($F^{-}$) | 0.4 Mg/L | Carbonate ($CO_3^{=}$) | 48 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 166 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed from 13-872

Date sampled February 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 66.0 | 3.29 | 6.5 |
| Magnesium ($Mg^{++}$) | 0.8 | 0.07 | 0.1 |
| Sodium ($Na^{+}$) | 1062.0 | 46.19 | 91.9 |
| Potassium ($K^{+}$) | 28.7 | 0.73 | 1.5 |
| Carbonate ($CO_3^{=}$) | 23.6 | 0.79 | 1.2 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 52.0 | 1.08 | 1.6 |
| Chloride ($Cl^{-}$) | 2000.0 | 56.40 | 84.6 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 52.8 | | |
| Hydroxide ($OH^{-}$) | 143.0 | 8.41 | 12.6 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 3470.0 | | |
| Total Anions (epm) | 66.68 | Total Cations (epm) | 50.3 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 8000 | Temperature (C) | |
| pH | 11.7 | pH | 12.2 |
| Fluoride ($F^{-}$) | 1.0 ppm | Carbonate ($CO_3^{=}$) | 61 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 153 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 154.0 | 7.68 | 20 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 713.0 | 31.01 | 79 |
| Potassium ($K^{+}$) | 25.8 | 0.66 | 2 |
| Carbonate ($CO_3^{=}$) | 33.6 | 1.12 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 55.0 | 1.15 | 3 |
| Chloride ($Cl^{-}$) | 1008.0 | 28.43 | 72 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 15.2 | | |
| Hydroxide ($OH^{-}$) | 154.0 | 9.05 | 23 |
| Calcium (Acidified) | 133.0 | | |
| Magnesium (Acidified) | 0.2 | | |
| Total dissolved solids | 2120 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 39.75 | Total Cations (epm) | 39.36 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 5400 | Temperature (C) | 7.0 | |
| pH | 12.0 | pH | 13.6 | |
| Fluoride ($F^{-}$) | 0.4 Mg/L | Carbonate ($CO_3^{=}$) | 48 | Mg/l |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 166 | Mg/L |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.6 | 0.18 | 0.2 |
| Magnesium ($Mg^{++}$) | 9.7 | 0.80 | 0.7 |
| Sodium ($Na^{+}$) | 2675.0 | 116.35 | 98.7 |
| Potassium ($K^{+}$) | 19.6 | 0.50 | 0.4 |
| Carbonate ($CO_3^{=}$) | 312.0 | 10.40 | 8.7 |
| Bicarbonate ($HCO_3^{-}$) | 444.0 | 7.28 | 6.1 |
| Sulfate ($SO_4^{=}$) | 111.0 | 2.31 | 1.9 |
| Chloride ($Cl^{-}$) | 3520.0 | 99.27 | 83.2 |
| Nitrate ($NO_3^{=}$) | 0.1 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 10.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 7.3 | | |
| Magnesium (Acidified) | 10.9 | | |
| Total dissolved solids | 6900.0 | | |

Total Anions (epm) 119.26 Total Cations (epm) 117.83

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | >8000 |
| pH | 9.8 |
| Fluoride ($F^{-}$) | 1.8 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 9.0 |
| pH | 9.8 |
| Carbonate ($CO_3^{=}$) | 326.0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 429.0 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

13-872-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 14.7 | 0.73 | 1.2 |
| Magnesium(Mg) | 0.2 | 0.02 | 0.0 |
| Sodium(Na) | 1338.0 | 58.20 | 97.5 |
| Potassium(K) | 28.3 | 0.72 | 1.2 |
| Carbonate(CO3) | 74.4 | 2.48 | 3.9 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 60.0 | 1.25 | 2.0 |
| Chloride(Cl) | 1940.0 | 54.71 | 86.8 |
| Nitrate(NO3) | 1.9 | 0.03 | 0.0 |
| Silica(SiO2) | 18.8 | | |
| Hydroxide(OH) | 77.0 | 4.53 | 7.2 |
| Calcium(Acidified) | 15.9 | | |
| Magnesium(Acidified) | 0.2 | | |
| TDS(mg/l) | 3656.0 | | |
| Total Anions(epm) | 63.00 | Total Cations(epm) | 59.67 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 6300 | | Temperature(C) | 8.00 | |
| pH | 11.3 | | pH | 11.6 | |
| Fluoride(F) | 1.0 | mg/l | Carbonate(CO3) | 87 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 83 | mg/l |

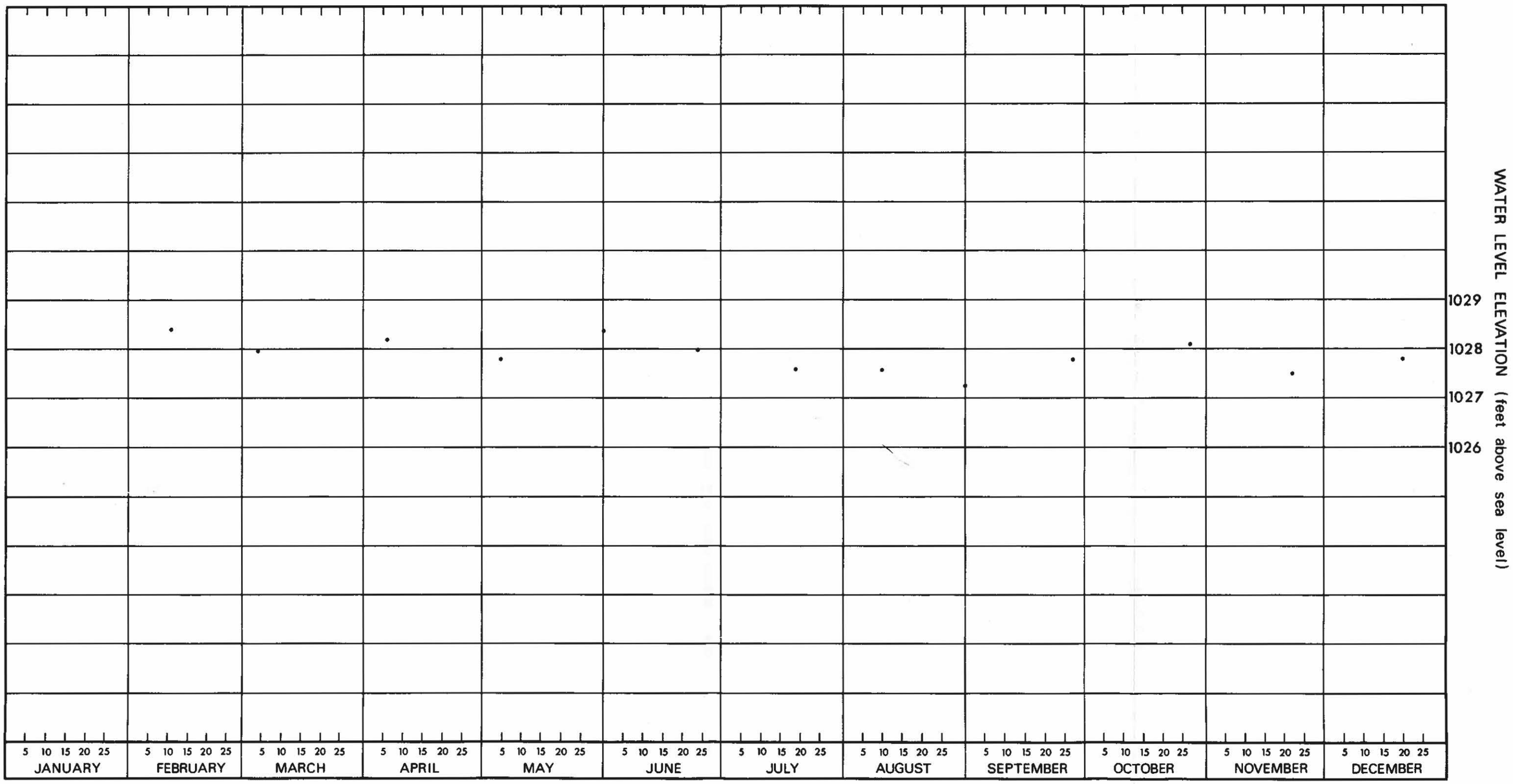
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

13 - 872 - H - 77




1976

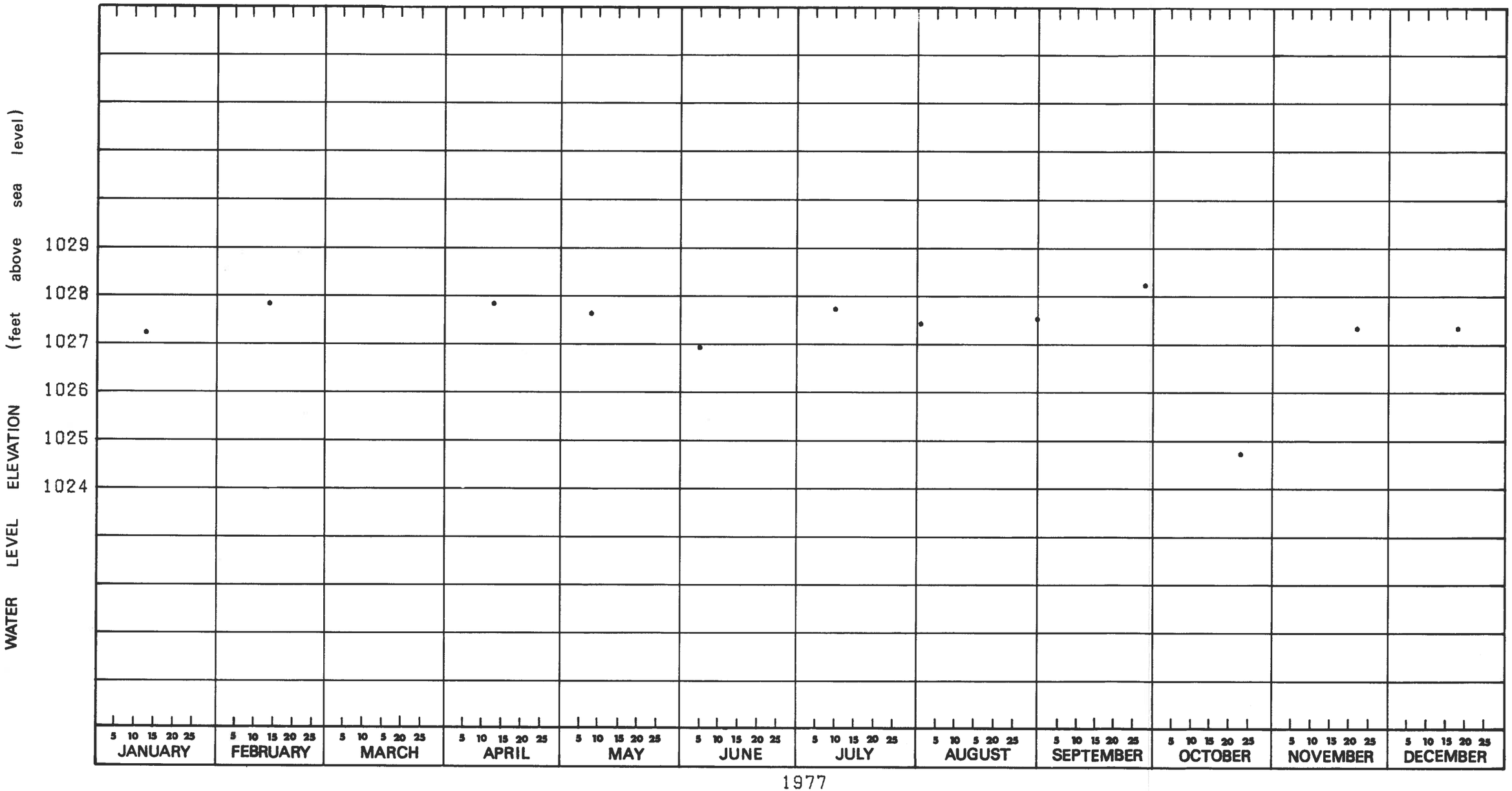
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-872-H-78




1977

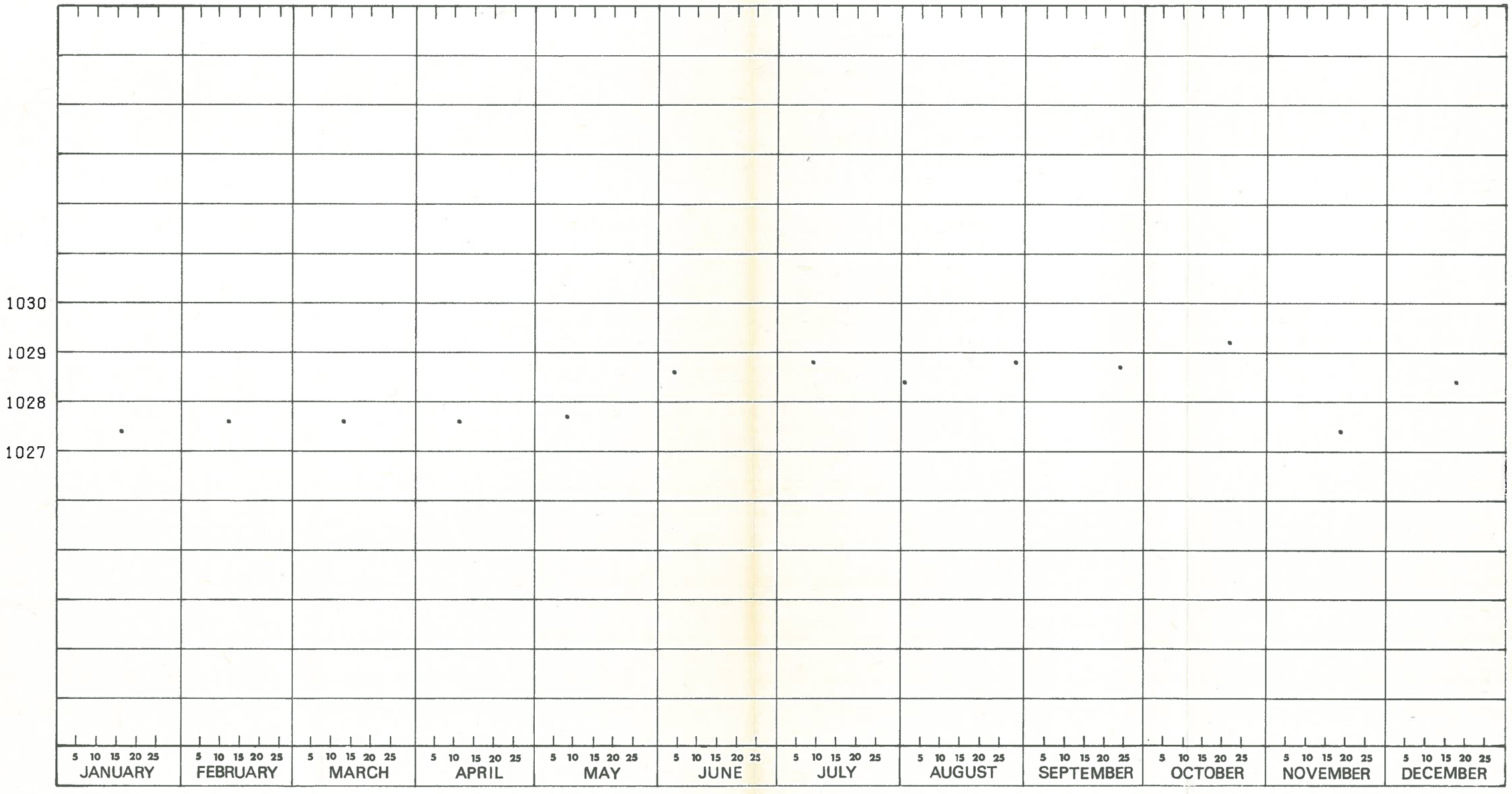
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-872

LSD 8 SEC 11 TWP 90 R 12 W4TH

Alberta Research Council

13-872-H-79




1978

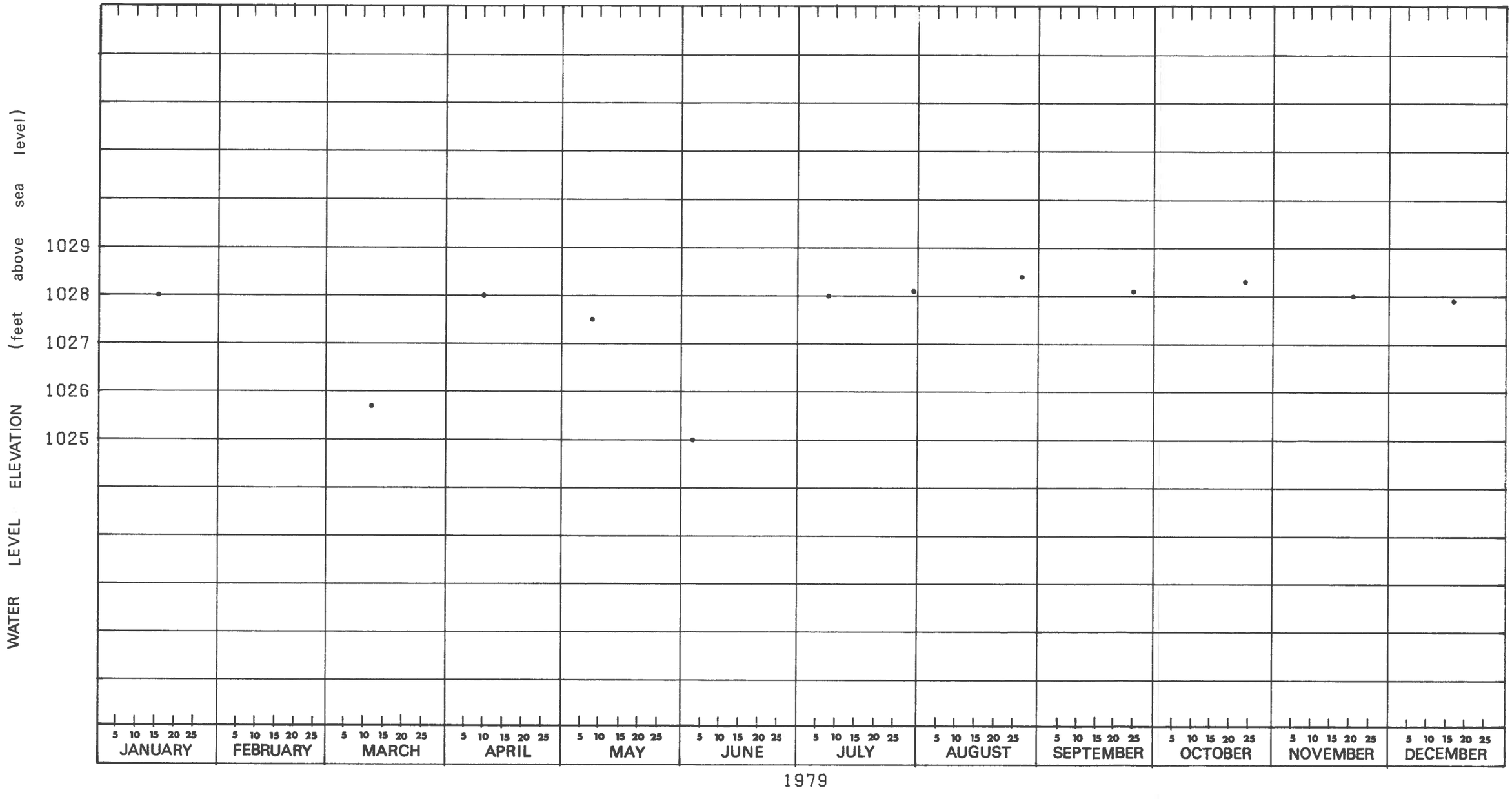
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-872-H-80



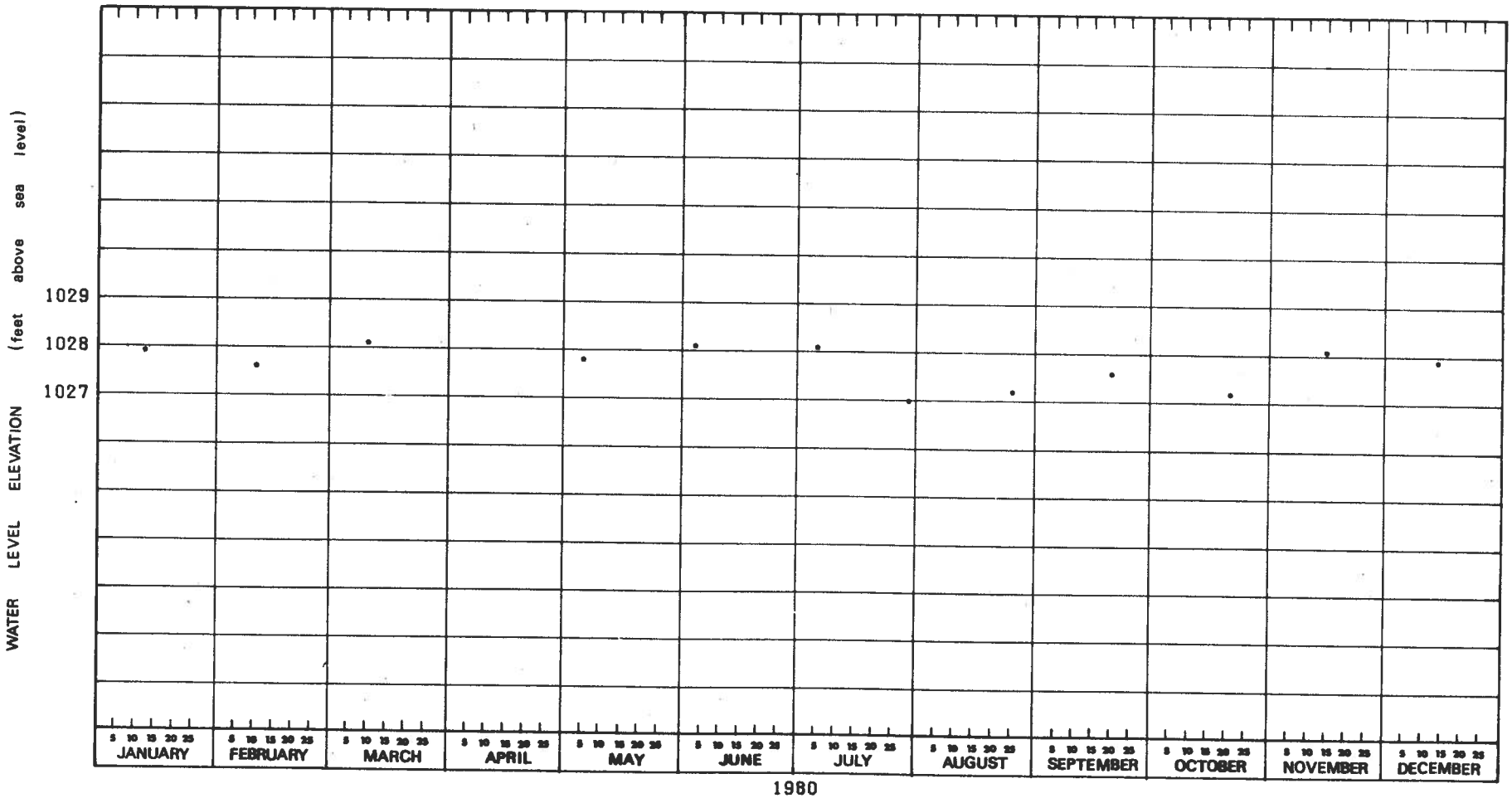
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-872-H-81



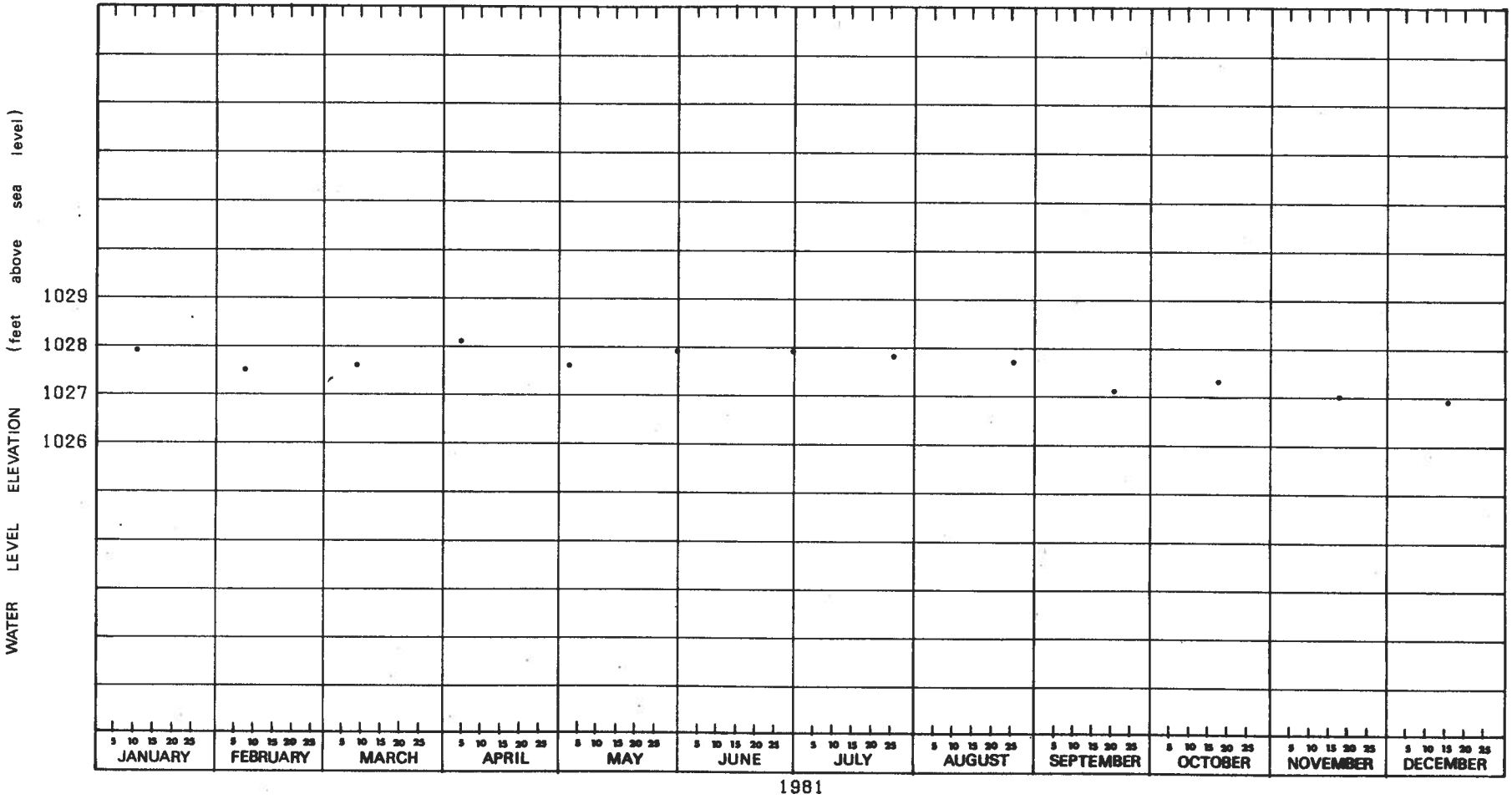
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-872

13-872-H-82

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1750.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/76 | | | Well completed |
| Feb 11/76 | 220.74 MP | 1028.5 | MP = 0.75 m TOC, (1752.5) |
| Feb 20/76 | | | Water sample |
| Mar 4/76 | 220.88 MP | 1028.0 | |
| Apr 6/76 | 220.81 MP | 1028.2 | |
| May 5/76 | 220.93 MP | 1027.8 | |
| May 31/76 | 220.76 MP | 1028.4 | |
| June 24/76 | 220.88 MP | 1028.0 | |
| July 19/76 | 221.00 MP | 1027.6 | Sampled; temp. 7°C |
| Aug 10/76 | 221.00 MP | 1027.6 | |
| Aug 31/76 | 221.11 MP | 1027.3 | |
| Sept 27/76 | 220.94 MP | 1027.8 | |
| Oct 27/76 | 220.85 MP | 1028.1 | |
| Nov 22/76 | 221.05 MP | 1027.5 | |
| Dec 20/76 | 220.94 MP | 1027.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1750.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 221.12 MP | 1027.2 | MP (1752.5) |
| Feb 15/77 | 220.95 MP | 1027.8 | |
| Mar 16/77 | | | >200 m |
| Apr 14/77 | 220.93 MP | 1027.8 | |
| May 9/77 | 221.00 MP | 1027.6 | |
| June 6/77 | 221.23 MP | 1026.9 | |
| July 11/77 | 220.98 MP | 1027.7 | Sampled; temp. 9°C |
| Aug 2/77 | 221.06 MP | 1027.4 | |
| Sept 1/77 | 221.04 MP | 1027.5 | |
| Sept 29/77 | 220.82 MP | 1928.2 | |
| Oct 24/77 | 221.89 MP | 1024.7 | |
| Nov 23/77 | 221.10 MP | 1027.3 | |
| Dec 19/77 | 221.09 MP | 1027.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1750.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 221.07 MP | 1027.4 | MP (1752.5) |
| Feb 13/78 | 221.01 MP | 1027.6 | |
| Mar 14/78 | 221.01 MP | 1027.6 | |
| Apr 12/78 | 221.01 MP | 1027.6 | |
| May 9/78 | 220.96 MP | 1027.7 | |
| June 5/78 | 220.70 MP | 1028.6 | |
| July 10/78 | 220.65 MP | 1028.8 | Sampled; temp. 8°C |
| Aug 2/78 | 220.75 MP | 1028.4 | |
| Aug 30/78 | 220.64 MP | 1028.8 | |
| Sept 25/78 | 220.66 MP | 1028.7 | |
| Oct 23/78 | 220.51 MP | 1029.2 | |
| Nov 20/78 | 221.05 MP | 1027.4 | |
| Dec 19/78 | 220.75 MP | 1028.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-872

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1750.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 220.88 MP | 1028.0 | MP (1752.5) |
| Feb 15/79 | | | Could not measure |
| Mar 13/79 | 221.59 MP | 1025.7 | |
| Apr 11/79 | 220.89 MP | 1028.0 | |
| May 9/79 | 221.05 MP | 1027.5 | |
| June 4/79 | 221.81 MP | 1025.0 | |
| July 9/79 | 220.87 MP | 1028.0 | Sampled; temp. 12°C; Organic matter in well; chemical analysis will not be done |
| July 31/79 | 220.84 MP | 1028.1 | |
| Aug 28/79 | 220.76 MP | 1028.4 | |
| Sept 26/79 | 220.84 MP | 1028.1 | |
| Oct 25/79 | 220.78 MP | 1028.3 | |
| Nov 22/79 | 220.88 MP | 1028.0 | |
| Dec 18/79 | 220.90 MP | 1027.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

13 - 872 - W - 82

WELL HISTORY

OBSERVATION WELL NUMBER 13 - 872

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1750.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/80 | 220.92 MP | 1027.9 | |
| Feb 12/80 | 221.01 MP | 1027.6 | |
| Mar 12/80 | 220.84 MP | 1028.1 | |
| Apr 10/80 | | | Could not measure |
| May 7/80 | 220.94 MP | 1027.8 | |
| June 5/80 | 220.84 MP | 1028.1 | |
| July 7/80 | 220.84 MP | 1028.1 | |
| July 11/80 | | | Bailed 125 gals, recovered and bailed 210 gals sampled. |
| July 31/80 | 221.20 MP | 1027.0 | |
| Aug 27/80 | 221.14 MP | 1027.2 | |
| Sept 22/80 | 220.99 MP | 1027.6 | |
| Oct 23/80 | 221.13 MP | 1027.2 | |
| Nov 17/80 | 220.86 MP | 1028.1 | |
| Dec 16/80 | 220.90 MP | 1027.9 | |
| Jan 12/81 | 220.93 MP | 1027.9 | |
| Feb 9/81 | 221.04 MP | 1027.5 | |
| Mar 10/81 | 221.00 MP | 1027.6 | |
| Apr 6/81 | 220.85 MP | 1028.1 | |
| May 4/81 | 221.02 MP | 1027.6 | |
| June 1/81 | 220.92 MP | 1027.9 | |
| July 1/81 | 220.92 MP | 1027.9 | |
| July 27/81 | 220.95 MP | 1027.8 | |
| Aug 27/81 | 220.98 MP | 1027.7 | |
| Sept 22/81 | 221.15 MP | 1027.1 | |
| Oct 19/81 | 221.11 MP | 1027.3 | |
| Nov 19/81 | 221.19 MP | 1027.0 | |
| Dec 17/81 | 221.23 MP | 1026.9 | |

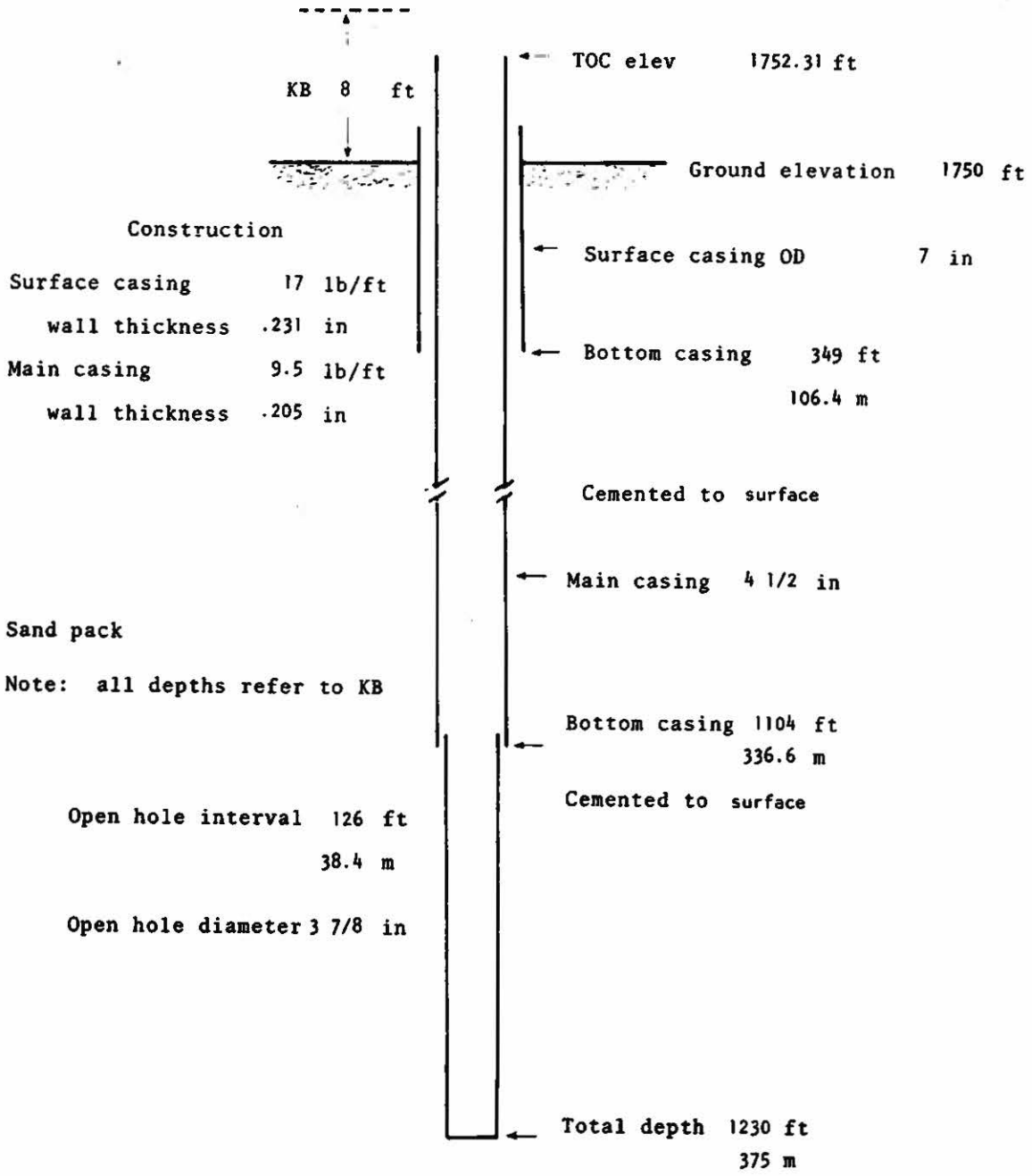
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Tp 90 R 12 W 4th

Alberta Research Council




N.B. - 40 ft of 10 3/4 in casing at surface

## DRILL STEM TEST

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Tp 90 R 12 W4th

Alberta Research Council

Elevation: gl 1750
KB 1758

Type of test Open hole, Bottom hole

Date of test January 7, 1976 I

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0130 | hrs |
| Tool opened | 0309 | hrs |
| First flow | 2 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0456 | hrs |
| Out of hole at | 0630 | hrs |
| Wt on packers | 15,000 | lbs |

Description of blow Weak initial puff. Weak blow, dead in 7 minutes on second opening

Total water recovered 5 ft

Water sample No. - (drilling mud)

Gas blow -

Remarks

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 899-1010'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .60 | |
| Shut-In Tool | 6.10 | |
| Hydraulic Tool | 7.10 | |
| S.S. & Packer | 6.45 | 5 1/2" |
| T.C. & Packer | 5.40 | 5 1/2" |
| Total | 25.65 | |
| Packer Stub | 1.12 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.35 | |
| Drill Pipe | 92.28 | |
| Sub | 1.42 | |
| Bull Nose | 1.00 | |
| Total Interval | 110.97 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 905 | 909 |
| Initial hydrostatic | A | 416 | 418 |
| First flow | B | 18 | 19 |
| | B1 | 16 | 18 |
| Initial shut in | C | 27 | 30 |
| Second flow | D | 16 | 19 |
| | D1 | 16 | 19 |
| Final shut in | G | 22 | 24 |
| Final hydrostatic | H | 403 | 405 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

13-1230-D-77

OBSERVATION WELL NUMBER 13-1230

INTERVAL TESTED 899-1010

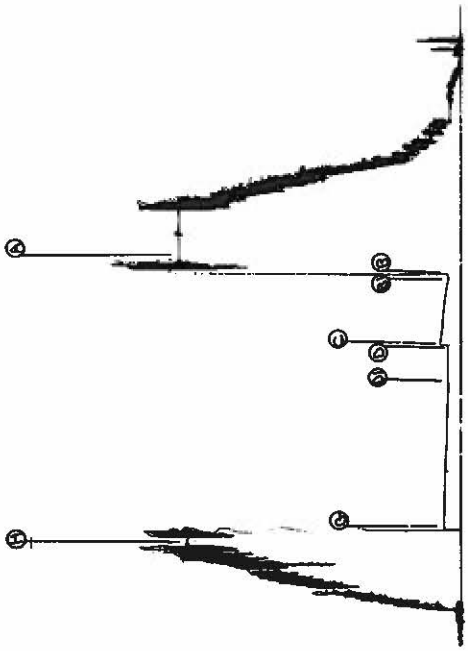
PRESSURE INCREMENTS

Recorder AK1-65

January 7, 1976 |

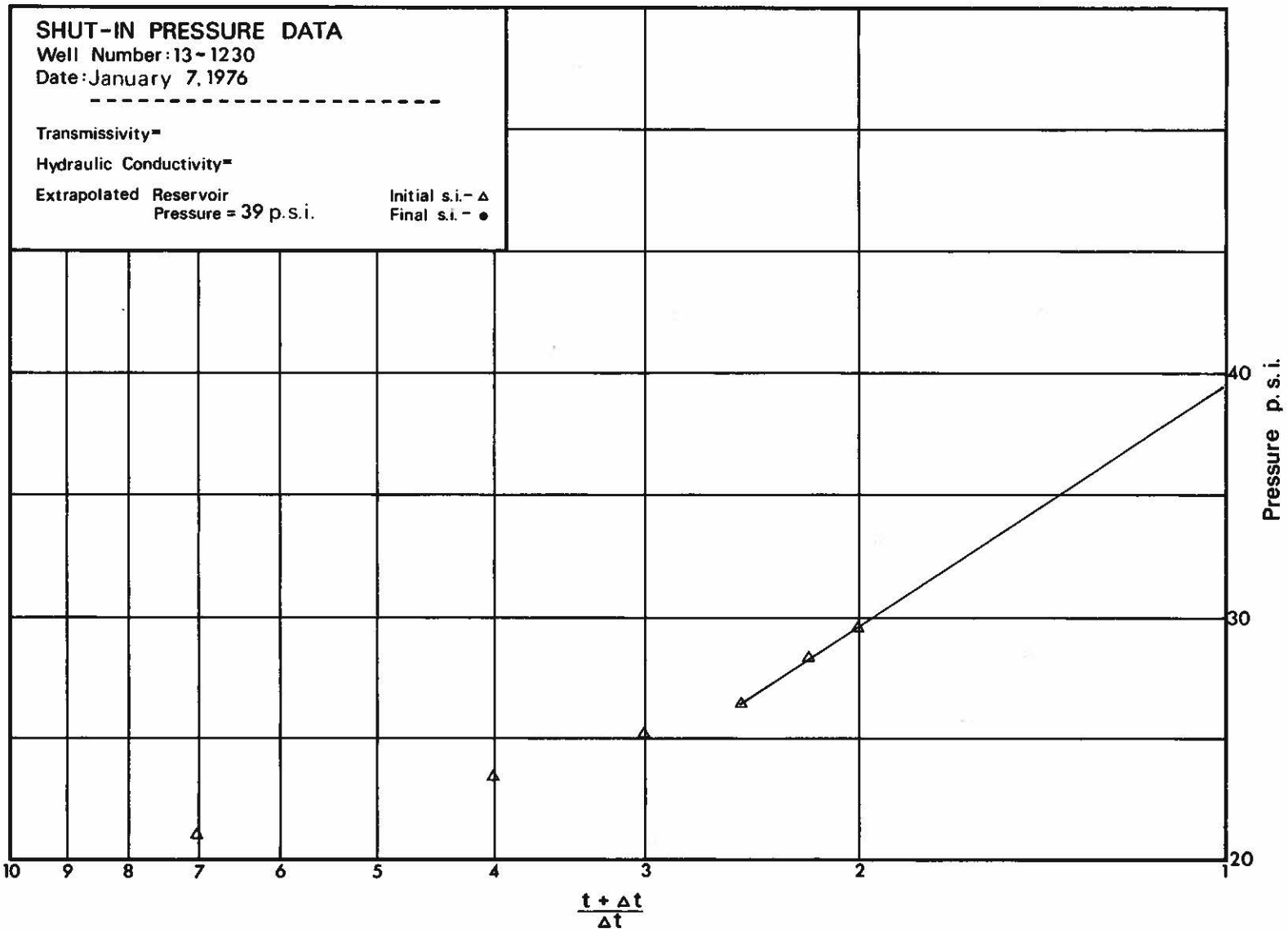
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 20.9 | 7.00 |
| 10 | 23.4 | 4.00 |
| 15 | 25.1 | 3.00 |
| 20 | 26.3 | 2.50 |
| 25 | 28.3 | 2.20 |
| 30 | 29.5 | 2.00 |

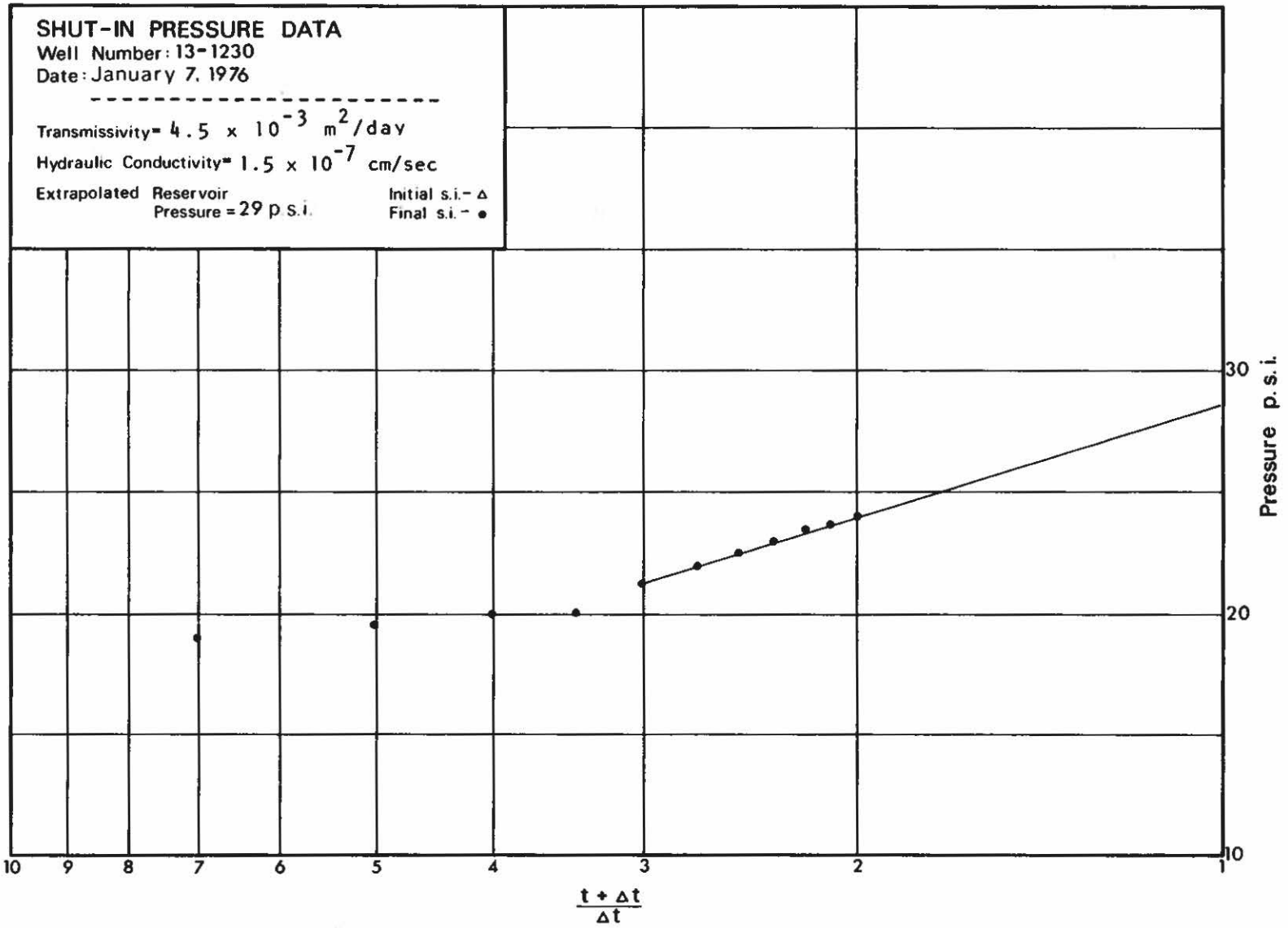


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 18.0 | 13.00 |
| 10 | 19.0 | 7.00 |
| 15 | 19.5 | 5.00 |
| 20 | 19.8 | 4.00 |
| 25 | 20.0 | 3.40 |
| 30 | 21.2 | 3.00 |
| 35 | 21.9 | 2.71 |
| 40 | 22.5 | 2.50 |
| 45 | 22.9 | 2.33 |
| 50 | 23.4 | 2.20 |
| 55 | 23.7 | 2.09 |
| 60 | 24.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 13-1230
Date: January 7, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 39 p.s.i.
Initial s.i.- Δ
Final s.i. - ●
Pressure p.s.i.
40
30
20
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

13-1230-D-77


SHUT-IN PRESSURE DATA
Well Number: 13-1230
Date: January 7, 1976
Transmissivity = 4.5 x 10^-3 m^2/day
Hydraulic Conductivity = 1.5 x 10^-7 cm/sec
Extrapolated Reservoir Pressure = 29 p.s.i.
Initial s.i. - Δ
Final s.i. - •
30
20
10
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

13-1230-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Tp 90 R 12 W4th

Alberta Research Council

Elevation: gl 1750
KB 1758

Type of test Open hole, Bottom hole

Date of test January 7, 1976

Testing company Johnston Testers

### TEST DATA

| | |
|---|---|
| Time started | 2330 hrs |
| Tool opened | 0130 hrs |
| First flow | 2 min |
| Initial shut in | 30 min |
| Second flow | 15 min |
| Final shut in | 60 min |
| Pulled loose at | 0318 hrs |
| Out of hole at | 0415 hrs |
| Wt on packers | 15,000 lbs |

Description of blow Faint initial puff. Fair blow, dead in 10 minutes on second opening.

Total water recovered 30 ft

Water sample No. - (drilling mud)

Gas blow -

Remarks

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 1009-1120'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .60 | |
| Shut-In Tool | 6.10 | |
| Hydraulic Tool | 7.10 | |
| S.S. & Packer | 6.45 | 5 1/2" |
| T.C. & Packer | 5.40 | 5 1/2" |
| Total | 25.65 | |
| Packer Stub | 1.12 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.35 | |
| Drill Pipe | 92.04 | |
| Sub | 1.42 | |
| Bull Nose | 1.00 | |
| Total Interval | 110.73 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 1015 | 1019 |
| Initial hydrostatic | A | 468 | 470 |
| First flow | B | 22 | 24 |
| | B1 | 23 | 26 |
| Initial shut in | C | 470 | 472 |
| Second flow | D | 25 | 28 |
| | D1 | 30 | 32 |
| Final shut in | G | 69 | 71 |
| Final hydrostatic | H | 458 | 459 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

13-1230-D-77

OBSERVATION WELL NUMBER 13-1230

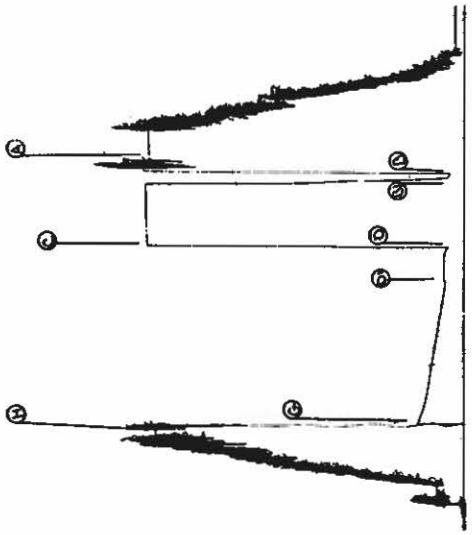
INTERVAL TESTED 1009-1120

PRESSURE INCREMENTS
Recorder AK1-65

January 7, 1976 ||

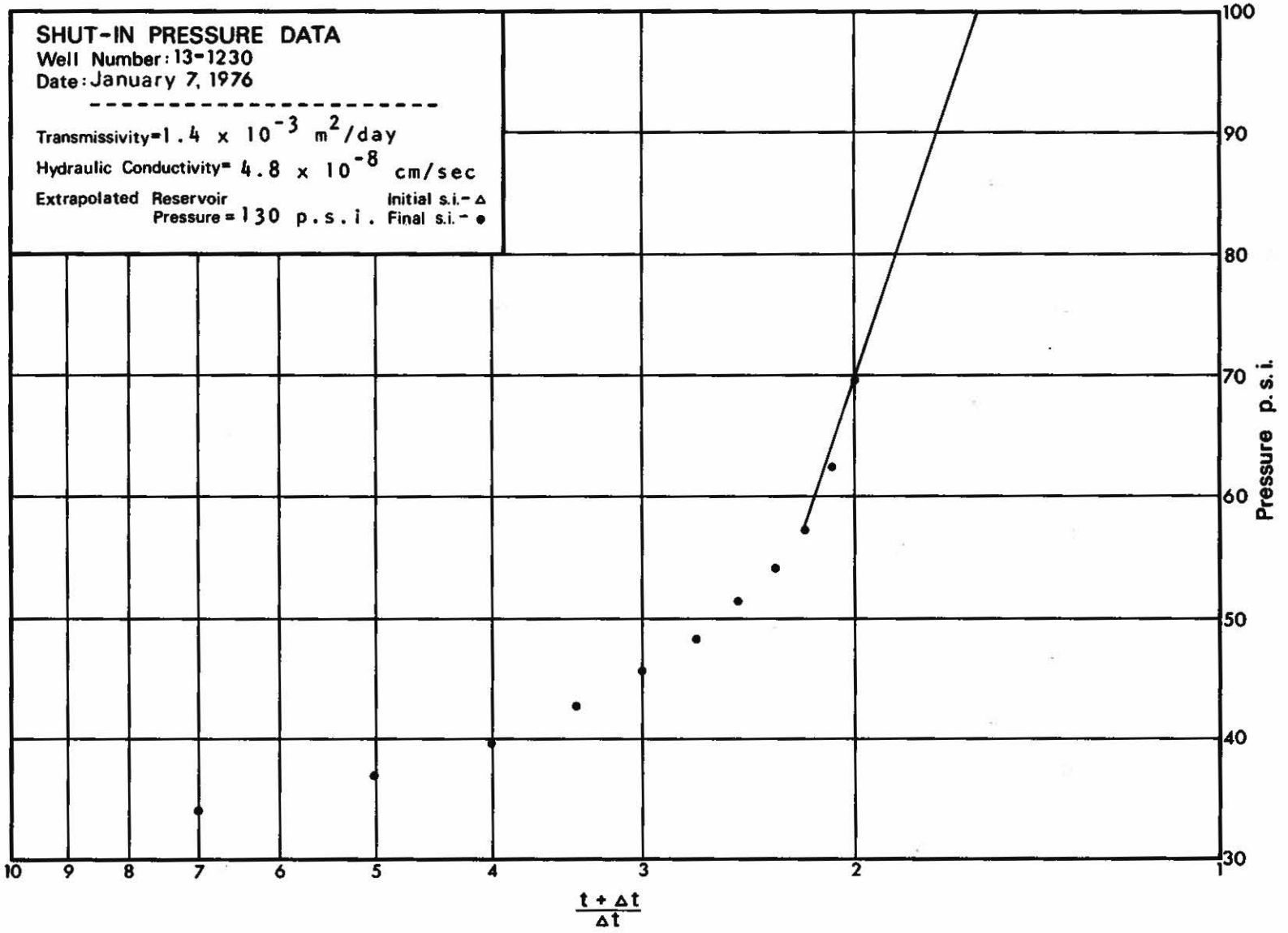
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 483.3 | 7.00 |
| 10 | 482.3 | 4.00 |
| 15 | 482.3 | 3.00 |
| 20 | 481.8 | 2.50 |
| 25 | 481.0 | 2.20 |
| 30 | 480.2 | 2.00 |



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 30.2 | 13.00 |
| 10 | 33.1 | 7.00 |
| 15 | 36.1 | 5.00 |
| 20 | 39.0 | 4.00 |
| 25 | 42.1 | 3.40 |
| 30 | 45.1 | 3.00 |
| 35 | 47.9 | 2.71 |
| 40 | 51.0 | 2.50 |
| 45 | 53.8 | 2.33 |
| 50 | 57.7 | 2.20 |
| 55 | 62.3 | 2.09 |
| 60 | 69.7 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 13-1230
Date: January 7, 1976
Transmissivity = 1.4 x 10^-3 m^2/day
Hydraulic Conductivity = 4.8 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 130 p.s.i.
Initial s.i. - Δ
Final s.i. - •
100
90
80
70
60
50
40
30
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

13-1230-D-77

# DRILL STEM TEST

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Tp 90 R 12 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1750 |
| | KB | 1758 |
| Type of test | - | Open hole, Bottom hole |
| Date of test | | January 8, 1976 |
| Testing company | | Johnston Testers |

## TEST DATA

| | | |
|---|---|---|
| Time started | 1730 | hrs |
| Tool opened | 1927 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 2115 | hrs |
| Out of hole at | 2300 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff on preflow. Weak air blow decreasing to nil in 3 minutes on final flow period

Total water recovered ft

Water sample No. - (drilling mud)

Gas blow No

Remarks Test satisfactory

## HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 1120-1230'

Formation tested Beaverhill Lake

## TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .60 | |
| Shut-In Tool | 6.10 | |
| Hydraulic Tool | 7.10 | |
| S.S. & Packer | 6.45 | 5 1/2" |
| T.C. & Packer | 5.40 | 5 1/2" |
| Total | 25.65 | |
| Packer Stub | 1.12 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.35 | |
| Drill Pipe | 92.04 | |
| Sub | 1.42 | |
| Bull Nose | 1.00 | |
| Total Interval | 110.73 | |

## PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 1127 | 1131 |
| Initial hydrostatic | A | 522 | 520 |
| First flow | B | 18 | 17 |
| | B1 | 18 | 17 |
| Initial shut in | C | 93 | 92 |
| Second flow | D | 21 | 20 |
| | D1 | 21 | 20 |
| Final shut in | G | 34 | 32 |
| Final hydrostatic | H | 507 | 504 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

13-1230-D-77

OBSERVATION WELL NUMBER 13-1230

INTERVAL TESTED 1120-1230

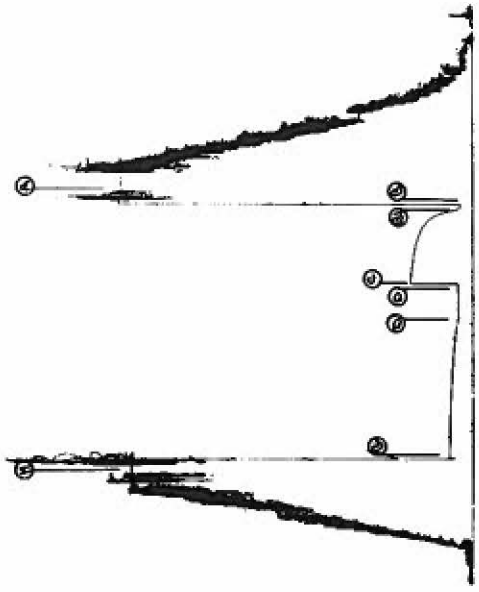
PRESSURE INCREMENTS

Recorder AK1-65

January 8, 1976

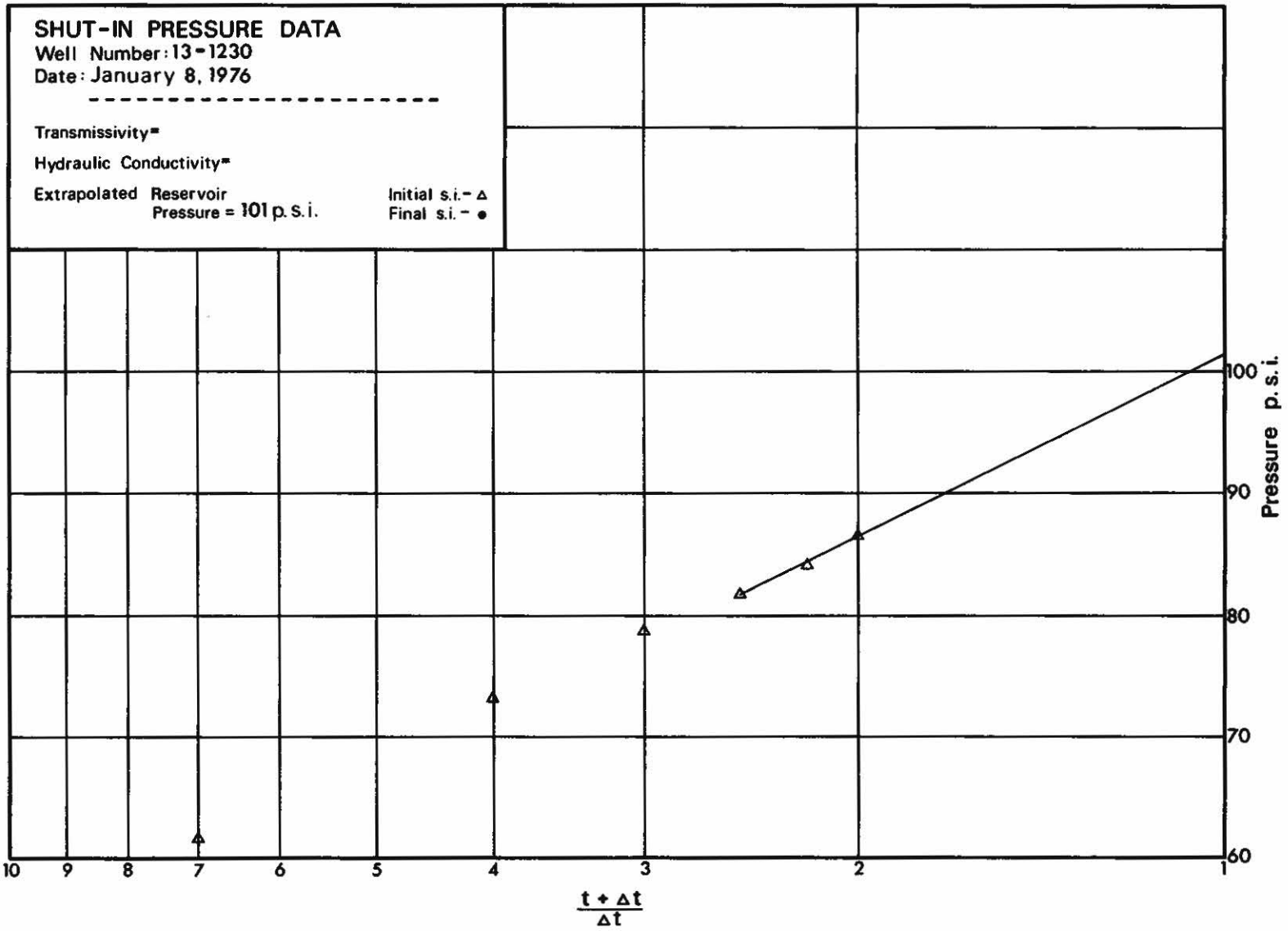
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 61.4 | 7.00 |
| 10 | 73.0 | 4.00 |
| 15 | 78.6 | 3.00 |
| 20 | 81.6 | 2.50 |
| 25 | 84.0 | 2.20 |
| 30 | 86.5 | 2.00 |

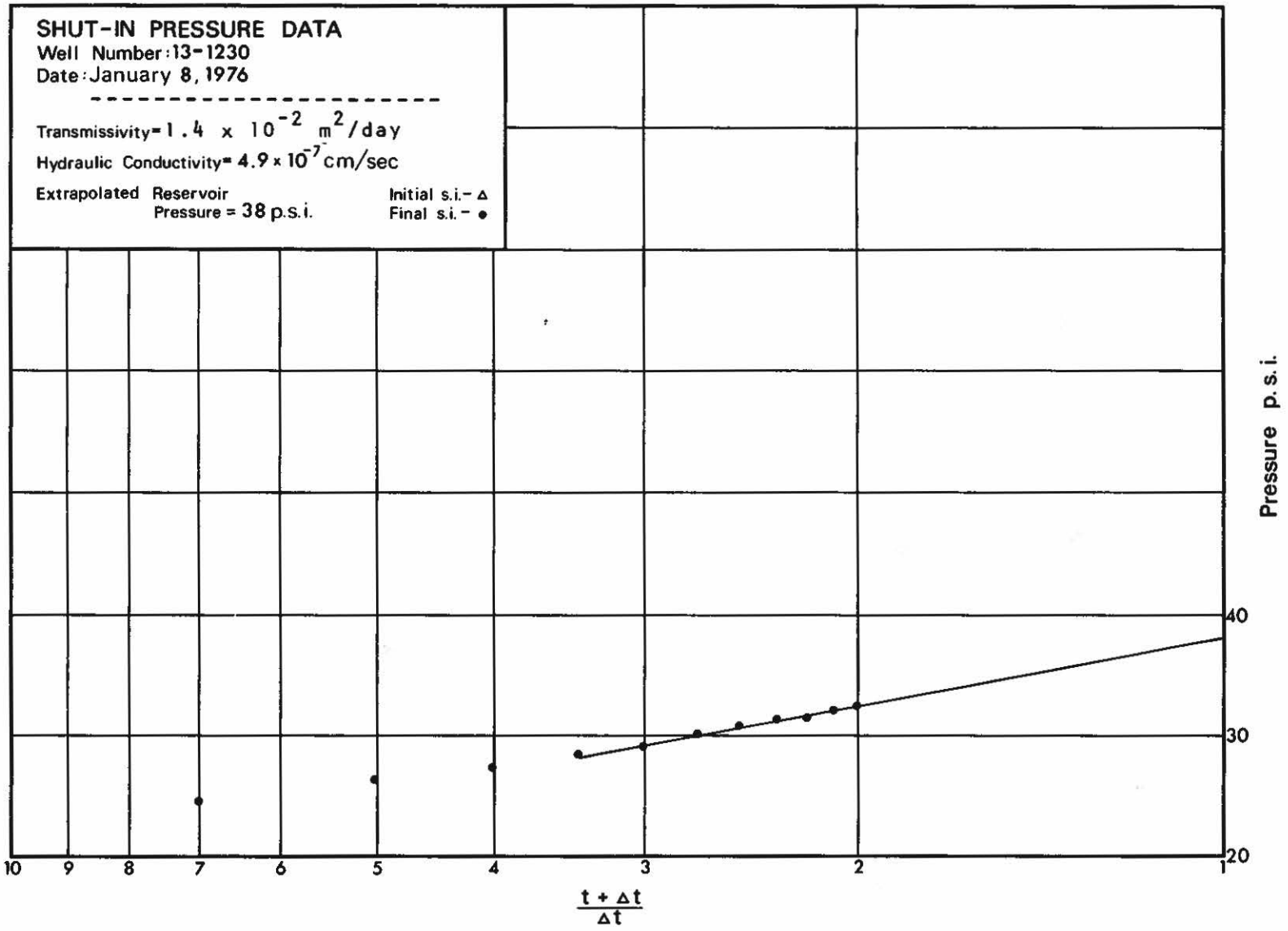


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 22.8 | 13.00 |
| 10 | 24.6 | 7.00 |
| 15 | 26.3 | 5.00 |
| 20 | 27.4 | 4.00 |
| 25 | 28.6 | 3.40 |
| 30 | 29.3 | 3.00 |
| 35 | 30.2 | 2.71 |
| 40 | 30.9 | 2.50 |
| 45 | 31.4 | 2.33 |
| 50 | 31.6 | 2.20 |
| 55 | 32.1 | 2.09 |
| 60 | 32.6 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 13-1230
Date: January 8, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 101 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
100
90
80
70
60
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

13-1230-D-77


SHUT-IN PRESSURE DATA
Well Number: 13-1230
Date: January 8, 1976
Transmissivity = 1.4 x 10^-2 m^2/day
Hydraulic Conductivity = 4.9 x 10^-7 cm/sec
Extrapolated Reservoir Pressure = 38 p.s.i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
40
30
20
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

13-1230-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed from 13-1230

Date sampled February 20, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 29.0 | 1.45 | 19.3 |
| Magnesium ($Mg^{++}$) | 4.8 | 0.40 | 5.3 |
| Sodium ($Na^{+}$) | 124.0 | 5.39 | 71.8 |
| Potassium ($K^{+}$) | 10.8 | 0.28 | 3.7 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 66.0 | 1.08 | 3.4 |
| Sulfate ($SO_4^{=}$) | 264.0 | 5.50 | 17.0 |
| Chloride ($Cl^{-}$) | 910.0 | 25.66 | 79.5 |
| Nitrate ($NO_3^{=}$) | 1.6 | 0.03 | 0.1 |
| Silica ($SiO_2$) | 19.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1806.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 32.3 | Total Cations (epm) | 7.5 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | |
| pH | 7.2 | pH | 9.5 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | 14.5 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | 13.6 ppm |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 19, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 44.0 | 2.20 | 3 |
| Magnesium ($Mg^{++}$) | 25.0 | 2.06 | 2 |
| Sodium ($Na^{+}$) | 1900.0 | 82.64 | 95 |
| Potassium ($K^{+}$) | 15.8 | 0.40 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 66.0 | 1.08 | 1 |
| Sulfate ($SO_4^{=}$) | 635.0 | 13.22 | 16 |
| Chloride ($Cl^{-}$) | 2450.0 | 69.09 | 83 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 6.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 41.8 | | |
| Magnesium (Acidified) | 25.3 | | |
| Total dissolved solids | 4980 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 83.41 | Total Cations (epm) | 87.30 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 78000 | | Temperature (C) | 9.0 | |
| pH | 8.3 | | pH | 10.0 | |
| Fluoride ($F^{-}$) | 0.4 | Mg/L | Carbonate ($CO_3^{=}$) | 53 | Mg/L |
| | | | Bicarbonate ($HCO_3^{-}$) | 20 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 11, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 69.0 | 3.44 | 2.5 |
| Magnesium ($Mg^{++}$) | 46.0 | 3.79 | 2.7 |
| Sodium ($Na^{+}$) | 3019.0 | 131.32 | 94.3 |
| Potassium ($K^{+}$) | 26.7 | 0.68 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 83.0 | 1.36 | 0.9 |
| Sulfate ($SO_4^{=}$) | 1066.0 | 22.19 | 15.3 |
| Chloride ($Cl^{-}$) | 4320.0 | 121.83 | 83.8 |
| Nitrate ($NO_3^{=}$) | 0.1 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 2.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 51.0 | | |
| Magnesium (Acidified) | 55.0 | | |
| Total dissolved solids | 8656.0 | | |
| Total Anions (epm) | 145.38 | Total Cations (epm) | 139.23 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 10.0 |
| pH | 8.3 | pH | 8.6 |
| Fluoride ($F^{-}$) | 0.8 ppm | Carbonate ($CO_3^{=}$) | 14.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 49.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Date sampled: July 19, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .013 |
| Au | <.003 | Mo | <.006 |
| Al | 0.11 | Na | 1848 |
| As | <.038 | Ni | <.010 |
| B | 1.66 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 46.1 | Si | 3.25 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 1.13 |
| Cr | <.006 | Te | <.065 |
| Cu | .013 | Ti | .004 |
| Eu | <.015 | U | <.020 |
| Fe | .066 | V | .007 |
| K | 44 | W | <.078 |
| Mg | 22.8 | Zn | .033 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 67.0 | 3.34 | 2.0 |
| Magnesium(Mg) | 11.0 | 0.91 | 0.6 |
| Sodium(Na) | 3638.0 | 158.24 | 96.6 |
| Potassium(K) | 49.6 | 1.27 | 0.8 |
| Carbonate(CO3) | 33.6 | 1.12 | 0.7 |
| Bicarbonate(HCO3) | 7.3 | 0.12 | 0.1 |
| Sulphate(SO4) | 1176.0 | 24.48 | 14.5 |
| Chloride(Cl) | 5080.0 | 143.26 | 84.8 |
| Nitrate(NO3) | 1.5 | 0.02 | 0.0 |
| Silica(SiO2) | 1.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 79.0 | | |
| Magnesium(Acidified) | 10.8 | | |
| TDS(mg/l) | 10204.0 | | |
| Total Anions(epm) | 169.01 | Total Cations(epm) | 163.76 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 14800 | | Temperature(C) | 10.00 | |
| pH | 9.2 | | pH | 10.2 | |
| Fluoride(F) | 0.5 | mg/l | Carbonate(CO3) | 38 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 9 | mg/l |

13-1230-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 132.0 | 6.59 | 2.9 |
| Magnesium(Mg) | 94.0 | 7.74 | 3.4 |
| Sodium(Na) | 4825.0 | 209.87 | 93.3 |
| Potassium(K) | 32.9 | 0.84 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 127.0 | 2.08 | 0.9 |
| Sulphate(SO4) | 1510.0 | 31.44 | 13.8 |
| Chloride(Cl) | 6900.0 | 194.59 | 85.3 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 3.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 154.0 | | |
| Magnesium(Acidified) | 88.0 | | |
| TDS(mg/l) | 13666.0 | | |
| Total Anions(epm) | 228.11 | Total Cations(epm) | 225.04 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 19000 | | Temperature(C) | 9.50 | |
| pH | 8.0 | | pH | 8.5 | |
| Fluoride(F) | 0.5 | mg/l | Carbonate(CO3) | 10 | mg/l |
| | | | Bicarbonate(HCO3) | 122 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS

13-1230-E-82

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Rge 12 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 7, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 187.0 | 9.35 | 3.6 |
| Magnesium(Mg) | 126.0 | 10.50 | 4.0 |
| Sodium(Na) | 5500.0 | 239.13 | 92.0 |
| Potassium(K) | 33.0 | 0.85 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 117.0 | 1.92 | 0.7 |
| Sulphate(SO4) | 2050.0 | 42.71 | 16.3 |
| Chloride(Cl) | 7700.0 | 216.90 | 82.9 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 3.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 151.0 | | |
| Magnesium(Acidified) | 100.0 | | |
| TDS(mg/l) | 16492.0 | | |
| Total Anions(epm) | 261.53 | Total Cations(epm) | 259.83 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 25000 |
| pH | 7.9 |
| Fluoride | 0.6 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 11.00 | |
| pH | 8.2 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 122 | mg/l |
| Hydroxide(OH) | | |

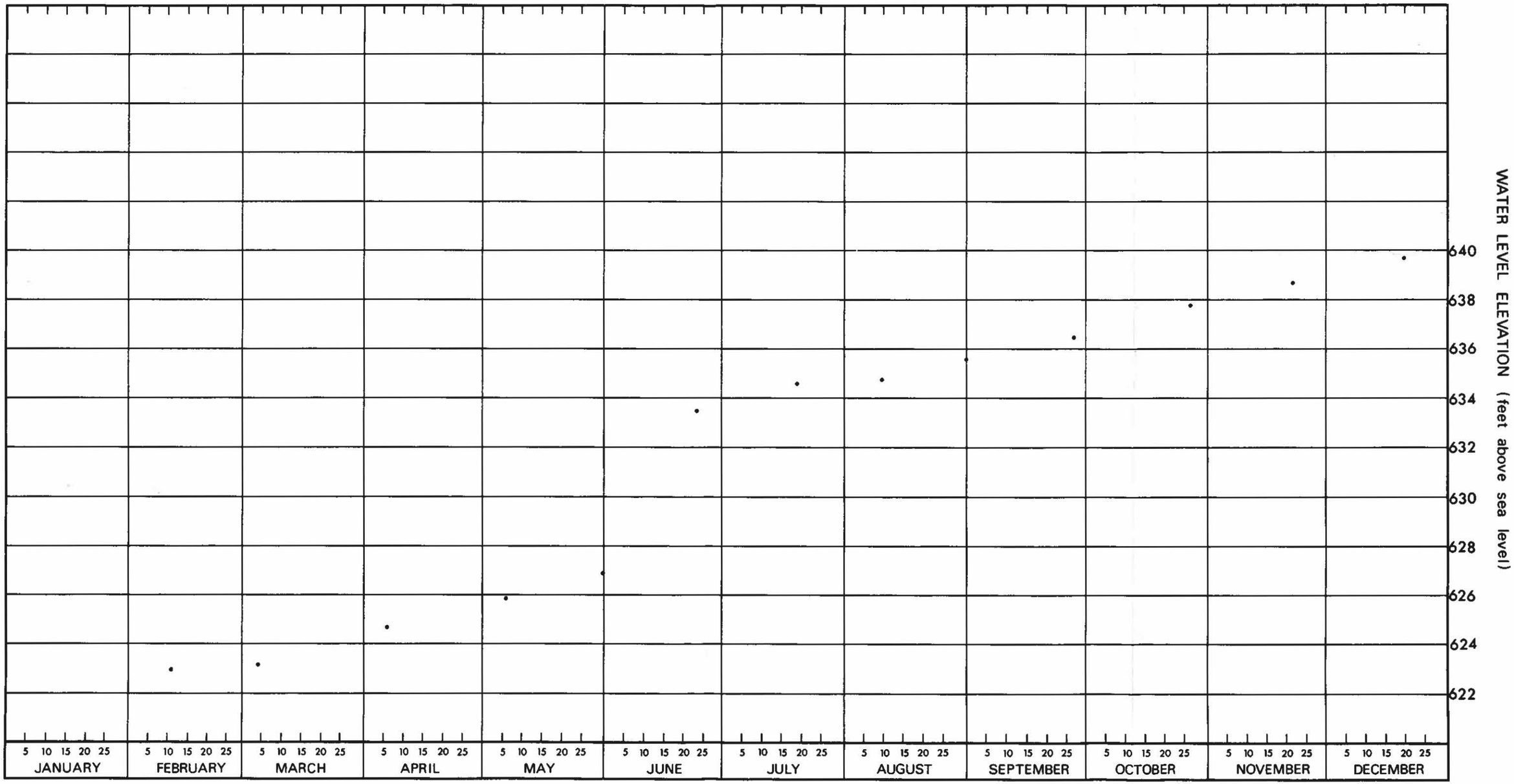
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **13-1230**

Lsd **8** Sec **11** Twp **90** R **12** W4th

Alberta Research Council

13 - 1230 - H - 77




1976

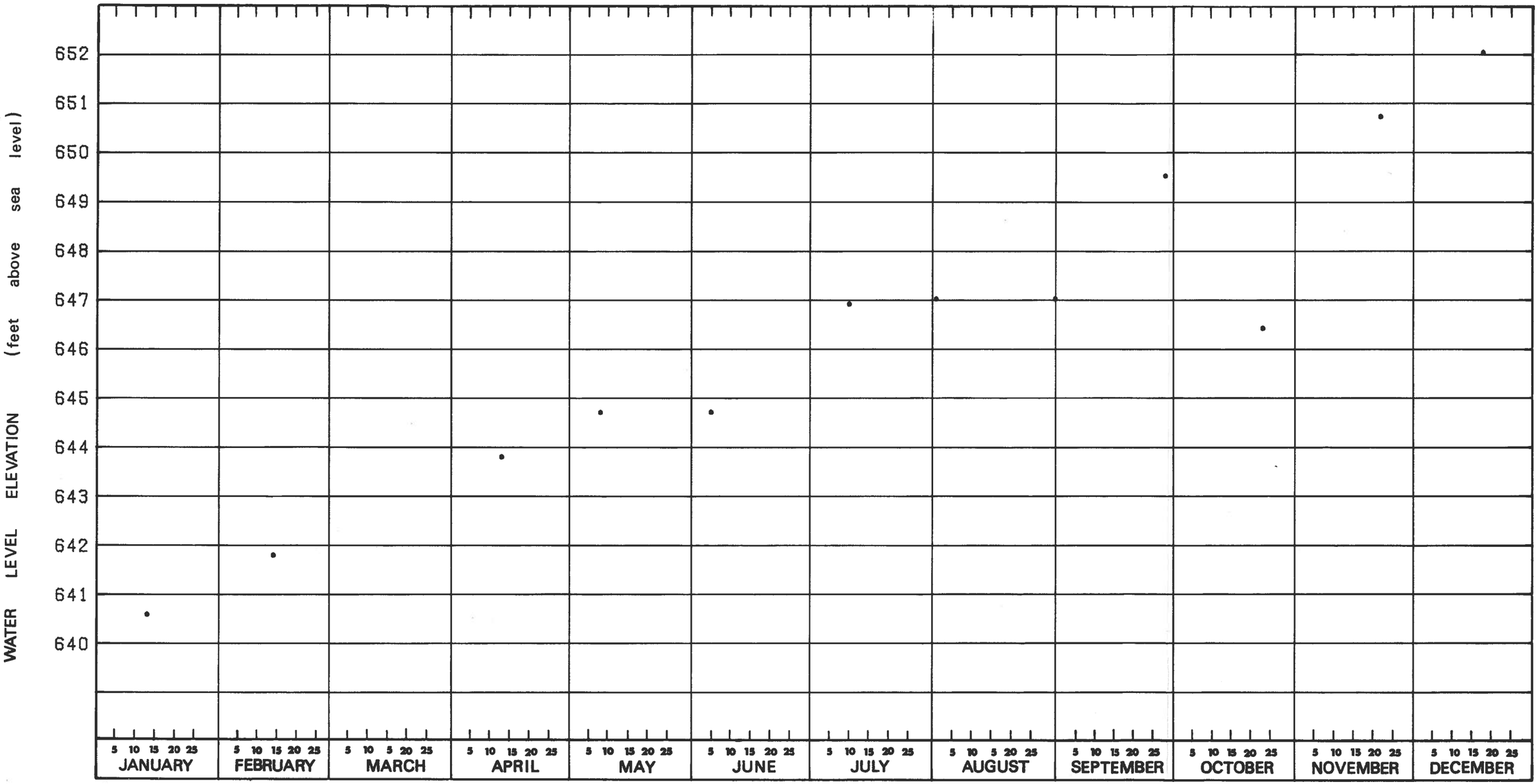
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-1230

13-1230-H-78

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council




1977

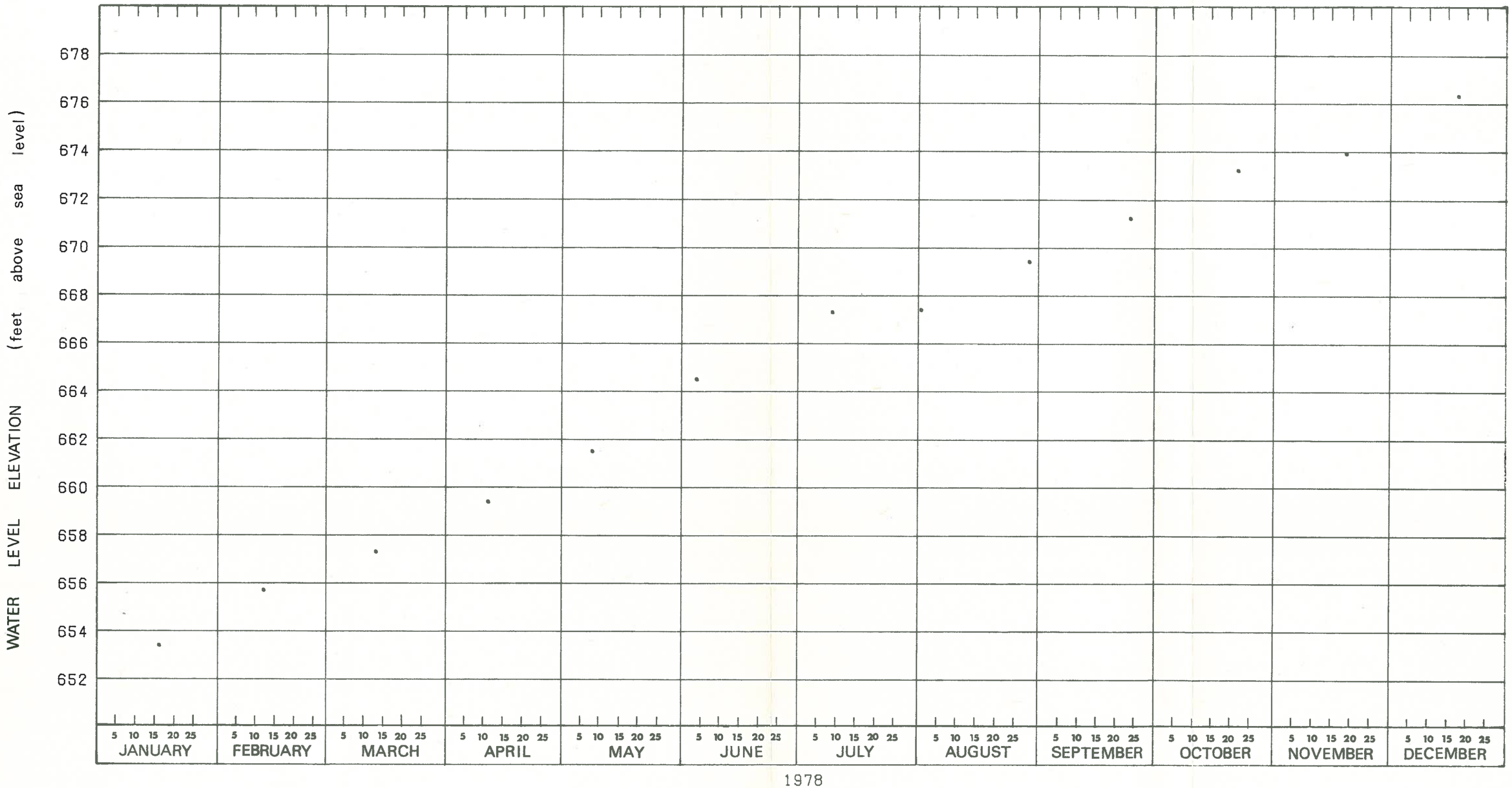
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-1230

LSD 8 SEC 11 TWP 90 R 12 W4TH

Alberta Research Council

13-1230-H-79




1978

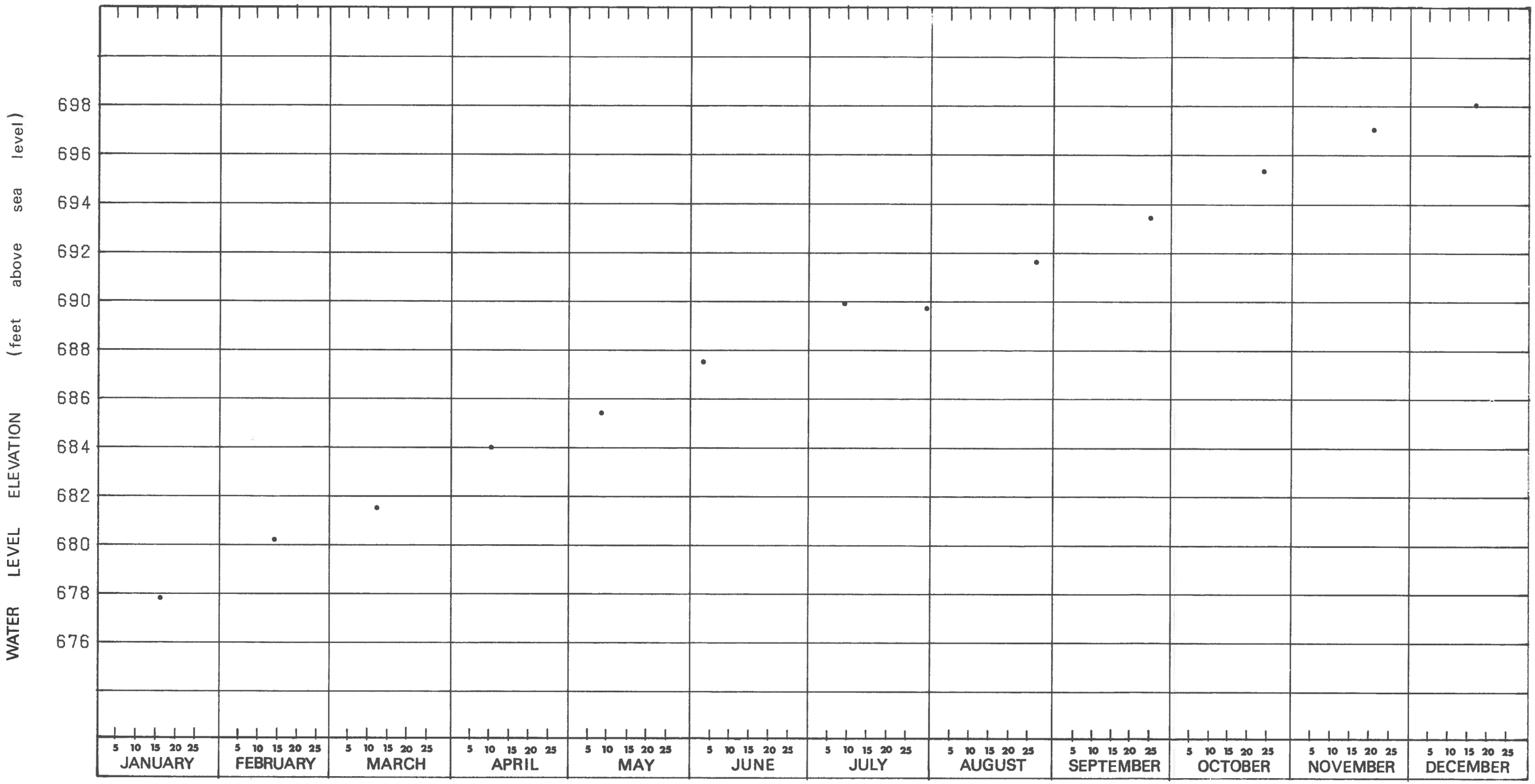
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-1230

13-1230-H-80

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council



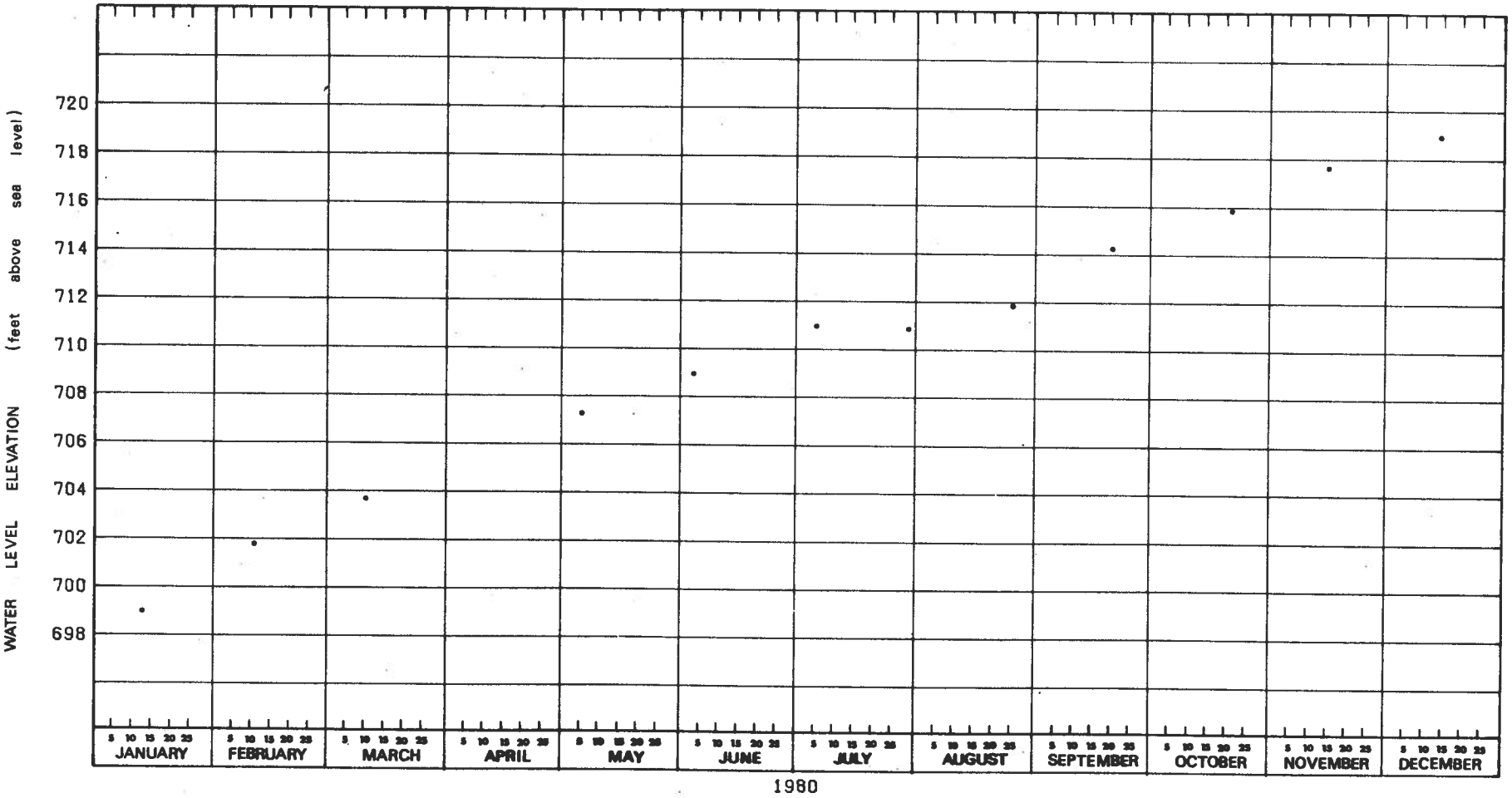
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-1230-H-81



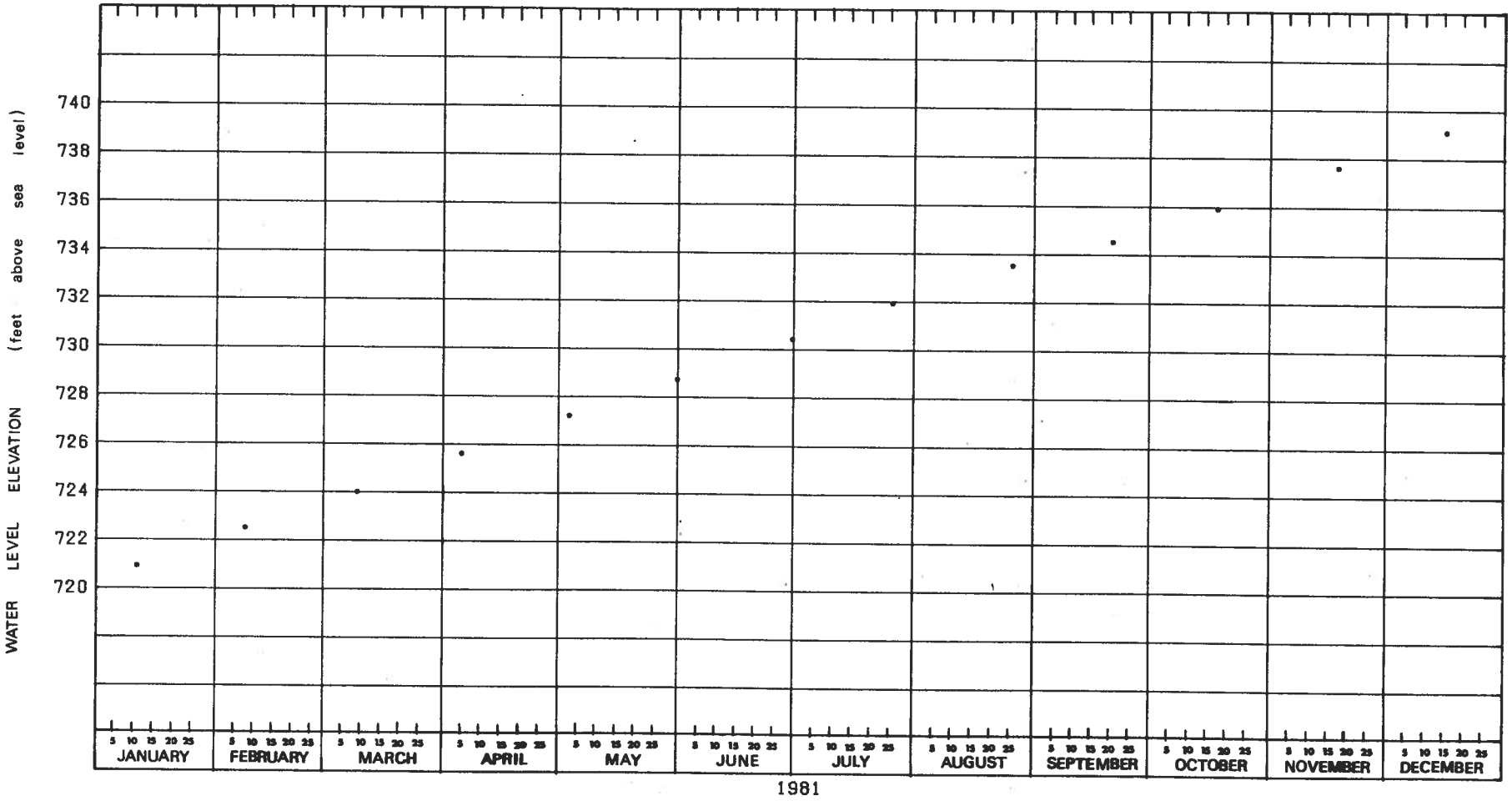
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Twp 90 R 12 W4 th

Alberta Research Council

13-1230-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1752.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 10/76 | | | Well completed |
| Feb 11/76 | 344.75 MP | 623.0 | MP = 0.46 m TOC, (1753.8) |
| Feb 20/76 | | | Water sample |
| Mar 4/76 | 344.68 MP | 623.2 | |
| Apr 6/76 | 344.23 MP | 624.7 | |
| May 6/76 | 343.87 MP | 625.9 | |
| May 31/76 | 343.56 MP | 626.9 | |
| June 24/76 | 341.54 MP | 633.5 | |
| July 19/76 | 341.23 MP | 634.6 | Sampled; temp. 9°C |
| Aug 10/76 | 341.15 MP | 634.8 | |
| Aug 31/76 | 340.91 MP | 635.6 | |
| Sept 27/76 | 340.60 MP | 636.6 | |
| Oct 27/76 | 340.25 MP | 637.8 | |
| Nov 22/76 | 339.96 MP | 638.7 | |
| Dec 20/76 | 339.66 MP | 639.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1752.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 339.38 MP | 640.6 | MP (1753.8) |
| Feb 15/77 | 339.02 MP | 641.8 | |
| Mar 16/77 | | | >200 m |
| Apr 14/77 | 338.41 MP | 643.8 | |
| May 9/77 | 338.13 MP | 644.7 | |
| June 6/77 | 338.13 MP | 644.7 | |
| July 11/77 | 337.46 MP | 646.9 | Sampled; temp. 10°C |
| Aug 2/77 | 337.45 MP | 647.0 | |
| Sept 1/77 | 337.45 MP | 647.0 | |
| Sept 29/77 | 336.68 MP | 649.5 | |
| Oct 24/77 | 337.62 MP | 646.4 | |
| Nov 23/77 | 336.31 MP | 650.7 | |
| Dec 19/77 | 335.90 MP | 652.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1752.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 335.48 MP | 653.4 | MP (1753.8) |
| Feb 13/78 | 334.80 MP | 655.7 | |
| Mar 14/78 | 334.31 MP | 657.3 | |
| Apr 12/78 | 333.65 MP | 659.4 | |
| May 9/78 | 333.03 MP | 661.5 | |
| June 5/78 | 332.09 MP | 664.5 | |
| July 10/78 | 331.26 MP | 667.3 | Sampled; temp. 10°C |
| Aug 2/78 | 331.22 MP | 667.4 | |
| Aug 30/78 | 330.61 MP | 669.4 | |
| Sept 25/78 | 330.06 MP | 671.2 | |
| Oct 23/78 | 329.45 MP | 673.2 | |
| Nov 20/78 | 329.25 MP | 673.9 | |
| Dec 19/78 | 328.51 MP | 676.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 13-1230

Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1752.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 328.04 MP | 677.8 | MP (1753.8) |
| Feb 15/79 | 327.32 MP | 680.2 | |
| Mar 13/79 | 326.91 MP | 681.5 | |
| Apr 11/79 | 326.17 MP | 684.0 | |
| May 9/79 | 325.74 MP | 685.4 | |
| June 4/79 | 325.10 MP | 687.5 | |
| July 10/79 | 324.35 MP | 689.9 | Sampled; temp. 9.5°C |
| July 31/79 | 324.41 MP | 689.7 | |
| Aug 28/79 | 323.88 MP | 691.6 | |
| Sept 26/79 | 323.28 MP | 693.4 | |
| Oct 25/79 | 322.71 MP | 695.3 | |
| Nov 22/79 | 322.18 MP | 697.0 | |
| Dec 18/79 | 321.88 MP | 698.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing.

13 - 1230 - W - 82

WELL HISTORY

OBSERVATION WELL NUMBER 13 - 1230

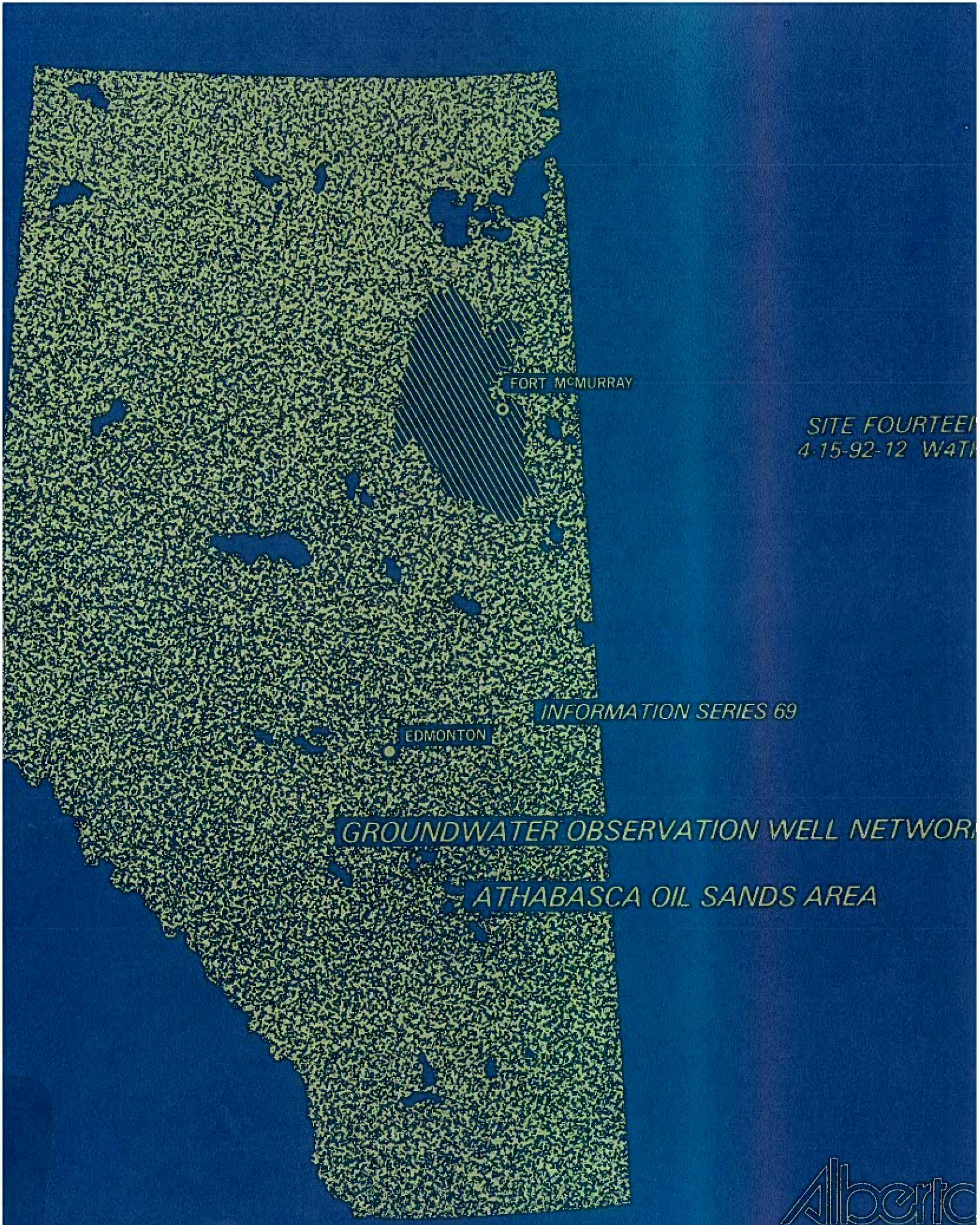
Lsd 8 Sec 11 Twp 90 R 12 W4th

Alberta Research Council

Elevation of top of casing 1752.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/80 | 321.58 MP | 699.0 | |
| Feb 12/80 | 320.72 MP | 701.8 | |
| Mar 12/80 | 320.14 MP | 703.7 | |
| Apr 10/80 | | | Could not measure |
| May 7/80 | 319.05 MP | 707.3 | |
| June 5/80 | 318.53 MP | 709.0 | |
| July 7/80 | 317.94 MP | 711.0 | Temp. 11°C |
| July 31/80 | 317.95 MP | 710.9 | |
| Aug 27/80 | 317.65 MP | 711.9 | |
| Sept 22/80 | 316.93 MP | 714.3 | |
| Oct 23/80 | 316.43 MP | 715.9 | |
| Nov 17/80 | 315.89 MP | 717.7 | |
| Dec 16/80 | 315.48 MP | 719.0 | |
| Jan 12/81 | 314.91 MP | 720.9 | |
| Feb 9/81 | 314.43 MP | 722.5 | |
| Mar 10/81 | 313.95 MP | 724.0 | |
| Apr 6/81 | 313.47 MP | 725.6 | |
| May 4/81 | 312.98 MP | 727.2 | |
| June 1/81 | 312.52 MP | 728.7 | |
| July 1/81 | 312.00 MP | 730.4 | |
| July 27/81 | 311.57 MP | 731.9 | |
| Aug 27/81 | 311.07 MP | 733.5 | |
| Sept 22/81 | 310.76 MP | 734.5 | |
| Oct 19/81 | 310.35 MP | 735.9 | |
| Nov 19/81 | 309.81 MP | 737.6 | |
| Dec 17/81 | 309.35 MP | 739.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing




SITE FOURTEEN
4-15-92-12 W4TH

INFORMATION SERIES 69

GROUNDWATER OBSERVATION WELL NETWORK

ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites (numbers 1, 2, 3, 6, 7, 8 and 9), containing 36 individual wells, were instrumented in this manner during the winter of 1974-75. Eight sites (numbered 10, 11, 12, 13, 14, 15 16 and 17), containing 38 individual wells, were instrumented during the winter of 1975-76.

The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The page indexing system is also consistent with the updating process. All update volumes will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this Introduction and a Legend. There are 15 piezometer nests in the system and thus there are 15 separate

site publications in Information Series 69. Table 1 lists the location of wells in the system as of August 31, 1976. Figure 1 indicates the location of these wells. Publications are available as of the date of this document for all sites.

Five oil companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing.

## ACKNOWLEDGMENTS

The installation and monitoring of wells in this Program was funded by Alberta Energy and Natural Resources; Non-Renewable Resources Division.

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1976: BPOG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., Shell Canada Ltd. and Home Oil Company Ltd.

D. Hackbarth

EDMONTON

1977

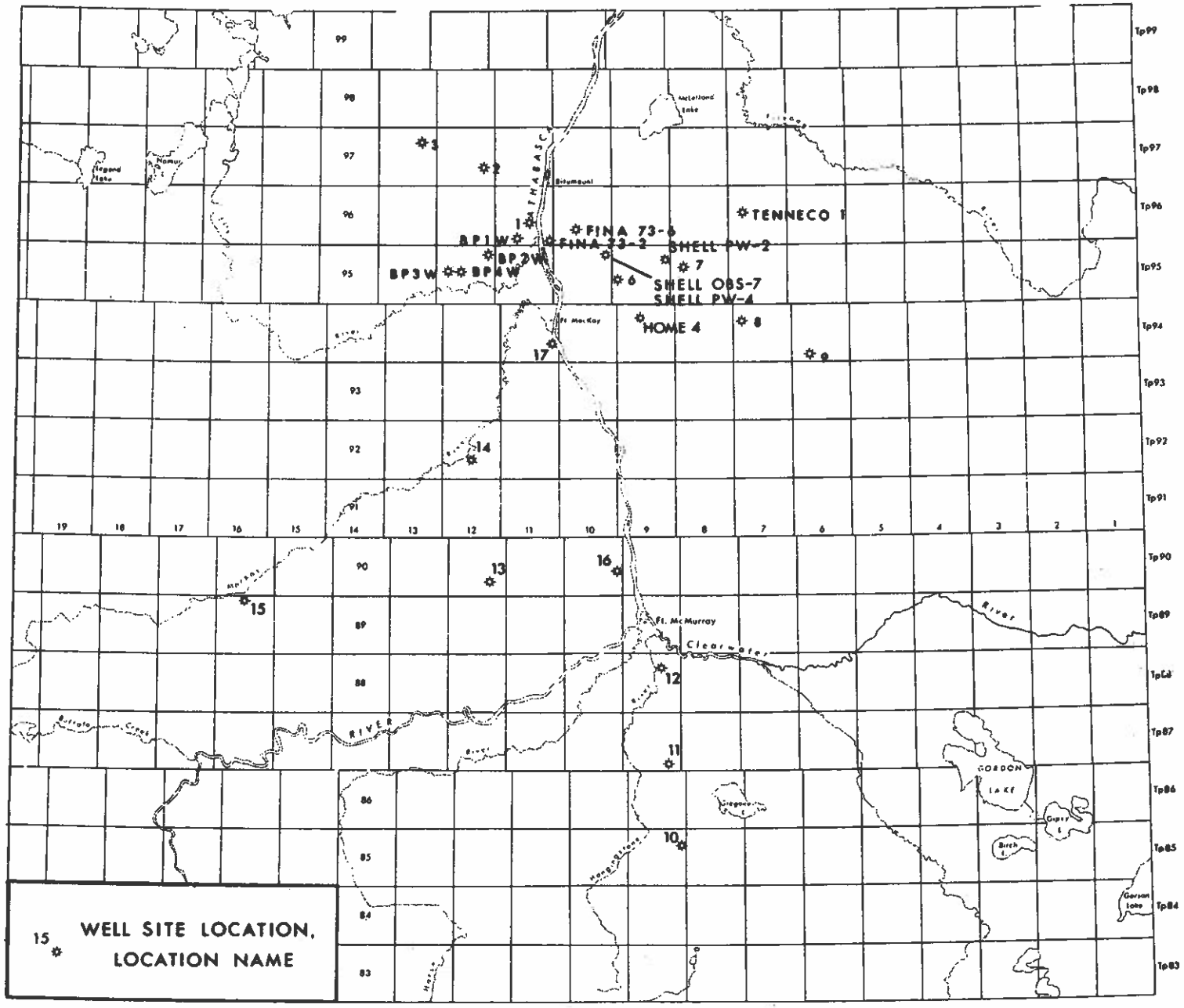



FIGURE 1. Athabasca Oil Sands observation well network, January 1977

Table 1

Athabasca Oil Sands Observation Wells

August 31, 1976

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 9-24-85-9 | 10 |
| Lsd 16-2-87-9 | 11 |
| Lsd 8-27-88-9 | 12 |
| Lsd 8-11-90-12 | 13 |
| Lsd 4-15-92-12 | 14 |
| Lsd 15-33-89-16 | 15 |
| Lsd 6-13-90-10 | 16 |
| Lsd 13-12-94-11 | 17 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |
| Lsd 3-28-94-9 | Home 4 |
| Lsd 10-25-95-10 | Shell PW-4 |
| Lsd 10-24-95-9 | Shell PW-2 |
| Lsd 10-25-95-10 | Shell Obs-7 |

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

| | | |
|---|---|---|
| Well Number | - | the name used for designating the well |
| Subject Code | - | as follows: |
| I | - | Introduction (no site number indicated) |
| L | - | Legend (no site number indicated) |
| G | - | General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents |
| C | - | Well construction details |
| D | - | Drill stem testing |
| A | - | Aquifer testing |
| E | - | Chemical analyses including multielement analyses and routine water analyses |
| H | - | Annual hydrograph |
| W | - | Well history |
| Year of Publication | - | the last two numerals of the year of publication. |

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within tha tabbed section for that particular well.

# GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
| | sandstone, arkosic |
| | silt |
| | siltstone |
| | siltstone & sandstone |
| | clay |
| | clay, sandy |
| | claystone, shale |
| | sandstone & shale |
| | oil sand |
| | limestone |
| | limestone, shaley |
| | dolomite |
| | dolomite, argillaceous |
| | rock salt |
| | gypsum & anhydrite |
| | coal |
| | igneous rock |

| Symbol | Stratigraphic Unit |
|---|---|
| | Pleistocene and Recent |
| Qd | Surface deposits |
| | Cretaceous |
| Ks | Smoky Group |
| Klb | La Biche Formation |
| Kd | Dunvegan Formation |
| Ksh | Shaftesbury Formation |
| Kpl | Pelican Formation |
| Kj | Joli Fou Formation |
| Kg | Grand Rapids Formation |
| Kc | Clearwater Formation |
| Kw | Wabiskaw Member |
| Km | McMurray Formation |
| | Devonian |
| Dwd | Woodbend Group |
| Dbl | Beaverhill Lake Formation |
| Dsw | Slave Point Formation & Fort Vermilion Formation & Watt Mountain Formation |
| Dmk | Muskeg Formation |
| Dpe | Prairie Evaporite Formation |
| Dm | Methy Formation (Keg River Formation equivalent) |
| Dmr | McLean River Formation (Chinchaga Formation equivalent) |
| Dl | La Loche Formation |
| | Precambrian |
| Pε | Undivided |

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

| Symbol | Units or Parameter |
|---|---|
| Sec. | section |
| ss | stainless steel |
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) or time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| $\Delta t$ | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| WILL | Analysis done at Western Industrial Laboratories Ltd. |
| Wt | weight |

## GEOLOGICAL ABBREVIATIONS

| | |
|---|---|
| biocl | bioclast |
| brac | brachiopod |
| bry | bryozoan |
| calc | calcareous |
| carb | carbonaceous |
| cht | chert |
| fld | feldspar |
| glauc | glauconite, glauconitic |
| gvl | gravel |
| hvy | heavy |
| lt | light |
| mnrls | minerals |
| pbl | pebbles |
| qtz | quartz |
| strgr(s) | stringer(s) |
| stroms | stromotoporoids |
| subang | subangular |
| subrd | subrounded |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: a complete routine analysis and a multielement analysis (multielement radio frequency induction coupled plasma emission spectrometer). Some of the samples collected appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years. Results of analyses performed on samples obtained during July 1976 are included in this report.

Most routine water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source" and are limited to samples from wells contributed by oil companies. Spectral emission estimates were done at commercial laboratories.

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface
3. drill through the aquifer using very light mud
4. insert a screening device (if necessary)
5. develop the well with air.

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma, caliper and neutron were the logs run during the 1975-76 drilling. Results of the caliper logs are not presented. The geological log presented represents an interpretation based upon the sample

description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

4) A summary of contents page noting the number of pages in each of the subject areas that have been issued for that site. Pages which have been replaced because of errors are noted in the total.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells where the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, some wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the measuring tape sticking to the wet casing.

Drill stem testing equipment was utilized in two manners during the 1975-76 drilling program. Open hole - bottom hole drill stem tests

were conducted in the Devonian sediments to locate relatively productive zones for well completion. Casing tests were performed on completed wells at Site 10, 11 and 15 because of great depth to water or low permeability in the completion zone.

Information from these drill stem tests is presented under the heading "Drill Stem Testing". Results of open hole - bottom hole tests are presented in the section containing information about the deepest well at the Site as this is the hole in which the tests were conducted. An exception to this is at Site 14 where three tests were conducted on hole 14-699 and six tests performed in 14-1590.

A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day

V = volume of production into drill collars and stem

t = total flow time of test

T = transmissivity in millidarcy-feet

M = slope of final shut-in pressure plot

K = permeability in millidarcys (1 millidarcy = $10^{-6}$ cm/sec)

h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot. Calculations of transmissivity are according to the Modified Nonequilibrium Formula or the analogous Recovery Formula as follows:

$$T = \frac{0.92\ Q\ \log_{10}\ (t_2/t_1)}{d_2 - d_1} : \quad \text{(For pumping)}$$

or

$$T = \frac{0.92\ Q\ \log_{10}\ \left[\left(\frac{t + t'}{t'}\right)_2 - \left(\frac{t + t'}{t'}\right)_1\right]}{d_2 - d_1} : \quad \text{(For recovery)}$$

where:

$d_2$, $d_1$ = depth to water at corresponding subscripted time (meters) $d_2 > t_1$

$t_2$, $t_1$ = time since pumping started, $t_2 > t_1$

$t$ = length of time pumping

$t'$ = time since pumping stopped: $\left(\frac{t + t'}{t'}\right)_2 > \left(\frac{t + t'}{t'}\right)_1$

$T$ = transmissivity in sequence meters per day

$Q$ = pumping rate in imperial gallons per minute

That portion of the drawdown plot used to calculate the transmissivity is indicated on each drawing.

## SUMMARY OF CONTENTS

SITE NUMBER FOURTEEN

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

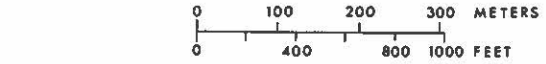
number of pages distributed for this site in 1977

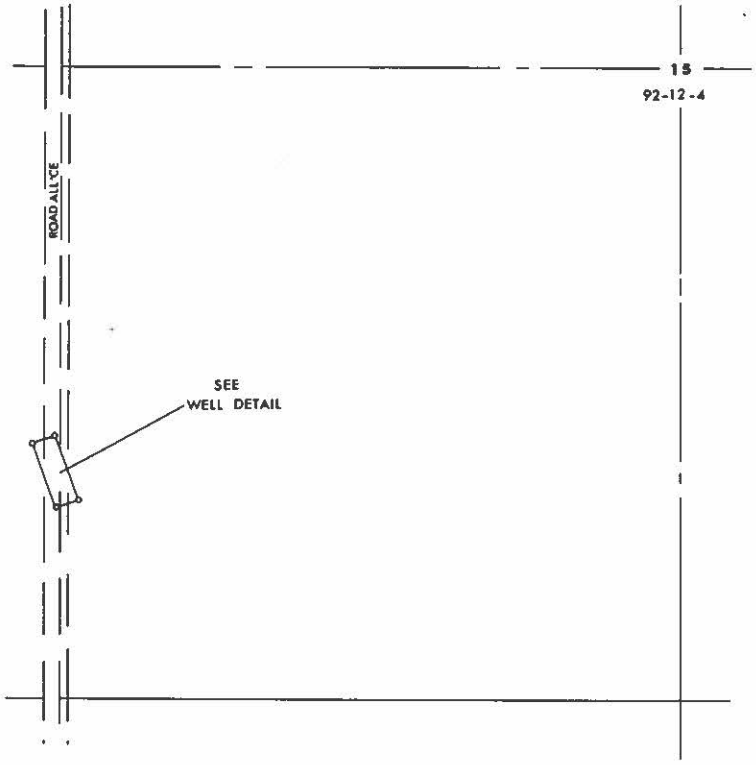
| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | site | 14-31 | 14-119 | 14-247 | 14-699 | 14-1590 |
| Introduction | 4 | — | — | — | — | — |
| Legend | 9 | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — |
| Geological Sample Description | 3 | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 1 | 1 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 0 | 5 | 11 |
| Shut-In Pressure Data | — | 0 | 0 | 0 | 2 | 10 |
| Water Analysis | — | 2 | 2 | 2 | 2 | 4 |
| Water Level Hydrograph | — | 1 | 1 | 0 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 |

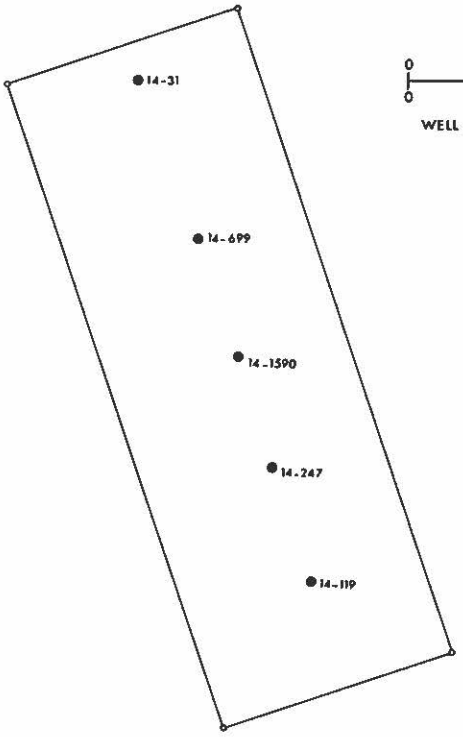
OBSERVATION WELL SITE 14

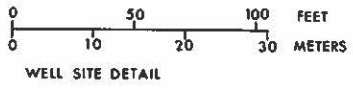
4-15-92-12 W.4 th

ALBERTA RESEARCH COUNCIL




WELL SITE DETAIL

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Fourteen

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Ground elevation 1223 Total depth 1590 feet

KB elevation 1231

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 8 | 30 | No samples | Drift |
| 30 | 80 | Clay, light-medium grey, silty, calc, boulder-chips, carb flakes on the bottom; siltstone, medium grey, sandy, calc, interbedded | |
| 80 | 130 | Sandstone, medium grey, fine grained, silty, calc cement, poor-fair porosity, qtz, hvy dark mnrls, fld, glauc traces | Clearwater |
| 130 | 140 | Siltstone, medium grey, sandy, qtz, fld, glauc and ferruginous traces; medium grey clay, inter-bedded | |
| 140 | 190 | Clay, medium grey, silty, calc, ferruginous strgrs | |
| 190 | 210 | Siltstone, lt grey, sandy, calc, glauc; clay, lt grey, calc, interbedded | |
| 210 | 225 | Siltstone, lt grey, sandy, argillaceous, calc, glauc; clay, medium grey, interbedded (20-40%) | |
| 225 | 240 | Sandstone, lt grey, fine grained, poor-fair porosity, subrounded, well sorted, poor-moderate oil stain qtz, fld, lt cht; interbedded siltstone, lt grey, clayey, carb strgrs (10-20%) | McMurray |
| 240 | 250 | Sandstone. lt grey, fine grained, fair porosity, subangular, well sorted, qtz, hvy dark mnrls; siltstone, lt grey, sandy, argillaceous (25-35%) | |
| 250 | 270 | Clay, medium grey, silty, calc | |
| 270 | 290 | Siltstone, medium grey, sandy, oil stained, qtz, fld, lt cht, hvy drk mnrls | |
| 290 | 350 | Sandstone, lt brown, coarse grained, oil stained, subangular, poorly sorted, qtz, fld, cht, hvy mnrls. Siltstone, medium grey, and dark shale in thin strgrs. Clay, grey, in the bottom | |
| 350 | 430 | Limestone, buff-lt grey, argillaceous, fossili-ferous, pyrite, leaching, recrystallization. Shale, medium-dark grey, calc, interbedded (10-20%) | Beaverhill Lake |
| 430 | 510 | Limestone, lt grey, argillaceous, fossiliferous, pyrite | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Fourteen (continued)

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 510 | 520 | Limestone as above | |
| 520 | 630 | Limestone, lt grey, argillaceous, fossiliferous, pyrite, calcite recrystallization, interbedded with shale, medium-dark grey, calc and black carb shale | |
| 630 | 640 | Limestone, lt brown, dolomitic, argillaceous, fossiliferous | |
| 640 | 710 | Limestone, lt grey-buff, argillaceous, fossiliferous (coral, crin, bry, brac), microcrystalline, calcite recrystallization; interbedded with shale, dark grey, calc (30-40%) | |
| 710 | 730 | Limestone, lt grey, dolomitic, argillaceous, fossiliferous | |
| 730 | 790 | Limestone, lt grey-buff, argillaceous, fossiliferous; shale, medium grey, calc; marlstone, medium grey, calc, thin bedded | |
| 790 | 820 | Limestone, buff, dolomitic, fossiliferous, pyrite | |
| 820 | 830 | Limestone, buff, dolomitic, fossiliferous | |
| 830 | 860 | Shale, medium grey, dolomitic with thin beds of argillaceous anhydrite | Slave Point and Watt Mountain |
| 860 | 900 | Anhydrite, white, red mottling, interbedded with buff-lt brown dolomite and medium grey dolomitic shale | Muskeg |
| 900 | 930 | Anhydrite, white, silty, interbedded with medium grey argillaceous dolomite | |
| 930 | 1030 | Rock salt, smoky grey with white-grey anhydrite and medium grey shale stringers | Prairie Evaporite |
| 1030 | 1050 | Anhydrite, lt brown and grey, dolomitic | |
| 1050 | 1170 | Rock salt, with thin beds of medium grey dolomitic shale, grey anhydrite and lt brown dolomitic anhydrite | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Fourteen (continued)

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 1170 | 1200 | Anhydrite, white, interbedded with shale, medium grey, dolomitic | |
| 1200 | 1220 | Rock salt with shale stringers | |
| 1220 | 1290 | Anhydrite, white, interbedded with medium grey, calcareous shale and smoky grey rock salt | |
| 1290 | 1345 | Rock salt, smoky grey, argillaceous; stringers of anhydrite and shale | |
| 1345 | 1375 | Anhydrite, lt brown-white, dolomitic, interbedded with shale,medium grey, calc | |
| 1375 | 1450 | Dolomite, buff-lt brown, fossiliferous (coral, crin, bry, biocl), vuggy, good-excellent porosity; thin strgrs of anhydrite and shale on the top | Methy |
| 1450 | 1540 | Dolomite, buff-lt brown, fossiliferous (coral, brac, biocl), poor vuggy porosity, carbonaceous traces in the bottom; secondary anhydrite | |
| 1540 | 1560 | Shale, dark brown-black, slightly dolomitic, carbonaceous interbedded with dolomite, buff-lt brown, fossiliferous (reefal), poor vuggy porosity, anhydrite traces | |
| 1560 | 1590 | Dolomite, buff-lt brown, fossiliferous (reefal on the top), partially granular, poor vuggy porosity, carbonaceous and anhydrite traces | |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 13
## 8 – 11 – 90 – 12 W4th
ALBERTA RESEARCH COUNCIL

GEOLOGICAL LOG

DRILLING RATE (MIN. PER 10 FEET)
0 50 100

– SP +(MV)
10 32.5 67.5 87.5

RESISTANCE (OHMS)
0 100 800 2400 4000

GAMMA (CPS)

NEUTRON (API UNITS)

0
100
200
300
400
500
600
700
800
900
1000
1100
1200

Qd
Kg
Kc
Km
Dbl

SHIFT

20 70 170 270

SCALE CHANGE

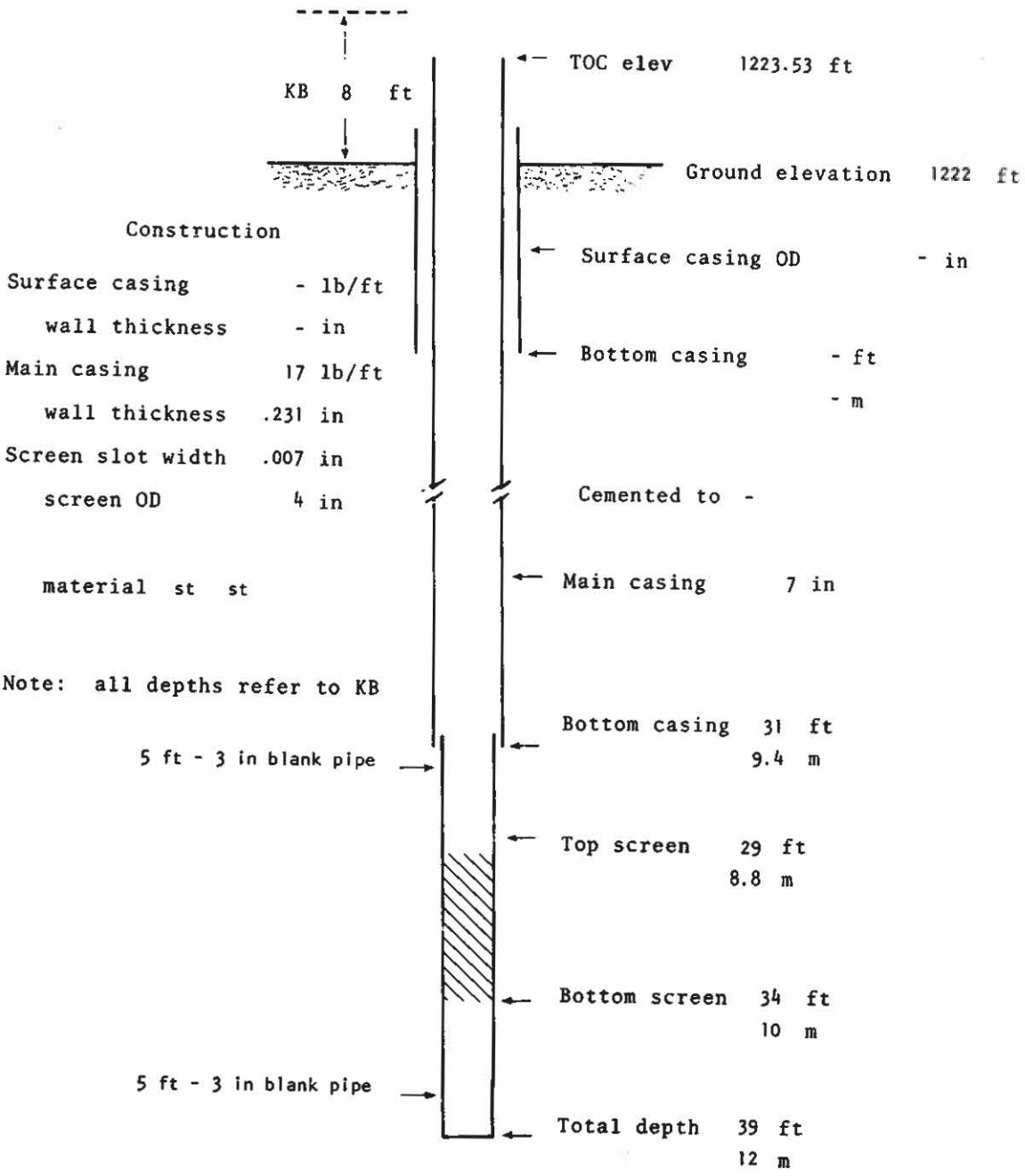
13-G-77

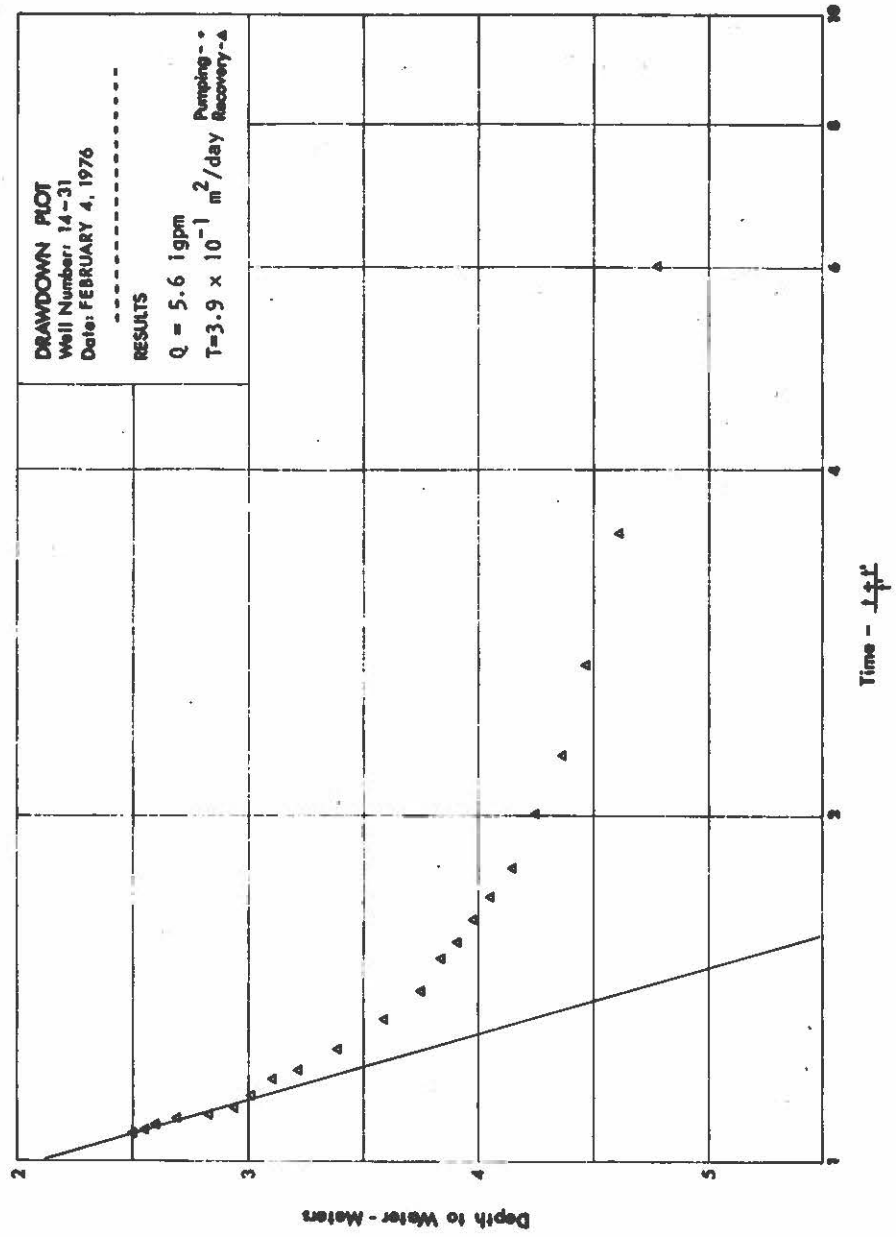
WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Tp 92 R 12 W 4th

Alberta Research Council




DRAWDOWN PLOT
Well Number: 14-31
Date: FEBRUARY 4, 1976
RESULTS
Q = 5.6 igpm
T=3.9 x 10⁻¹ m²/day
Pumping - •
Recovery - ▲
Depth to Water - Meters
Time - t+t'/t'

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed from 14-31

Date sampled February 9, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 121.0 | 6.04 | 28.6 |
| Magnesium ($Mg^{++}$) | 73.0 | 6.01 | 28.5 |
| Sodium ($Na^{+}$) | 204.0 | 8.87 | 42.1 |
| Potassium ($K^{+}$) | 6.7 | 0.17 | 0.8 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 627.0 | 10.28 | 53.5 |
| Sulfate ($SO_4^{=}$) | 410.0 | 8.54 | 44.4 |
| Chloride ($Cl^{-}$) | 14.0 | 0.39 | 2.1 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 6.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1250.0 | | |
| Total Anions (epm) | 19.2 | Total Cations (epm) | 21.1 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1900 | Temperature (C) | | |
| pH | 7.3 | pH | 6.9 | |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 639 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 15, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 112.0 | 5.59 | 24 |
| Magnesium ($Mg^{++}$) | 71.0 | 5.84 | 25 |
| Sodium ($Na^{+}$) | 266.0 | 11.57 | 50 |
| Potassium ($K^{+}$) | 6.7 | 0.17 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 522.0 | 8.56 | 39 |
| Sulfate ($SO_4^{=}$) | 535.0 | 11.14 | 50 |
| Chloride ($Cl^{-}$) | 90.0 | 2.54 | 11 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0 |
| Silica ($SiO_2$) | 5.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 112.2 | | |
| Magnesium (Acidified) | 67.1 | | |
| Total dissolved solids | 1368 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 22.24 | Total Cations (epm) | 23.17 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2000 | Temperature (C) | 5.0 |
| pH | 7.3 | pH | 7.2 |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 542 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 7, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 131.0 | 6.54 | 30.7 |
| Magnesium ($Mg^{++}$) | 64.0 | 5.27 | 24.8 |
| Sodium ($Na^{+}$) | 214.0 | 9.31 | 43.8 |
| Potassium ($K^{+}$) | 5.8 | 0.15 | 0.7 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 603.0 | 9.88 | 43.6 |
| Sulfate ($SO_4^{=}$) | 562.0 | 11.70 | 51.6 |
| Chloride ($Cl^{-}$) | 38.0 | 1.07 | 4.7 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 3.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 118.0 | | |
| Magnesium (Acidified) | 55.0 | | |
| Total dissolved solids | 1218.0 | | |
| Total Anions (epm) | 22.66 | Total Cations (epm) | 21.26 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1900 | Temperature (C) | 6.0 |
| pH | 7.7 | pH | 7.1 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 678.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Date sampled: July 15, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .338 |
| Au | <.003 | Mo | <.006 |
| Al | 0.22 | Na | 258 |
| As | <.038 | Ni | <.010 |
| B | .554 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 112 | Si | 2.65 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 1.17 |
| Cr | <.006 | Te | <.065 |
| Cu | <.0004 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 1.64 | V | .006 |
| K | 33 | W | <.078 |
| Mg | 60.8 | Zn | .088 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Date sampled: July 15, 1976
(duplicate of other sample of this date)

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | 0.32 |
| Au | <.003 | Mo | <.006 |
| Al | 0.22 | Na | 244 |
| As | <.038 | Ni | <.010 |
| B | .518 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | .003 | Se | <.060 |
| Ca | 114 | Si | 2.50 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 1.08 |
| Cr | <.006 | Te | <.065 |
| Cu | .013 | Ti | .003 |
| Eu | <.015 | U | <.020 |
| Fe | 1.60 | V | .013 |
| K | 99 | W | <.078 |
| Mg | 58.2 | Zn | .099 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 07, 1978

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 116.0 | 5.79 | 28.3 |
| Magnesium(Mg) | 57.0 | 4.69 | 23.0 |
| Sodium(Na) | 226.0 | 9.83 | 48.1 |
| Potassium(K) | 5.0 | 0.13 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 615.0 | 10.08 | 49.0 |
| Sulphate(SO4) | 414.0 | 8.62 | 41.9 |
| Chloride(Cl) | 66.0 | 1.86 | 9.0 |
| Nitrate(NO3) | 1.6 | 0.03 | 0.1 |
| Silica(SiO2) | 6.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 117.0 | | |
| Magnesium(Acidified) | 61.0 | | |
| TDS(mg/l) | 1208.0 | | |
| Total Anions(epm) | 20.59 | Total Cations(epm) | 20.44 |

## Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1590 | | Temperature(C) | 5.00 | |
| pH | 7.1 | | pH | 7.0 | |
| Fluoride(F) | 0.3 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 654 | mg/l |
| | | | Hydroxide(OH) | | |

14-31-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 96.0 | 4.79 | 25.5 |
| Magnesium(Mg) | 62.0 | 5.10 | 27.2 |
| Sodium(Na) | 201.0 | 8.74 | 46.6 |
| Potassium(K) | 5.0 | 0.13 | 0.7 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 500.0 | 8.20 | 40.1 |
| Sulphate(SO4) | 502.0 | 10.45 | 51.1 |
| Chloride(Cl) | 64.0 | 1.80 | 8.8 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 5.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 97.0 | | |
| Magnesium(Acidified) | 52.0 | | |
| TDS(mg/l) | 1136.0 | | |
| Total Anions(epm) | 20.45 | Total Cations(epm) | 18.76 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1520 | Temperature(C) | 4.00 | |
| pH | 7.6 | pH | 6.9 | |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 629 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 14-31-E-82

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 5, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 113.0 | 5.65 | 31.5 |
| Magnesium(Mg) | 64.0 | 5.33 | 29.8 |
| Sodium(Na) | 156.0 | 6.78 | 37.9 |
| Potassium(K) | 5.8 | 0.15 | 0.8 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 310.0 | 5.08 | 33.4 |
| Sulphate(SO4) | 420.0 | 8.75 | 57.5 |
| Chloride(Cl) | 49.0 | 1.38 | 9.1 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 3.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 90.0 | | |
| Magnesium(Acidified) | 54.0 | | |
| TDS(mg/l) | 961.0 | | |
| Total Anions(epm) | 15.21 | Total Cations(epm) | 17.91 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1450 |
| pH | 8.3 |
| Fluoride | 0.1 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 4.50 | |
| pH | 7.0 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 620 | mg/l |
| Hydroxide(OH) | | |

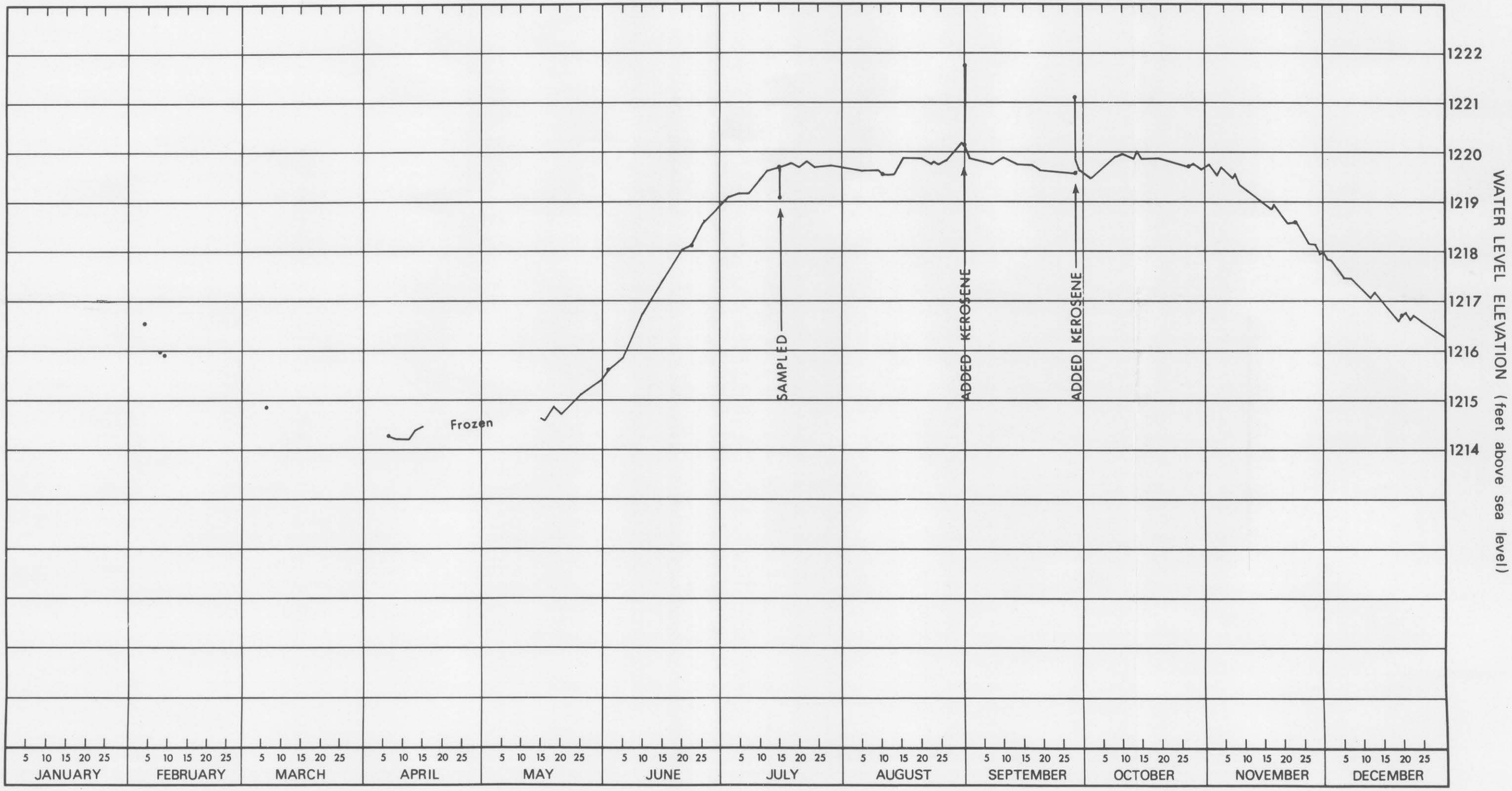
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **14-31**

Lsd **4** Sec **15** Twp **92** R **12** W4th

Alberta Research Council

14 - 31 - H - 77




1976

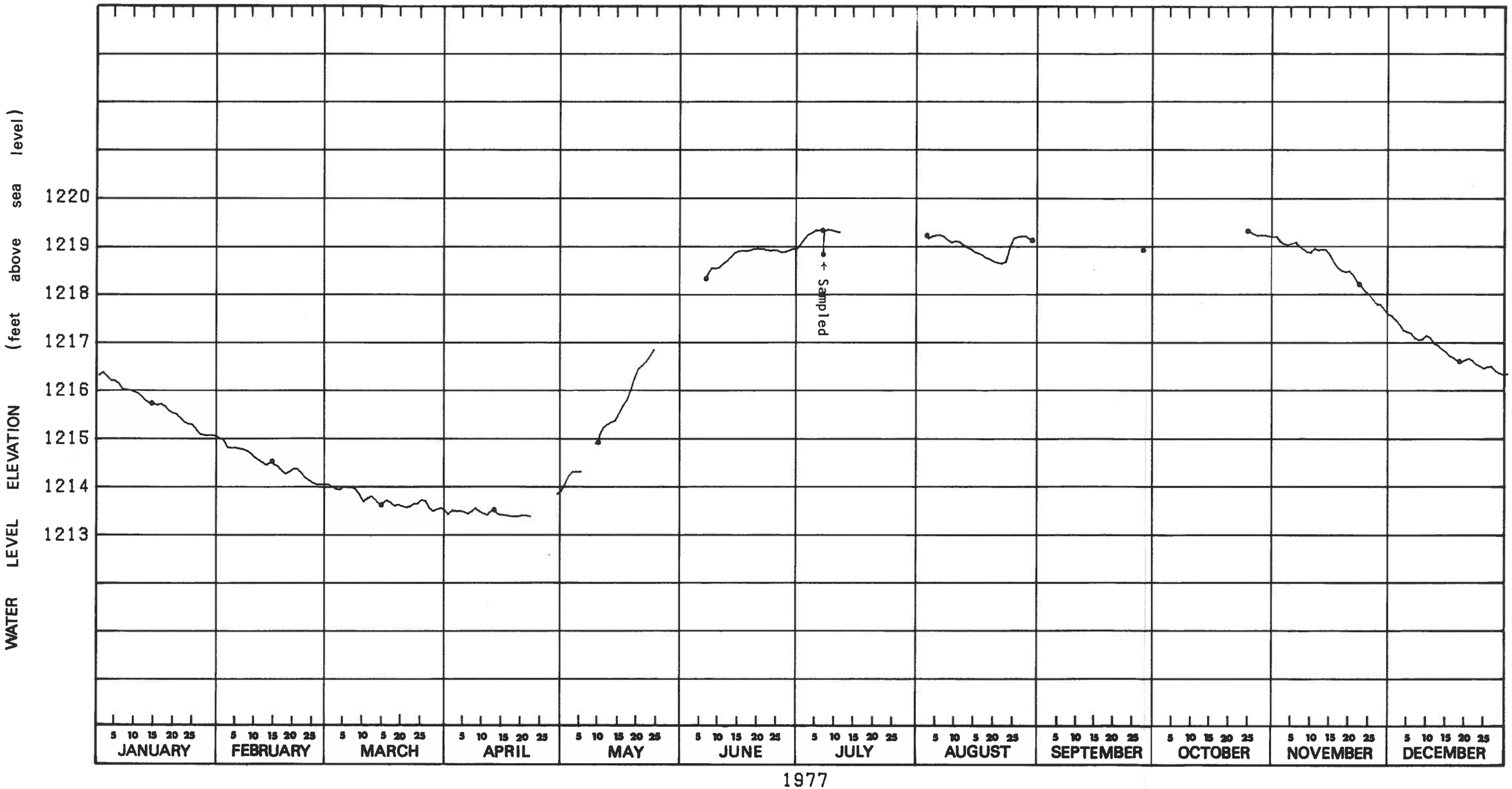
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-31-H-78




1977

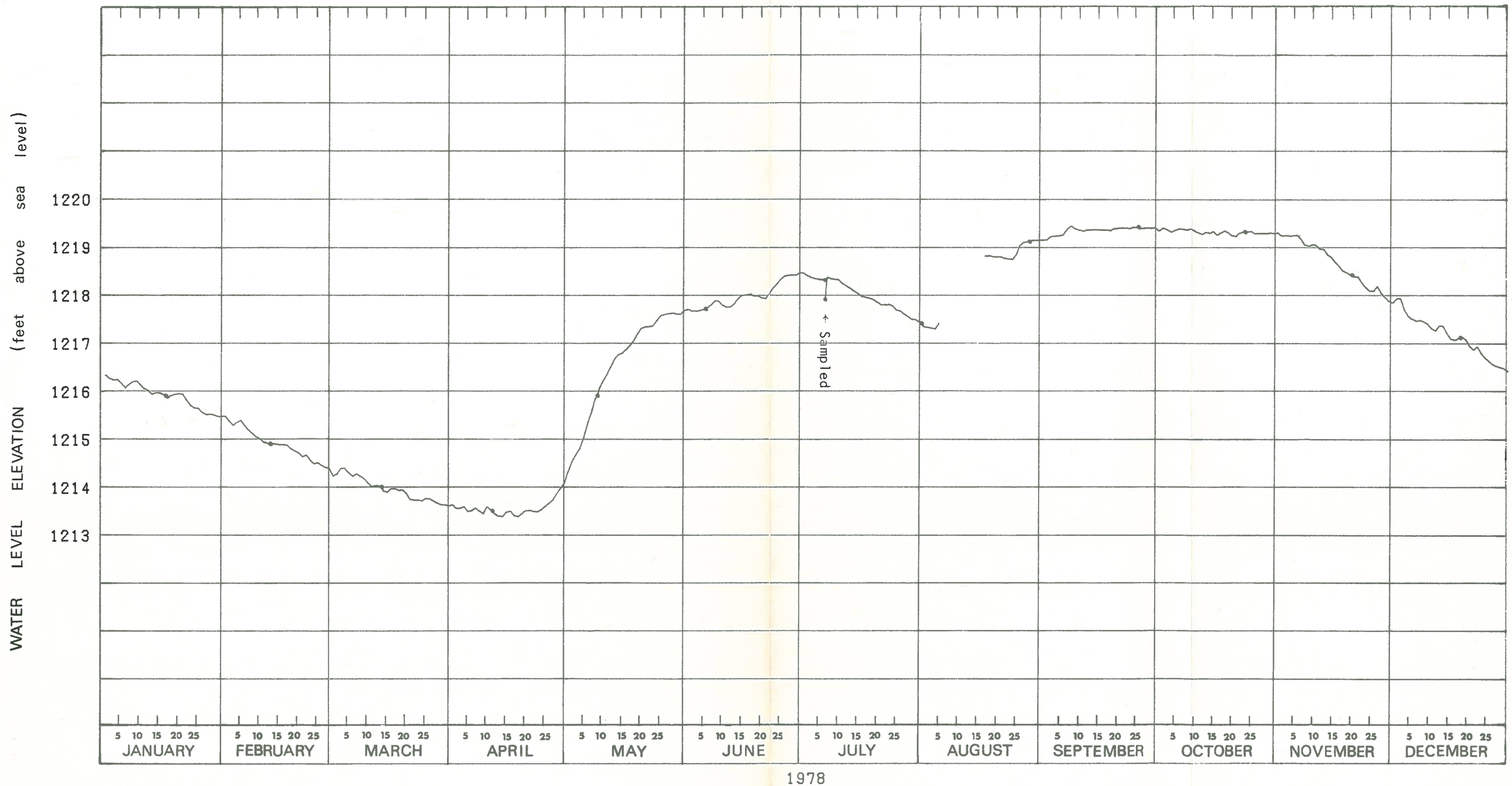
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-31

LSD 4 SEC 15 TWP 92 R 12 W4TH

14-31-H-79

Alberta Research Council




1978

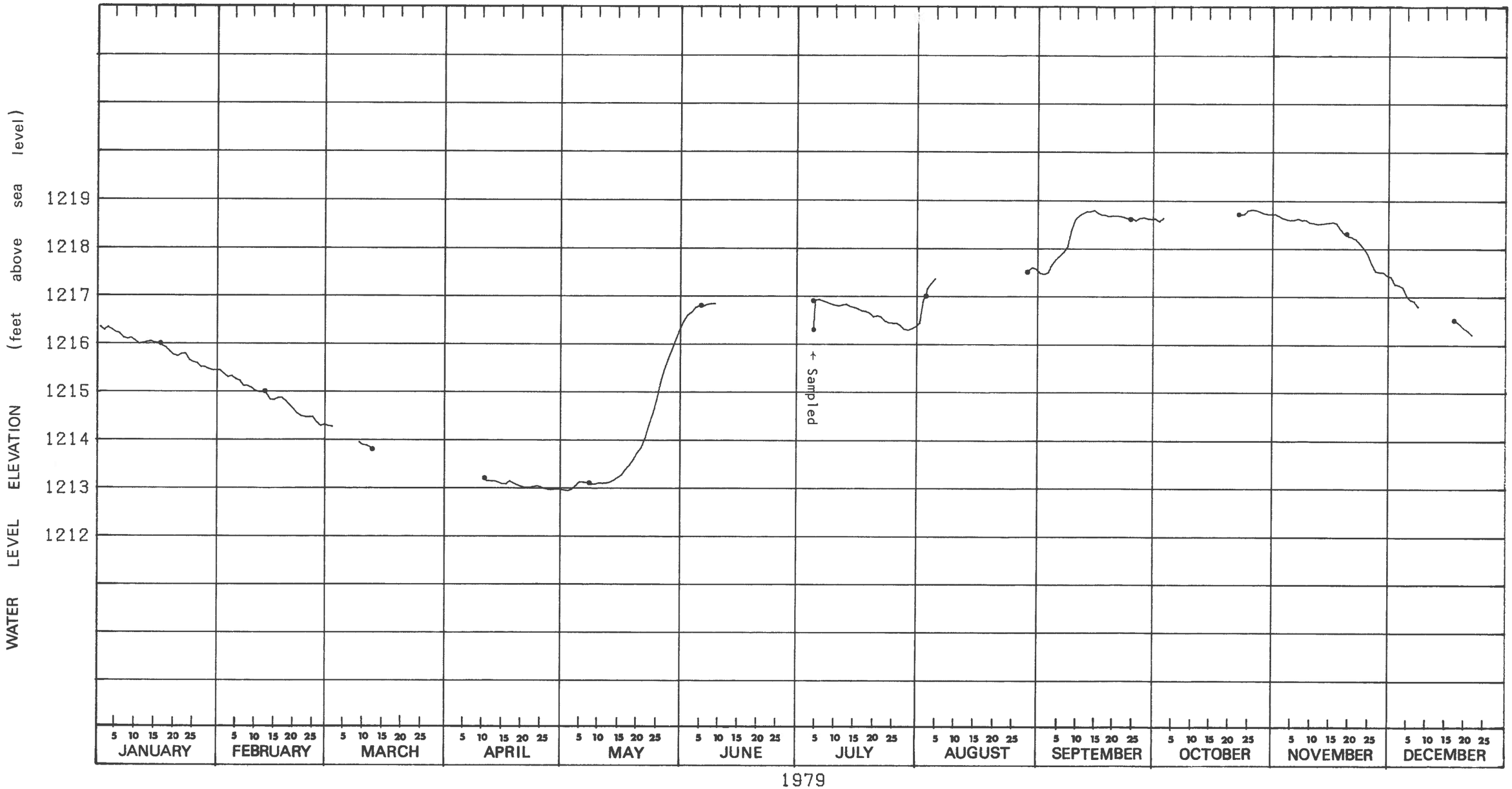
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-31

14-31-H-80

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council



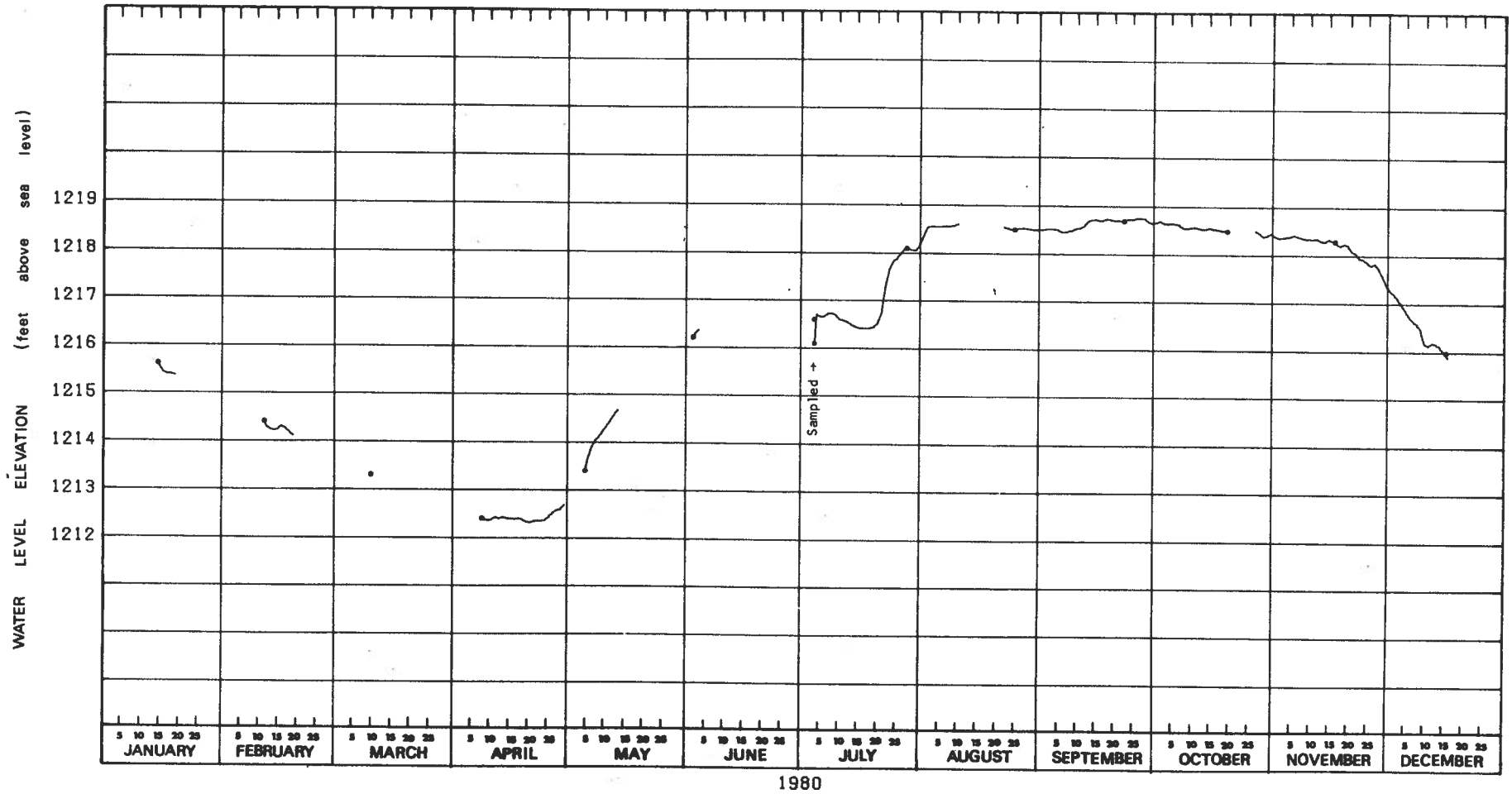
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-31-H-81



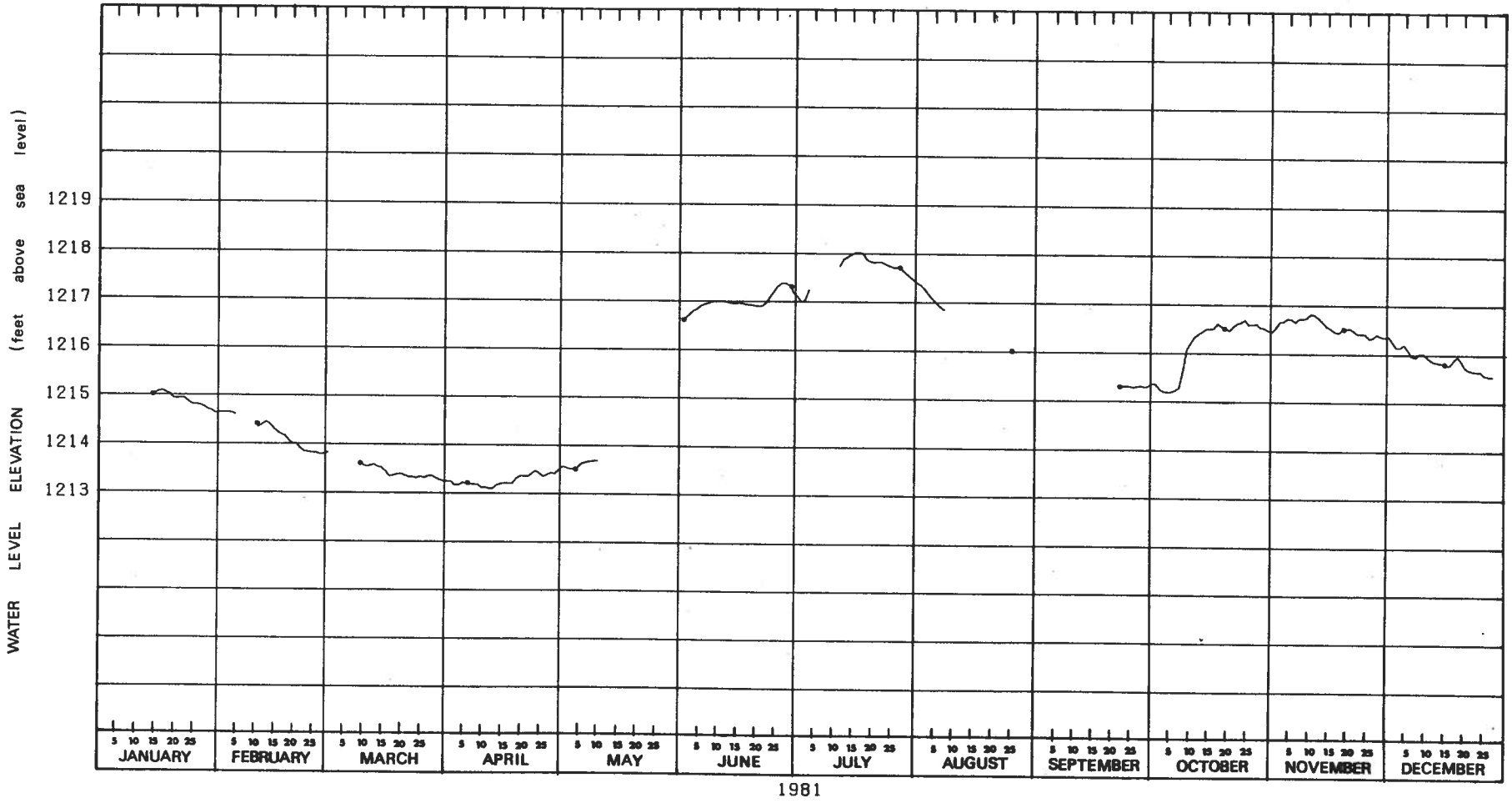
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-31-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1223.53

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 3/76 | | | Well completed |
| Feb 4/76 | 2.13 TOC | 1216.5 | Bail test, Q = 5 IGPM, T = 28 IGPD/FT |
| Feb 8/76 | 2.31 TOC | 1215.9 | |
| Feb 9/76 | 2.33 TOC | 1215.9 | Water sample |
| Mar 6/76 | 3.36 MP | 1214.9 | MP = 0.71 m TOC, (1225.9) |
| Apr 6/76 | 3.54 MP | 1214.3 | |
| May 4/76 | 3.30 MP approx. | 1215.1 | Frozen |
| June 1/76 | 3.13 MP | 1215.6 | |
| June 22/76 | 2.36 MP | 1218.2 | |
| July 15/76 | 1.89 MP | 1219.7 | |
| | 2.07 MP | 1219.1 | After sample; temp. 5°C |
| Aug 10/76 | 1.93 MP | 1219.6 | |
| Aug 31/76 | 1.74 MP | 1220.2 | Added 9 gallons of kerosene; |
| | 0.85 MP | 1221.8 | water level elevation adjusted downward by 1.3 ft after this date |
| Sept 28/76 | 1.52 MP | 1219.6 | Added 5 gallons of kerosene, |
| | 0.82 MP | 1221.1 | water level elevation adjusted downward by 2.1 ft after this date |
| Oct 26/76 | 1.24 MP | 1219.7 | |
| Nov 23/76 | 1.57 MP | 1218.6 | |
| Dec 20/76 | 2.15 MP | 1216.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1223.53

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 2.46 MP | 1215.7 | MP (1225.9) water level elevation adjusted downward by 2.1 ft to compensate for kerosene |
| Feb 15/77 | 2.84 MP | 1214.5 | |
| Mar 15/77 | 3.10 MP | 1213.6 | |
| Apr 13/77 | 3.15 MP | 1213.5 | |
| May 10/77 | 2.72 MP | 1214.9 | |
| June 7/77 | 1.68 MP | 1218.3 | |
| July 7/77 | 1.37 MP | 1219.3 | |
| | 1.51 MP | 1218.8 | After sample; temp. 6°C |
| Aug 3/77 | 1.40 MP | 1219.2 | |
| Aug 30/77 | 1.42 MP | 1219.1 | |
| Sept 28/77 | 1.48 MP | 1218.9 | |
| Oct 25/77 | 1.38 MP | 1219.3 | |
| Nov 23/77 | 1.70 MP | 1218.2 | |
| Dec 19/77 | 2.18 MP | 1216.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1223.53

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 2.40 MP | 1215.9 | MP (1225.9) Water level elevation adjusted downward by 2.1 ft to compensate for kerosene |
| Feb 13/78 | 2.72 MP | 1214.9 | |
| Mar 14/78 | 2.98 MP | 1214.0 | |
| Apr 12/78 | 3.15 MP | 1213.5 | |
| May 9/78 | 2.42 MP | 1215.9 | |
| June 6/78 | 1.85 MP | 1217.7 | |
| July 7/78 | 1.66 MP | 1218.3 | |
| | 1.79 MP | 1217.9 | After sample; temp 5°C |
| Aug 1/78 | 1.95 MP | 1217.4 | |
| Aug 29/78 | 1.42 MP | 1219.1 | |
| Sept 26/78 | 1.33 MP | 1219.4 | |
| Oct 24/78 | 1.37 MP | 1219.3 | |
| Nov 21/78 | 1.65 MP | 1218.4 | |
| Dec 19/78 | 2.04 MP | 1217.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-31

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1223.53

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 2.39 MP | 1216.0 | MP (1225.9) Water level elevation adjusted downward by 2.1 ft to compensate for kerosene |
| Feb 13/79 | 2.68 MP | 1215.0 | |
| Mar 13/79 | 3.05 MP | 1213.8 | |
| Apr 11/79 | 3.22 MP | 1213.2 | |
| May 8/79 | 3.25 MP | 1213.1 | |
| June 6/79 | 2.12 MP | 1216.8 | |
| July 5/79 | 2.11 MP | 1216.9 | |
| | 2.27 MP | 1216.3 | After sample; temp. 4°C |
| Aug 3/79 | 2.06 MP | 1217.0 | |
| Aug 29/79 | 1.73 MP | 1217.5 | New MP 0.54m TOC (1225.3) |
| Sept 25/79 | 1.41 MP | 1218.6 | |
| Oct 23/79 | 1.36 MP | 1218.7 | |
| Nov 20/79 | 1.50 MP | 1218.3 | |
| Dec 18/79 | 2.04 MP | 1216.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14 - 31

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1223.53

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 2.31 MP | 1215.6 | |
| Feb 12/80 | 2.68 MP | 1214.4 | |
| Mar 11/80 | 3.02 MP | 1213.3 | |
| Apr 9/80 | 3.28 MP | 1212.4 | |
| May 6/80 | 2.99 MP | 1213.4 | |
| June 3/80 | 2.14 MP | 1216.2 | |
| July 5/80 | 2.00 MP | 1216.6 | Temp. 4.5°C |
| | 2.16 MP | 1216.1 | After Sample |
| July 29/80 | 1.56 MP | 1218.1 | |
| Aug 26/80 | 1.42 MP | 1218.5 | |
| Sept 24/80 | 1.37 MP | 1218.7 | |
| Oct 21/80 | 1.42 MP | 1218.5 | |
| Nov 18/80 | 1.49 MP | 1218.3 | |
| Dec 17/80 | 2.18 MP | 1216.0 | |
| Jan 15/81 | 2.51 MP | 1215.0 | |
| Feb 11/81 | 2.68 MP | 1214.4 | |
| Mar 10/81 | 2.94 MP | 1213.6 | |
| Apr 7/81 | 3.05 MP | 1213.2 | |
| May 5/81 | 2.96 MP | 1213.5 | |
| June 2/81 | 2.01 MP | 1216.6 | |
| June 30/81 | 1.81 MP | 1217.3 | |
| July 28/81 | 1.69 MP | 1217.7 | |
| Aug 26/81 | 2.21 MP | 1216.0 | |
| Sept 23/81 | 2.40 MP | 1215.3 | |
| Oct 20/81 | 2.04 MP | 1216.5 | |
| Nov 20/81 | 2.05 MP | 1216.5 | |
| Dec 16/81 | 2.25 MP | 1215.8 | |

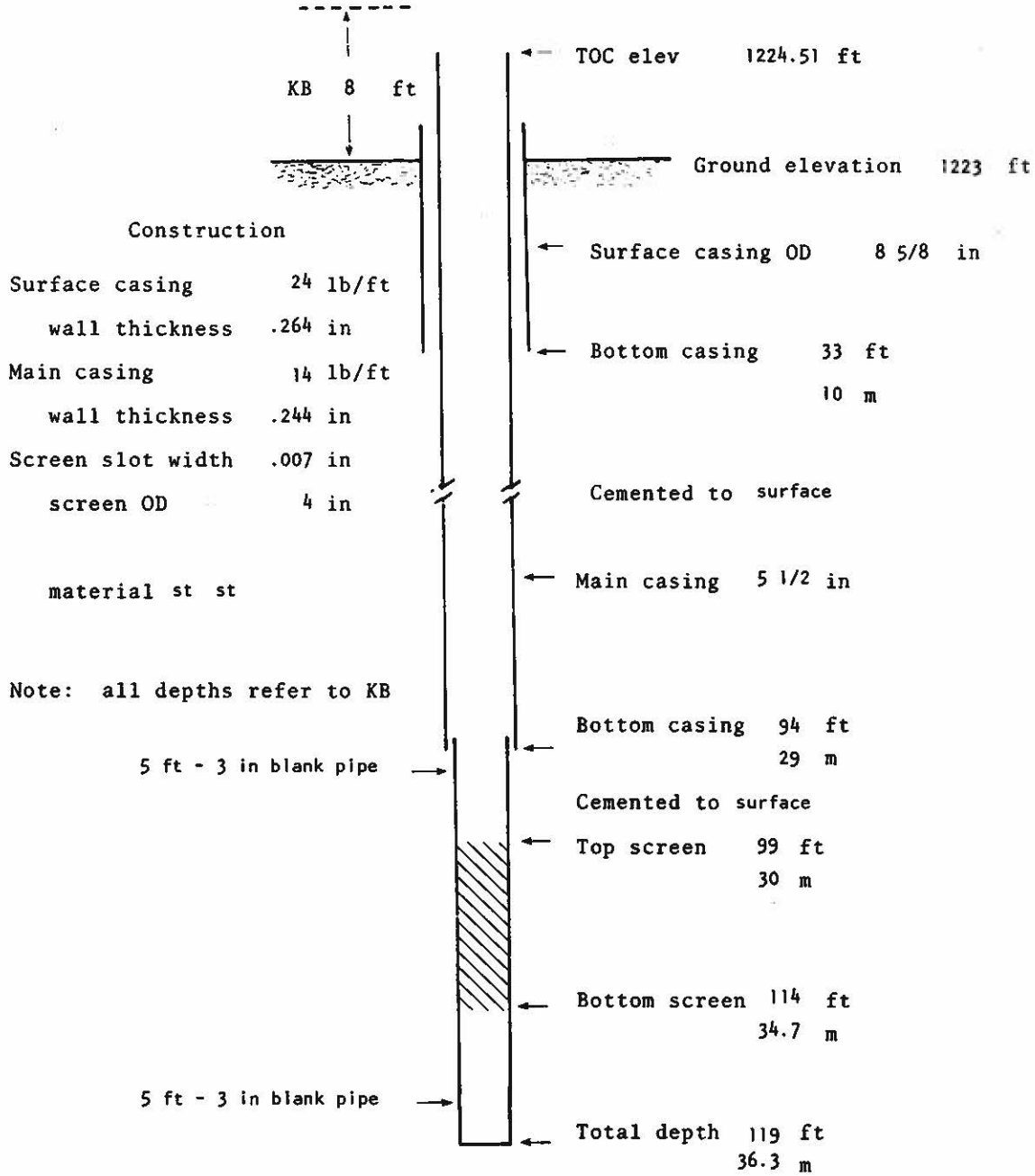
MP - Depth from measuring point
TOC - Depth from top of casing

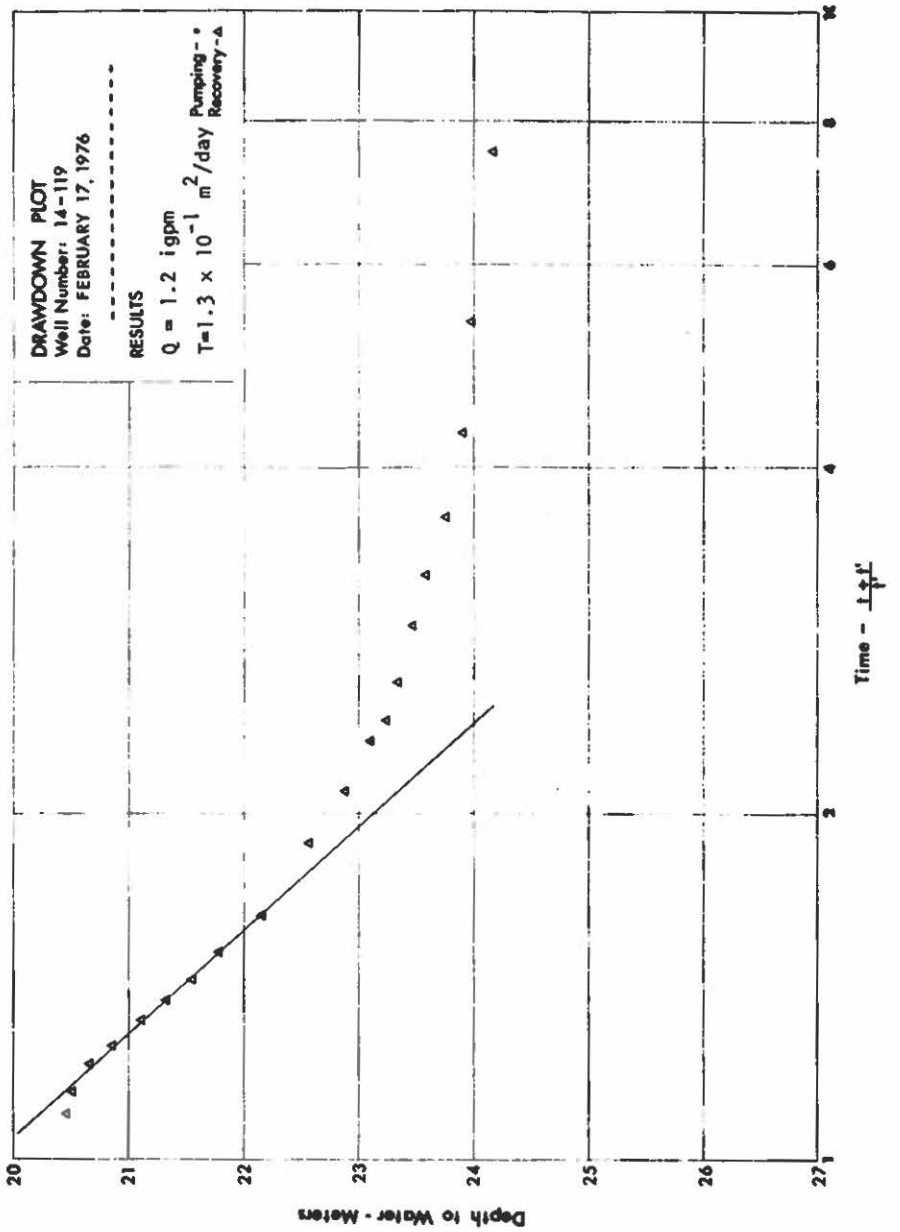
WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Tp 92 R 12 W 4th

Alberta Research Council




DRAWDOWN PLOT
Well Number: 14-119
Date: FEBRUARY 17, 1976
RESULTS
Q = 1.2 igpm
T=1.3 x 10^-1 m^2/day
Pumping - •
Recovery - Δ
Depth to Water - Meters
Time - t+t'/t'
20
21
22
23
24
25
26
27
1
2
4
6
8
∞

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed from 14-119

Date sampled February 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 14.7 | 0.73 | 2.2 |
| Magnesium ($Mg^{++}$) | 6.5 | 0.53 | 1.6 |
| Sodium ($Na^{+}$) | 737.0 | 32.06 | 95.7 |
| Potassium ($K^{+}$) | 7.1 | 0.18 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 995.0 | 16.31 | 48.8 |
| Sulfate ($SO_4^{=}$) | 13.9 | 0.29 | 0.9 |
| Chloride ($Cl^{-}$) | 594.0 | 16.75 | 50.1 |
| Nitrate ($NO_3^{=}$) | 5.2 | 0.08 | 0.3 |
| Silica ($SiO_2$) | 19.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1844.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 33.4 | Total Cations (epm) | 33.5 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 3300 | Temperature (C) | |
| pH | 8.3 | pH | 8.9 |
| Fluoride ($F^{-}$) | 0.7 ppm | Carbonate ($CO_3^{=}$) | 132 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 832 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 15, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 8.8 | 0.44 | 1 |
| Magnesium ($Mg^{++}$) | 8.7 | 0.72 | 1 |
| Sodium ($Na^{+}$) | 1450.0 | 63.07 | 98 |
| Potassium ($K^{+}$) | 7.9 | 0.20 | 0 |
| Carbonate ($CO_3^{=}$) | 14.4 | 0.48 | 1 |
| Bicarbonate ($HCO_3^{-}$) | 1837.0 | 30.11 | 47 |
| Sulfate ($SO_4^{=}$) | 3.3 | 0.07 | 0 |
| Chloride ($Cl^{-}$) | 1176.0 | 33.16 | 52 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 5.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 9.2 | | |
| Magnesium (Acidified) | 9.0 | | |
| Total dissolved solids | 3580 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 63.83 | Total Cations (epm) | 64.43 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 6500 | Temperature (C) | 7.0 | |
| pH | 8.2 | pH | 8.5 | |
| Fluoride ($F^{-}$) | 0.9 Mg/L | Carbonate ($CO_3^{=}$) | 48 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 1795 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 7, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.9 | 0.14 | 0.3 |
| Magnesium ($Mg^{++}$) | 3.6 | 0.30 | 0.6 |
| Sodium ($Na^{+}$) | 1038.0 | 45.15 | 98.5 |
| Potassium ($K^{+}$) | 8.8 | 0.23 | 0.5 |
| Carbonate ($CO_3^{=}$) | 209.0 | 6.97 | 13.6 |
| Bicarbonate ($HCO_3^{-}$) | 1274.0 | 20.88 | 40.7 |
| Sulfate ($SO_4^{=}$) | 14.5 | 0.30 | 0.6 |
| Chloride ($Cl^{-}$) | 820.0 | 23.12 | 45.1 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 0.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 17.5 | | |
| Magnesium (Acidified) | 10.6 | | |
| Total dissolved solids | 2472.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 51.28 | Total Cations (epm) | 45.82 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 5000 | Temperature (C) | 7.0 |
| pH | 9.4 | pH | 9.6 |
| Fluoride ($F^{-}$) | 0.7 ppm | Carbonate ($CO_3^{=}$) | 240.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 756.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Date sampled: July 15, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .023 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 1859 |
| As | <.038 | Ni | <.010 |
| B | 4.05 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 11.33 | Si | 3.25 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 1.13 |
| Cr | <.006 | Te | <.065 |
| Cu | .018 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .044 | V | <.0008 |
| K | 22 | W | <.078 |
| Mg | 10.68 | Zn | .033 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

14-119-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 07, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 6.3 | 0.31 | 0.5 |
| Magnesium(Mg) | 7.9 | 0.65 | 1.0 |
| Sodium(Na) | 1438.0 | 62.55 | 98.5 |
| Potassium(K) | 0.0 | 0.00 | 0.0 |
| Carbonate(CO3) | 19.2 | 0.64 | 1.0 |
| Bicarbonate(HCO3) | 1862.0 | 30.52 | 46.1 |
| Sulphate(SO4) | 4.3 | 0.09 | 0.1 |
| Chloride(Cl) | 1240.0 | 34.97 | 52.8 |
| Nitrate(NO3) | 2.1 | 0.03 | 0.1 |
| Silica(SiO2) | 5.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 6.5 | | |
| Magnesium(Acidified) | 8.0 | | |
| TDS(mg/l) | 3482.0 | | |
| Total Anions(epm) | 66.25 | Total Cations(epm) | 63.51 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 5080 | | Temperature(C) | 5.50 | |
| pH | 8.4 | | pH | 8.5 | |
| Fluoride(F) | 0.9 | mg/l | Carbonate(CO3) | 53 | mg/l |
| | | | Bicarbonate(HCO3) | 1806 | mg/l |
| | | | Hydroxide(OH) | | |

14-119-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.4 | 0.12 | 0.3 |
| Magnesium(Mg) | 2.4 | 0.20 | 0.5 |
| Sodium(Na) | 993.0 | 43.19 | 98.7 |
| Potassium(K) | 9.6 | 0.25 | 0.6 |
| Carbonate(CO3) | 185.0 | 6.17 | 13.3 |
| Bicarbonate(HCO3) | 861.0 | 14.11 | 30.5 |
| Sulphate(SO4) | 27.8 | 0.58 | 1.3 |
| Chloride(Cl) | 900.0 | 25.38 | 54.9 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 1.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 2.5 | | |
| Magnesium(Acidified) | 2.3 | | |
| TDS(mg/l) | 2200.0 | | |
| Total Anions(epm) | 46.25 | Total Cations(epm) | 43.76 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3860 | | Temperature(C) | 4.50 | |
| pH | 9.3 | | pH | 9.5 | |
| Fluoride(F) | 0.9 | mg/l | Carbonate(CO3) | 254 | mg/l |
| | | | Bicarbonate(HCO3) | 751 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 14-119-E-82

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 5, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 31.0 | 1.55 | 2.1 |
| Magnesium(Mg) | 31.0 | 2.58 | 3.6 |
| Sodium(Na) | 1556.0 | 67.65 | 93.5 |
| Potassium(K) | 22.0 | 0.56 | 0.8 |
| Carbonate(CO3) | 24.0 | 0.80 | 1.2 |
| Bicarbonate(HCO3) | 659.0 | 10.80 | 15.8 |
| Sulphate(SO4) | 21.0 | 0.44 | 0.6 |
| Chloride(Cl) | 2000.0 | 56.34 | 82.4 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 2.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 34.0 | | |
| Magnesium(Acidified) | 25.7 | | |
| TDS(mg/l) | 4005.0 | | |
| Total Anions(epm) | 68.38 | Total Cations(epm) | 72.35 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 7000 |
| pH | 8.6 |
| Fluoride | 0.0 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 10.00 | |
| pH | 8.1 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 844 | mg/l |
| Hydroxide(OH) | | |

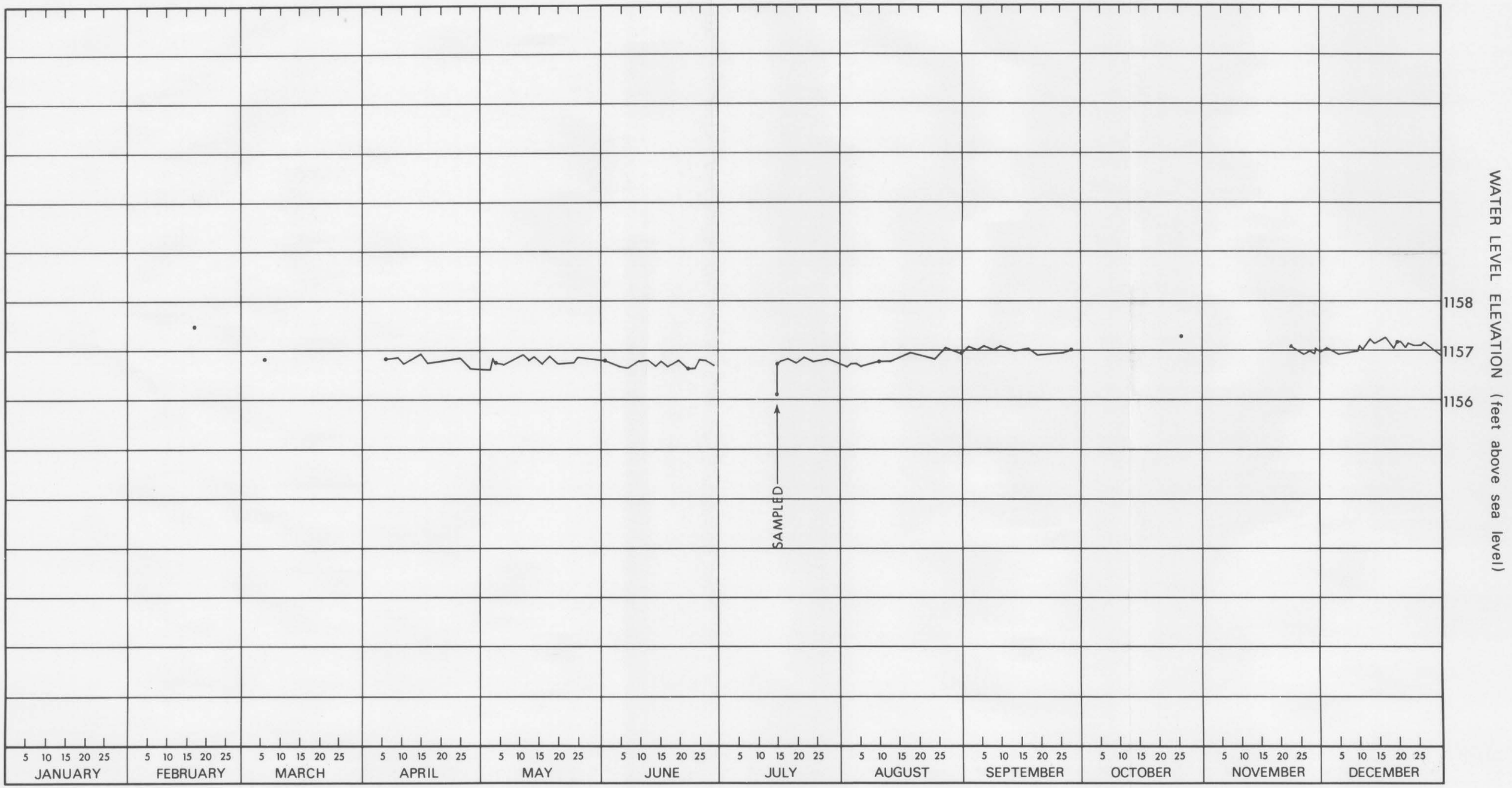
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-119

14 - 119 - H - 77

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council




1976

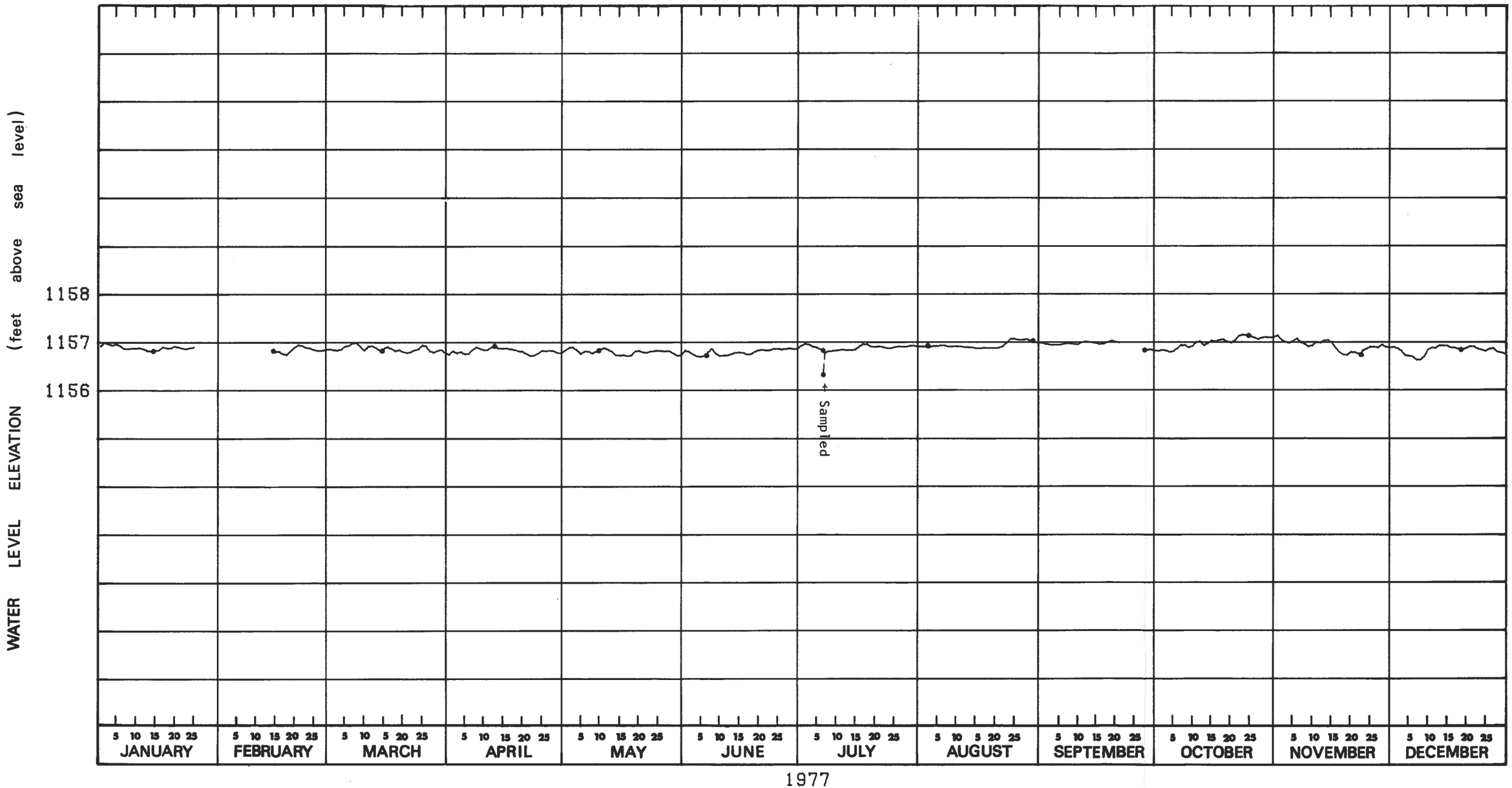
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-119-H-78




1977

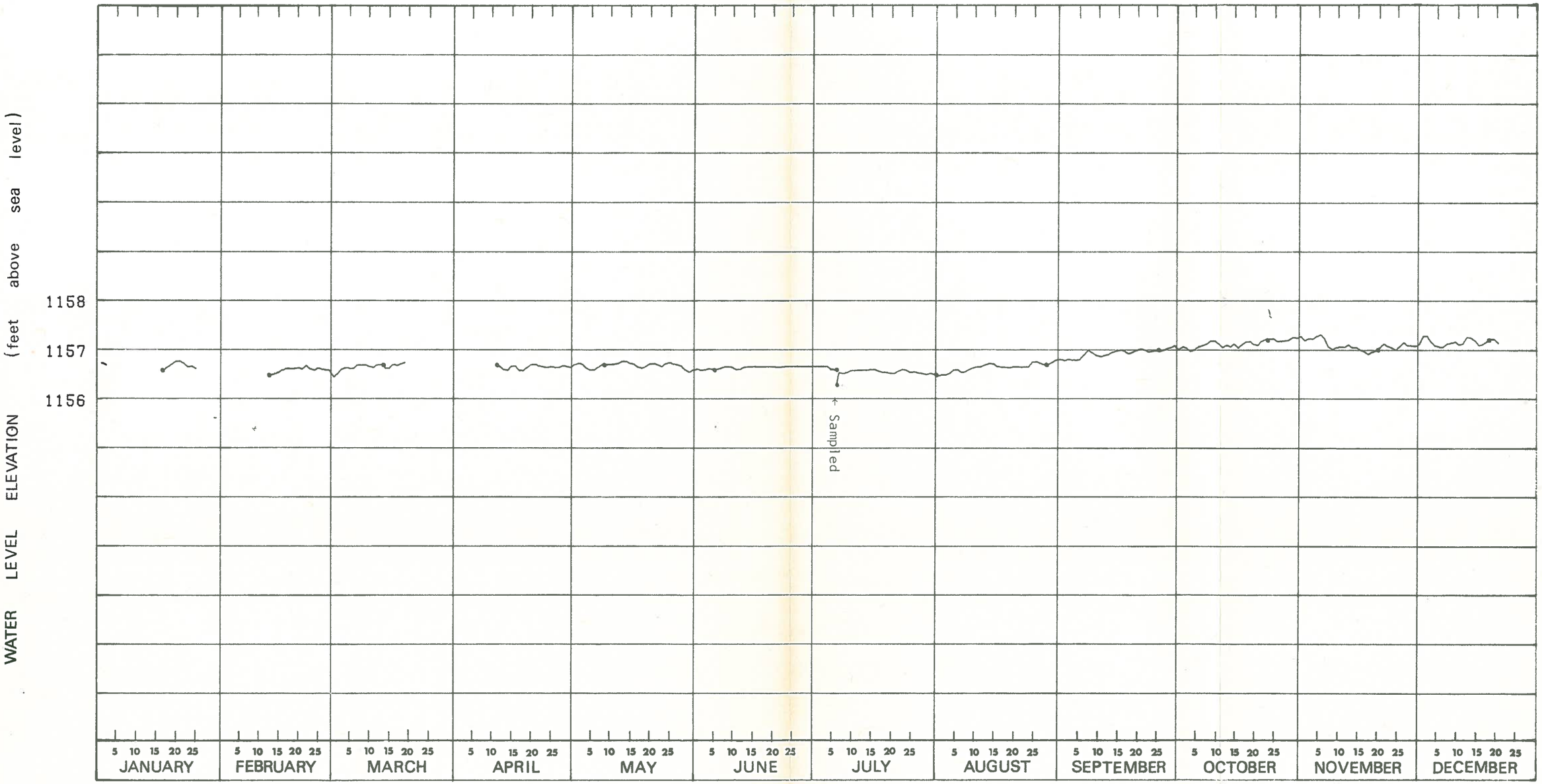
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-119

LSD 4 SEC 15 TWP 92 R 12 W4TH

Alberta Research Council

14-119-H-79




1978

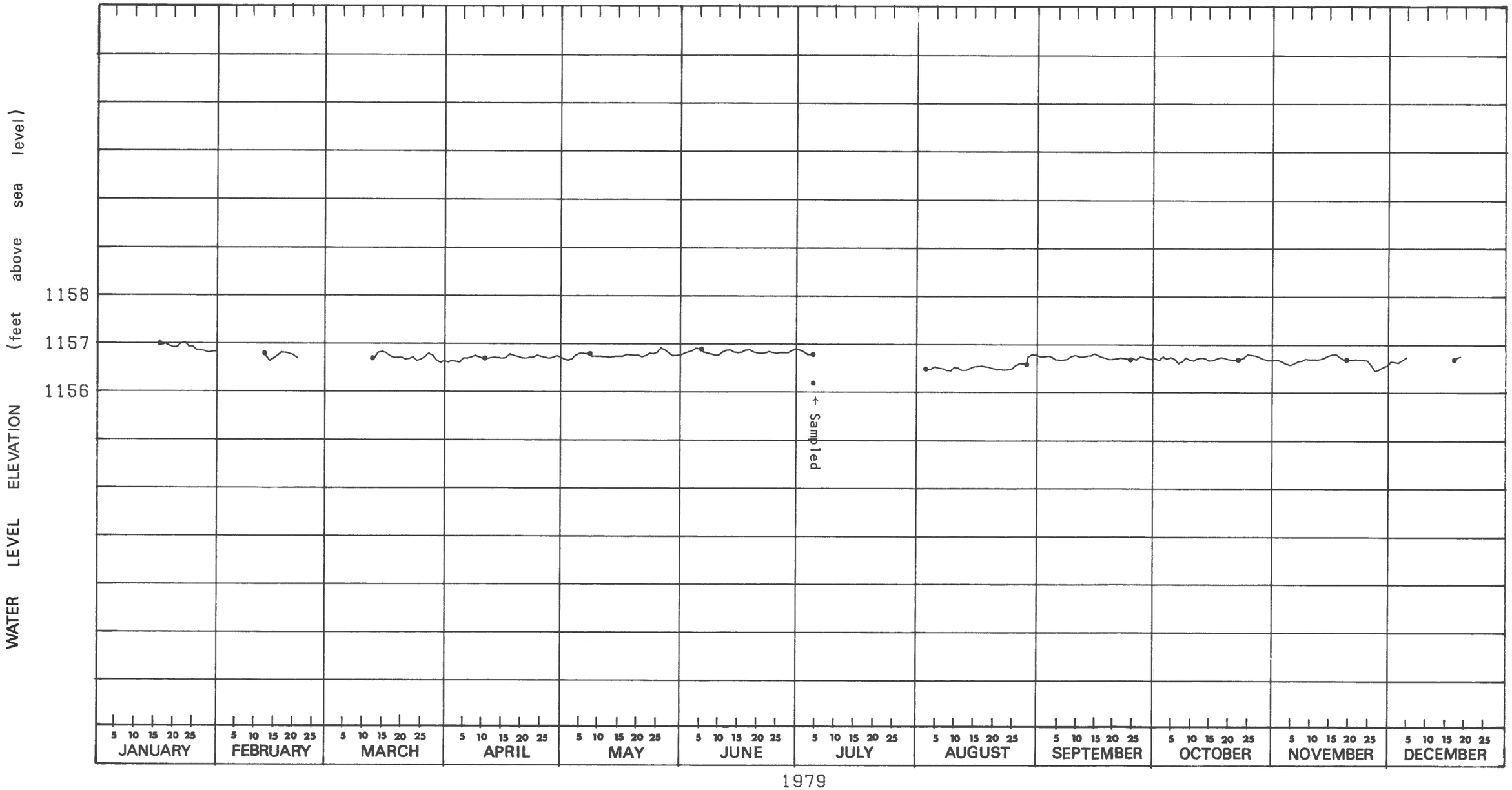
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-119-H-80



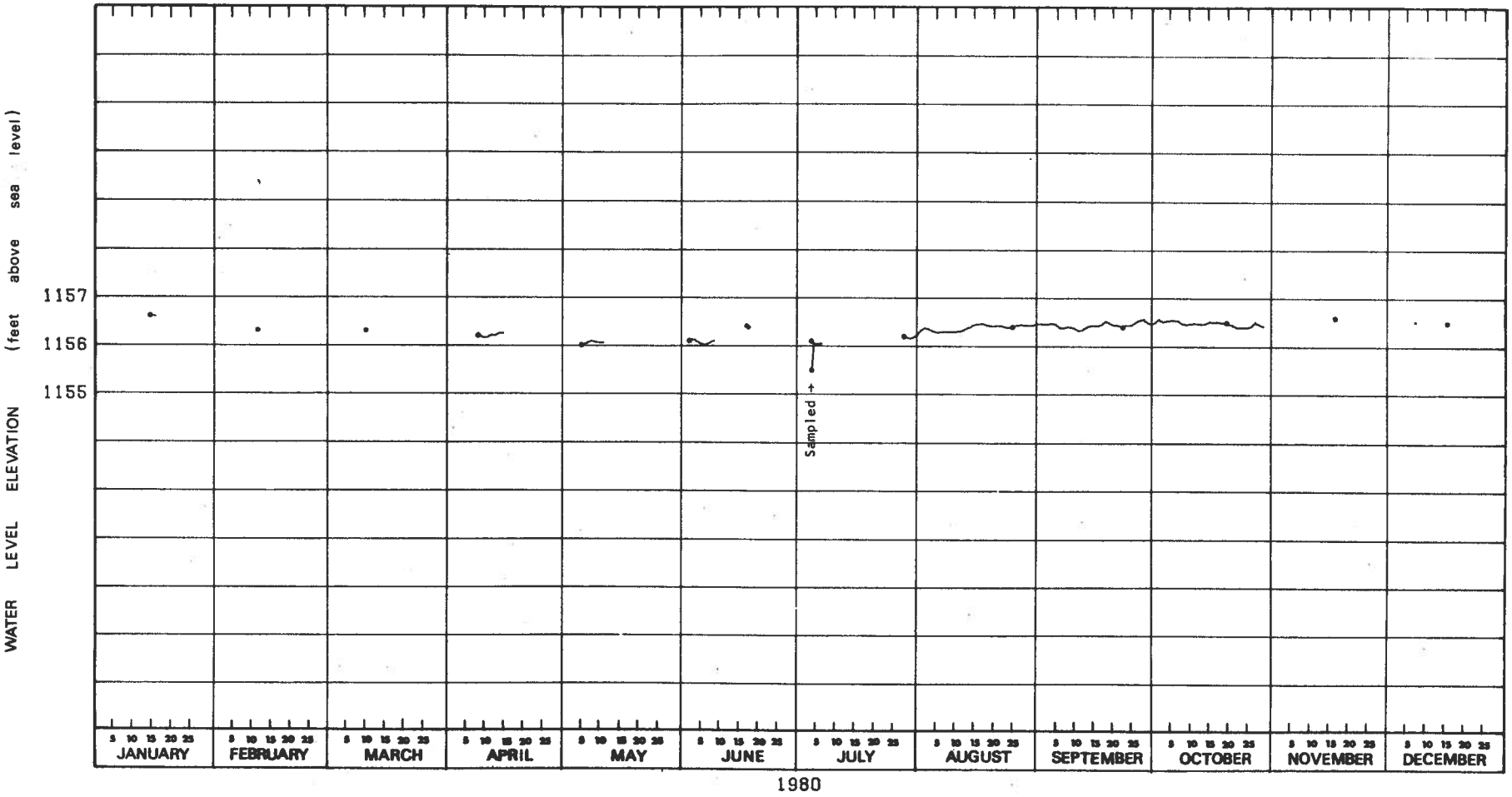
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-119-H-81



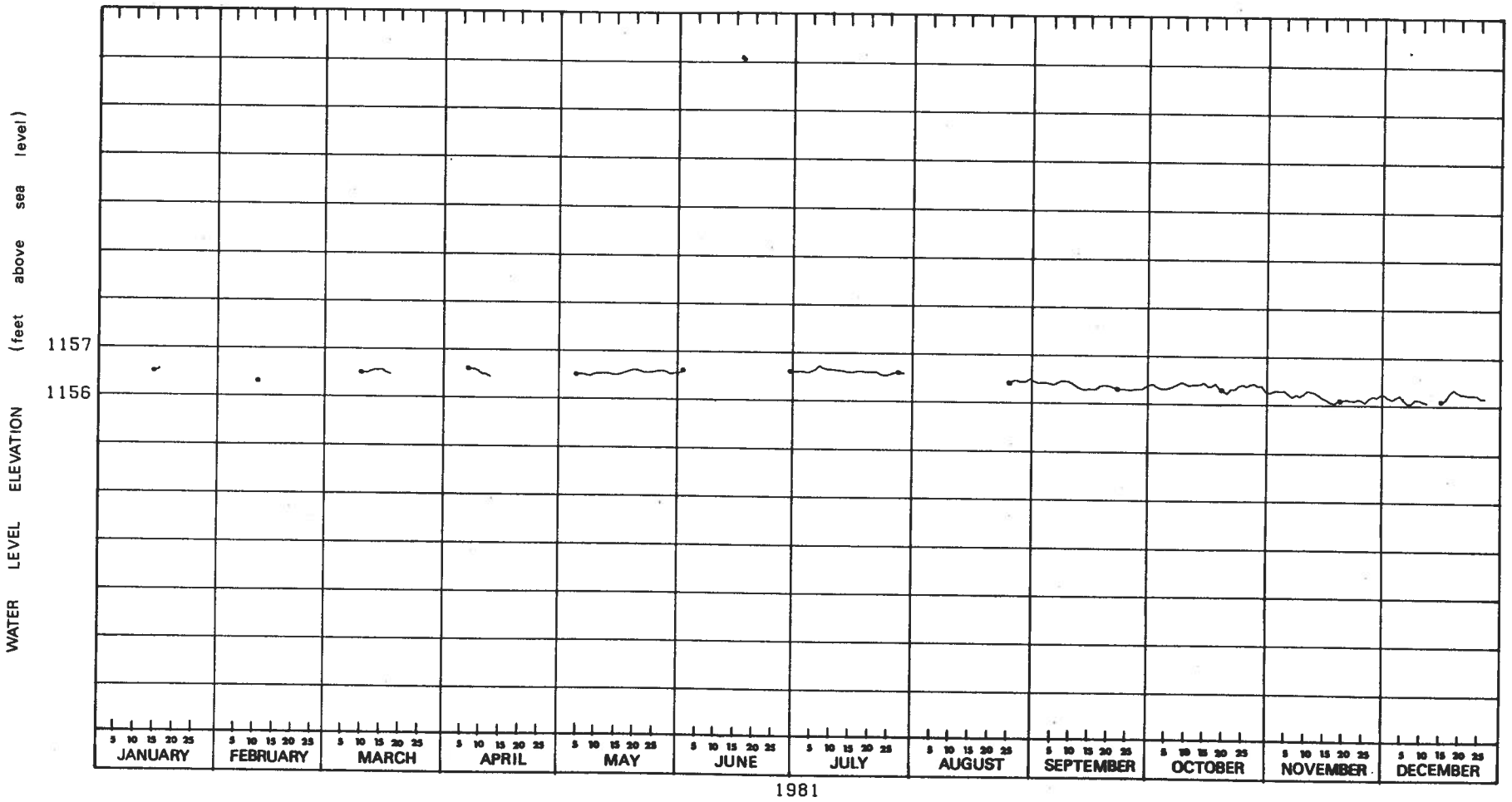
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-119-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1224.51

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 17/76 | 20.43 TOC | 1157.5 | Well completed; bail test, |
| | 20.47 TOC | 1157.4 | Q = 1 IGPM, T = 8.7 IGPD/FT, MP - 0.78 m TOC, (1227.1) |
| Mar 6/76 | 21.41 MP | 1156.9 | |
| Apr 6/76 | 21.41 MP | 1156.9 | |
| May 4/76 | 21.44 MP | 1156.8 | |
| June 1/76 | 21.42 MP | 1156.8 | |
| June 22/76 | 21.47 MP | 1156.7 | |
| July 15/76 | 21.44 MP | 1156.8 | |
| | 21.63 MP | 1156.1 | After sample; temp. 7°C |
| Aug 10/76 | 21.43 MP | 1156.8 | |
| Aug 31/76 | 21.38 MP | 1157.0 | |
| Sept 28/76 | 21.35 MP | 1157.1 | |
| Oct 26/76 | 21.28 MP | 1157.3 | |
| Nov 23/76 | 21.35 MP | 1157.1 | |
| Dec 20/76 | 21.31 MP | 1157.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1224.51

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 21.44 MP | 1156.8 | MP (1227.1) |
| Feb 15/77 | 21.42 MP | 1156.8 | |
| Mar 15/77 | 21.43 MP | 1156.8 | |
| Apr 13/77 | 21.40 MP | 1156.9 | |
| May 10/77 | 21.44 MP | 1156.8 | |
| June 7/77 | 21.46 MP | 1156.7 | |
| July 7/77 | 21.42 MP | 1156.8 | |
| | 21.57 MP | 1156.3 | After sample; temp. 7°C |
| Aug 3/77 | 21.39 MP | 1156.9 | |
| Aug 30/77 | 21.38 MP | 1157.0 | |
| Sept 28/77 | 21.43 MP | 1156.8 | |
| Oct 25/77 | 21.35 MP | 1157.1 | |
| Nov 23/77 | 21.46 MP | 1156.7 | |
| Dec 19/77 | 21.42 MP | 1156.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1224.51

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 21.49 MP | 1156.6 | MP (1227.1) |
| Feb 13/78 | 21.51 MP | 1156.5 | |
| Mar 14/78 | 21.47 MP | 1156.7 | |
| Apr 12/78 | 21.47 MP | 1156.7 | |
| May 9/78 | 21.47 MP | 1156.7 | |
| June 6/78 | 21.49 MP | 1156.6 | |
| July 7/78 | 21.49 MP | 1156.6 | |
| | 21.57 MP | 1156.3 | After sample; temp 5.5°C |
| Aug 1/78 | 21.51 MP | 1156.5 | |
| Aug 29/78 | 21.46 MP | 1156.7 | |
| Sept 26/78 | 21.37 MP | 1157.0 | |
| Oct 24/78 | 21.32 MP | 1157.2 | |
| Nov 21/78 | 21.37 MP | 1157.0 | |
| Dec 19/78 | 21.30 MP | 1157.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-119

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1224.51

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 21.36 MP | 1157.0 | MP (1227.1) |
| Feb 13/79 | 21.42 MP | 1156.8 | |
| Mar 13/79 | 21.45 MP | 1156.7 | |
| Apr 11/79 | 21.47 MP | 1156.7 | |
| May 8/79 | 21.44 MP | 1156.8 | |
| June 6/79 | 21.40 MP | 1156.9 | |
| July 5/79 | 21.44 MP | 1156.8 | |
| | 21.60 MP | 1156.2 | After sample; temp. 4.5°C |
| Aug 3/79 | 21.22 MP | 1156.5 | New MP 0.50m TOC (1226.1) |
| Aug 29/79 | 21.19 MP | 1156.6 | |
| Sept 25/79 | 21.16 MP | 1156.7 | |
| Oct 23/79 | 21.15 MP | 1156.7 | |
| Nov 20/79 | 21.15 MP | 1156.7 | |
| Dec 18/79 | 21.17 MP | 1156.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

14 - 119 - W - 82

WELL HISTORY

OBSERVATION WELL NUMBER 14 - 119

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1224.51

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 21.20 MP | 1156.6 | |
| Feb 12/80 | 21.29 MP | 1156.3 | |
| Mar 11/80 | 21.27 MP | 1156.3 | |
| Apr 9/80 | 21.32 MP | 1156.2 | |
| May 6/80 | 21.37 MP | 1156.0 | |
| June 3/80 | 21.34 MP | 1156.1 | |
| July 5/80 | 21.34 MP | 1156.1 | Temp. 10°C |
| | 21.53 MP | 1155.5 | After Sample |
| July 29/80 | 21.31 MP | 1156.2 | |
| Aug 26/80 | 21.26 MP | 1156.4 | |
| Sept 24/80 | 21.24 MP | 1156.4 | |
| Oct 21/80 | 21.21 MP | 1156.5 | |
| Nov 18/80 | 21.18 MP | 1156.6 | |
| Dec 17/80 | 21.22 MP | 1156.5 | |
| Jan 15/81 | 21.22 MP | 1156.5 | |
| Feb 11/81 | 21.28 MP | 1156.3 | |
| Mar 10/81 | 21.22 MP | 1156.5 | |
| Apr 7/81 | 21.19 MP | 1156.6 | |
| May 5/81 | 21.21 MP | 1156.5 | |
| June 2/81 | 21.18 MP | 1156.6 | |
| June 30/81 | 21.18 MP | 1156.6 | |
| July 28/81 | 21.20 MP | 1156.6 | |
| Aug 26/81 | 21.26 MP | 1156.4 | |
| Sept 23/81 | 21.28 MP | 1156.3 | |
| Oct 20/81 | 21.29 MP | 1156.3 | |
| Nov 20/81 | 21.33 MP | 1156.1 | |
| Dec 16/81 | 21.33 MP | 1156.1 | |

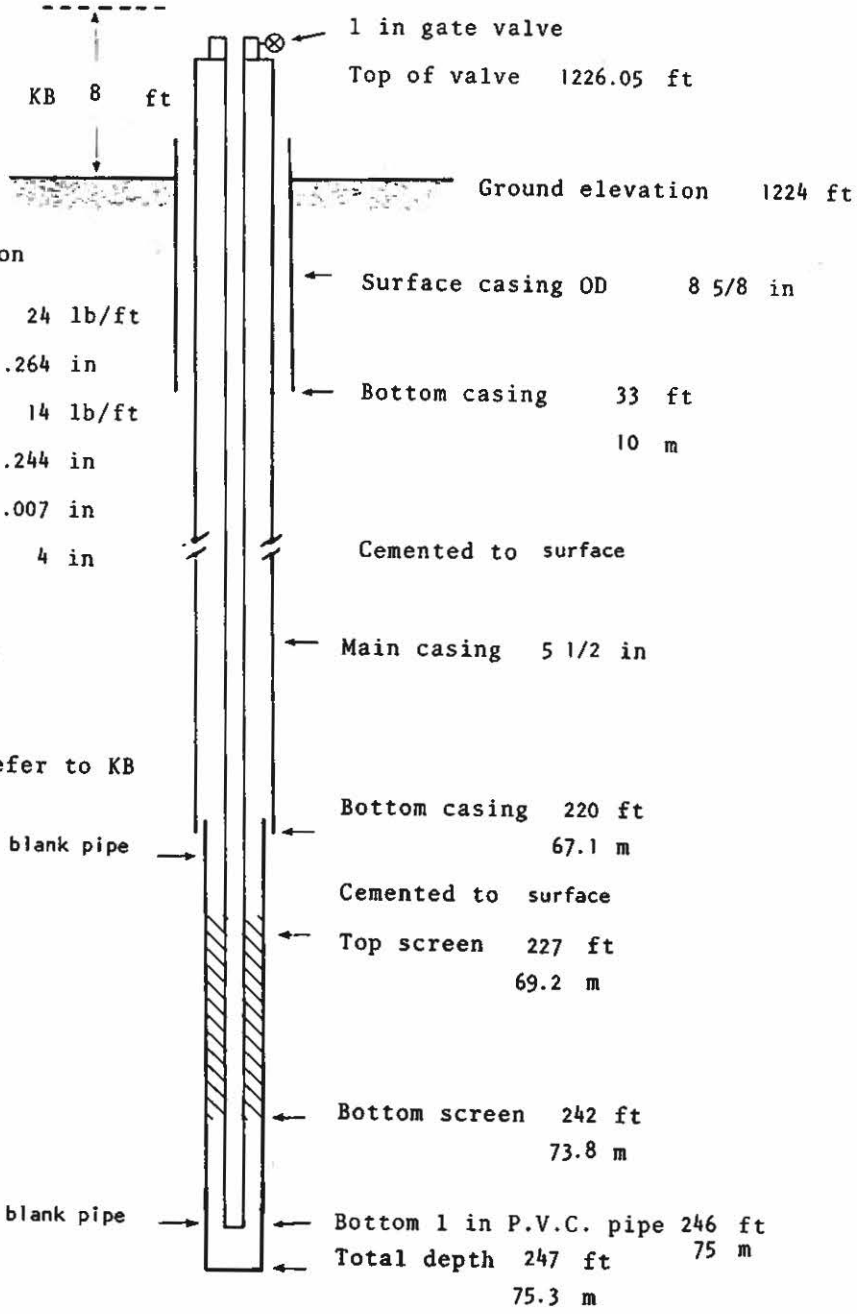
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Tp 92 R 12 W4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| material | st | st |

Note: all depths refer to KB

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed from 14-247

Date sampled February 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 173.0 | 8.63 | 5.4 |
| Magnesium ($Mg^{++}$) | 79.0 | 6.50 | 4.1 |
| Sodium ($Na^{+}$) | 3281.0 | 142.71 | 89.6 |
| Potassium ($K^{+}$) | 57.0 | 1.46 | 0.9 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 2113.0 | 34.63 | 19.7 |
| Sulfate ($SO_4^{=}$) | 29.0 | 0.60 | 0.3 |
| Chloride ($Cl^{-}$) | 5000.0 | 141.00 | 80.0 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 16.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 9320.0 | | |
| Total Anions (epm) 176.2 | | Total Cations (epm) 159.3 | |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | >8000 |
| pH | 7.3 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 7.2 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | 2152 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 12 R 92 W4th

Alberta Research Council

Sample source Bailed

Date sampled October 26, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 109.0 | 5.44 | 3 |
| Magnesium ($Mg^{++}$) | 75.0 | 6.17 | 3 |
| Sodium ($Na^{+}$) | 4038.0 | 175.64 | 93 |
| Potassium ($K^{+}$) | 32.1 | 0.82 | 0 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1891.0 | 30.99 | 27 |
| Sulfate ($SO_4^{=}$) | 16.9 | 0.35 | 0 |
| Chloride ($Cl^{-}$) | 3020.0 | 85.17 | 73 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 0 |
| Silica ($SiO_2$) | 11.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 10420 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 116.53 | Total Cations (epm) | 188.08 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 78,000 | Temperature (C) |
| pH | 7.4 | pH |
| Fluoride ($F^{-}$) | 0.3 mg/l | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 7, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 95.0 | 4.74 | 2.7 |
| Magnesium ($Mg^{++}$) | 68.0 | 5.60 | 3.2 |
| Sodium ($Na^{+}$) | 3738.0 | 162.59 | 93.6 |
| Potassium ($K^{+}$) | 33.3 | 0.85 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1603.0 | 26.27 | 14.9 |
| Sulfate ($SO_4^{=}$) | 14.5 | 0.30 | 0.2 |
| Chloride ($Cl^{-}$) | 5320.0 | 150.03 | 84.9 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 2.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 93.0 | | |
| Magnesium (Acidified) | 59.0 | | |
| Total dissolved solids | 10074.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 176.61 | Total Cations (epm) | 173.78 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 9.0 |
| pH | 7.4 | pH | 7.3 |
| Fluoride ($F^{-}$) | 0.8 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 1434.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Date sampled: October 26, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .246 |
| Au | <.003 | Mo | <.006 |
| Al | 0.22 | Na | 3883 |
| As | <.038 | Ni | <.010 |
| B | 3.73 | P | <.110 |
| Ba | 5.17 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 109.6 | Si | 5.25 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 7.14 |
| Cr | <.006 | Te | <.065 |
| Cu | .043 | Ti | .004 |
| Eu | <.015 | U | <.020 |
| Fe | 39.0 | V | .016 |
| K | 154 | W | <.078 |
| Mg | 63.7 | Zn | 0.26 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

14-247-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 07, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 70.0 | 3.49 | 2.1 |
| Magnesium(Mg) | 54.0 | 4.44 | 2.6 |
| Sodium(Na) | 3675.0 | 159.85 | 95.0 |
| Potassium(K) | 20.8 | 0.53 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 934.0 | 15.31 | 8.9 |
| Sulphate(SO4) | 11.2 | 0.23 | 0.1 |
| Chloride(Cl) | 5560.0 | 156.80 | 91.0 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 9.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 80.0 | | |
| Magnesium(Acidified) | 58.0 | | |
| TDS(mg/l) | 9606.0 | | |
| Total Anions(epm) | 172.34 | Total Cations(epm) | 168.32 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 14500 | | Temperature(C) | 8.00 | |
| pH | 7.5 | | pH | 7.4 | |
| Fluoride(F) | 0.6 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 966 | mg/l |
| | | | Hydroxide(OH) | | |

14-247-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source BAILED

Date sampled August 30, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 67.0 | 3.34 | 1.7 |
| Magnesium(Mg) | 75.0 | 6.17 | 3.1 |
| Sodium(Na) | 4413.0 | 191.95 | 95.0 |
| Potassium(K) | 25.8 | 0.66 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1991.0 | 32.63 | 16.4 |
| Sulphate(SO4) | 8.6 | 0.18 | 0.1 |
| Chloride(Cl) | 5880.0 | 165.82 | 83.5 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 10.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 11104.0 | | |
| Total Anions(epm) | 198.64 | Total Cations(epm) | 202.13 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 16300 | | Temperature(C) |
| pH | 7.5 | | pH |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) |
| | | | Bicarbonate(HCO3) |
| | | | Hydroxide(OH) |

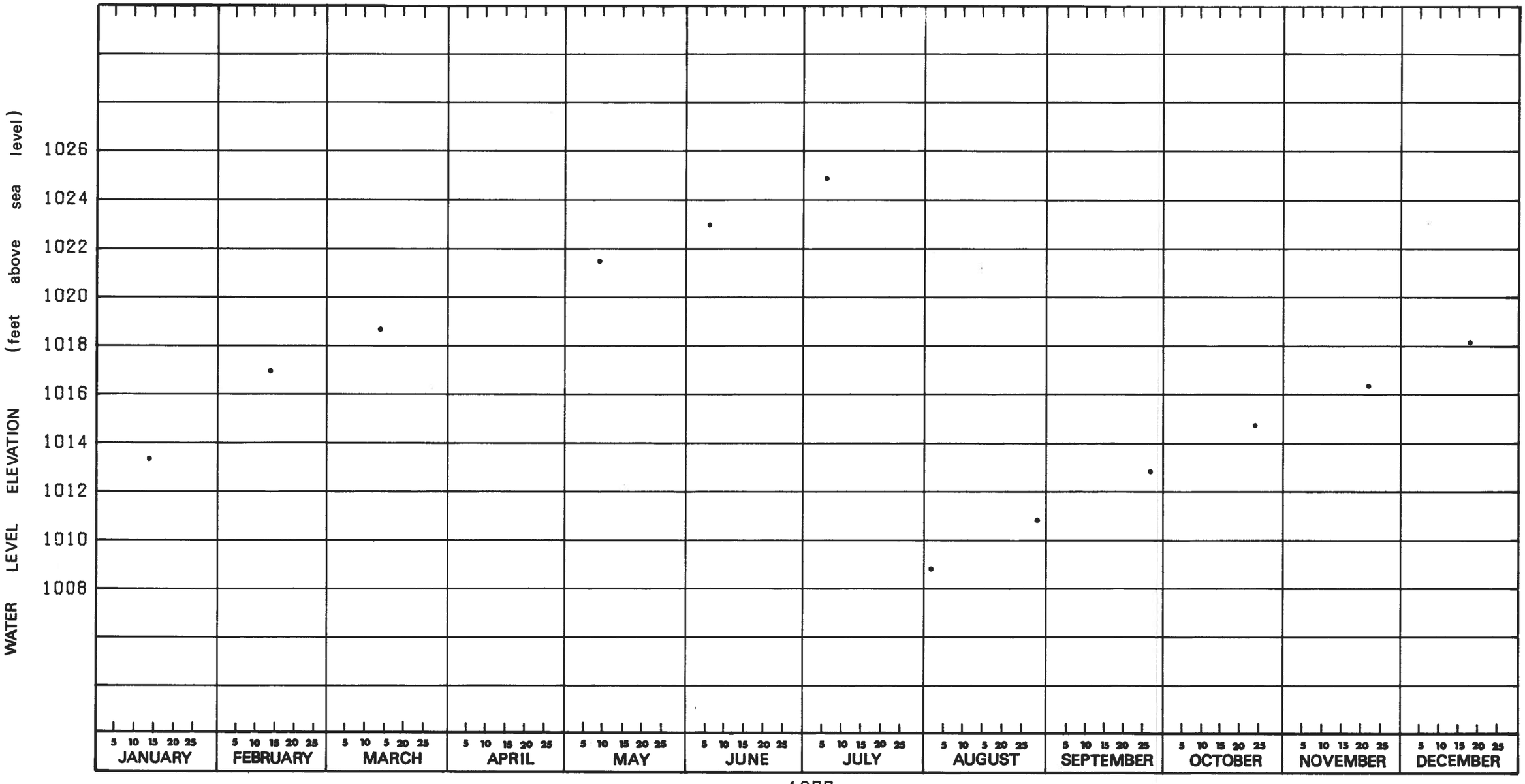
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-247-H-78



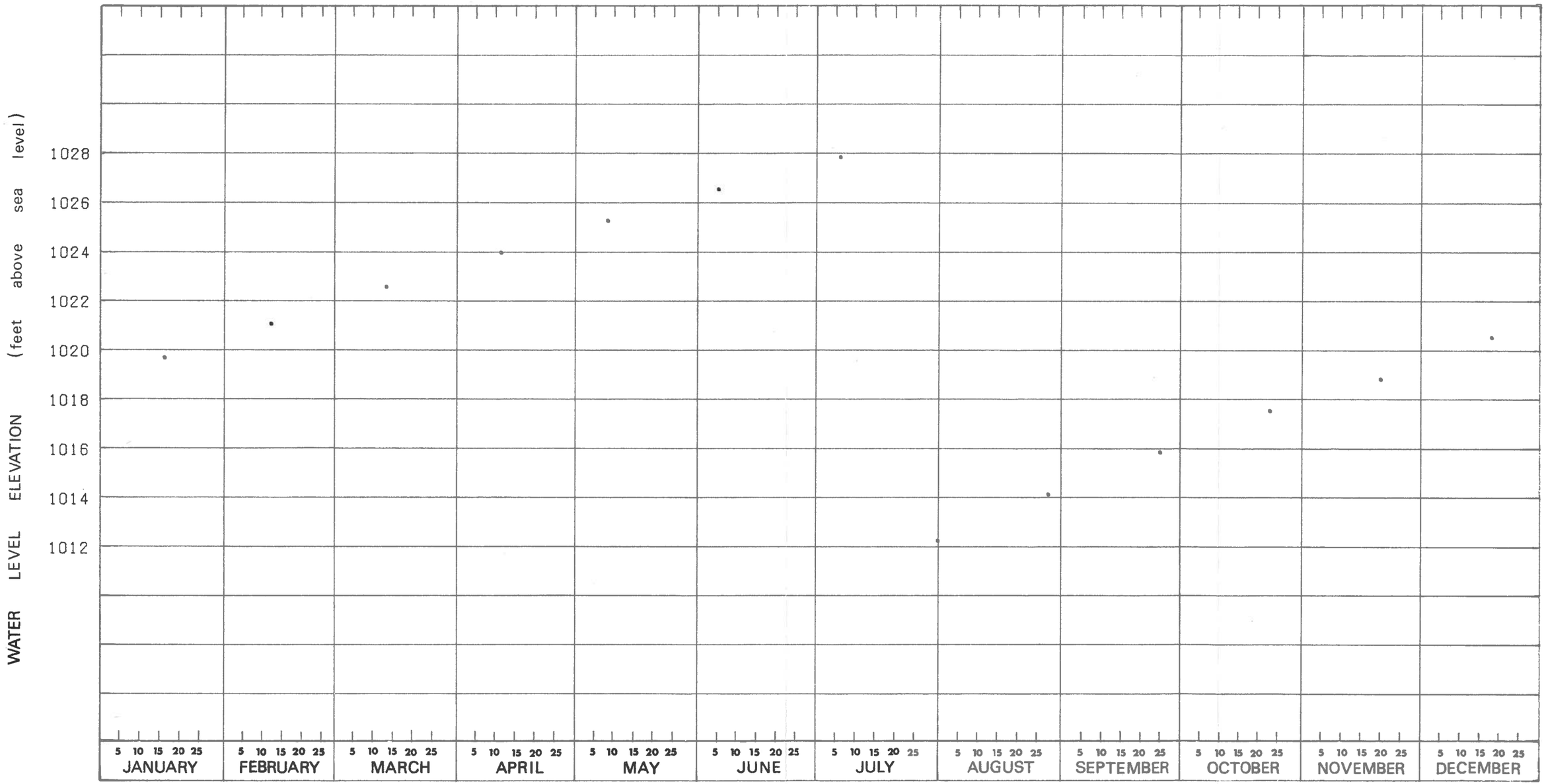
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-247

LSD 4 SEC 15 TWP 92 R 12 W4TH

14-247-H-79

Alberta Research Council




1978

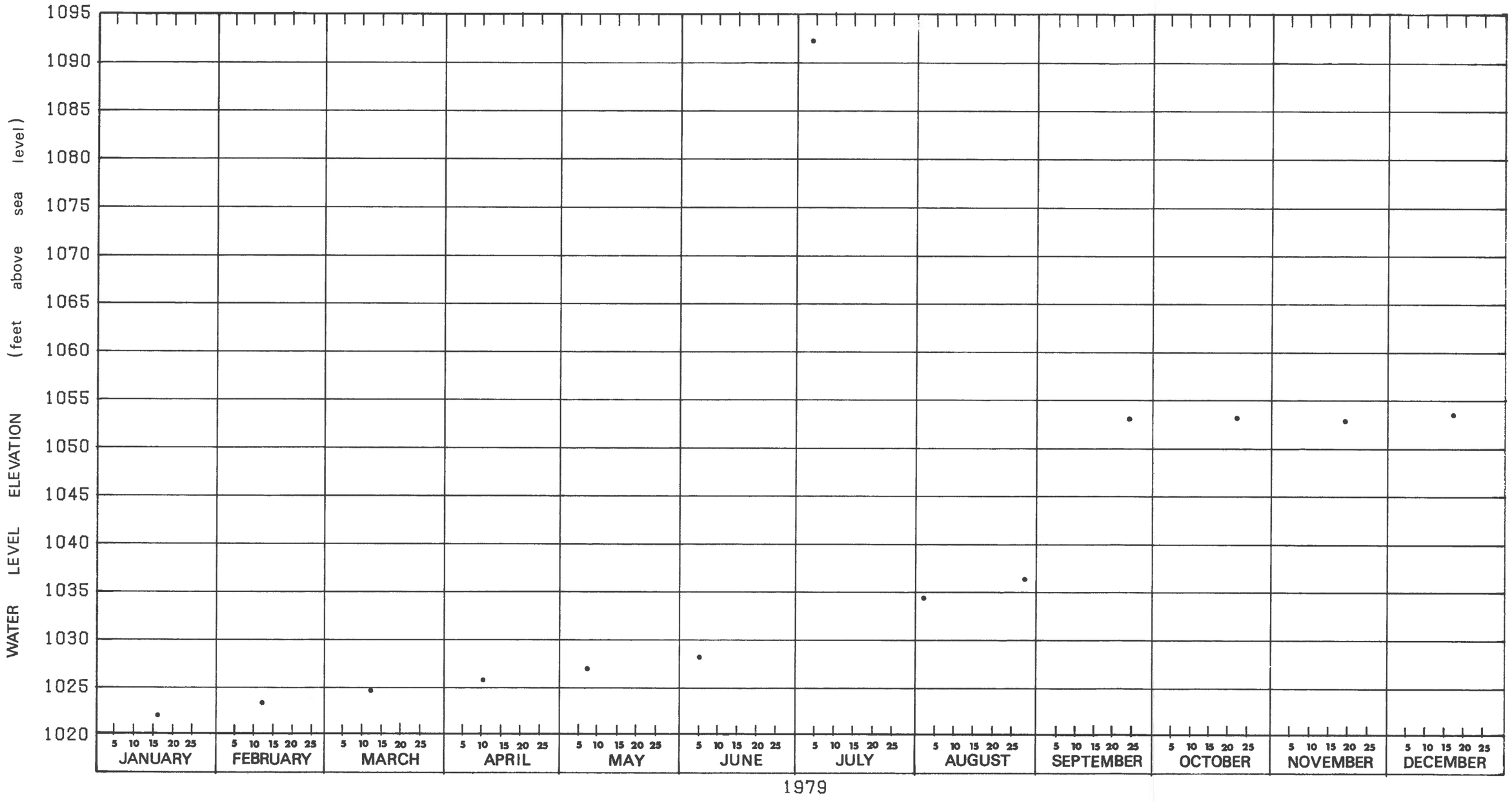
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-247-H-80



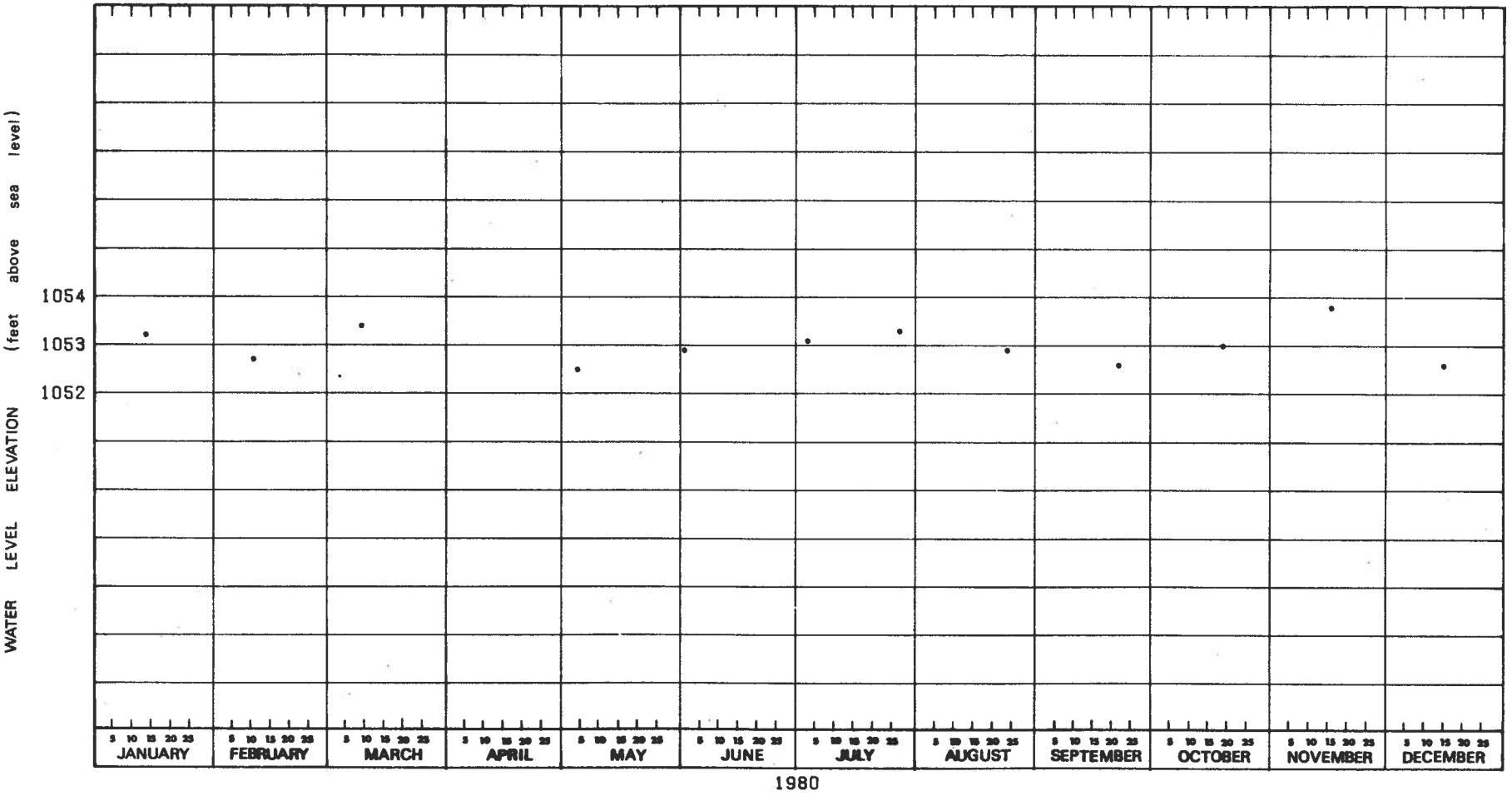
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-247-H-81



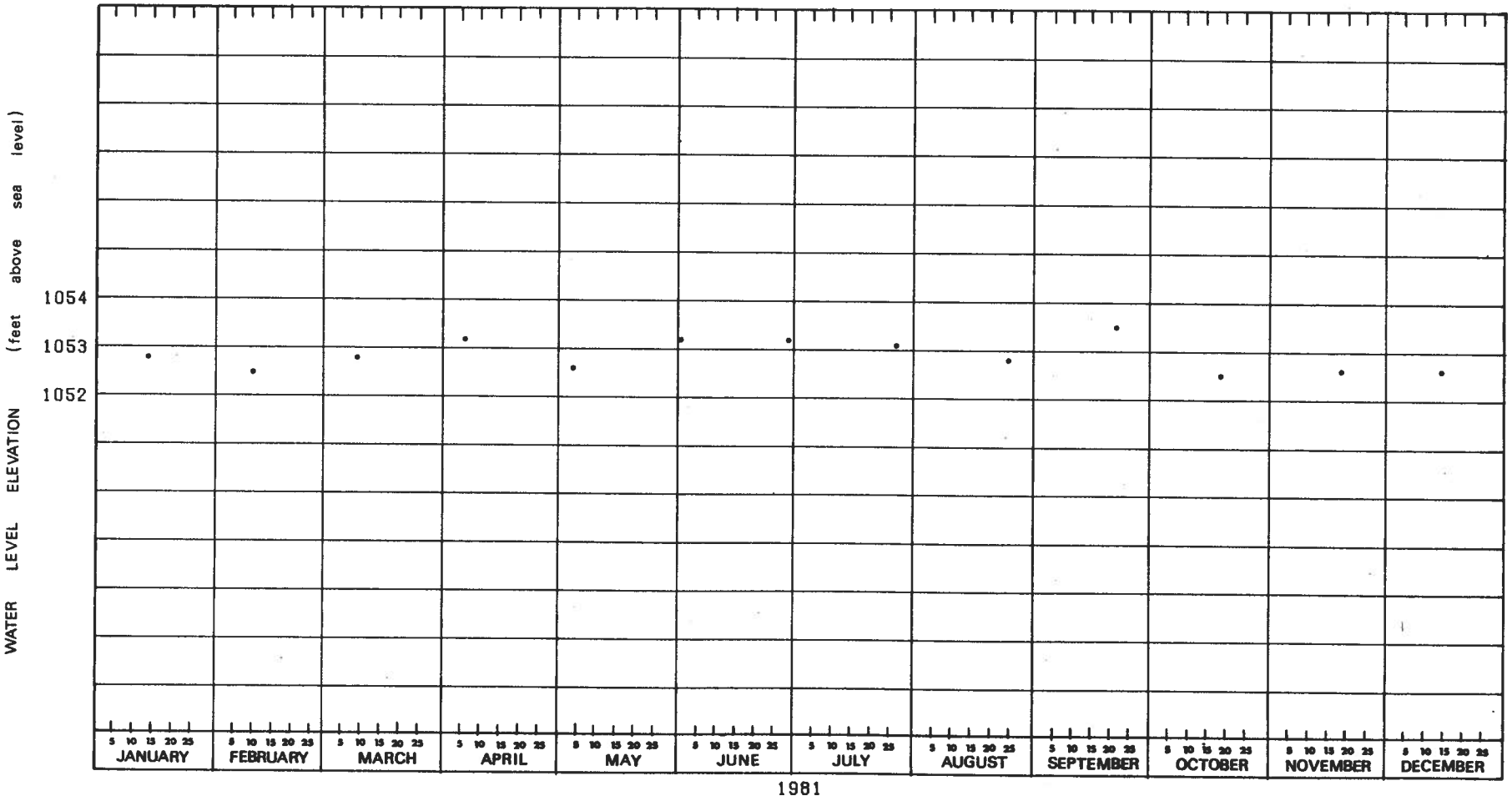
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-247-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing (valve) 1226.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 16/76 | | | Well completed; Producing gas |
| Mar 6/76 | | | Too much gas to measure water level |
| Oct 26/76 | approx. 51 m | 1058.7 | In casing; Install plastic pipe; Sampled |
| Nov 23/76 | 61.42 TOC | 1024.5 | Inside plastic pipe |
| Dec 20/76 | 64.71 TOC | 1013.7 | " |

MP - Depth from measuring point
TOC - Depth from top of casing (valve)

## WELL HISTORY

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1226.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 64.68 TOC | 1013.3 | |
| Feb 15/77 | 63.74 TOC | 1016.9 | |
| Mar 15/77 | 63.24 TOC | 1018.6 | |
| May 10/77 | 62.38 TOC | 1021.4 | |
| June 7/77 | 61.93 TOC | 1022.9 | |
| July 7/77 | 61.36 TOC | 1024.8 | Sampled; temp. 9°C |
| Aug 3/77 | 66.22 TOC | 1008.8 | |
| Aug 30/77 | 65.60 TOC | 1010.8 | |
| Sept 28/77 | 65.00 TOC | 1012.8 | |
| Oct 25/77 | 64.42 TOC | 1014.7 | |
| Nov 23/77 | 63.95 TOC | 1016.3 | |
| Dec 19/77 | 63.40 TOC | 1018.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1226.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 62.91 TOC | 1019.7 | |
| Feb 13/78 | 62.47 TOC | 1021.1 | |
| Mar 14/78 | 62.02 TOC | 1022.6 | |
| Apr 12/78 | 61.58 TOC | 1024.0 | |
| May 9/78 | 61.19 TOC | 1025.3 | |
| June 6/78 | 60.81 TOC | 1026.6 | |
| July 7/78 | 60.40 TOC | 1027.9 | Sampled; temp 8°C |
| Aug 1/78 | 65.15 TOC | 1012.3 | |
| Aug 29/78 | 64.58 TOC | 1014.2 | |
| Sept 26/78 | 64.05 TOC | 1015.9 | |
| Oct 24/78 | 63.55 TOC | 1017.6 | |
| Nov 21/78 | 63.15 TOC | 1018.9 | |
| Dec 19/78 | 62.63 TOC | 1020.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-247

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1226.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 62.19 TOC | 1022.0 | |
| Feb 13/79 | 61.79 TOC | 1023.3 | |
| Mar 13/79 | 61.40 TOC | 1024.6 | |
| Apr 11/79 | 61.06 TOC | 1025.7 | |
| May 8/79 | 60.70 TOC | 1026.9 | |
| June 6/79 | 60.35 TOC | 1028.1 | |
| July 5/79 | 60.01 TOC | 1029.2 | |
| Aug 3/79 | 58.44 TOC | 1034.3 | |
| Aug 29/79 | 57.85 TOC | 1036.3 | Sampled; Aug 30/79 |
| Sept 25/79 | 52.75 TOC | 1053.0 | |
| Oct 23/79 | 52.73 TOC | 1053.1 | |
| Nov 20/79 | 52.81 TOC | 1052.8 | |
| Dec 18/79 | 52.62 TOC | 1053.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14 - 247

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1226.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 52.69 TOC | 1053.2 | |
| Feb 12/80 | 52.82 TOC | 1052.7 | |
| Mar 11/80 | 52.63 TOC | 1053.4 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 52.90 TOC | 1052.5 | |
| June 3/80 | 52.77 TOC | 1052.9 | |
| July 5/80 | 52.70 TOC | 1053.1 | |
| July 29/80 | 52.64 TOC | 1053.3 | |
| Aug 26/80 | 52.78 TOC | 1052.9 | |
| Sept 24/80 | 52.86 TOC | 1052.6 | |
| Oct 21/80 | 52.74 TOC | 1053.0 | |
| Nov 18/80 | 52.51 TOC | 1053.8 | |
| Dec 17/80 | 52.86 TOC | 1052.6 | |
| Jan 15/81 | 52.79 TOC | 1052.8 | |
| Feb 11/81 | 52.90 TOC | 1052.5 | |
| Mar 10/81 | 52.80 TOC | 1052.8 | |
| Apr 7/81 | 52.68 TOC | 1053.2 | |
| May 5/81 | 52.87 TOC | 1052.6 | |
| June 3/81 | 52.67 TOC | 1053.2 | |
| June 30/81 | 52.68 TOC | 1053.2 | |
| July 28/81 | 52.72 TOC | 1053.1 | |
| Aug 26/81 | 52.87 TOC | 1052.8 | |
| Sept 23/81 | 52.58 TOC | 1053.5 | |
| Oct 20/81 | 52.91 TOC | 1052.5 | |
| Nov 20/81 | 52.86 TOC | 1052.6 | |
| Dec 16/81 | 52.86 TOC | 1052.6 | |

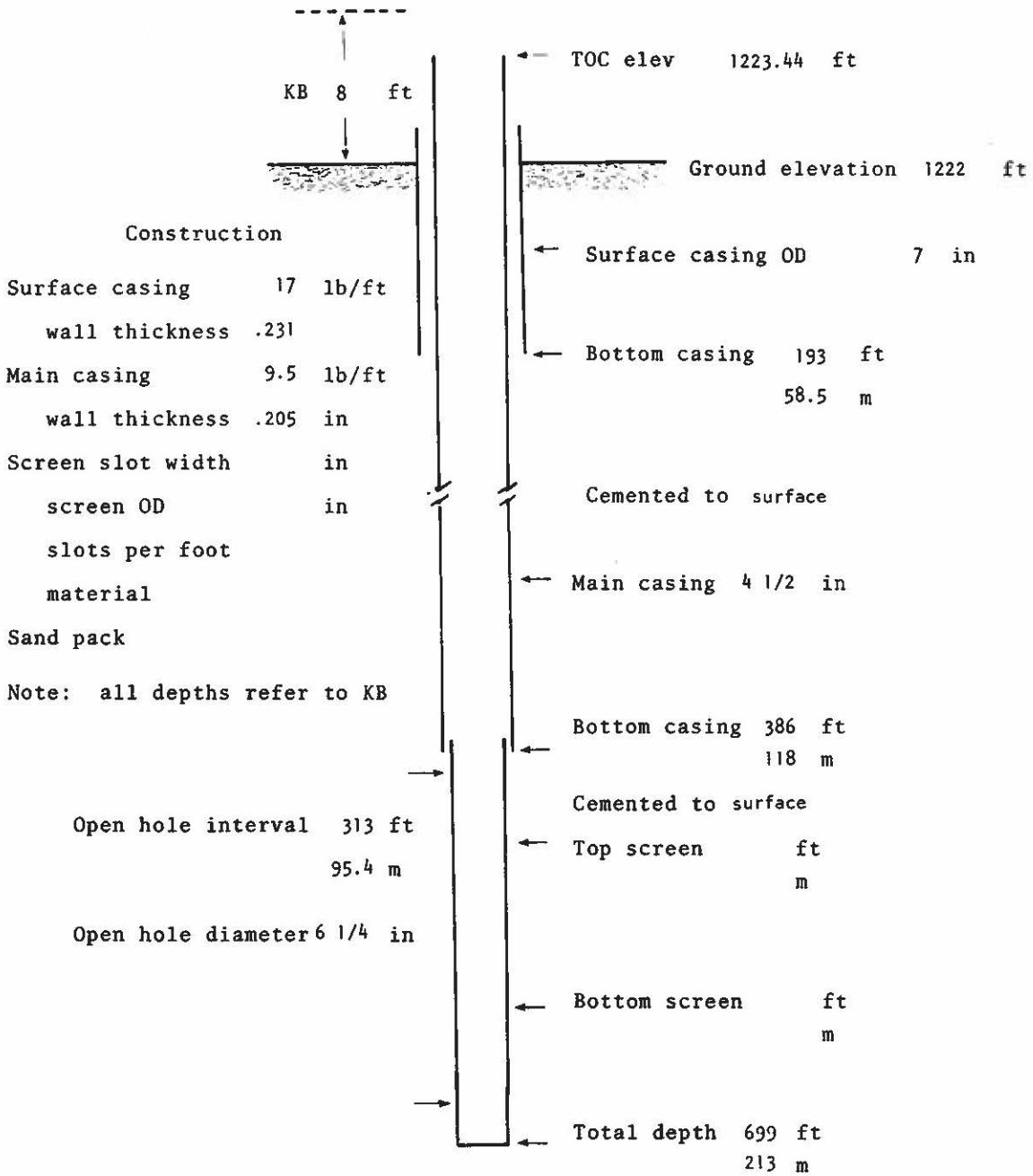
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Tp 92 R 12 Mer W4th

Alberta Research Council



## DRILL STEM TEST

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Tp 92 R 12 W4th

Alberta Research Council

Elevation: gl 1222
KB 1230

Type of test Open hole, Bottom hole

Date of test February 2, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1130 | hrs |
| Tool opened | 1159 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0145 | hrs |
| Out of hole at | 0300 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Good initial puff decreasing to faint at end of preflow. Faint air blow decreasing to nil in 1/2 min

Total water recovered 10 ft

Water sample No. - (drilling mud)

Gas blow No

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 358-500'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.70 | |
| Drill Pipe | 123.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 142.00 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 365 | 369 |
| Initial hydrostatic | A | 163 | 165 |
| First flow | B | 14 | 14 |
| | B1 | 12 | 16 |
| Initial shut in | C | 42 | 44 |
| Second flow | D | 14 | 16 |
| | D1 | 14 | 16 |
| Final shut in | G | 26 | 29 |
| Final hydrostatic | H | - | 160 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

14-699-D-77

OBSERVATION WELL NUMBER 14-699

INTERVAL TESTED 358-500

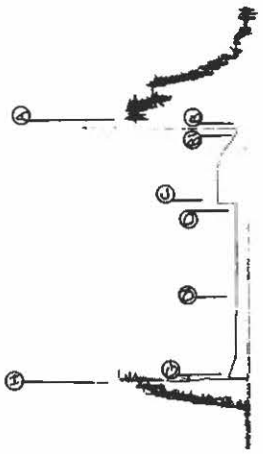
PRESSURE INCREMENTS

Recorder AK1-65

February 2, 1976

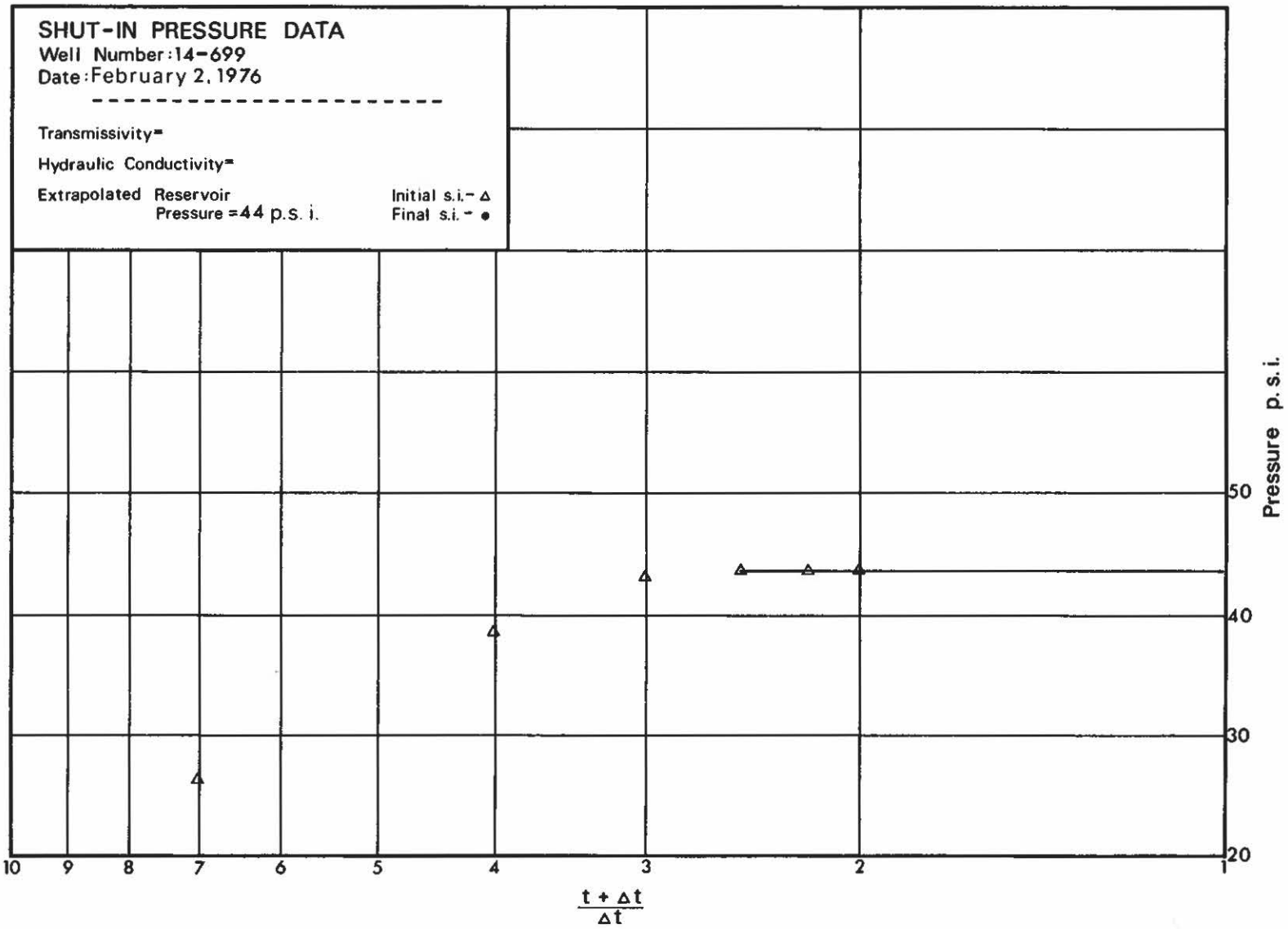
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 26.4 | 7.00 |
| 10 | 38.6 | 4.00 |
| 15 | 43.1 | 3.00 |
| 20 | 43.8 | 2.50 |
| 25 | 43.8 | 2.20 |
| 30 | 43.8 | 2.00 |

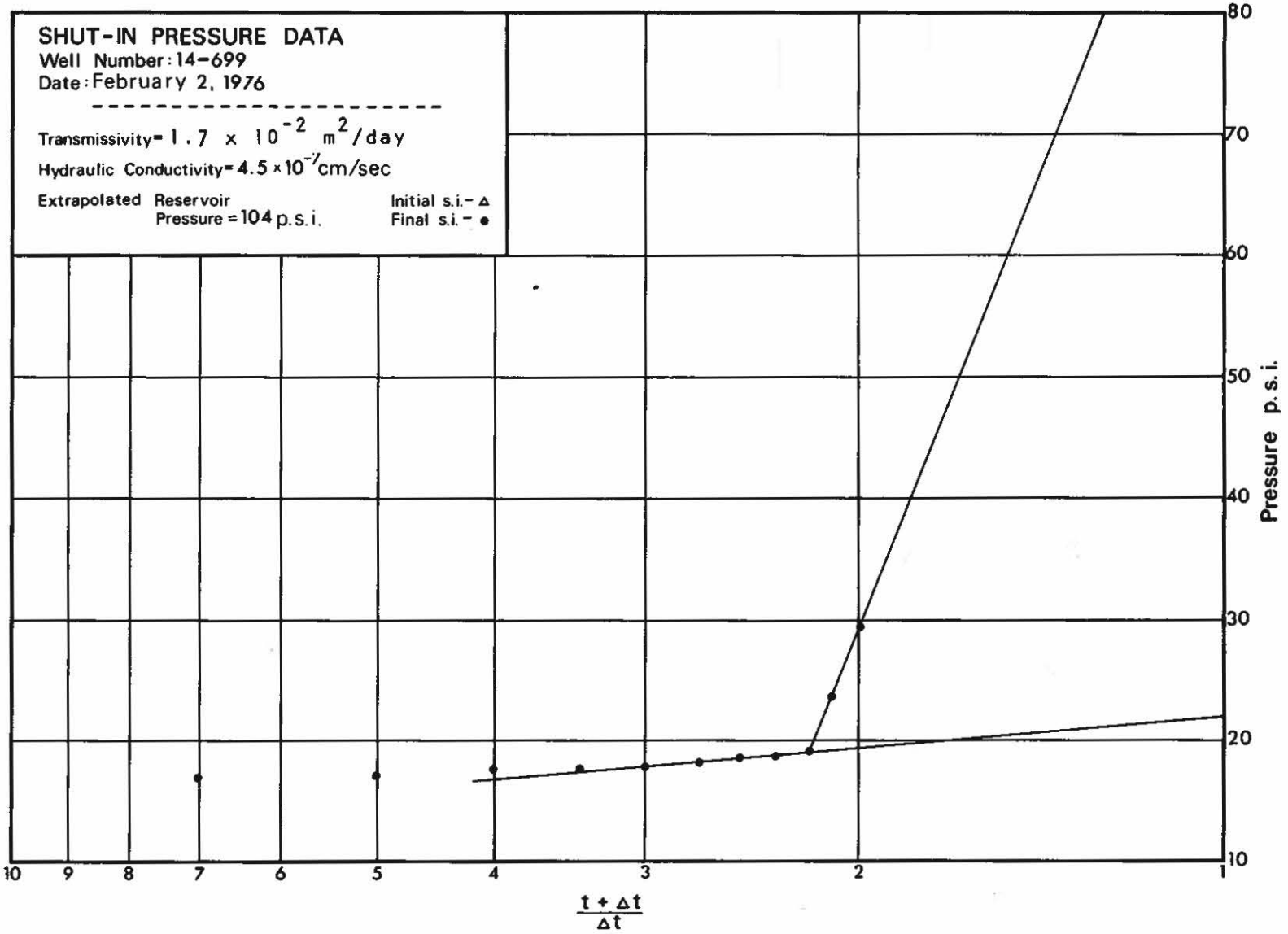


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 16.9 | 13.00 |
| 10 | 16.9 | 7.00 |
| 15 | 16.9 | 5.00 |
| 20 | 17.4 | 4.00 |
| 25 | 17.6 | 3.40 |
| 30 | 17.6 | 3.00 |
| 35 | 18.1 | 2.71 |
| 40 | 18.6 | 2.50 |
| 45 | 18.7 | 2.33 |
| 50 | 19.0 | 2.20 |
| 55 | 23.5 | 2.09 |
| 60 | 29.3 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 14-699
Date: February 2, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 44 p.s.i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
50
40
30
20
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

14-699-D-77


SHUT-IN PRESSURE DATA
Well Number: 14-699
Date: February 2, 1976
Transmissivity = 1.7 x 10^-2 m^2/day
Hydraulic Conductivity = 4.5 x 10^-7 cm/sec
Extrapolated Reservoir Pressure = 104 p.s.i.
Initial s.i. - △
Final s.i. - ●
80
70
60
50
40
30
20
10
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

14-699-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Tp 92 R 12 W4th

Alberta Research Council

Elevation: gl 1222
KB 1230

Type of test Open hole, Bottom hole

Date of test February 3, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1900 | hrs |
| Tool opened | 1928 | hrs |
| First flow | 2 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 2115 | hrs |
| Out of hole at | 2200 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Fair initial puff on preflow. Faint air blow dying to nil in 2 minutes on final flow period

Total water recovered 60 ft

Water sample No. - (drilling mud)

Gas blow No

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 500-642'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.70 | |
| Drill Pipe | 123.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 142.00 | |

### PRESSURE DATA (psi)

| Instrument No. | | 64 | 65 |
|---|---|---|---|
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 507 | 511 |
| Initial hydrostatic | A | 228 | 230 |
| First flow | B | 24 | 27 |
| | B1 | 37 | 39 |
| Initial shut in | C | 228 | 229 |
| Second flow | D | 38 | 41 |
| | D1 | 39 | 42 |
| Final shut in | G | 22 | 25 |
| Final hydrostatic | H | 214 | 216 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

14-699-D-77

OBSERVATION WELL NUMBER 14-699

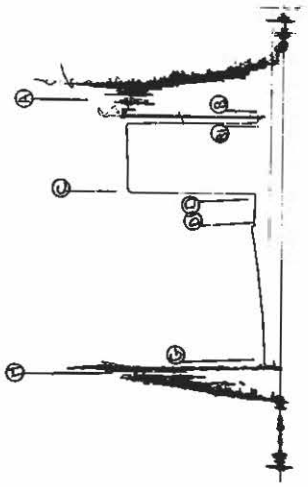
INTERVAL TESTED 500-642

PRESSURE INCREMENTS

Recorder AKI-5565
February 3, 1976

Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 230.0 | 7.00 |
| 10 | 229.2 | 4.00 |
| 15 | 229.0 | 3.00 |
| 20 | 228.2 | 2.50 |
| 25 | 228.0 | 2.20 |
| 30 | 227.7 | 2.00 |



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 42.0 | 13.00 |
| 10 | 39.5 | 7.00 |
| 15 | 37.0 | 5.00 |
| 20 | 34.5 | 4.00 |
| 25 | 32.7 | 3.40 |
| 30 | 31.0 | 3.00 |
| 35 | 29.2 | 2.71 |
| 40 | 27.0 | 2.50 |
| 45 | 26.2 | 2.33 |
| 50 | 25.2 | 2.20 |
| 55 | 24.5 | 2.09 |
| 60 | 23.7 | 2.00 |

## DRILL STEM TEST

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Tp 92 R 12 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1222 |
| | KB | 1230 |
| Type of test | | Open hole, Bottom hole |
| Date of test | | February 4, 1976 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 0200 | hrs |
| Tool opened | - | hrs |
| First flow | - | min |
| Initial shut in | - | min |
| Second flow | - | min |
| Final shut in | - | min |
| Pulled loose at | - | hrs |
| Out of hole at | - | hrs |
| Wt on packers | 10,000 | lbs |
| Description of blow | Nil | |
| Total water recovered | - | ft |
| Water sample No. | - | |
| Gas blow | No | |
| Remarks | Misrun, unable to get to bottom | |

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 510-652'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.70 | |
| Drill Pipe | 123.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 142.00 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 517 | 521 |
| Initial hydrostatic | A | - | 225 |
| First flow | B | - | - |
| | B1 | - | - |
| Initial shut in | C | - | - |
| Second flow | D | - | - |
| | D1 | - | - |
| Final shut in | G | - | - |
| Final hydrostatic | H | - | 225 |

B1, D1, etc. Initial Hyd. Pressure

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed from 14-699

Date sampled February 19, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 16.1 | 0.80 | 3.9 |
| Magnesium ($Mg^{++}$) | 11.2 | 0.92 | 4.4 |
| Sodium ($Na^{+}$) | 428.0 | 18.62 | 89.5 |
| Potassium ($K^{+}$) | 17.5 | 0.45 | 2.2 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 432.0 | 7.08 | 32.4 |
| Sulfate ($SO_4^{=}$) | 188.0 | 3.91 | 17.9 |
| Chloride ($Cl^{-}$) | 384.0 | 10.83 | 49.6 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 17.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1826.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 21.8 | Total Cations (epm) | 20.8 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2200 | Temperature (C) | |
| pH | 7.3 | pH | 8.8 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | 38 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 427 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 15, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 28.0 | 1.40 | 2 |
| Magnesium ($Mg^{++}$) | 18.0 | 1.48 | 2 |
| Sodium ($Na^{+}$) | 1563.0 | 67.99 | 96 |
| Potassium ($K^{+}$) | 10.8 | 0.28 | 0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 415.0 | 6.80 | 9 |
| Sulfate ($SO_4^{=}$) | 699.0 | 13.93 | 19 |
| Chloride ($Cl^{-}$) | 1820.0 | 51.33 | 71 |
| Nitrate ($NO_3^{=}$) | 2.7 | 0.04 | 0 |
| Silica ($SiO_2$) | 7.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 27.5 | | |
| Magnesium (Acidified) | 18.6 | | |
| Total dissolved solids | 4242 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 72.10 | Total Cations (epm) | 71.14 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 8000 | | Temperature (C) | 9.0 | |
| pH | 7.5 | | pH | 7.5 | |
| Fluoride ($F^{-}$) | 0.7 | Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | | Bicarbonate ($HCO_3^{-}$) | 434 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 7, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 113.0 | 5.64 | 4.0 |
| Magnesium ($Mg^{++}$) | 65.0 | 5.35 | 3.8 |
| Sodium ($Na^{+}$) | 3013.0 | 131.06 | 91.9 |
| Potassium ($K^{+}$) | 20.4 | 0.52 | 0.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 537.0 | 8.80 | 5.8 |
| Sulfate ($SO_4^{=}$) | 1610.0 | 33.52 | 22.2 |
| Chloride ($Cl^{-}$) | 3860.0 | 108.86 | 72.0 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 1.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 101.0 | | |
| Magnesium (Acidified) | 55.0 | | |
| Total dissolved solids | 8704.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 151.19 | Total Cations (epm) | 142.57 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 15.0 |
| pH | 7.6 | pH | 7.5 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 532.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Date sampled: July 15, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .021 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 1617 |
| As | <.038 | Ni | <.010 |
| B | 2.37 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 24.5 | Si | 3.49 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .699 |
| Cr | <.006 | Te | <.065 |
| Cu | .025 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .099 | V | .004 |
| K | 33 | W | <.078 |
| Mg | 18.7 | Zn | .066 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Date sampled: July 15, 1976
(duplicate of other sample of this date)

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .02 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 1430 |
| As | <.038 | Ni | <.010 |
| B | 2.11 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 24.4 | Si | 3.12 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .060 |
| Cr | <.006 | Te | <.065 |
| Cu | .028 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .088 | V | .004 |
| K | 33 | W | <.078 |
| Mg | 17.3 | Zn | 0.14 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 07, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 188.0 | 9.38 | 4.8 |
| Magnesium(Mg) | 100.0 | 8.23 | 4.3 |
| Sodium(Na) | 4038.0 | 175.64 | 90.7 |
| Potassium(K) | 12.5 | 0.32 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 610.0 | 10.00 | 5.0 |
| Sulphate(SO4) | 1670.0 | 34.77 | 17.4 |
| Chloride(Cl) | 5500.0 | 155.10 | 77.6 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.0 |
| Silica(SiO2) | 6.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 201.0 | | |
| Magnesium(Acidified) | 101.0 | | |
| TDS(mg/l) | 11892.0 | | |
| Total Anions(epm) | 199.88 | Total Cations(epm) | 193.57 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 16400 | | Temperature(C) | 11.00 | |
| pH | 7.4 | | pH | 7.5 | |
| Fluoride(F) | 0.5 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 600 | mg/l |
| | | | Hydroxide(OH) | | |

14-699-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 116.0 | 5.79 | 2.9 |
| Magnesium(Mg) | 99.0 | 8.15 | 4.1 |
| Sodium(Na) | 4225.0 | 183.78 | 92.7 |
| Potassium(K) | 25.0 | 0.64 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 683.0 | 11.19 | 5.2 |
| Sulphate(SO4) | 1790.0 | 37.27 | 17.3 |
| Chloride(Cl) | 5900.0 | 166.38 | 77.4 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 7.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 109.0 | | |
| Magnesium(Acidified) | 90.0 | | |
| TDS(mg/l) | 12748.0 | | |
| Total Anions(epm) | 214.85 | Total Cations(epm) | 198.35 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 17400 | | Temperature(C) | 11.00 | |
| pH | 7.7 | | pH | 7.5 | |
| Fluoride(F) | 0.5 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 678 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 14-699-E-82

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 5, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 136.0 | 6.80 | 2.8 |
| Magnesium(Mg) | 110.0 | 9.17 | 3.8 |
| Sodium(Na) | 5188.0 | 225.57 | 93.1 |
| Potassium(K) | 28.0 | 0.72 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 669.0 | 10.97 | 4.9 |
| Sulphate(SO4) | 2100.0 | 43.75 | 19.6 |
| Chloride(Cl) | 6000.0 | 169.01 | 75.5 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 6.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 113.0 | | |
| Magnesium(Acidified) | 10.0 | | |
| TDS(mg/l) | 14108.0 | | |
| Total Anions(epm) | 223.73 | Total Cations(epm) | 242.25 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 21000 |
| pH | 8.1 |
| Fluoride | 0.0 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 8.00 | |
| pH | 7.5 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 712 | mg/l |
| Hydroxide(OH) | | |

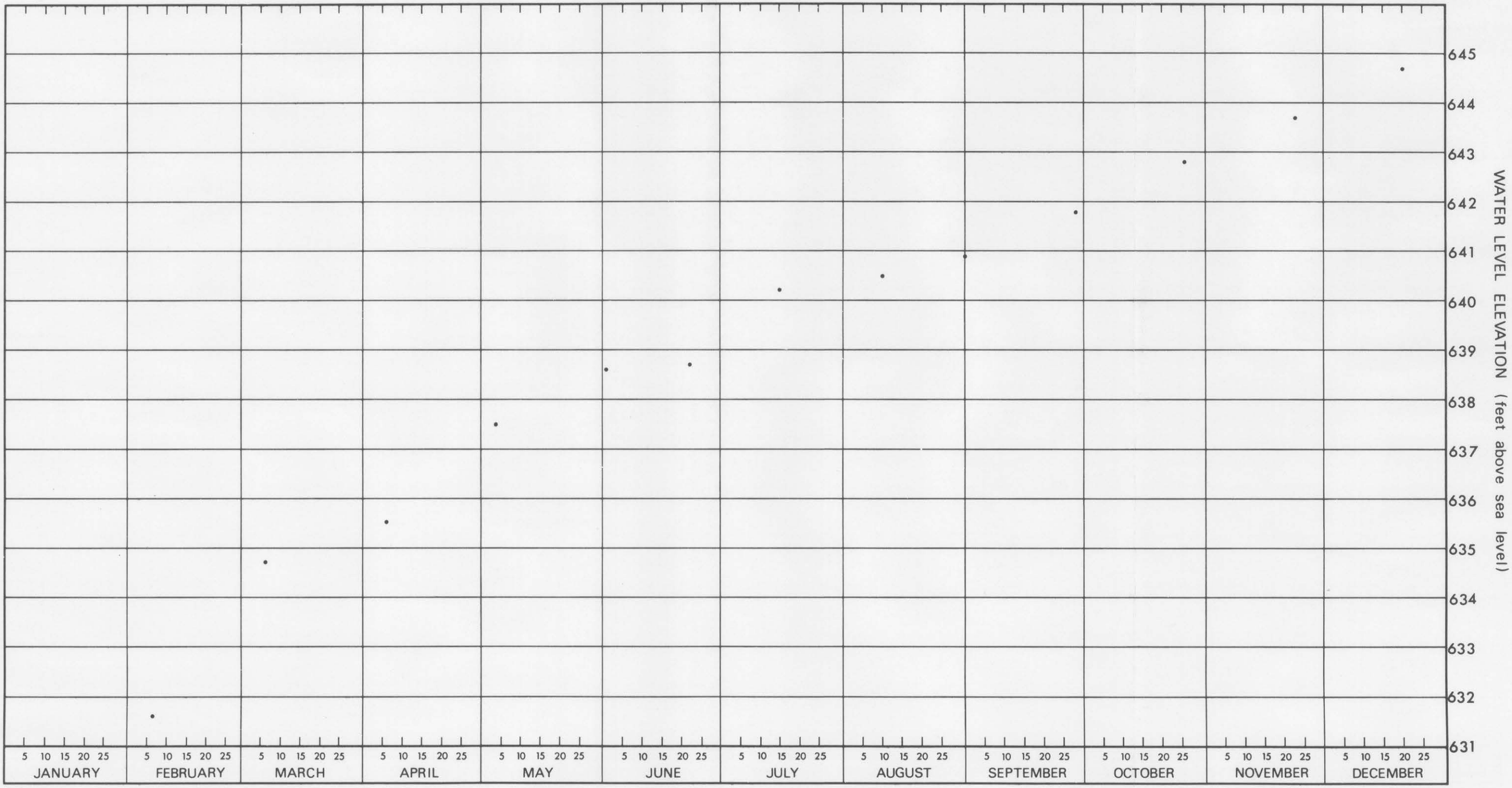
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **14-699**

14 - 699 - H - 77

Lsd **4** Sec **15** Twp **92** R **12** W4th

Alberta Research Council




1976

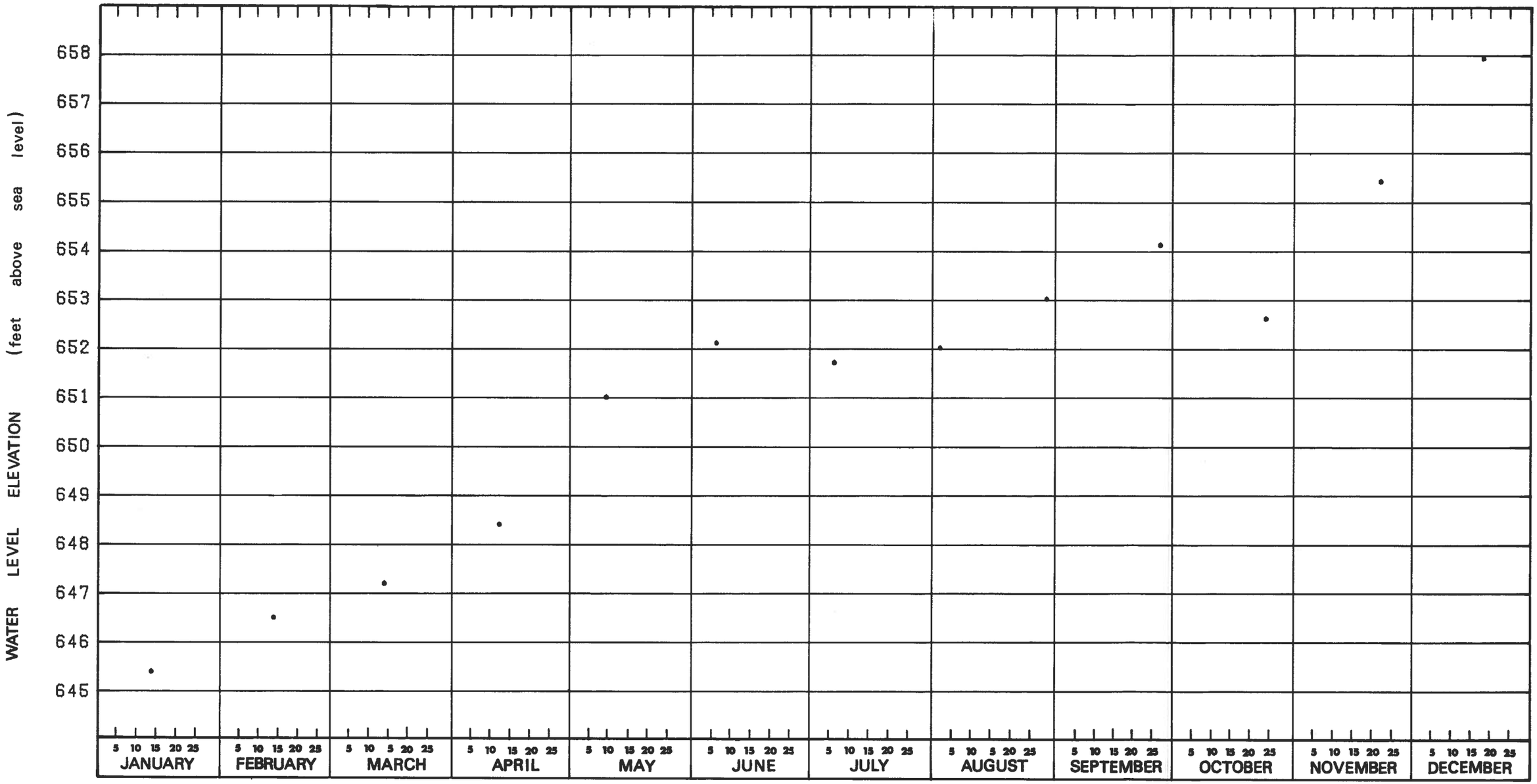
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-699-H-78




1977

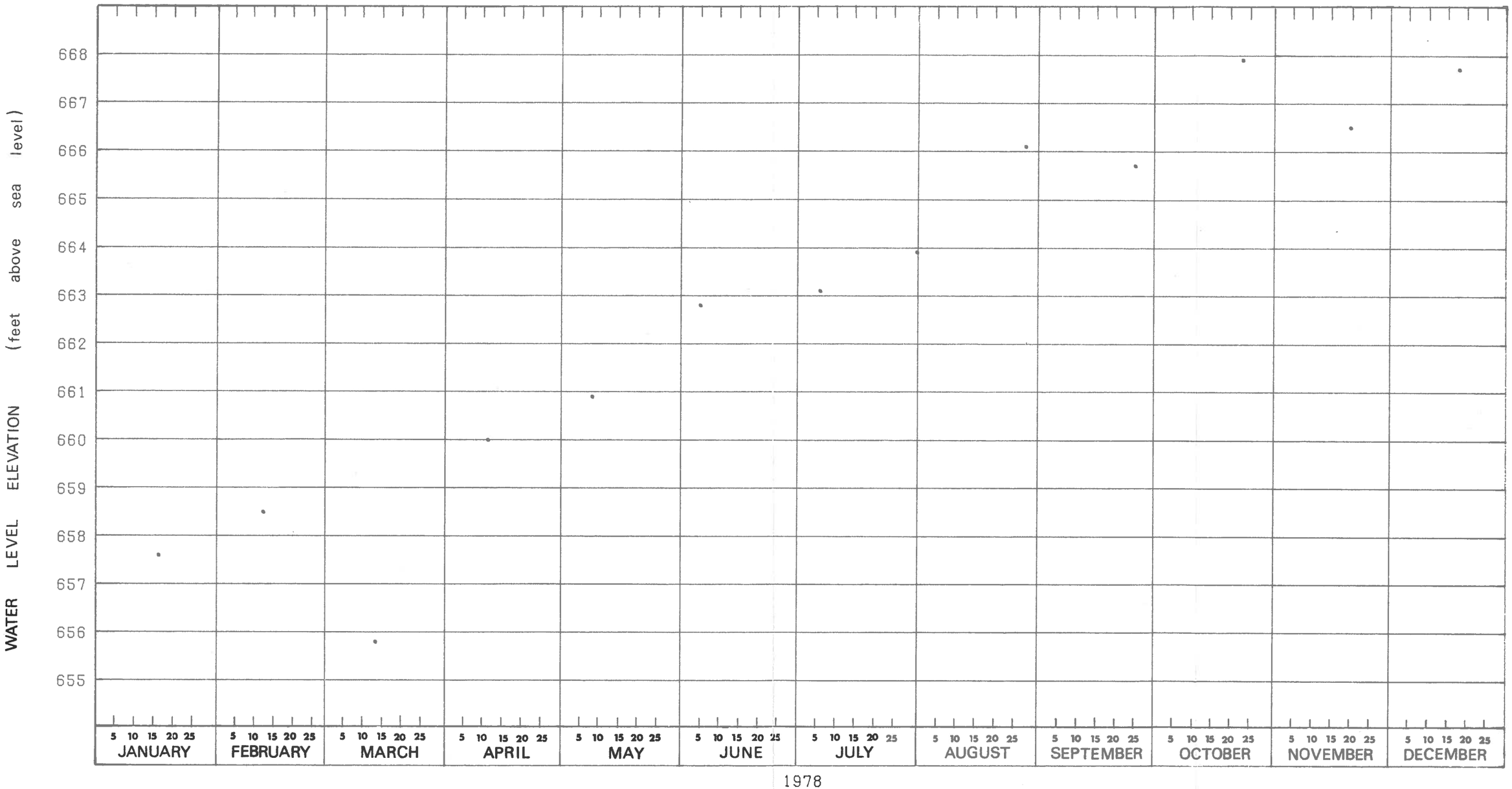
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-699

LSD 4 SEC 15 TWP 92 R 12 W4TH

14-699-H-79

Alberta Research Council




1978

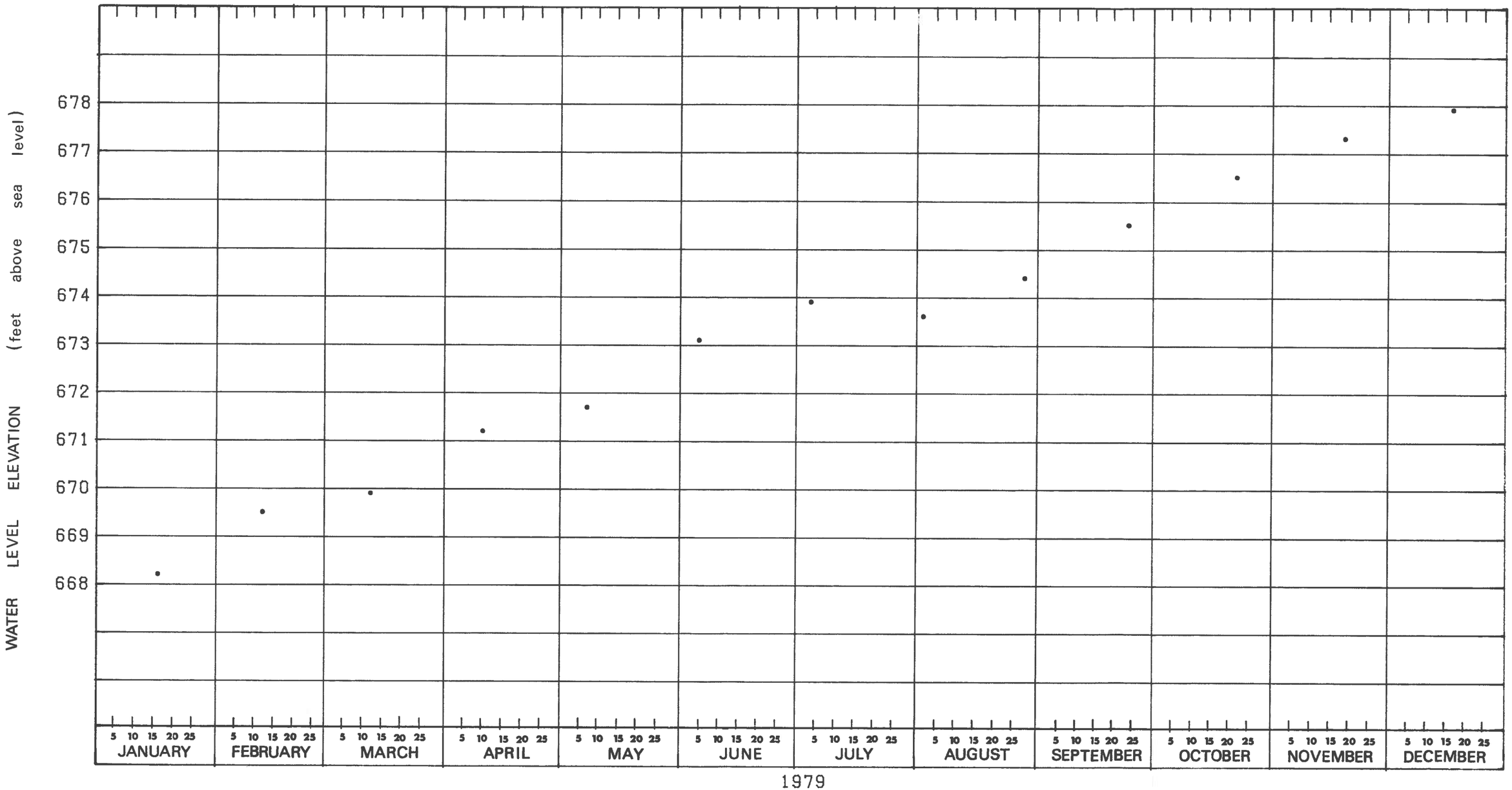
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-699-H-80



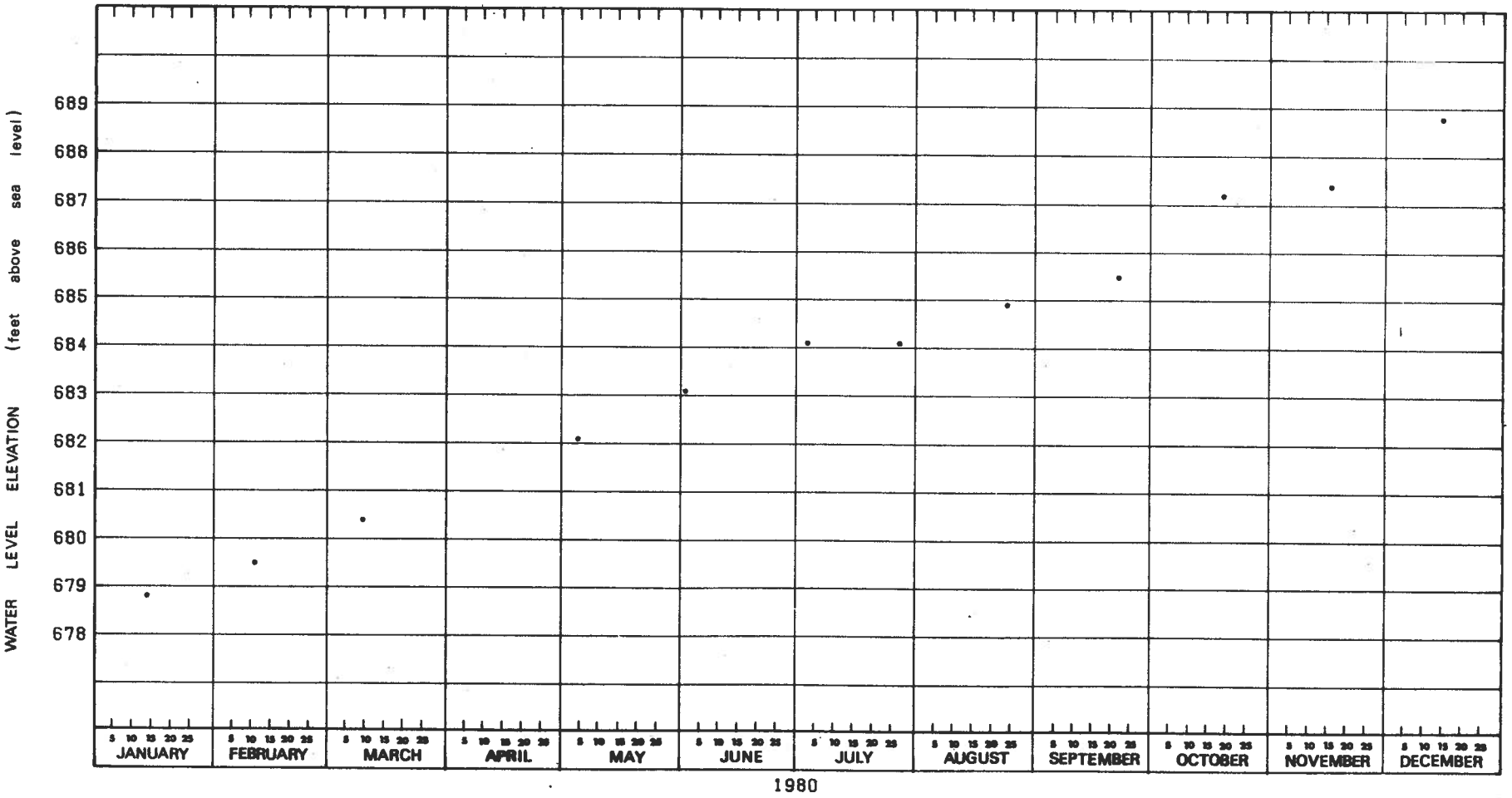
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-699-H-81



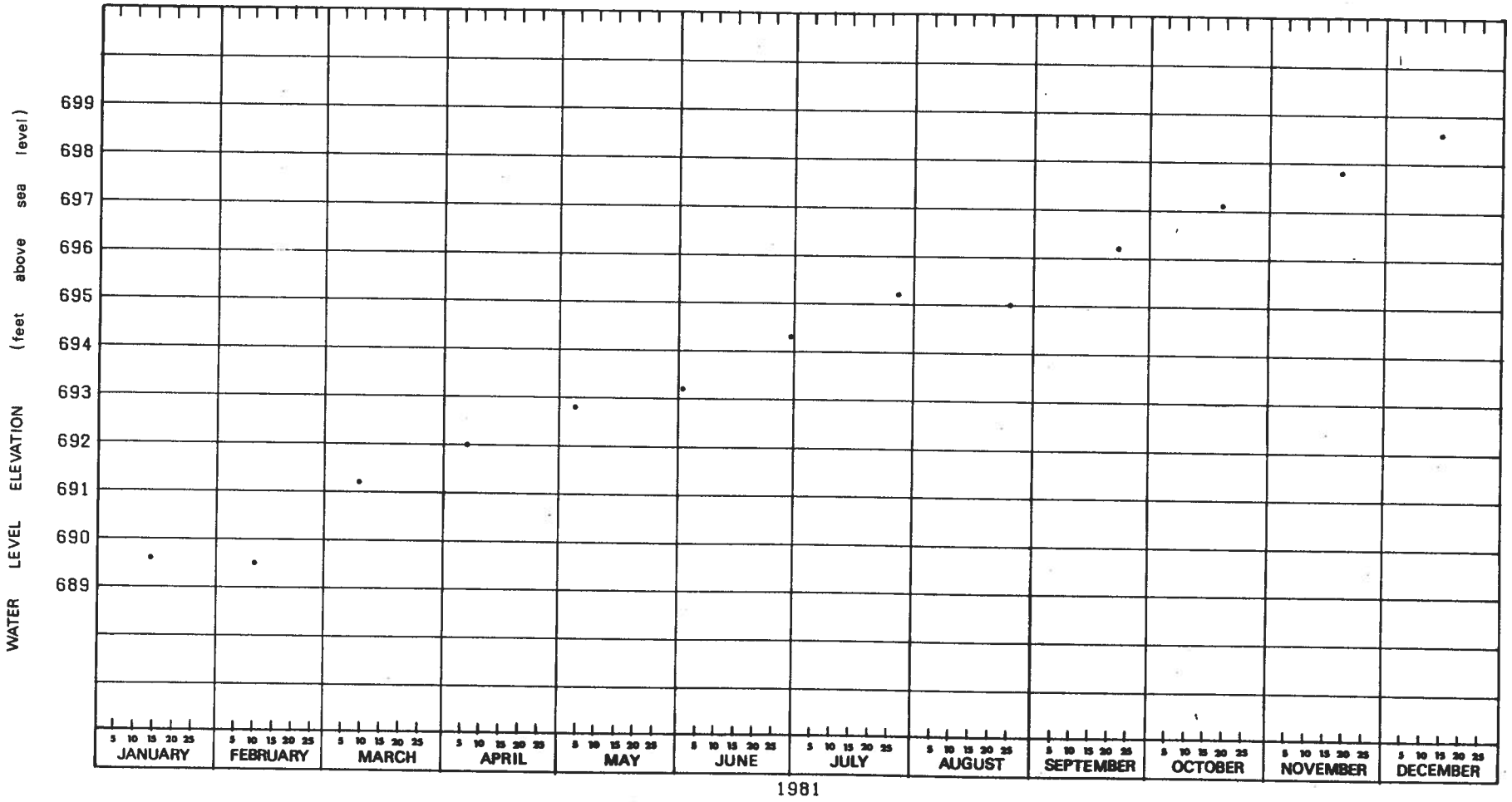
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-699-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1223.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 5/76 | | | Well completed |
| Feb 7/76 | 180.44 TOC | 631.6 | MP = 0.87 m TOC, (1226.3) |
| Mar 6/76 | 180.36 MP | 634.7 | |
| Apr 6/76 | 180.11 MP | 635.5 | |
| May 4/76 | 179.51 MP | 637.5 | |
| June 1/76 | 179.17 MP | 638.6 | |
| June 22/76 | 179.14 MP | 638.7 | |
| July 15/76 | 178.70 MP | 640.2 | Sample; temp. 9°C |
| Aug 10/76 | 178.60 MP | 640.5 | |
| Aug 31/76 | 178.48 MP | 640.9 | |
| Sept 29/76 | 178.21 MP | 641.8 | |
| Oct 26/76 | 177.90 MP | 642.8 | |
| Nov 23/76 | 177.61 MP | 643.7 | |
| Dec 20/76 | 177.31 MP | 644.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1223.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 177.09 MP | 645.4 | MP (1226.3) |
| Feb 15/77 | 176.77 MP | 646.5 | |
| Mar 15/77 | 176.55 MP | 647.2 | |
| Apr 13/77 | 176.18 MP | 648.4 | |
| May 10/77 | 175.38 MP | 651.0 | |
| June 7/77 | 175.05 MP | 652.1 | |
| July 7/77 | 175.17 MP | 651.7 | Sampled; temp. 15°C |
| Aug 3/77 | 175.09 MP | 652.0 | |
| Aug 30/77 | 174.80 MP | 653.0 | |
| Sept 28/77 | 174.44 MP | 654.1 | |
| Oct 25/77 | 174.92 MP | 652.6 | |
| Nov 23/77 | 174.05 MP | 655.4 | |
| Dec 19/77 | 173.30 MP | 657.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1223.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 173.37 MP | 657.6 | MP (1226.3) |
| Feb 13/78 | 173.10 MP | 658.5 | |
| Mar 14/78 | 173.94 MP | 655.8 | |
| Apr 12/78 | 172.66 MP | 660.0 | |
| May 9/78 | 172.38 MP | 660,9 | |
| June 6/78 | 171.80 MP | 662.8 | |
| July 7/78 | 171.71 MP | 663.1 | Sampled; temp 11°C |
| Aug 1/78 | 171.45 MP | 663.9 | |
| Aug 29/78 | 170.80 MP | 666.1 | |
| Sept 26/78 | 170.90 MP | 665.7 | |
| Oct 24/78 | 170.25 MP | 667.9 | |
| Nov 21/78 | 170.68 MP | 666.5 | |
| Dec 19/78 | 170.31 MP | 667.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-699

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1223.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 170.15 MP | 668.2 | MP (1226.3) |
| Feb 13/79 | 169.76 MP | 669.5 | |
| Mar 13/79 | 169.62 MP | 669.9 | |
| Apr 11/79 | 169.23 MP | 671.2 | |
| May 8/79 | 169.08 MP | 671.7 | |
| June 6/79 | 168.67 MP | 673.1 | |
| July 5/79 | 168.41 MP | 673.9 | Sampled; temp. 11°C |
| Aug 3/79 | 168.27 MP | 673.6 | New MP 0.64m TOC (1225.5) |
| Aug 29/79 | 168.02 MP | 674.4 | |
| Sept 25/79 | 167.67 MP | 675.5 | |
| Oct 23/79 | 167.38 MP | 676.5 | |
| Nov 20/79 | 167.14 MP | 677.3 | |
| Dec 18/79 | 166.94 MP | 677.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

14 - 699 - W - 82

WELL HISTORY

OBSERVATION WELL NUMBER 14 - 699

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1223.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 166.68 MP | 678.8 | |
| Feb 12/80 | 166.45 MP | 679.5 | |
| Mar 11/80 | 166.19 MP | 680.4 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 165.66 MP | 682.1 | |
| June 3/80 | 165.35 MP | 683.1 | |
| July 5/80 | 165.05 MP | 684.1 | Temp. 8°C |
| July 29/80 | 165.07 MP | 684.1 | |
| Aug 26/80 | 164.83 MP | 684.9 | |
| Sept 24/80 | 164.62 MP | 685.5 | |
| Oct 21/80 | 164.13 MP | 687.2 | |
| Nov 18/80 | 164.05 MP | 687.4 | |
| Dec 17/80 | 163.63 MP | 688.8 | |
| Jan 15/81 | 163.39 MP | 689.6 | |
| Feb 11/81 | 163.41 MP | 689.5 | |
| Mar 10/81 | 162.91 MP | 691.2 | |
| Apr 7/81 | 162.66 MP | 692.0 | |
| May 5/81 | 162.42 MP | 692.8 | |
| June 2/81 | 162.30 MP | 693.2 | |
| June 30/81 | 161.94 MP | 694.3 | |
| July 28/81 | 161.68 MP | 695.2 | |
| Aug 26/81 | 161.75 MP | 695.0 | |
| Sept 23/81 | 161.36 MP | 696.2 | |
| Oct 20/81 | 161.10 MP | 697.1 | |
| Nov 20/81 | 160.87 MP | 697.8 | |
| Dec 16/81 | 160.64 MP | 698.6 | |

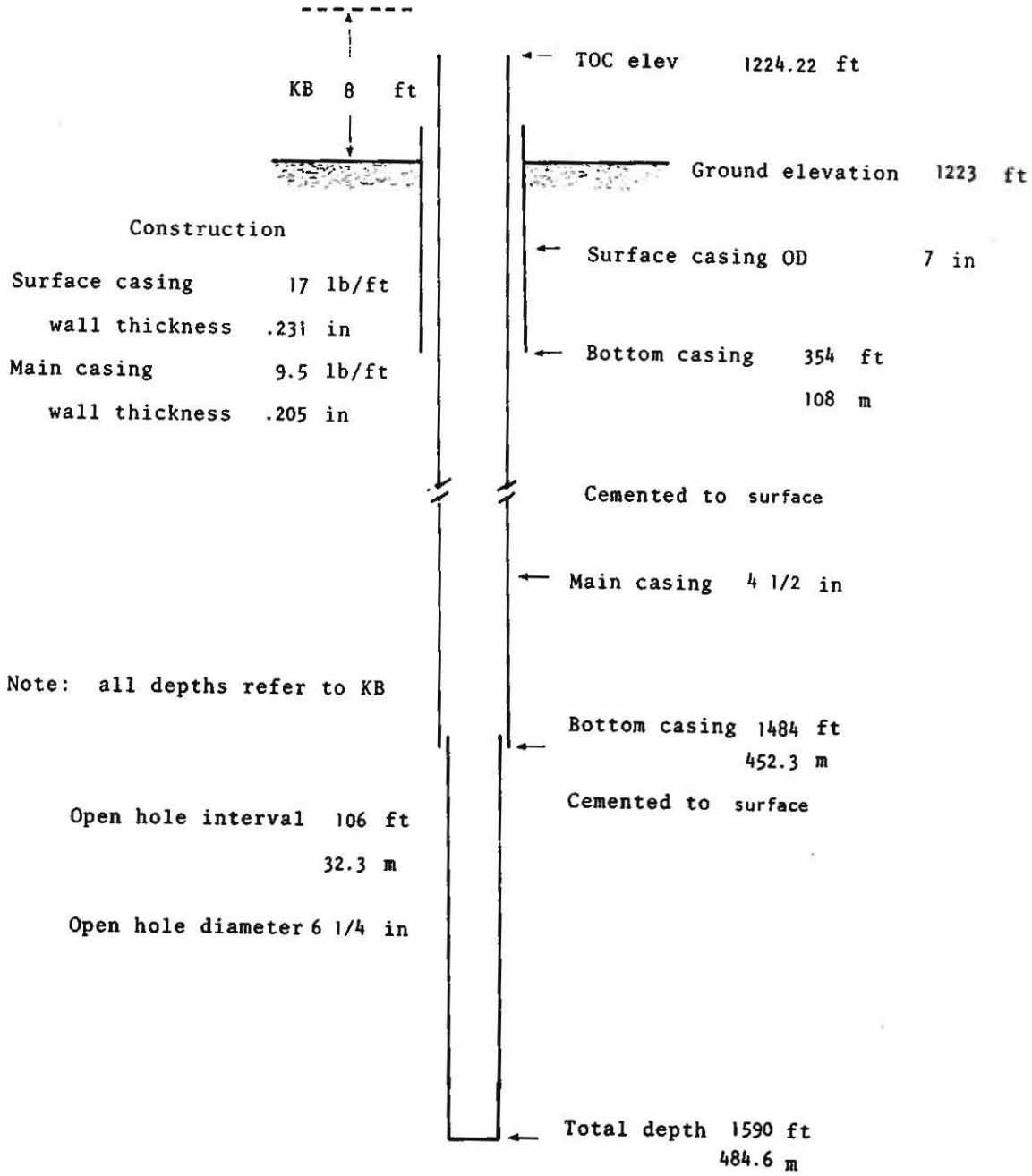
MP - Depth from measuring point
TOC - Depth from top of casing

**WELL CONSTRUCTION.**

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Tp 92 R 12 W 4th

Alberta Research Council




Construction

Surface casing 17 lb/ft

wall thickness .231 in

Main casing 9.5 lb/ft

wall thickness .205 in

Note: all depths refer to KB

Open hole interval 106 ft

32.3 m

Open hole diameter 6 1/4 in

## DRILL STEM TEST

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Tp 92 R 12 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1223 |
| | KB | 1231 |
| Type of test | | Open hole, Bottom hole |
| Date of test | | February 8, 1976 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 1100 | hrs |
| Tool opened | 1200 | hrs |
| First flow | 2 | min |
| Initial shut in | 28 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1345 | hrs |
| Out of hole at | 1400 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Fair initial puff decreasing to nil in one minute on preflow. No blow on final flow period

Total water recovered 10 ft

Water sample No. - (drilling mud)

Gas blow No

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 586-698'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 592 | 596 |
| Initial hydrostatic | A | 262 | 264 |
| First flow | B | 13 | 16 |
| | B1 | 12 | 14 |
| Initial shut in | C | 55 | 57 |
| Second flow | D | 14 | 16 |
| | D1 | 14 | 16 |
| Final shut in | G | 145 | 147 |
| Final hydrostatic | H | - | 262 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 14-1590

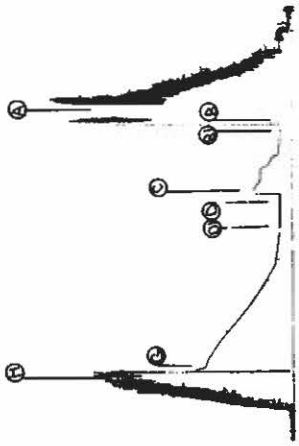
INTERVAL TESTED 586-698'

PRESSURE INCREMENTS

Recorder AK1-65
February 8, 1976

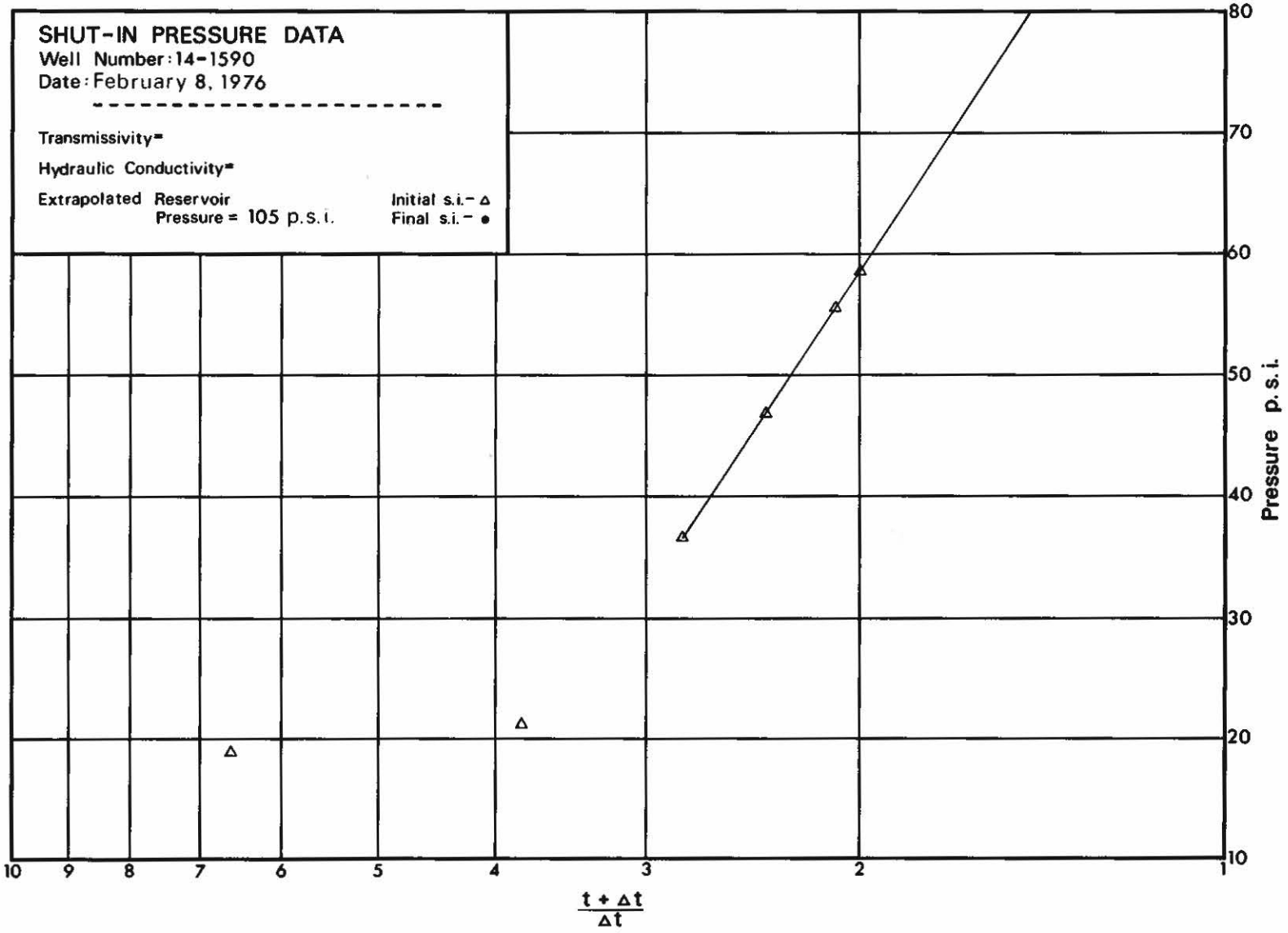
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 18.7 | 6.6 |
| 10 | 21.0 | 3.8 |
| 15 | 36.7 | 2.8 |
| 20 | 47.0 | 2.4 |
| 25 | 56.0 | 2.1 |
| 30 | 59.0 | 2.0 |

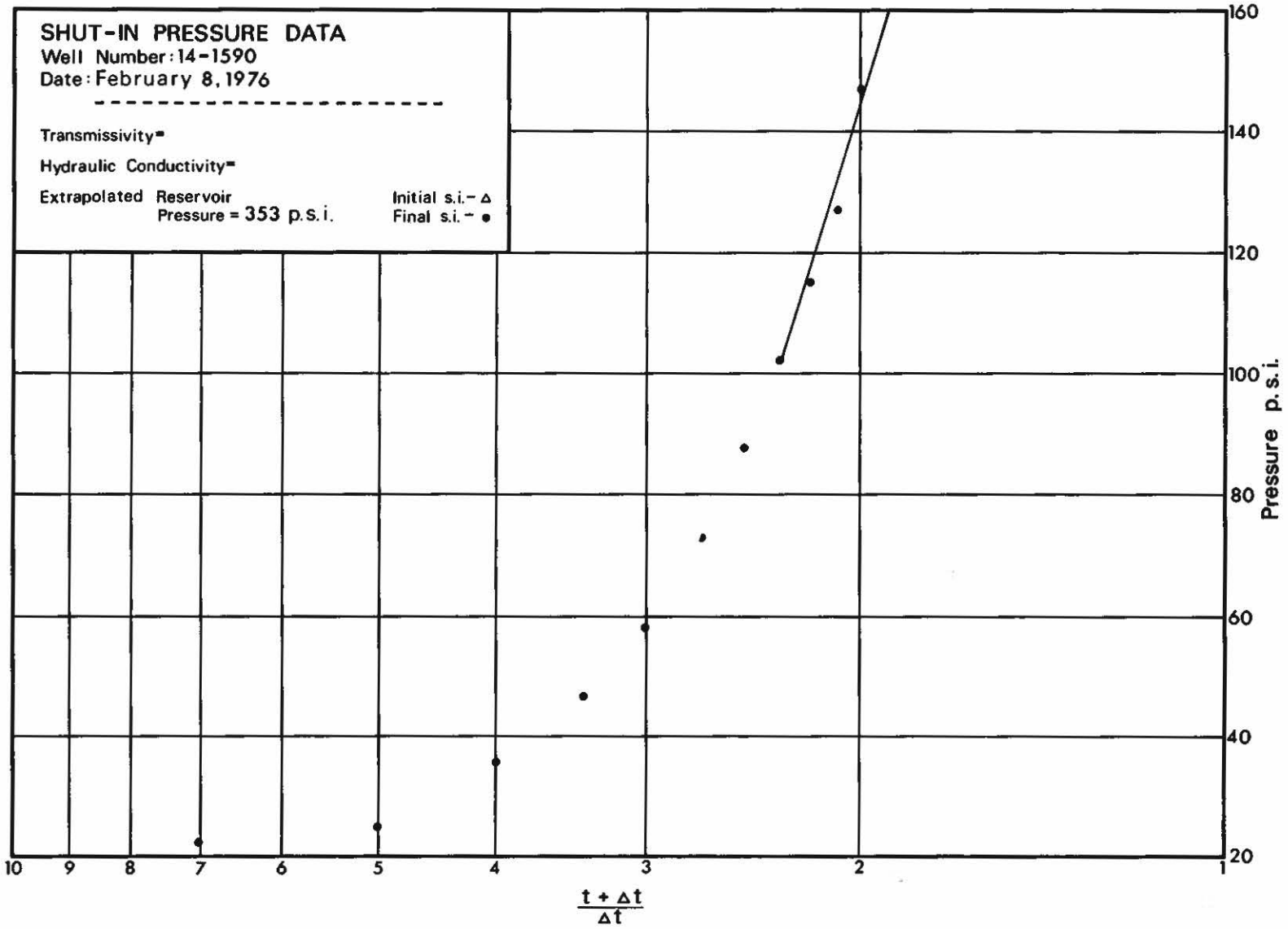


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 21.0 | 13.00 |
| 10 | 23.2 | 7.00 |
| 15 | 26.5 | 5.00 |
| 20 | 36.0 | 4.00 |
| 25 | 47.2 | 3.40 |
| 30 | 58.5 | 3.00 |
| 35 | 72.0 | 2.71 |
| 40 | 86.7 | 2.50 |
| 45 | 102.0 | 2.33 |
| 50 | 115.0 | 2.20 |
| 55 | 127.0 | 2.09 |
| 60 | 147.7 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 14-1590
Date: February 8, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 105 p.s.i.
Initial s.i.- Δ
Final s.i.- •
80
70
60
50
40
30
20
10
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

14-1590-D-77


SHUT-IN PRESSURE DATA
Well Number: 14-1590
Date: February 8, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 353 p.s.i.
Initial s.i.- Δ
Final s.i. - •
160
140
120
100
80
60
40
20
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

14-1590-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Tp 92 R 12 W4th

Alberta Research Council

Elevation: gl 1223
KB 1231

Type of test Open hole, Bottom hole

Date of test February 9, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1200 | hrs |
| Tool opened | 1313 | hrs |
| First flow | 2 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1500 | hrs |
| Out of hole at | 1600 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff on preflow. Faint blow on final flow period decreasing to nil in one minute

Total water recovered 10 ft

Water sample No. - (drilling mud)

Gas blow No

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF MOD.

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 713-855'

Formation tested Beaverhill Lake & Slave Point

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.70 | |
| Drill Pipe | 123.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 142.00 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 719 | 724 |
| Initial hydrostatic | A | 317 | 318 |
| First flow | B | 13 | 14 |
| | B1 | 12 | 13 |
| Initial shut in | C | 15 | 16 |
| Second flow | D | 13 | 13 |
| | D1 | 13 | 13 |
| Final shut in | G | 15 | 16 |
| Final hydrostatic | H | - | 315 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

14-1590-D-77

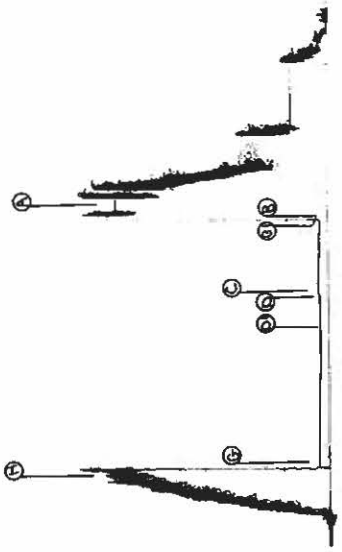
OBSERVATION WELL NUMBER 14-1590

INTERVAL TESTED 713-855

PRESSURE INCREMENTS
Recorder AKI-65
February 9, 1976

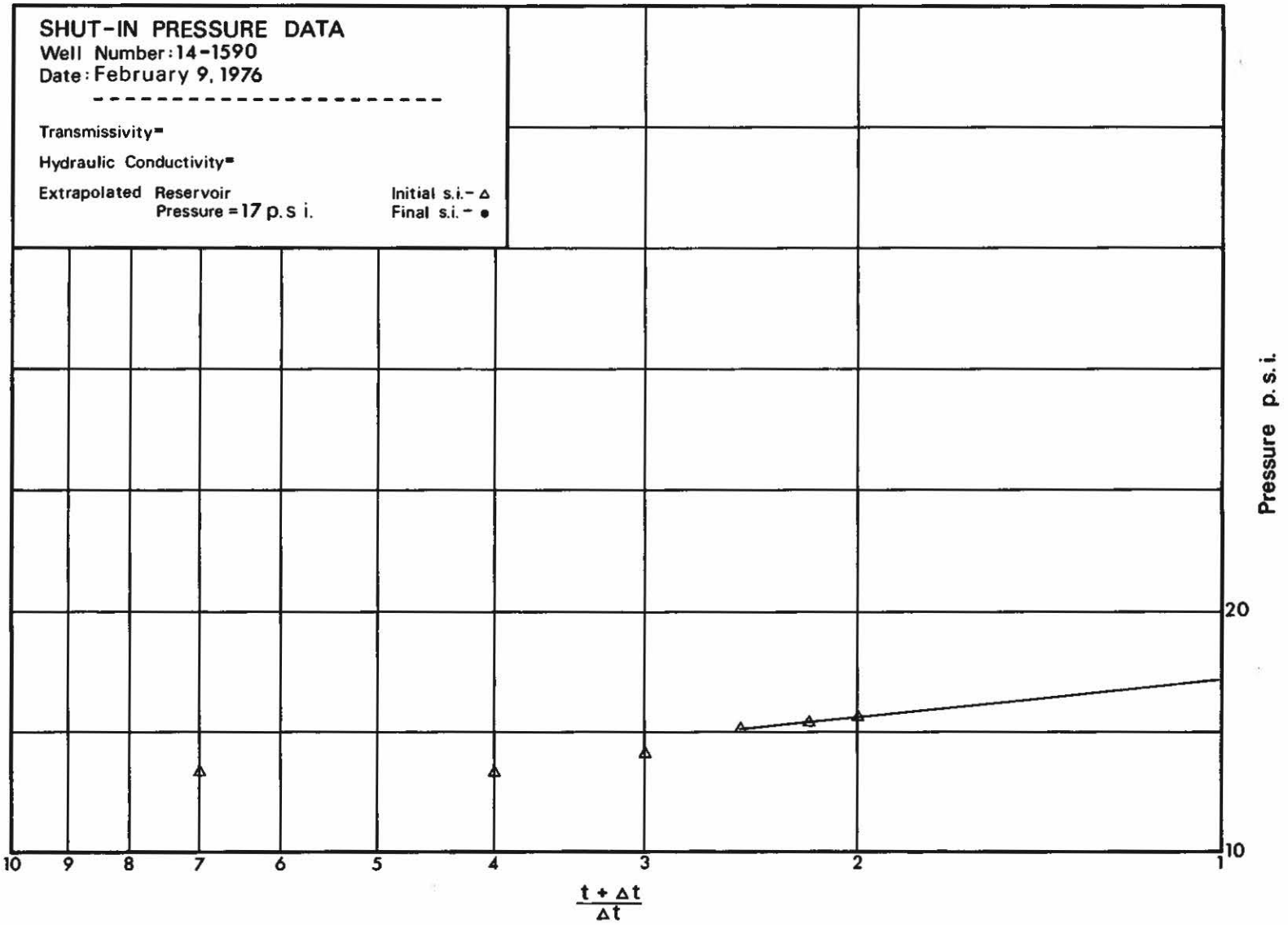
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 13.3 | 7.00 |
| 10 | 13.3 | 4.00 |
| 15 | 14.1 | 3.00 |
| 20 | 15.1 | 2.50 |
| 25 | 15.4 | 2.20 |
| 30 | 15.6 | 2.00 |

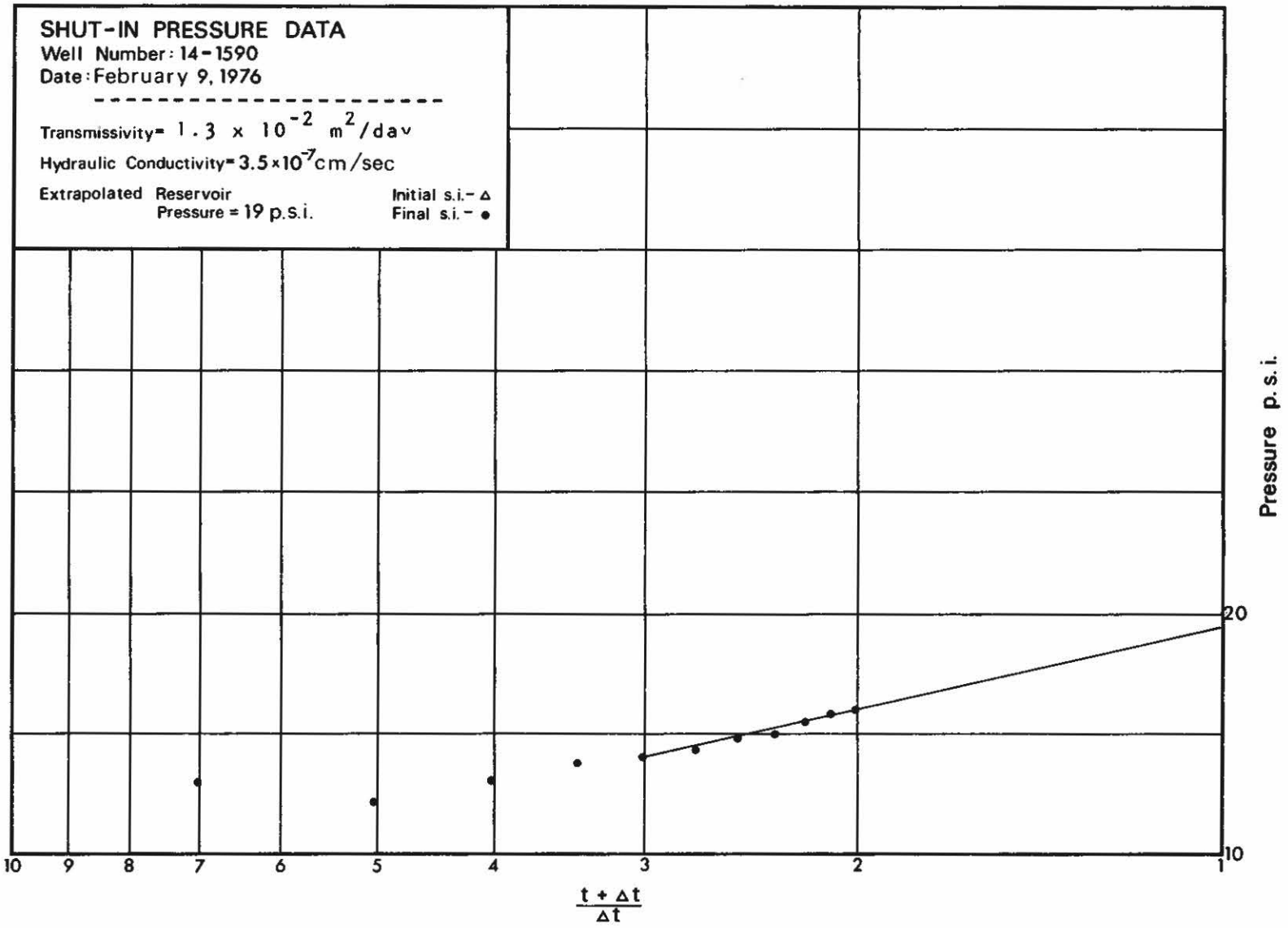


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 12.8 | 13.00 |
| 10 | 13.1 | 7.00 |
| 15 | 12.3 | 5.00 |
| 20 | 13.1 | 4.00 |
| 25 | 13.8 | 3.40 |
| 30 | 14.1 | 3.00 |
| 35 | 14.5 | 2.71 |
| 40 | 14.9 | 2.50 |
| 45 | 15.1 | 2.33 |
| 50 | 15.6 | 2.20 |
| 55 | 15.9 | 2.09 |
| 60 | 16.2 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 14-1590
Date: February 9, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 17 p.s i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
20
10
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

14-1590-D-77


SHUT-IN PRESSURE DATA
Well Number: 14-1590
Date: February 9, 1976
Transmissivity= 1.3 x 10^-2 m^2/day
Hydraulic Conductivity= 3.5 x 10^-7 cm/sec
Extrapolated Reservoir Pressure = 19 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
20
10
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

14-1590-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Tp 92 R 12 W4th

Alberta Research Council

Elevation: gl 1222

KB 1230

Type of test Open hole, Bottom hole

Date of test February 11, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0100 | hrs |
| Tool opened | 0228 | hrs |
| First flow | 2 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0415 | hrs |
| Out of hole at | 0530 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff on preflow. Very faint air blow on final flow period

Total water recovered 180 ft

Water sample No. - (drilling mud)

Gas blow No

Remarks Misrun, crossover sub leaked

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 1265-1325'

Formation tested Prairie Evaporite

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Perfs | 10.00 | |
| Sub | 1.70 | |
| Drill Pipe | 31.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 60.00 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 1272 | 1276 |
| Initial hydrostatic | A | - | 677 |
| First flow | B | - | - |
| | B1 | - | - |
| Initial shut in | C | - | - |
| Second flow | D | - | - |
| | D1 | - | - |
| Final shut in | G | - | - |
| Final hydrostatic | H | 652 | 653 |

B1, D1, etc. Initial Hyd. Pressure

## DRILL STEM TEST

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Tp 92 R 12 W4th

Alberta Research Council

Elevation: gl 1223
KB 1231

Type of test Open hole, Bottom hole

Date of test February 12, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1130 | hrs |
| Tool opened | 1328 | hrs |
| First flow | 2 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1515 | hrs |
| Out of hole at | 1630 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff. Faint air blow on second opening decreasing to nil in 2 minutes.

Total water recovered 40 ft

Water sample No. - (drilling mud)

Gas blow Nil

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 1400-1450'

Formation tested Methy

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.70 | |
| Drill Pipe | 31.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 50.00 | |

### PRESSURE DATA (psi)

| Instrument No. | | 64 | 65 |
|---|---|---|---|
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 1407 | 1411 |
| Initial hydrostatic | A | 730 | 732 |
| First flow | B | 20 | 22 |
| | B1 | 19 | 21 |
| Initial shut in | C | 26 | 28 |
| Second flow | D | 23 | 25 |
| | D1 | 21 | 23 |
| Final shut in | G | 29 | 31 |
| Final hydrostatic | H | 709 | 711 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

14-1590-D-77

OBSERVATION WELL NUMBER 14-1590

INTERVAL TESTED 1400-1450

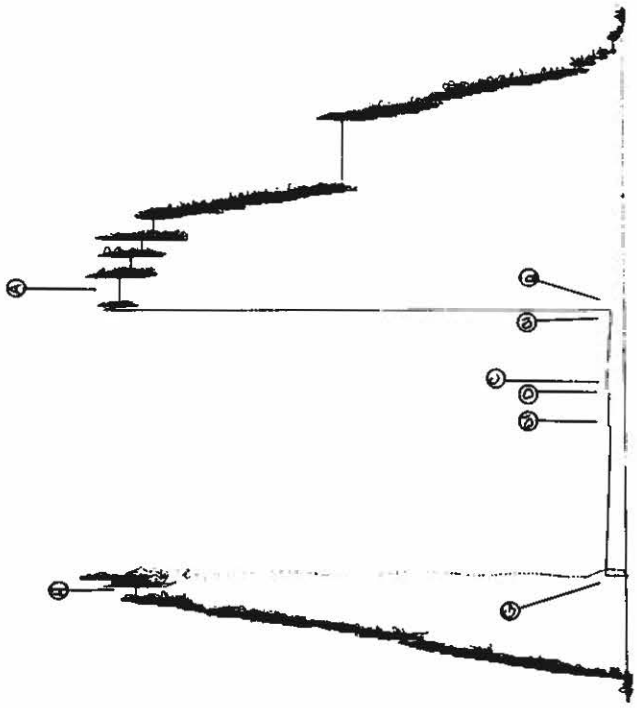
PRESSURE INCREMENTS

Recorder AK1-65

February 12, 1976

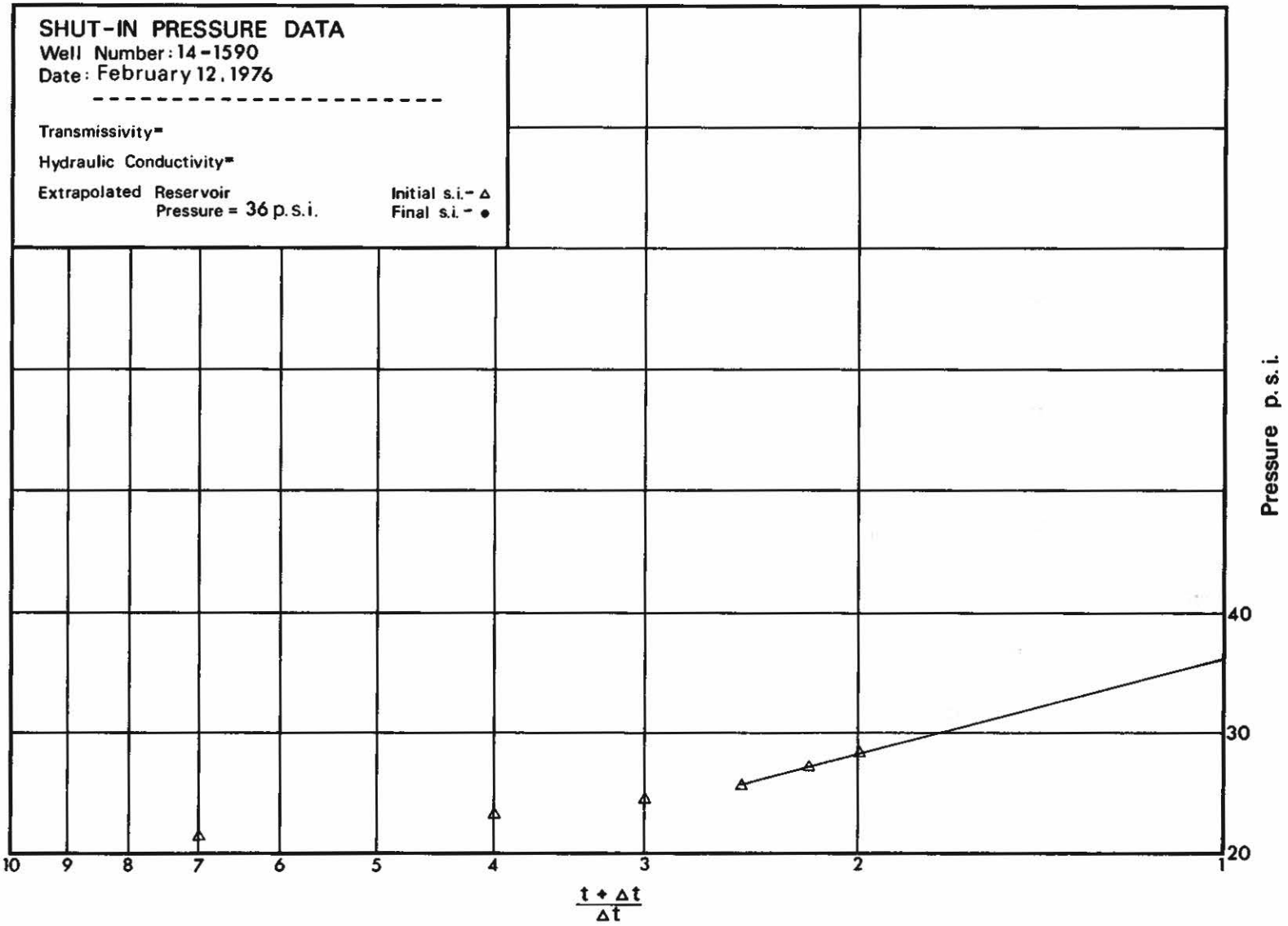
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 21.6 | 7.00 |
| 10 | 23.2 | 4.00 |
| 15 | 24.7 | 3.00 |
| 20 | 25.8 | 2.50 |
| 25 | 27.1 | 2.20 |
| 30 | 28.2 | 2.00 |

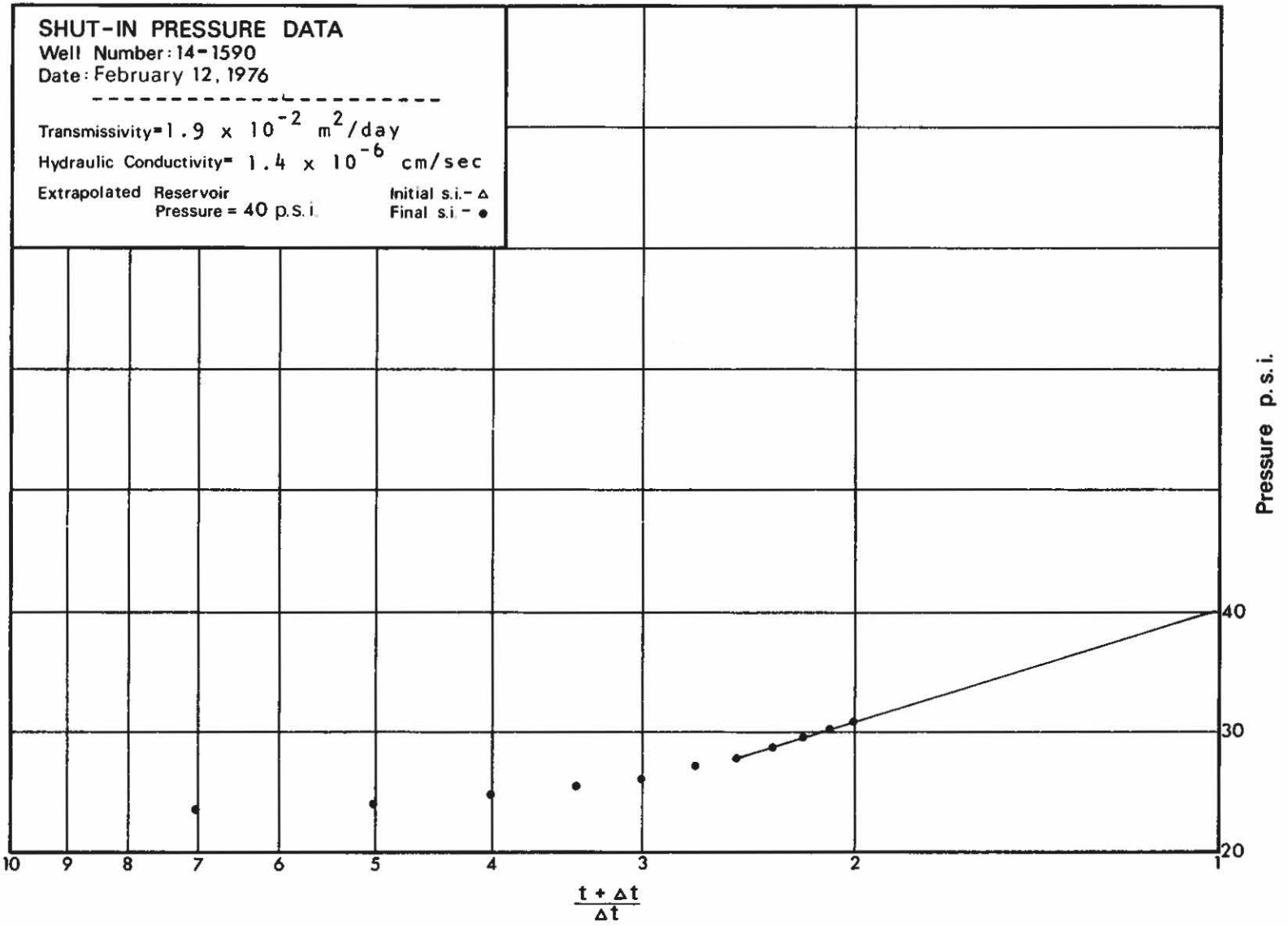


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 22.6 | 13.00 |
| 10 | 23.4 | 7.00 |
| 15 | 23.9 | 5.00 |
| 20 | 24.7 | 4.00 |
| 25 | 25.3 | 3.40 |
| 30 | 26.0 | 3.00 |
| 35 | 27.1 | 2.71 |
| 40 | 27.8 | 2.50 |
| 45 | 28.7 | 2.33 |
| 50 | 29.5 | 2.20 |
| 55 | 30.0 | 2.09 |
| 60 | 31.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 14-1590
Date: February 12, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 36 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
40
30
20
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

14-1590-D-77


SHUT-IN PRESSURE DATA
Well Number: 14-1590
Date: February 12, 1976
Transmissivity = 1.9 x 10^-2 m^2/day
Hydraulic Conductivity = 1.4 x 10^-6 cm/sec
Extrapolated Reservoir Pressure = 40 p.s.i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
40
30
20
10
9
8
7
6
5
4
3
2
1
(t + Δt)/Δt

14-1590-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Tp 92 R 12 W4th

Alberta Research Council

Elevation: gl 1223
KB 1231

Type of test Open hole, Bottom hole

Date of test February 13, 1976 I

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1030 | hrs |
| Tool opened | 1244 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1430 | hrs |
| Out of hole at | 1600 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Good initial puff. Fair air blow and steady on second opening.

Total water recovered 120 ft

Water sample No. - (Salty water 147,000 ppm)

Gas blow Nil

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 1450-1530'

Formation tested Methy

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.70 | |
| Drill Pipe | 62.00 | |
| Sub | 2.70 | |
| Total Interval | 81.00 | |

### PRESSURE DATA (psi)

| Instrument No. | | 64 | 65 |
|---|---|---|---|
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 1457 | 1461 |
| Initial hydrostatic | A | 736 | 740 |
| First flow | B | 24 | 28 |
| | B1 | 27 | 29 |
| Initial shut in | C | 552 | 556 |
| Second flow | D | 45 | 47 |
| | D1 | 59 | 62 |
| Final shut in | G | 513 | 517 |
| Final hydrostatic | H | 730 | 734 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

14-1590-D-77

OBSERVATION WELL NUMBER 14-1590

INTERVAL TESTED 1450-1530

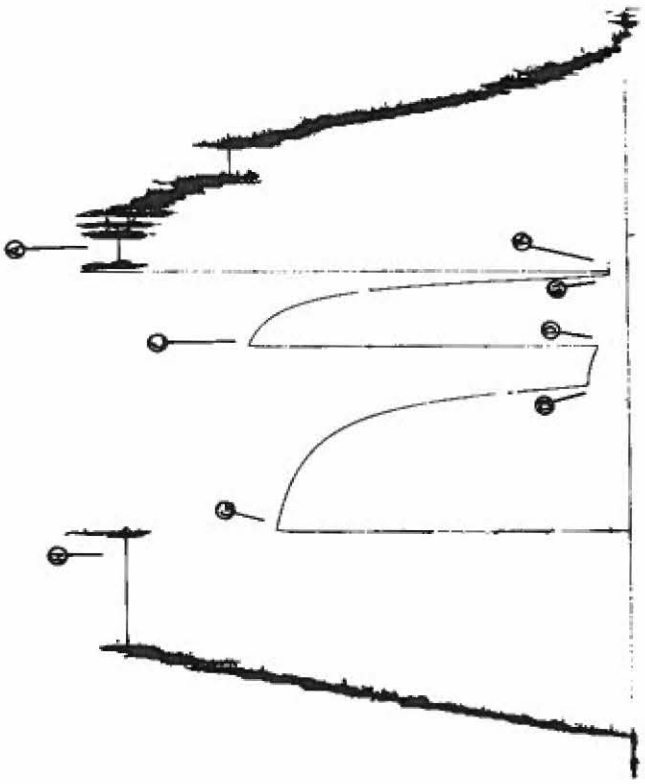
PRESSURE INCREMENTS

Recorder AK1-65

February 13, 1976 |

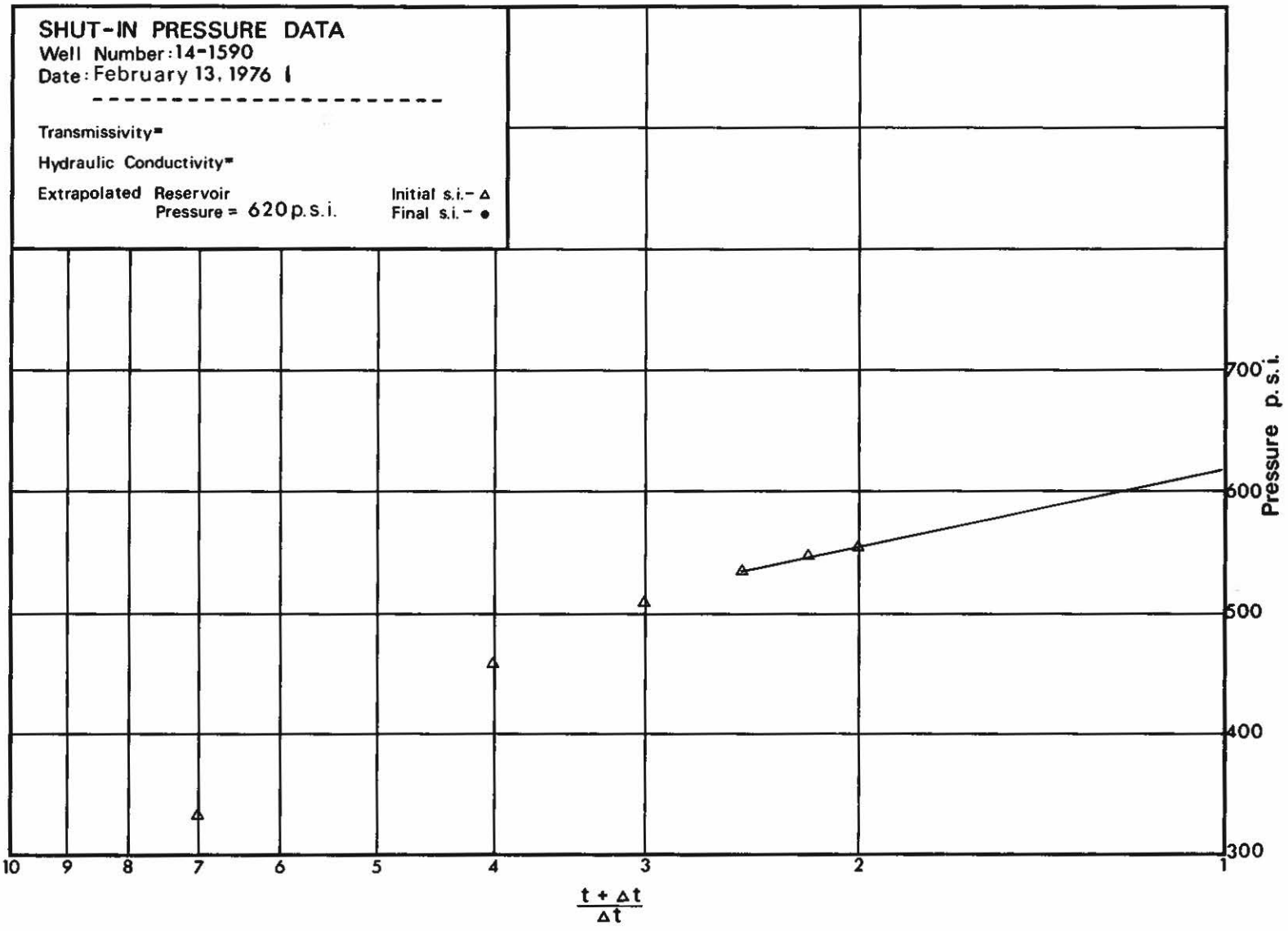
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 332.1 | 7.00 |
| 10 | 457.5 | 4.00 |
| 15 | 508.8 | 3.00 |
| 20 | 534.6 | 2.50 |
| 25 | 549.0 | 2.20 |
| 30 | 555.5 | 2.00 |

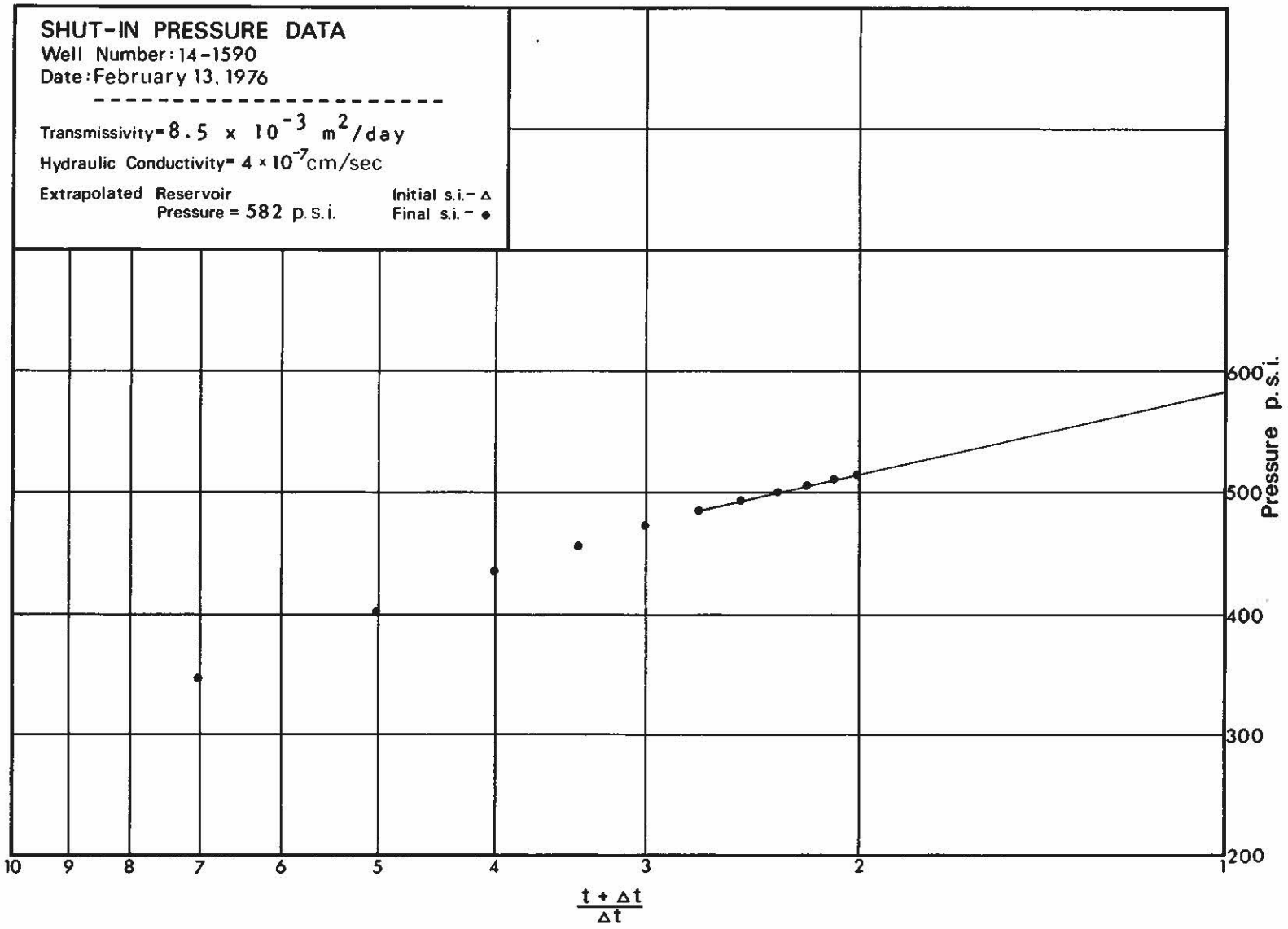


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 241.6 | 13.00 |
| 10 | 345.0 | 7.00 |
| 15 | 400.5 | 5.00 |
| 20 | 434.3 | 4.00 |
| 25 | 457.3 | 3.40 |
| 30 | 473.7 | 3.00 |
| 35 | 486.1 | 2.71 |
| 40 | 495.7 | 2.50 |
| 45 | 503.0 | 2.33 |
| 50 | 508.8 | 2.20 |
| 55 | 513.6 | 2.09 |
| 60 | 516.9 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 14-1590
Date: February 13, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 620 p.s.i.
Initial s.i. - Δ
Final s.i. - •
700
600
500
400
300
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

14-1590-D-77


SHUT-IN PRESSURE DATA
Well Number: 14-1590
Date: February 13, 1976
Transmissivity = 8.5 x 10^-3 m^2/day
Hydraulic Conductivity = 4 x 10^-7 cm/sec
Extrapolated Reservoir Pressure = 582 p.s.i.
Initial s.i. - Δ
Final s.i. - •
600
500
400
300
200
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
(t + Δt)/Δt

14-1590-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Tp 92 R 12 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1223 |
| | KB | 1231 |
| Type of test | | Open hole, Bottom hole |
| Date of test | | February 13, 1976 11 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 1245 | hrs |
| Tool opened | 1344 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1530 | hrs |
| Out of hole at | 1700 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Fair initial puff. Fair air blow and steady for 10 min on second opening decreasing to nil in 15 minutes

Total water recovered 210 ft

Water sample No. - (Salty water 250,000 ppm)

Gas blow Nil

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 1510-1590'

Formation tested Methy

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.70 | |
| Drill Pipe | 62.00 | |
| Sub | 2.70 | |
| Total Interval | 81.00 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 1516 | 1521 |
| Initial hydrostatic | A | 776 | 781 |
| First flow | B | 63 | 66 |
| | B1 | 63 | 67 |
| Initial shut in | C | 577 | 583 |
| Second flow | D | 72 | 77 |
| | D1 | 85 | 89 |
| Final shut in | G | 535 | 540 |
| Final hydrostatic | H | Unreadable | 773 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 14-1590

INTERVAL TESTED 1510-1590

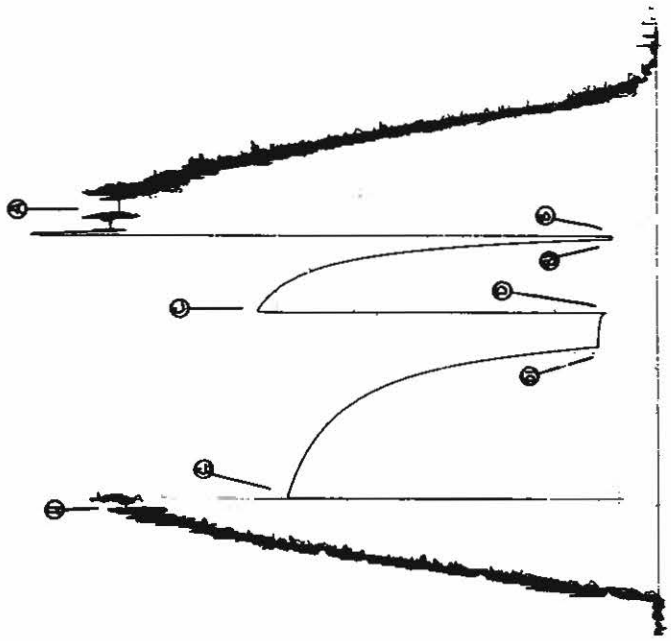
PRESSURE INCREMENTS

Recorder AK1-65

February 13, 1976 ||

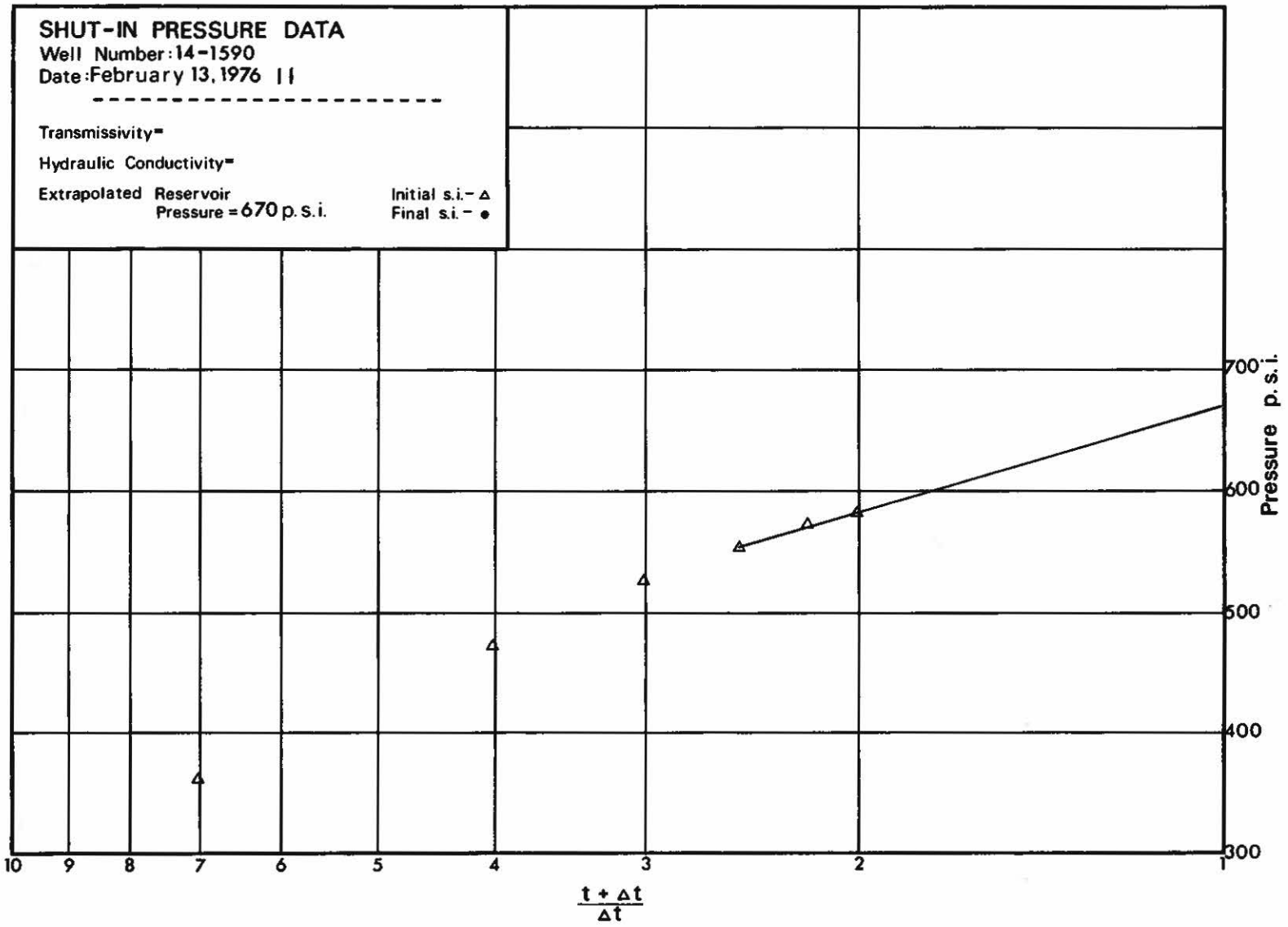
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 360.5 | 7.00 |
| 10 | 471.3 | 4.00 |
| 15 | 523.9 | 3.00 |
| 20 | 553.4 | 2.50 |
| 25 | 572.5 | 2.20 |
| 30 | 582.6 | 2.00 |



Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 244.3 | 13.00 |
| 10 | 335.6 | 7.00 |
| 15 | 391.4 | 5.00 |
| 20 | 429.2 | 4.00 |
| 25 | 456.7 | 3.40 |
| 30 | 477.3 | 3.00 |
| 35 | 493.5 | 2.71 |
| 40 | 506.3 | 2.50 |
| 45 | 516.4 | 2.33 |
| 50 | 525.4 | 2.20 |
| 55 | 532.7 | 2.09 |
| 60 | 539.8 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 14-1590
Date: February 13, 1976 II
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 670 p.s.i.
Initial s.i. - Δ
Final s.i. - •
700
600
500
400
300
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

14-1590-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source DST #5 on 14-1590

Date sampled February 13, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1700.0 | 84.83 | 2.0 |
| Magnesium ($Mg^{++}$) | 190.0 | 15.64 | 0.4 |
| Sodium ($Na^{+}$) | 96750.0 | 4208.35 | 97.6 |
| Potassium ($K^{+}$) | 58.0 | 1.48 | 0.0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 90.0 | 1.48 | 0.0 |
| Sulfate ($SO_4^{=}$) | 3890.0 | 80.99 | 1.7 |
| Chloride ($Cl^{-}$) | 164400.0 | 4636.21 | 98.3 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 1.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 288960.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4718.7 | Total Cations (epm) | 4310.3 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | |
| pH | 7.1 | pH | 6.9 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 83 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source DST #6 on 14-1590

Date sampled February 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1710.0 | 85.33 | 1.9 |
| Magnesium ($Mg^{++}$) | 220.0 | 18.11 | 0.4 |
| Sodium ($Na^{+}$) | 102500.0 | 4458.46 | 97.7 |
| Potassium ($K^{+}$) | 60.0 | 1.53 | 0.0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 102.0 | 1.67 | 0.0 |
| Sulfate ($SO_4^{=}$) | 2960.0 | 61.63 | 1.3 |
| Chloride ($Cl^{-}$) | 170000.0 | 4794.13 | 98.7 |
| Nitrate ($NO_3^{=}$) | 1.9 | 0.03 | 0.0 |
| Silica ($SiO_2$) | 1.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 284560.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4857.4 | Total Cations (epm) | 4563.4 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | | |
| pH | 7.1 | pH | 7.2 | |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 142 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Blown from 14-1590

Date sampled February 15, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 56.0 | 2.79 | 4.0 |
| Magnesium ($Mg^{++}$) | 6.7 | 0.55 | 0.8 |
| Sodium ($Na^{+}$) | 1512.0 | 65.77 | 94.4 |
| Potassium ($K^{+}$) | 22.1 | 0.57 | 0.8 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 237.0 | 3.88 | 3.8 |
| Sulfate ($SO_4^{=}$) | 163.0 | 3.39 | 3.3 |
| Chloride ($Cl^{-}$) | 3400.0 | 95.88 | 92.9 |
| Nitrate ($NO_3^{=}$) | 2.7 | 0.04 | 0.0 |
| Silica ($SiO_2$) | 11.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 5000.0 | | |
| Total Anions (epm) 103.2 | | Total Cations (epm) | 69.7 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | ~8000 | Temperature (C) | |
| pH | 7.3 | pH | 8.9 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 15, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3360.0 | 167.66 | 4 |
| Magnesium ($Mg^{++}$) | 6300.0 | 518.52 | 13 |
| Sodium ($Na^{+}$) | 75750.0 | 3294.91 | 82 |
| Potassium ($K^{+}$) | 1750.0 | 44.77 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 395.0 | 6.47 | 0 |
| Sulfate ($SO_4^{=}$) | 258.0 | 5.37 | 0 |
| Chloride ($Cl^{-}$) | 203000.0 | 5724.76 | 100 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0 |
| Silica ($SiO_2$) | 0.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 3454.0 | | |
| Magnesium (Acidified) | 6215.0 | | |
| Total dissolved solids | 354240 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5736.63 | Total Cations (epm) | 4025.86 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 12.0 | |
| pH | 7.1 | pH | 7.4 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 478 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 7, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3350.0 | 167.17 | 4.2 |
| Magnesium ($Mg^{++}$) | 5480.0 | 451.03 | 11.5 |
| Sodium ($Na^{+}$) | 75250.0 | 3273.16 | 83.2 |
| Potassium ($K^{+}$) | 1688.0 | 43.18 | 1.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 549.0 | 9.00 | 0.2 |
| Sulfate ($SO_4^{=}$) | 297.0 | 6.18 | 0.1 |
| Chloride ($Cl^{-}$) | 199200.0 | 5617.60 | 99.7 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 0.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 3400.0 | | |
| Magnesium (Acidified) | 5200.0 | | |
| Total dissolved solids | 364660.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5632.79 | Total Cations (epm) | 3934.54 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 15.0 |
| pH | 7.9 | pH | 8.1 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 576.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Date sampled: July 15, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | 0.87 |
| Au | <.003 | Mo | <.006 |
| Al | 19.8 | Na | 68530 |
| As | <.038 | Ni | <.010 |
| B | 78.9 | P | 33 |
| Ba | <.200 | Pb | <.088 |
| Be | 0.42 | Se | <.060 |
| Ca | 33990 | Si | 5.28 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 606 |
| Cr | <.006 | Te | <.065 |
| Cu | .242 | Ti | 0.29 |
| Eu | <.015 | U | <.020 |
| Fe | 0.88 | V | 0.79 |
| K | 8140 | W | <.078 |
| Mg | 5412 | Zn | 4.29 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

14-1590-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 07, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 9999.0 | 498.95 | 11.9 |
| Magnesium(Mg) | 5500.0 | 452.67 | 10.8 |
| Sodium(Na) | 73750.0 | 3207.92 | 76.8 |
| Potassium(K) | 625.0 | 15.99 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 510.0 | 8.36 | 0.1 |
| Sulphate(SO4) | 281.0 | 5.85 | 0.1 |
| Chloride(Cl) | 204000.0 | 5752.96 | 99.7 |
| Nitrate(NO3) | 35.6 | 0.57 | 0.0 |
| Silica(SiO2) | 0.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 9999.0 | | |
| Magnesium(Acidified) | 5400.0 | | |
| TDS(mg/l) | 337600.0 | | |
| Total Anions(epm) | 5767.75 | Total Cations(epm) | 4175.53 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | | Temperature(C) | 16.00 | |
| pH | 8.0 | pH | 8.0 | |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 507 | mg/l |
| | | Hydroxide(OH) | | |

14-1590-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3340.0 | 166.67 | 4.5 |
| Magnesium(Mg) | 4400.0 | 362.14 | 9.9 |
| Sodium(Na) | 71250.0 | 3099.17 | 84.4 |
| Potassium(K) | 1667.0 | 42.65 | 1.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 454.0 | 7.44 | 0.1 |
| Sulphate(SO4) | 278.0 | 5.79 | 0.1 |
| Chloride(Cl) | 200000.0 | 5640.16 | 99.8 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 0.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 2940.0 | | |
| Magnesium(Acidified) | 3800.0 | | |
| TDS(mg/l) | 341900.0 | | |
| Total Anions(epm) | 5653.39 | Total Cations(epm) | 3670.63 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 18800 | Temperature(C) | 0.00 | |
| pH | 7.7 | pH | 7.8 | |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 507 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 14-1590-E-82

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Rge 12 Twp 92 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 5, 1980

## Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3430.0 | 171.50 | 7.8 |
| Magnesium(Mg) | 4600.0 | 383.33 | 17.5 |
| Sodium(Na) | 36563.0 | 1589.70 | 72.5 |
| Potassium(K) | 1875.0 | 48.08 | 2.2 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 403.0 | 6.61 | 0.1 |
| Sulphate(SO4) | 220.0 | 4.58 | 0.1 |
| Chloride(Cl) | 190000.0 | 5352.11 | 99.8 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 9.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1900.0 | | |
| Magnesium(Acidified) | 4600.0 | | |
| TDS(mg/l) | 405587.0 | | |
| Total Anions(epm) | 5363.30 | Total Cations(epm) | 2192.61 |

## Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 210000 |
| pH | 7.5 |
| Fluoride | 0.0 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 15.00 | |
| pH | 7.6 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 463 | mg/l |
| Hydroxide(OH) | | |

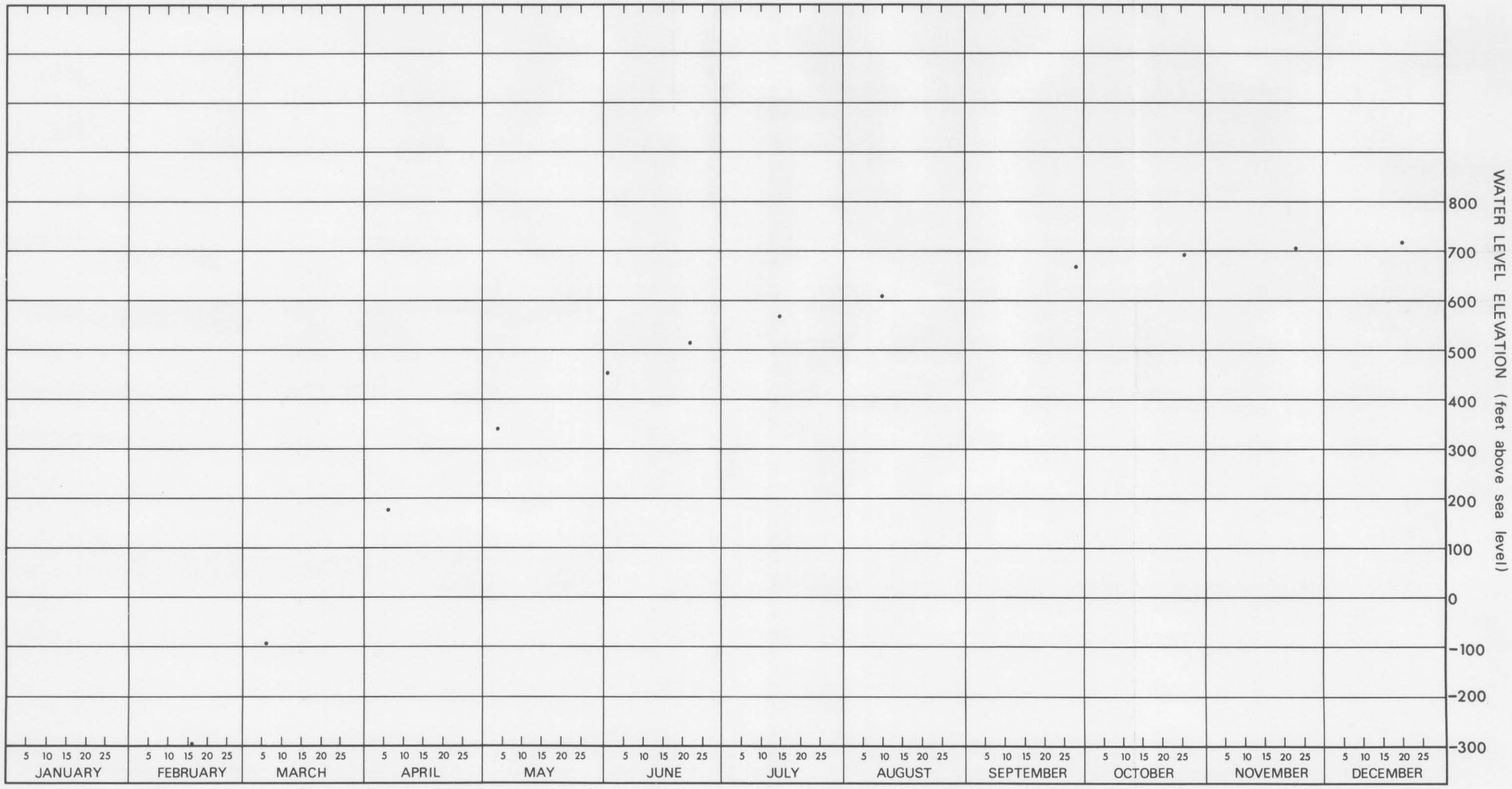
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **14-1590**

Lsd **4** Sec **15** Twp **92** R **12** W4th

Alberta Research Council

14 - 1590 - H - 77




1976

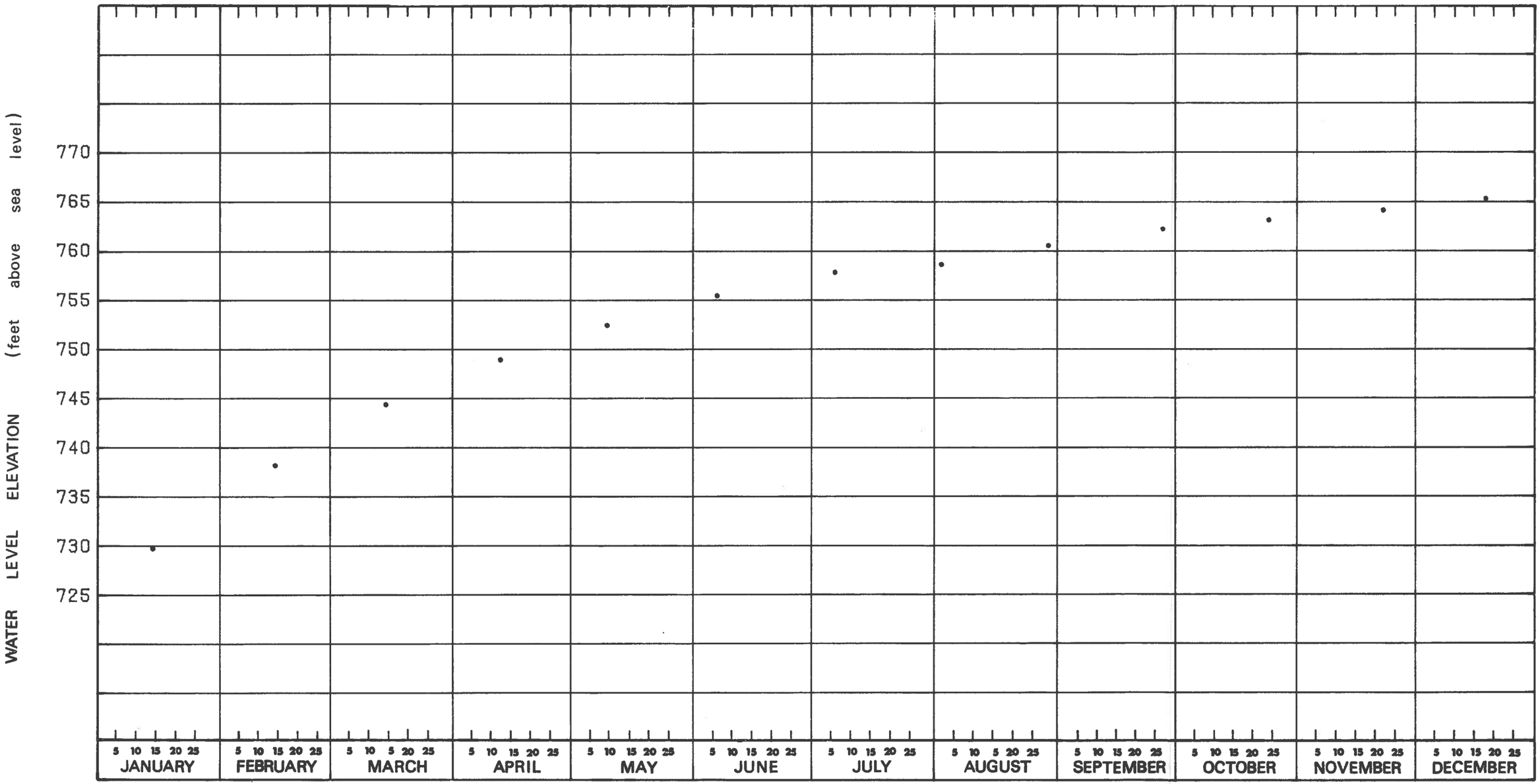
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-1590

14-1590-H-78

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council




1977

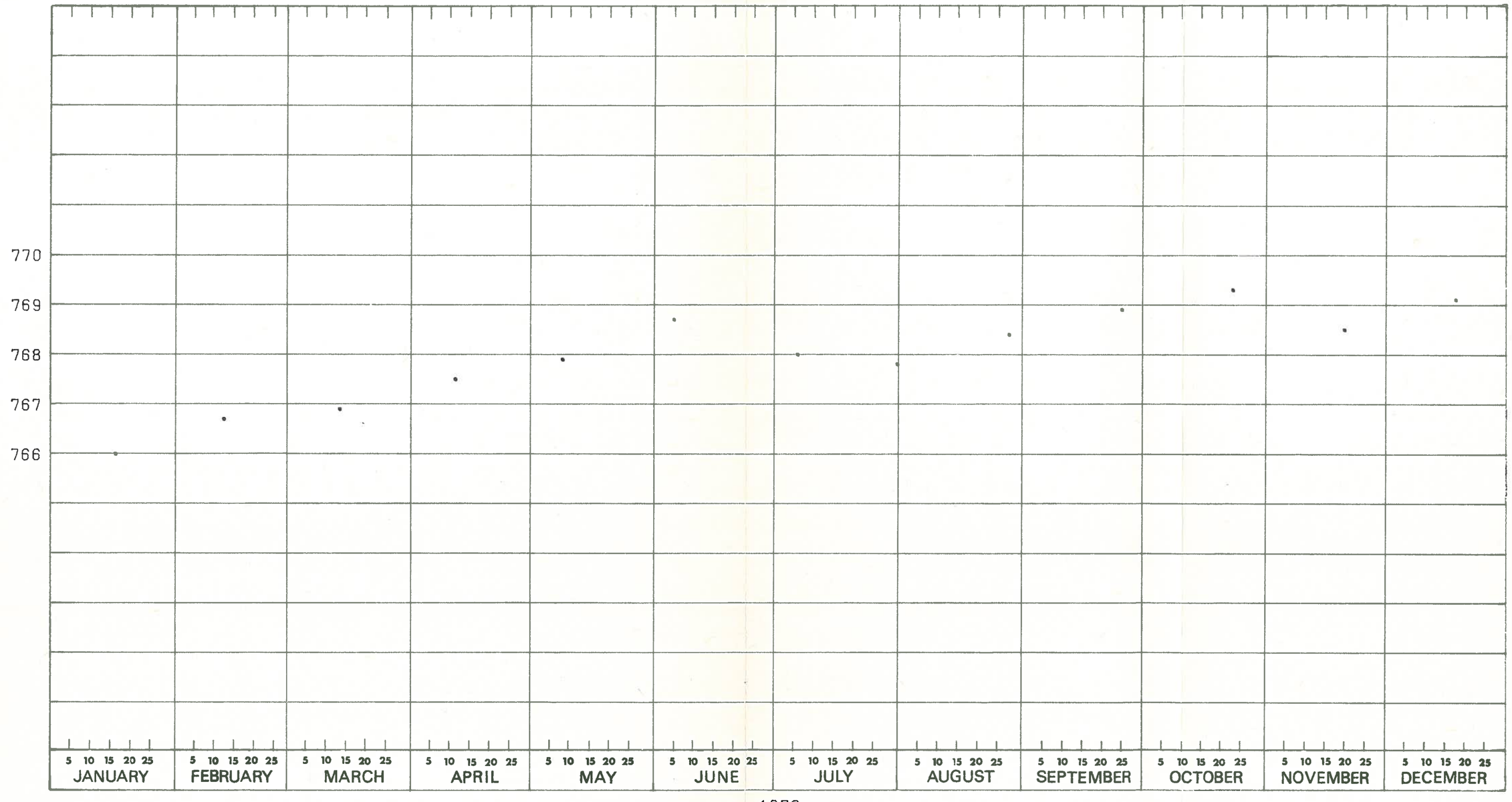
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-1590

LSD 4 SEC 15 TWP 92 R 12 W4TH

14-1590-H-79

Alberta Research Council




1978

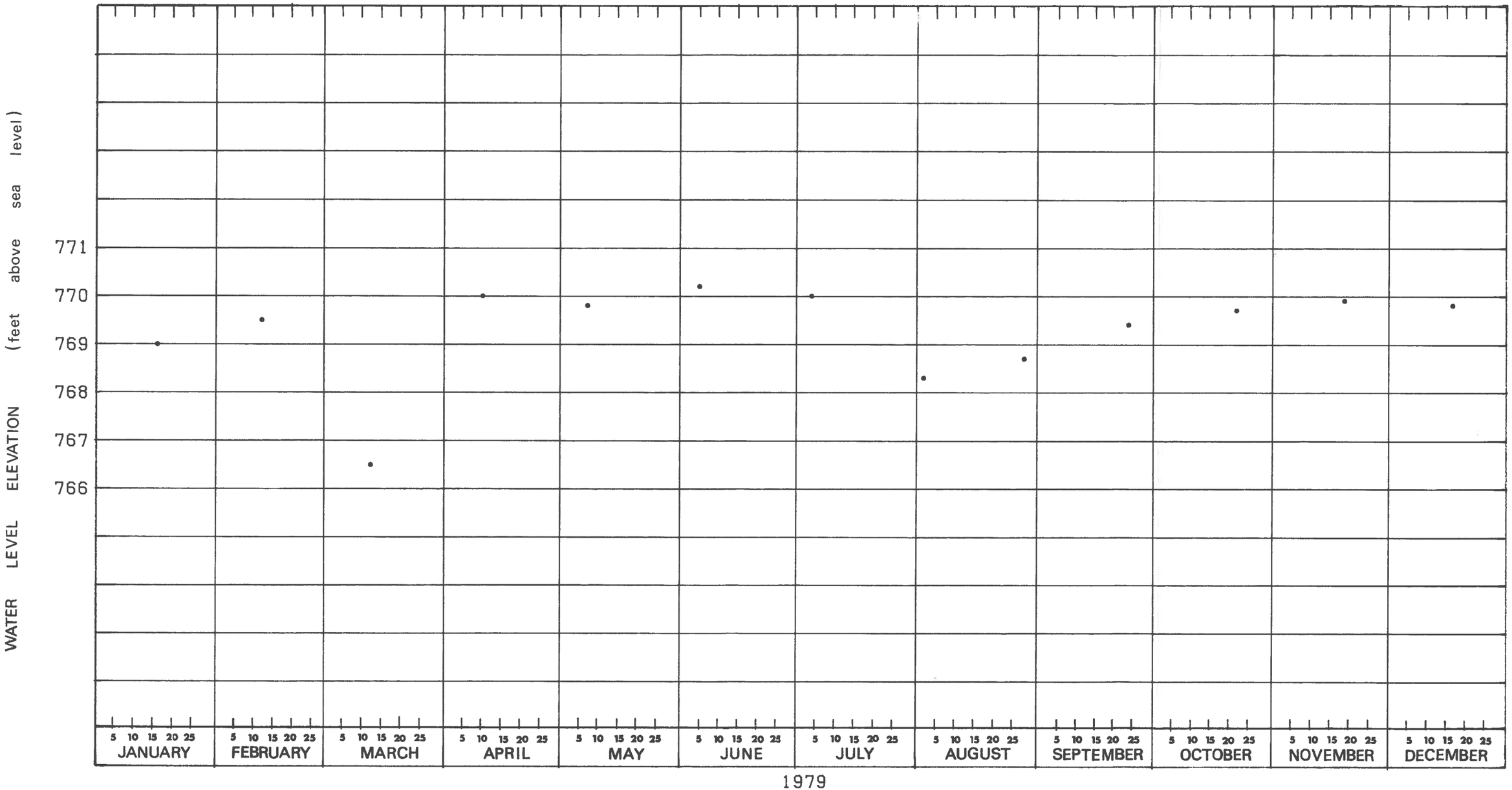
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-1590

14-1590-H-80

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council



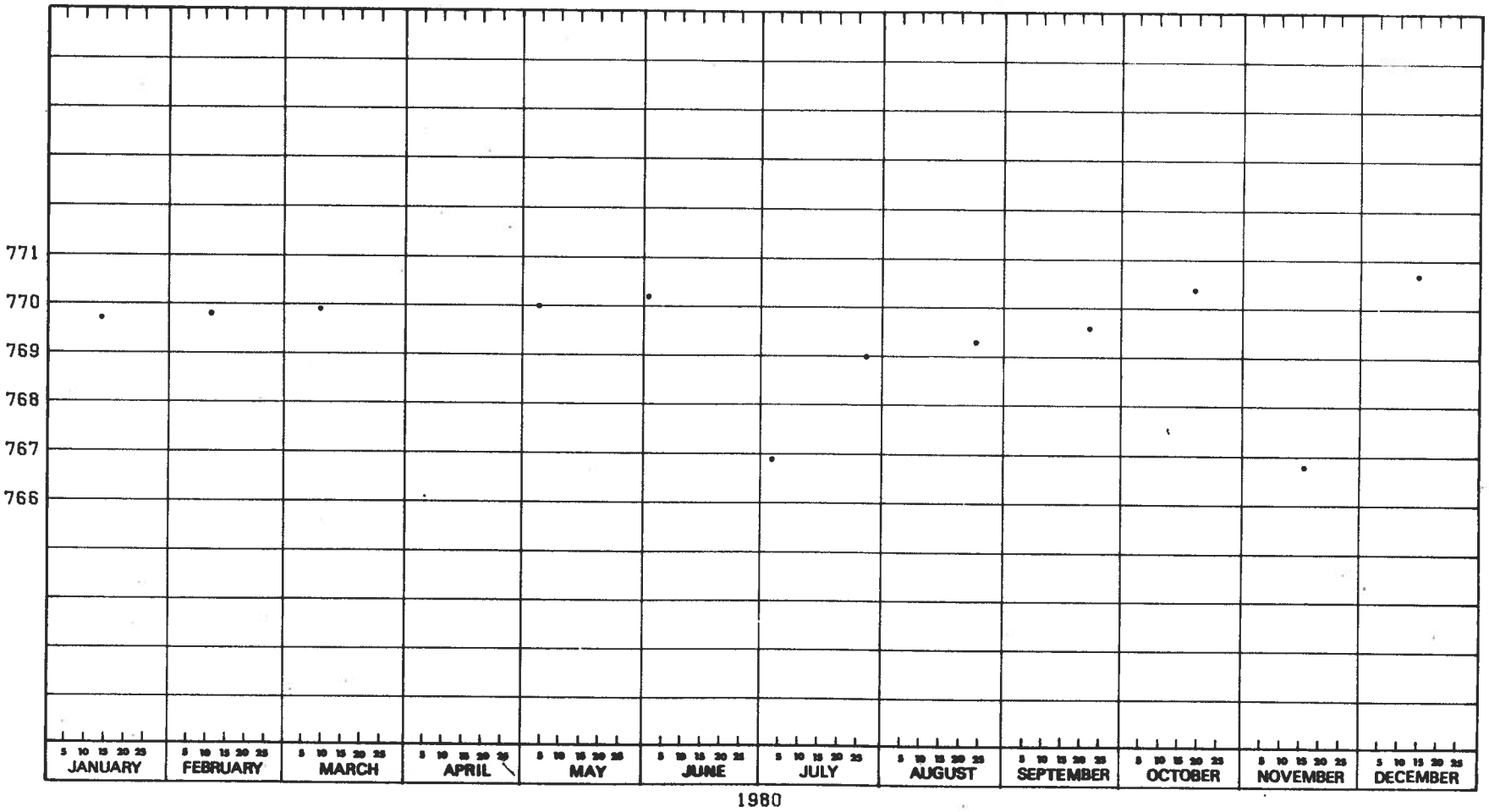
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council

14-1590-H-81



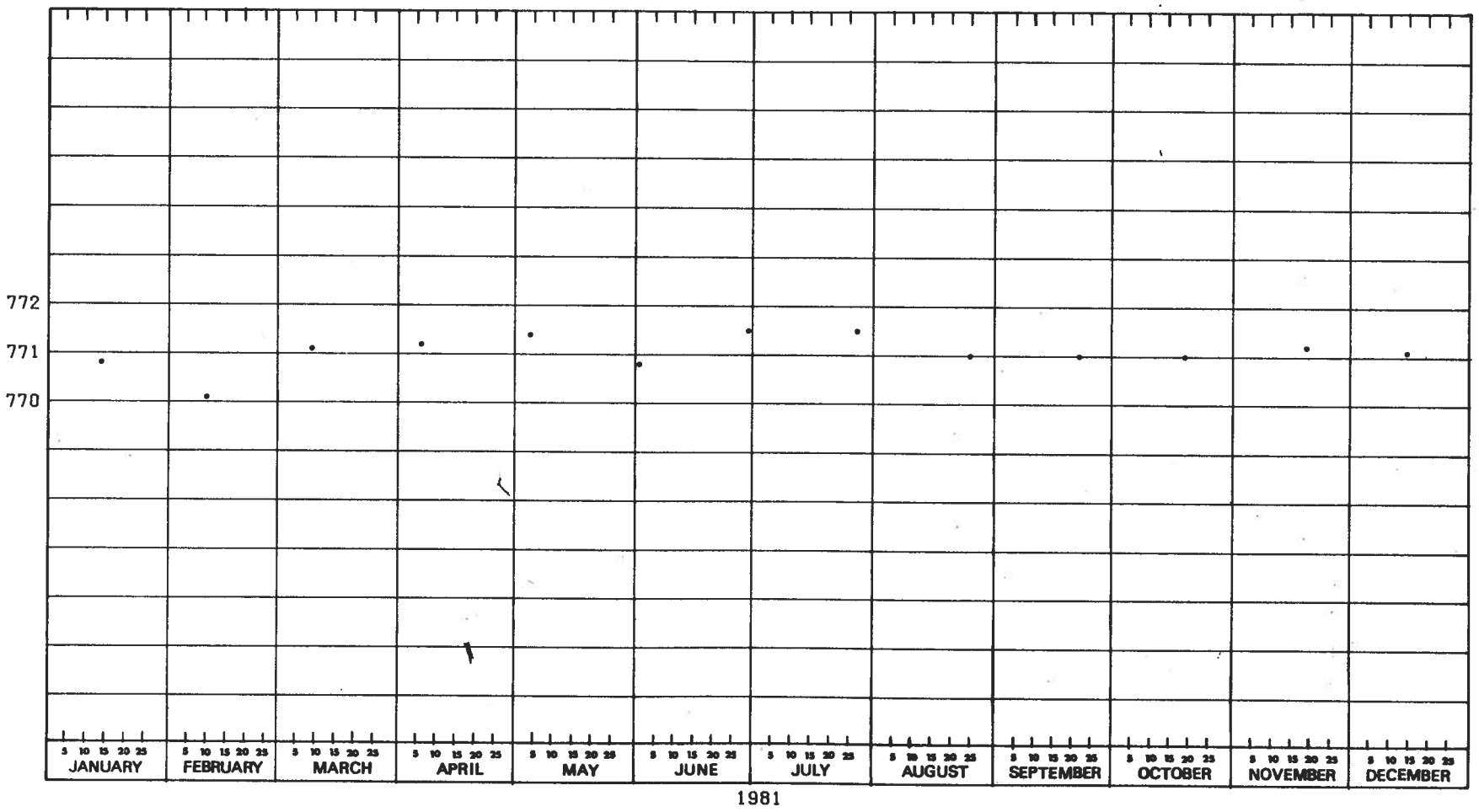
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 14-1590

14-1590-H-82

Lsd 4 Sec 15 Twp 92 R 12 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1224.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 15/76 | | | Well completed |
| Feb 16/76 | 467.35 MP | -306.3 | MP = 0.72 m TOC, (1226.6) |
| Mar 6/76 | 402.06 MP | -92.2 | |
| Apr 6/76 | 319.91 MP | 177.3 | |
| May 6/76 | 269.42 MP | 342.9 | |
| June 1/76 | 235.37 MP | 454.6 | |
| June 22/76 | 216.50 MP | 516.5 | |
| July 15/76 | 200.35 MP | 569.4 | Sampled; temp. 12°C |
| Aug 10/76 | 186.91 MP | 613.5 | |
| Sept 28/76 | 169.61 MP | 670.3 | |
| Oct 26/76 | 162.96 MP | 692.1 | |
| Nov 23/76 | 157.95 MP | 708.5 | |
| Dec 20/76 | 154.28 MP | 720.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1224.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 151.49 MP | 729.7 | MP (1226.6) |
| Feb 15/77 | 148.94 MP | 738.1 | |
| Mar 15/77 | 147.05 MP | 744.3 | |
| Apr 13/77 | 145.66 MP | 748.8 | |
| May 10/77 | 144.59 MP | 752.3 | |
| June 7/77 | 143.68 MP | 755.3 | |
| July 7/77 | 142.95 MP | 757.7 | Sampled; temp. 15°C |
| Aug 3/77 | 142.70 MP | 758.5 | |
| Aug 30/77 | 142.13 MP | 760.4 | |
| Sept 28/77 | 141.60 MP | 762.1 | |
| Oct 25/77 | 141.34 MP | 763.0 | |
| Nov 23/77 | 141.02 MP | 764.0 | |
| Dec 19/77 | 140.67 MP | 765.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1224.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 140.44 MP | 766.0 | MP (1226.6) |
| Feb 13/78 | 140.22 MP | 766.7 | |
| Mar 14/78 | 140.14 MP | 766.9 | |
| Apr 12/78 | 139.98 MP | 767.5 | |
| May 9/78 | 139.85 MP | 767.9 | |
| June 6/78 | 139.59 MP | 768.7 | |
| July 7/78 | 139.82 MP | 768.0 | Sampled; temp. 16°C |
| Aug 1/78 | 139.87 MP | 767.8 | |
| Aug 29/78 | 139.70 MP | 768.4 | |
| Sept 26/78 | 139.54 MP | 768.9 | |
| Oct 24/78 | 139.42 MP | 769.3 | |
| Nov 21/78 | 139.67 MP | 768.5 | |
| Dec 19/78 | 139.48 MP | 769.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 14-1590

Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1224.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 139.51 MP | 769.0 | MP (1226.6) |
| Feb 13/79 | 139.35 MP | 769.5 | |
| Mar 13/79 | 140.27 MP | 766.5 | |
| Apr 11/79 | 139.22 MP | 770.0 | |
| May 8/79 | 139.28 MP | 769.8 | |
| June 6/79 | 139.14 MP | 770.2 | |
| July 5/79 | 139.20 MP | 770.0 | Sampled; lost thermometer in hole |
| Aug 3/79 | 139.48 MP | 768.3 | New MP 0.49m TOC (1225.8) |
| Aug 29/79 | 139.36 MP | 768.7 | |
| Sept 25/79 | 139.14 MP | 769.4 | |
| Oct 23/79 | 139.05 MP | 769.7 | |
| Nov 20/79 | 139.00 MP | 769.9 | |
| Dec 18/79 | 139.02 MP | 769.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

14 - 1590 - W - 82

WELL HISTORY

OBSERVATION WELL NUMBER 14 - 1590

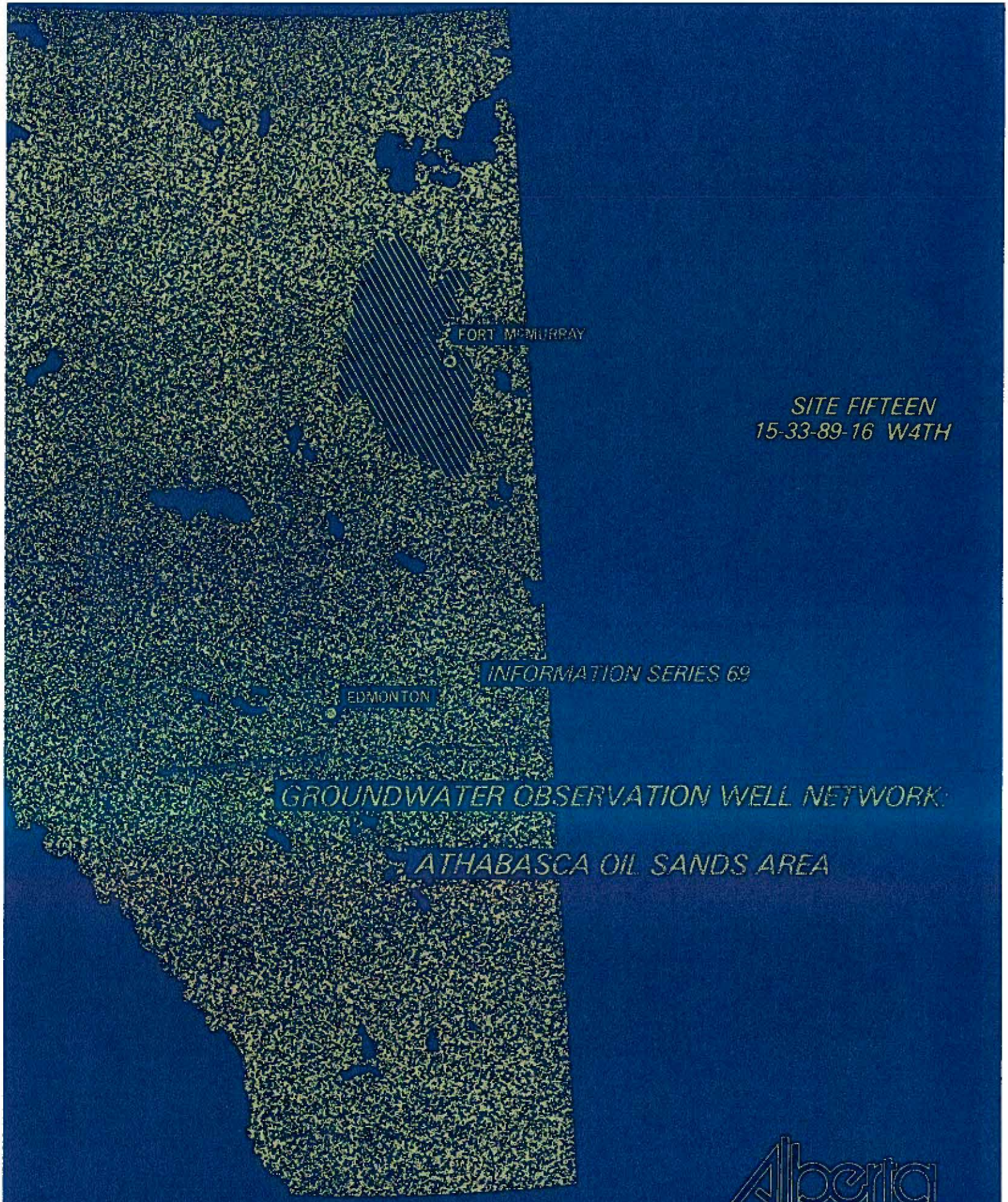
Lsd 4 Sec 15 Twp 92 R 12 W4th

Alberta Research Council

Elevation of top of casing 1224.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 139.04 MP | 769.7 | |
| Feb 12/80 | 139.03 MP | 769.8 | |
| Mar 11/80 | 138.99 MP | 769.9 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 138.96 MP | 770.0 | |
| June 3/80 | 138.90 MP | 770.2 | |
| July 5/80 | 139.91 MP | 766.9 | Temp. 15°C |
| July 29/80 | 139.28 MP | 769.0 | |
| Aug 26/80 | 139.17 MP | 769.3 | |
| Sept 24/80 | 139.07 MP | 769.6 | |
| Oct 21/80 | 138.84 MP | 770.4 | |
| Nov 18/80 | 139.95 MP | 766.8 | |
| Dec 17/80 | 138.75 MP | 770.7 | |
| Jan 15/81 | 138.71 MP | 770.8 | |
| Feb 11/81 | 138.92 MP | 770.1 | |
| Mar 10/81 | 138.63 MP | 771.1 | |
| Apr 7/81 | 138.59 MP | 771.2 | |
| May 5/81 | 138.55 MP | 771.4 | |
| June 2/81 | 138.71 MP | 770.8 | |
| June 30/81 | 138.52 MP | 771.5 | |
| July 28/81 | 138.51 MP | 771.5 | |
| Aug 26/81 | 138.66 MP | 771.0 | |
| Sept 23/81 | 138.65 MP | 771.0 | |
| Oct 20/81 | 138.66 MP | 771.0 | |
| Nov 20/81 | 138.61 MP | 771.2 | |
| Dec 16/81 | 138.62 MP | 771.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing




SITE FIFTEEN
15-33-89-16 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

## INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites (numbers 1, 2, 3, 6, 7, 8 and 9), containing 36 individual wells, were instrumented in this manner during the winter of 1974-75. Eight sites (numbered 10, 11, 12, 13, 14, 15 16 and 17), containing 38 individual wells, were instrumented during the winter of 1975-76.

The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The page indexing system is also consistent with the updating process. All update volumes will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this Introduction and a Legend. There are 15 piezometer nests in the system and thus there are 15 separate

site publications in Information Series 69. Table 1 lists the location of wells in the system as of August 31, 1976. Figure 1 indicates the location of these wells. Publications are available as of the date of this document for all sites.

Five oil companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing.

## ACKNOWLEDGMENTS

The installation and monitoring of wells in this Program was funded by Alberta Energy and Natural Resources; Non-Renewable Resources Division.

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1976: BPOG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., Shell Canada Ltd. and Home Oil Company Ltd.

D. Hackbarth

EDMONTON

1977

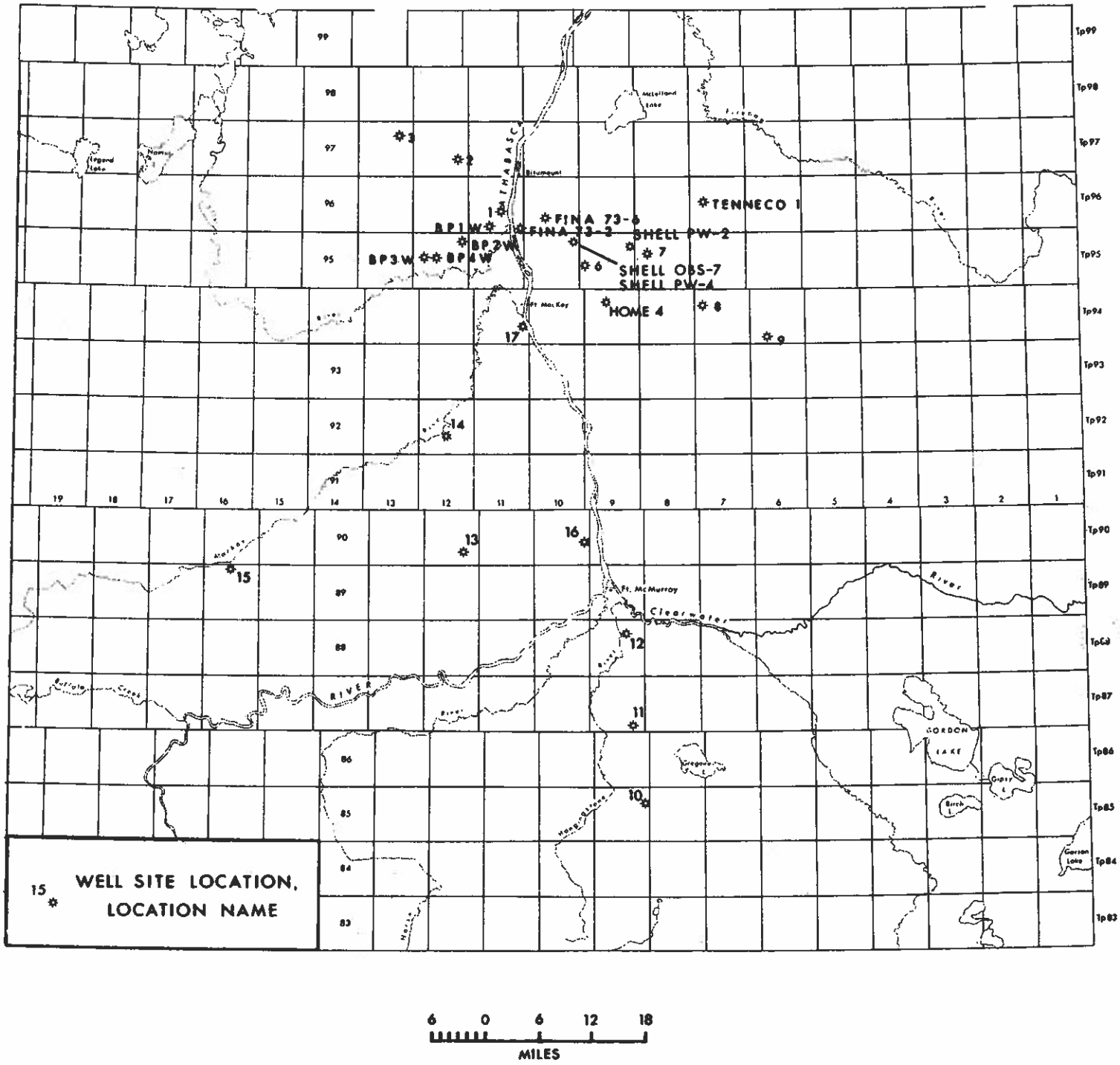



FIGURE 1. Athabasca Oil Sands observation well network, January 1977

# Table 1

## Athabasca Oil Sands Observation Wells

## August 31, 1976

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 9-24-85-9 | 10 |
| Lsd 16-2-87-9 | 11 |
| Lsd 8-27-88-9 | 12 |
| Lsd 8-11-90-12 | 13 |
| Lsd 4-15-92-12 | 14 |
| Lsd 15-33-89-16 | 15 |
| Lsd 6-13-90-10 | 16 |
| Lsd 13-12-94-11 | 17 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |
| Lsd 3-28-94-9 | Home 4 |
| Lsd 10-25-95-10 | Shell PW-4 |
| Lsd 10-24-95-9 | Shell PW-2 |
| Lsd 10-25-95-10 | Shell Obs-7 |

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

| | | |
|---|---|---|
| Well Number | - | the name used for designating the well |
| Subject Code | - | as follows: |
| I | - | Introduction (no site number indicated) |
| L | - | Legend (no site number indicated) |
| G | - | General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents |
| C | - | Well construction details |
| D | - | Drill stem testing |
| A | - | Aquifer testing |
| E | - | Chemical analyses including multielement analyses and routine water analyses |
| H | - | Annual hydrograph |
| W | - | Well history |
| Year of Publication | - | the last two numerals of the year of publication. |

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within tha tabbed section for that particular well.

# GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
| | sandstone, arkosic |
| | silt |
| | siltstone |
| | siltstone & sandstone |
| | clay |
| | clay, sandy |
| | claystone, shale |
| | sandstone & shale |
| | oil sand |
| | limestone |
| | limestone, shaley |
| | dolomite |
| | dolomite, argillaceous |
| | rock salt |
| | gypsum & anhydrite |
| | coal |
| | igneous rock |

| Symbol | Stratigraphic Unit |
|---|---|
| | Pleistocene and Recent |
| Qd | Surface deposits |
| | Cretaceous |
| Ks | Smoky Group |
| Klb | La Biche Formation |
| Kd | Dunvegan Formation |
| Ksh | Shaftesbury Formation |
| Kpl | Pelican Formation |
| Kj | Joli Fou Formation |
| Kg | Grand Rapids Formation |
| Kc | Clearwater Formation |
| Kw | Wabiskaw Member |
| Km | McMurray Formation |
| | Devonian |
| Dwd | Woodbend Group |
| Dbl | Beaverhill Lake Formation |
| Dsw | Slave Point Formation & Fort Vermilion Formation & Watt Mountain Formation |
| Dmk | Muskeg Formation |
| Dpe | Prairie Evaporite Formation |
| Dm | Methy Formation (Keg River Formation equivalent) |
| Dmr | McLean River Formation (Chinchaga Formation equivalent) |
| Dl | La Loche Formation |
| | Precambrian |
| Pε | Undivided |

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

| Symbol | Units or Parameter |
|---|---|
| Sec. | section |
| ss | stainless steel |
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) or time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| WILL | Analysis done at Western Industrial Laboratories Ltd. |
| Wt | weight |

## GEOLOGICAL ABBREVIATIONS

| | |
|---|---|
| biocl | bioclast |
| brac | brachiopod |
| bry | bryozoan |
| calc | calcareous |
| carb | carbonaceous |
| cht | chert |
| fld | feldspar |
| glauc | glauconite, glauconitic |
| gvl | gravel |
| hvy | heavy |
| lt | light |
| mnrls | minerals |
| pbl | pebbles |
| qtz | quartz |
| strgr(s) | stringer(s) |
| stroms | stromotoporoids |
| subang | subangular |
| subrd | subrounded |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: a complete routine analysis and a multielement analysis (multielement radio frequency induction coupled plasma emission spectrometer). Some of the samples collected appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years. Results of analyses performed on samples obtained during July 1976 are included in this report.

Most routine water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source" and are limited to samples from wells contributed by oil companies. Spectral emission estimates were done at commercial laboratories.

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface
3. drill through the aquifer using very light mud
4. insert a screening device (if necessary)
5. develop the well with air.

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma, caliper and neutron were the logs run during the 1975-76 drilling. Results of the caliper logs are not presented. The geological log presented represents an interpretation based upon the sample

description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

4) A summary of contents page noting the number of pages in each of the subject areas that have been issued for that site. Pages which have been replaced because of errors are noted in the total.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells where the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, some wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the measuring tape sticking to the wet casing.

Drill stem testing equipment was utilized in two manners during the 1975-76 drilling program. Open hole - bottom hole drill stem tests

were conducted in the Devonian sediments to locate relatively productive zones for well completion. Casing tests were performed on completed wells at Site 10, 11 and 15 because of great depth to water or low permeability in the completion zone.

Information from these drill stem tests is presented under the heading "Drill Stem Testing". Results of open hole - bottom hole tests are presented in the section containing information about the deepest well at the Site as this is the hole in which the tests were conducted. An exception to this is at Site 14 where three tests were conducted on hole 14-699 and six tests performed in 14-1590.

A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day

V = volume of production into drill collars and stem

t = total flow time of test

T = transmissivity in millidarcy-feet

M = slope of final shut-in pressure plot

K = permeability in millidarcys (1 millidarcy = $10^{-6}$ cm/sec)

h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot. Calculations of transmissivity are according to the Modified Nonequilibrium Formula or the analogous Recovery Formula as follows:

$$T = \frac{0.92\ Q \log_{10}\ (t_2/t_1)}{d_2 - d_1} : \quad \text{(For pumping)}$$

or

$$T = \frac{0.92\ Q \log_{10}\ \left[\left(\frac{t + t'}{t'}\right)_2 - \left(\frac{t + t'}{t'}\right)_1\right]}{d_2 - d_1} : \quad \text{(For recovery)}$$

where:

$d_2$, $d_1$ = depth to water at corresponding subscripted time (meters) $d_2 > t_1$

$t_2$, $t_1$ = time since pumping started, $t_2 > t_1$

$t$ = length of time pumping

$t'$ = time since pumping stopped: $\left(\frac{t + t'}{t'}\right)_2 > \left(\frac{t + t'}{t'}\right)_1$

$T$ = transmissivity in sequence meters per day

$Q$ = pumping rate in imperial gallons per minute

That portion of the drawdown plot used to calculate the transmissivity is indicated on each drawing.

## SUMMARY OF CONTENTS

SITE NUMBER FIFTEEN

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | site | 15-53 | 15-135 | 15-477 | 15-750 | 15-997 |
| Introduction | 4 | — | — | — | — | — |
| Legend | 9 | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — |
| Geological Sample Description | 3 | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 1 | 2 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 2 | 2 | 6 |
| Shut-In Pressure Data | — | 0 | 0 | 2 | 2 | 6 |
| Water Analysis | — | 2 | 2 | 2 | 2 | 2 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 |

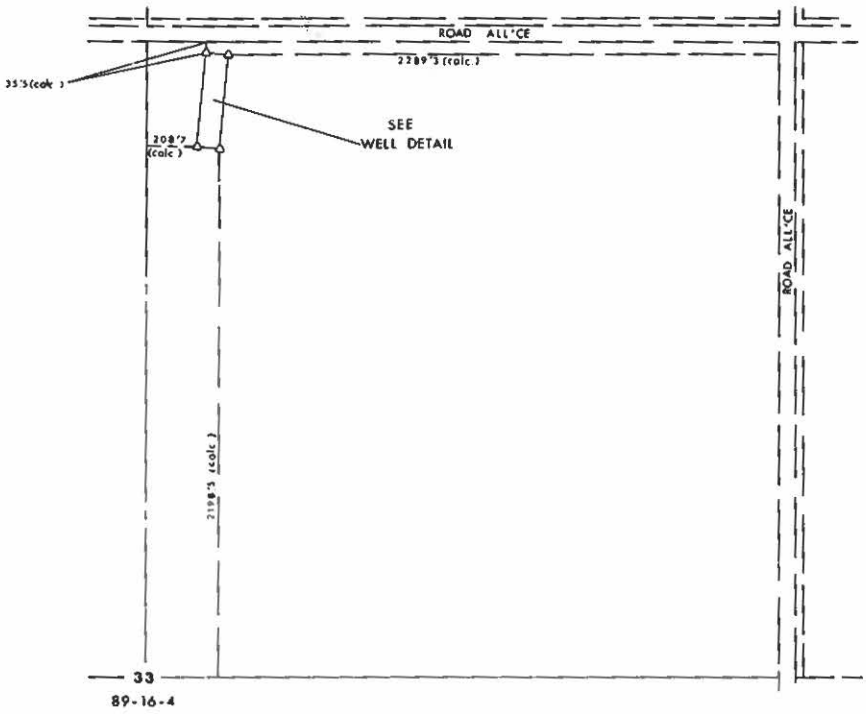
OBSERVATION WELL SITE 15

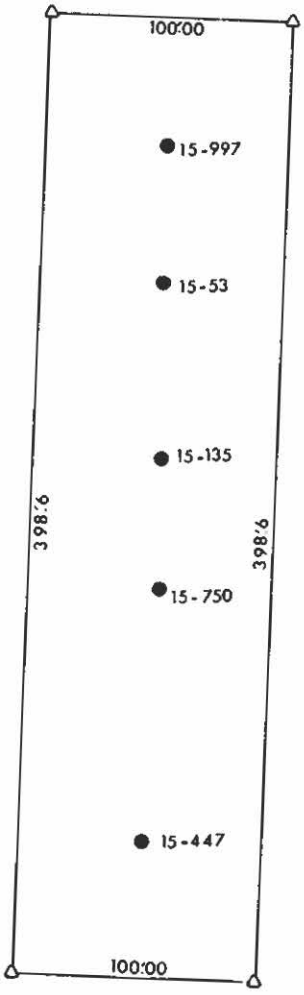
15-33-89-16 W 4th

ALBERTA RESEARCH COUNCIL

0 100 200 300 METERS

0 400 800 1000 FEET




WELLSITE DETAIL

0 10 20 30 METERS

0 40 80 100 FEET

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Fifteen (continued)

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 750 | 770 | Limestone, lt grey, argillaceous, mud supported, fossils (stroms, biocl) and shale, dark grey, calc (15-20%) | Cooking Lake (?) |
| 770 | 790 | Limestone, buff, micrograined, fossils (as above), leaching, calcite recrystallization, interbedded with shale, dark grey, calc (up to 50%) | |
| 790 | 870 | Limestone, buff, micrograined, fossils (stroms, bry, biocl), leaching, calcite recrystallization, pyrite. Poor pinpoint and vuggy porosity in the lower part; lightly oil stained. Shale, medium-dark grey, calc; bituminous in the bottom (10-15%) | |
| 870 | 890 | Limestone, lt grey, argillaceous, mud supported, pyrite; interbedded with shale, medium grey, calc, carb; clay, medium grey, calc, ferruginous | Beaverhill Lake |
| 890 | 900 | Limestone, buff, fossils (stroms, biocl), pyrite, calc recrystallization, fair pinpoint and vuggy porosity; interbedded with marlstone, dark, calc, bituminous (?) | |
| 900 | 970 | Limestone, lt grey-buff, fossils (stroms, pelecypods, brac, biocl), pyrite, leaching, calcite recrystallization. Poor pinpoint porosity between the 910-930 and 950-960 depth intervals. Shale, dark grey, calc, carbonaceous, bituminous (20-30% up to 40% on the bottom) | |
| 970 | 990 | Limestone, white-buff, fossils (as above), leaching, calcite recrystallization, pyrite, argillaceous in the lower part. Shale, medium grey, calc, in the bottom | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Fifteen

Lsd 15 Sec 33 Twp 89 R 16 W4th

lberta Research Council

Ground elevation 1575 Total depth 997 feet

KB elevation 1583

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 8 | 40 | No samples | Drift |
| 40 | 110 | Sandstone, lt-medium grey, fine-coarse grained, subang-subrd, poorly sorted, excellent porosity, qtz, lt cht, fld, dark hvy mnrls, garnet, pebbles of all, some boulderchips; silty sand strgrs in the lower part | |
| 110 | 180 | Unsorted drift: clay, medium grey, sandy, calc cement ferruginous; silty beds; fine-coarse-grained, medium grey sand of qtz and fld, lt cht; pebbles and boulderchips | |
| 180 | 190 | Siltstone, medium grey, sandy, calc cement, ferruginous, coal flakes | Clearwater |
| 190 | 280 | Shale, medium grey, silty, calc, ferruginous, occasional sand grains | |
| 280 | 300 | Sandstone, brown, silty, argillaceous, coarse grained, calc cement, angular-subangular, well sorted, poor porosity, qtz, fld; interbedded shale, lt-medium grey, silty, calc, ferruginous | |
| 300 | 350 | Shale, medium grey, silty, sand grains, calc, carb (coal strgrs between 330-350 feet), ferruginous traces | |
| 350 | 400 | Shale, medium grey, silty, calc, glauc and ferruginous traces | |
| 400 | 430 | Siltstone, medium grey, sandy, argillaceous, calc, poor porosity, qtz, glauc traces, interbedded with shale medium grey, silty, calc | |
| 430 | 440 | Clay, medium grey, silty, calc | |
| 440 | 450 | Shale, medium grey, silty, calc; siltstone, medium grey, argillaceous, calc in the bottom | |
| 450 | 480 | Sandstone, lt-medium grey, fine-medium grained, argillaceous, subangular, poorly sorted, fair porosity, calc cement, glauc, qtz, ferruginous, pyrite; some coarse-grained qtz sand strgrs (between 450-460 feet). Shale, brown, hard, calc, ferruginous interbedded (20-30%) | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Fifteen (continued)

Lsd 15 Sec 33 Twp 89 R 16 W4th

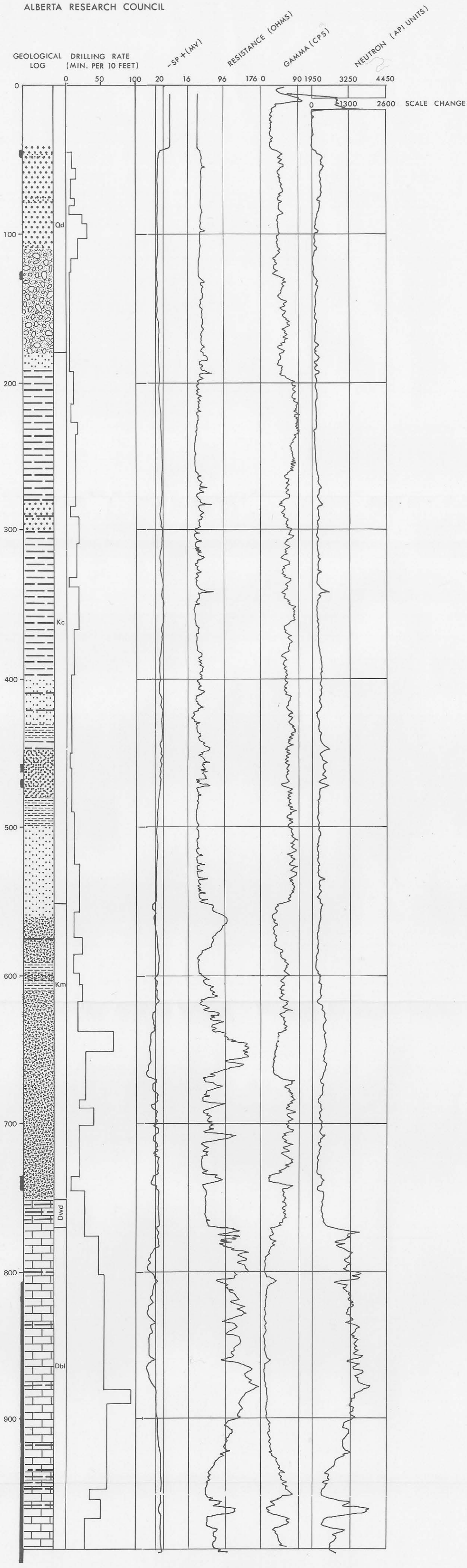
Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 480 | 500 | Clay, medium grey, silty, calc | |
| 500 | 550 | Siltstone, medium grey, sandy, argillaceous, calc, poor porosity | |
| 550 | 560 | Siltstone, as above interbedded with shale, medium grey, silty, calc | |
| 560 | 570 | Sandstone, medium brown, fine-coarse grained, subang-subrd, poorly sorted, fair porosity, slightly oil impregnated; qtz, fld, pyrite; beds of shale, dark grey, calc, bituminous (30-40%) | McMurray |
| 570 | 580 | Sandstone, medium grey, fine-coarse grained, subang-subrd, poorly sorted, good porosity, oil impregnated in strgrs, qtz, fld, pyrite, pebbles of lt cht, strgrs of shale as above (20-30%) | |
| 580 | 590 | Sandstone, medium grey, silty, oil saturated, qtz grains; laminated dark grey bituminous shale | |
| 590 | 610 | Clay, medium grey, silty, carb, bituminous, interbedded with siltstone, medium grey, sandy, oil saturated, micaceous | |
| 610 | 640 | Sandstone, lt-medium grey, fine grained, silty, subang-subrd, well sorted, heavily oil saturated, laminated dark grey, bituminous shale | |
| 640 | 660 | Sandstone, medium grey, fine-coarse grained, angular-subangular, poorly sorted, fair-good porosity, oil impregnated in strgrs, qtz, lt cht, fld, pyrite. Shale, dark grey, carbonaceous, bituminous (20-30%) | |
| 660 | 710 | Sandstone, medium grey, silty-fine grained, subangular, well sorted, oil saturated, qtz. Interbedded clay, medium grey and shale, dark grey, silty, carbonaceous, bituminous | |
| 710 | 750 | Sandstone, lt-medium grey, fine-coarse grained, silty matrix, subangular, poorly sorted, fair-good porosity, slightly-moderately oil impregnated, qtz, lt cht, dark hvy mnrls, pyrite. Clay, medium grey; shale, dark grey and siltstone, medium grey, carbonaceous, bituminous, interbedded | |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 15
## 15-33-89-16 W4th
### ALBERTA RESEARCH COUNCIL



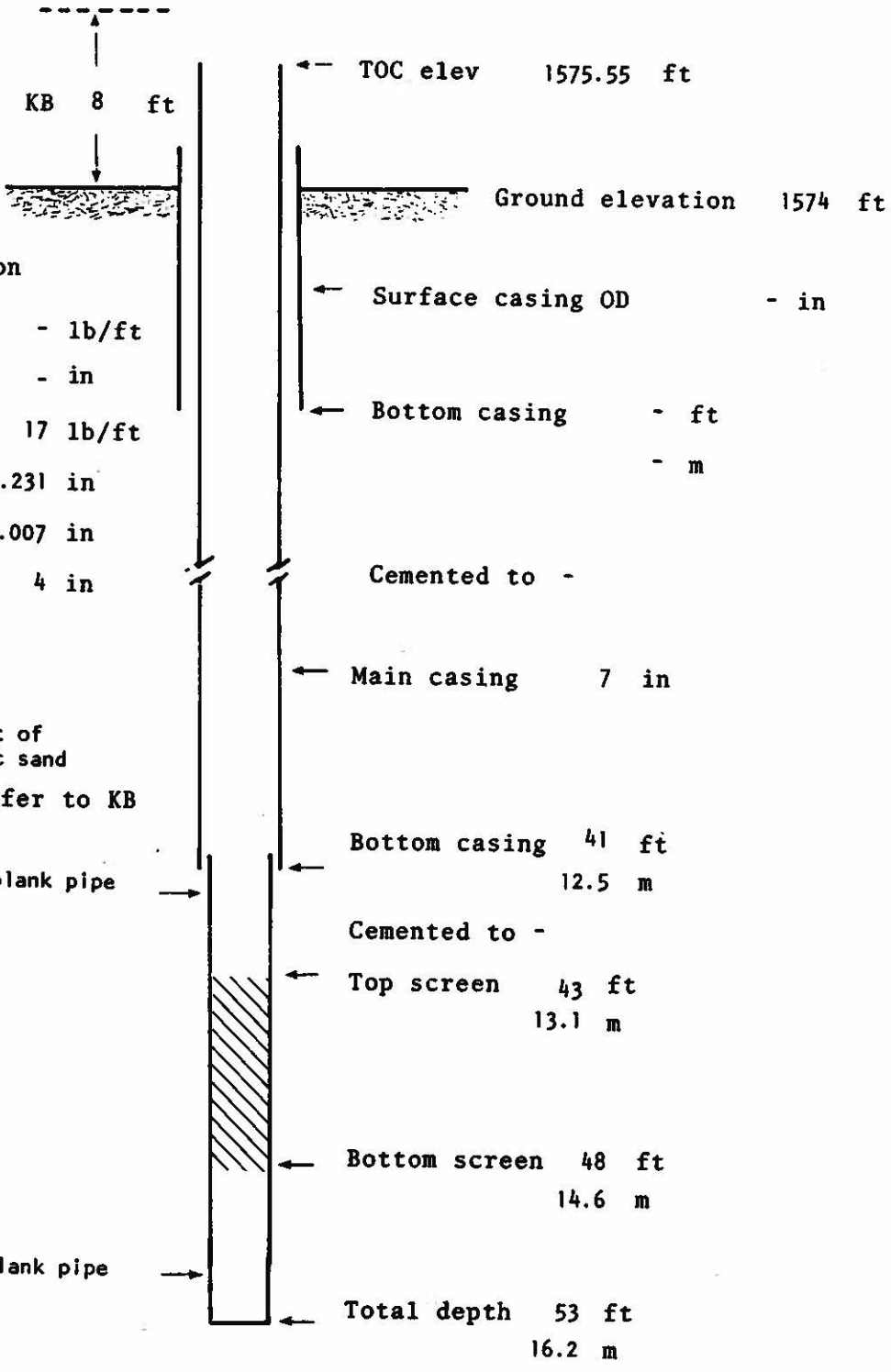

15-G-77

**WELL CONSTRUCTION.**

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Tp 89 R 16 W 4th

Alberta Research Council

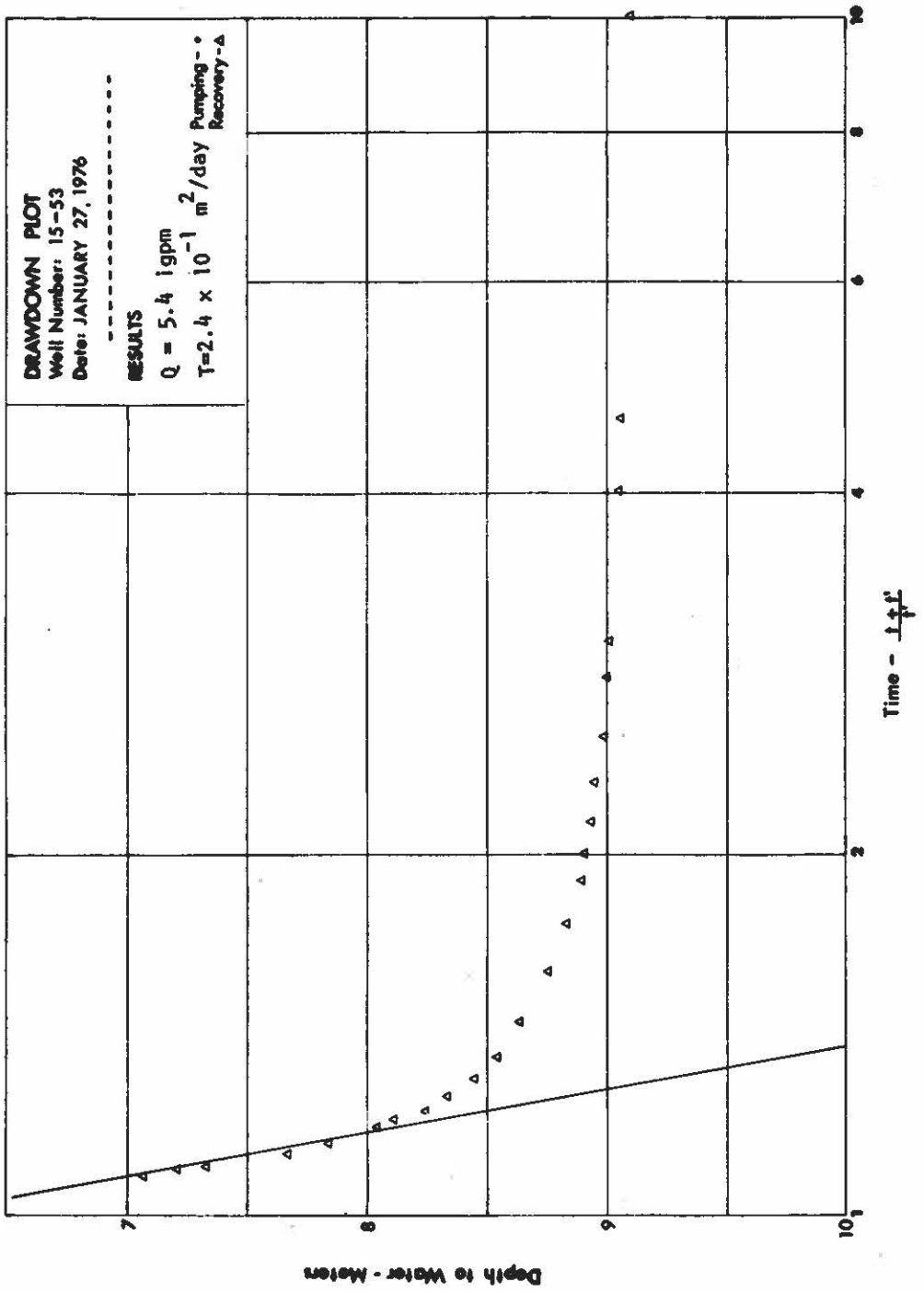



Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | in |
| Main casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Sand pack 5 cubic ft of 10-20 frac sand

Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 15-53
Date: JANUARY 27, 1976
RESULTS
Q = 5.4 igpm
T=2.4 x 10^-1 m^2/day
Pumping - •
Recovery - △
Depth to Water - Meters
Time - t+t'/t'
7
8
9
10
2
4
6
8
10

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed from 15-53

Date sampled January 30, 1976 Time

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 320.0 | 15.97 | 45.9 |
| Magnesium ($Mg^{++}$) | 115.0 | 9.47 | 27.2 |
| Sodium ($Na^{+}$) | 207.0 | 9.00 | 25.9 |
| Potassium ($K^{+}$) | 13.3 | 0.34 | 1.0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 298.0 | 4.88 | 13.4 |
| Sulfate ($SO_4^{=}$) | 1500.0 | 31.23 | 85.4 |
| Chloride ($Cl^{-}$) | 11.0 | 0.31 | 0.8 |
| Nitrate ($NO_3^{=}$) | 7.8 | 0.13 | 0.3 |
| Silica ($SiO_2$) | 1.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 2880.0 | | |
| Total Anions (epm) 36.6 | | Total Cations (epm) | 34.8 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 3300 |
| pH | 7.4 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 8.1 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | 334 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 15, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 460.0 | 22.95 | 55 |
| Magnesium ($Mg^{++}$) | 151.0 | 12.43 | 30 |
| Sodium ($Na^{+}$) | 138.0 | 6.00 | 14 |
| Potassium ($K^{+}$) | 11.3 | 0.29 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 505.0 | 8.28 | 19 |
| Sulfate ($SO_4^{=}$) | 1360.0 | 28.32 | 66 |
| Chloride ($Cl^{-}$) | 220.0 | 6.20 | 15 |
| Nitrate ($NO_3^{=}$) | 2.6 | 0.04 | 0 |
| Silica ($SiO_2$) | 15.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 550.0 | | |
| Magnesium (Acidified) | 168.3 | | |
| Total dissolved solids | 2958 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 42.84 | Total Cations (epm) | 41.67 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3000 | | Temperature (C) | 4.0 | |
| pH | 7.4 | | pH | 7.1 | |
| Fluoride ($F^{-}$) | 0.4 | Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | | Bicarbonate ($HCO_3^{-}$) | 464 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Date sampled: July 15, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .898 |
| Au | <.003 | Mo | <.006 |
| Al | 0.55 | Na | 330 |
| As | <.038 | Ni | <.010 |
| B | .721 | P | 0.88 |
| Ba | <.200 | Pb | <.088 |
| Be | .005 | Se | <.060 |
| Ca | 540 | Si | 6.48 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 4.62 |
| Cr | <.006 | Te | <.065 |
| Cu | <.0004 | Ti | .005 |
| Eu | <.015 | U | <.020 |
| Fe | 8.05 | V | .019 |
| K | 154 | W | <.078 |
| Mg | 170.5 | Zn | .165 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 7, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 231.0 | 11.53 | 48.0 |
| Magnesium ($Mg^{++}$) | 99.0 | 8.15 | 33.9 |
| Sodium ($Na^{+}$) | 96.0 | 4.18 | 17.4 |
| Potassium ($K^{+}$) | 7.1 | 0.18 | 0.8 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 373.0 | 6.11 | 22.6 |
| Sulfate ($SO_4^{=}$) | 980.0 | 20.40 | 75.3 |
| Chloride ($Cl^{-}$) | 20.0 | 0.56 | 2.1 |
| Nitrate ($NO_3^{=}$) | 1.1 | 0.02 | 0.1 |
| Silica ($SiO_2$) | 10.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 255.0 | | |
| Magnesium (Acidified) | 94.0 | | |
| Total dissolved solids | 1610.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 27.10 | Total Cations (epm) | 24.03 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1950 | Temperature (C) | 5.0 |
| pH | 7.4 | pH | 7.3 |
| Fluoride ($F^{-}$) | 1.1 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 371.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 07, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 231.0 | 11.53 | 41.9 |
| Magnesium(Mg) | 126.0 | 10.37 | 37.7 |
| Sodium(Na) | 126.0 | 5.48 | 19.9 |
| Potassium(K) | 5.4 | 0.14 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 320.0 | 5.25 | 17.3 |
| Sulphate(SO4) | 1165.0 | 24.26 | 80.1 |
| Chloride(Cl) | 26.0 | 0.73 | 2.4 |
| Nitrate(NO3) | 2.2 | 0.04 | 0.1 |
| Silica(SiO2) | 7.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 400.0 | | |
| Magnesium(Acidified) | 148.0 | | |
| TDS(mg/l) | 2054.0 | | |
| Total Anions(epm) | 30.27 | Total Cations(epm) | 27.52 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1990 | Temperature(C) | 4.00 | |
| pH | 7.4 | pH | 7.1 | |
| Fluoride(F) | 0.5 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 337 | mg/l |
| | | Hydroxide(OH) | | |

15-53-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 4, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 320.0 | 15.97 | 47.1 |
| Magnesium(Mg) | 135.0 | 11.11 | 32.8 |
| Sodium(Na) | 153.0 | 6.66 | 19.6 |
| Potassium(K) | 5.8 | 0.15 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 342.0 | 5.61 | 16.8 |
| Sulphate(SO4) | 1310.0 | 27.27 | 81.8 |
| Chloride(Cl) | 16.0 | 0.45 | 1.4 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 8.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 0.0 | | |
| Magnesium(Acidified) | 0.0 | | |
| TDS(mg/l) | 2408.0 | | |
| Total Anions(epm) | 33.33 | Total Cations(epm) | 33.88 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2320 | Temperature(C) | 4.00 | |
| pH | 7.2 | pH | 7.1 | |
| Fluoride(F) | 0.7 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 356 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 15-53-E-82

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 5, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 320.0 | 16.00 | 40.3 |
| Magnesium(Mg) | 180.0 | 15.00 | 37.8 |
| Sodium(Na) | 195.0 | 8.48 | 21.3 |
| Potassium(K) | 9.6 | 0.25 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 108.0 | 1.77 | 5.6 |
| Sulphate(SO4) | 1400.0 | 29.17 | 92.3 |
| Chloride(Cl) | 23.0 | 0.65 | 2.1 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 4.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 300.0 | | |
| Magnesium(Acidified) | 146.0 | | |
| TDS(mg/l) | 2518.0 | | |
| Total Anions(epm) | 31.59 | Total Cations(epm) | 39.72 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2640 | Temperature | 4.00 | |
| pH | 8.3 | pH | 7.1 | |
| Fluoride | 0.0 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 263 | mg/l |
| | | Hydroxide(OH) | | |

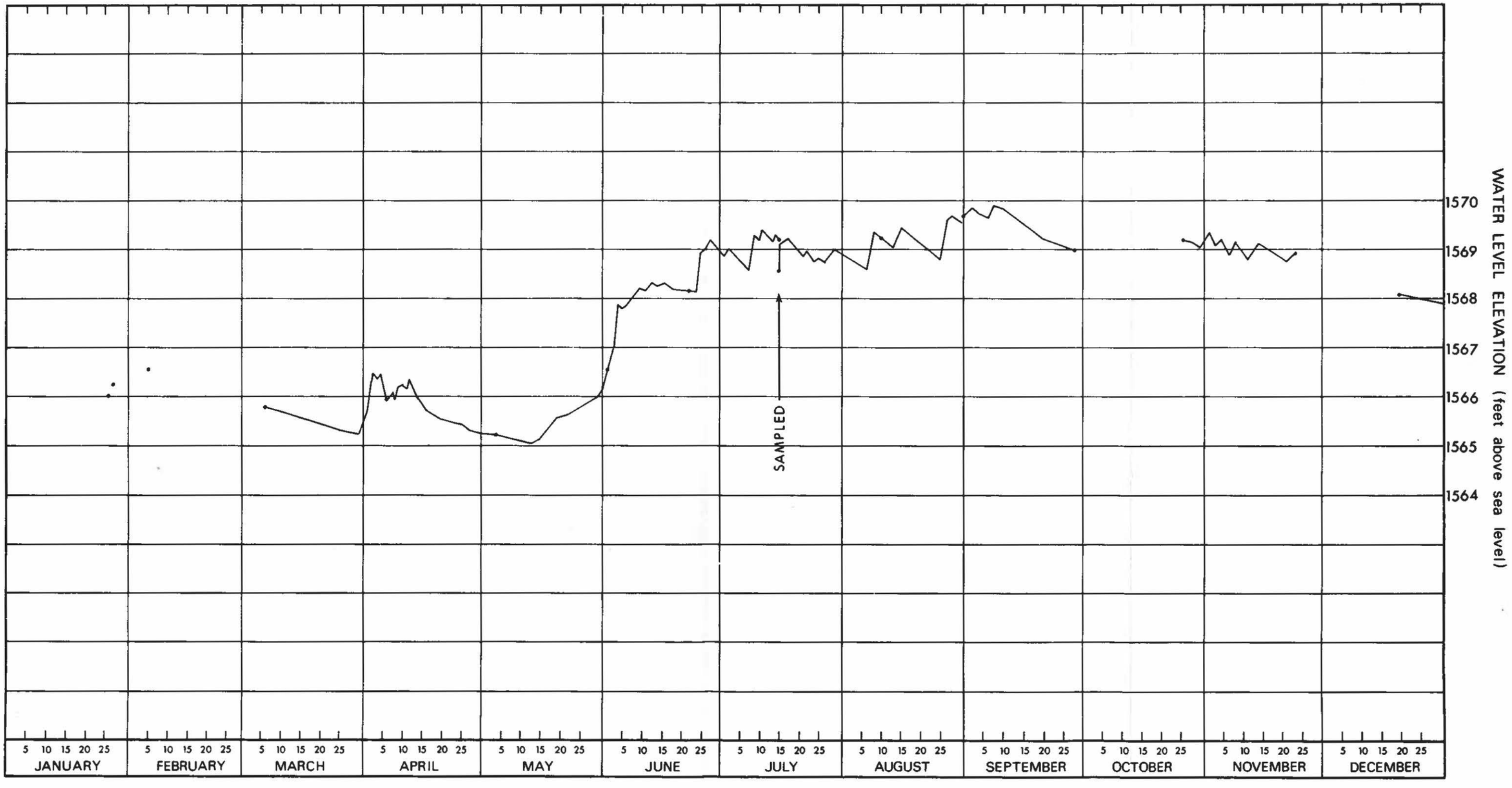
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-53

15 - 53 - H - 77

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council




1976

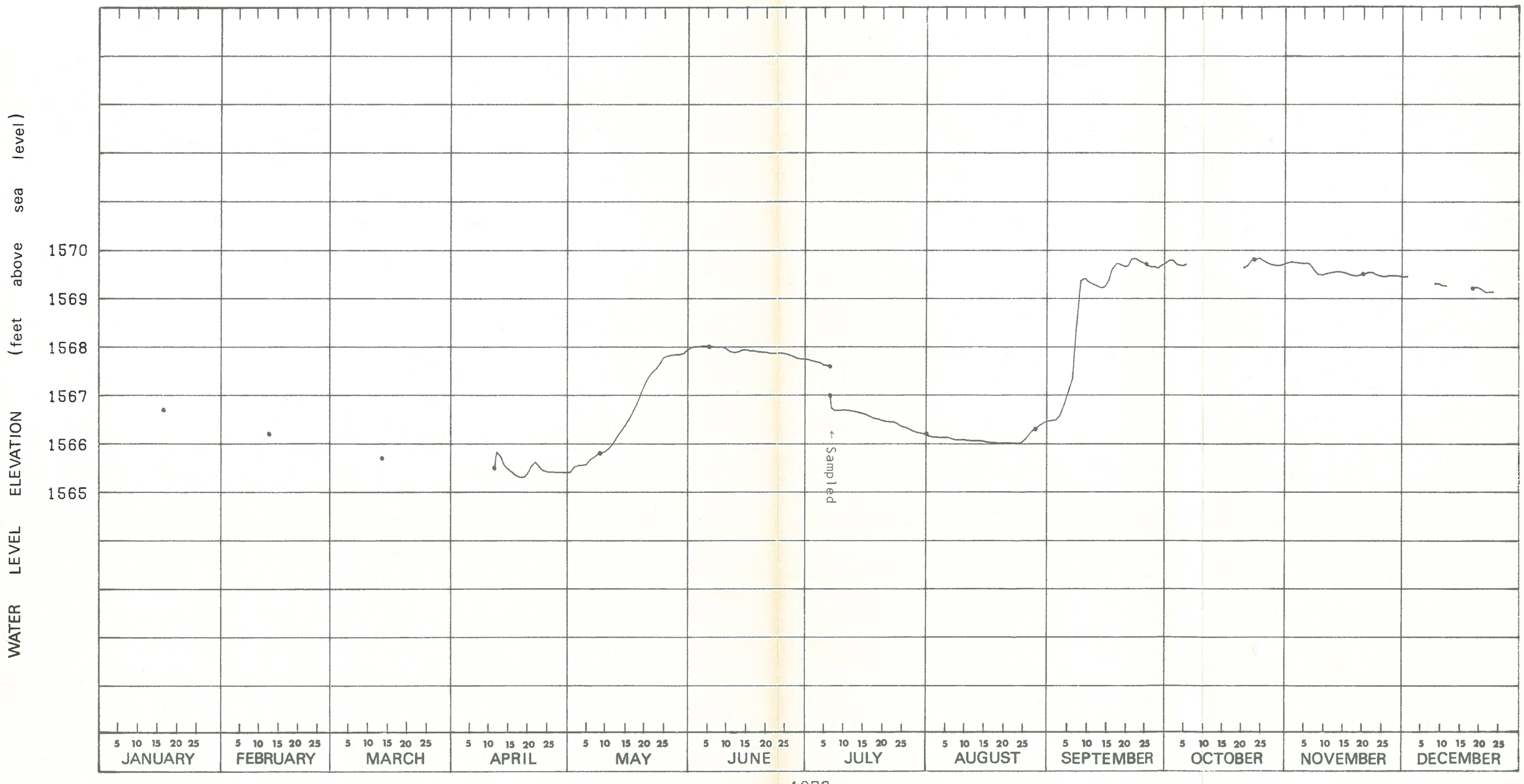
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-53

LSD 15 SEC 33 TWP 89 R 16 W4TH

15-53-H-79

Alberta Research Council



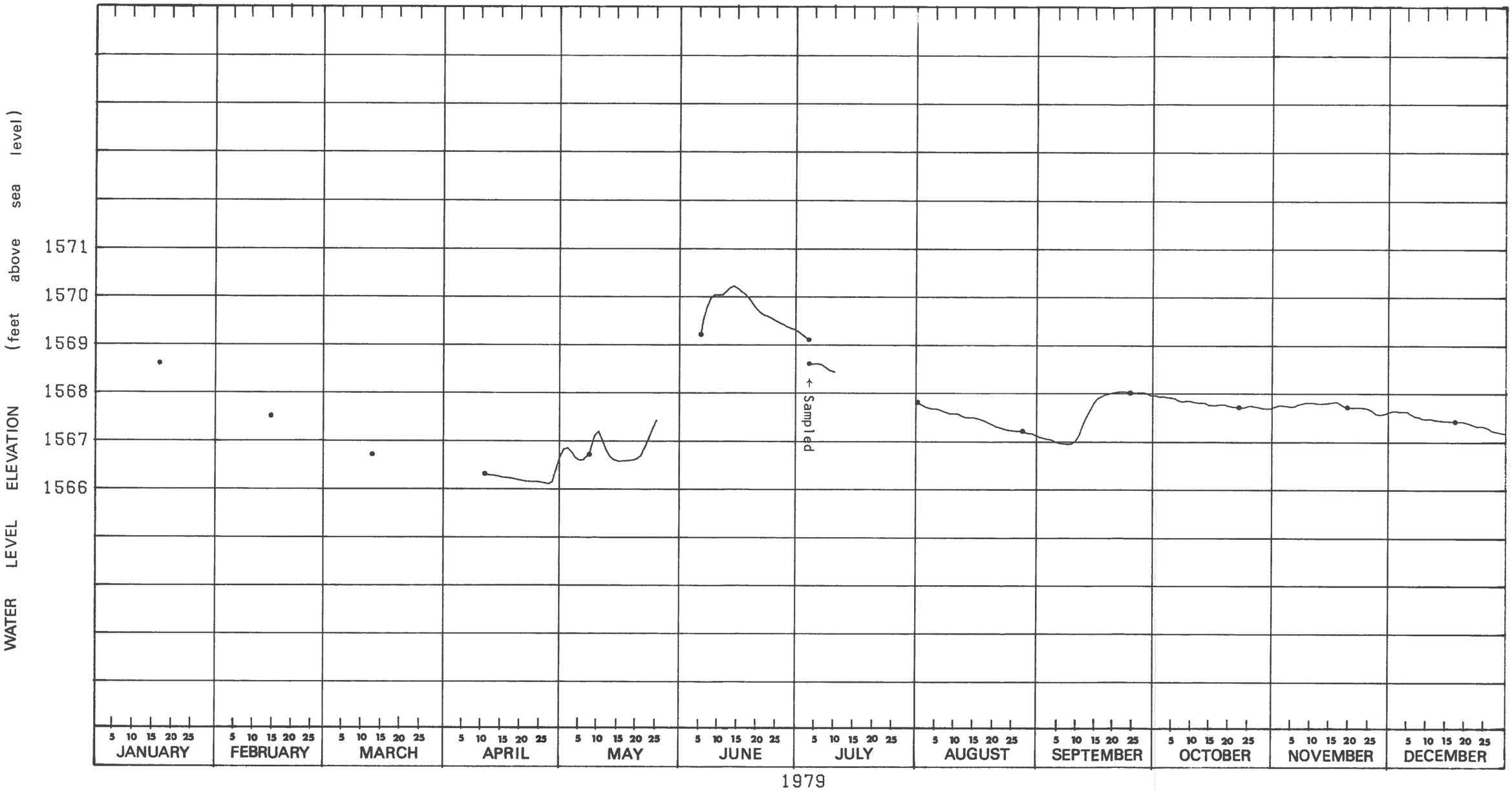
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-53

15-53-H-80

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council



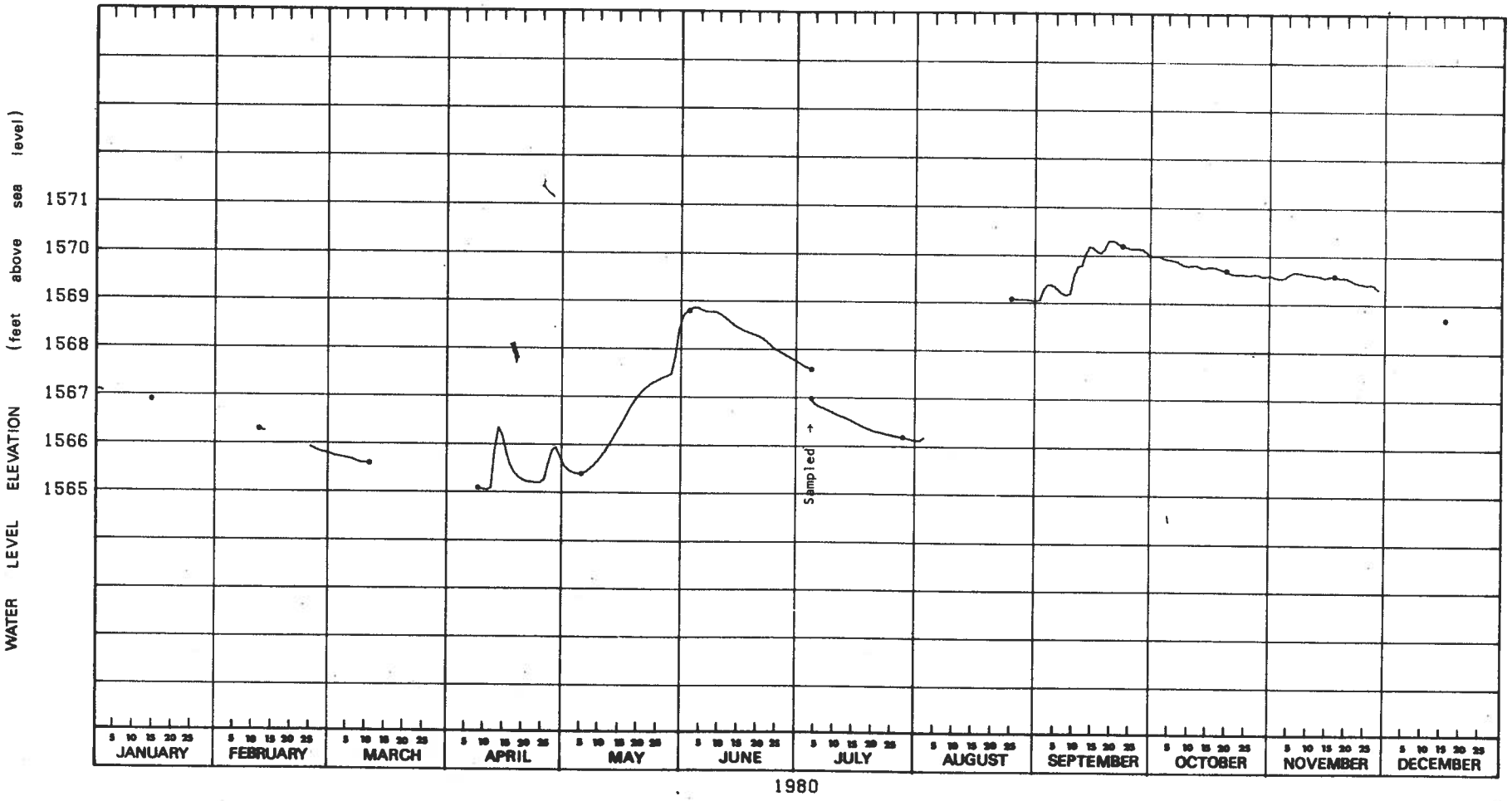
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-53-H-81



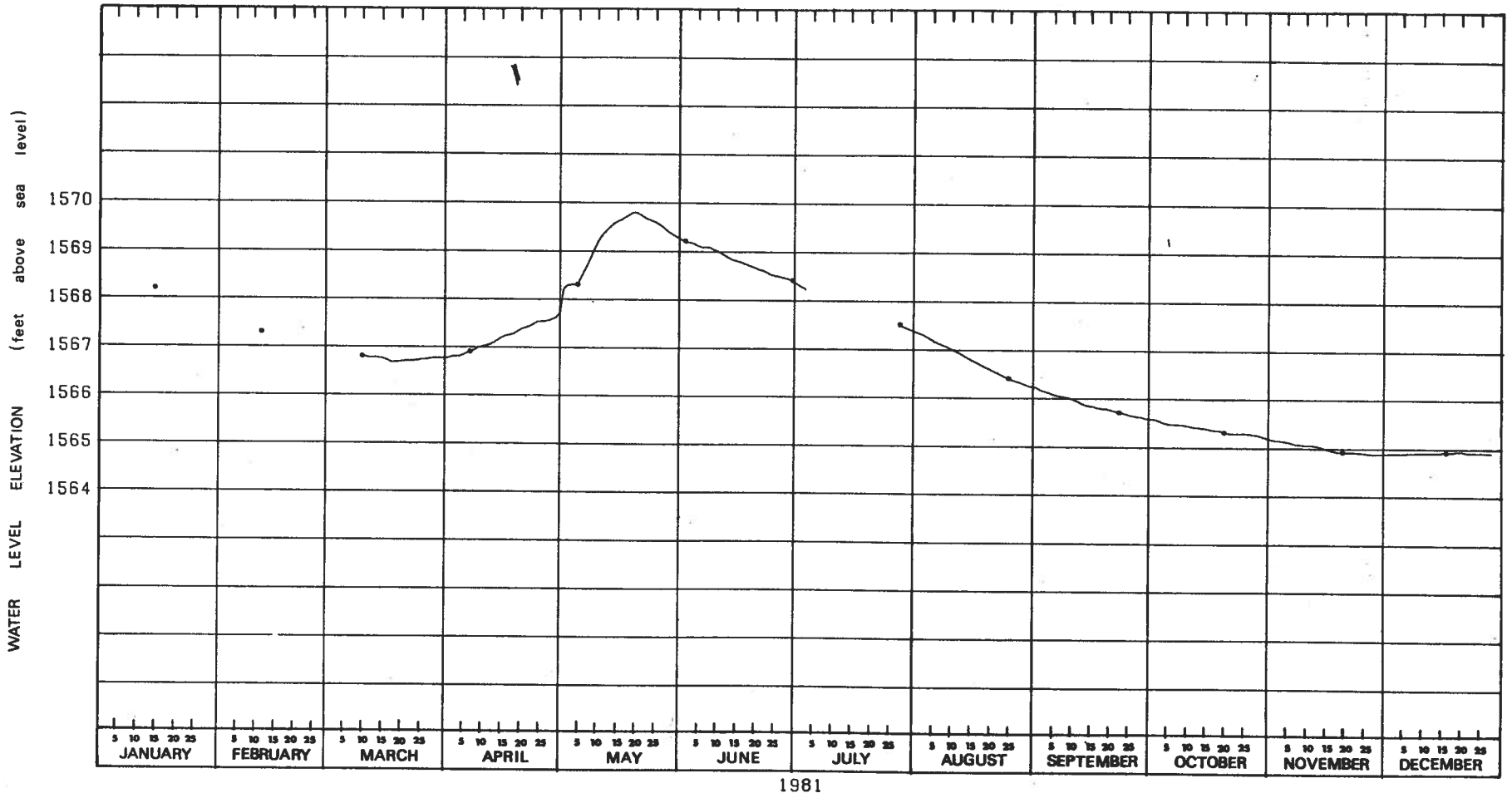
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-53-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1575.55

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 24/76 | | | Well completed |
| Jan 26/76 | 2.90 TOC | 1566.1 | |
| Jan 27/76 | 2.84 TOC | 1566.3 | Bail test, Q = 5 IGPM<br>T = 16 IGPD/FT |
| Jan 30/76 | | | Water sample |
| Feb 5/76 | 3.74 MP | 1566.5 | MP = 0.99 m TOC, (1578.8) |
| Mar 6/76 | 3.97 MP | 1565.8 | |
| Apr 6/76 | 3.92 MP | 1565.9 | |
| May 4/76 | 4.14 MP | 1565.2 | |
| June 1/76 | 3.73 MP | 1566.6 | |
| June 22/76 | 3.25 MP | 1568.1 | |
| July 15/76 | 2.93 MP | 1569.2 | |
| | 3.13 MP | 1568.5 | After sample; temp. 4°C |
| Aug 10/76 | 2.92 MP | 1569.2 | |
| Aug 31/76 | 2.78 MP | 1569.7 | |
| Sept 28/76 | 2.99 MP | 1569.0 | |
| Oct 26/76 | 2.92 MP | 1569.2 | |
| Nov 23/76 | 3.03 MP | 1568.9 | |
| Dec 20/76 | 3.26 MP | 1568.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1575.55

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 3.51 MP | 1567.2 | MP (1578.8) |
| Feb 15/77 | 3.82 MP | 1566.3 | |
| Mar 15/77 | 3.99 MP | 1565.7 | |
| Apr 14/77 | 3.42 MP | 1567.6 | |
| May 10/77 | 3.71 MP | 1566.6 | |
| June 7/77 | 2.80 MP | 1569.6 | |
| July 7/77 | 2.66 MP | 1570.1 | |
| | 2.87 MP | 1569.4 | After sample; temp. 5°C |
| Aug 3/77 | 3.11 MP | 1568.6 | |
| Aug 30/77 | 3.33 MP | 1567.9 | |
| Sept 28/77 | 3.51 MP | 1567.3 | |
| Oct 25/77 | 3.57 MP | 1567.1 | |
| Nov 23/77 | 3.65 MP | 1566.8 | |
| Dec 19/77 | 3.64 MP | 1566.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1575.55

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 3.70 MP | 1566.7 | MP (1578.8) |
| Feb 13/78 | 3.84 MP | 1566.2 | |
| Mar 14/78 | 3.99 MP | 1565.7 | |
| Apr 12/78 | 4.06 MP | 1565.5 | |
| May 9/78 | 3.97 MP | 1565.8 | |
| June 6/78 | 3.28 MP | 1568.0 | |
| July 7/78 | 3.42 MP | 1567.6 | |
| | 3.61 MP | 1567.0 | After sample; temp 4°C |
| Aug 1/78 | 3.85 MP | 1566.2 | |
| Aug 29/78 | 3.82 MP | 1566.3 | |
| Sept 26/78 | 2.78 MP | 1569.9 | |
| Oct 24/78 | 2.74 MP | 1569.8 | |
| Nov 21/78 | 2.84 MP | 1569.5 | |
| Dec 19/78 | 2.94 MP | 1569.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-53

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1575.55

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 3.12 MP | 1568.6 | MP (1578.8) |
| Feb 15/79 | 3.44 MP | 1567.5 | |
| Mar 13/79 | 3.68 MP | 1566.7 | |
| Apr 11/79 | 3.82 MP | 1566.3 | |
| May 8/79 | 3.68 MP | 1566.7 | |
| June 6/79 | 2.91 MP | 1569.2 | |
| July 4/79 | 2.95 MP | 1569.1 | |
| | 3.12 MP | 1568.6 | After sample; temp. 4°C |
| Aug 1/79 | 3.36 MP | 1567.8 | |
| Aug 28/79 | 3.52 MP | 1567.2 | |
| Sept 25/79 | 3.28 MP | 1568.0 | |
| Oct 23/79 | 3.39 MP | 1567.7 | |
| Nov 20/79 | 3.39 MP | 1567.7 | |
| Dec 18/79 | 3.47 MP | 1567.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing.

## WELL HISTORY

OBSERVATION WELL NUMBER 15 - 53

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1575.55

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 3.62 MP | 1566.9 | |
| Feb 12/80 | 3.80 MP | 1566.3 | |
| Mar 12/80 | 4.01 MP | 1565.6 | |
| Apr 9/80 | 4.17 MP | 1565.1 | |
| May 6/80 | 4.07 MP | 1565.4 | |
| June 3/80 | 3.05 MP | 1568.8 | |
| July 5/80 | 3.40 MP | 1567.6 | Temp. 4°C |
| | 3.59 MP | 1567.0 | After Sample |
| July 29/80 | 3.83 MP | 1566.2 | |
| Aug 26/80 | 2.97 MP | 1569.1 | |
| Sept 24/80 | 2.61 MP | 1570.2 | |
| Oct 21/80 | 2.77 MP | 1569.7 | |
| Nov 18/80 | 2.81 MP | 1569.6 | |
| Dec 17/80 | 3.07 MP | 1568.7 | |
| Jan 15/81 | 3.24 MP | 1568.2 | |
| Feb 12/81 | 3.49 MP | 1567.3 | |
| Mar 10/81 | 3.66 MP | 1566.8 | |
| Apr 7/81 | 3.63 MP | 1566.9 | |
| May 5/81 | 3.21 MP | 1568.3 | |
| June 2/81 | 2.92 MP | 1569.2 | |
| June 30/81 | 3.18 MP | 1568.4 | |
| July 28/81 | 3.45 MP | 1567.5 | |
| Aug 25/81 | 3.79 MP | 1566.4 | |
| Sept 23/81 | 4.00 MP | 1565.7 | |
| Oct 20/81 | 4.12 MP | 1565.3 | |
| Nov 20/81 | 4.24 MP | 1564.9 | |
| Dec 17/81 | 4.25 MP | 1564.9 | |

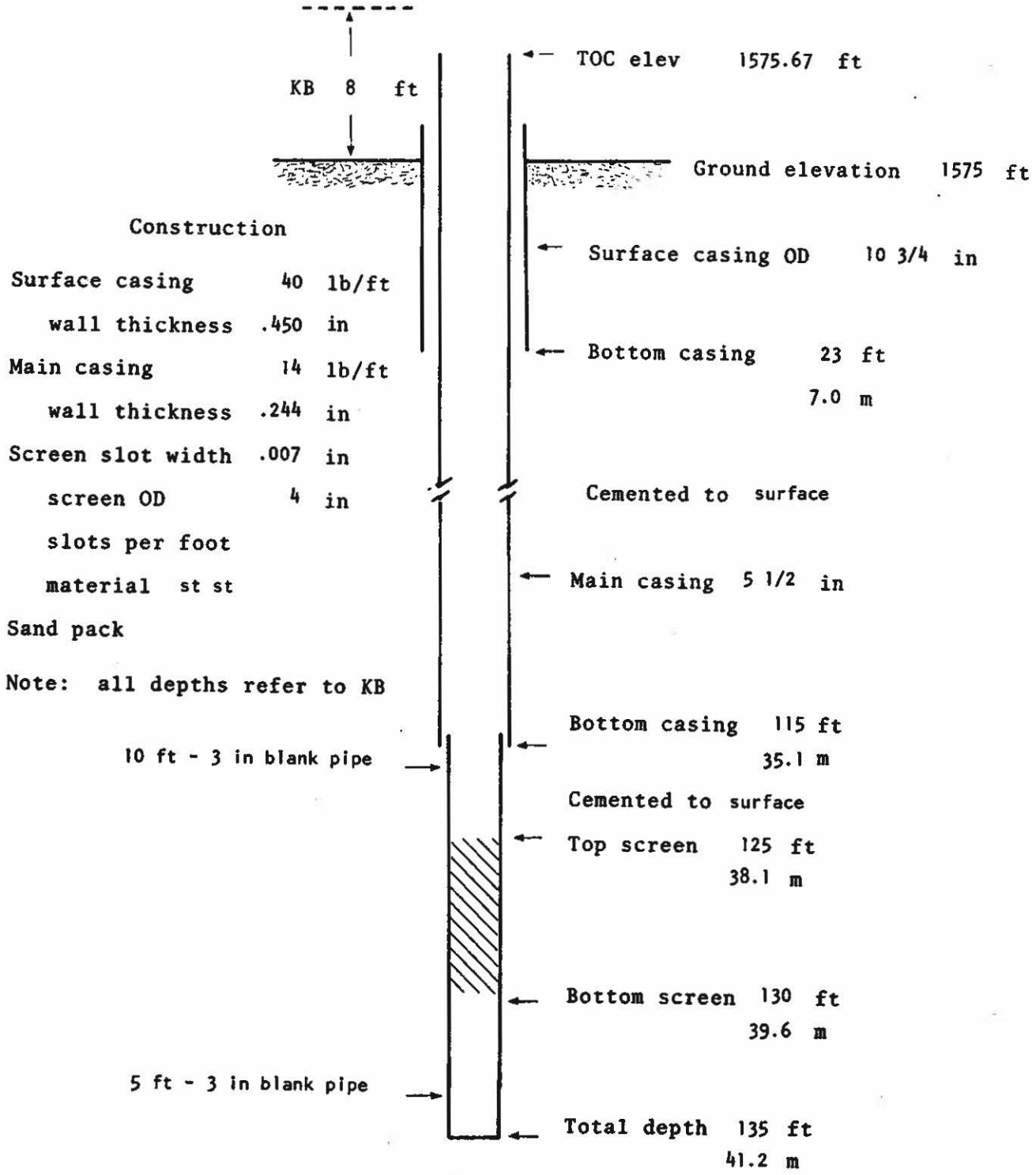
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Tp 89 R 16 W 4th

Alberta Research Council

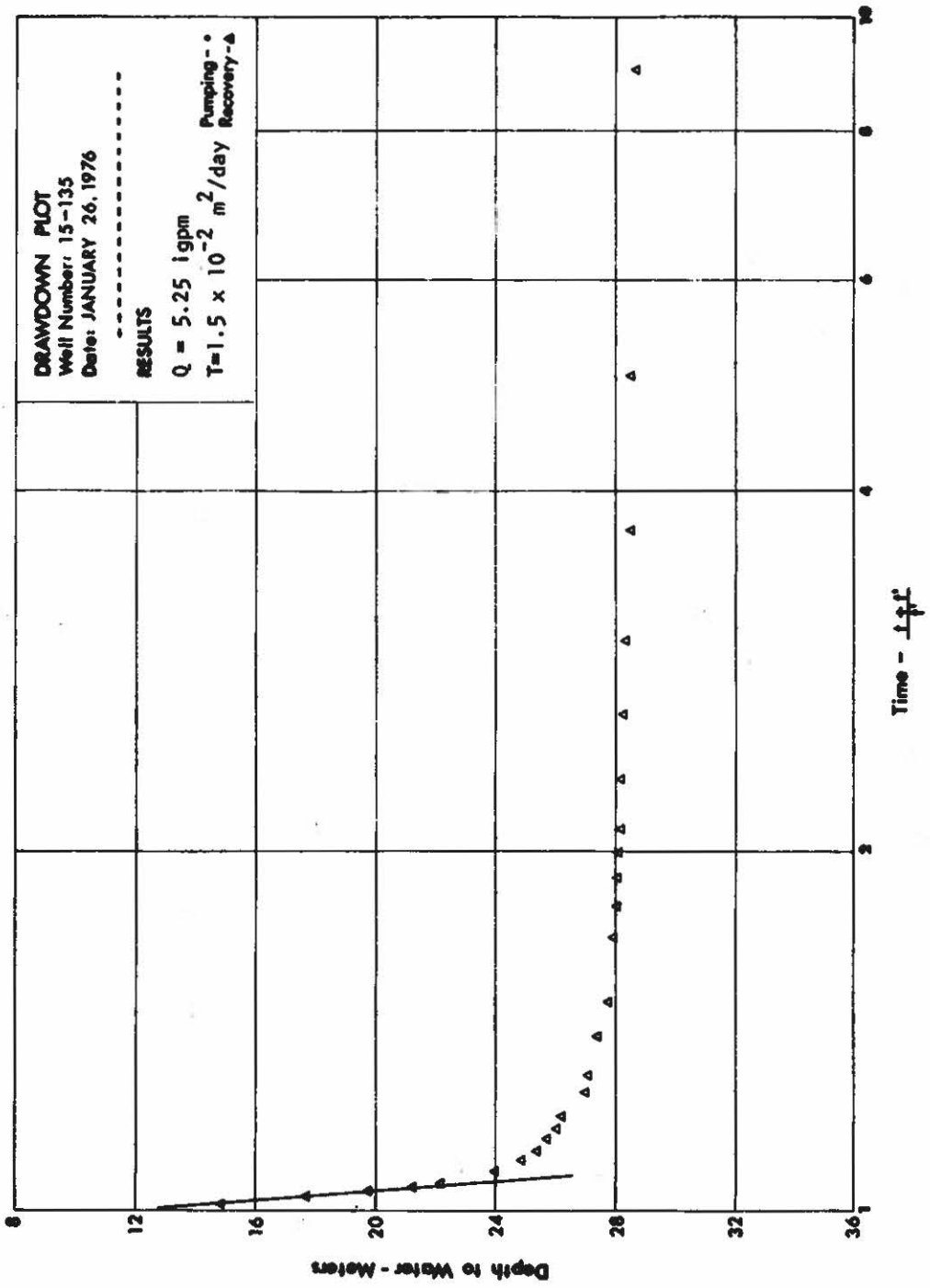


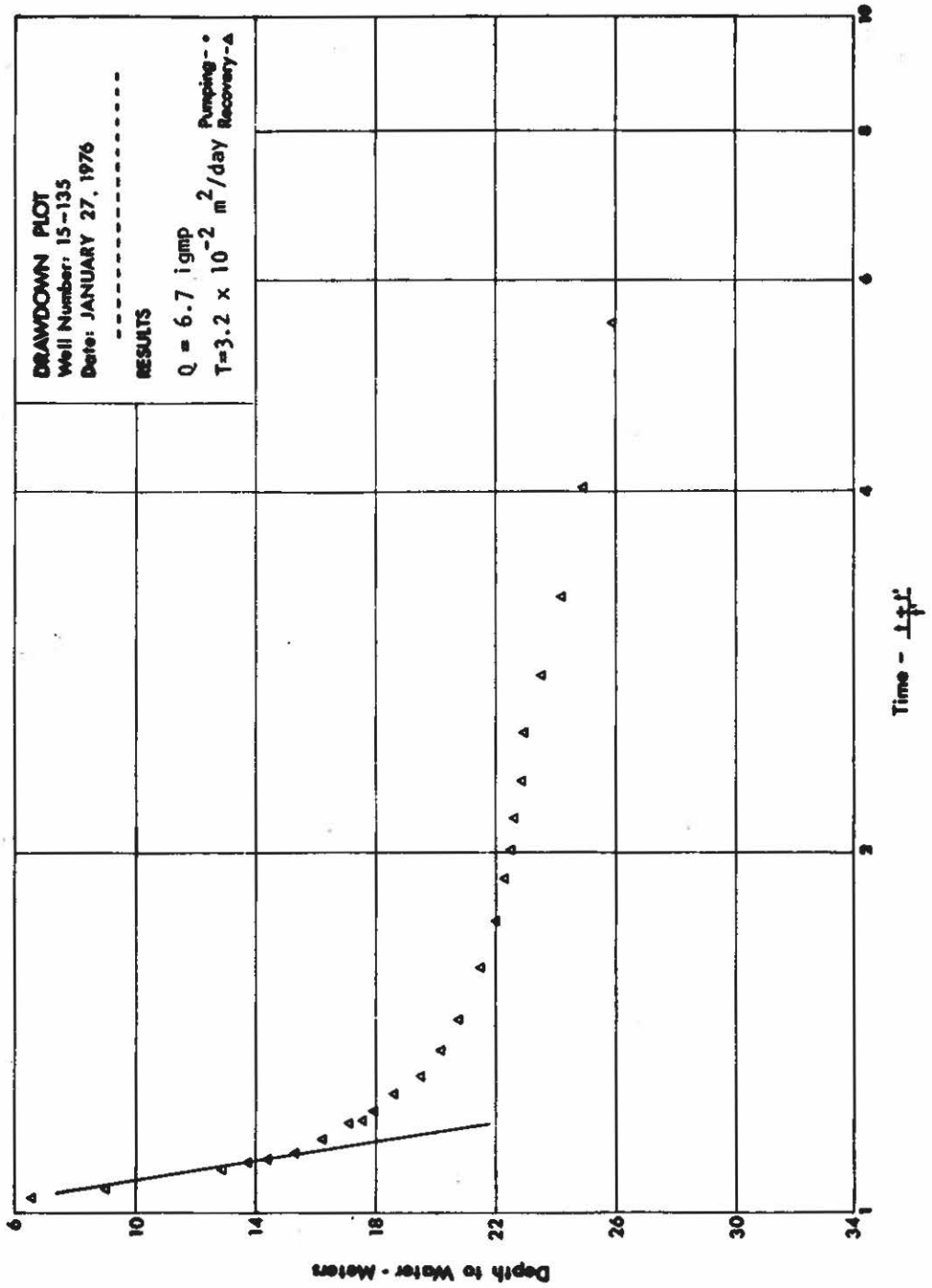

Construction

| | | |
|---|---|---|
| Surface casing | 40 | lb/ft |
| wall thickness | .450 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Sand pack

Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 15-135
Date: JANUARY 26, 1976
RESULTS
Q = 5.25 igpm
T=1.5 x 10^-2 m^2/day
Pumping - •
Recovery - ▲
Depth to Water - Meters
8
12
16
20
24
28
32
36
1
2
4
6
8
10
Time - t/t'


DRAWDOWN PLOT
Well Number: 15--135
Date: JANUARY 27, 1976
RESULTS
Q = 6.7 igmp
T=3.2 x 10^-2 m^2/day
Pumping-•
Recovery-▲
Depth to Water - Meters
6
10
14
18
22
26
30
34
1
2
4
6
8
10
Time - t+t'/t'

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed from 15-135

Date sampled January 29, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 187.0 | 9.33 | 47.1 |
| Magnesium ($Mg^{++}$) | 7.5 | 0.62 | 3.1 |
| Sodium ($Na^{+}$) | 251.0 | 9.35 | 47.2 |
| Potassium ($K^{+}$) | 20.0 | 0.51 | 2.6 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 412.0 | 6.75 | 22.5 |
| Sulfate ($SO_4^{=}$) | 1025.0 | 21.34 | 71.0 |
| Chloride ($Cl^{-}$) | 69.0 | 1.95 | 6.5 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 1.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1870 | | |
| Total Anions (epm) | 30.0 | Total Cations (epm) | 19.8 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | | Temperature (C) | | |
| pH | 7.3 | pH | 7.5 | |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 578 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 15, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 165.0 | 8.23 | 31 |
| Magnesium ($Mg^{++}$) | 91.0 | 7.49 | 28 |
| Sodium ($Na^{+}$) | 238.0 | 10.35 | 39 |
| Potassium ($K^{+}$) | 21.3 | 0.54 | 2 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 251.0 | 4.11 | 16 |
| Sulfate ($SO_4^{=}$) | 950.0 | 19.78 | 78 |
| Chloride ($Cl^{-}$) | 50.0 | 1.41 | 6 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0 |
| Silica ($SiO_2$) | 2.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 160.1 | | |
| Magnesium (Acidified) | 90.2 | | |
| Total dissolved solids | 1806 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 25.31 | Total Cations (epm) | 26.62 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2350 | | Temperature (C) | 4.0 | |
| pH | 7.4 | | pH | 6.9 | |
| Fluoride ($F^{-}$) | 0.4 | Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | | Bicarbonate ($HCO_3^{-}$) | 234 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

15-135-E-78

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Date sampled: July 15, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .334 |
| Au | <.003 | Mo | <.006 |
| Al | 0.22 | Na | 221 |
| As | <.038 | Ni | <.010 |
| B | .445 | P | 0.66 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 146.3 | Si | .858 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 1.72 |
| Cr | <.006 | Te | <.065 |
| Cu | .017 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .858 | V | .009 |
| K | 77 | W | <.078 |
| Mg | 74.5 | Zn | .099 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 7, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 109.0 | 5.44 | 23.6 |
| Magnesium ($Mg^{++}$) | 80.0 | 6.58 | 28.5 |
| Sodium ($Na^{+}$) | 241.0 | 10.48 | 45.4 |
| Potassium ($K^{+}$) | 22.0 | 0.56 | 2.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 61.0 | 1.00 | 4.2 |
| Sulfate ($SO_4^{=}$) | 964.0 | 20.07 | 83.6 |
| Chloride ($Cl^{-}$) | 104.0 | 2.93 | 12.2 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 0.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 104.0 | | |
| Magnesium (Acidified) | 72.0 | | |
| Total dissolved solids | 1610.0 | | |
| Total Anions (epm) | 24.01 | Total Cations (epm) | 23.07 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2200 |
| pH | 7.7 |
| Fluoride ($F^{-}$) | 0.2 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 5.0 |
| pH | 8.6 |
| Carbonate ($CO_3^{=}$) | 10.0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 34.0 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

15-135-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 07, 1978

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 88.0 | 4.39 | 21.1 |
| Magnesium(Mg) | 70.0 | 5.76 | 27.7 |
| Sodium(Na) | 233.0 | 10.13 | 48.8 |
| Potassium(K) | 19.6 | 0.50 | 2.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 54.0 | 0.89 | 3.7 |
| Sulphate(SO4) | 948.0 | 19.74 | 83.1 |
| Chloride(Cl) | 110.0 | 3.10 | 13.1 |
| Nitrate(NO3) | 2.4 | 0.04 | 0.2 |
| Silica(SiO2) | 0.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 102.0 | | |
| Magnesium(Acidified) | 68.0 | | |
| TDS(mg/l) | 1388.0 | | |
| Total Anions(epm) | 23.76 | Total Cations(epm) | 20.79 |

## Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1780 | | Temperature(C) | 4.00 | |
| pH | 6.6 | | pH | 9.0 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | 10 | mg/l |
| | | | Bicarbonate(HCO3) | 24 | mg/l |
| | | | Hydroxide(OH) | | |

15-135-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 4, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 150.0 | 7.49 | 34.3 |
| Magnesium(Mg) | 43.0 | 3.54 | 16.2 |
| Sodium(Na) | 236.0 | 10.27 | 47.1 |
| Potassium(K) | 19.6 | 0.50 | 2.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 63.0 | 1.03 | 5.1 |
| Sulphate(SO4) | 778.0 | 16.20 | 79.2 |
| Chloride(Cl) | 114.0 | 3.21 | 15.7 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 1.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 122.0 | | |
| Magnesium(Acidified) | 35.0 | | |
| TDS(mg/l) | 1492.0 | | |
| Total Anions(epm) | 20.45 | Total Cations(epm) | 21.79 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1830 | Temperature(C) | 4.00 | |
| pH | 7.9 | pH | 9.2 | |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) | 10 | mg/l |
| | | Bicarbonate(HCO3) | 20 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 15-135-E-82

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 5, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 196.0 | 9.80 | 42.2 |
| Magnesium(Mg) | 31.0 | 2.58 | 11.1 |
| Sodium(Na) | 234.0 | 10.17 | 43.9 |
| Potassium(K) | 25.0 | 0.64 | 2.8 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 54.0 | 0.89 | 3.9 |
| Sulphate(SO4) | 900.0 | 18.75 | 82.5 |
| Chloride(Cl) | 110.0 | 3.10 | 13.6 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 3.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 140.0 | | |
| Magnesium(Acidified) | 27.0 | | |
| TDS(mg/l) | 1611.0 | | |
| Total Anions(epm) | 22.73 | Total Cations(epm) | 23.20 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 2060 |
| pH | 7.9 |
| Fluoride | 0.0 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 5.00 | |
| pH | 8.8 | |
| Carbonate(CO3) | 10 | mg/l |
| Bicarbonate(HCO3) | 15 | mg/l |
| Hydroxide(OH) | | |

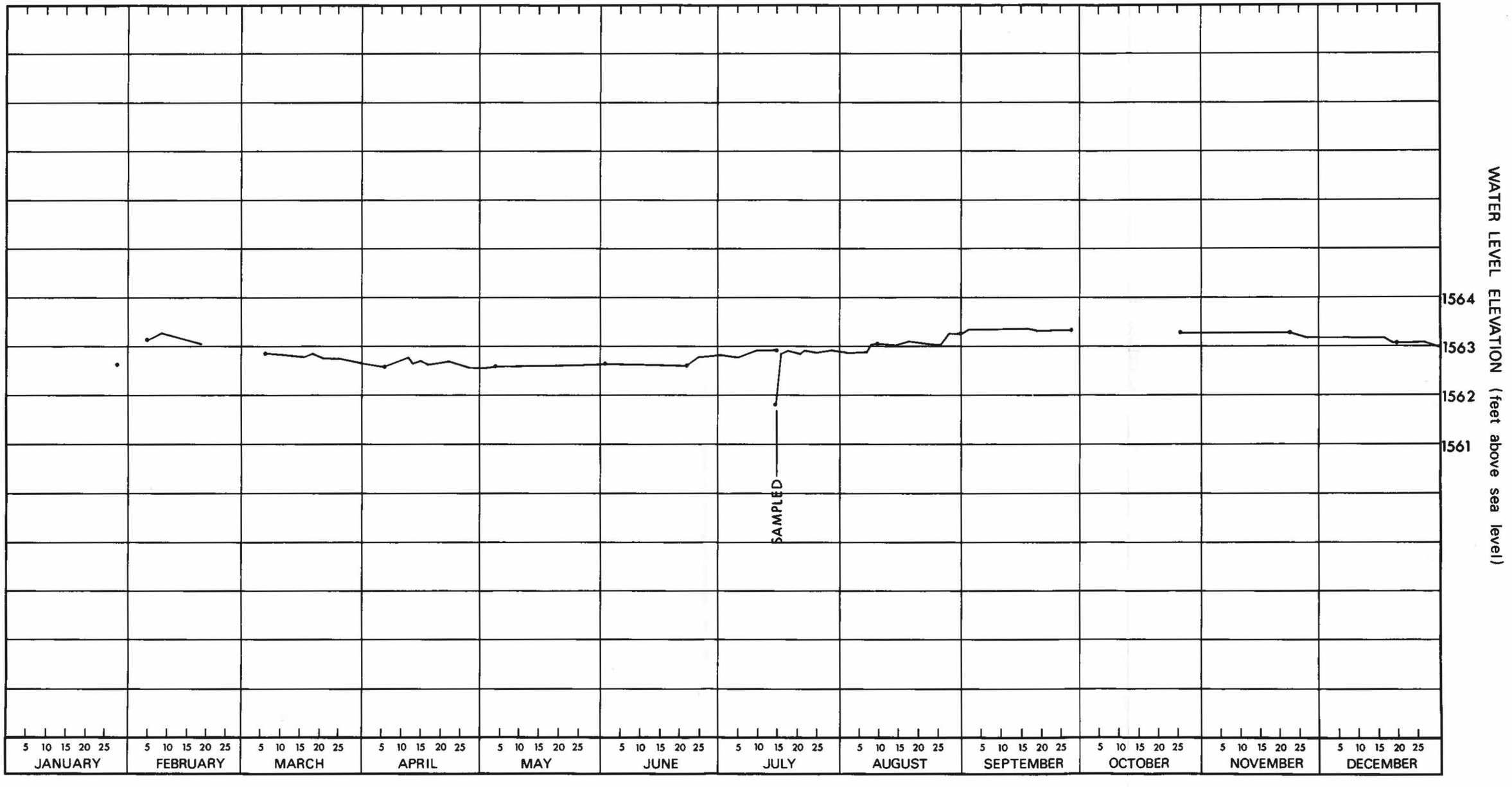
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **15-135**

15 - 135 - H - 77

Lsd **15** Sec **33** Twp **89** R **16** W4th

Alberta Research Council



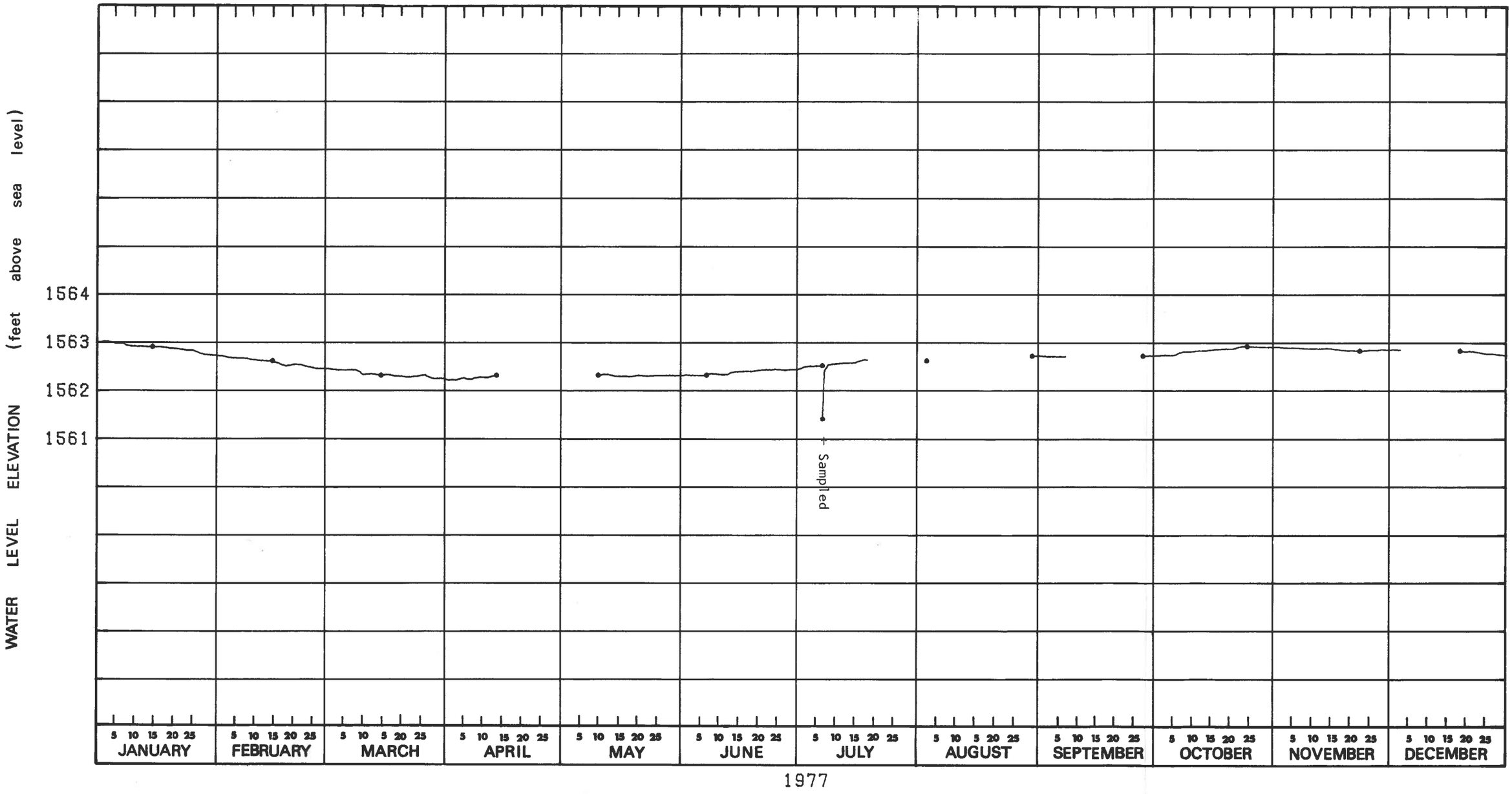
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-135

15-135-H-78

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council




1977

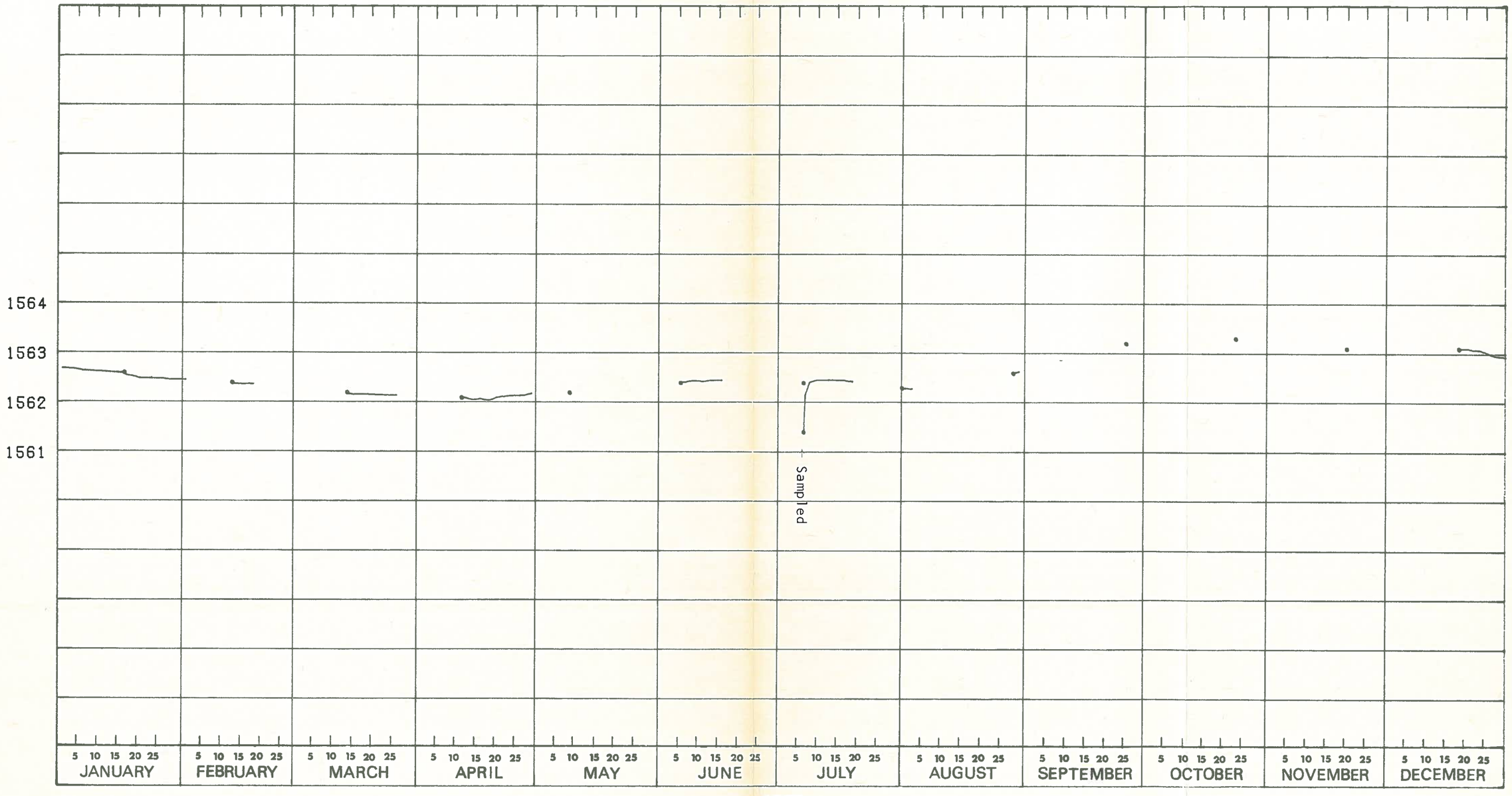
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-135

LSD 15 SEC 33 TWP 89 R 16 W4TH

15-135-H-79

Alberta Research Council




1978

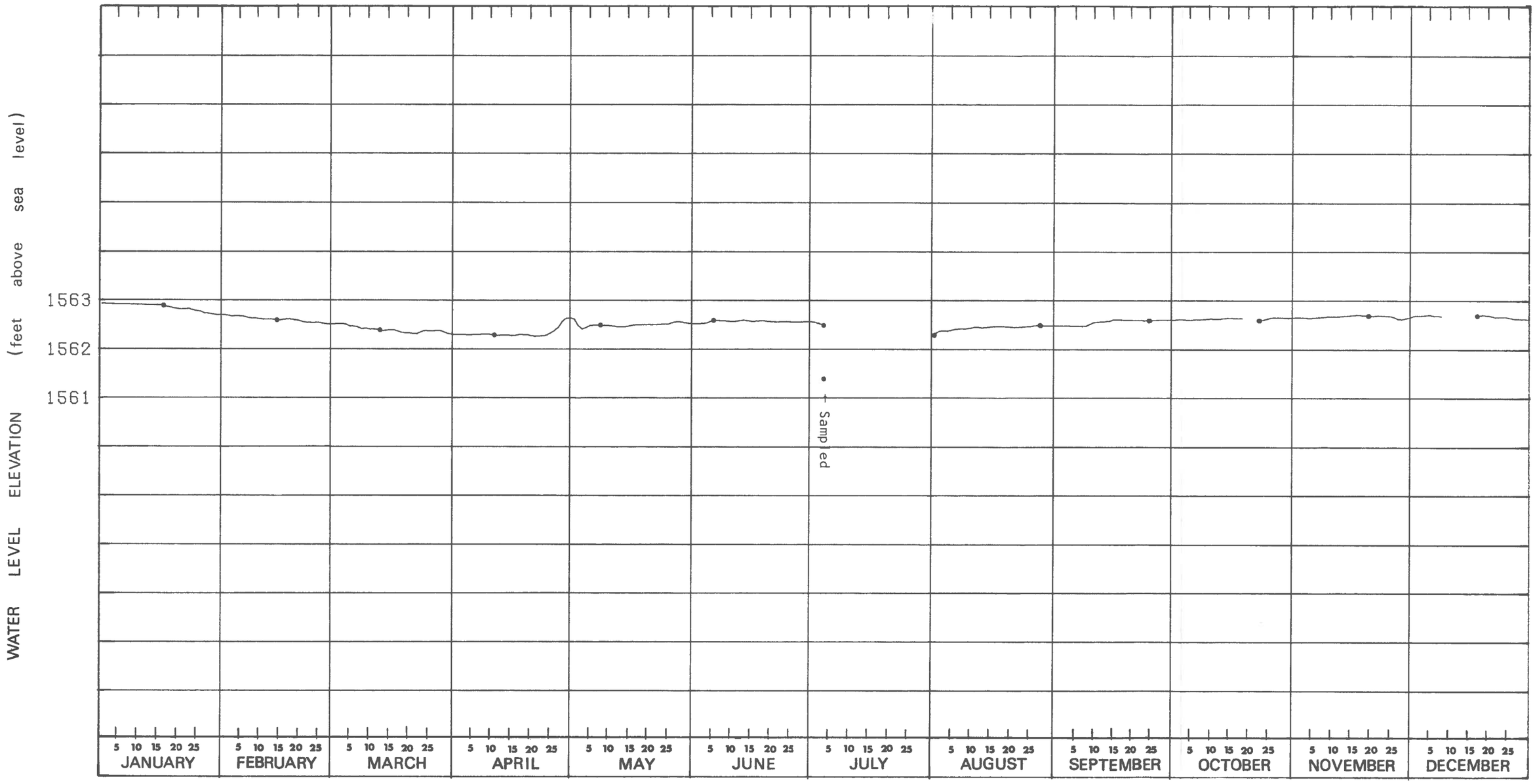
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-135-H-80




1979

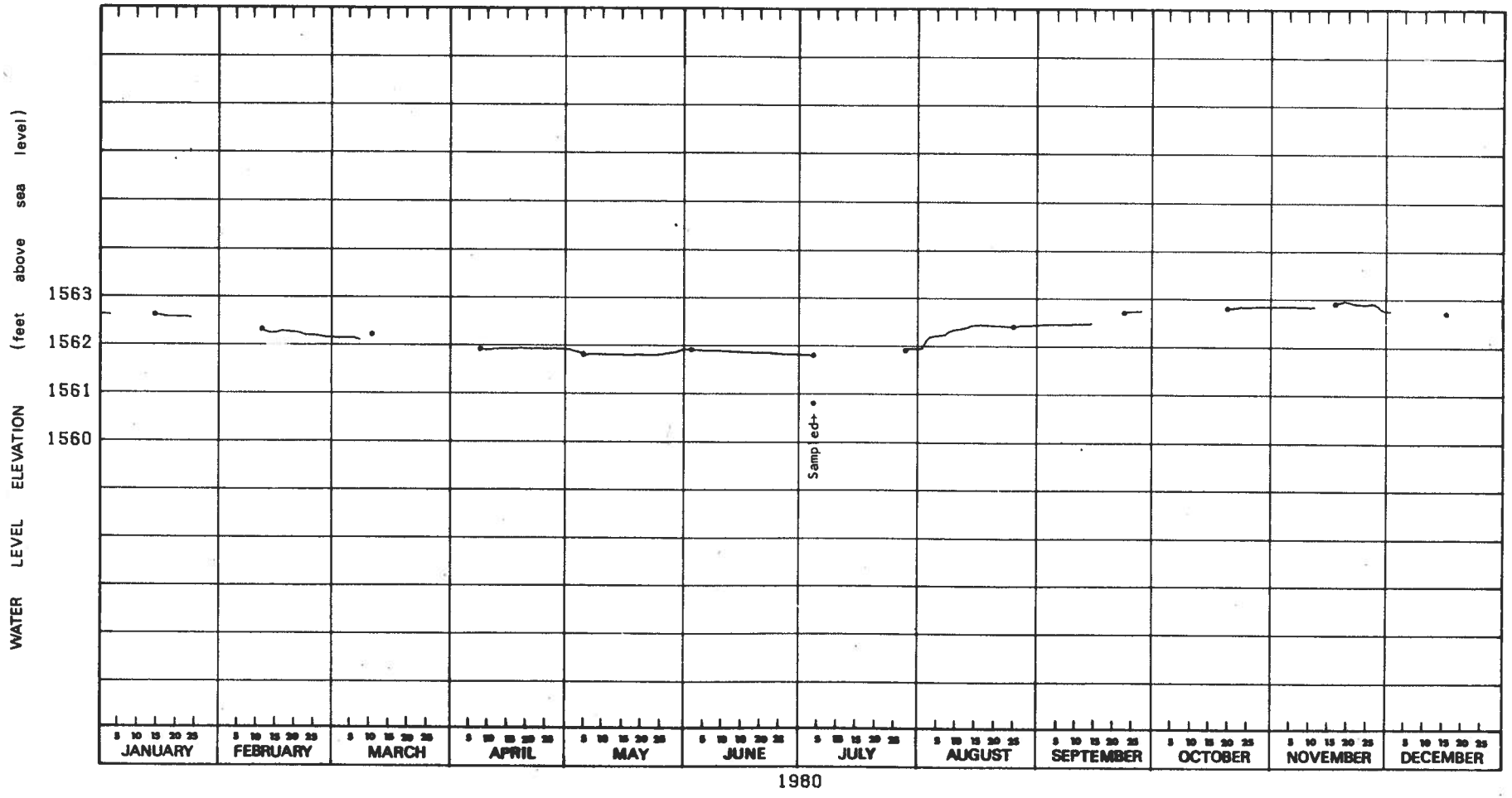
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-135-H-81



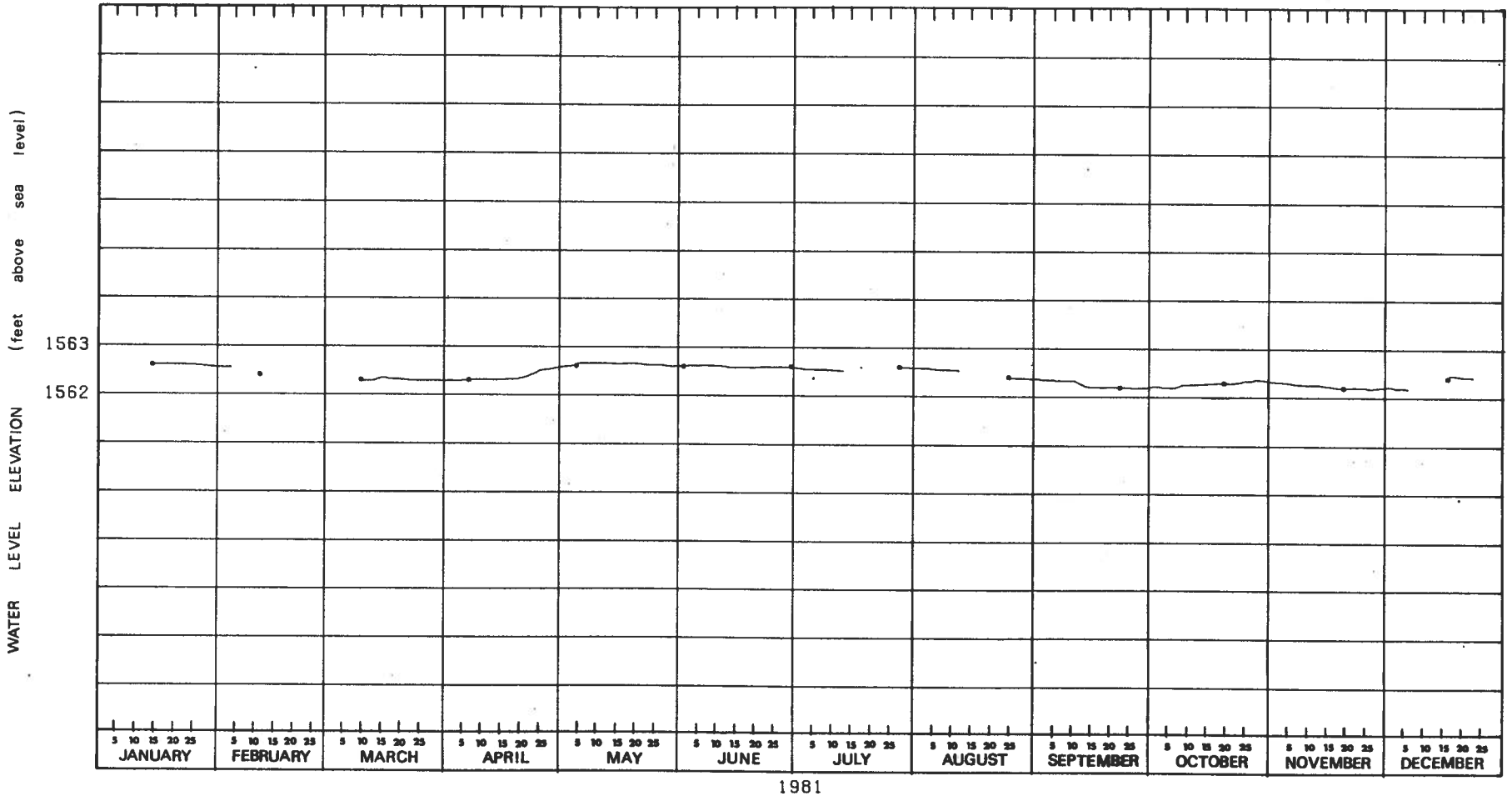
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-135-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1575.67

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 25/76 | | | Well completed; blown with air |
| Jan 26/76 | 13.98 TOC | 1529.8 | Bail test, Q = 5.25 IGPM<br>T = 1 IGPD/FT |
| Jan 27/76 | | | Bail test, Q = 6.7 IGPM<br>T = 2 IGPD/FT |
| Jan 28/76 | 3.96 TOC | 1562.7 | |
| Jan 29/76 | | | Water sample |
| Feb 5/76 | 4.68 MP | 1563.1 | MP = 0.87 m TOC, (1578.5) |
| Mar 6/76 | 4.77 MP | 1562.8 | |
| Apr 6/76 | 4.85 MP | 1562.6 | |
| May 4/76 | 4.69 MP | 1562.6 | New MP = 0.71 m TOC, (1578.0) |
| June 1/76 | 4.68 MP | 1562.6 | |
| June 22/76 | 4.69 MP | 1562.6 | |
| July 15/76 | 4.60 MP | 1562.9 | |
| | 4.94 MP | 1561.8 | After sample; temp. 4°C |
| Aug 10/76 | 4.56 MP | 1563.0 | |
| Aug 31/76 | 4.49 MP | 1563.3 | |
| Sept 28/76 | 4.47 MP | 1563.3 | |
| Oct 26/76 | 4.47 MP | 1563.3 | |
| Nov 23/76 | 4.49 MP | 1563.3 | |
| Dec 20/76 | 4.53 MP | 1563.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1575.67

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 4.61 MP | 1562.9 | MP (1578.0) |
| Feb 15/77 | 4.68 MP | 1562.6 | |
| Mar 15/77 | 4.78 MP | 1562.3 | |
| Apr 14/77 | 4.79 MP | 1562.3 | |
| May 10/77 | 4.80 MP | 1562.3 | |
| June 7/77 | 4.79 MP | 1562.3 | |
| July 7/77 | 4.71 MP | 1562.5 | |
| | 5.05 MP | 1561.4 | After sample; temp. 5°C |
| Aug 3/77 | 4.68 MP | 1562.6 | |
| Aug 30/77 | 4.65 MP | 1562.7 | |
| Sept 28/77 | 4.67 MP | 1562.7 | |
| Oct 25/77 | 4.61 MP | 1562.9 | |
| Nov 23/77 | 4.64 MP | 1562.8 | |
| Dec 19/77 | 4.63 MP | 1562.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1575.67

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 4.68 MP | 1562.6 | MP (1578.0) |
| Feb 13/78 | 4.75 MP | 1562.4 | |
| Mar 14/78 | 4.81 MP | 1562.2 | |
| Apr 12/78 | 4.85 MP | 1562.1 | |
| May 9/78 | 4.81 MP | 1562.2 | |
| June 6/78 | 4.76 MP | 1562.4 | |
| July 7/78 | 4.75 MP | 1562.4 | |
| | 5.07 MP | 1561.4 | After sample; temp 4°C |
| Aug 1/78 | 4.77 MP | 1562.3 | |
| Aug 29/78 | 4.70 MP | 1562.6 | |
| Sept 26/78 | 4.52 MP | 1563.2 | |
| Oct 24/78 | 4.48 MP | 1563.3 | |
| Nov 21/78 | 4.53 MP | 1563.1 | |
| Dec 19/78 | 4.54 MP | 1563.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-135

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1575.67

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 4.59 MP | 1562.9 | MP (1578.0) |
| Feb 15/79 | 4.68 MP | 1562.6 | |
| Mar 13/79 | 4.74 MP | 1562.4 | |
| Apr 11/79 | 4.79 MP | 1562.3 | |
| May 8/79 | 4.73 MP | 1562.5 | |
| June 6/79 | 4.69 MP | 1562.6 | |
| July 4/79 | 4.72 MP | 1562.5 | |
| | 5.05 MP | 1561.4 | After sample; temp. 4°C |
| Aug 1/79 | 4.77 MP | 1562.3 | |
| Aug 28/79 | 4.73 MP | 1562.5 | |
| Sept 25/79 | 4.69 MP | 1562.6 | |
| Oct 23/79 | 4.68 MP | 1562.6 | |
| Nov 20/79 | 4.66 MP | 1562.7 | |
| Dec 12/79 | 4.66 MP | 1562.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing.

## WELL HISTORY

OBSERVATION WELL NUMBER 15 - 135

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1575.67

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 4.69 MP | 1562.6 | |
| Feb 12/80 | 4.77 MP | 1562.3 | |
| Mar 12/80 | 4.83 MP | 1562.2 | |
| Apr 9/80 | 4.90 MP | 1561.9 | |
| May 6/80 | 4.94 MP | 1561.8 | |
| June 3/80 | 4.92 MP | 1561.9 | |
| July 5/80 | 4.93 MP | 1561.8 | Temp. 5°C |
| | 5.25 MP | 1560.8 | After Sample |
| July 29/80 | 4.92 MP | 1561.9 | |
| Aug 26/80 | 4.74 MP | 1562.4 | |
| Sept 24/80 | 4.67 MP | 1562.7 | |
| Oct 21/80 | 4.63 MP | 1562.8 | |
| Nov 18/80 | 4.61 MP | 1562.9 | |
| Dec 17/80 | 4.65 MP | 1562.7 | |
| Jan 15/81 | 4.69 MP | 1562.6 | |
| Feb 12/81 | 4.75 MP | 1562.4 | |
| Mar 10/81 | 4.78 MP | 1562.3 | |
| Apr 7/81 | 4.78 MP | 1562.3 | |
| May 5/81 | 4.70 MP | 1562.6 | |
| June 2/81 | 4.70 MP | 1562.6 | |
| June 30/81 | 4.68 MP | 1562.6 | |
| July 28/81 | 4.69 MP | 1562.6 | |
| Aug 25/81 | 4.76 MP | 1562.4 | |
| Sept 23/81 | 4.81 MP | 1562.2 | |
| Oct 20/81 | 4.80 MP | 1562.3 | |
| Nov 20/81 | 4.82 MP | 1562.2 | |
| Dec 17/81 | 4.76 MP | 1562.4 | |

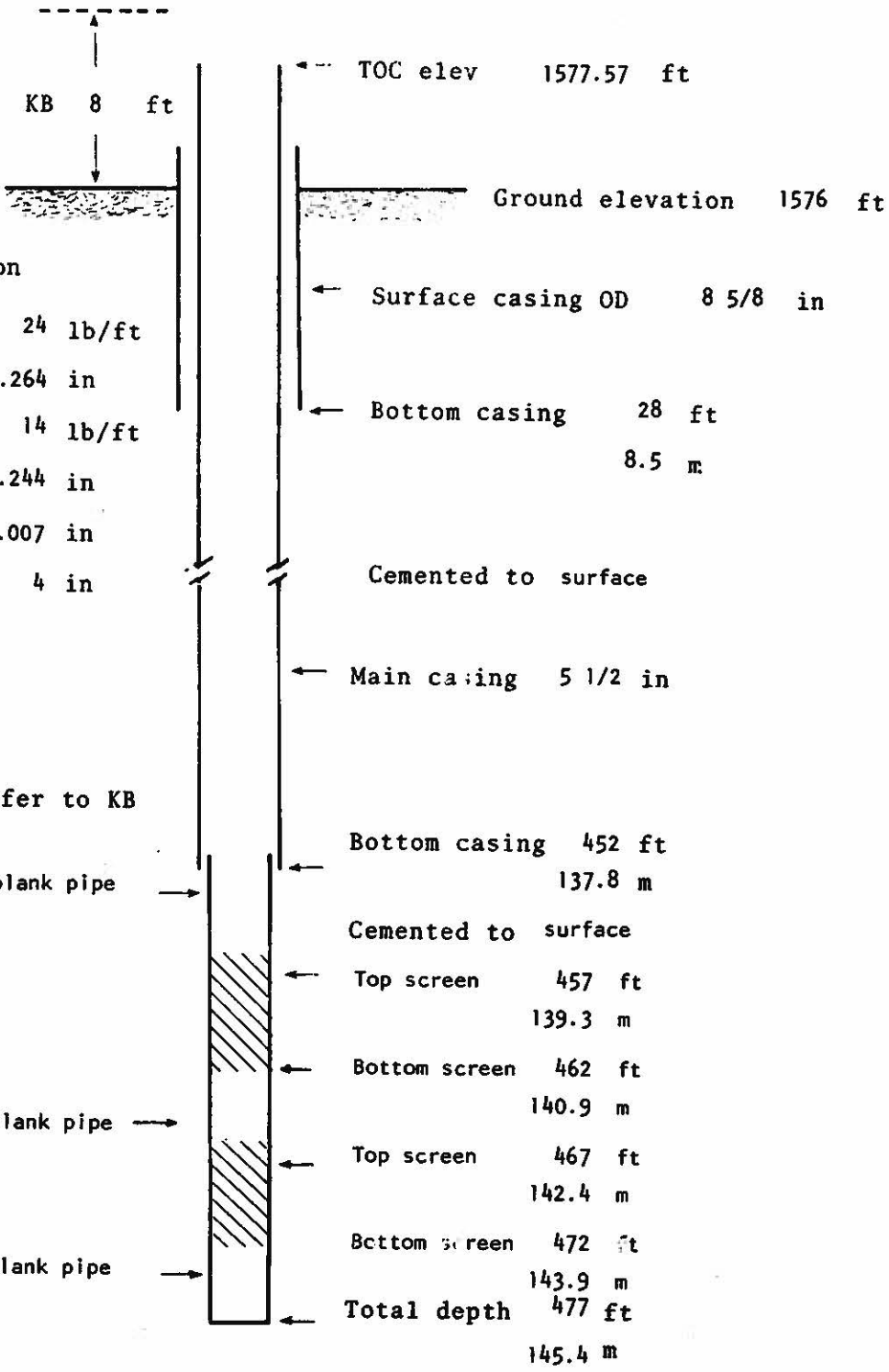
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Tp 89 R 16 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB

## DRILL STEM TEST

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Tp 89 R 16 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1576 |
| | KB | 1584 |
| Type of test | | Casing Positrieve |
| Date of test | | January 29, 1976 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 0315 | hrs |
| Tool opened | 0344 | hrs |
| First flow | 2 | min |
| Initial shut in | 60 | min |
| Second flow | 15 | min |
| Final shut in | 90 | min |
| Pulled loose at | 0635 | hrs |
| Out of hole at | 0700 | hrs |
| Wt on packers | 2000 | lbs |
| Description of blow | Good initial puff on preflow. Good air blow on final flow period | |
| Total water recovered | 95 | ft |
| Water sample No. | - (water) | |
| Gas blow | No | |
| Remarks | | |

### HOLE DATA

| | |
|---|---|
| Contractor | Tri City Drilling |
| Drill pipe size (OD) | 2 7/8" IF |
| Drill collar size (ID) | 2 7/8" |
| Drill collar length (ft) | 62 |
| Open or screened interval | 452-477' |
| Formation tested | Wabiskaw |

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | 1.90 | |
| MFE Tool | 10.02 | |
| Ret. Bridge Plug | 2.65 | 5 1/2" |
| Total | 14.57 | |
| Ret. Bridge Plug | 3.50 | |
| Recorder | 7.00 | |
| Recorder | 7.00 | |
| Total Interval | 17.50 | |

### PRESSURE DATA (psi)

| Instrument No. | | ON | IN |
|---|---|---|---|
| Capacity (psig) | | 700 | 700 |
| Instrument set at (ft) | | 432 | 439 |
| Initial hydrostatic | A | 179 | 173 |
| First flow | B | 28 | 27 |
| | B1 | 38 | 38 |
| Initial shut in | C | 115 | 114 |
| Second flow | D | 43 | 42 |
| | D1 | 76 | 74 |
| Final shut in | G | 115 | 115 |
| Final hydrostatic | H | 170 | 167 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 15-477

INTERVAL TESTED 452-477

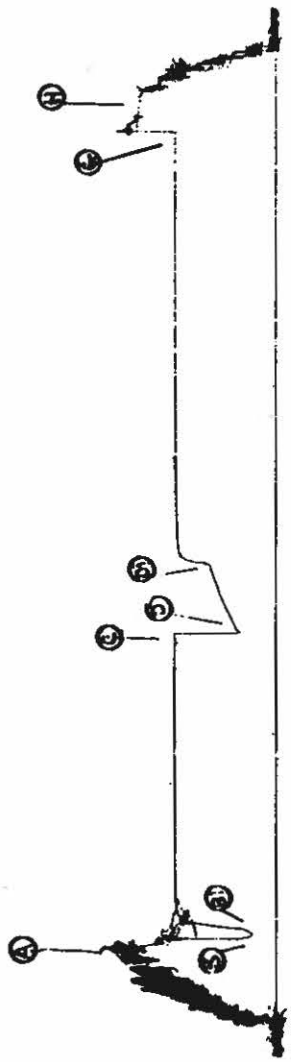
PRESSURE INCREMENTS

Recorder RPG-01N

January 29, 1976

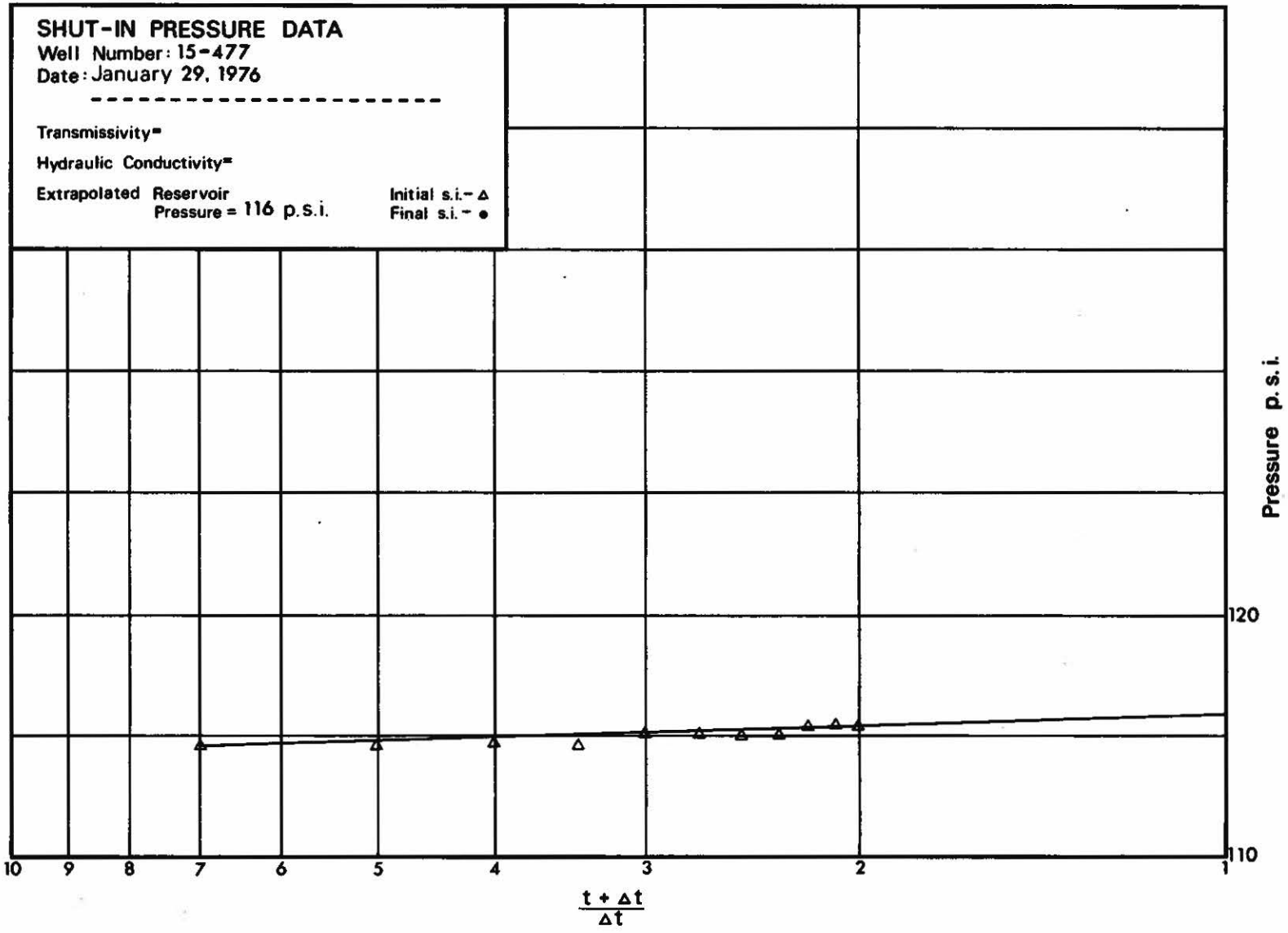
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 113.5 | 13.00 |
| 10 | 114.6 | 7.00 |
| 15 | 114.6 | 5.00 |
| 20 | 114.6 | 4.00 |
| 25 | 114.6 | 3.40 |
| 30 | 115.0 | 3.00 |
| 35 | 115.0 | 2.71 |
| 40 | 115.0 | 2.50 |
| 45 | 115.0 | 2.33 |
| 50 | 115.4 | 2.20 |
| 55 | 115.4 | 2.09 |
| 60 | 115.4 | 2.00 |

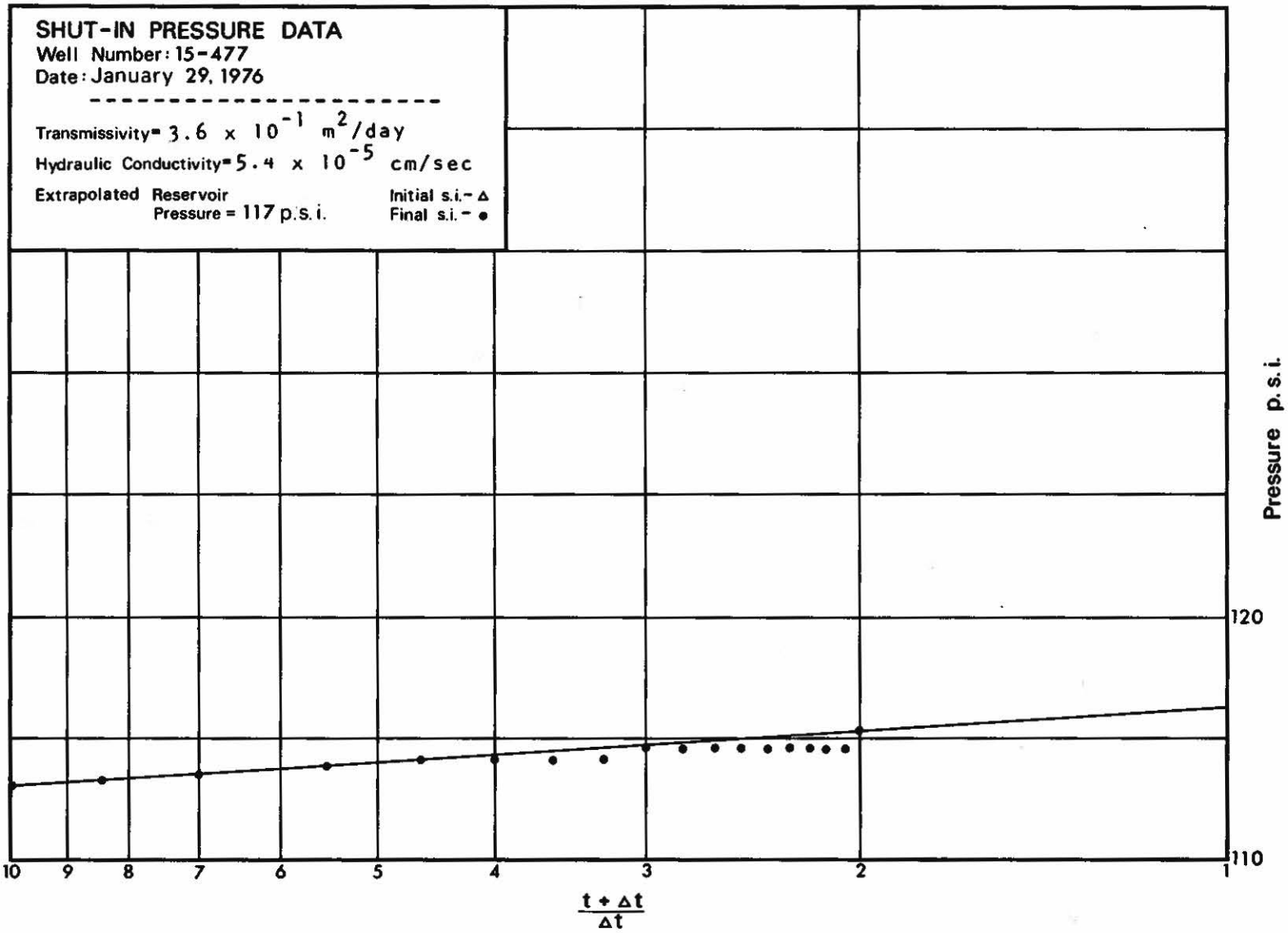


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 111.5 | 19.00 |
| 10 | 113.1 | 10.00 |
| 15 | 113.5 | 7.00 |
| 20 | 113.8 | 5.50 |
| 25 | 114.2 | 4.60 |
| 30 | 114.2 | 4.00 |
| 35 | 114.2 | 3.57 |
| 40 | 114.2 | 3.25 |
| 45 | 114.6 | 3.00 |
| 50 | 114.6 | 2.80 |
| 55 | 114.6 | 2.64 |
| 60 | 114.6 | 2.50 |
| 65 | 114.6 | 2.38 |
| 70 | 114.6 | 2.29 |
| 75 | 114.6 | 2.20 |
| 80 | 114.6 | 2.13 |
| 85 | 114.6 | 2.06 |
| 90 | 115.4 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 15-477
Date: January 29, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 116 p.s.i.
Initial s.i.- Δ
Final s.i. - ●
Pressure p.s.i.
120
110
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

15-477-D-77


SHUT-IN PRESSURE DATA
Well Number: 15-477
Date: January 29, 1976
Transmissivity = 3.6 x 10^-1 m^2/day
Hydraulic Conductivity = 5.4 x 10^-5 cm/sec
Extrapolated Reservoir Pressure = 117 p.s.i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
120
110
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

15-477-0-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source DST on 15-477

Date sampled January 29, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 5.7 | 0.28 | 0.7 |
| Magnesium ($Mg^{++}$) | 4.7 | 0.39 | 0.9 |
| Sodium ($Na^{+}$) | 950.0 | 41.32 | 97.1 |
| Potassium ($K^{+}$) | 22.5 | 0.58 | 1.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1581.0 | 25.91 | 58.6 |
| Sulfate ($SO_4^{=}$) | 83.0 | 1.73 | 3.9 |
| Chloride ($Cl^{-}$) | 587.0 | 16.55 | 37.4 |
| Nitrate ($NO_3^{=}$) | 2.7 | 0.04 | 0.1 |
| Silica ($SiO_2$) | 1.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 2616.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 44.2 | Total Cations (epm) | 42.6 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | | Temperature (C) | | |
| pH | 8.3 | pH | 8.8 | |
| Fluoride ($F^{-}$) | 2.1 ppm | Carbonate ($CO_3^{=}$) | 91 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1654 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |
| | | Sulfide | 0.5 | --- |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 15, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.0 | 0.15 | 0 |
| Magnesium ($Mg^{++}$) | 4.9 | 0.40 | 1 |
| Sodium ($Na^{+}$) | 1113.0 | 48.41 | 98 |
| Potassium ($K^{+}$) | 11.3 | 0.29 | 1 |
| Carbonate ($CO_3^{=}$) | 175.0 | 5.83 | 12 |
| Bicarbonate ($HCO_3^{-}$) | 1344.0 | 22.03 | 47 |
| Sulfate ($SO_4^{=}$) | 67.0 | 1.39 | 3 |
| Chloride ($Cl^{-}$) | 640.0 | 18.05 | 38 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0 |
| Silica ($SiO_2$) | 0.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 3.9 | | |
| Magnesium (Acidified) | 5.4 | | |
| Total dissolved solids | 2732 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 47.31 | Total Cations (epm) | 49.25 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 6000 |
| pH | 9.0 |
| Fluoride ($F^{-}$) | 2.3 Mg/L |

Field:

| | |
|---|---|
| Temperature (C) | 7.0 |
| pH | 9.3 |
| Carbonate ($CO_3^{=}$) | 269 Mg/L |
| Bicarbonate ($HCO_3^{-}$) | 1210 Mg/L |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 7, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1.9 | 0.09 | 0.2 |
| Magnesium ($Mg^{++}$) | 3.7 | 0.30 | 0.6 |
| Sodium ($Na^{+}$) | 1125.0 | 48.93 | 98.6 |
| Potassium ($K^{+}$) | 11.3 | 0.29 | 0.6 |
| Carbonate ($CO_3^{=}$) | 278.0 | 9.27 | 19.1 |
| Bicarbonate ($HCO_3^{-}$) | 1149.0 | 18.83 | 38.9 |
| Sulfate ($SO_4^{=}$) | 85.0 | 1.77 | 3.7 |
| Chloride ($Cl^{-}$) | 658.0 | 18.56 | 38.3 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 1.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 2.4 | | |
| Magnesium (Acidified) | 4.0 | | |
| Total dissolved solids | 2654.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 48.43 | Total Cations (epm) | 49.62 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 4800 | Temperature (C) | 5.0 |
| pH | 9.4 | pH | 9.5 |
| Fluoride ($F^{-}$) | 3.2 ppm | Carbonate ($CO_3^{=}$) | 317.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1069.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Date sampled: July 15, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .009 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 1070 |
| As | <.038 | Ni | <.010 |
| B | 3.22 | P | 0.66 |
| Ba | <.200 | Pb | <.088 |
| Be | .003 | Se | <.060 |
| Ca | 4.09 | Si | 0.76 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .301 |
| Cr | <.006 | Te | <.065 |
| Cu | .012 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .044 | V | <.0008 |
| K | <.150 | W | <.078 |
| Mg | 5.16 | Zn | <.002 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 07, 1978

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.6 | 0.08 | 0.2 |
| Magnesium(Mg) | 3.6 | 0.30 | 0.6 |
| Sodium(Na) | 1050.0 | 45.67 | 98.8 |
| Potassium(K) | 6.7 | 0.17 | 0.4 |
| Carbonate(CO3) | 298.0 | 9.93 | 20.3 |
| Bicarbonate(HCO3) | 1103.0 | 18.08 | 36.9 |
| Sulphate(SO4) | 60.0 | 1.25 | 2.5 |
| Chloride(Cl) | 700.0 | 19.74 | 40.3 |
| Nitrate(NO3) | 2.2 | 0.04 | 0.1 |
| Silica(SiO2) | 1.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 1.9 | | |
| Magnesium(Acidified) | 3.8 | | |
| TDS(mg/l) | 2602.0 | | |
| Total Anions(epm) | 49.04 | Total Cations(epm) | 46.22 |

## Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3880 | | Temperature(C) | 7.00 | |
| pH | 9.4 | | pH | 9.5 | |
| Fluoride(F) | 2.4 | mg/l | Carbonate(CO3) | 350 | mg/l |
| | | | Bicarbonate(HCO3) | 991 | mg/l |
| | | | Hydroxide(OH) | | |

15-477-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 4, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.5 | 0.12 | 0.3 |
| Magnesium(Mg) | 3.5 | 0.29 | 0.6 |
| Sodium(Na) | 1050.0 | 45.67 | 98.6 |
| Potassium(K) | 10.0 | 0.26 | 0.6 |
| Carbonate(CO3) | 305.0 | 10.17 | 21.1 |
| Bicarbonate(HCO3) | 1066.0 | 17.47 | 36.3 |
| Sulphate(SO4) | 63.0 | 1.31 | 2.7 |
| Chloride(Cl) | 680.0 | 19.18 | 39.8 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 1.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 2.0 | | |
| Magnesium(Acidified) | 3.3 | | |
| TDS(mg/l) | 2546.0 | | |
| Total Anions(epm) | 48.13 | Total Cations(epm) | 46.34 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3880 | Temperature(C) | 6.00 | |
| pH | 9.3 | pH | 9.7 | |
| Fluoride(F) | 2.5 mg/l | Carbonate(CO3) | 350 | mg/l |
| | | Bicarbonate(HCO3) | 961 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 15-477-E-82

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 5, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.1 | 0.11 | 0.2 |
| Magnesium(Mg) | 2.8 | 0.23 | 0.5 |
| Sodium(Na) | 1081.0 | 47.00 | 98.7 |
| Potassium(K) | 11.3 | 0.29 | 0.6 |
| Carbonate(CO3) | 276.0 | 9.20 | 19.6 |
| Bicarbonate(HCO3) | 1135.0 | 18.61 | 39.6 |
| Sulphate(SO4) | 54.0 | 1.13 | 2.4 |
| Chloride(Cl) | 640.0 | 18.03 | 38.4 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 0.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 2.9 | | |
| Magnesium(Acidified) | 3.3 | | |
| TDS(mg/l) | 2693.0 | | |
| Total Anions(epm) | 46.96 | Total Cations(epm) | 47.63 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4399 | Temperature | 7.00 | |
| pH | 9.4 | pH | 9.6 | |
| Fluoride | 0.0 mg/l | Carbonate(CO3) | 350 | mg/l |
| | | Bicarbonate(HCO3) | 991 | mg/l |
| | | Hydroxide(OH) | | |

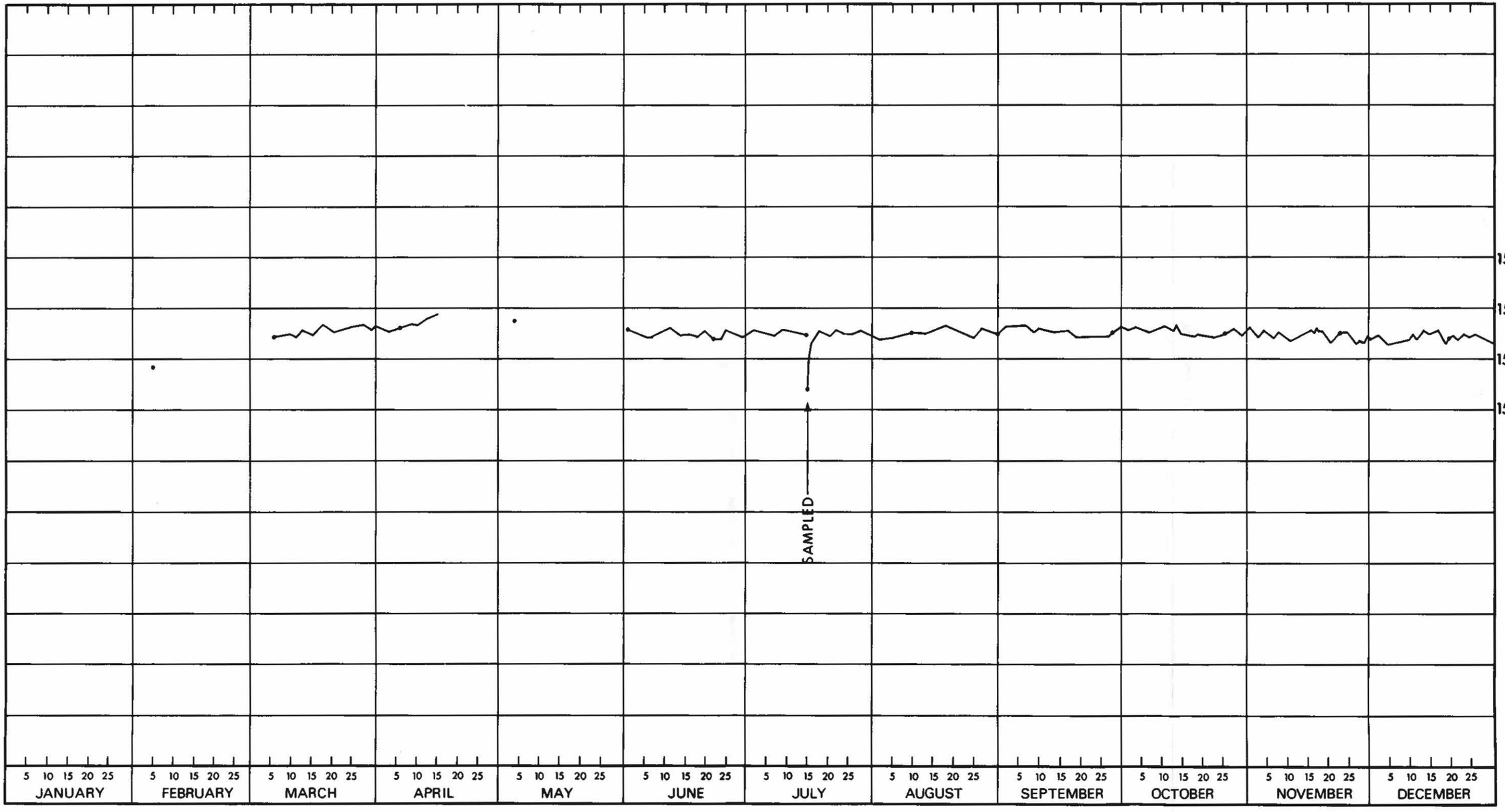
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-477

15 - 477 - H - 77

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council



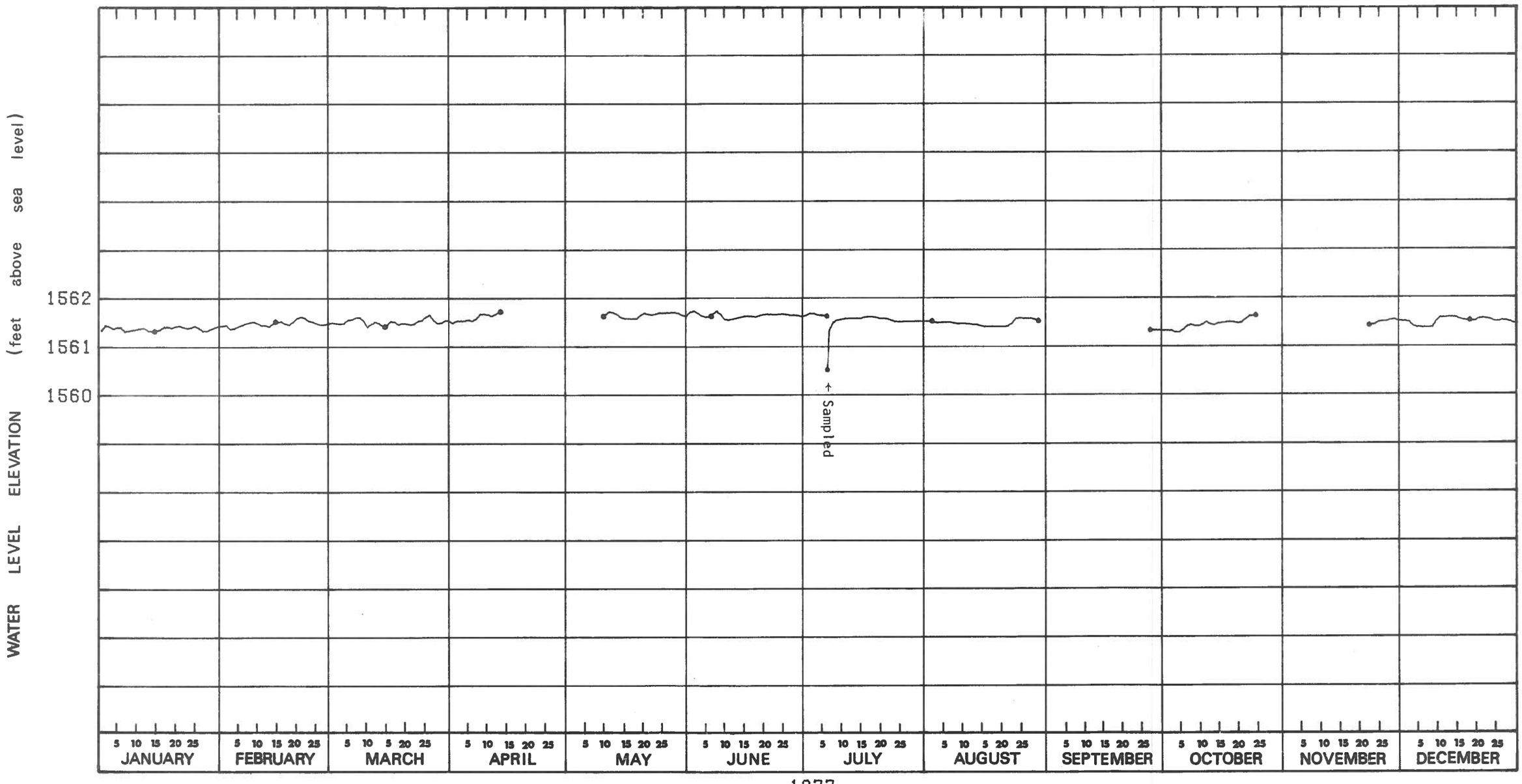
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-477-H-78




1977

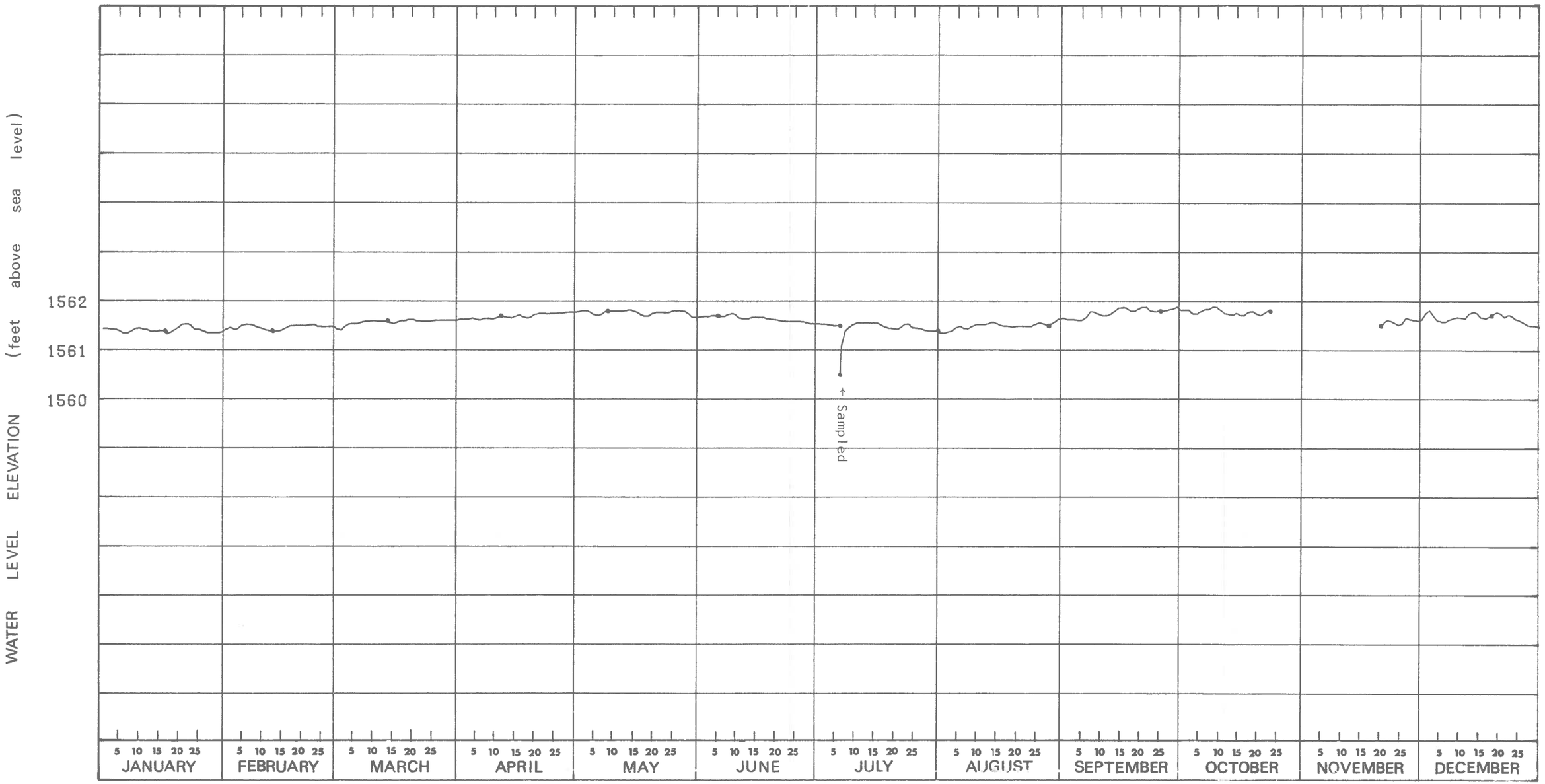
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-477

LSD 15 SEC 33 TWP 89 R 16 W4TH

15-477-H-79

Alberta Research Council



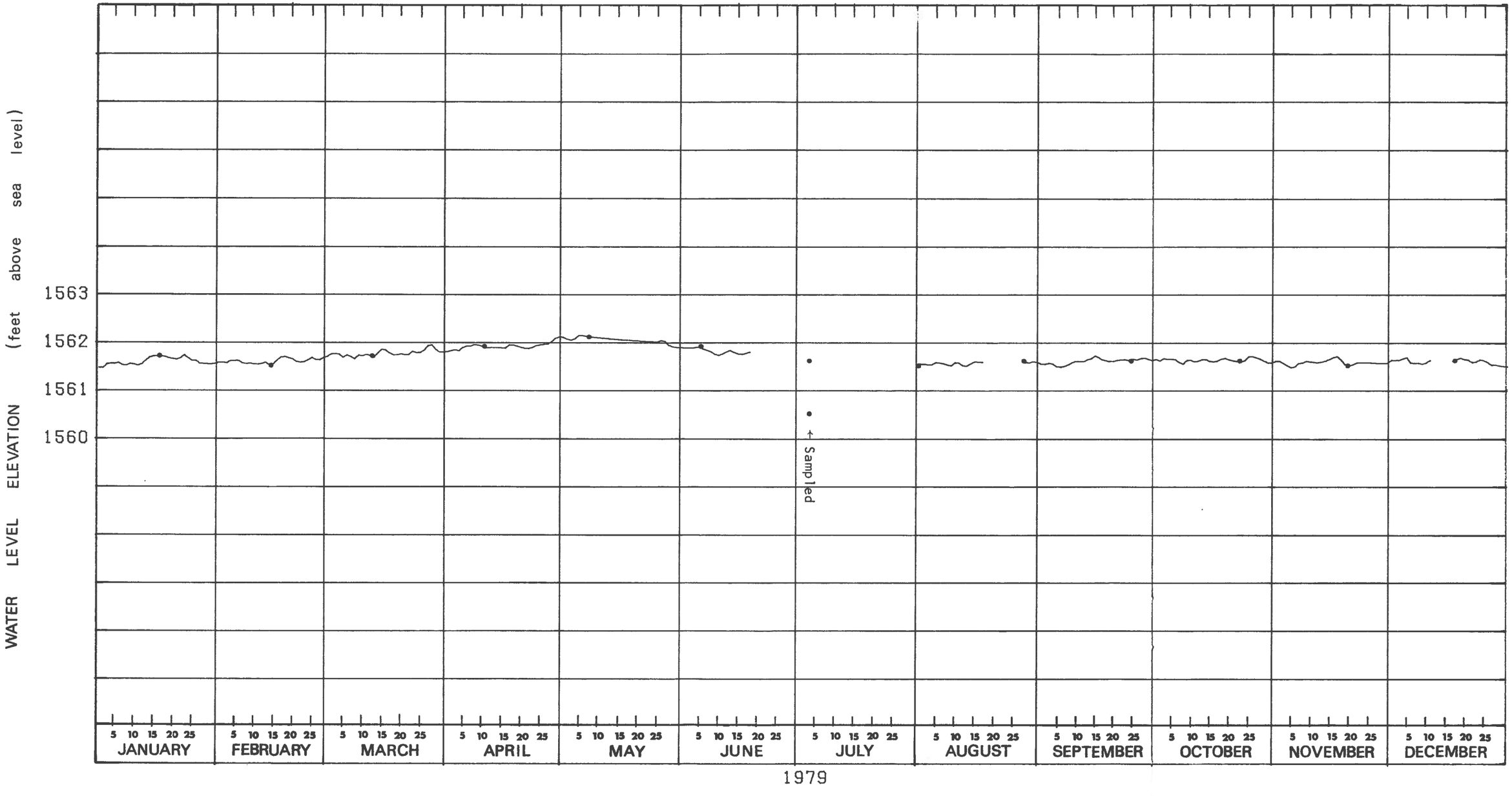
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-477

15-477-H-80

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council



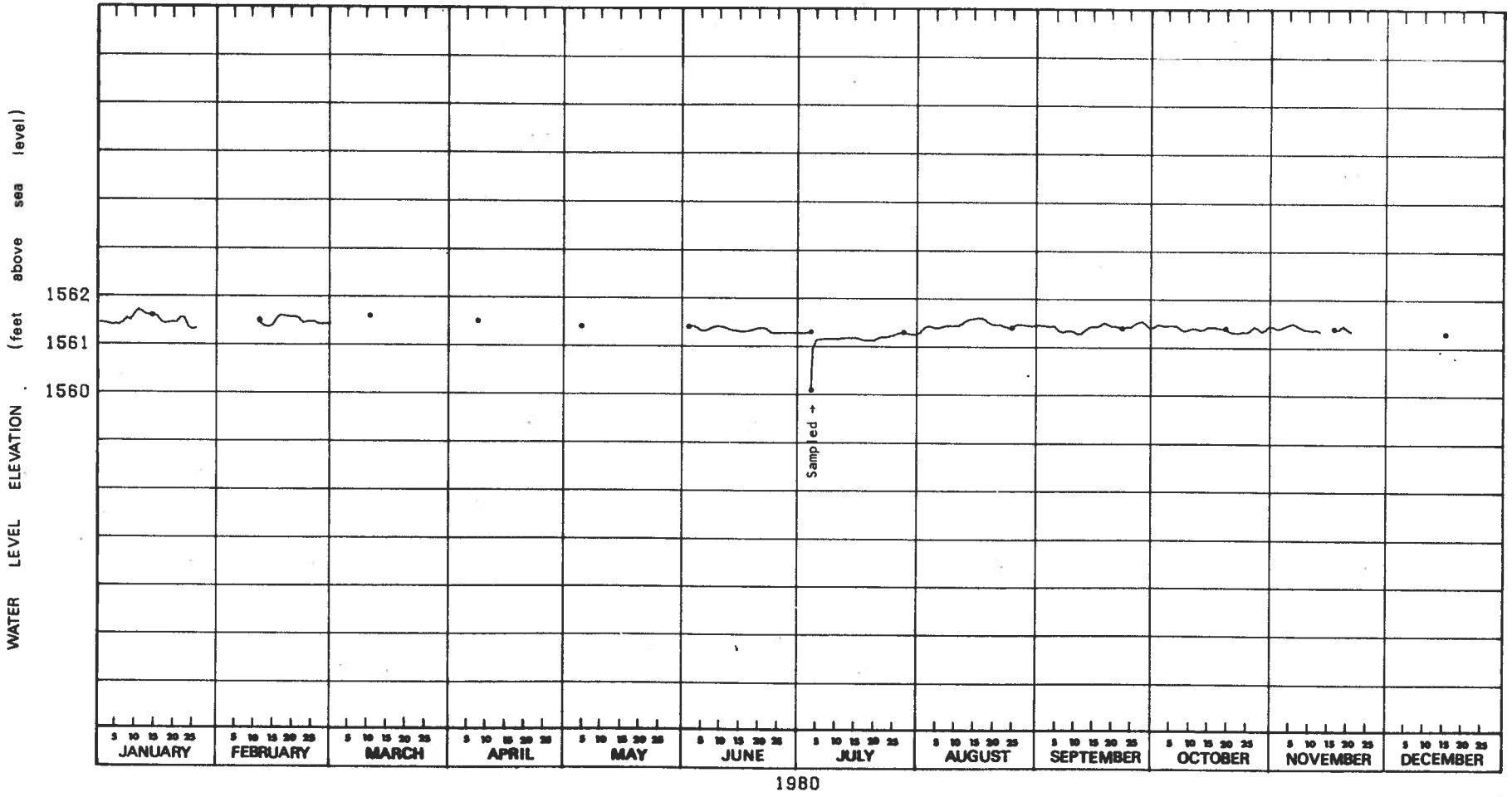
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-477-H-81



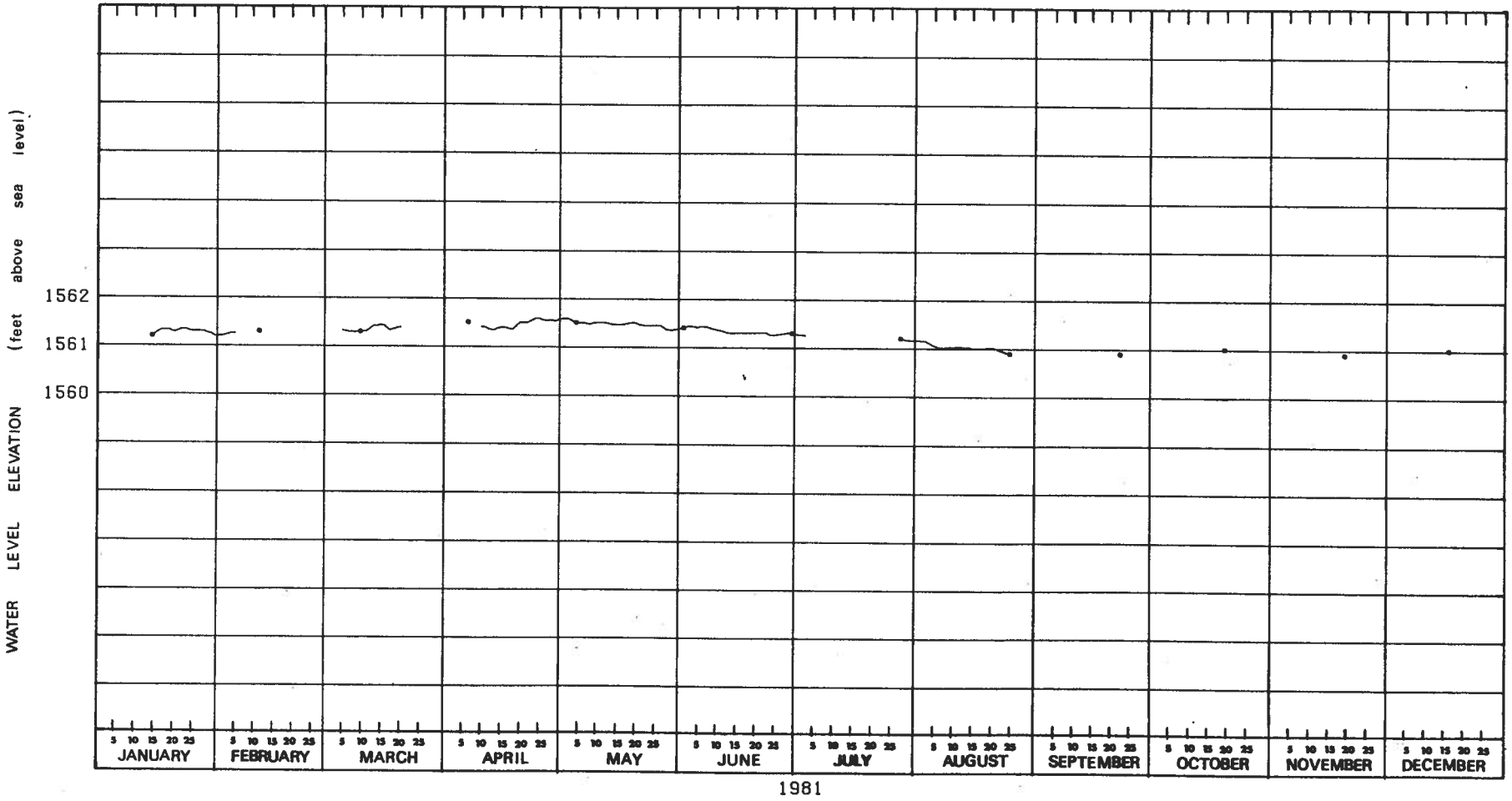
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-477-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1577.57

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 29/76 | | | Well completed; blown with air; DST FSI = 115# from 432 ft; water sample |
| Feb 5/76 | 5.75 MP | 1560.8 | MP = 0.66 m TOC, (1579.7) |
| Mar 6/76 | 5.57 MP | 1561.4 | |
| Apr 6/76 | 5.52 MP | 1561.6 | |
| May 4/76 | 5.49 MP | 1561.7 | |
| June 1/76 | 5.55 MP | 1561.6 | New MP = 0.67 m TOC, (1579.8) |
| June 22/76 | 5.60 MP | 1561.4 | |
| July 15/76 | 5.58 MP | 1561.5 | |
| | 5.91 MP | 1560.4 | After sample; temp. 7°C |
| Aug 10/76 | 5.56 MP | 1561.6 | |
| Aug 31/76 | 5.57 MP | 1561.5 | |
| Sept 28/76 | 5.56 MP | 1561.6 | |
| Oct 26/76 | 5.57 MP | 1561.5 | |
| Nov 23/76 | 5.59 MP | 1561.5 | |
| Dec 20/76 | 5.61 MP | 1561.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1577.57

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 5.64 MP | 1561.3 | MP (1579.8) |
| Feb 15/77 | 5.59 MP | 1561.5 | |
| Mar 15/77 | 5.60 MP | 1561.4 | |
| Apr 14/77 | 5.53 MP | 1561.7 | |
| May 10/77 | 5.54 MP | 1561.6 | |
| June 7/77 | 5.55 MP | 1561.6 | |
| July 7/77 | 5.56 MP | 1561.6 | |
| | 5.88 MP | 1560.5 | After sample; temp. 5°C |
| Aug 3/77 | 5.58 MP | 1561.5 | |
| Aug 30/77 | 5.58 MP | 1561.5 | |
| Sept 28/77 | 5.63 MP | 1561.3 | |
| Oct 25/77 | 5.56 MP | 1561.6 | |
| Nov 23/77 | 5.61 MP | 1561.4 | |
| Dec 19/77 | 5.57 MP | 1561.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1577.57

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 5.60 MP | 1561.4 | MP (1579.8) |
| Feb 13/78 | 5.61 MP | 1561.4 | |
| Mar 14/78 | 5.55 MP | 1561.6 | |
| Apr 12/78 | 5.52 MP | 1561.7 | |
| May 9/78 | 5.49 MP | 1561.8 | |
| June 6/78 | 5.51 MP | 1561.7 | |
| July 7/78 | 5.57 MP | 1561.5 | |
| | 5.89 MP | 1560.5 | After sample; temp 7°C |
| Aug 1/78 | 5.61 MP | 1561.4 | |
| Aug 29/78 | 5.58 MP | 1561.5 | |
| Sept 26/78 | 5.49 MP | 1561.8 | |
| Oct 24/78 | 5.50 MP | 1561.8 | |
| Nov 21/78 | 5.57 MP | 1561.5 | |
| Dec 19/78 | 5.52 MP | 1561.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-477

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1577.57

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 5.51 MP | 1561.7 | MP (1579.8) |
| Feb 15/79 | 5.59 MP | 1561.5 | |
| Mar 13/79 | 5.52 MP | 1561.7 | |
| Apr 11/79 | 5.47 MP | 1561.9 | |
| May 8/79 | 5.38 MP | 1562.1 | |
| June 6/79 | 5.32 MP | 1561.9 | New MP 0.57m TOC (1579.4) |
| July 4/79 | 5.42 MP | 1561.6 | |
| | 5.75 MP | 1560.5 | After sample; temp. 6°C |
| Aug 1/79 | 5.46 MP | 1561.5 | |
| Aug 28/79 | 5.43 MP | 1561.6 | |
| Sept 25/79 | 5.44 MP | 1561.6 | |
| Oct 23/79 | 5.43 MP | 1561.6 | |
| Nov 20/79 | 5.46 MP | 1561.5 | |
| Dec 18/79 | 5.42 MP | 1561.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 15 - 477

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1577.57

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 5.43 MP | 1561.6 | |
| Feb 12/80 | 5.46 MP | 1561.5 | |
| Mar 12/80 | 5.43 MP | 1561.6 | |
| Apr 9/80 | 5.45 MP | 1561.5 | |
| May 6/80 | 5.50 MP | 1561.4 | |
| June 3/80 | 5.48 MP | 1561.4 | |
| July 5/80 | 5.52 MP | 1561.3 | Temp. 7°C |
| | 5.87 MP | 1560.1 | After Sample |
| July 29/80 | 5.52 MP | 1561.3 | |
| Aug 26/80 | 5.50 MP | 1561.4 | |
| Sept 24/80 | 5.49 MP | 1561.4 | |
| Oct 21/80 | 5.50 MP | 1561.4 | |
| Nov 18/80 | 5.48 MP | 1561.4 | |
| Dec 17/80 | 5.53 MP | 1561.3 | |
| Jan 15/81 | 5.54 MP | 1561.2 | |
| Feb 12/81 | 5.53 MP | 1561.3 | |
| Mar 10/81 | 5.52 MP | 1561.3 | |
| Apr 7/81 | 5.45 MP | 1561.5 | |
| May 5/81 | 5.45 MP | 1561.5 | |
| June 2/81 | 5.50 MP | 1561.4 | |
| June 30/81 | 5.53 MP | 1561.3 | |
| July 28/81 | 5.56 MP | 1561.2 | |
| Aug 25/81 | 5.64 MP | 1560.9 | |
| Sept 23/81 | 5.63 MP | 1560.9 | |
| Oct 20/81 | 5.62 MP | 1561.0 | |
| Nov 20/81 | 5.65 MP | 1560.9 | |
| Dec 17/81 | 5.60 MP | 1561.0 | |

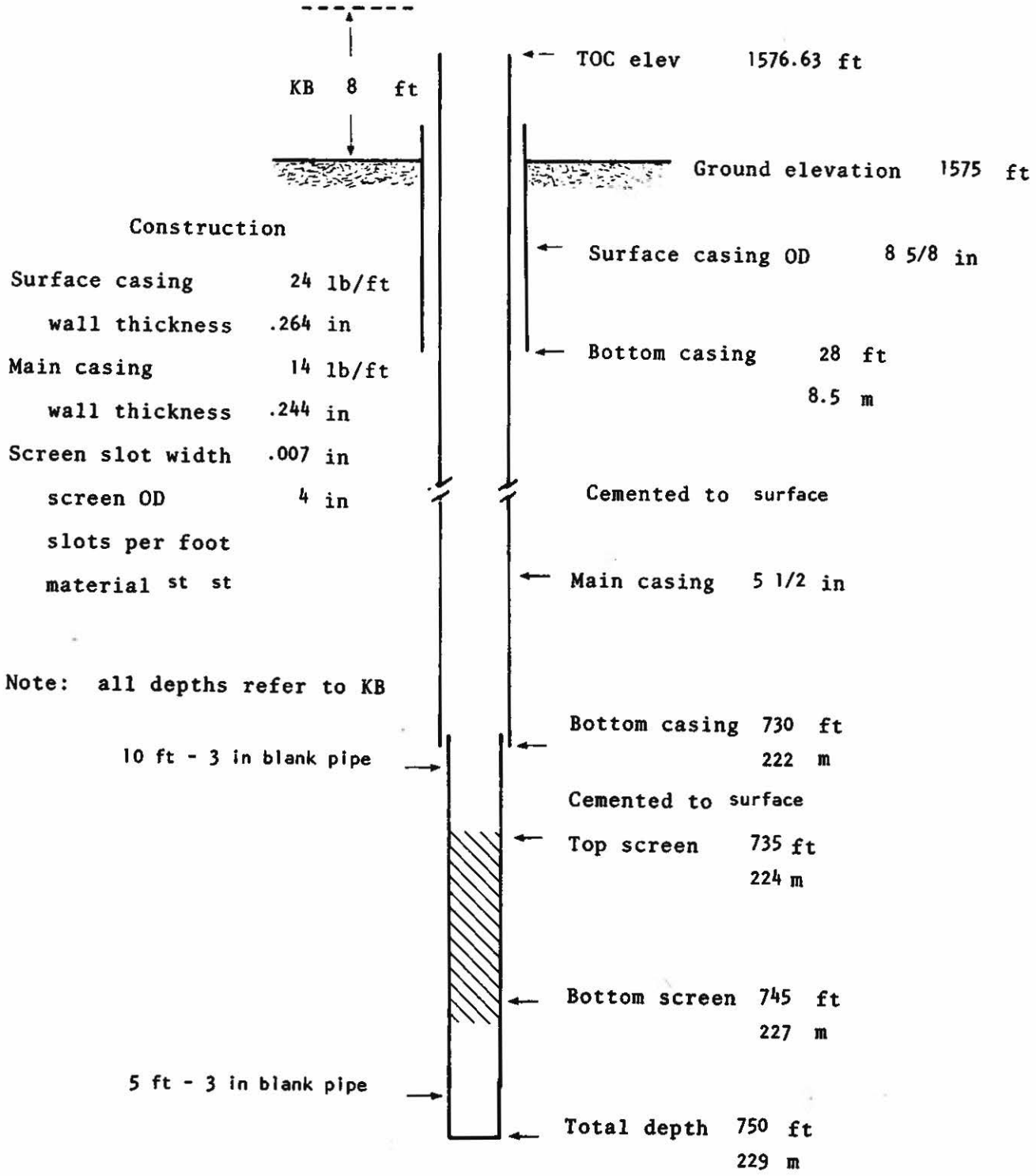
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Tp 89 R 16 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 24 | lb/ft |
| wall thickness | .264 | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to KB

## DRILL STEM TEST

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Tp 89 R 16 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1575 |
| | KB | 1583 |
| Type of test | | Casing Positrieve |
| Date of test | | January 29, 1976 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 1100 | hrs |
| Tool opened | 1147 | hrs |
| First flow | 2 | min |
| Initial shut in | 60 | min |
| Second flow | 18 | min |
| Final shut in | 90 | min |
| Pulled loose at | 1440 | hrs |
| Out of hole at | 1520 | hrs |
| Wt on packers | 2000 | lbs |

Description of blow Strong initial puff. Strong air blow remaining throughout flow period

Total water recovered 160 ft

Water sample No. - (water)

Gas blow No

Remarks

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 3/8" IF

Drill collar size (ID) 2 3/8"

Drill collar length (ft) -

Open or screened interval 730-750'

Formation tested McMurray

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | 1.90 | |
| MFE Tool | 10.02 | |
| Ret. Bridge Plug | 2.65 | 5 1/2" |
| Total | 14.57 | |
| Ret. Bridge Plug | 3.50 | 5 1/2" |
| Recorder | 7.00 | |
| Recorder | 7.00 | |
| Total interval | 17.50 | |

### PRESSURE DATA (psi)

| Instrument No. | | ON | IN |
|---|---|---|---|
| Capacity (psig) | | 700 | 700 |
| Instrument set at (ft) | | 710 | 717 |
| Initial hydrostatic | A | 76 | 83 |
| First flow | B | 5 | 11 |
| | B1 | 9 | 16 |
| Initial shut in | C | 159 | 164 |
| Second flow | D | 13 | 19 |
| | D1 | 47 | 53 |
| Final shut in | G | 165 | 169 |
| Final hydrostatic | H | 82 | 85 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 15-750

INTERVAL TESTED 730-750

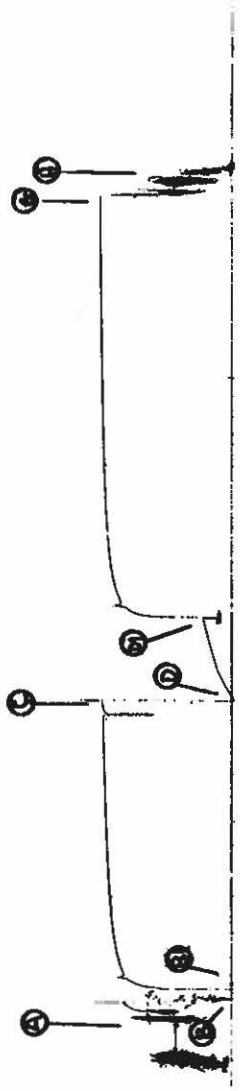
PRESSURE INCREMENTS

Recorder RPG-01N

January 29, 1976

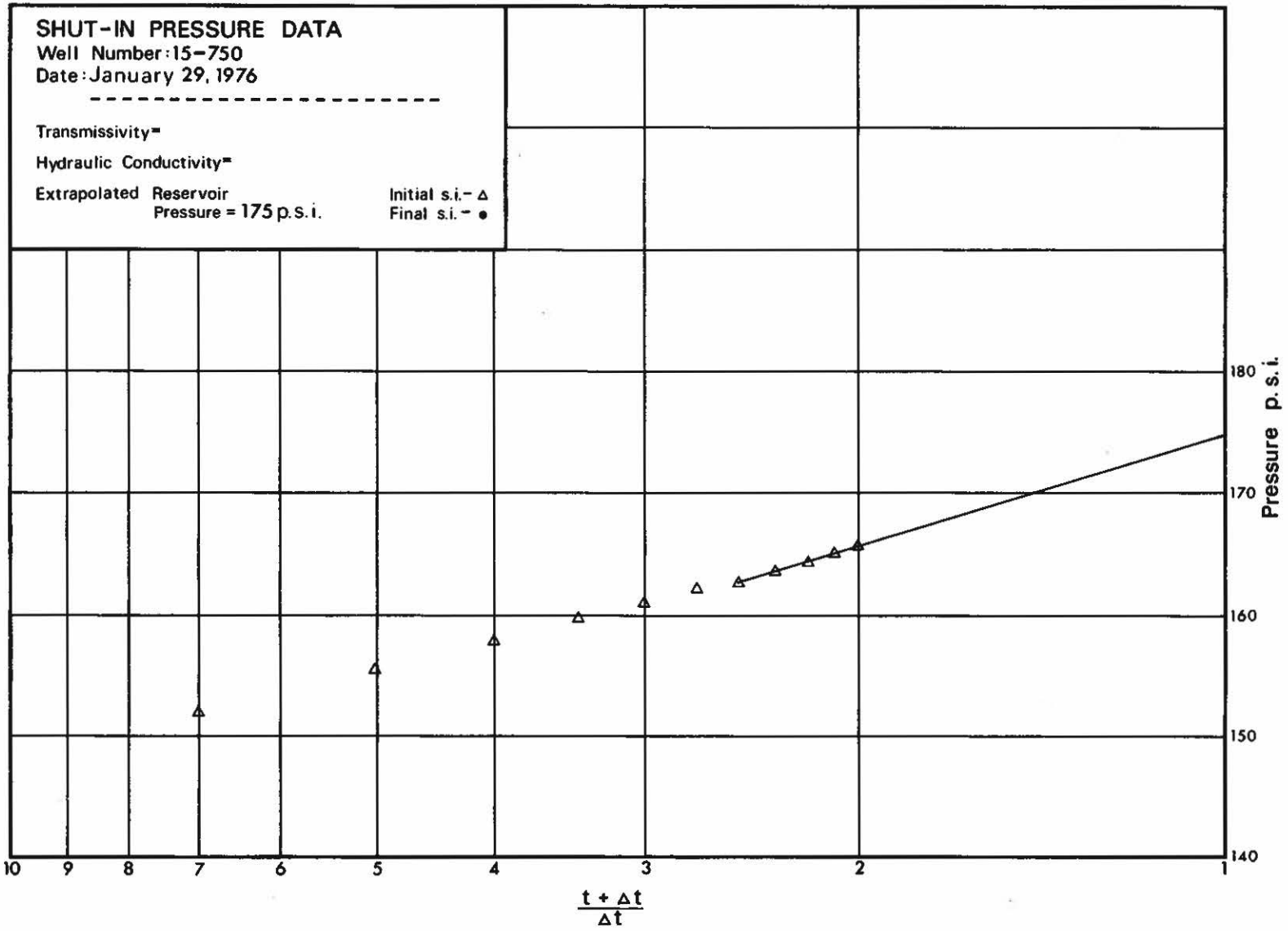
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 145.8 | 13.00 |
| 10 | 151.9 | 7.00 |
| 15 | 155.4 | 5.00 |
| 20 | 157.7 | 4.00 |
| 25 | 159.6 | 3.40 |
| 30 | 160.8 | 3.00 |
| 35 | 162.0 | 2.71 |
| 40 | 162.7 | 2.50 |
| 45 | 163.5 | 2.33 |
| 50 | 164.2 | 2.20 |
| 55 | 165.0 | 2.09 |
| 60 | 165.8 | 2.00 |

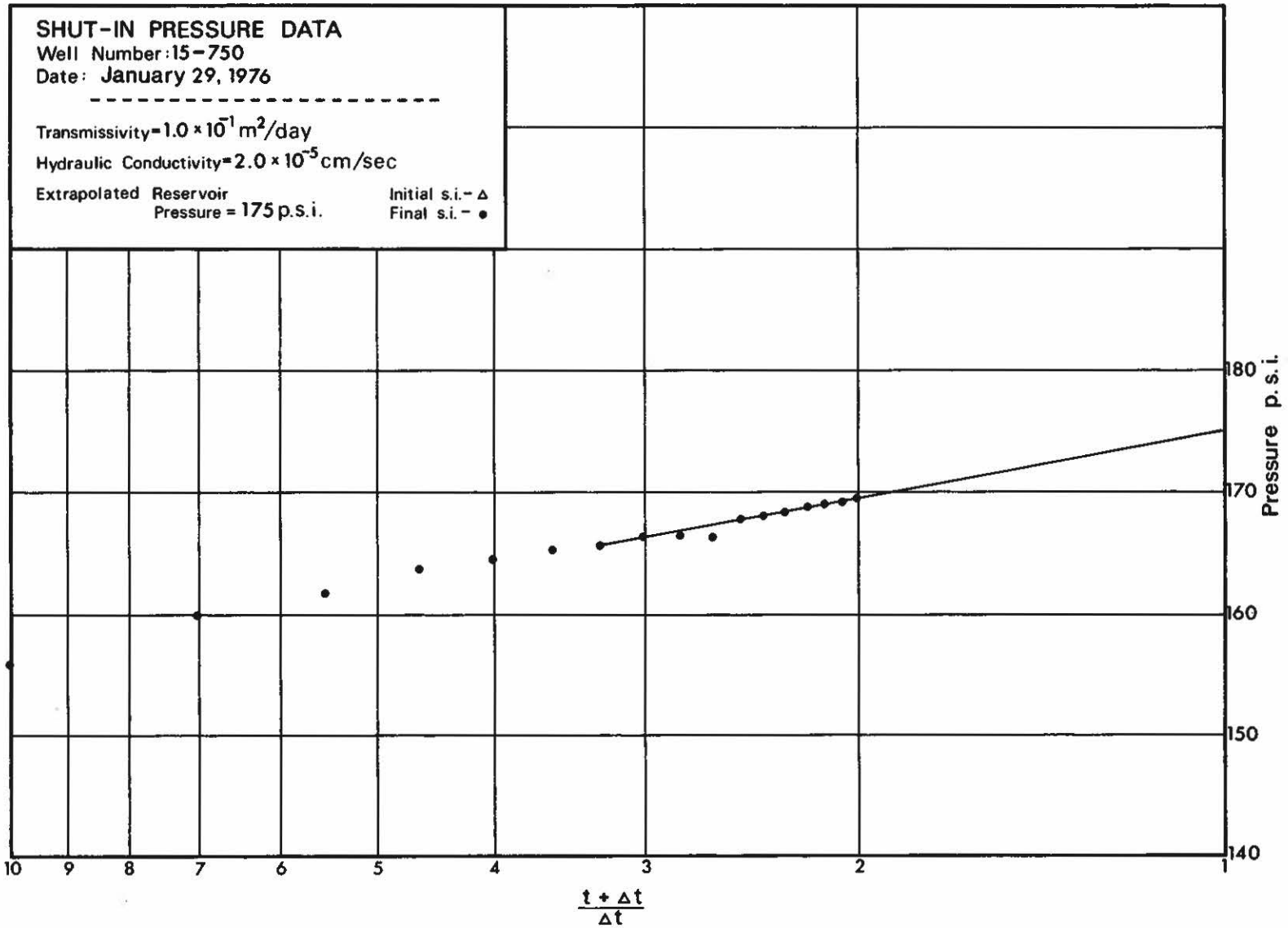


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 149.6 | 19.00 |
| 10 | 155.8 | 10.00 |
| 15 | 159.6 | 7.00 |
| 20 | 161.5 | 5.50 |
| 25 | 163.5 | 4.60 |
| 30 | 164.2 | 4.00 |
| 35 | 165.2 | 3.51 |
| 40 | 165.6 | 3.25 |
| 45 | 166.2 | 3.00 |
| 50 | 166.2 | 2.80 |
| 55 | 166.2 | 2.64 |
| 60 | 167.7 | 2.50 |
| 65 | 168.1 | 2.38 |
| 70 | 168.3 | 2.29 |
| 75 | 168.9 | 2.20 |
| 80 | 168.9 | 2.13 |
| 85 | 169.0 | 2.06 |
| 90 | 169.6 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 15-750
Date: January 29, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 175 p.s.i.
Initial s.i.- Δ
Final s.i. - •
180
170
160
150
140
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

15-750-D-77


SHUT-IN PRESSURE DATA
Well Number: 15-750
Date: January 29, 1976
Transmissivity = 1.0 × 10⁻¹ m²/day
Hydraulic Conductivity = 2.0 × 10⁻⁵ cm/sec
Extrapolated Reservoir Pressure = 175 p.s.i.
Initial s.i. - Δ
Final s.i. - •
180
170
160
150
140
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

15-750-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source DST on 15-750

Date sampled January 29, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 53.0 | 2.64 | 1.7 |
| Magnesium ($Mg^{++}$) | 43.0 | 3.54 | 2.3 |
| Sodium ($Na^{+}$) | 3425.0 | 148.98 | 95.5 |
| Potassium ($K^{+}$) | 32.5 | 0.83 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 2235.0 | 36.63 | 20.9 |
| Sulfate ($SO_4^{=}$) | 14.2 | 0.30 | 0.2 |
| Chloride ($Cl^{-}$) | 4900.0 | 138.18 | 78.9 |
| Nitrate ($NO_3^{=}$) | 1.6 | 0.03 | 0.0 |
| Silica ($SiO_2$) | 0.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 9764.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 175.1 | Total Cations (epm) | 156.0 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | | |
| pH | 7.7 | pH | 7.5 | |
| Fluoride ($F^{-}$) | 1.2 ppm | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 2560 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |
| | | Sulphide | 0.4 | ppm |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 15, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 19.7 | 0.98 | 1 |
| Magnesium ($Mg^{++}$) | 60.0 | 4.94 | 3 |
| Sodium ($Na^{+}$) | 3650.0 | 158.76 | 96 |
| Potassium ($K^{+}$) | 30.4 | 0.78 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 895.0 | 14.67 | 10 |
| Sulfate ($SO_4^{=}$) | 3.0 | 0.06 | 0 |
| Chloride ($Cl^{-}$) | 4860.0 | 137.06 | 90 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 6.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 20.0 | | |
| Magnesium (Acidified) | 61.6 | | |
| Total dissolved solids | 9380 | | |
| Total Anions (epm) | 151.79 | Total Cations (epm) | 165.46 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 8.0 |
| pH | 8.3 | pH | 8.4 |
| Fluoride ($F^{-}$) | 0.4 Mg/L | Carbonate ($CO_3^{=}$) | 29 Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 376 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Date sampled: July 15, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .021 |
| Au | <.003 | Mo | <.006 |
| Al | 0.11 | Na | 3498 |
| As | <.038 | Ni | <.010 |
| B | 4.17 | P | <.110 |
| Ba | 4.51 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 19.25 | Si | 3.43 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 3.75 |
| Cr | <.006 | Te | <.065 |
| Cu | .013 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .044 | V | <.0008 |
| K | 66 | W | <.078 |
| Mg | 49.9 | Zn | .033 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 7, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 15.2 | 0.76 | 0.5 |
| Magnesium ($Mg^{++}$) | 59.0 | 4.86 | 2.9 |
| Sodium ($Na^{+}$) | 3700.0 | 160.94 | 96.2 |
| Potassium ($K^{+}$) | 30.0 | 0.77 | 0.5 |
| Carbonate ($CO_3^{=}$) | 14.4 | 0.48 | 0.3 |
| Bicarbonate ($HCO_3^{-}$) | 2106.0 | 34.52 | 20.0 |
| Sulfate ($SO_4^{=}$) | 7.3 | 0.15 | 0.1 |
| Chloride ($Cl^{-}$) | 4880.0 | 137.62 | 79.7 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 5.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 14.7 | | |
| Magnesium (Acidified) | 55.0 | | |
| Total dissolved solids | 9712.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 172.77 | Total Cations (epm) | 167.32 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 9.0 |
| pH | 8.4 | pH | 8.5 |
| Fluoride ($F^{-}$) | 1.9 ppm | Carbonate ($CO_3^{=}$) | 38.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 2015.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 07, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 11.8 | 0.59 | 0.4 |
| Magnesium(Mg) | 62.0 | 5.10 | 3.1 |
| Sodium(Na) | 3638.0 | 158.24 | 96.4 |
| Potassium(K) | 8.3 | 0.21 | 0.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 859.0 | 14.08 | 8.8 |
| Sulphate(SO4) | 3.8 | 0.08 | 0.0 |
| Chloride(Cl) | 5200.0 | 146.64 | 91.2 |
| Nitrate(NO3) | 1.1 | 0.02 | 0.0 |
| Silica(SiO2) | 3.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 12.9 | | |
| Magnesium(Acidified) | 51.0 | | |
| TDS(mg/l) | 9518.0 | | |
| Total Anions(epm) | 160.82 | Total Cations(epm) | 164.15 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 13900 | | Temperature(C) | 9.00 | |
| pH | 8.3 | | pH | 8.5 | |
| Fluoride(F) | 1.3 | mg/l | Carbonate(CO3) | 91 | mg/l |
| | | | Bicarbonate(HCO3) | 1888 | mg/l |
| | | | Hydroxide(OH) | | |

15-750-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 4, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 11.2 | 0.56 | 0.3 |
| Magnesium(Mg) | 50.0 | 4.12 | 2.6 |
| Sodium(Na) | 3550.0 | 154.41 | 96.6 |
| Potassium(K) | 27.9 | 0.71 | 0.4 |
| Carbonate(CO3) | 24.0 | 0.80 | 0.5 |
| Bicarbonate(HCO3) | 2020.0 | 33.11 | 19.1 |
| Sulphate(SO4) | 6.0 | 0.12 | 0.1 |
| Chloride(Cl) | 4940.0 | 139.31 | 80.4 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 4.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 10.3 | | |
| Magnesium(Acidified) | 42.0 | | |
| TDS(mg/l) | 9560.0 | | |
| Total Anions(epm) | 173.35 | Total Cations(epm) | 159.80 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 14500 | | Temperature(C) | 8.00 | |
| pH | 8.5 | | pH | 8.6 | |
| Fluoride(F) | 1.4 | mg/l | Carbonate(CO3) | 77 | mg/l |
| | | | Bicarbonate(HCO3) | 1898 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 15-750-E-82

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 5, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 11.7 | 0.58 | 0.3 |
| Magnesium(Mg) | 44.0 | 3.67 | 2.0 |
| Sodium(Na) | 4138.0 | 179.91 | 97.3 |
| Potassium(K) | 29.0 | 0.74 | 0.4 |
| Carbonate(CO3) | 103.0 | 3.43 | 2.0 |
| Bicarbonate(HCO3) | 1867.0 | 30.61 | 18.1 |
| Sulphate(SO4) | 6.0 | 0.13 | 0.1 |
| Chloride(Cl) | 4800.0 | 135.21 | 79.8 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 2.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 9.8 | | |
| Magnesium(Acidified) | 42.0 | | |
| TDS(mg/l) | 11619.0 | | |
| Total Anions(epm) | 169.38 | Total Cations(epm) | 184.91 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 16000 |
| pH | 8.8 |
| Fluoride | 0.0 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 0.0 | |
| pH | 8.6 | |
| Carbonate(CO3) | 86 | mg/l |
| Bicarbonate(HCO3) | 1883 | mg/l |
| Hydroxide(OH) | | |

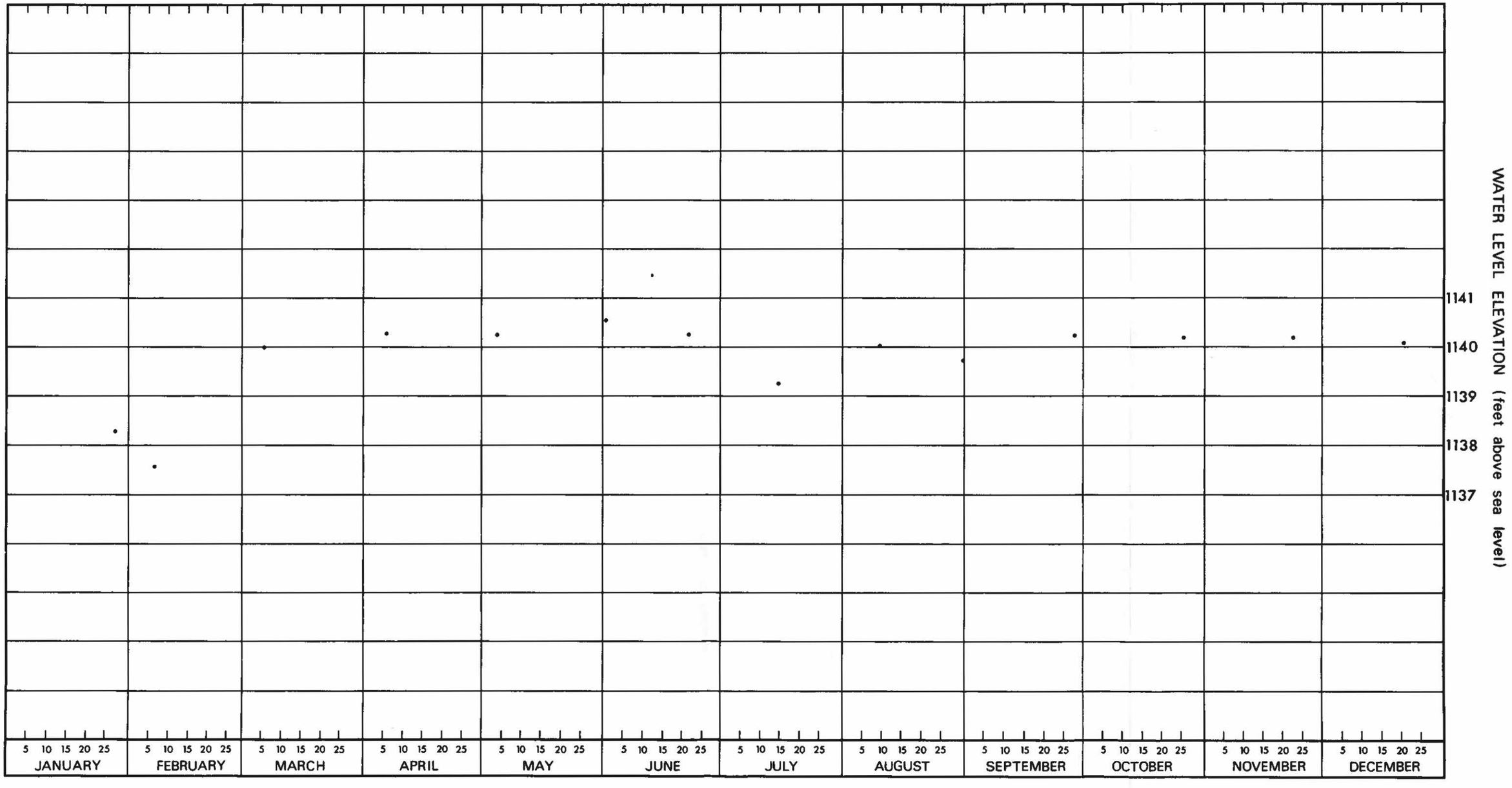
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **15-750**

Lsd **15** Sec **33** Twp **89** R **16** W4th

Alberta Research Council

15 - 750 - H - 77




1976

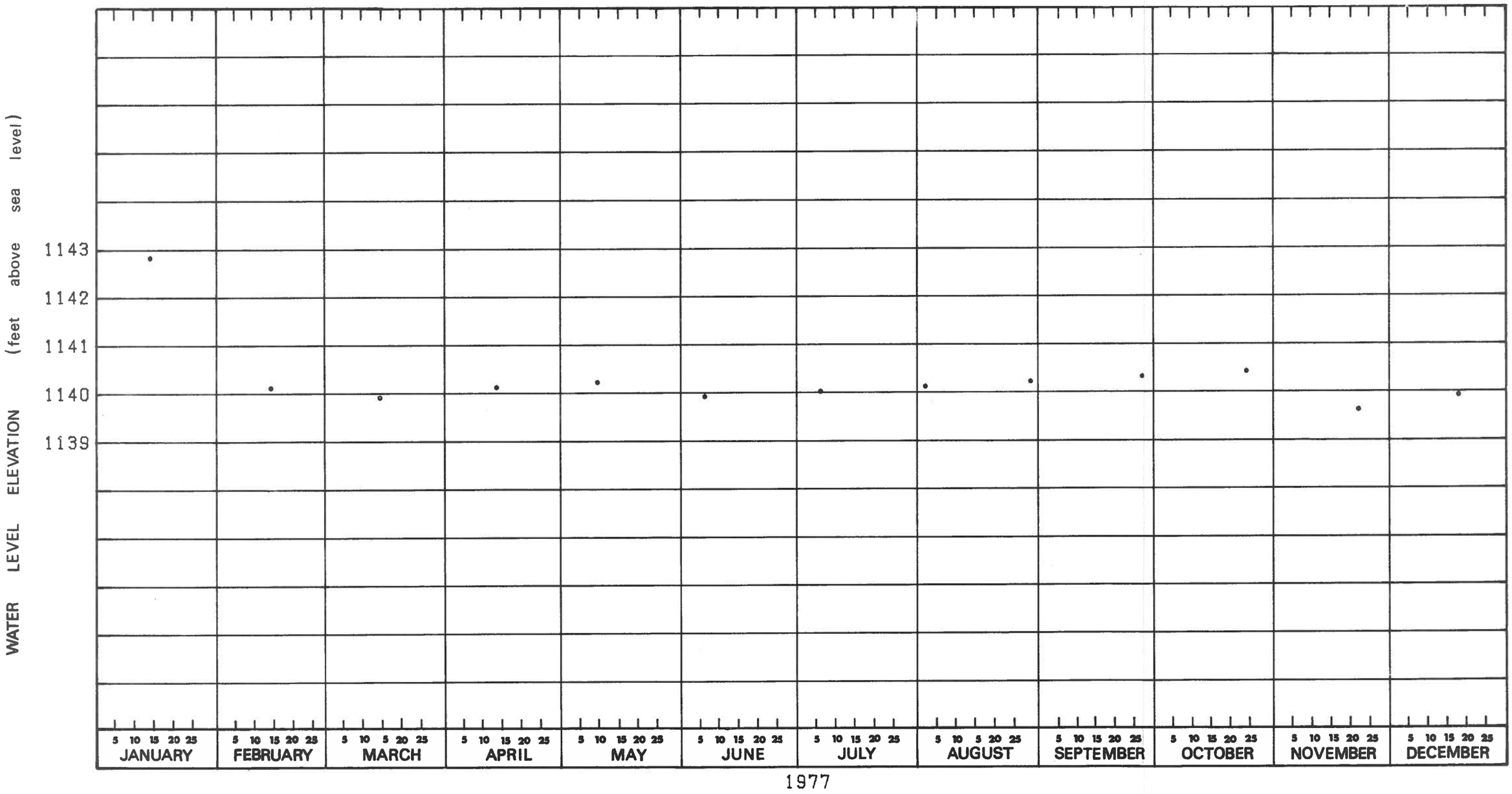
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-750-H-78




1977

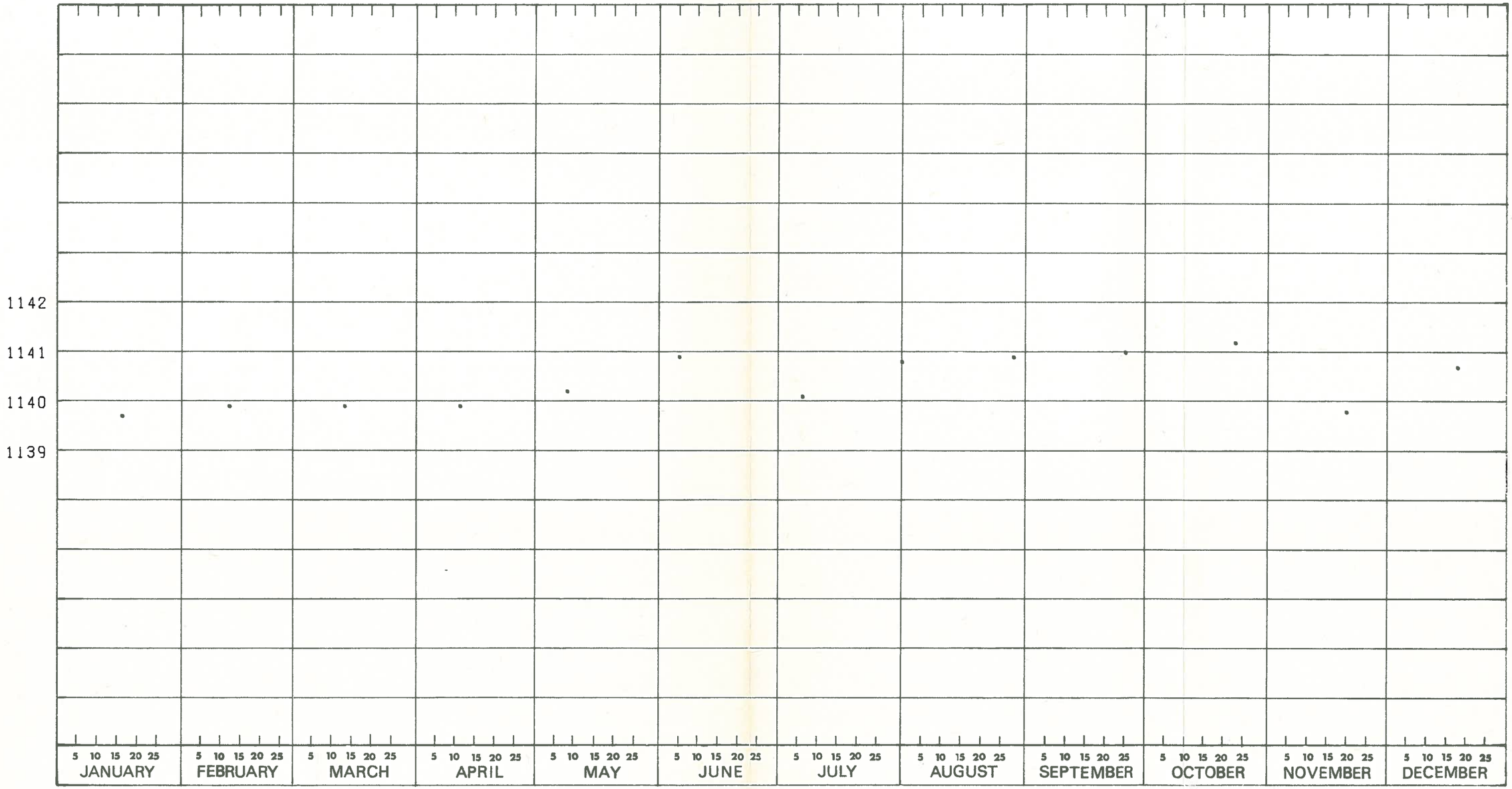
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-750

LSD 15 SEC 33 TWP 89 R 16 W4TH

15-750-H-79

Alberta Research Council




1978

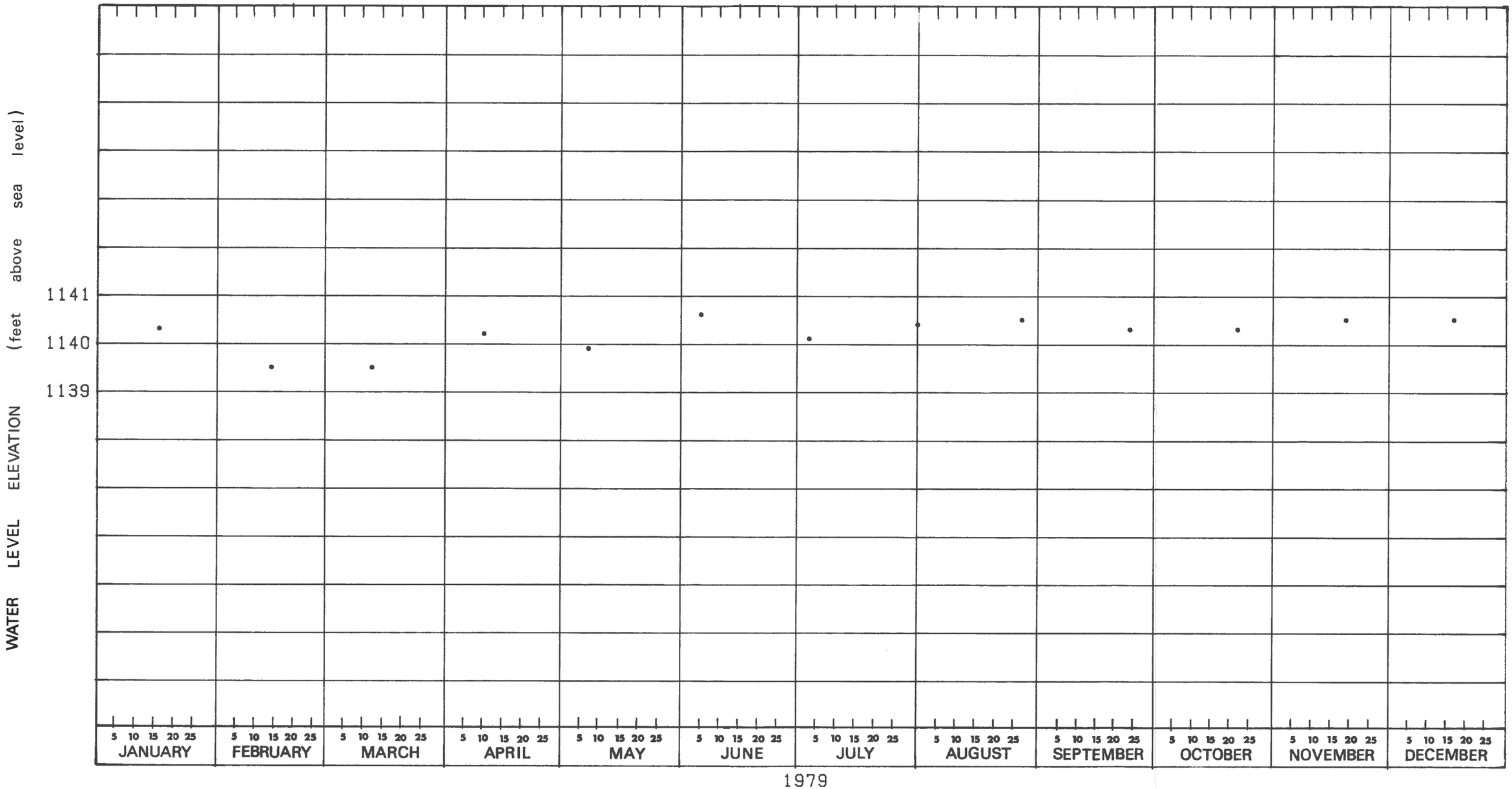
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-750-H-80



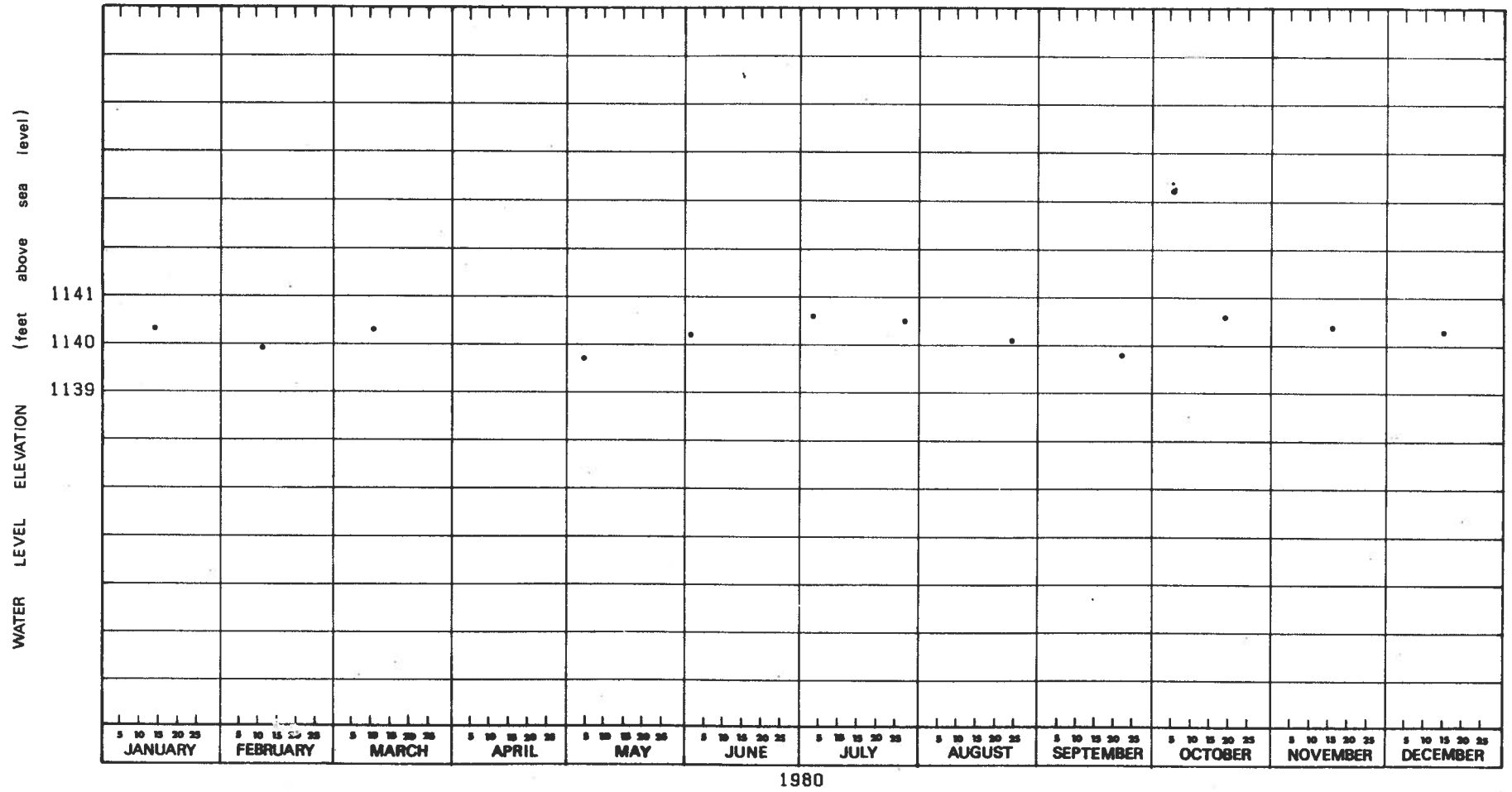
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-750-H-81



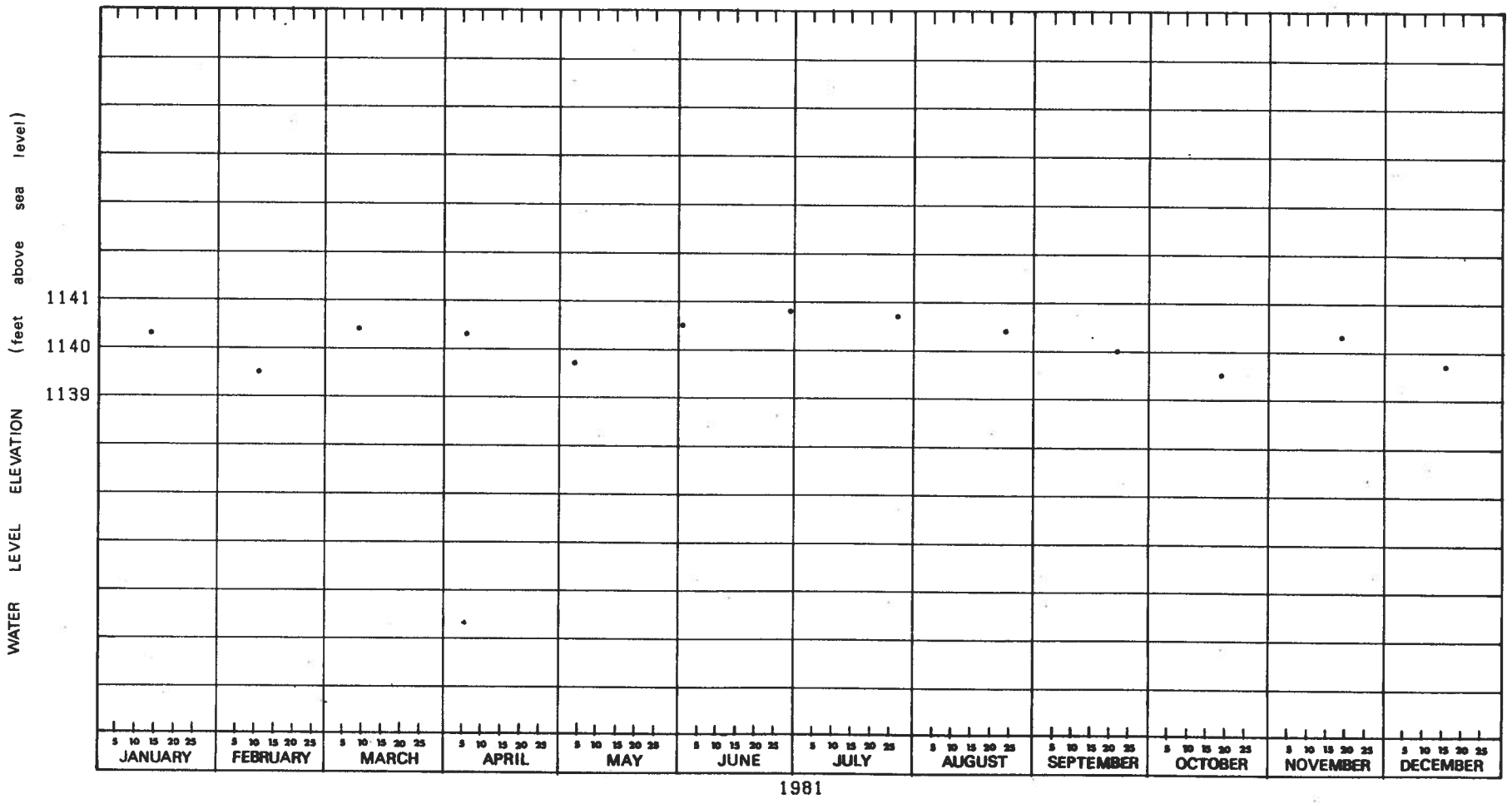
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-750-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1576.63

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 27/76 | | | Well completed; blown with air |
| Jan 28/76 | 133.64 TOC | 1138.3 | |
| Jan 29/76 | | | DST, FSI = 165# from 710 FT; water sample |
| Feb 7/76 | 134.53 | 1137.5 | MP = 0.67 m TOC, (1578.8) |
| Mar 6/76 | 133.79 MP | 1140.0 | |
| Apr 6/76 | 133.70 MP | 1140.3 | |
| May 4/76 | 133.71 MP | 1140.2 | |
| June 1/76 | 133.62 MP | 1140.5 | |
| June 22/76 | 133.72 MP | 1140.2 | |
| July 15/76 | 134.02 MP | 1139.2 | Sampled; temp. 8°C |
| Aug 10/76 | 133.78 MP | 1140.0 | |
| Aug 31/76 | 133.87 MP | 1139.7 | |
| Sept 28/76 | 133.71 MP | 1140.2 | |
| Oct 26/76 | 133.73 MP | 1140.2 | |
| Nov 23/76 | 133.71 MP | 1140.2 | |
| Dec 20/76 | 133.74 MP | 1140.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1576.63

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 132.91 MP | 1142.8 | MP (1578.8) |
| Feb 15/77 | 133.74 MP | 1140.1 | |
| Mar 15/77 | 133.81 MP | 1139.9 | |
| Apr 14/77 | 133.74 MP | 1140.1 | |
| May 10/77 | 133.72 MP | 1140.2 | |
| June 7/77 | 133.80 MP | 1139.9 | |
| July 7/77 | 133.79 MP | 1140.0 | Sampled; temp. 9°C |
| Aug 3/77 | 133.75 MP | 1140.1 | |
| Aug 30/77 | 133.72 MP | 1140.2 | |
| Sept 28/77 | 133.69 MP | 1140.3 | |
| Oct 25/77 | 133.67 MP | 1140.4 | |
| Nov 23/77 | 133.91 MP | 1139.6 | |
| Dec 19/77 | 133.80 MP | 1139.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1576.63

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 133.88 MP | 1139.7 | MP (1578.8) |
| Feb 13/78 | 133.82 MP | 1139.9 | |
| Mar 14/78 | 133.80 MP | 1139.9 | |
| Apr 12/78 | 133.80 MP | 1139.9 | |
| May 9/78 | 133.73 MP | 1140.2 | |
| June 6/78 | 133.50 MP | 1140.9 | |
| July 7/78 | 133.76 MP | 1140.1 | Sampled; temp 9°C |
| Aug 1/78 | 133.53 MP | 1140.8 | |
| Aug 29/78 | 133.51 MP | 1140.9 | |
| Sept 26/78 | 133.48 MP | 1141.0 | |
| Oct 24/78 | 133.40 MP | 1141.2 | |
| Nov 21/78 | 133.85 MP | 1139.8 | |
| Dec 19/78 | 133.57 MP | 1140.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-750

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1576.63

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 133.69 MP | 1140.3 | MP (1578.8) |
| Feb 15/79 | 133.94 MP | 1139.5 | |
| Mar 13/79 | 133.93 MP | 1139.5 | |
| Apr 11/79 | 133.73 MP | 1140.2 | |
| May 8/79 | 133.80 MP | 1139.9 | |
| June 6/79 | 133.60 MP | 1140.6 | |
| July 4/79 | 133.76 MP | 1140.1 | Sampled; temp. 8°C |
| Aug 1/79 | 133.65 MP | 1140.4 | |
| Aug 28/79 | 133.62 MP | 1140.5 | |
| Sept 25/79 | 133.69 MP | 1140.3 | |
| Oct 23/79 | 133.68 MP | 1140.3 | |
| Nov 20/79 | 133.62 MP | 1140.5 | |
| Dec 18/79 | 133.64 MP | 1140.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing.

WELL HISTORY

OBSERVATION WELL NUMBER 15 - 750

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1576.63

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 133.68 MP | 1140.3 | |
| Feb 12/80 | 133.82 MP | 1139.9 | |
| Mar 12/80 | 133.70 MP | 1140.3 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 133.88 MP | 1139.7 | |
| June 3/80 | 133.71 MP | 1140.2 | |
| July 5/80 | 133.60 MP | 1140.6 | |
| July 29/80 | 133.64 MP | 1140.5 | |
| Aug 26/80 | 133.76 MP | 1140.1 | |
| Sept 24/80 | 133.83 MP | 1139.8 | |
| Oct 21/80 | 133.59 MP | 1140.6 | |
| Nov 18/80 | 133.66 MP | 1140.4 | |
| Dec 17/80 | 133.69 MP | 1140.3 | |
| Jan 15/81 | 133.70 MP | 1140.3 | |
| Feb 12/81 | 133.93 MP | 1139.5 | |
| Mar 10/81 | 133.67 MP | 1140.4 | |
| Apr 7/81 | 133.68 MP | 1140.3 | |
| May 5/81 | 133.88 MP | 1139.7 | |
| June 2/81 | 133.64 MP | 1140.5 | |
| June 30/81 | 133.53 MP | 1140.8 | |
| July 28/81 | 133.56 MP | 1140.7 | |
| Aug 25/81 | 133.67 MP | 1140.4 | |
| Sept 23/81 | 133.78 MP | 1140.0 | |
| Oct 20/81 | 133.93 MP | 1139.5 | |
| Nov 20/81 | 133.68 MP | 1140.3 | |
| Dec 17/81 | 133.86 MP | 1139.7 | |

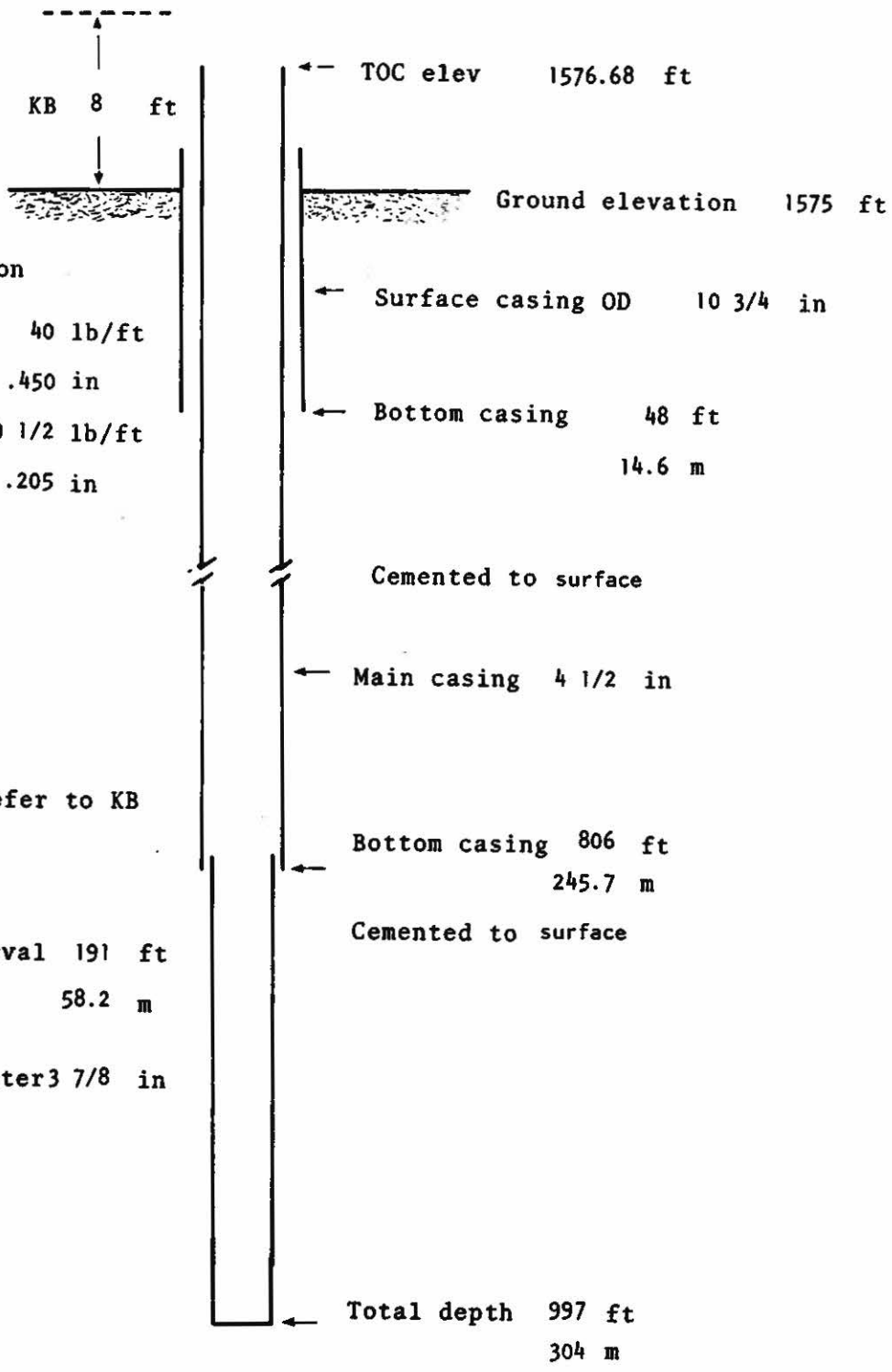
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Tp 89 R 16 W 4th

Alberta Research Council




Construction

Surface casing 40 lb/ft

wall thickness .450 in

Main casing 9 1/2 lb/ft

wall thickness .205 in

Note: all depths refer to KB

Open hole interval 191 ft

58.2 m

Open hole diameter 3 7/8 in

## DRILL STEM TEST

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Tp 89 R 16 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1575 |
| | KB | 1583 |
| Type of test | | Open hole, Bottom hole |
| Date of test | | January 19, 1976 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 0730 | hrs |
| Tool opened | 0843 | hrs |
| First flow | 2 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1030 | hrs |
| Out of hole at | 1130 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Fair initial puff. Weak air blow on second flow decreasing to nil in 2 minutes

Total water recovered 30 ft

Water sample No. - (drilling mud)

Gas blow No

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 768-880'

Formation tested Cooking Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 774 | 778 |
| Initial hydrostatic | A | 355 | 357 |
| First flow | B | 15 | 16 |
| | B1 | 15 | 18 |
| Initial shut in | C | 198 | 200 |
| Second flow | D | 17 | 19 |
| | D1 | 19 | 19 |
| Final shut in | G | 149 | 152 |
| Final hydrostatic | H | 351 | 353 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST 15-997-D-77

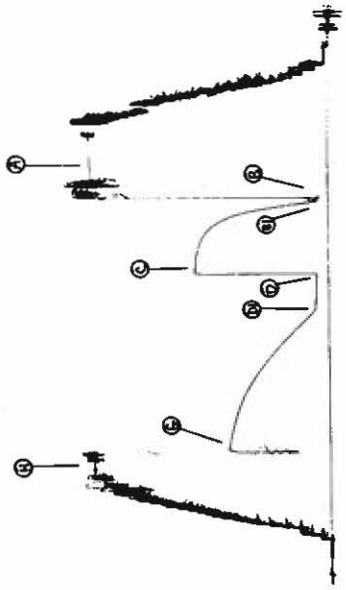
OBSERVATION WELL NUMBER 15-997

INTERVAL TESTED 768-880

PRESSURE INCREMENTS
Recorder AK1-65
January 19, 1976

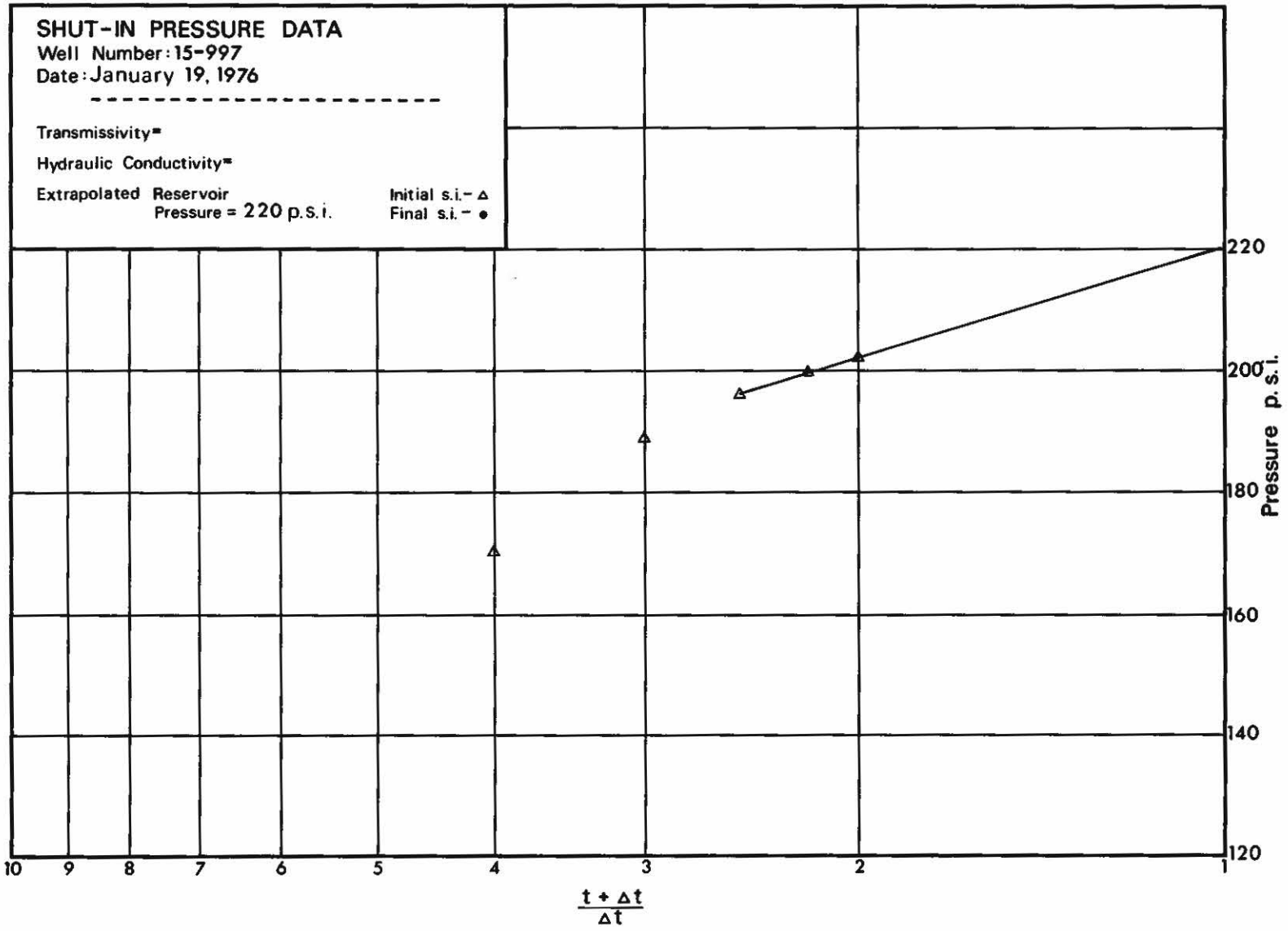
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 122.5 | 7.00 |
| 10 | 170.2 | 4.00 |
| 15 | 189.0 | 3.00 |
| 20 | 196.6 | 2.50 |
| 25 | 200.5 | 2.20 |
| 30 | 202.0 | 2.00 |

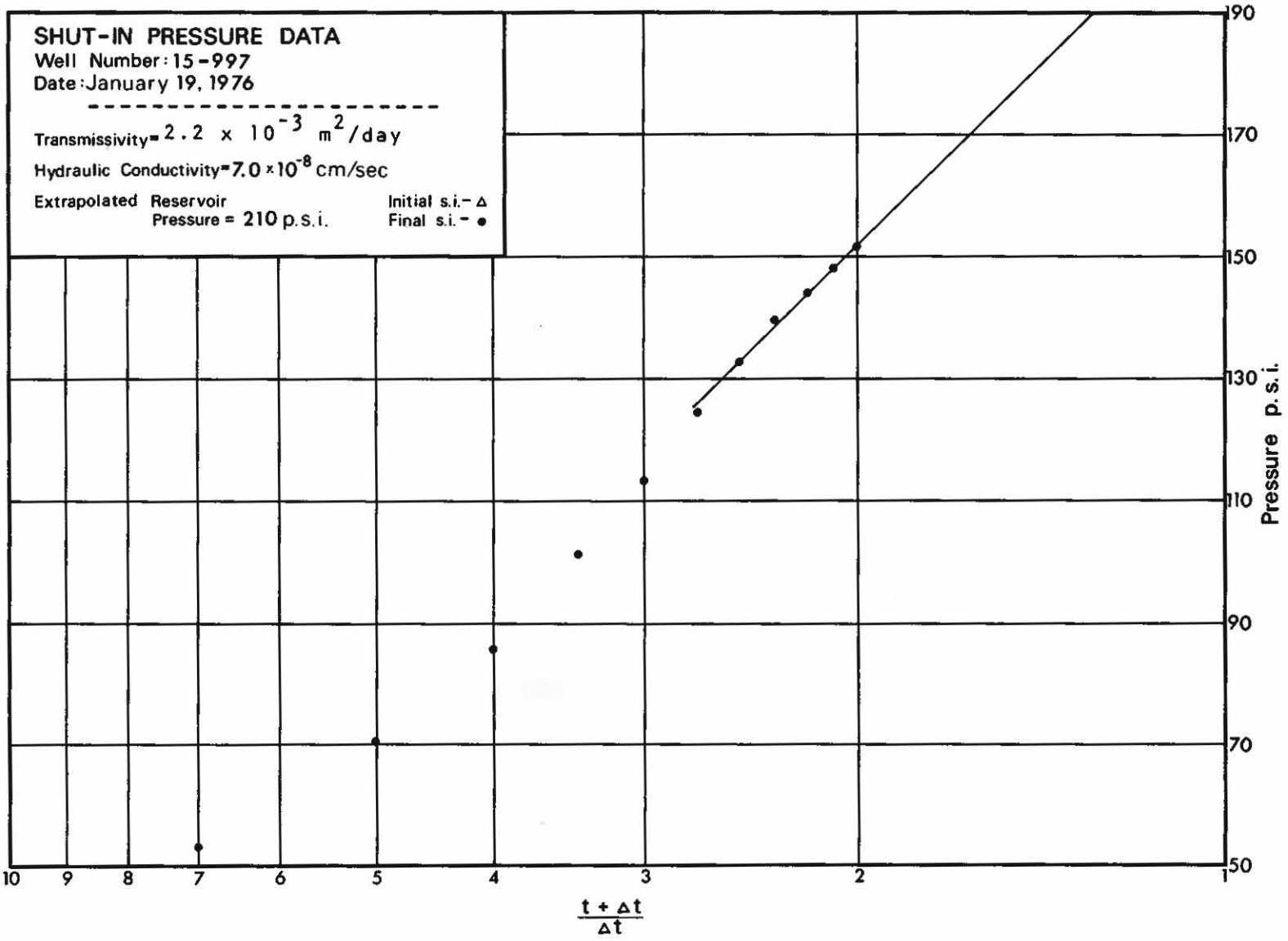


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 35.1 | 13.00 |
| 10 | 53.3 | 7.00 |
| 15 | 70.8 | 5.00 |
| 20 | 86.4 | 4.00 |
| 25 | 100.8 | 3.40 |
| 30 | 113.3 | 3.00 |
| 35 | 124.4 | 2.71 |
| 40 | 132.8 | 2.50 |
| 45 | 139.5 | 2.33 |
| 50 | 144.6 | 2.20 |
| 55 | 148.7 | 2.09 |
| 60 | 152.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 15-997
Date: January 19, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 220 p.s.i.
Initial s.i.- Δ
Final s.i. - •
220
200
180
160
140
120
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

15-997-D-77


SHUT-IN PRESSURE DATA
Well Number: 15-997
Date: January 19, 1976
Transmissivity = 2.2 x 10^-3 m^2/day
Hydraulic Conductivity = 7.0 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 210 p.s.i.
Initial s.i. - Δ
Final s.i. - •
190
170
150
130
110
90
70
50
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

15-997-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Tp 89 R 16 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1575 |
| | KB | 1583 |
| Type of test | | Open hole, Bottom hole |
| Date of test | | January 20, 1976 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 0130 | hrs |
| Tool opened | 0157 | hrs |
| First flow | 3 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0345 | hrs |
| Out of hole at | - | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff. Weak air blow on second opening decreasing to nil in one minute

Total water recovered NIL ft

Water sample No. -

Gas blow No

Remarks Test satisfactory

### HOLE DATA

| | |
|---|---|
| Contractor | Tri City Drilling |
| Drill pipe size (OD) | 2 7/8" IF |
| Drill collar size (ID) | 2" |
| Drill collar length (ft) | 60 |
| Open or screened interval | 880-992' |
| Formation tested | Beaverhill Lake |

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| Instrument No. | | 64 | 65 |
|---|---|---|---|
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 886 | 890 |
| Initial hydrostatic | A | 418 | 420 |
| First flow | B | 13 | 18 |
| | B1 | 15 | 18 |
| Initial shut in | C | 31 | 33 |
| Second flow | D | 15 | 17 |
| | D1 | 15 | 17 |
| Final shut in | G | 38 | 40 |
| Final hydrostatic | H | 424 | 426 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

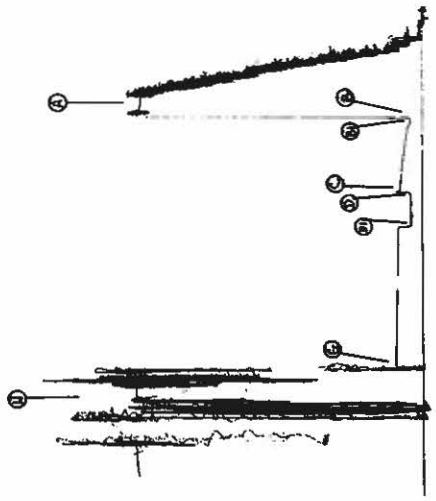
OBSERVATION WELL NUMBER 15-997

INTERVAL TESTED 880-992

PRESSURE INCREMENTS
Recorder AK1-65
January 20, 1976

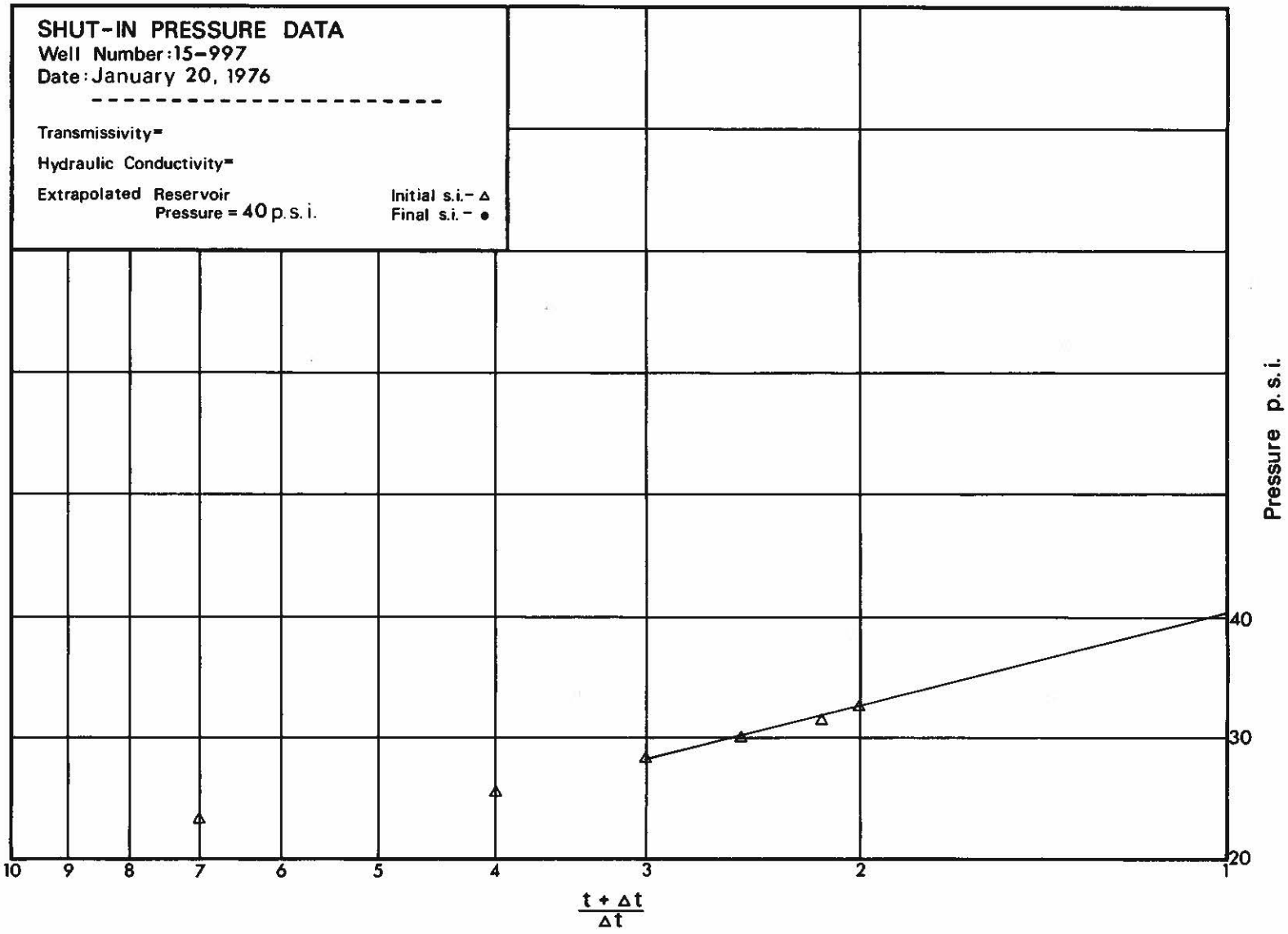
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 23.1 | 7.00 |
| 10 | 25.6 | 4.00 |
| 15 | 28.2 | 3.00 |
| 20 | 30.0 | 2.50 |
| 25 | 31.5 | 2.20 |
| 30 | 33.0 | 2.00 |

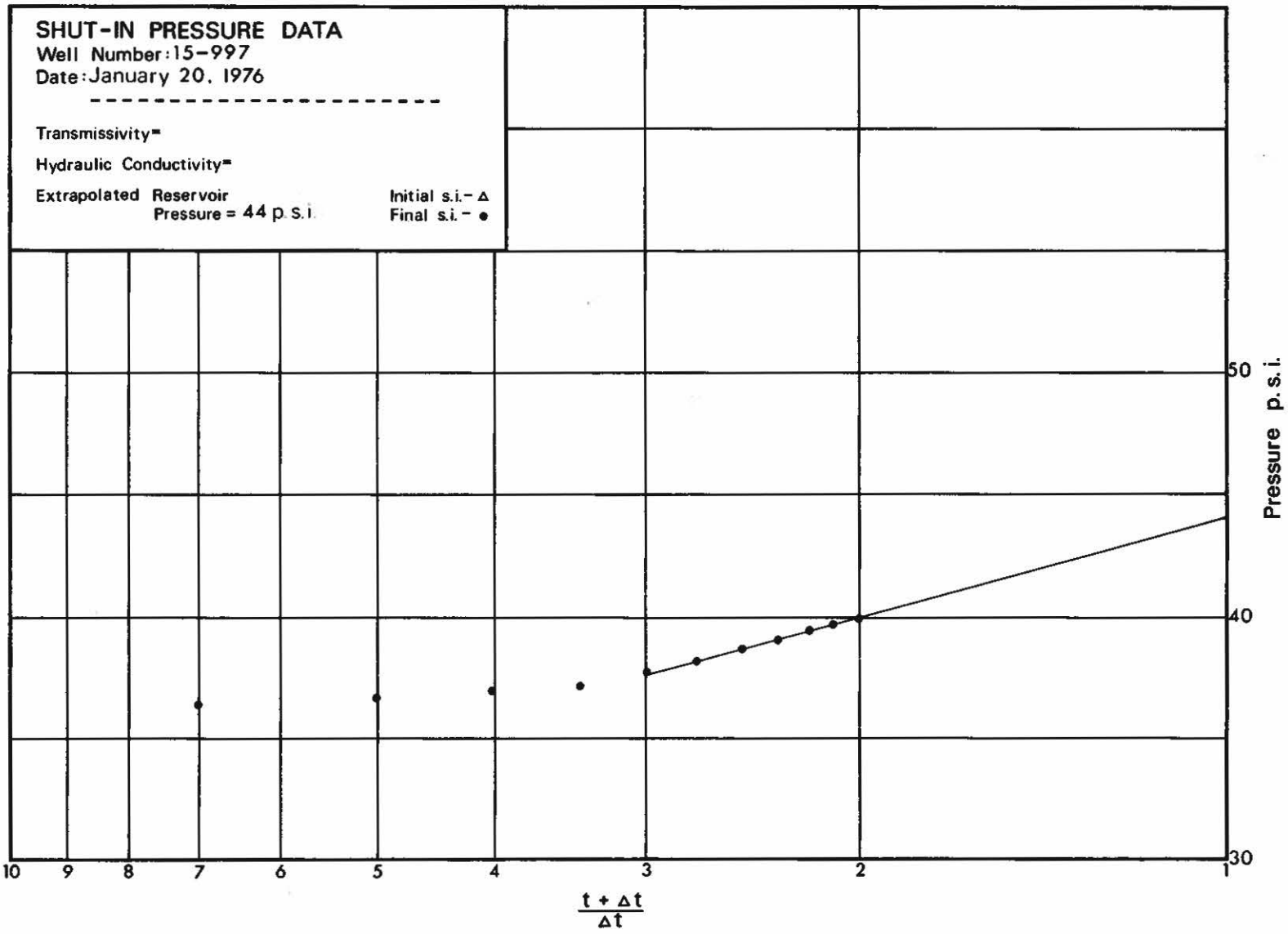


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 36.1 | 13.00 |
| 10 | 36.4 | 7.00 |
| 15 | 36.7 | 5.00 |
| 20 | 36.9 | 4.00 |
| 25 | 37.2 | 3.40 |
| 30 | 37.7 | 3.00 |
| 35 | 38.2 | 2.71 |
| 40 | 38.7 | 2.50 |
| 45 | 39.1 | 2.33 |
| 50 | 39.4 | 2.20 |
| 55 | 39.7 | 2.09 |
| 60 | 40.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 15-997
Date: January 20, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 40 p.s.i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
40
30
20
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

15-997-D-77


SHUT-IN PRESSURE DATA
Well Number: 15-997
Date: January 20, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 44 p.s.i.
Initial s.i. - Δ
Final s.i. - •
50
40
30
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

15-997-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Tp 89 R 16 W4th

Alberta Research Council

| | | |
|---|---|---|
| Elevation: | gl | 1575 |
| | KB | 1583 |
| Type of test | | Casing Positrieve |
| Date of test | | January 29, 1976 |
| Testing company | | Johnston Testers |

### TEST DATA

| | | |
|---|---|---|
| Time started | 1730 | hrs |
| Tool opened | 1821 | hrs |
| First flow | 2 | min |
| Initial shut in | 60 | min |
| Second flow | 45 | min |
| Final shut in | 150 | min |
| Pulled loose at | 2245 | hrs |
| Out of hole at | - | hrs |
| Wt on packers | 2000 | lbs |

Description of blow Good initial puff. Good air blow decreasing to very faint at end of flow period

Total water recovered 30 ft

Water sample No. - (water)

Gas blow No

Remarks

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 3/8" IF

Drill collar size (ID) 2 3/8"

Drill collar length (ft) 29

Open or screened interval 806-997'

Formation tested Cooking Lake & Beaverhill

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | 1.90 | |
| MFE Tool | 10.02 | |
| Ret. Bridge Plug | 2.05 | 4 1/2" |
| Total | 13.97 | |
| | | |
| Ret. Bridge Plug | 3.50 | 4 1/2" |
| Recorder | 7.00 | |
| Recorder | 7.00 | |
| Total Interval | 17.50 | |

### PRESSURE DATA (psi)

| Instrument No. | | ON | IN |
|---|---|---|---|
| Capacity (psig) | | 700 | 700 |
| Instrument set at (ft) | | 793 | 780 |
| Initial hydrostatic | A | 130 | 133 |
| First flow | B | 11 | 14 |
| | B1 | 16 | 20 |
| Initial shut in | C | 52 | 55 |
| Second flow | D | 12 | 16 |
| | D1 | 11 | 15 |
| Final shut in | G | 47 | 51 |
| Final hydrostatic | H | 130 | 132 |

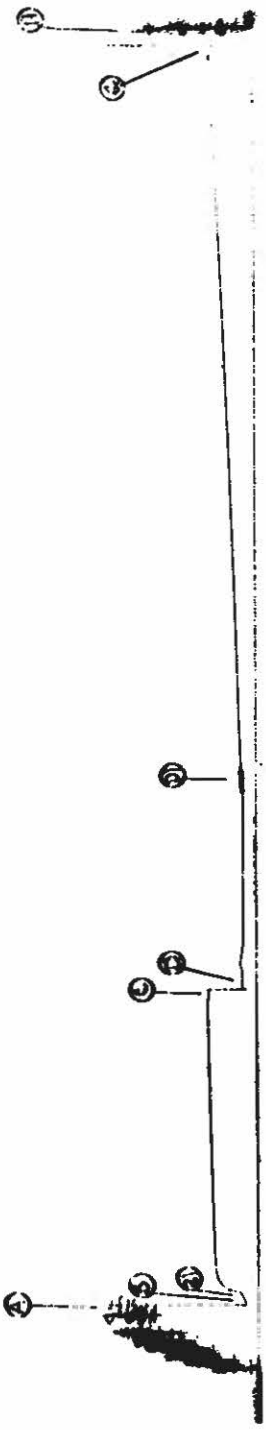
B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

OBSERVATION WELL NUMBER 15-997

INTERVAL TESTED 806-997

PRESSURE INCREMENTS
Recorder RPG-01N
January 29, 1976

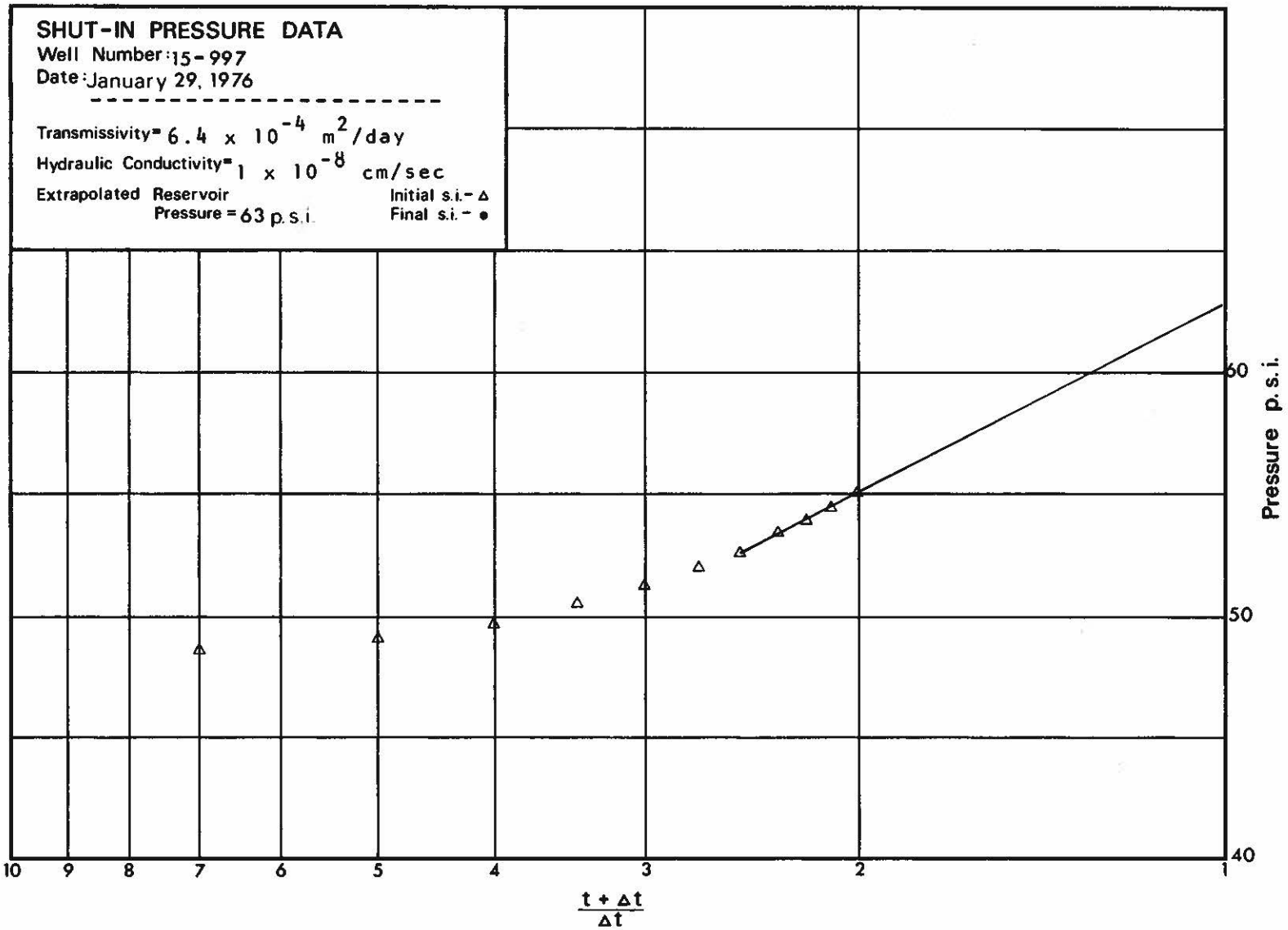


Initial Shut In

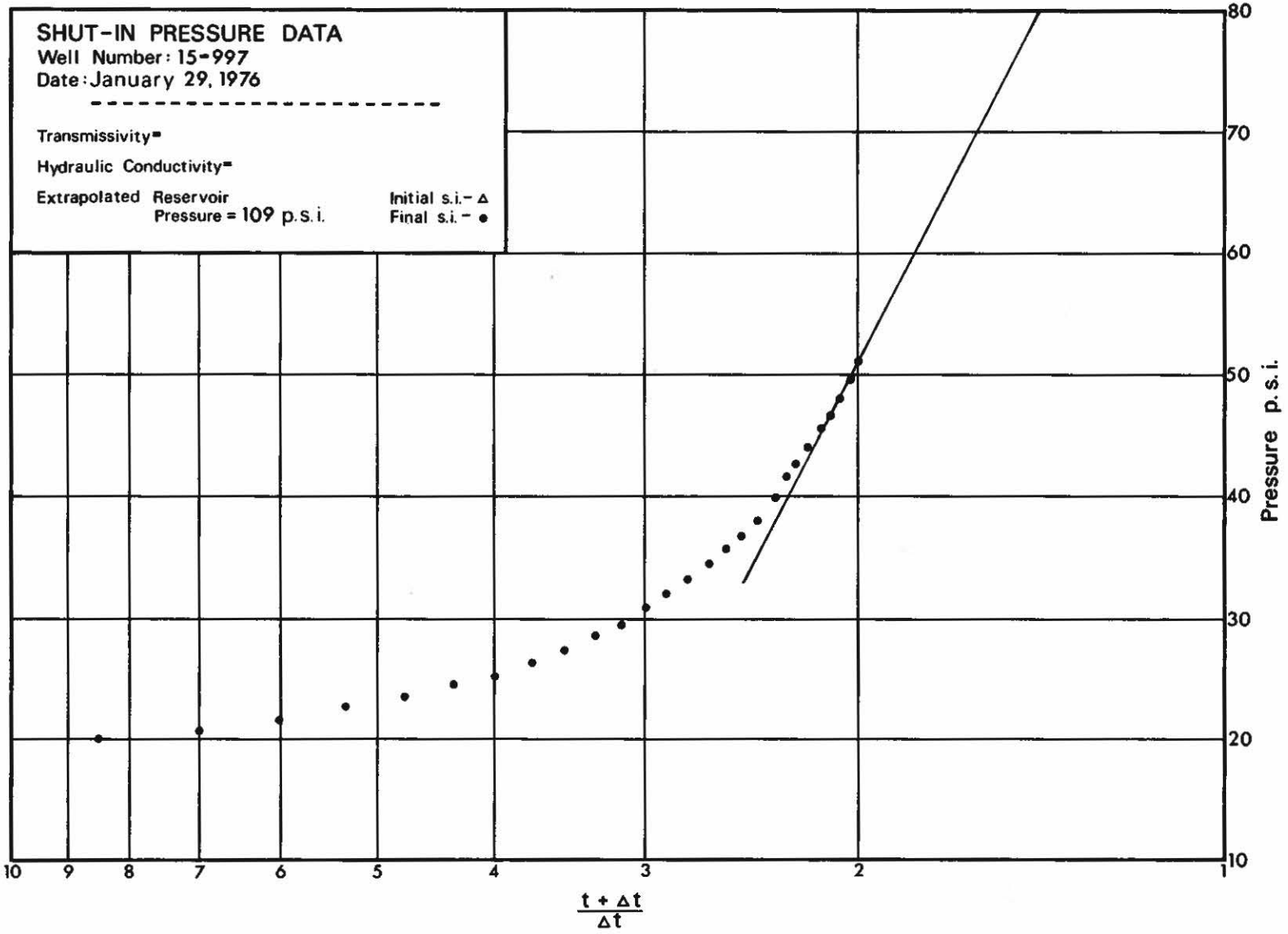
| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 47.1 | 13.00 |
| 10 | 48.7 | 7.00 |
| 15 | 49.2 | 5.00 |
| 20 | 49.8 | 4.00 |
| 25 | 50.6 | 3.40 |
| 30 | 51.3 | 3.00 |
| 35 | 52.1 | 2.71 |
| 40 | 52.7 | 2.50 |
| 45 | 53.5 | 2.33 |
| 50 | 54.0 | 2.20 |
| 55 | 54.4 | 2.09 |
| 60 | 55.2 | 2.00 |

Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 17.2 | 31.00 |
| 10 | 18.2 | 16.00 |
| 15 | 19.2 | 11.00 |
| 20 | 19.9 | 8.50 |
| 25 | 20.7 | 7.00 |
| 30 | 21.7 | 6.00 |
| 35 | 22.6 | 5.29 |
| 40 | 23.6 | 4.75 |
| 45 | 24.5 | 4.33 |
| 50 | 25.3 | 4.00 |
| 55 | 26.4 | 3.73 |
| 60 | 27.6 | 3.50 |
| 65 | 28.7 | 3.31 |
| 70 | 29.7 | 3.14 |
| 75 | 31.0 | 3.00 |
| 80 | 32.2 | 2.88 |
| 85 | 33.3 | 2.77 |
| 90 | 34.7 | 2.66 |
| 95 | 36.0 | 2.58 |
| 100 | 37.0 | 2.50 |
| 105 | 38.3 | 2.43 |
| 110 | 39.9 | 2.36 |
| 115 | 41.4 | 2.30 |
| 120 | 42.5 | 2.25 |
| 125 | 44.0 | 2.20 |
| 130 | 45.4 | 2.15 |
| 135 | 46.7 | 2.11 |
| 140 | 48.0 | 2.07 |
| 145 | 49.8 | 2.03 |
| 150 | 51.0 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 15-997
Date: January 29, 1976
Transmissivity = 6.4 x 10^-4 m^2/day
Hydraulic Conductivity = 1 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 63 p.s.i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
60
50
40
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

15-997-D-77


SHUT-IN PRESSURE DATA
Well Number: 15-997
Date: January 29, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 109 p.s.i.
Initial s.i.- Δ
Final s.i. - •
80
70
60
50
40
30
20
10
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

15-997-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source DST on 15-997

Date sampled January 29, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 40.0 | 2.00 | 13.0 |
| Magnesium ($Mg^{++}$) | 13.2 | 1.09 | 7.1 |
| Sodium ($Na^{+}$) | 272.0 | 11.83 | 77.2 |
| Potassium ($K^{+}$) | 16.2 | 0.41 | 2.7 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 390.0 | 6.39 | 39.5 |
| Sulfate ($SO_4^{=}$) | 50.0 | 1.04 | 6.4 |
| Chloride ($Cl^{-}$) | 308.0 | 8.69 | 53.7 |
| Nitrate ($NO_3^{=}$) | 3.8 | 0.06 | 0.4 |
| Silica ($SiO_2$) | 0.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 924.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 16.2 | Total Cations (epm) | 15.3 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | | Temperature (C) | | |
| pH | 7.8 | pH | 7.8 | |
| Fluoride ($F^{-}$) | 0.3 ppm | Carbonate ($CO_3^{=}$) | 0 | ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 429 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-977

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 15, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 9.5 | 0.47 | 0 |
| Magnesium ($Mg^{++}$) | 43.0 | 3.54 | 3 |
| Sodium ($Na^{+}$) | 2575.0 | 112.01 | 95 |
| Potassium ($K^{+}$) | 68.0 | 1.74 | 2 |
| Carbonate ($CO_3^{=}$) | 89.0 | 2.97 | 2 |
| Bicarbonate ($HCO_3^{-}$) | 1210.0 | 19.83 | 16 |
| Sulfate ($SO_4^{=}$) | 32.2 | 0.67 | 1 |
| Chloride ($Cl^{-}$) | 3520.0 | 99.27 | 81 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 4.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 16.8 | | |
| Magnesium (Acidified) | 39.6 | | |
| Total dissolved solids | 6400 | | |
| Total Anions (epm) | 122.74 | Total Cations (epm) | 117.76 |

### Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 78000 | | Temperature (C) | 9.0 | |
| pH | 8.8 | | pH | 8.9 | |
| Fluoride ($F^{-}$) | 0.8 | Mg/L | Carbonate ($CO_3^{=}$) | 125 | Mg/L |
| | | | Bicarbonate ($HCO_3^{-}$) | 1200 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 7, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 4.7 | 0.23 | 0.2 |
| Magnesium ($Mg^{++}$) | 40.0 | 3.29 | 2.7 |
| Sodium ($Na^{+}$) | 2638.0 | 114.75 | 95.2 |
| Potassium ($K^{+}$) | 86.0 | 2.20 | 1.8 |
| Carbonate ($CO_3^{=}$) | 228.0 | 7.60 | 7.2 |
| Bicarbonate ($HCO_3^{-}$) | 1027.0 | 16.83 | 15.9 |
| Sulfate ($SO_4^{=}$) | 37.5 | 0.78 | 0.7 |
| Chloride ($Cl^{-}$) | 2860.0 | 80.65 | 76.2 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 4.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 9.8 | | |
| Magnesium (Acidified) | 36.0 | | |
| Total dissolved solids | 7004.0 | | |
| Total Anions (epm) | 105.87 | Total Cations (epm) | 120.47 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 10.0 |
| pH | 9.3 | pH | 9.4 |
| Fluoride ($F^{-}$) | 1.8 ppm | Carbonate ($CO_3^{=}$) | 264.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 971.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Date sampled: July 15, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | <.001 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 2541 |
| As | <.038 | Ni | <.010 |
| B | 3.29 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 35.4 | Si | 2.23 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 2.48 |
| Cr | <.006 | Te | <.065 |
| Cu | <.0004 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .022 | V | .004 |
| K | 99 | W | <.078 |
| Mg | 40.7 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

15-997-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 07, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3.6 | 0.18 | 0.2 |
| Magnesium(Mg) | 34.0 | 2.80 | 2.4 |
| Sodium(Na) | 2538.0 | 110.40 | 95.5 |
| Potassium(K) | 86.0 | 2.20 | 1.9 |
| Carbonate(CO3) | 26.4 | 0.88 | 0.8 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 30.7 | 0.64 | 0.6 |
| Chloride(Cl) | 3600.0 | 101.52 | 95.2 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 4.5 | | |
| Hydroxide(OH) | 60.5 | 3.56 | 3.3 |
| Calcium(Acidified) | 12.4 | | |
| Magnesium(Acidified) | 34.0 | | |
| TDS(mg/l) | 6998.0 | | |
| Total Anions(epm) | 106.60 | Total Cations(epm) | 115.57 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 10550 | | Temperature(C) | 11.00 | |
| pH | 9.3 | | pH | 9.3 | |
| Fluoride(F) | 1.2 | mg/l | Carbonate(CO3) | 298 | mg/l |
| | | | Bicarbonate(HCO3) | 951 | mg/l |
| | | | Hydroxide(OH) | | |

15-997-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 4, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 5.8 | 0.29 | 0.2 |
| Magnesium(Mg) | 38.0 | 3.13 | 2.4 |
| Sodium(Na) | 2900.0 | 126.14 | 96.3 |
| Potassium(K) | 55.0 | 1.41 | 1.1 |
| Carbonate(CO3) | 7.0 | 0.23 | 0.2 |
| Bicarbonate(HCO3) | 1298.0 | 21.28 | 15.6 |
| Sulphate(SO4) | 35.0 | 0.73 | 0.5 |
| Chloride(Cl) | 4040.0 | 113.93 | 83.7 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 5.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 15.8 | | |
| Magnesium(Acidified) | 36.0 | | |
| TDS(mg/l) | 7540.0 | | |
| Total Anions(epm) | 136.17 | Total Cations(epm) | 130.97 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 11500 | | Temperature(C) | 9.50 | |
| pH | 8.7 | | pH | 8.8 | |
| Fluoride(F) | 1.4 | mg/l | Carbonate(CO3) | 115 | mg/l |
| | | | Bicarbonate(HCO3) | 1259 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 15-997-E-82

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Rge 16 Twp 89 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 5, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 142.0 | 7.10 | 13.6 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.0 |
| Sodium(Na) | 995.0 | 43.26 | 83.1 |
| Potassium(K) | 66.0 | 1.69 | 3.3 |
| Carbonate(CO3) | 24.0 | 0.80 | 3.6 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 13.0 | 0.27 | 1.2 |
| Chloride(Cl) | 750.0 | 21.13 | 95.2 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 0.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 114.0 | | |
| Magnesium(Acidified) | 0.2 | | |
| TDS(mg/l) | 3253.0 | | |
| Total Anions(epm) | 22.20 | Total Cations(epm) | 52.06 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 11000 |
| pH | 12.5 |
| Fluoride | 0.0 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 11.00 | |
| pH | 12.7 | |
| Carbonate(CO3) | 45 | mg/l |
| Bicarbonate(HCO3) | 0 | mg/l |
| Hydroxide(OH) | 611 | mg/l |

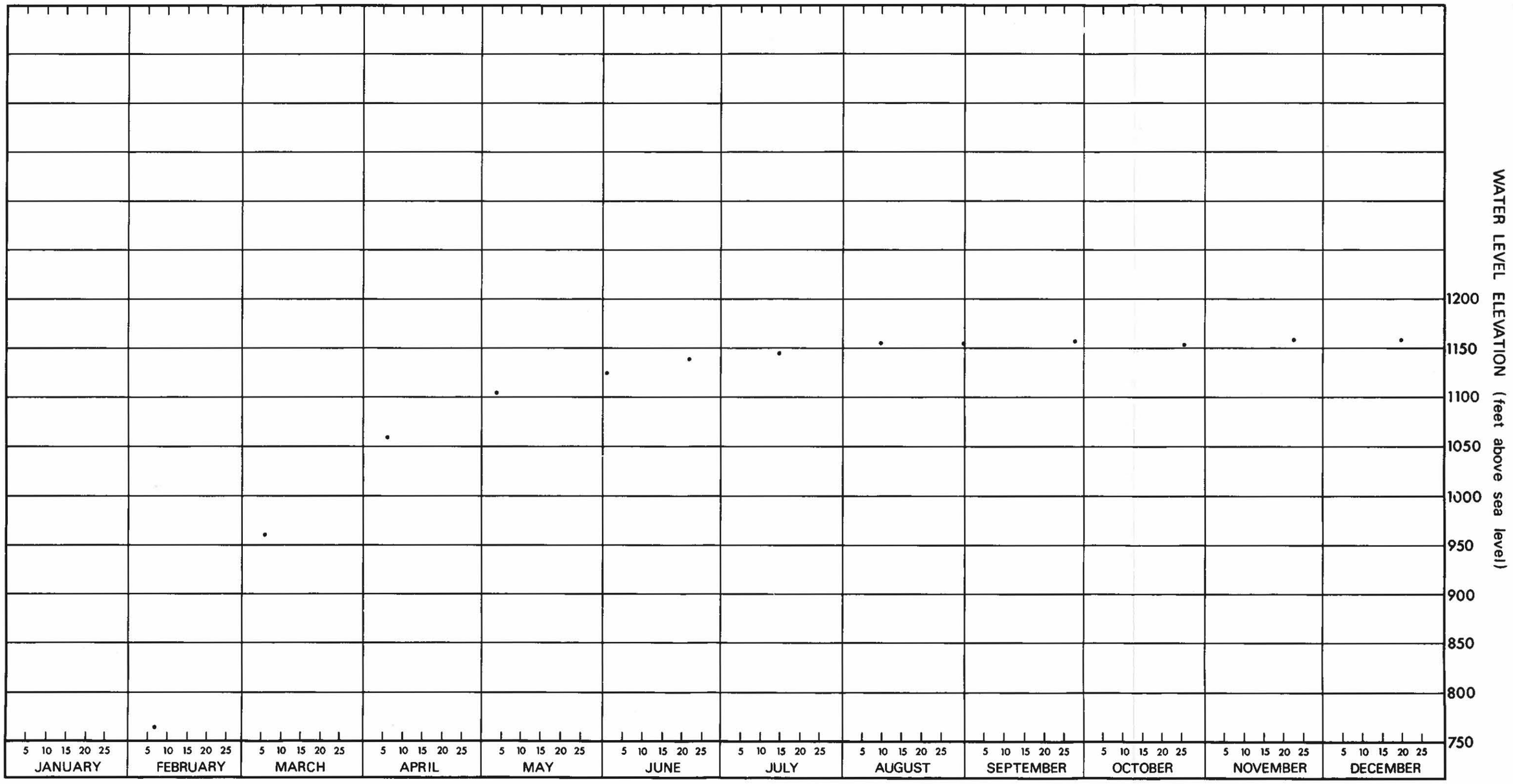
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-997

15 - 997 - H - 77

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council




1976

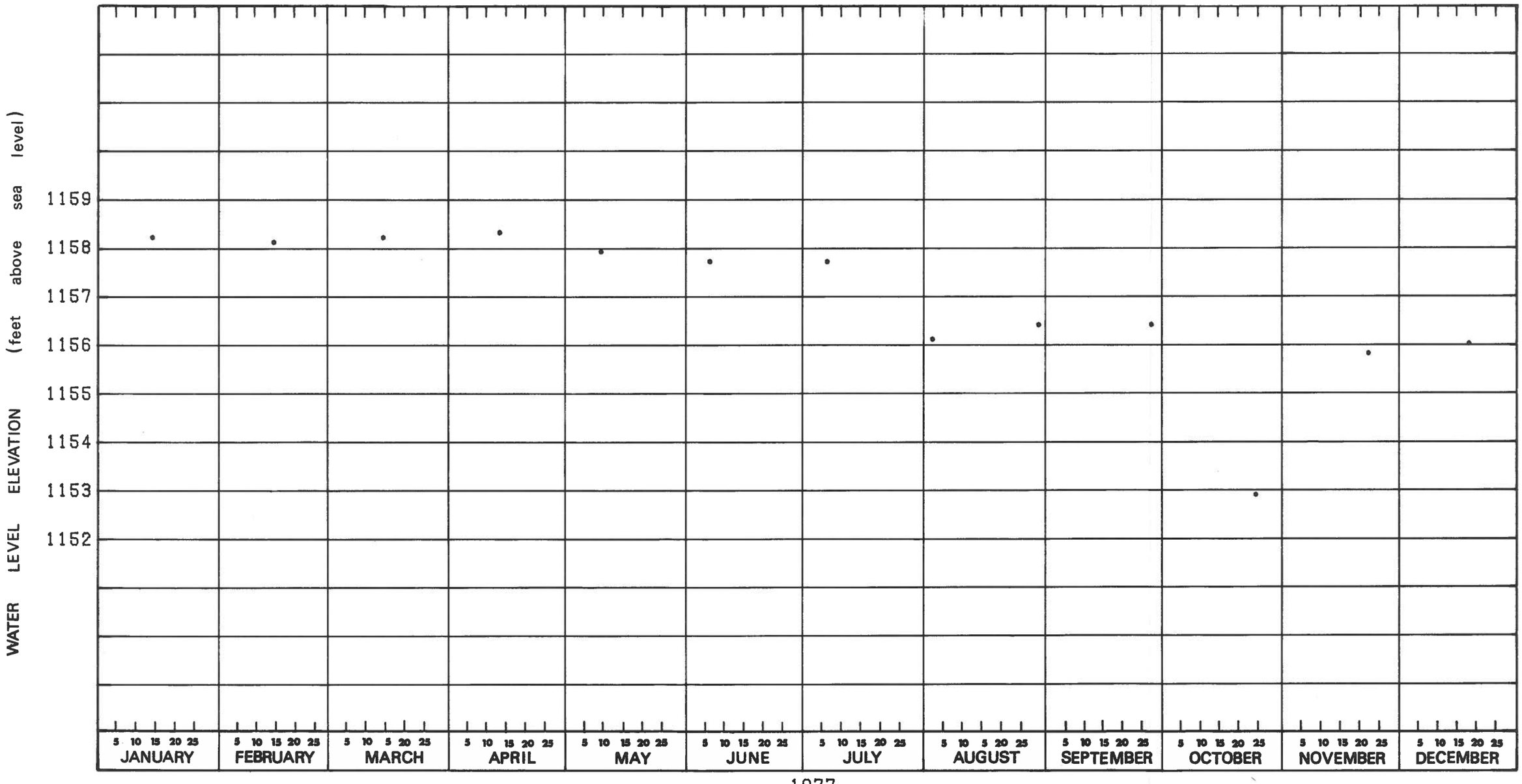
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-997-H-78



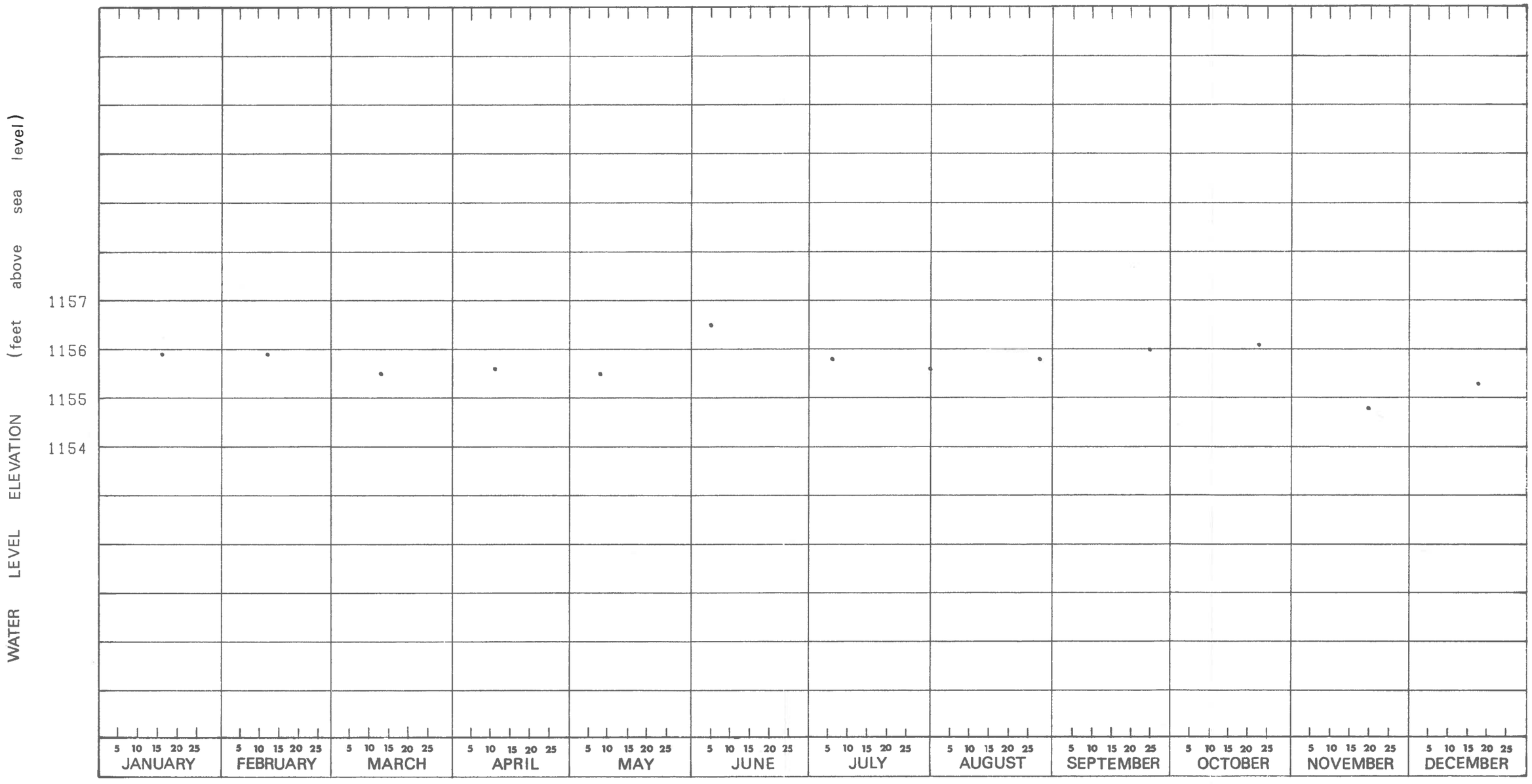
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-997

LSD 15 SEC 33 TWP 89 R 16 W4TH

15-997-H-79

Alberta Research Council




1978

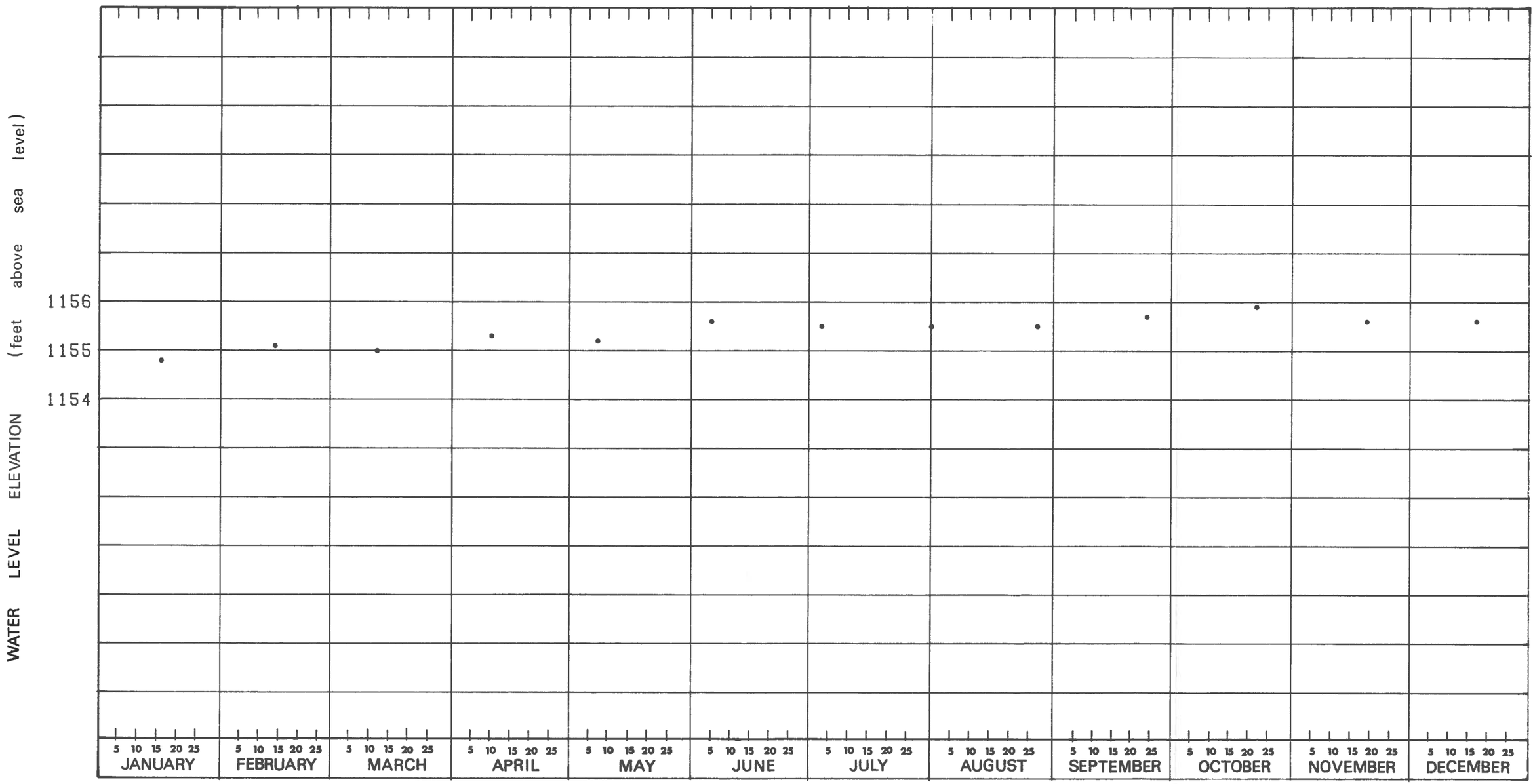
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-997-H-80



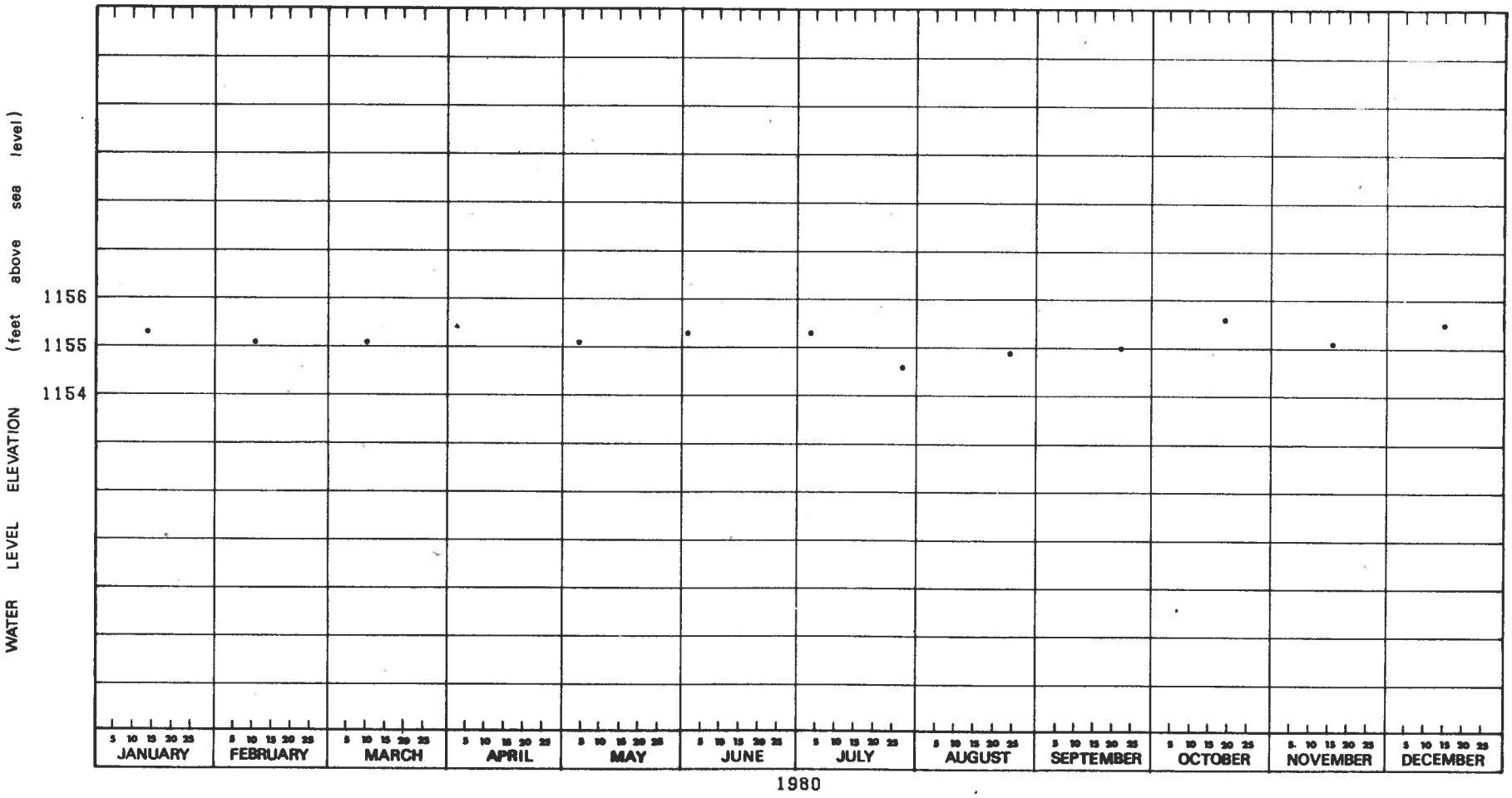
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-997-H-81



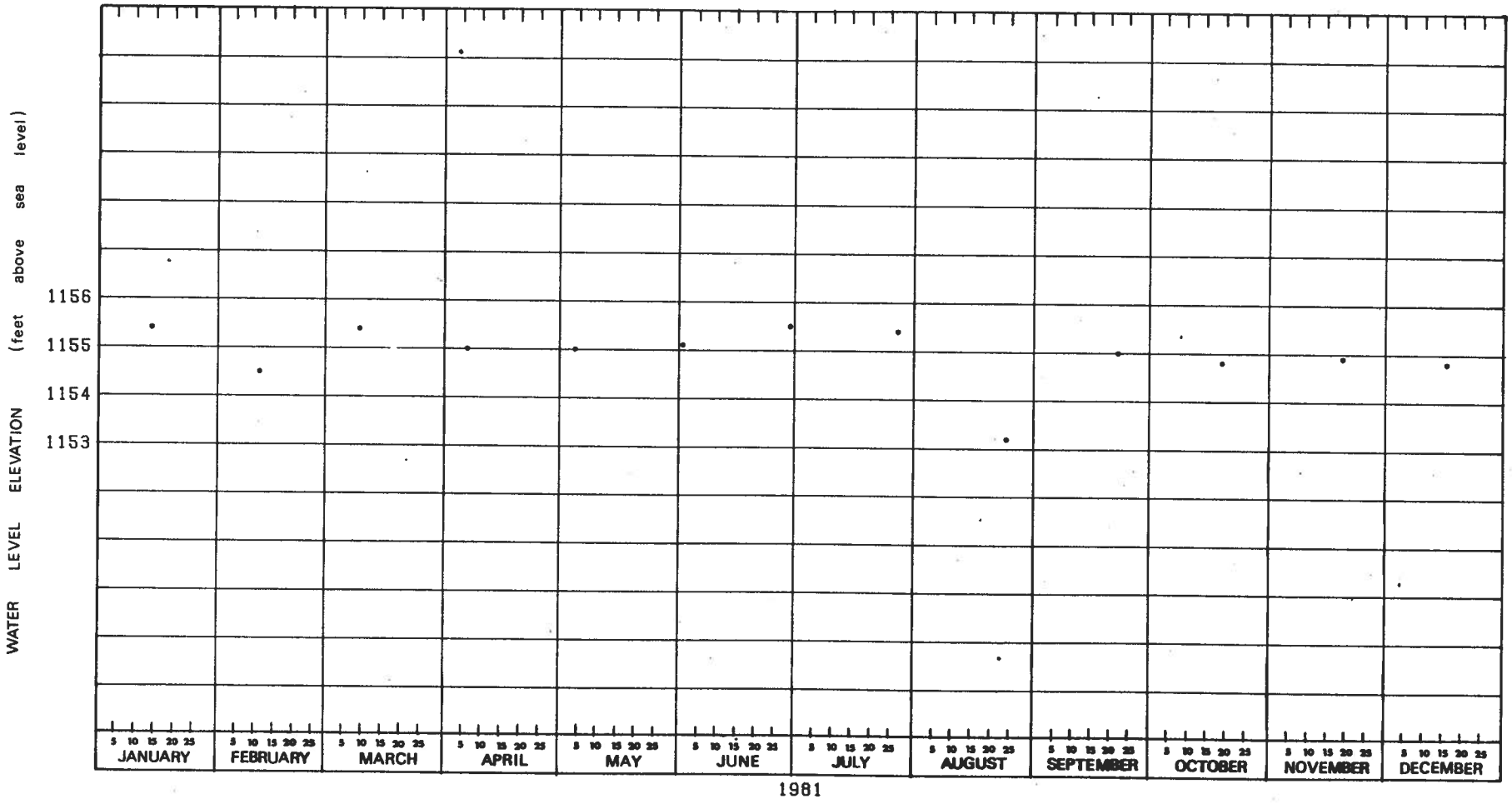
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Twp 89 R 16 W4 th

Alberta Research Council

15-997-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1576.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 24/76 | | | Well completed; blown with air |
| Jan 30/76 | | | DST, FSI = 52# from 793 FT; water sample |
| Feb 7/76 | 247.64 MP | 765.7 | MP = 0.39 m TOC, (1578.0) |
| Mar 6/76 | 188.28 MP | 960.4 | |
| Apr 6/76 | 157.87 MP | 1060.1 | |
| May 4/76 | 144.10 MP | 1105.0 | New MP = 0.31 m TOC, (1577.7) |
| June 1/76 | 137.62 MP | 1126.3 | |
| June 22/76 | 133.33 MP | 1140.4 | |
| July 15/76 | 131.05 MP | 1147.9 | Sampled; temp. 9°C |
| Aug 10/76 | 129.65 MP | 1152.4 | |
| Aug 31/76 | 128.85 MP | 1155.1 | |
| Sept 28/76 | 128.05 MP | 1157.7 | |
| Oct 26/76 | 128.88 MP | 1155.0 | |
| Nov 23/76 | 127.80 MP | 1158.5 | |
| Dec 20/76 | 127.75 MP | 1158.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1576.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 127.88 MP | 1158.2 | MP (1577.7) |
| Feb 15/77 | 127.93 MP | 1158.1 | |
| Mar 15/77 | 127.88 MP | 1158.2 | |
| Apr 14/77 | 127.86 MP | 1158.3 | |
| May 10/77 | 128.00 MP | 1157.9 | |
| June 7/77 | 128.05 MP | 1157.7 | |
| July 7/77 | 128.04 MP | 1157.7 | Sampled; temp. 10°C |
| Aug 3/77 | 128.53 MP | 1156.1 | |
| Aug 30/77 | 128.44 MP | 1156.4 | |
| Sept 28/77 | 128.43 MP | 1156.4 | |
| Oct 25/77 | 129.52 MP | 1152.9 | |
| Nov 23/77 | 128.61 MP | 1155.8 | |
| Dec 19/77 | 128.55 MP | 1156.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1576.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 128.61 MP | 1155.9 | MP (1577.7) |
| Feb 13/78 | 128.61 MP | 1155.9 | |
| Mar 14/78 | 128.71 MP | 1155.5 | |
| Apr 12/78 | 128.70 MP | 1155.6 | |
| May 9/78 | 128.71 MP | 1155.5 | |
| June 6/78 | 128.42 MP | 1156.5 | |
| July 7/78 | 128.64 MP | 1155.8 | After sample; temp 11°C |
| Aug 1/78 | 128.70 MP | 1155.6 | |
| Aug 29/78 | 128.62 MP | 1155.8 | |
| Sept 26/78 | 128.56 MP | 1156.0 | |
| Oct 24/78 | 128.54 MP | 1156.1 | |
| Nov 21/78 | 128.92 MP | 1154.8 | |
| Dec 19/78 | 128.79 MP | 1155.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 15-997

Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1576.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 128.94 MP | 1154.8 | MP (1577.7) |
| Feb 15/79 | 128.85 MP | 1155.1 | |
| Mar 13/79 | 128.88 MP | 1155.0 | |
| Apr 11/79 | 128.77 MP | 1155.3 | |
| May 8/79 | 128.80 MP | 1155.2 | |
| June 6/79 | 128.69 MP | 1155.6 | |
| July 4/79 | 128.73 MP | 1155.5 | Sampled; temp. 9.5°C |
| Aug 1/79 | 129.02 MP | 1155.5 | New MP 0.31m TOC (1578.7) |
| Aug 28/79 | 129.01 MP | 1155.5 | |
| Sept 25/79 | 128.95 MP | 1155.7 | |
| Oct 23/79 | 128.90 MP | 1155.9 | |
| Nov 20/79 | 128.98 MP | 1155.6 | |
| Dec 18/79 | 129.00 MP | 1155.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 15 - 997

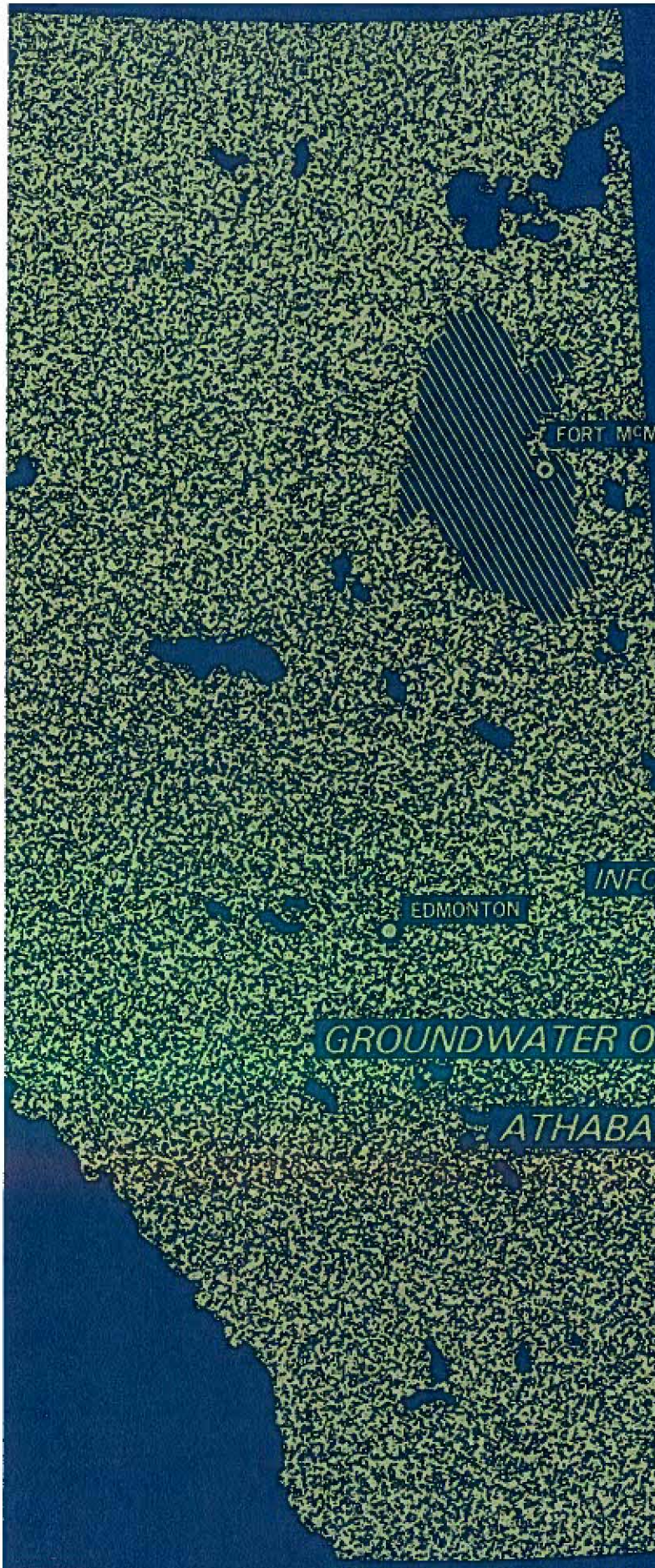
Lsd 15 Sec 33 Twp 89 R 16 W4th

Alberta Research Council

Elevation of top of casing 1576.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 129.08 MP | 1155.3 | |
| Feb 12/80 | 129.13 MP | 1155.1 | |
| Mar 12/80 | 129.14 MP | 1155.1 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 129.14 MP | 1155.1 | |
| June 3/80 | 129.08 MP | 1155.3 | |
| July 5/80 | 129.08 MP | 1155.3 | Temp. 11°C |
| July 29/80 | 129.31 MP | 1154.6 | |
| Aug 26/80 | 129.21 MP | 1154.9 | |
| Sept 24/80 | 129.16 MP | 1155.0 | |
| Oct 21/80 | 128.98 MP | 1155.6 | |
| Nov 18/80 | 129.14 MP | 1155.1 | |
| Dec 17/80 | 129.02 MP | 1155.5 | |
| Jan 15/81 | 129.07 MP | 1155.4 | |
| Feb 12/81 | 129.33 MP | 1154.5 | |
| Mar 10/81 | 129.06 MP | 1155.4 | |
| Apr 7/81 | 129.19 MP | 1155.0 | |
| May 5/81 | 129.18 MP | 1155.0 | |
| June 2/81 | 129.15 MP | 1155.1 | |
| June 30/81 | 129.01 MP | 1155.5 | |
| July 28/81 | 129.04 MP | 1155.4 | |
| Aug 25/81 | 129.73 MP | 1153.2 | |
| Sept 23/81 | 129.19 MP | 1155.0 | |
| Oct 20/81 | 129.25 MP | 1154.8 | |
| Nov 20/81 | 129.21 MP | 1154.9 | |
| Dec 17/81 | 129.24 MP | 1154.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing




SITE SIXTEEN
6-13-90-10 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites (numbers 1, 2, 3, 6, 7, 8 and 9), containing 36 individual wells, were instrumented in this manner during the winter of 1974-75. Eight sites (numbered 10, 11, 12, 13, 14, 15 16 and 17), containing 38 individual wells, were instrumented during the winter of 1975-76.

The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The page indexing system is also consistent with the updating process. All update volumes will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this Introduction and a Legend. There are 15 piezometer nests in the system and thus there are 15 separate

site publications in Information Series 69. Table 1 lists the location of wells in the system as of August 31, 1976. Figure 1 indicates the location of these wells. Publications are available as of the date of this document for all sites.

Five oil companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing.

## ACKNOWLEDGMENTS

The installation and monitoring of wells in this Program was funded by Alberta Energy and Natural Resources; Non-Renewable Resources Division.

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1976: BPOG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., Shell Canada Ltd. and Home Oil Company Ltd.

D. Hackbarth

EDMONTON

1977

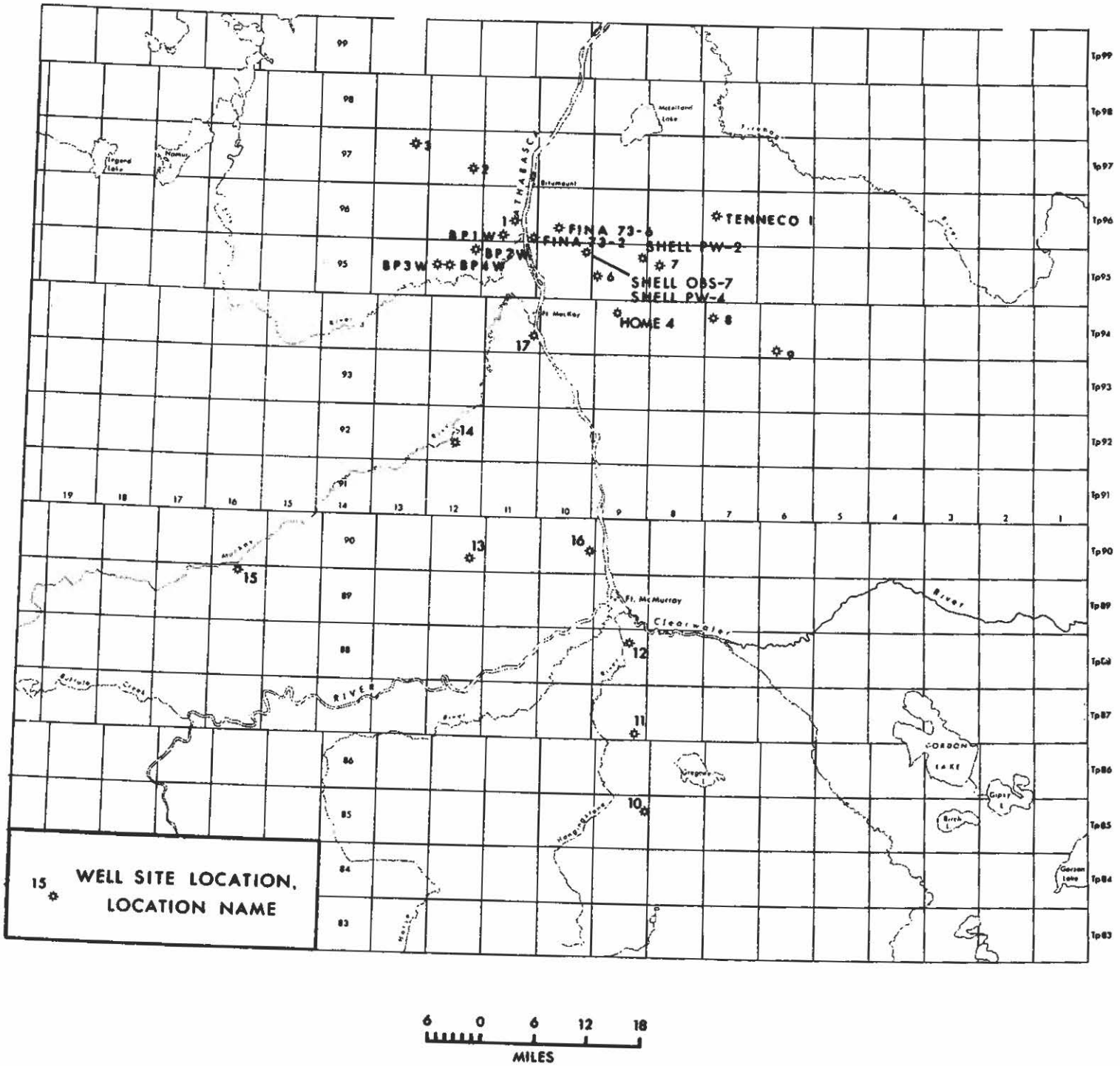



FIGURE 1. Athabasca Oil Sands observation well network, January 1977

Table 1

Athabasca Oil Sands Observation Wells

August 31, 1976

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 9-24-85-9 | 10 |
| Lsd 16-2-87-9 | 11 |
| Lsd 8-27-88-9 | 12 |
| Lsd 8-11-90-12 | 13 |
| Lsd 4-15-92-12 | 14 |
| Lsd 15-33-89-16 | 15 |
| Lsd 6-13-90-10 | 16 |
| Lsd 13-12-94-11 | 17 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |
| Lsd 3-28-94-9 | Home 4 |
| Lsd 10-25-95-10 | Shell PW-4 |
| Lsd 10-24-95-9 | Shell PW-2 |
| Lsd 10-25-95-10 | Shell Obs-7 |

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

Well Number - the name used for designating the well

Subject Code - as follows:

- I - Introduction (no site number indicated)
- L - Legend (no site number indicated)
- G - General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents
- C - Well construction details
- D - Drill stem testing
- A - Aquifer testing
- E - Chemical analyses including multielement analyses and routine water analyses
- H - Annual hydrograph
- W - Well history

Year of Publication - the last two numerals of the year of publication.

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within tha tabbed section for that particular well.

# GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
| | sandstone, arkosic |
| | silt |
| | siltstone |
| | siltstone & sandstone |
| | clay |
| | clay, sandy |
| | claystone, shale |
| | sandstone & shale |
| | oil sand |
| | limestone |
| | limestone, shaley |
| | dolomite |
| | dolomite, argillaceous |
| | rock salt |
| | gypsum & anhydrite |
| | coal |
| | igneous rock |

| Symbol | Stratigraphic Unit |
|---|---|
| | Pleistocene and Recent |
| Qd | Surface deposits |
| | Cretaceous |
| Ks | Smoky Group |
| Klb | La Biche Formation |
| Kd | Dunvegan Formation |
| Ksh | Shaftesbury Formation |
| Kpl | Pelican Formation |
| Kj | Joli Fou Formation |
| Kg | Grand Rapids Formation |
| Kc | Clearwater Formation |
| Kw | Wabiskaw Member |
| Km | McMurray Formation |
| | Devonian |
| Dwd | Woodbend Group |
| Dbl | Beaverhill Lake Formation |
| Dsw | Slave Point Formation & Fort Vermilion Formation & Watt Mountain Formation |
| Dmk | Muskeg Formation |
| Dpe | Prairie Evaporite Formation |
| Dm | Methy Formation (Keg River Formation equivalent) |
| Dmr | McLean River Formation (Chinchaga Formation equivalent) |
| Dl | La Loche Formation |
| | Precambrian |
| Pc | Undivided |

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

| Symbol | Units or Parameter |
|---|---|
| Sec. | section |
| ss | stainless steel |
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) or time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| WILL | Analysis done at Western Industrial Laboratories Ltd. |
| Wt | weight |

## GEOLOGICAL ABBREVIATIONS

| | |
|---|---|
| biocl | bioclast |
| brac | brachiopod |
| bry | bryozoan |
| calc | calcareous |
| carb | carbonaceous |
| cht | chert |
| fld | feldspar |
| glauc | glauconite, glauconitic |
| gvl | gravel |
| hvy | heavy |
| lt | light |
| mnrls | minerals |
| pbl | pebbles |
| qtz | quartz |
| strgr(s) | stringer(s) |
| stroms | stromotoporoids |
| subang | subangular |
| subrd | subrounded |

## CHEMICAL ANALYSES

Two types of chemical analysis were performed on water samples: a complete routine analysis and a multielement analysis (multielement radio frequency induction coupled plasma emission spectrometer). Some of the samples collected appear to be influenced by the cement used to seal the well casing into place. Water affected by cement will exhibit high values of pH, hydroxide, calcium and chloride. The reader should regard waters with a pH greater than about 10 as probably cement-contaminated.

Cementing of the casings into place must be done due to the close proximity of the wells to each other in the site. Without cement, the movement of fluids and transmission of pressures along the boreholes would always be a possibility. It is expected that the influence of the cement will diminish with time.

All wells in the Network will be sampled by bailing at least once a year for the first few years. Results of analyses performed on samples obtained during July 1976 are included in this report.

Most routine water analyses are being done at Alberta Research Council. Those done at other laboratories are indicated by a notation under "Sample source" and are limited to samples from wells contributed by oil companies. Spectral emission estimates were done at commercial laboratories.

## WELL CONSTRUCTION

The general procedure at each site was to drill the deepest well first to determine the exact geology of the location. Two to four shallower aquifers were then selected for monitoring. A water table well 30 to 50 feet deep was constructed at each site.

Once an aquifer was selected for monitoring the construction procedure was generally as follows:

1. drill to about 5 feet above the zone
2. land casing and cement to surface
3. drill through the aquifer using very light mud
4. insert a screening device (if necessary)
5. develop the well with air.

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma, caliper and neutron were the logs run during the 1975-76 drilling. Results of the caliper logs are not presented. The geological log presented represents an interpretation based upon the sample

description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

4) A summary of contents page noting the number of pages in each of the subject areas that have been issued for that site. Pages which have been replaced because of errors are noted in the total.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells where the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, some wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the measuring tape sticking to the wet casing.

Drill stem testing equipment was utilized in two manners during the 1975-76 drilling program. Open hole - bottom hole drill stem tests

were conducted in the Devonian sediments to locate relatively productive zones for well completion. Casing tests were performed on completed wells at Site 10, 11 and 15 because of great depth to water or low permeability in the completion zone.

Information from these drill stem tests is presented under the heading "Drill Stem Testing". Results of open hole - bottom hole tests are presented in the section containing information about the deepest well at the Site as this is the hole in which the tests were conducted. An exception to this is at Site 14 where three tests were conducted on hole 14-699 and six tests performed in 14-1590.

A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day

V = volume of production into drill collars and stem

t = total flow time of test

T = transmissivity in millidarcy-feet

M = slope of final shut-in pressure plot

K = permeability in millidarcys (1 millidarcy = $10^{-6}$ cm/sec)

h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot. Calculations of transmissivity are according to the Modified Nonequilibrium Formula or the analogous Recovery Formula as follows:

$$T = \frac{0.92\ Q \log_{10} (t_2/t_1)}{d_2 - d_1} : \quad \text{(For pumping)}$$

or

$$T = \frac{0.92\ Q \log_{10} \left[\left(\frac{t + t'}{t'}\right)_2 - \left(\frac{t + t'}{t'}\right)_1\right]}{d_2 - d_1} : \quad \text{(For recovery)}$$

where:

$d_2$, $d_1$ = depth to water at corresponding subscripted time (meters) $d_2 > t_1$

$t_2$, $t_1$ = time since pumping started, $t_2 > t_1$

$t$ = length of time pumping

$t'$ = time since pumping stopped: $\left(\frac{t + t'}{t'}\right)_2 > \left(\frac{t + t'}{t'}\right)_1$

$T$ = transmissivity in sequence meters per day

$Q$ = pumping rate in imperial gallons per minute

That portion of the drawdown plot used to calculate the transmissivity is indicated on each drawing.

OBSERVATION WELL SITE 16

6-13-90-10 W 4th

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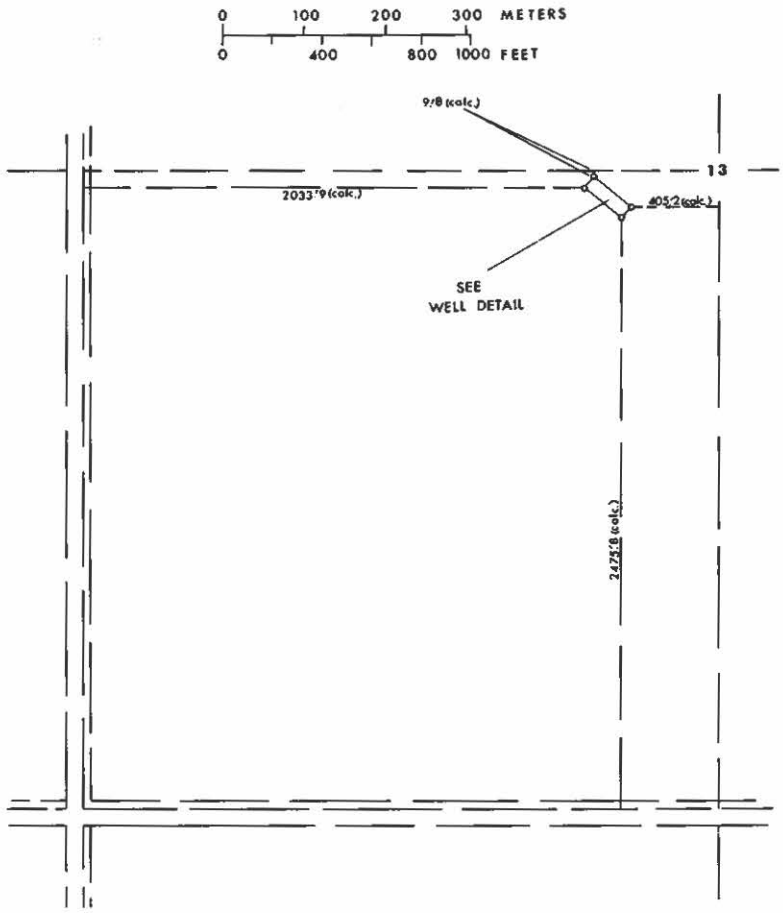
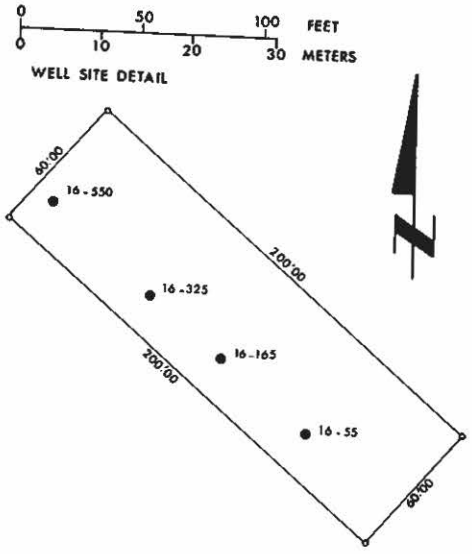


## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Sixteen

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Ground elevation 1122 Total depth 550 feet

KB elevation 1130

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 8 | 20 | Sand, lt brown, medium-very coarse grained, pebbles, subangular-subrounded, poorly sorted, excellent porosity, qtz, lt cht, hvy mnrls, fld, ferruginous, boulderchips of sandstone, limestone, dolomite and igneous rocks | Drift |
| 20 | 50 | Sand, lt brown, coarse grained, pebbles, and boulderchips as above | |
| 50 | 105 | Unsorted drift: sand, gravel, boulderchips as above in silty or clayey matrix (up to 40-50%); thin beds of coal | |
| 105 | 125 | Shale, medium grey, calcareous, carbonaceous | Clearwater |
| 125 | 140 | Sandstone, medium green, fine grained, silty, calc cement, subrounded, well-sorted, good porosity, qtz, glauc, lt cht, dark hvy mnrls. Siltstone, medium grey, calc, interbedded | Wabiskaw |
| 140 | 150 | Sandstone, medium grey, fine grained, subang-subrd, well sorted, good porosity, qtz, lt and dark cht, glauc, dark hvy mnrls. Siltstone, medium grey, slightly calc, in the bottom | |
| 150 | 180 | Sandstone, medium grey, fine-medium grained, silty, subangular-subrounded, fair-good porosity, slightly-moderately oil stained, qtz, lt cht, dark hvy mnrls. Siltstone, medium grey, sandy, thin beds | McMurray |
| 180 | 230 | Sandstone, lt brown, fine-coarse grained, angular-subangular, poorly sorted, oil impregnated, qtz, traces of pyrite and fld | |
| 230 | 240 | Sandstone as above, interbedded with shale, dark grey, carb calc. Pyrite traces | |
| 240 | 260 | Sandstone, lt brown, fine-coarse grained, angular-subangular, poorly sorted, oil impregnated, qtz. Pyrite, fld, calc traces | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Sixteen (continued)

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 260 | 290 | Sandstone as above, interbedded with shale medium grey, calcareous, carbonaceous, bituminous. Pyrite traces | |
| 290 | 320 | Sandstone, lt brown, fine-medium grained, subrd, well sorted, excellent porosity, slightly oil stained, qtz, lt cht, dark hvy mnrls | |
| 320 | 350 | Limestone, lt grey-buff, argillaceous, fossiliferous (stroms, brac, biocl), pyrite traces, interbedded with shale, dark grey, silty, calcareous, bituminous | Beaverhill Lake |
| 350 | 380 | Shale, medium grey, limy, silty and shale dark grey, calcareous, bituminous, interbedded with limestone, medium grey, argillaceous, pyrite traces | |
| 380 | 430 | Limestone, buff, microgranular and mud supported, fossiliferous (crinoid, brac, biocl), leaching, calcite recrystallization, poor-fair porosity, pyrite traces, interbedded with limy shale, lt grey, in the top | |
| 430 | 440 | Limestone, lt grey, microgranular, argillaceous, fossiliferous, pyrite | |
| 440 | 520 | Shale, lt grey, limy, silty (in the lower part), pyrite traces. Thin strgrs of argillaceous limestone on the upper part | |
| 520 | 550 | Limestone, buff, argillaceous, fossiliferous (crinoid, brac, biocl), pyrite, calcite recrystallization, poor vuggy porosity, limy shale beds in the bottom | |

## SUMMARY OF CONTENTS

SITE NUMBER SIXTEEN

L . 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

number of pages distributed for this site in 1977

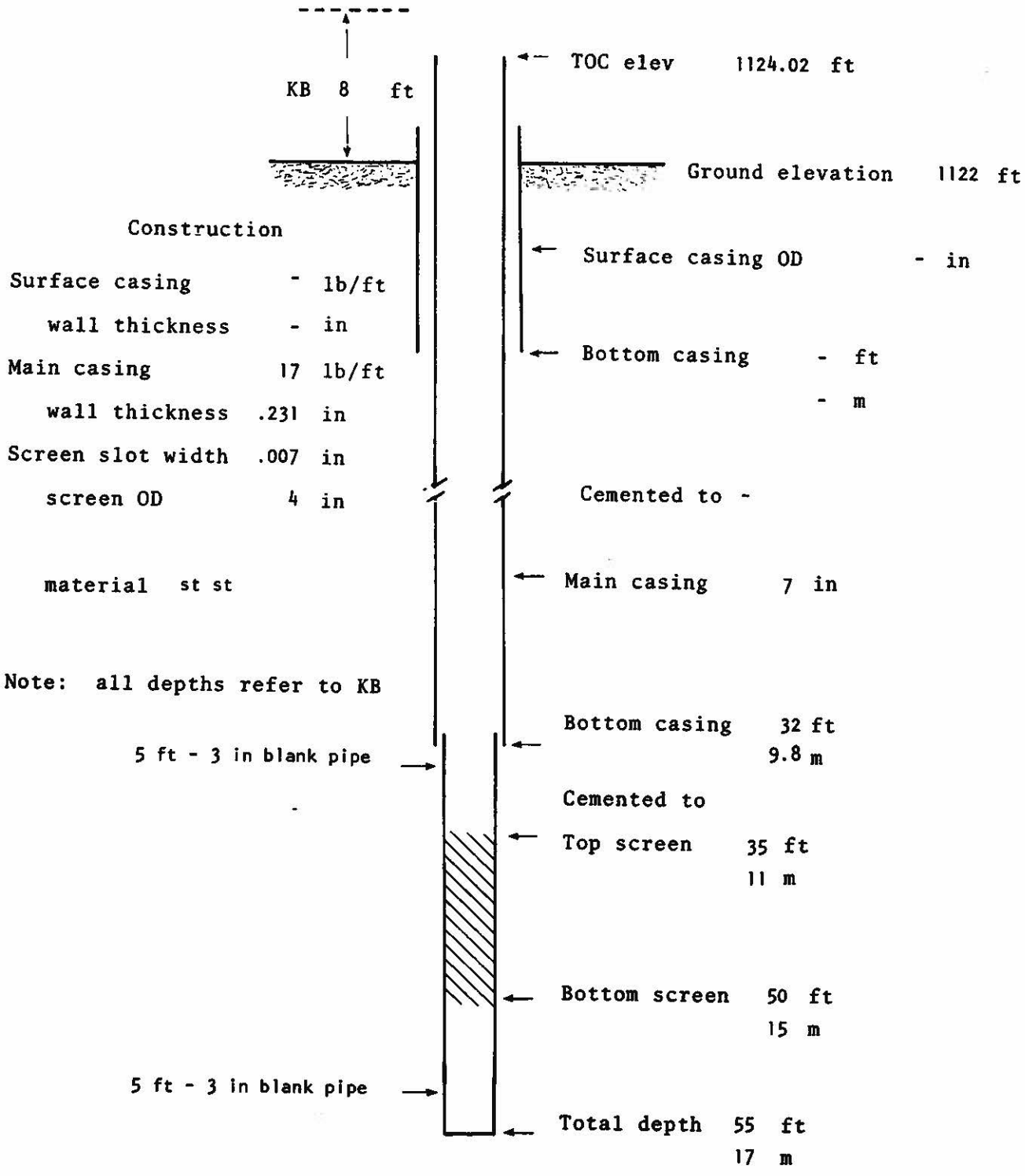
| page title | well name | | | | |
|---|---|---|---|---|---|
| | site | 16-55 | 16-165 | 16-325 | 16-550 |
| Introduction | 4 | — | — | — | — |
| Legend | 9 | — | — | — | — |
| Site Plan | 1 | — | — | — | — |
| Geological Sample Description | 2 | — | — | — | — |
| G ›hysical and Geological Logs | 1 | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 0 | 0 | 1 | 0 |
| Drill Stem Test | — | 0 | 0 | 0 | 0 |
| Shut-In Pressure Data | — | 0 | 0 | 0 | 0 |
| Water Analysis | — | 1 | 0 | 2 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 |

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Tp 90 R 10 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | in |
| Main casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| material | st st | |

Note: all depths refer to KB

## WATER ANALYSIS

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 116.0 | 5.79 | 33 |
| Magnesium ($Mg^{++}$) | 120.0 | 9.88 | 57 |
| Sodium ($Na^{+}$) | 40.0 | 1.74 | 10 |
| Potassium ($K^{+}$) | 3.3 | 0.08 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 761.0 | 12.47 | 79 |
| Sulfate ($SO_4^{=}$) | 157.0 | 3.27 | 21 |
| Chloride ($Cl^{-}$) | 4.0 | 0.11 | 1 |
| Nitrate ($NO_3^{=}$) | 2.1 | 0.03 | 0 |
| Silica ($SiO_2$) | 12.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 117.7 | | |
| Magnesium (Acidified) | 121.0 | | |
| Total dissolved solids | 1056 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 15.89 | Total Cations (epm) | 17.49 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1400 | | Temperature (C) | 5.0 | |
| pH | 7.6 | | pH | 6.9 | |
| Fluoride ($F^{-}$) | 0.5 | Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | | Bicarbonate ($HCO_3^{-}$) | 805 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 34.0 | 1.70 | 29.2 |
| Magnesium ($Mg^{++}$) | 36.0 | 2.96 | 51.1 |
| Sodium ($Na^{+}$) | 25.0 | 1.09 | 18.7 |
| Potassium ($K^{+}$) | 2.1 | 0.05 | 0.9 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 244.0 | 4.00 | 66.7 |
| Sulfate ($SO_4^{=}$) | 54.0 | 1.12 | 18.8 |
| Chloride ($Cl^{-}$) | 30.0 | 0.85 | 14.1 |
| Nitrate ($NO_3^{=}$) | 1.5 | 0.02 | 0.4 |
| Silica ($SiO_2$) | 2.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 31.0 | | |
| Magnesium (Acidified) | 32.0 | | |
| Total dissolved solids | 372.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5.99 | Total Cations (epm) | 5.80 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 550 | Temperature (C) | 5.0 |
| pH | 7.3 | pH | 7.3 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 238.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Date sampled: July 18, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .554 |
| Au | <.003 | Mo | <.006 |
| Al | .44 | Na | 41.8 |
| As | <.038 | Ni | <.010 |
| B | .161 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 133 | Si | 7.53 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .486 |
| Cr | <.006 | Te | <.065 |
| Cu | .012 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 7.86 | V | .012 |
| K | 44 | W | <.078 |
| Mg | 130.1 | Zn | .016 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Rge 10 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 04, 1978

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 13.9 | 0.69 | 7.8 |
| Magnesium(Mg) | 82.0 | 6.75 | 76.1 |
| Sodium(Na) | 31.3 | 1.36 | 15.4 |
| Potassium(K) | 2.5 | 0.06 | 0.7 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 478.0 | 7.83 | 85.3 |
| Sulphate(SO4) | 38.5 | 0.80 | 8.7 |
| Chloride(Cl) | 18.0 | 0.51 | 5.5 |
| Nitrate(NO3) | 2.3 | 0.04 | 0.4 |
| Silica(SiO2) | 1.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 15.5 | | |
| Magnesium(Acidified) | 70.0 | | |
| TDS(mg/l) | 438.0 | | |
| Total Anions(epm) | 9.18 | Total Cations(epm) | 8.87 |

## Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 650 | Temperature(C) | 6.50 | |
| pH | 8.1 | pH | 8.9 | |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) | 230 | mg/l |
| | | Bicarbonate(HCO3) | 810 | mg/l |
| | | Hydroxide(OH) | | |

16-55-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Rge 10 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 3, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 35.0 | 1.75 | 21.1 |
| Magnesium(Mg) | 48.0 | 3.95 | 47.6 |
| Sodium(Na) | 59.0 | 2.57 | 30.9 |
| Potassium(K) | 1.3 | 0.03 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 393.0 | 6.44 | 72.8 |
| Sulphate(SO4) | 31.0 | 0.65 | 7.3 |
| Chloride(Cl) | 62.0 | 1.75 | 19.8 |
| Nitrate(NO3) | 0.7 | 0.01 | 0.1 |
| Silica(SiO2) | 3.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 30.0 | | |
| Magnesium(Acidified) | 42.0 | | |
| TDS(mg/l) | 472.0 | | |
| Total Anions(epm) | 8.85 | Total Cations(epm) | 8.30 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 690 | Temperature(C) | 6.00 | |
| pH | 7.6 | pH | 8.2 | |
| Fluoride(F) | 0.6 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 395 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 16-55-E-82

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Rge 10 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 7, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 37.0 | 1.85 | 21.1 |
| Magnesium(Mg) | 64.0 | 5.33 | 60.9 |
| Sodium(Na) | 35.0 | 1.52 | 17.4 |
| Potassium(K) | 2.0 | 0.05 | 0.6 |
| Carbonate(CO3) | 15.5 | 0.52 | 6.1 |
| Bicarbonate(HCO3) | 400.0 | 6.56 | 77.8 |
| Sulphate(SO4) | 27.0 | 0.56 | 6.7 |
| Chloride(Cl) | 28.0 | 0.79 | 9.4 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.1 |
| Silica(SiO2) | 1.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 28.4 | | |
| Magnesium(Acidified) | 53.0 | | |
| TDS(mg/l) | 404.0 | | |
| Total Anions(epm) | 8.43 | Total Cations(epm) | 8.76 |

Other Constituents

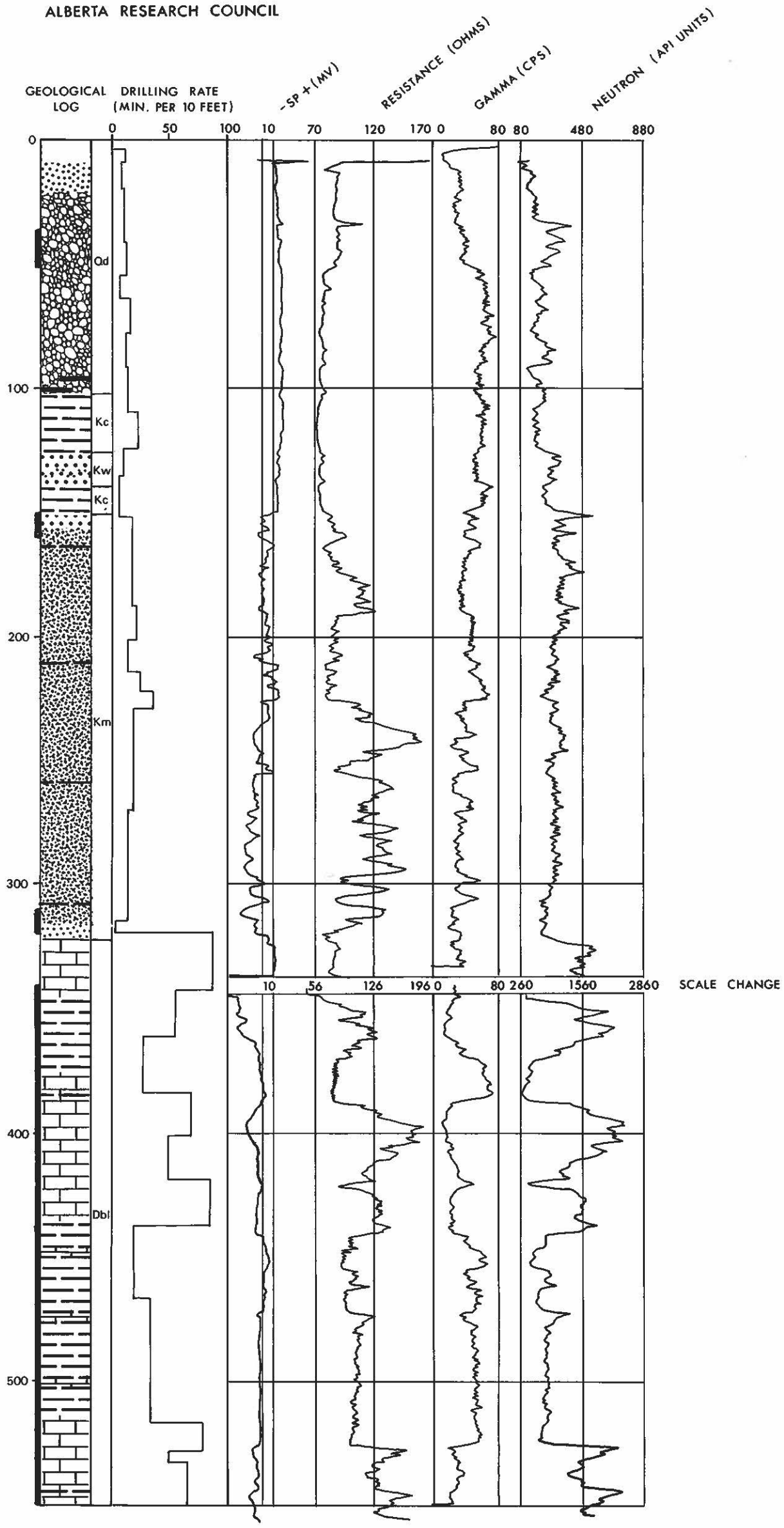
Lab:

| | |
|---|---|
| Conductivity | 8800 |
| pH | 8.5 |
| Fluoride | 0.3 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 5.00 | |
| pH | 8.3 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 434 | mg/l |
| Hydroxide(OH) | | |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 16
## 6-13-90-10 W4th
### ALBERTA RESEARCH COUNCIL




16-G-77

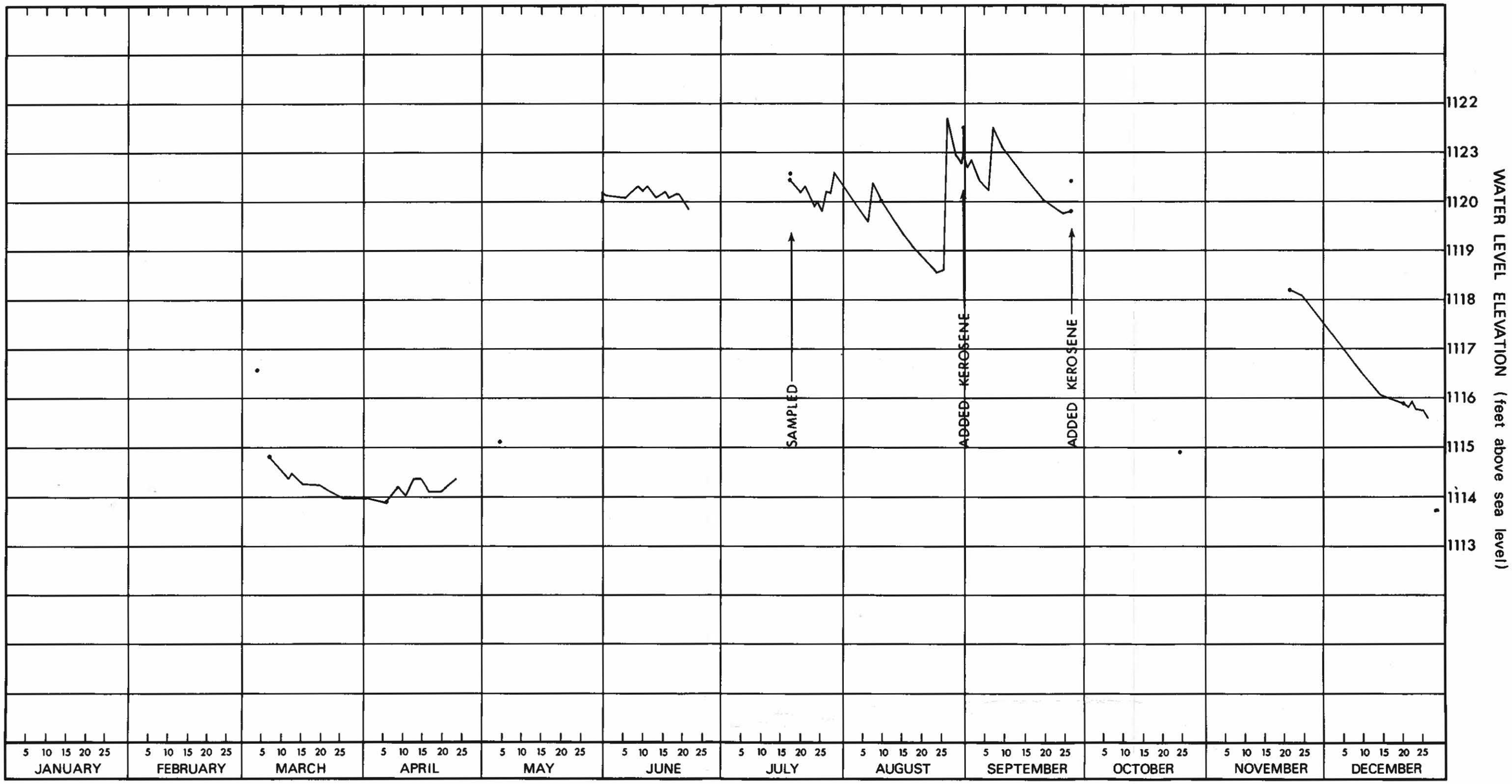
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **16-55**

Lsd **6** Sec **13** Twp **90** R **10** W4th

Alberta Research Council

16 - 55 - H - 77




1976

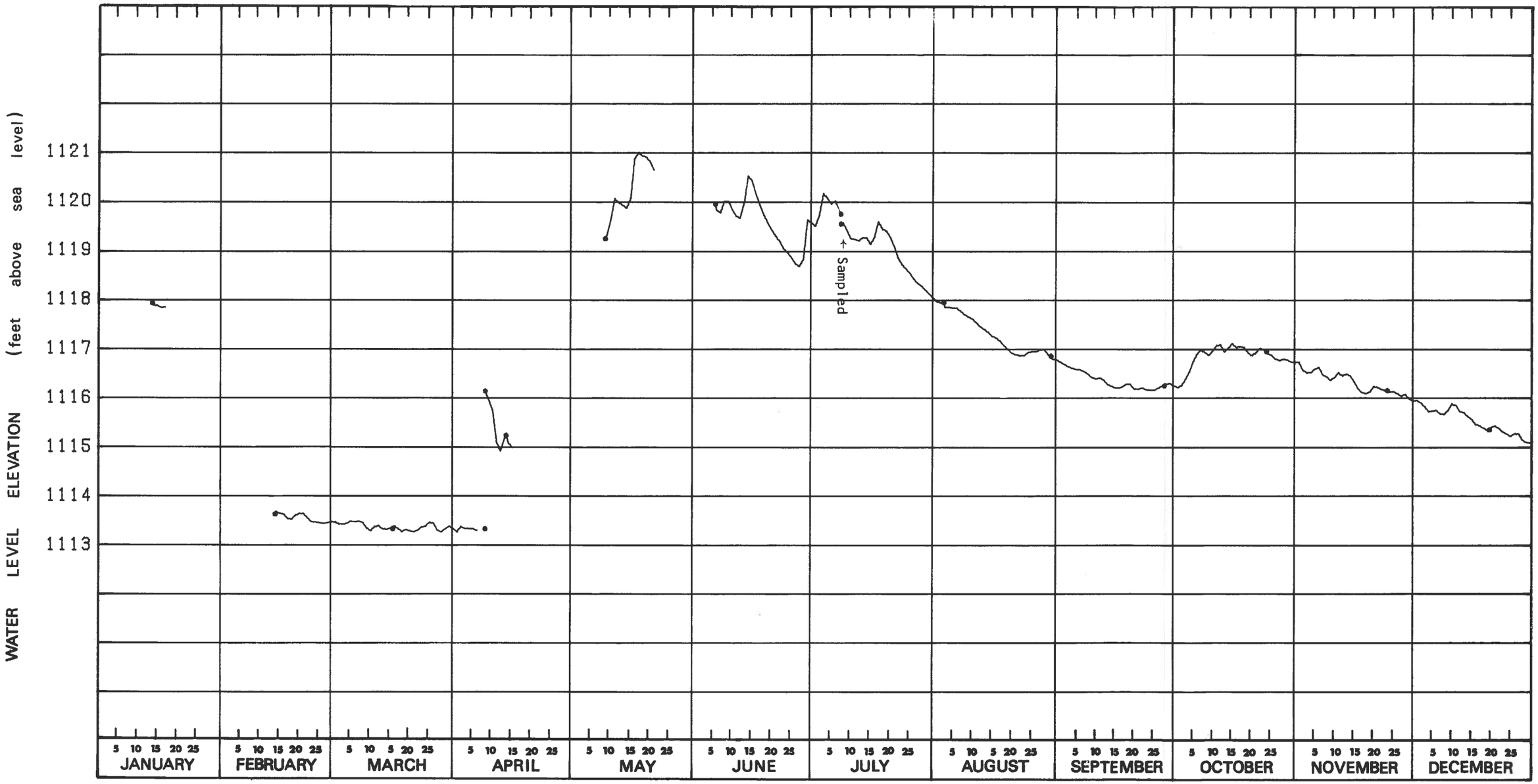
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-55

16-55-H-78

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council




1977

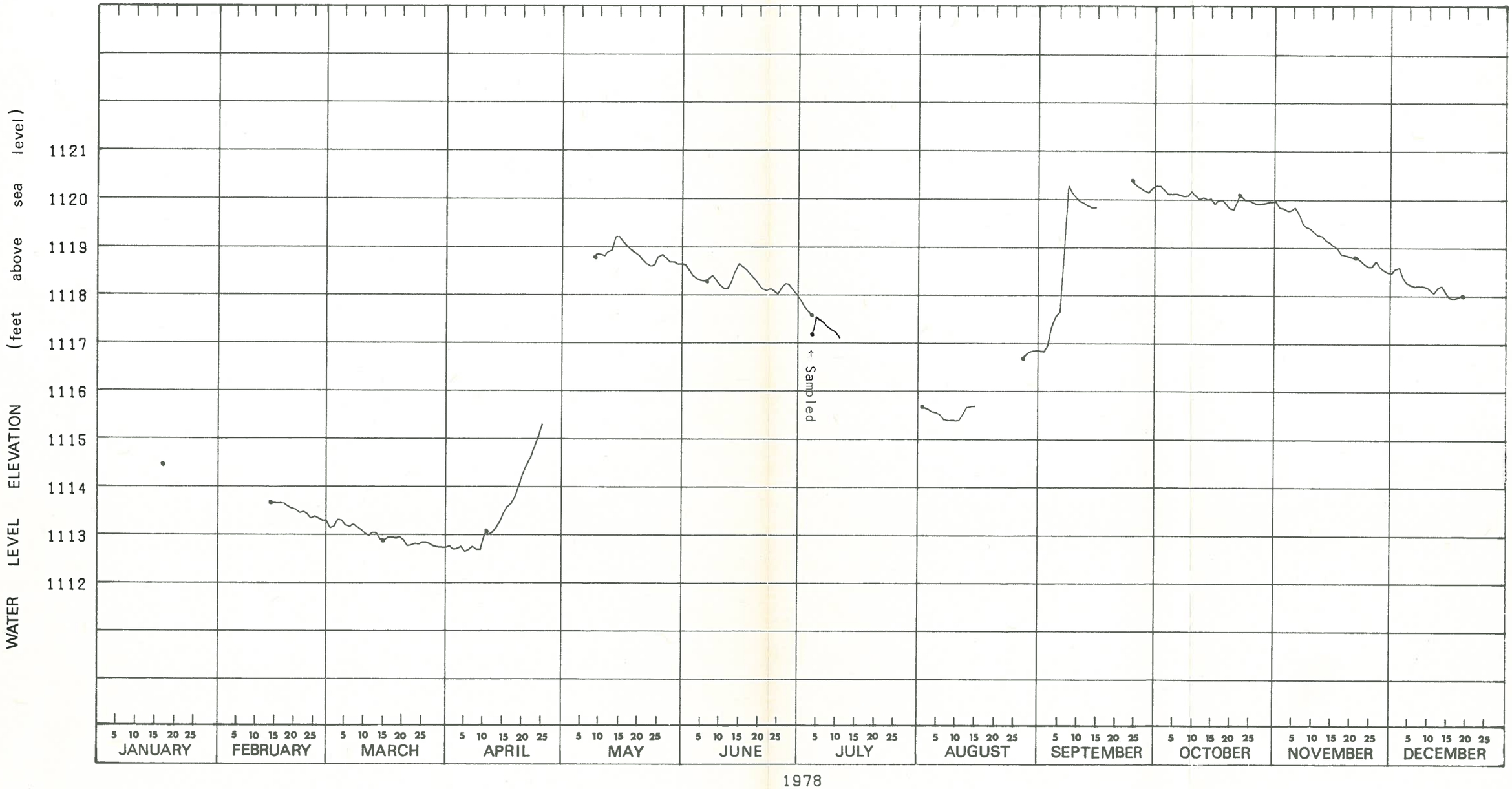
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-55

LSD 6 SEC 13 TWP 90 R 10 W4TH

16-55-H-79

Alberta Research Council




1978

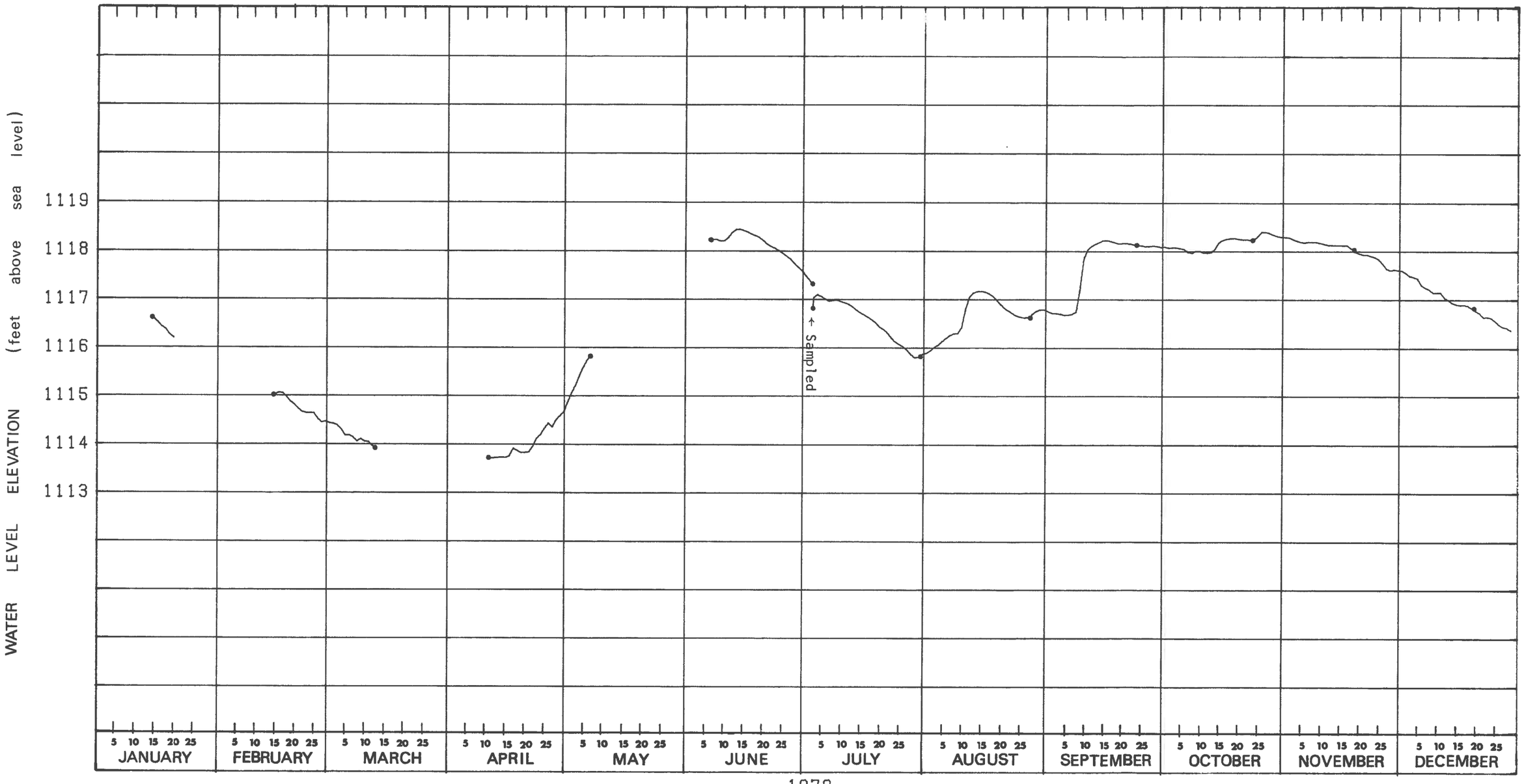
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-55

16-55-H-80

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council



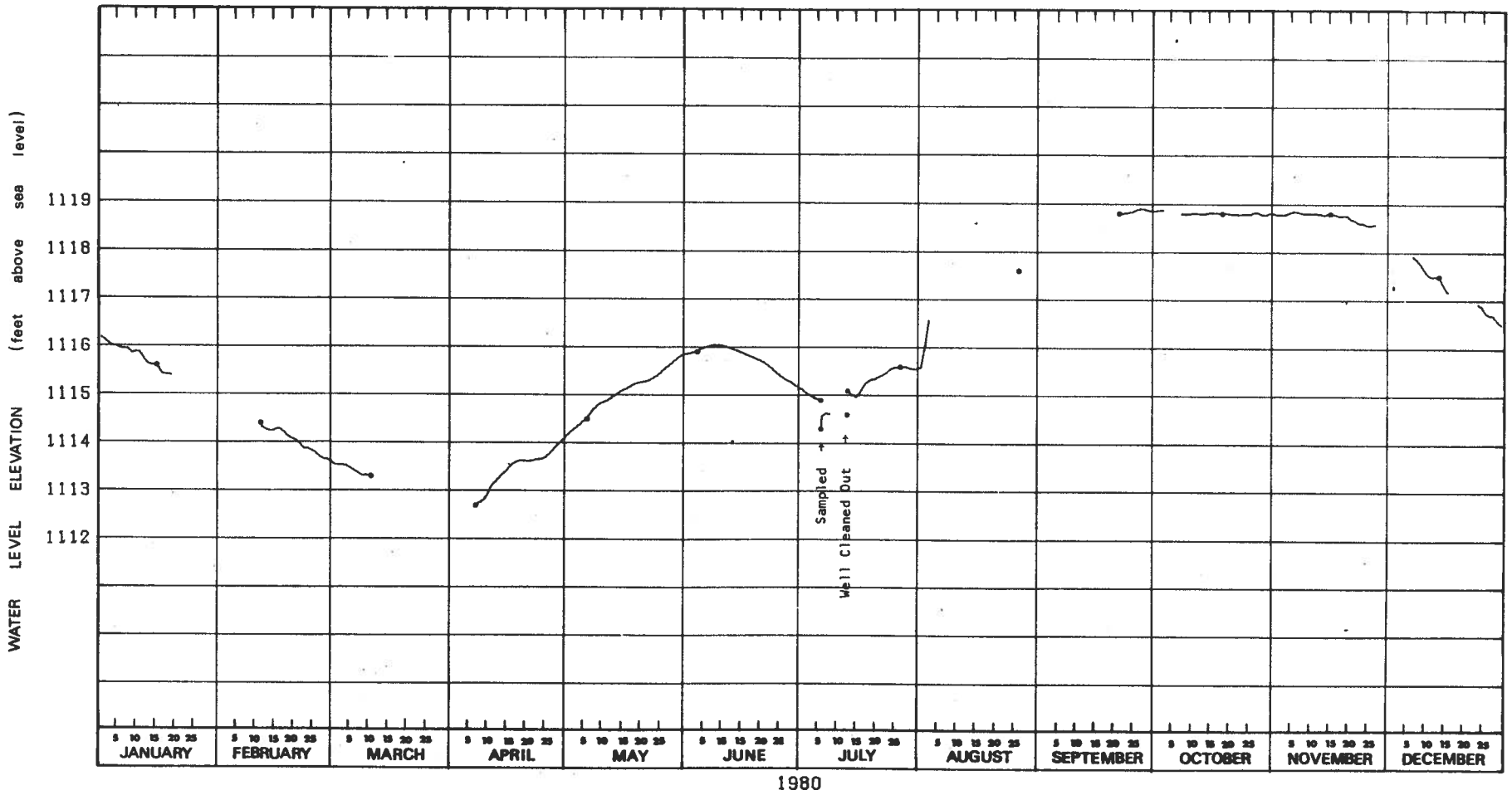
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council

16-55-H-81



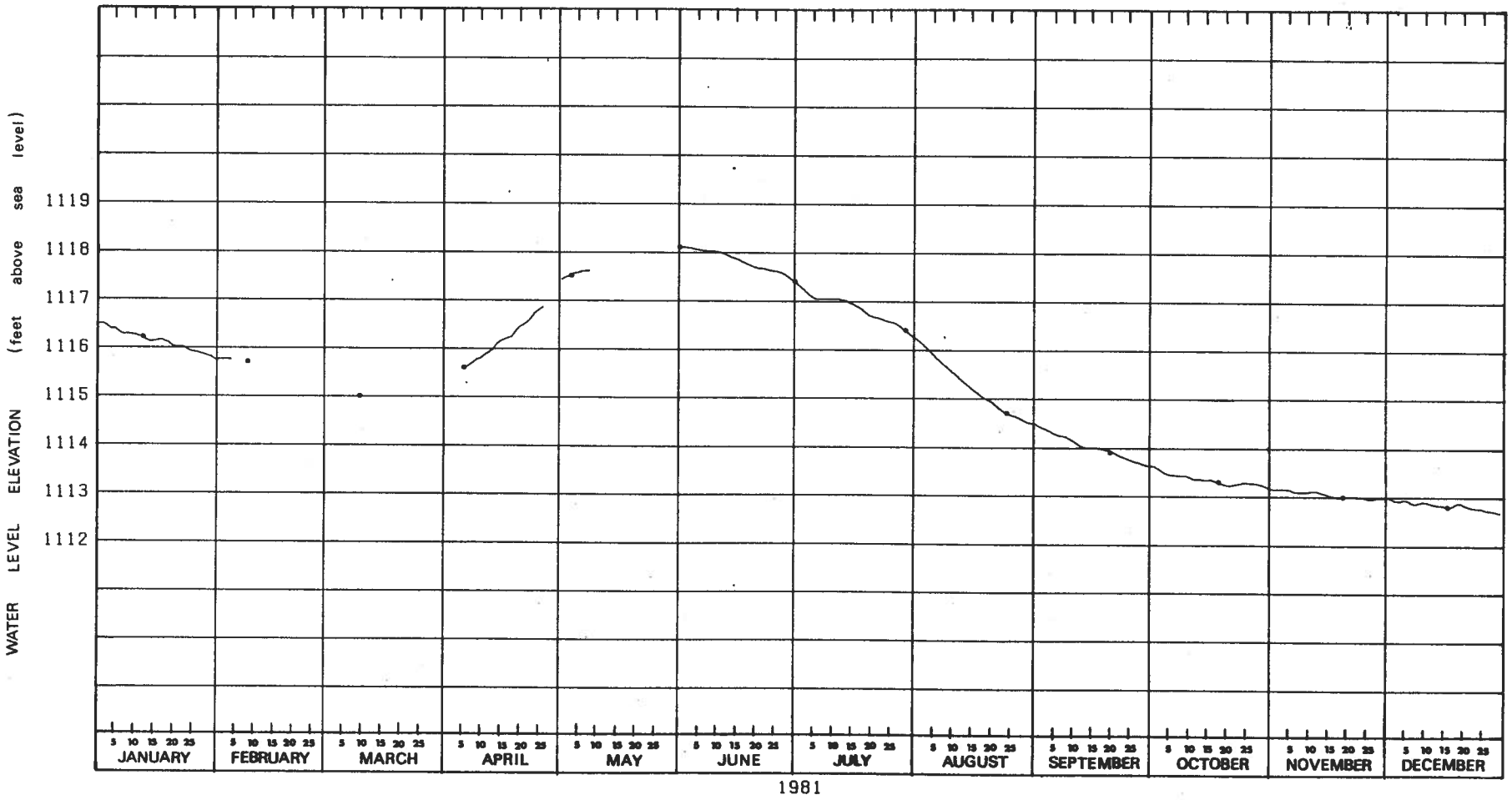
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-55

16-55-H-82

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar 4/76 | 2.28 TOC | 1116.5 | Well completed; blown with air |
| Mar 7/76 | 3.49 MP | 1114.7 | MP = 0.68 m TOC, (1126.2) |
| Apr 6/76 | 3.77 MP | 1113.8 | |
| May 5/76 | 3.40 MP | 1115.0 | |
| May 31/76 | 1.91 MP | 1119.9 | |
| June 22/76 | 1.96 MP | 1119.8 | |
| July 18/76 | 1.74 MP | 1120.5 | |
| | 1.78 MP | 1120.4 | After sample; temp. 5°C |
| Aug 10/76 | 1.91 MP | 1119.9 | |
| Aug 31/76 | 1.62 MP | 1120.9 | Added 10 gallons of kerosene; |
| | 1.00 MP | 1121.4 | water level elevation adjusted downward by 1.5 ft after this date |
| Sept 27/76 | 1.51 MP | 1119.7 | Added 4 gallons of kerosene; |
| | 1.16 MP | 1120.3 | water level elevation adjusted downward by 2.1 ft after this date |
| Oct 25/76 | 2.80 MP | 1114.9 | |
| Nov 22/76 | 1.79 MP | 1118.2 | |
| Dec 21/76 | 2.50 MP | 1115.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 1.90 MP | 1117.9 | MP (1126.2) water level elevation adjusted downward by 2.1 ft to compensate for kerosene |
| Feb 14/77 | 3.21 MP | 1113.6 | |
| Mar 16/77 | 3.30 MP | 1113.3 | |
| Apr 14/77 | 2.71 MP | 1115.2 | |
| May 9/77 | 1.50 MP | 1119.2 | |
| June 6/77 | 1.29 MP | 1119.9 | |
| July 8/77 | 1.34 MP | 1119.7 | |
| | 1.41 MP | 1119.5 | After sample; temp. 5°C |
| Aug 3/77 | 1.89 MP | 1117.9 | |
| Aug 30/77 | 2.23 MP | 1116.8 | |
| Sept 28/77 | 2.42 MP | 1116.2 | |
| Oct 24/77 | 2.20 MP | 1116.9 | |
| Nov 24/77 | 2.45 MP | 1116.1 | |
| Dec 20/77 | 2.68 MP | 1115.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 2.91 MP | 1114.5 | MP (1126.2) Water level adjusted downward by 2.1 ft to compensate for kerosene |
| Feb 14/78 | 3.16 MP | 1113.7 | |
| Mar 15/78 | 3.42 MP | 1112.9 | |
| Apr 11/78 | 3.35 MP | 1113.1 | |
| May 9/78 | 1.62 MP | 1118.8 | |
| June 7/78 | 1.76 MP | 1118.3 | |
| July 4/78 | 1.98 MP | 1117.6 | |
| | 2.10 MP | 1117.2 | After sample; temp 6.5°C |
| Aug 2/78 | 2.55 MP | 1115.7 | |
| Aug 28/78 | 2.24 MP | 1116.7 | |
| Sept 25/78 | 1.12 MP | 1120.4 | |
| Oct 23/78 | 1.21 MP | 1120.1 | |
| Nov 22/78 | 1.61 MP | 1118.8 | |
| Dec 20/78 | 1.87 MP | 1118.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/79 | 2.27 MP | 1116.6 | MP (1126.2) Water level elevation adjusted downward by 2.1 ft to compensate for kerosene |
| Feb 15/79 | 2.77 MP | 1115.0 | |
| Mar 13/79 | 3.10 MP | 1113.9 | |
| Apr 11/79 | 3.17 MP | 1113.7 | |
| May 7/79 | 2.53 MP | 1115.8 | |
| June 7/79 | 1.79 MP | 1118.2 | |
| July 3/79 | 2.08 MP | 1117.3 | |
| | 2.21 MP | 1116.8 | After sample; temp. 6°C |
| July 31/79 | 2.53 MP | 1115.8 | |
| Aug 28/79 | 2.28 MP | 1116.6 | |
| Sept 24/79 | 1.83 MP | 1118.1 | |
| Oct 24/79 | 1.80 MP | 1118.2 | |
| Nov 19/79 | 1.86 MP | 1118.0 | |
| Dec 20/79 | 2.23 MP | 1116.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 16-55

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 2.58 MP | 1115.6 | |
| Feb 12/80 | 2.97 MP | 1114.4 | |
| Mar 12/80 | 3.30 MP | 1113.3 | |
| Apr 8/80 | 3.46 MP | 1112.7 | |
| May 7/80 | 2.92 MP | 1114.5 | |
| June 5/80 | 2.49 MP | 1115.9 | |
| July 7/80 | 2.79 MP | 1114.9 | Temp. 5°C |
| | 2.98 MP | 1114.3 | After Sample |
| July 10/80 | 2.88 MP | 1114.6 | Airlift to clean, sampled cond. = 775 |
| July 14/80 | 3.24 MP | 1115.1 | 62 cm. of kerosene left. |
| July 28/80 | 3.08 MP | 1115.6 | |
| Aug 28/80 | 2.47 MP | 1117.6 | |
| Sept 23/80 | 2.09 MP | 1118.8 | |
| Oct 20/80 | 2.10 MP | 1118.8 | |
| Nov 17/80 | 2.11 MP | 1118.8 | |
| Dec 15/80 | 2.51 MP | 1117.5 | |
| Jan 13/81 | 2.89 MP | 1116.2 | |
| Feb 9/81 | 3.06 MP | 1115.7 | |
| Mar 10/81 | 3.27 MP | 1115.0 | |
| Apr 6/81 | 3.07 MP | 1115.6 | |
| May 4/81 | 2.49 MP | 1117.5 | |
| June 1/81 | 2.32 MP | 1118.1 | |
| July 1/81 | 2.54 MP | 1117.4 | |
| July 30/81 | 2.85 MP | 1116.4 | |
| Aug 25/81 | 3.36 MP | 1114.7 | |
| Sept 22/81 | 3.60 MP | 1113.9 | |
| Oct 19/81 | 3.79 MP | 1113.3 | |
| Nov 20/81 | 3.34 MP | 1113.0 | |
| Dec 17/81 | 3.94 MP | 1112.8 | |

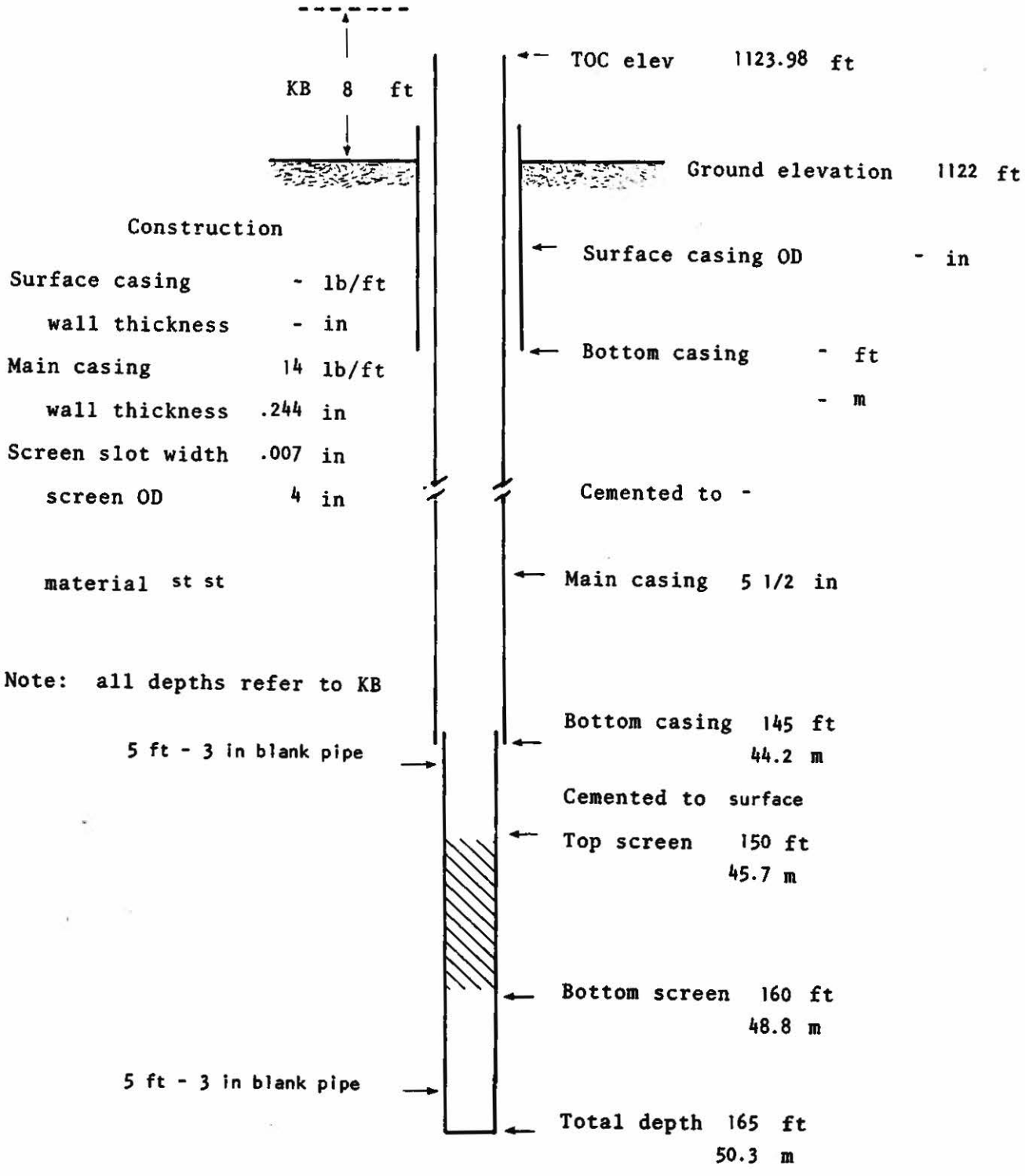
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 16-165

Lsd 6 Sec 13 Tp 90 R 10 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| material | st st | |

Note: all depths refer to KB

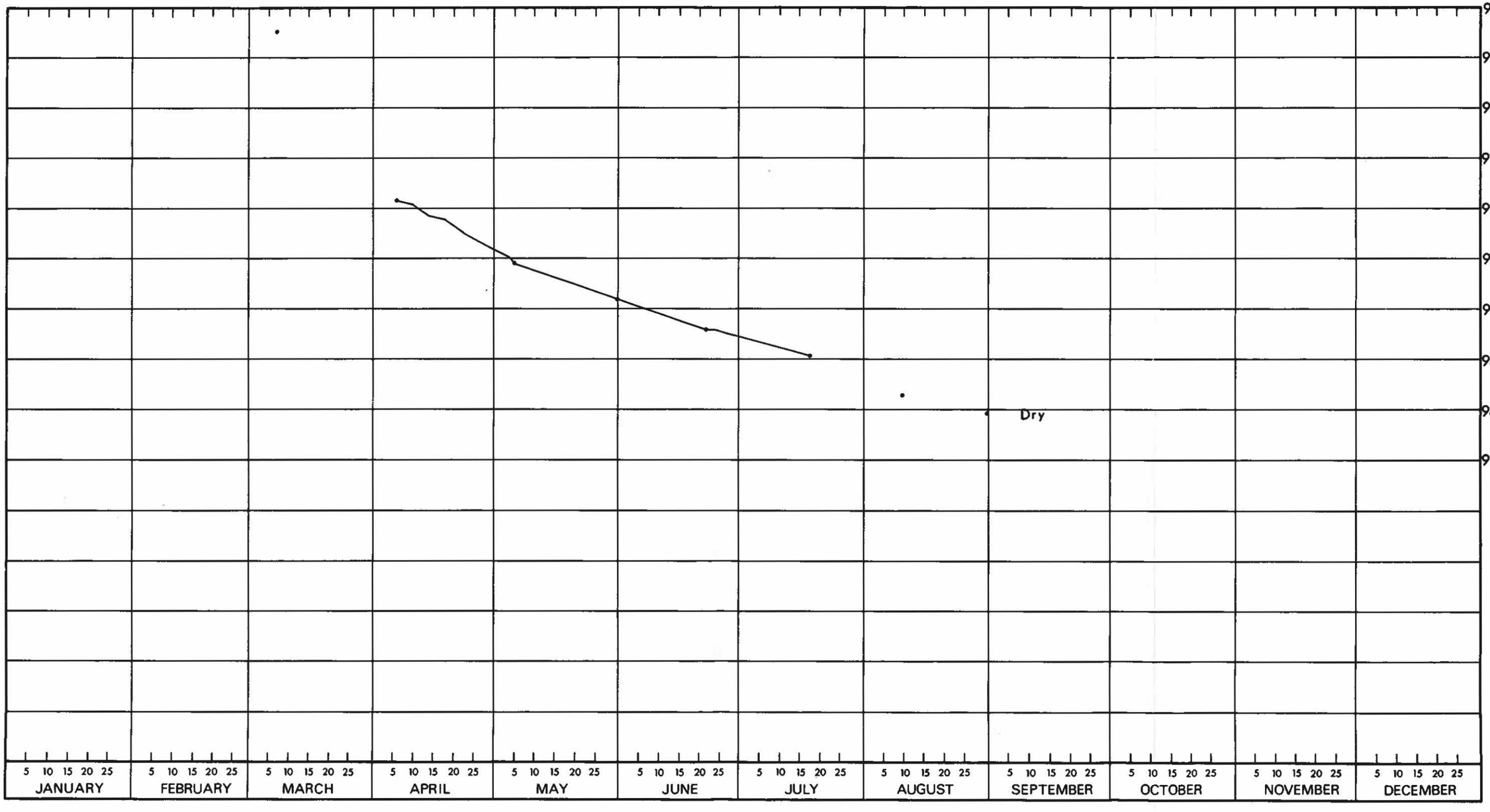
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **16-165**

16 - 165 - H -77

Lsd **6** Sec **13** Twp **90** R **10** W4th

Alberta Research Council




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 16-165

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1123.98

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar 4/76 | 42.20 TOC | 985.6 | Well completed; blown with air |
| Mar 7/76 | 46.60 MP | 973.6 | MP = 0.76 m TOC, (1126.5) |
| Apr 6/76 | 47.66 MP | 970.2 | |
| May 5/76 | 48.04 MP | 968.9 | |
| May 31/76 | 48.22 MP | 968.3 | |
| June 22/76 | 48.44 MP | 967.6 | |
| July 18/76 | 48.60 MP | 967.1 | Could not sample not enough water in well |
| Aug 10/76 | 48.84 MP | 966.3 | |
| Aug 31/76 | 48.94 MP | 966.0 | |
| Sept 27/76 | Dry | | |
| Oct 25/76 | Dry | | |
| Nov 22/76 | Dry | | |
| Dec 21/76 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-165

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1123.98

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | Dry | | |
| Feb 14/77 | Dry | | |
| Mar 16/77 | Dry | | |
| Apr 14/77 | Dry | | |
| May 9/77 | Dry | | |
| June 6/77 | Dry | | |
| July 8/77 | Dry | | |
| Aug 3/77 | Dry | | |
| Aug 30/77 | Dry | | |
| Sept 28/77 | Dry | | |
| Oct 24/77 | Dry | | |
| Nov 24/77 | Dry | | |
| Dec 20/77 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-165

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1123.98

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | Dry | | MP (1126.5) |
| Feb 14/78 | Dry | | |
| Mar 15/78 | Dry | | |
| Apr 11/78 | Dry | | |
| May 9/78 | Dry | | |
| June 7/78 | Dry | | |
| July 4/78 | Dry | | |
| Aug 2/78 | Dry | | |
| Aug 28/78 | Dry | | |
| Sept 25/78 | Dry | | |
| Oct 23/78 | Dry | | |
| Nov 22/78 | Dry | | |
| Dec 20/78 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-165

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1123.98

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/79 | Dry | | MP (1126.5) |
| Feb 15/79 | Dry | | |
| Mar 13/79 | Dry | | |
| Apr 11/79 | Dry | | |
| May 7/79 | Dry | | |
| June 7/79 | Dry | | |
| July 3/79 | Dry | | |
| July 31/79 | Dry | | |
| Aug 28/79 | Dry | | |
| Sept 24/79 | Dry | | |
| Oct 24/79 | Dry | | |
| Nov 19/79 | Dry | | |
| Dec 20/79 | Dry | | |

MP - Depth from measuring point
TOC - Depth from top of casing.

## WELL HISTORY

OBSERVATION WELL NUMBER 16 - 165

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1123.98

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | DRY | | |
| Feb 12/80 | DRY | | |
| Mar 12/80 | DRY | | |
| Apr 8/80 | DRY | | |
| May 7/80 | DRY | | |
| June 5/80 | DRY | | |
| July 7/80 | DRY | | |
| July 28/80 | DRY | | |
| Aug 28/80 | DRY | | |
| Sept 23/80 | DRY | | |
| Oct 20/80 | DRY | | |
| Nov 17/80 | DRY | | |
| Dec 15/80 | DRY | | |
| Jan 13/81 | DRY | | |
| Feb 9/81 | DRY | | |
| Mar 10/81 | DRY | | |
| Apr 6/81 | DRY | | |
| May 4/81 | DRY | | |
| June 1/81 | DRY | | |
| July 1/81 | DRY | | |
| July 30/81 | DRY | | |
| Aug 25/81 | DRY | | |
| Sept 22/81 | DRY | | |
| Oct 19/81 | DRY | | |
| Nov 20/81 | DRY | | |
| Dec 17/81 | DRY | | |

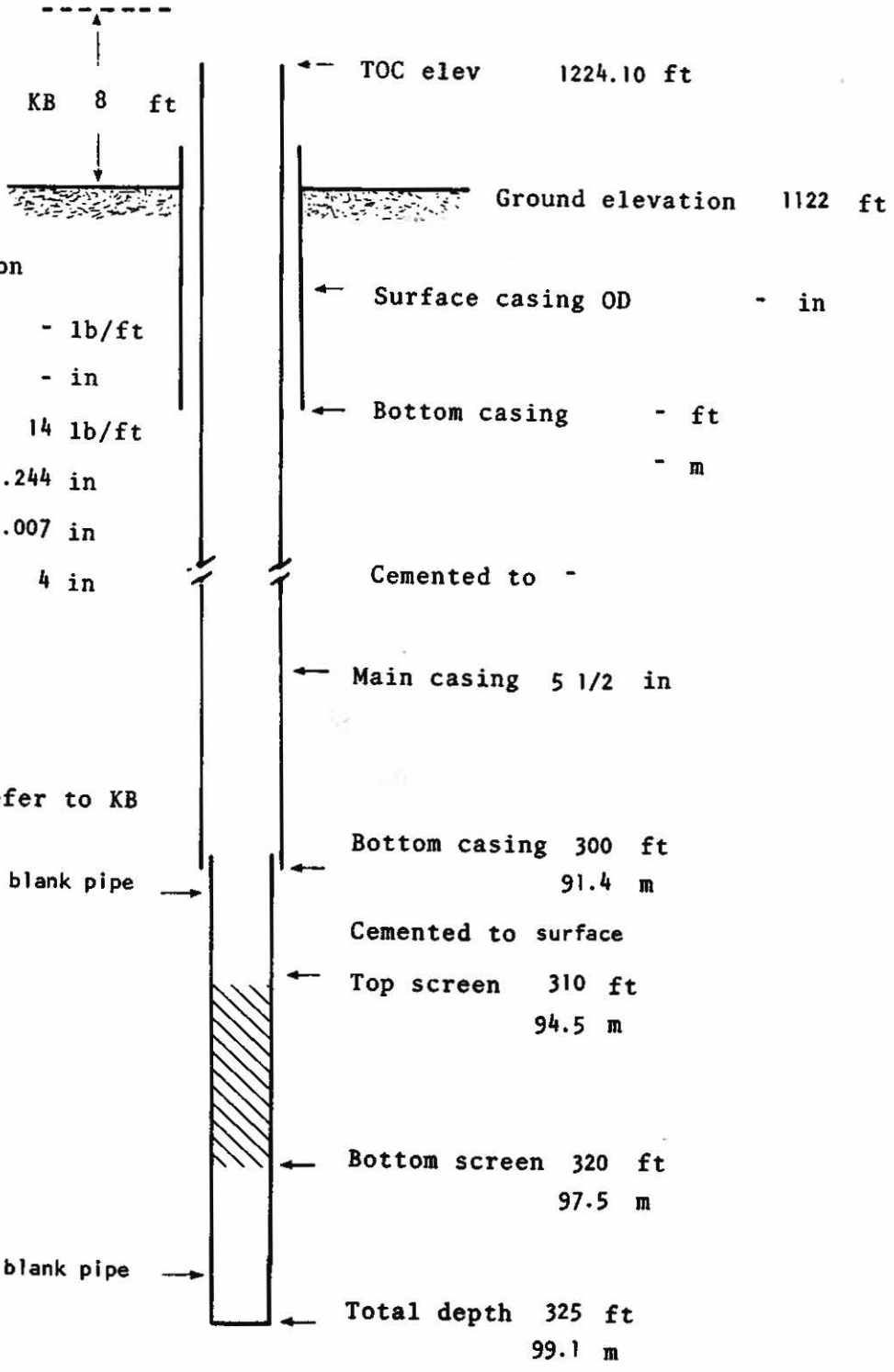
MP - Depth from measuring point
TOC - Depth from top of casing

**WELL CONSTRUCTION.**

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Tp 90 R 10 W 4th

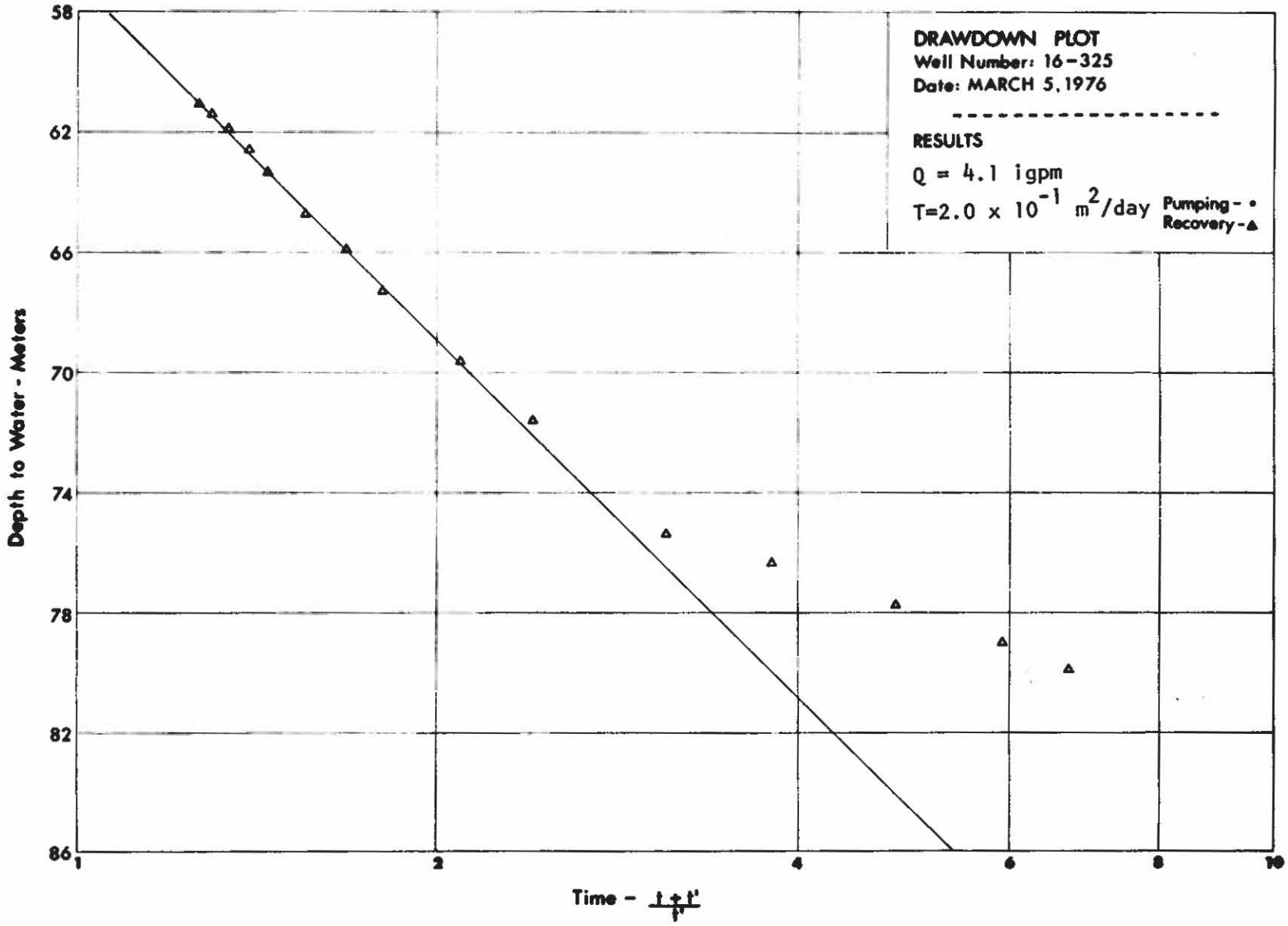
Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | in |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| material | st st | |

Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 16-325
Date: MARCH 5, 1976
RESULTS
Q = 4.1 igpm
T=2.0 x 10^-1 m^2/day
Pumping - •
Recovery - ▲
Depth to Water - Meters
58
62
66
70
74
78
82
86
1
2
4
6
8
10
Time - t + t'/t'

16-325-A-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Sample source Bailed from 16-325

Date sampled March 5, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 19.0 | 0.95 | 1.0 |
| Magnesium ($Mg^{++}$) | 16.9 | 1.39 | 1.5 |
| Sodium ($Na^{+}$) | 2025.0 | 88.08 | 96.7 |
| Potassium ($K^{+}$) | 25.4 | 0.65 | 0.7 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 813.0 | 13.33 | 14.0 |
| Sulfate ($SO_4^{=}$) | 37.4 | 0.78 | 0.8 |
| Chloride ($Cl^{-}$) | 2880.0 | 81.22 | 85.2 |
| Nitrate ($NO_3^{=}$) | 2.2 | 0.04 | 0.0 |
| Silica ($SiO_2$) | 15.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 5290.0 | | |
| Total Anions (epm) 95.3 | | Total Cations (epm) | 91.0 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | >8000 |
| pH | 8.0 |
| Fluoride ($F^{-}$) | 1.2 ppm |

Field:

| |
|---|
| Temperature (C) |
| pH |
| Carbonate ($CO_3^{=}$) |
| Bicarbonate ($HCO_3^{-}$) |
| Hydroxide ($OH^{-}$) |
| Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 4.0 | 0.20 | 0 |
| Magnesium ($Mg^{++}$) | 16.0 | 1.32 | 1 |
| Sodium ($Na^{+}$) | 2150.0 | 93.52 | 97 |
| Potassium ($K^{+}$) | 38.3 | 0.98 | 1 |
| Carbonate ($CO_3^{=}$) | 151.0 | 5.03 | 5 |
| Bicarbonate ($HCO_3^{-}$) | 603.0 | 9.88 | 10 |
| Sulfate ($SO_4^{=}$) | 45.7 | 0.95 | 1 |
| Chloride ($Cl^{-}$) | 3058.0 | 86.24 | 84 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 7.3 | | |
| Magnesium (Acidified) | 16.7 | | |
| Total dissolved solids | 5824 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 102.12 | Total Cations (epm) | 96.02 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 78000 | | Temperature (C) | 5.0 | |
| pH | 9.3 | | pH | 9.4 | |
| Fluoride ($F^{-}$) | 1.1 | Mg/L | Carbonate ($CO_3^{=}$) | 202 | Mg/L |
| | | | Bicarbonate ($HCO_3^{-}$) | 571 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.4 | 0.12 | 0.1 |
| Magnesium ($Mg^{++}$) | 14.0 | 1.15 | 1.2 |
| Sodium ($Na^{+}$) | 2138.0 | 93.00 | 97.6 |
| Potassium ($K^{+}$) | 41.3 | 1.06 | 1.1 |
| Carbonate ($CO_3^{=}$) | 185.0 | 6.17 | 5.3 |
| Bicarbonate ($HCO_3^{-}$) | 632.0 | 10.36 | 8.9 |
| Sulfate ($SO_4^{=}$) | 45.8 | 0.95 | 0.8 |
| Chloride ($Cl^{-}$) | 3500.0 | 98.70 | 85.0 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 0.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 4.3 | | |
| Magnesium (Acidified) | 13.6 | | |
| Total dissolved solids | 5596.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 116.19 | Total Cations (epm) | 95.33 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 6.0 |
| pH | 9.4 | pH | 9.5 |
| Fluoride ($F^{-}$) | 1.6 ppm | Carbonate ($CO_3^{=}$) | 216.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 586.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Date sampled: July 18, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .006 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 2541 |
| As | <.038 | Ni | <.010 |
| B | 3.29 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 7.68 | Si | 0.81 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .649 |
| Cr | <.006 | Te | <.065 |
| Cu | .011 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .022 | V | .004 |
| K | 99 | W | <.078 |
| Mg | 17.1 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

16-325-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Rge 10 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 04, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.5 | 0.07 | 0.1 |
| Magnesium(Mg) | 10.4 | 0.86 | 0.9 |
| Sodium(Na) | 2125.0 | 92.43 | 97.9 |
| Potassium(K) | 42.5 | 1.09 | 1.2 |
| Carbonate(CO3) | 187.0 | 6.23 | 5.9 |
| Bicarbonate(HCO3) | 678.0 | 11.11 | 10.5 |
| Sulphate(SO4) | 37.7 | 0.78 | 0.7 |
| Chloride(Cl) | 3100.0 | 87.42 | 82.8 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 0.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 3.9 | | |
| Magnesium(Acidified) | 12.3 | | |
| TDS(mg/l) | 5460.0 | | |
| Total Anions(epm) | 105.56 | Total Cations(epm) | 94.45 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 8350 | | Temperature(C) | 6.00 | |
| pH | 9.1 | | pH | 9.4 | |
| Fluoride(F) | 0.8 | mg/l | Carbonate(CO3) | 57 | mg/l |
| | | | Bicarbonate(HCO3) | 356 | mg/l |
| | | | Hydroxide(OH) | | |

16-325-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Rge 10 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 3, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.2 | 0.11 | 0.1 |
| Magnesium(Mg) | 11.4 | 0.94 | 1.0 |
| Sodium(Na) | 2150.0 | 93.52 | 97.9 |
| Potassium(K) | 37.5 | 0.96 | 1.0 |
| Carbonate(CO3) | 168.0 | 5.60 | 5.7 |
| Bicarbonate(HCO3) | 725.0 | 11.88 | 12.2 |
| Sulphate(SO4) | 37.0 | 0.77 | 0.8 |
| Chloride(Cl) | 2820.0 | 79.53 | 81.3 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.0 |
| Silica(SiO2) | 0.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 3.6 | | |
| Magnesium(Acidified) | 10.1 | | |
| TDS(mg/l) | 5426.0 | | |
| Total Anions(epm) | 97.79 | Total Cations(epm) | 95.53 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 8700 | Temperature(C) | 5.00 | |
| pH | 9.3 | pH | 9.4 | |
| Fluoride(F) | 1.3 mg/l | Carbonate(CO3) | 225 | mg/l |
| | | Bicarbonate(HCO3) | 629 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 16-325-E-82

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Rge 10 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 7, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.0 | 0.10 | 0.1 |
| Magnesium(Mg) | 11.0 | 0.92 | 1.0 |
| Sodium(Na) | 2162.0 | 94.00 | 97.7 |
| Potassium(K) | 48.0 | 1.23 | 1.3 |
| Carbonate(CO3) | 175.0 | 5.83 | 6.1 |
| Bicarbonate(HCO3) | 854.0 | 14.00 | 14.8 |
| Sulphate(SO4) | 18.0 | 0.38 | 0.4 |
| Chloride(Cl) | 2650.0 | 74.65 | 78.7 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.0 |
| Silica(SiO2) | 0.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 3.4 | | |
| Magnesium(Acidified) | 11.0 | | |
| TDS(mg/l) | 5356.0 | | |
| Total Anions(epm) | 94.86 | Total Cations(epm) | 96.25 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 9800 |
| pH | 9.4 |
| Fluoride | 0.9 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 5.00 | |
| pH | 9.3 | |
| Carbonate(CO3) | 226 | mg/l |
| Bicarbonate(HCO3) | 737 | mg/l |
| Hydroxide(OH) | | |

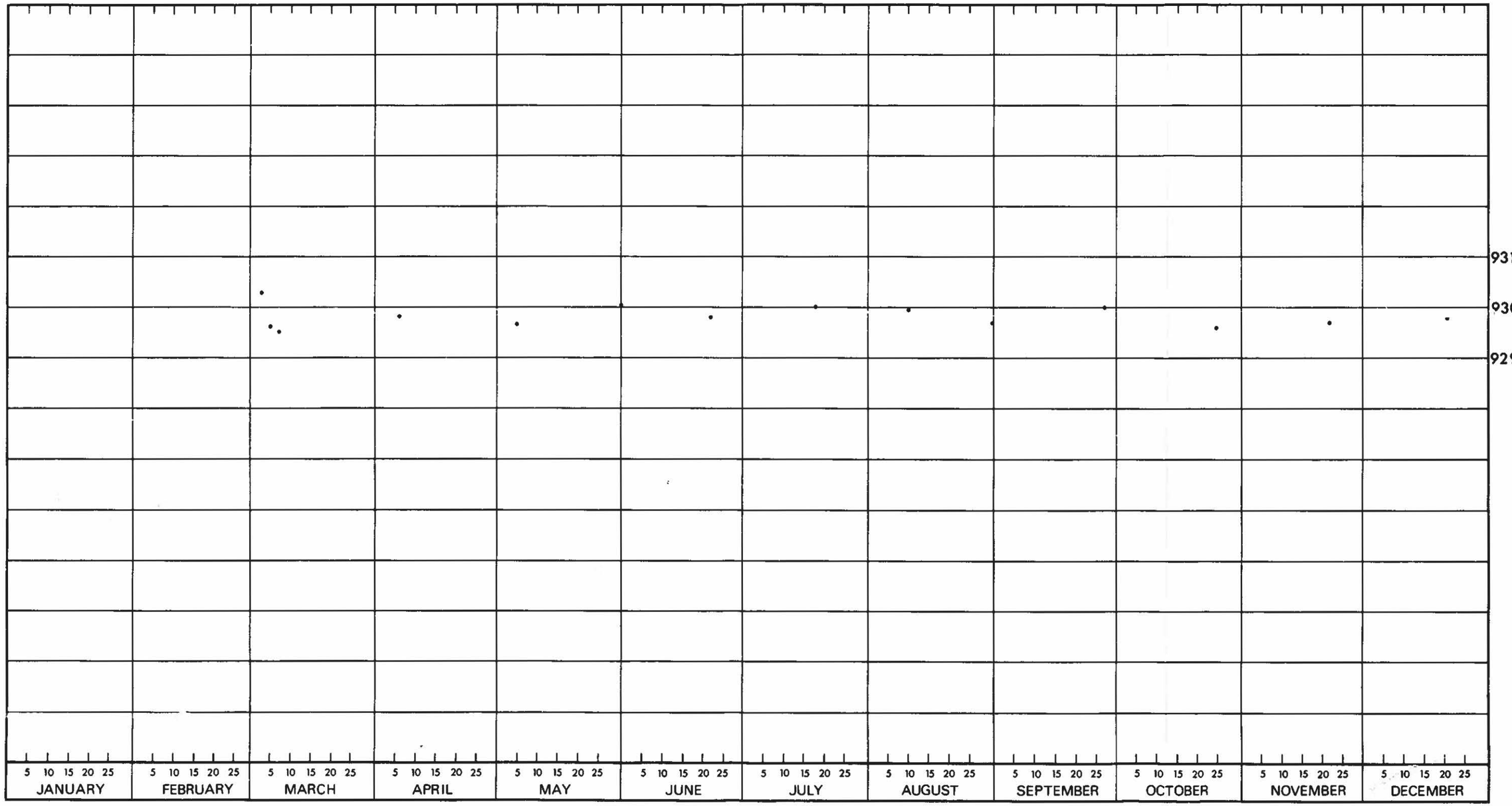
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-325

16 - 325 - H - 77

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council




1976

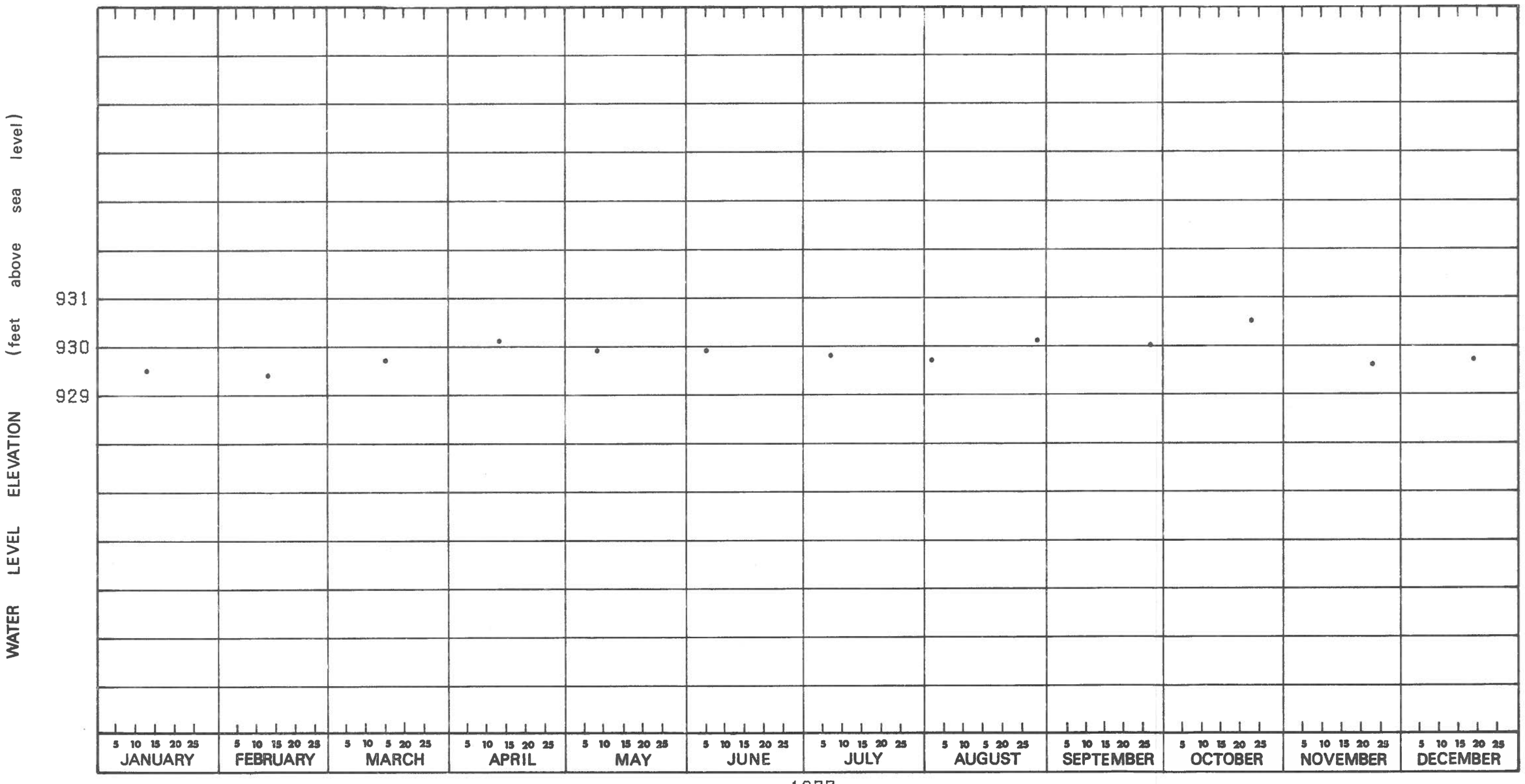
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council

16-325-H-78



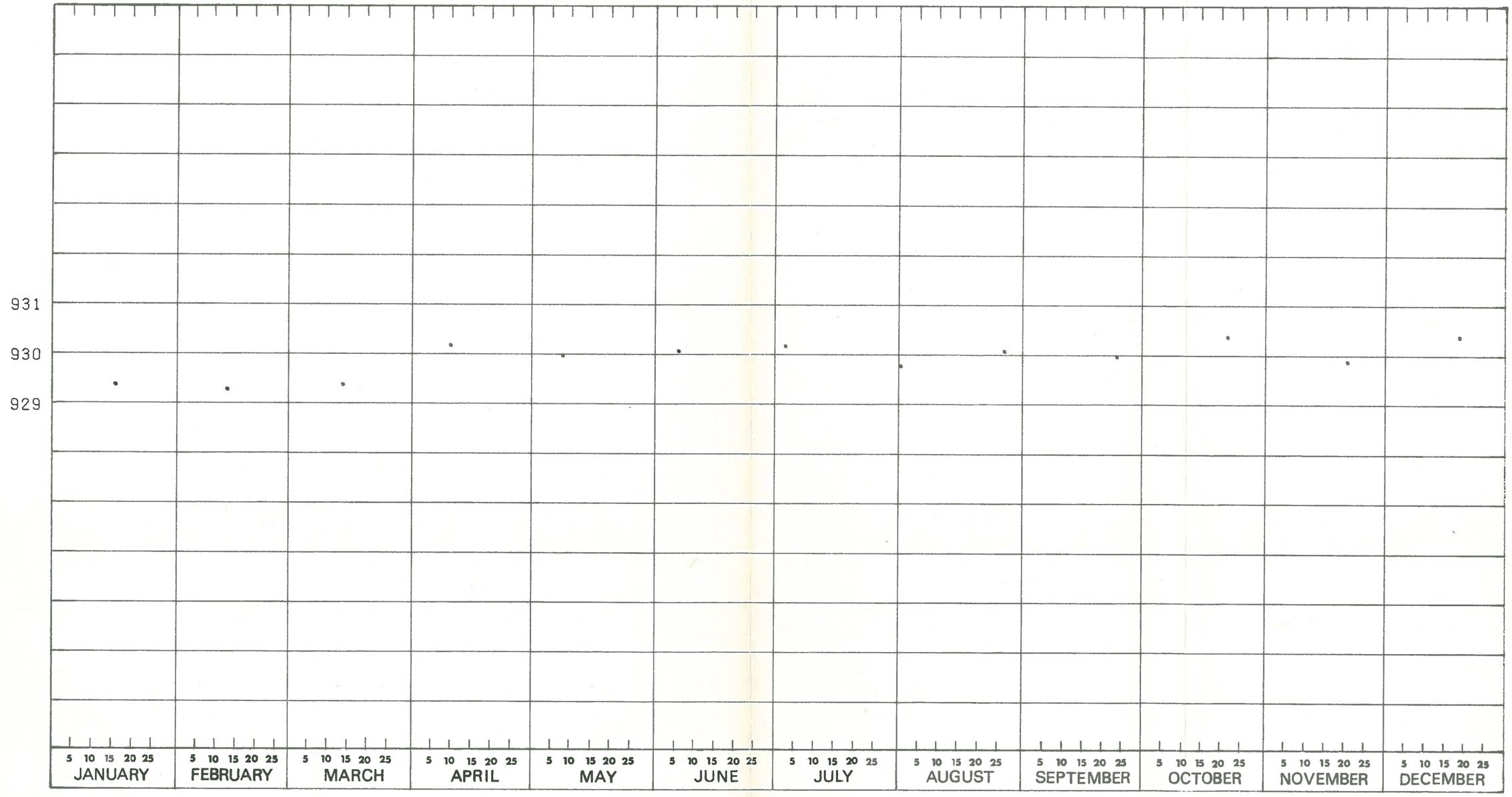
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-325

LSD 6 SEC 13 TWP 90 R 10 W4TH

16-325-H-79

Alberta Research Council




1978

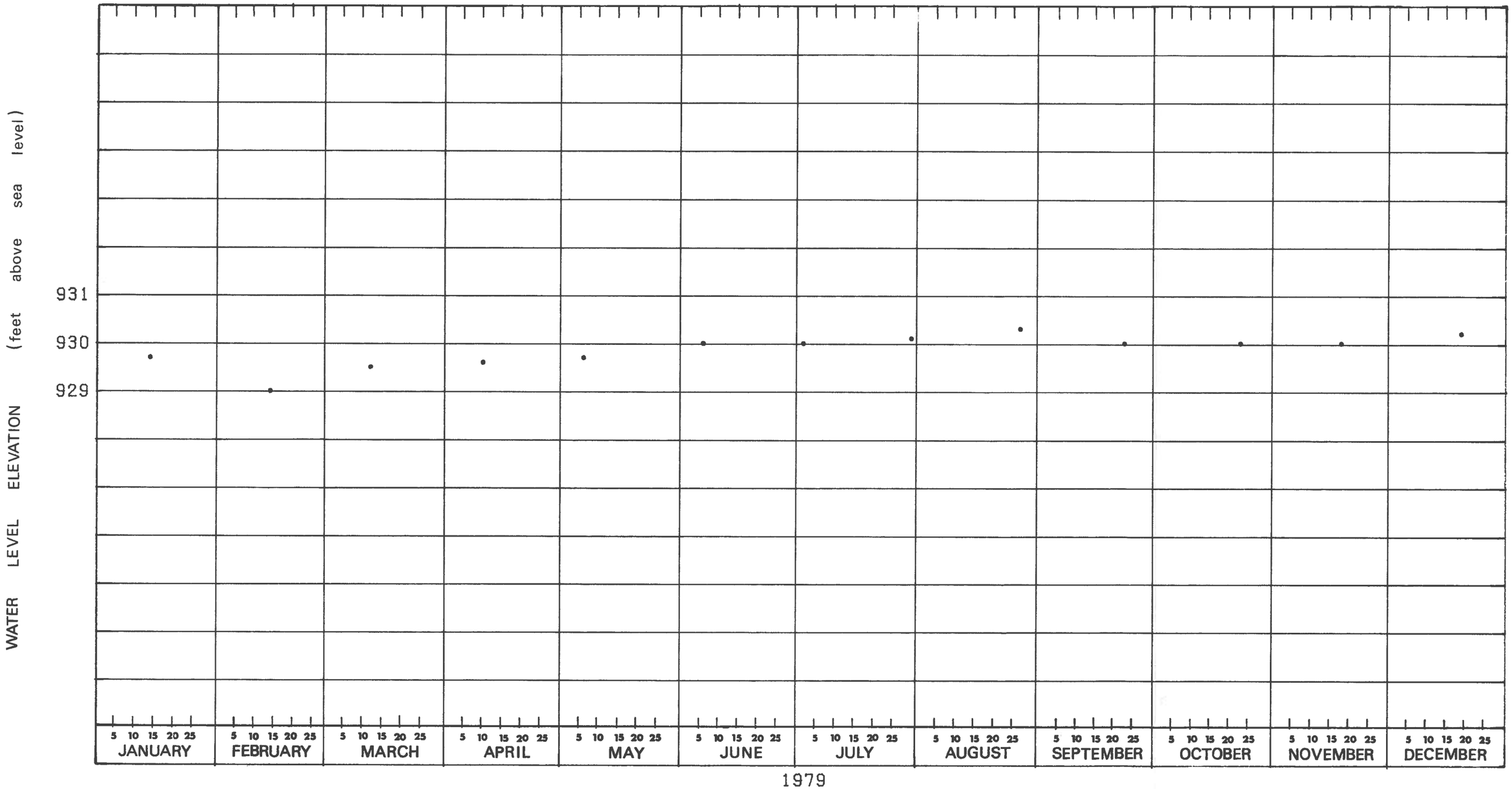
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-325

16-325-H-80

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council



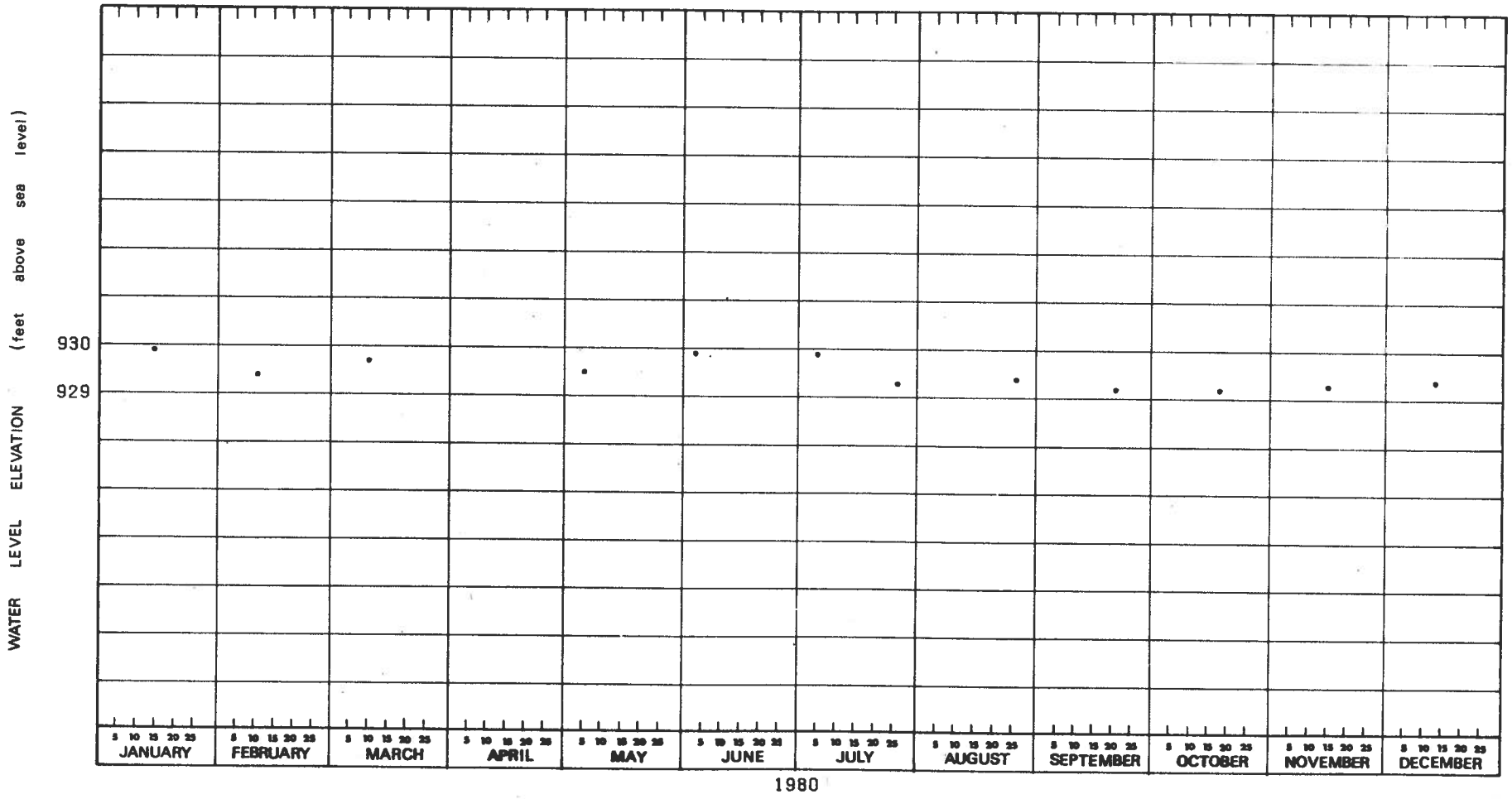
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council

16-325-H-81



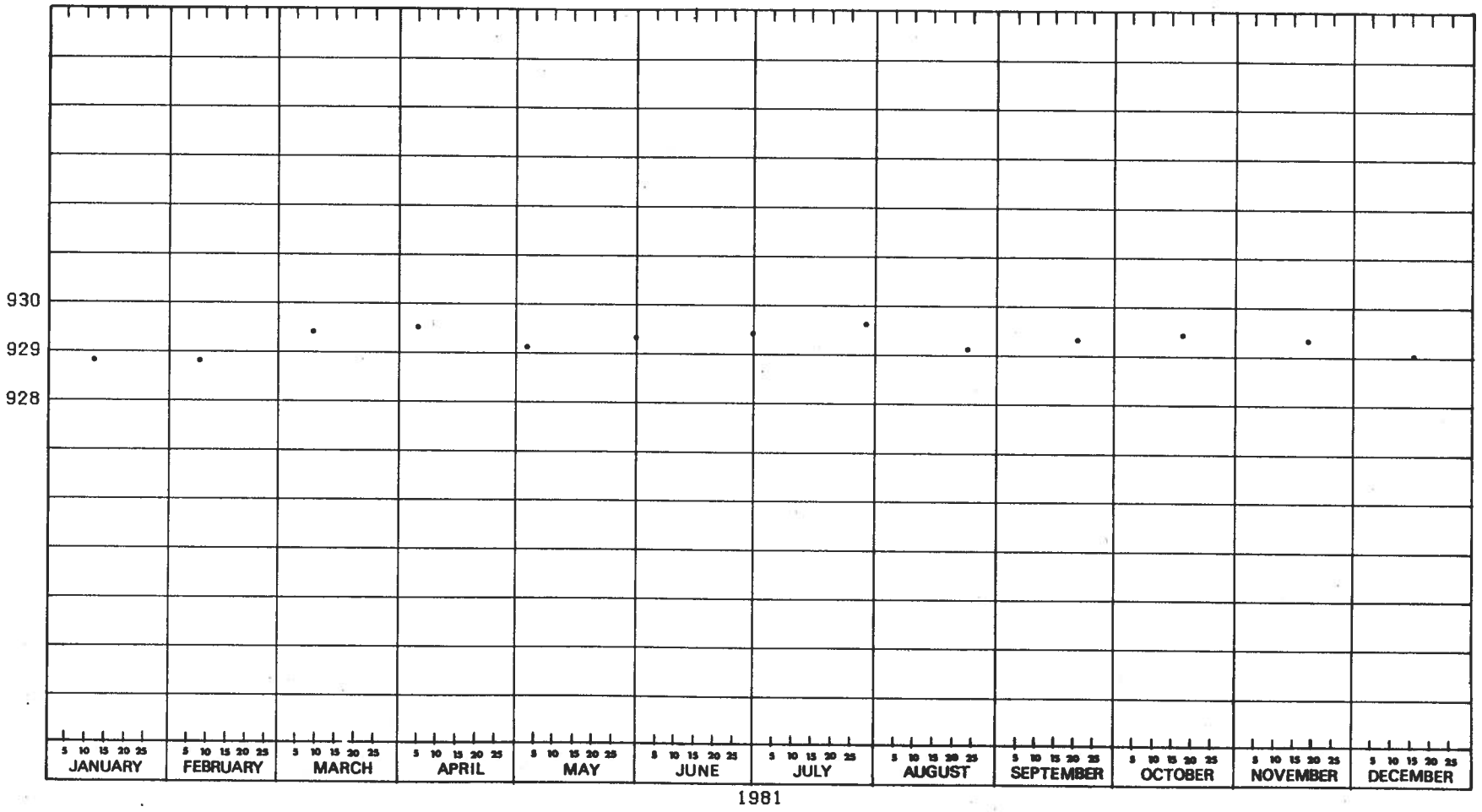
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-325

16-325-H-82

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.10

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar 3/76 | 59.09 TOC | 930.3 | Well completed; blown with air |
| Mar 5/76 | 59.30 TOC | 929.6 | Bail test Q = 4.1 IGPM<br>T = 13 IGPD/FT |
| Mar 7/76 | 60.05 MP | 929.5 | MP = 0.72 m TOC, (1126.5) |
| Apr 6/76 | 59.95 MP | 929.9 | |
| May 5/76 | 60.00 MP | 929.7 | |
| May 31/76 | 59.88 MP | 930.1 | |
| June 22/76 | 59.95 MP | 929.9 | |
| July 18/76 | 59.90 MP | 930.0 | Sampled; temp. 5°C |
| Aug 10/76 | 59.91 MP | 930.0 | |
| Aug 31/76 | 59.99 MP | 929.7 | |
| Sept 27/76 | 59.90 MP | 930.0 | |
| Oct 25/76 | 60.04 MP | 929.6 | |
| Nov 22/76 | 59.99 MP | 929.7 | |
| Dec 21/76 | 59.96 MP | 929.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.10

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 60.07 MP | 929.5 | MP (1126.5) |
| Feb 14/77 | 60.09 MP | 929.4 | |
| Mar 16/77 | 60.00 MP | 929.7 | |
| Apr 14/77 | 59.88 MP | 930.1 | |
| May 9/77 | 59.95 MP | 929.9 | |
| June 6/77 | 59.94 MP | 929.9 | |
| July 8/77 | 59.97 MP | 929.8 | Sampled; temp. 6°C |
| Aug 3/77 | 60.00 MP | 929.7 | |
| Aug 30/77 | 59.89 MP | 930.1 | |
| Sept 28/77 | 59.91 MP | 930.0 | |
| Oct 24/77 | 59.76 MP | 930.5 | |
| Nov 24/77 | 60.03 MP | 929.6 | |
| Dec 20/77 | 60.00 MP | 929.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.10

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 60.08 MP | 929.4 | MP (1126.5) |
| Feb 14/78 | 60.12 MP | 929.3 | |
| Mar 15/78 | 60.09 MP | 929.4 | |
| Apr 11/78 | 59.85 MP | 930.2 | |
| May 9/78 | 59.91 MP | 930.0 | |
| June 7/78 | 59.89 MP | 930.1 | |
| July 4/78 | 59.85 MP | 930.2 | Sampled; temp 6°C |
| Aug 2/78 | 59.96 MP | 929.8 | |
| Aug 28/78 | 59.89 MP | 930.1 | |
| Sept 25/78 | 59.91 MP | 930.0 | |
| Oct 23/78 | 59.79 MP | 930.4 | |
| Nov 22/78 | 59.93 MP | 929.9 | |
| Dec 20/78 | 59.80 MP | 930.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-325

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.10

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/79 | 60.00 MP | 929.7 | MP (1126.5) |
| Feb 15/79 | 60.20 MP | 929.0 | |
| Mar 13/79 | 60.05 MP | 929.5 | |
| Apr 11/79 | 60.03 MP | 929.6 | |
| May 7/79 | 60.01 MP | 929.7 | |
| June 7/79 | 59.92 MP | 930.0 | |
| July 3/79 | 59.92 MP | 930.0 | Sampled; temp. 5°C |
| July 31/79 | 59.88 MP | 930.1 | |
| Aug 28/79 | 59.83 MP | 930.3 | |
| Sept 24/79 | 59.92 MP | 930.0 | |
| Oct 24/79 | 59.92 MP | 930.0 | |
| Nov 19/79 | 59.91 MP | 930.0 | |
| Dec 20/79 | 59.85 MP | 930.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

16 - 325 - W - 82

WELL HISTORY

OBSERVATION WELL NUMBER 16 - 325

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.10

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 59.94 MP | 929.9 | |
| Feb 12/80 | 60.10 MP | 929.4 | |
| Mar 12/80 | 60.00 MP | 929.7 | |
| Apr 8/80 | | | Could not measure |
| May 7/80 | 60.07 MP | 929.5 | |
| June 5/80 | 59.89 MP | 929.9 | New MP 0.67 m TOC (1126.3) |
| July 7/80 | 59.87 MP | 929.9 | Temp. 5°C |
| July 10/80 | | | Bailed well to clean, sampled t=6°C cond.=13500 |
| July 28/80 | 60.06 MP | 929.3 | |
| Aug 28/80 | 60.04 MP | 929.4 | |
| Sept 23/80 | 60.09 MP | 929.2 | |
| Oct 20/80 | 60.09 MP | 929.2 | |
| Nov 17/80 | 60.05 MP | 929.3 | |
| Dec 15/80 | 60.03 MP | 929.4 | |
| Jan 13/81 | 60.21 MP | 928.8 | |
| Feb 9/81 | 60.22 MP | 928.8 | |
| Mar 10/81 | 60.03 MP | 929.4 | |
| Apr 6/81 | 59.99 MP | 929.5 | |
| May 4/81 | 60.12 MP | 929.1 | |
| June 1/81 | 60.07 MP | 929.3 | |
| July 1/81 | 60.04 MP | 929.4 | |
| July 30/81 | 59.96 MP | 929.6 | |
| Aug 25/81 | 60.13 MP | 929.1 | |
| Sept 22/81 | 60.07 MP | 929.3 | |
| Oct 19/81 | 60.03 MP | 929.4 | |
| Nov 20/81 | 60.07 MP | 929.3 | |
| Dec 17/81 | 60.16 MP | 929.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 42.0 | 2.10 | 3 |
| Magnesium ($Mg^{++}$) | 14.0 | 1.15 | 2 |
| Sodium ($Na^{+}$) | 1450.0 | 63.07 | 94 |
| Potassium ($K^{+}$) | 27.1 | 0.69 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 127.0 | 2.08 | 3 |
| Sulfate ($SO_4^{=}$) | 477.0 | 9.93 | 15 |
| Chloride ($Cl^{-}$) | 1920.0 | 54.15 | 82 |
| Nitrate ($NO_3^{=}$) | 2.7 | 0.04 | 0 |
| Silica ($SiO_2$) | 15.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 44.0 | | |
| Magnesium (Acidified) | 11.8 | | |
| Total dissolved solids | 3520 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 66.20 | Total Cations (epm) | 67.01 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 7000 | | Temperature (C) | 7.0 | |
| pH | 8.1 | | pH | 8.5 | |
| Fluoride ($F^{-}$) | 0.5 | Mg/L | Carbonate ($CO_3^{=}$) | 24 | Mg/L |
| | | | Bicarbonate ($HCO_3^{-}$) | 146 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 65.0 | 3.24 | 2.6 |
| Magnesium ($Mg^{++}$) | 55.0 | 4.53 | 3.7 |
| Sodium ($Na^{+}$) | 2638.0 | 114.75 | 93.1 |
| Potassium ($K^{+}$) | 29.2 | 0.75 | 0.6 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 310.0 | 5.08 | 3.9 |
| Sulfate ($SO_4^{=}$) | 842.0 | 17.53 | 13.6 |
| Chloride ($Cl^{-}$) | 3780.0 | 106.60 | 82.5 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 8.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 65.0 | | |
| Magnesium (Acidified) | 50.0 | | |
| Total dissolved solids | 7558.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 129.21 | Total Cations (epm) | 123.26 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 6.0 |
| pH | 7.8 | pH | 7.7 |
| Fluoride ($F^{-}$) | 1.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 688.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Date sampled: July 18, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .015 |
| Au | <.003 | Mo | <.006 |
| Al | 0.11 | Na | 1463 |
| As | <.038 | Ni | <.010 |
| B | 1.85 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 50.05 | Si | 7.52 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 1.17 |
| Cr | <.006 | Te | <.065 |
| Cu | .032 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .17 | V | .006 |
| K | 66 | W | <.078 |
| Mg | 13.1 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Rge 10 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 04, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 76.0 | 3.79 | 2.1 |
| Magnesium(Mg) | 73.0 | 6.01 | 3.3 |
| Sodium(Na) | 3938.0 | 171.29 | 94.2 |
| Potassium(K) | 31.7 | 0.81 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 505.0 | 8.28 | 4.2 |
| Sulphate(SO4) | 910.0 | 18.95 | 9.6 |
| Chloride(Cl) | 6000.0 | 169.20 | 86.1 |
| Nitrate(NO3) | 0.9 | 0.01 | 0.0 |
| Silica(SiO2) | 3.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 100.0 | | |
| Magnesium(Acidified) | 79.0 | | |
| TDS(mg/l) | 10788.0 | | |
| Total Anions(epm) | 196.44 | Total Cations(epm) | 181.90 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 15600 | | Temperature(C) | 8.50 | |
| pH | 7.5 | | pH | 7.6 | |
| Fluoride(F) | 0.7 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 503 | mg/l |
| | | | Hydroxide(OH) | | |

16-550-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Rge 10 Twp 90 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 3, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 88.0 | 4.39 | 1.9 |
| Magnesium(Mg) | 96.0 | 7.90 | 3.5 |
| Sodium(Na) | 4875.0 | 212.05 | 94.2 |
| Potassium(K) | 33.3 | 0.85 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 561.0 | 9.20 | 4.1 |
| Sulphate(SO4) | 1150.0 | 23.94 | 10.8 |
| Chloride(Cl) | 6700.0 | 188.95 | 85.1 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 3.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 82.0 | | |
| Magnesium(Acidified) | 86.0 | | |
| TDS(mg/l) | 12444.0 | | |
| Total Anions(epm) | 222.09 | Total Cations(epm) | 225.19 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 12300 | Temperature(C) | 7.00 | |
| pH | 8.0 | pH | 7.7 | |
| Fluoride(F) | 1.1 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 590 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 16-550-E-82

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Rge 10 Twp 90 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 7, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 85.0 | 4.25 | 1.8 |
| Magnesium(Mg) | 108.0 | 9.00 | 3.9 |
| Sodium(Na) | 5025.0 | 218.48 | 93.9 |
| Potassium(K) | 41.0 | 1.05 | 0.5 |
| Carbonate(CO3) | 33.6 | 1.12 | 0.5 |
| Bicarbonate(HCO3) | 456.0 | 7.48 | 3.1 |
| Sulphate(SO4) | 950.0 | 19.79 | 8.3 |
| Chloride(Cl) | 7500.0 | 211.27 | 88.2 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 3.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 70.0 | | |
| Magnesium(Acidified) | 93.0 | | |
| TDS(mg/l) | 13848.0 | | |
| Total Anions(epm) | 239.65 | Total Cations(epm) | 232.78 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 21999 |
| pH | 8.5 |
| Fluoride | 0.0 mg/l |

Field:

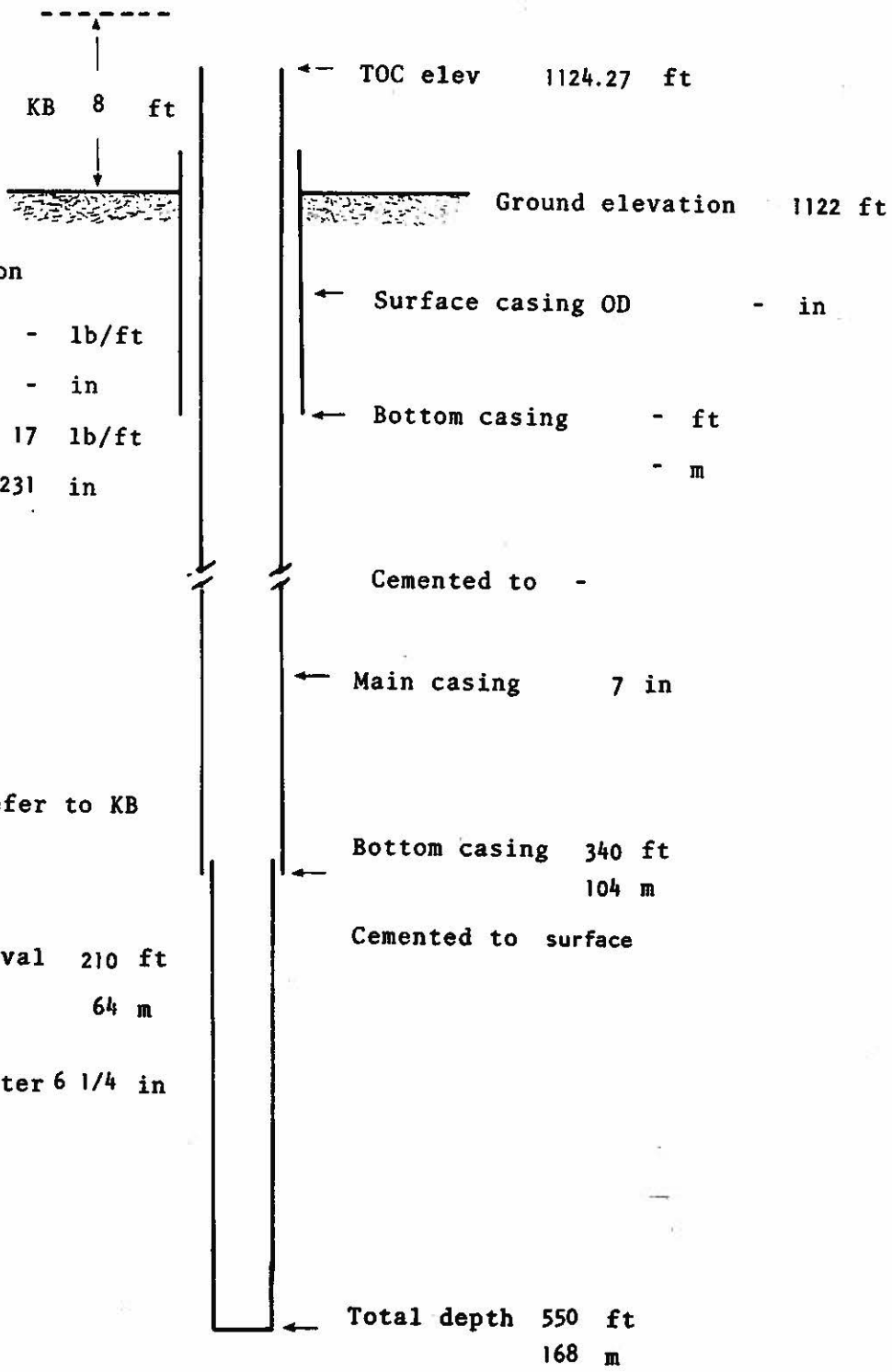
| | | |
|---|---|---|
| Temperature | 8.00 | |
| pH | 7.6 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 620 | mg/l |
| Hydroxide(OH) | | |

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Tp 90 R 10 W 4th

Alberta Research Council




Construction

Surface casing - lb/ft

wall thickness - in

Main casing 17 lb/ft

wall thickness .231 in

Note: all depths refer to KB

Open hole interval 210 ft

64 m

Open hole diameter 6 1/4 in

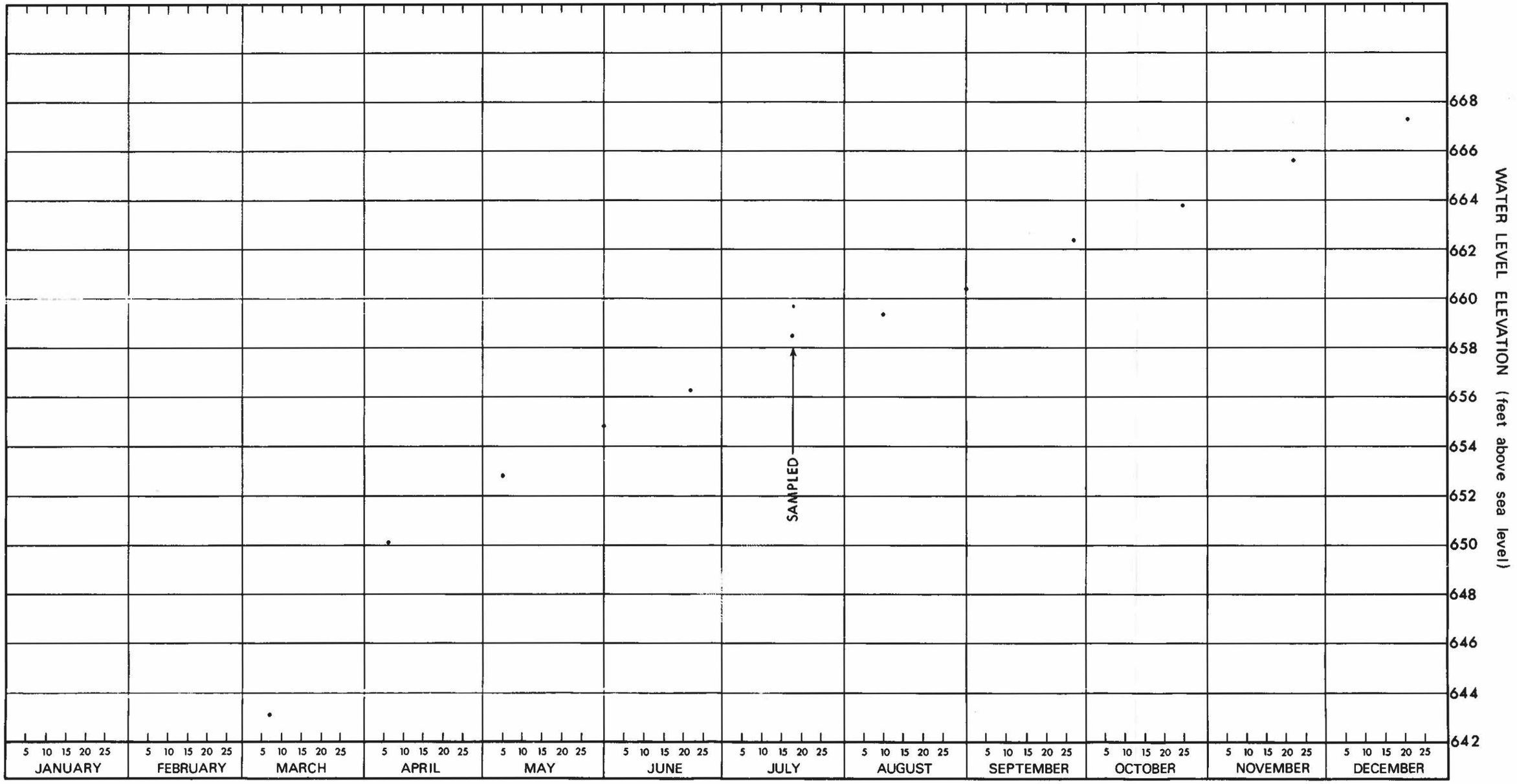
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-550

16 - 550 - H - 77

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council




1976

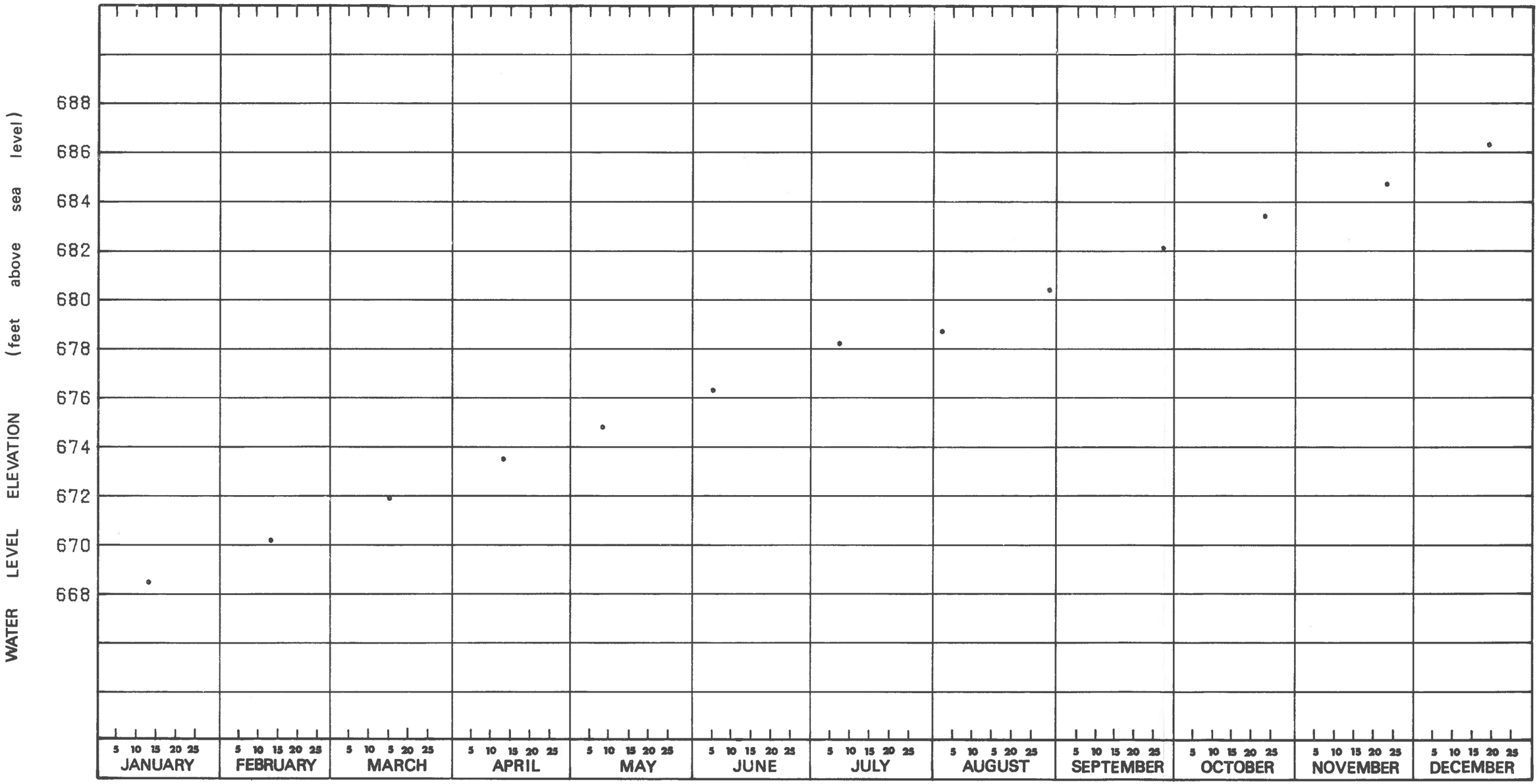
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-550

16-550-H-78

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council




1977

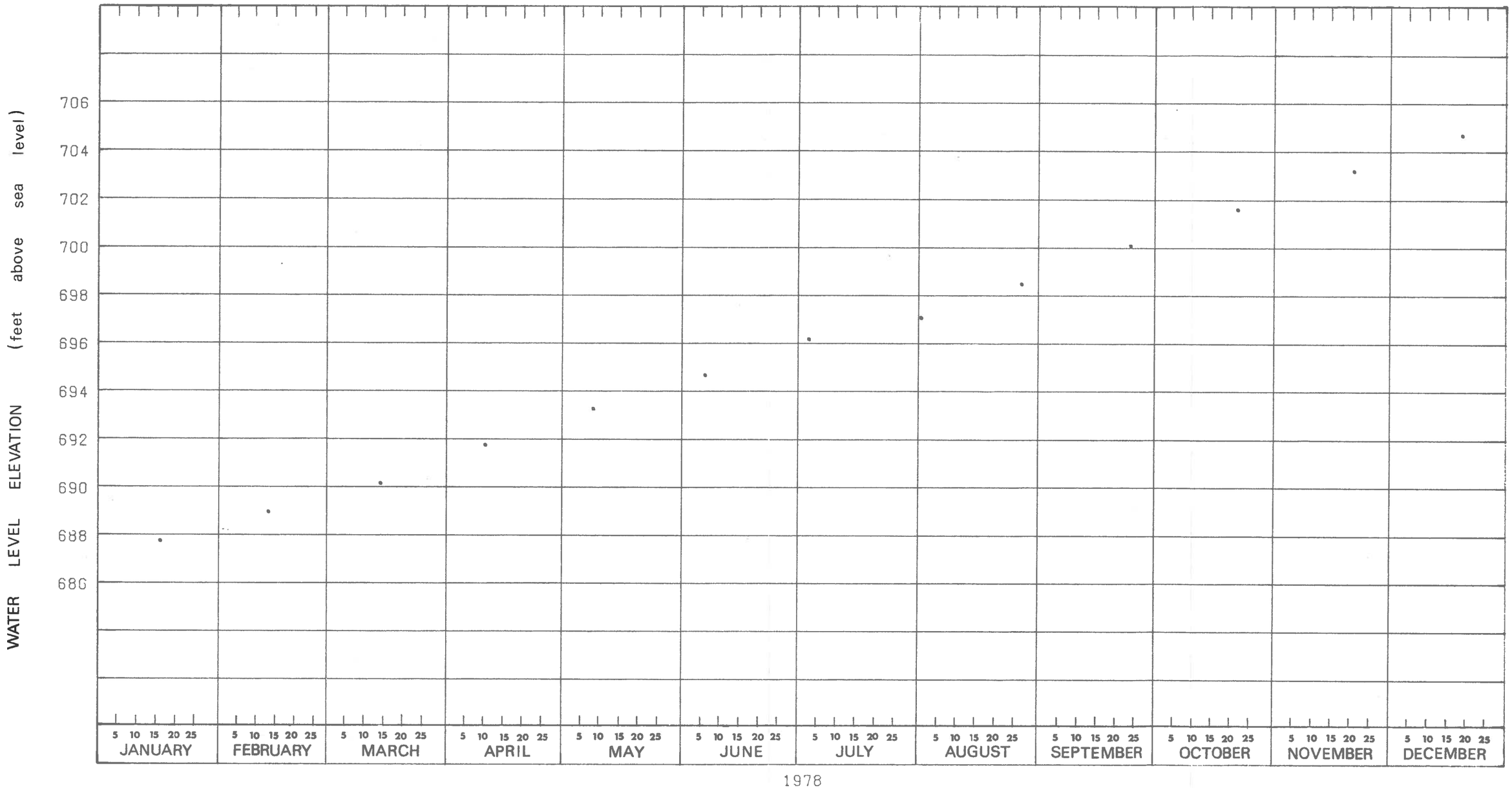
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-550

LSD 6 SEC 13 TWP 90 R 10 W4TH

16-550-H-79

Alberta Research Council




1978

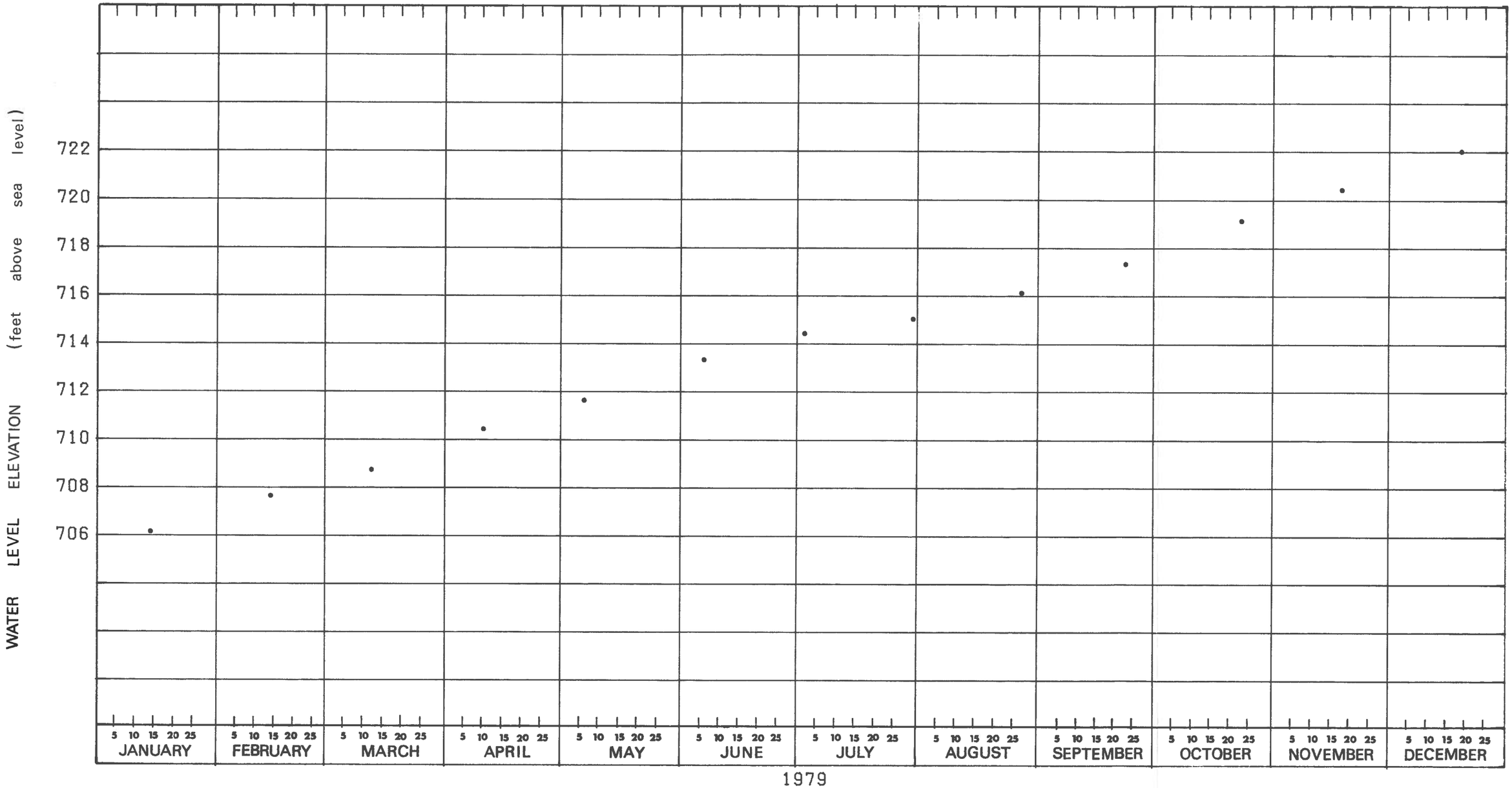
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council

16-550-H-80



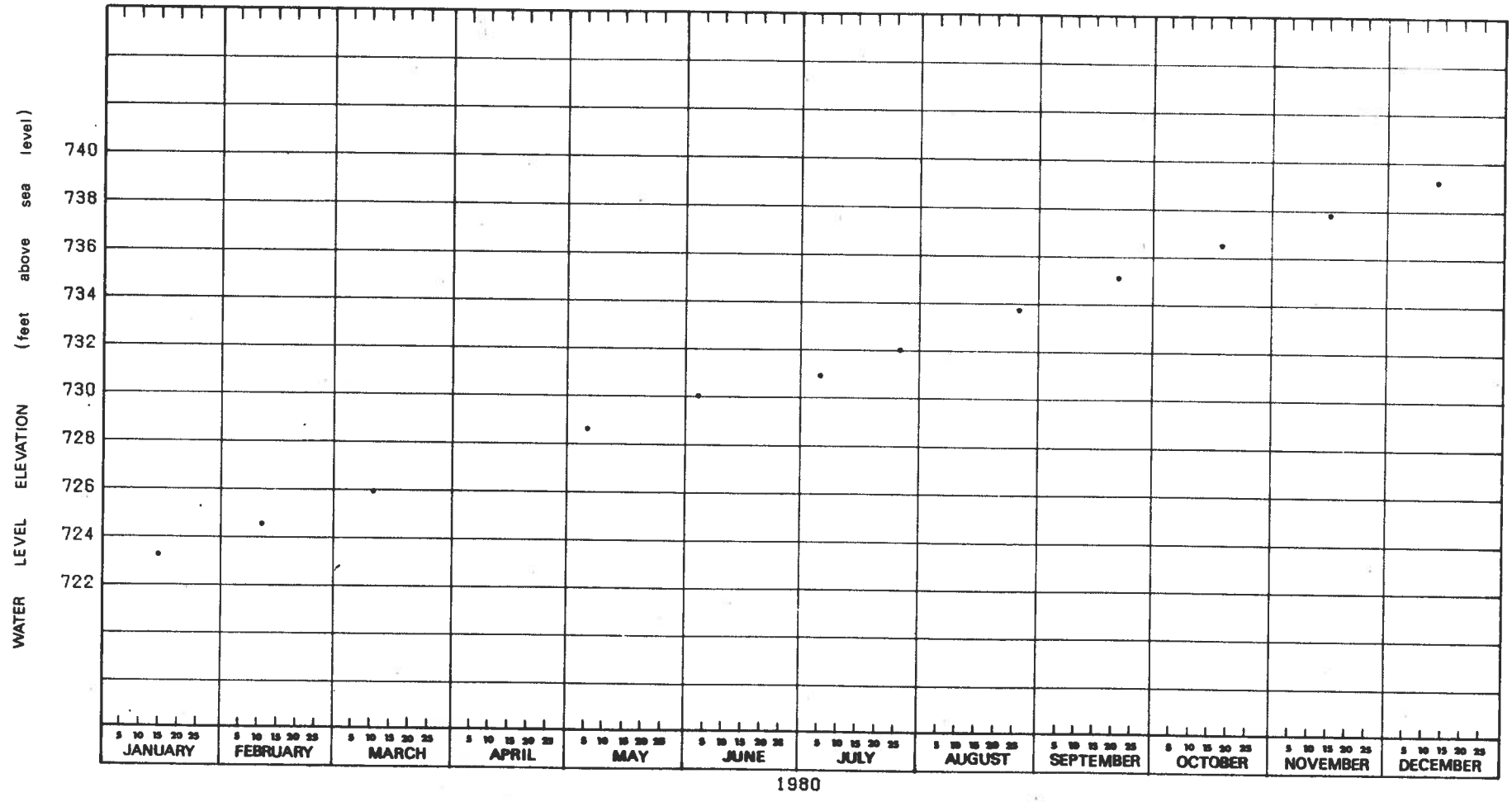
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council

16-550-H-81



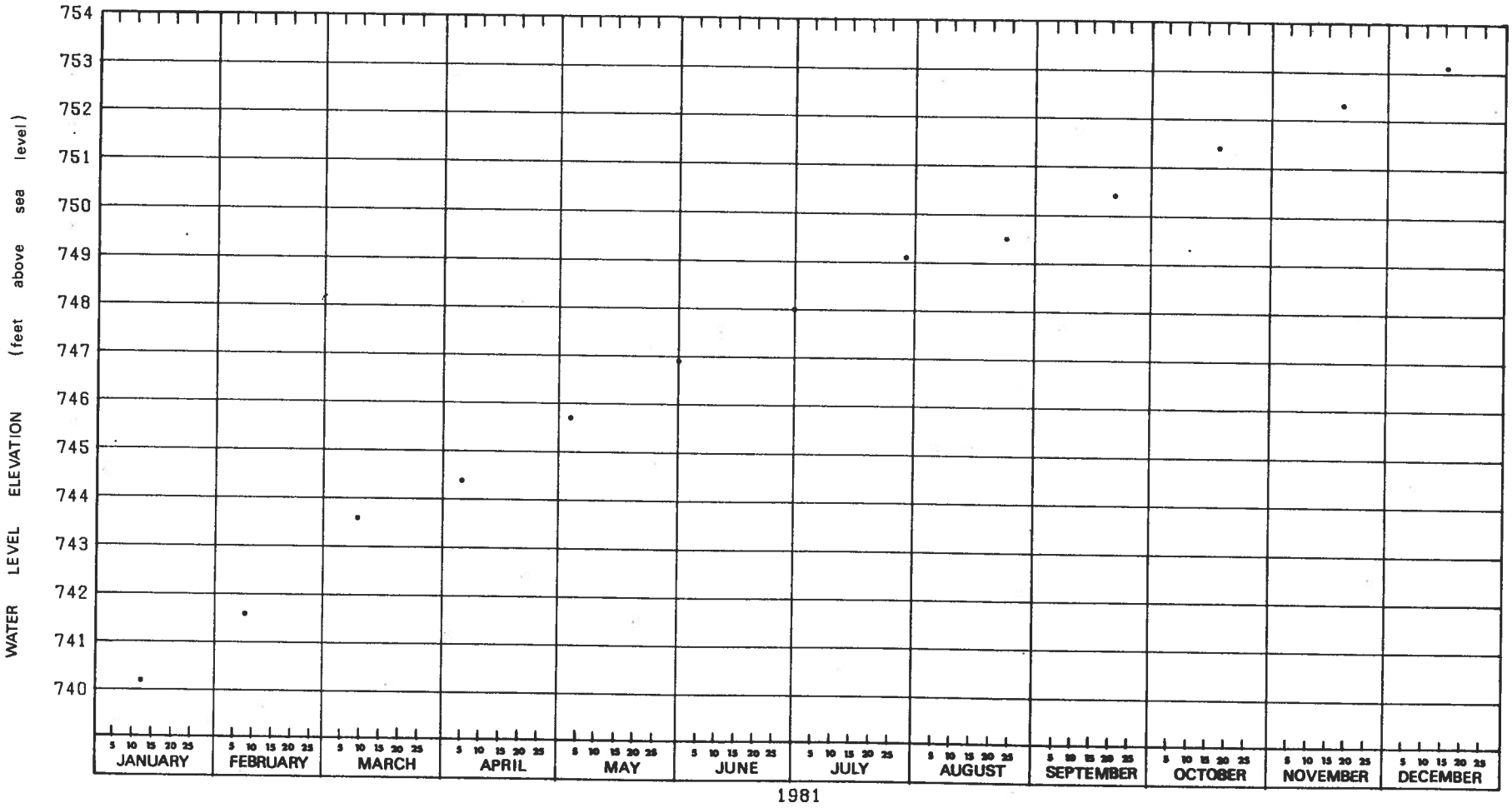
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Twp 90 R 10 W4 th

Alberta Research Council

16-550-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.27

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar 1/76 | | | Well completed; blown with air |
| Mar 7/76 | 147.30 MP | 643.2 | MP = 0.61 m TOC, (1126.3) |
| Apr 6/76 | 145.17 MP | 650.1 | |
| May 5/76 | 144.35 MP | 652.8 | |
| May 31/76 | 143.72 MP | 654.9 | |
| June 22/76 | 143.28 MP | 656.3 | |
| July 18/76 | 142.62 MP | 658.5 | Sampled; temp. 7°C |
| Aug 10/76 | 142.35 MP | 659.4 | |
| Aug 31/76 | 142.04 MP | 660.4 | |
| Sept 27/76 | 141.43 MP | 662.4 | |
| Oct 25/76 | 141.00 MP | 663.8 | |
| Nov 22/76 | 140.46 MP | 665.6 | |
| Dec 21/76 | 139.95 MP | 667.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.27

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 139.58 MP | 668.5 | MP (1126.3) |
| Feb 14/77 | 139.04 MP | 670.2 | |
| Mar 16/77 | 138.55 MP | 671.9 | |
| Apr 14/77 | 138.06 MP | 673.5 | |
| May 9/77 | 137.65 MP | 674.8 | |
| June 6/77 | 137.19 MP | 676.3 | |
| July 8/77 | 136.62 MP | 678.2 | Sampled; temp. 6°C |
| Aug 3/77 | 136.46 MP | 678.7 | |
| Aug 30/77 | 135.93 MP | 680.4 | |
| Sept 28/77 | 135.43 MP | 682.1 | |
| Oct 24/77 | 135.02 MP | 683.4 | |
| Nov 24/77 | 134.64 MP | 684.7 | |
| Dec 20/77 | 134.14 MP | 686.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.27

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 133.70 MP | 687.8 | MP (1126.3) |
| Feb 14/78 | 133.31 MP | 689.0 | |
| Mar 15/78 | 132.96 MP | 690.2 | |
| Apr 11/78 | 132.47 MP | 691.8 | |
| May 9/78 | 132.02 MP | 693.3 | |
| June 7/78 | 131.57 MP | 694.7 | |
| July 4/78 | 131.13 MP | 696.2 | Sampled; temp 8.5°C |
| Aug 2/78 | 130.86 MP | 697.1 | |
| Aug 28/78 | 130.42 MP | 698.5 | |
| Sept 25/78 | 129.95 MP | 700.1 | |
| Oct 23/78 | 129.48 MP | 701.6 | |
| Nov 22/78 | 128.98 MP | 703.2 | |
| Dec 20/78 | 128.52 MP | 704.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16-550

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.27

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/79 | 128.12 MP | 706.1 | MP (1126.3) |
| Feb 15/79 | 127.66 MP | 707.6 | |
| Mar 13/79 | 127.33 MP | 708.7 | |
| Apr 11/79 | 126.80 MP | 710.4 | |
| May 7/79 | 126.42 MP | 711.6 | |
| June 7/79 | 125.92 MP | 713.3 | |
| July 3/79 | 125.59 MP | 714.4 | Sampled; temp. 7°C |
| July 31/79 | 125.40 MP | 715.0 | |
| Aug 28/79 | 125.07 MP | 716.1 | |
| Sept 24/79 | 124.68 MP | 717.3 | |
| Oct 24/79 | 124.13 MP | 719.1 | |
| Nov 19/79 | 123.75 MP | 720.4 | |
| Dec 20/79 | 123.27 MP | 722.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 16 - 550

Lsd 6 Sec 13 Twp 90 R 10 W4th

Alberta Research Council

Elevation of top of casing 1124.27

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 122.90 MP | 723.2 | |
| Feb 12/80 | 122.50 MP | 724.5 | |
| Mar 12/80 | 122.08 MP | 725.9 | |
| Apr 8/80 | | | Could not measure |
| May 7/80 | 121.26 MP | 728.6 | |
| June 5/80 | 120.82 MP | 730.0 | |
| July 7/80 | 120.55 MP | 730.9 | Temp. 8°C |
| July 28/80 | 120.20 MP | 732.0 | |
| Aug 28/80 | 119.69 MP | 733.7 | |
| Sept 23/80 | 119.26 MP | 735.1 | |
| Oct 20/80 | 118.84 MP | 736.5 | |
| Nov 17/80 | 118.44 MP | 737.8 | |
| Dec 15/80 | 118.03 MP | 739.2 | |
| Jan 13/81 | 117.70 MP | 740.2 | |
| Feb 9/81 | 117.27 MP | 741.6 | |
| Mar 10/81 | 116.68 MP | 743.6 | |
| Apr 6/81 | 116.44 MP | 744.4 | |
| May 4/81 | 116.04 MP | 745.7 | |
| June 1/81 | 115.67 MP | 746.9 | |
| July 1/81 | 115.34 MP | 748.0 | |
| July 30/81 | 114.99 MP | 749.1 | |
| Aug 25/81 | 114.87 MP | 749.5 | |
| Sept 22/81 | 114.60 MP | 750.4 | |
| Oct 19/81 | 114.30 MP | 751.4 | |
| Nov 20/81 | 114.02 MP | 752.3 | |
| Dec 17/81 | 113.79 MP | 753.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

SITE SEVENTEEN
13-12-94-11 W4TH

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites (numbers 1, 2, 3, 6, 7, 8 and 9), containing 36 individual wells, were instrumented in this manner during the winter of 1974-75. Eight sites (numbered 10, 11, 12, 13, 14, 15 16 and 17), containing 38 individual wells, were instrumented during the winter of 1975-76.

The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill stem test results, 4) aquifer testing results, 5) well history, 6) water analyses, and 7) well completion details. The page indexing system is also consistent with the updating process. All update volumes will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this Introduction and a Legend. There are 15 piezometer nests in the system and thus there are 15 separate

site publications in Information Series 69. Table 1 lists the location of wells in the system as of August 31, 1976. Figure 1 indicates the location of these wells. Publications are available as of the date of this document for all sites.

Five oil companies have made available a total of nine wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing.

## ACKNOWLEDGMENTS

The installation and monitoring of wells in this Program was funded by Alberta Energy and Natural Resources; Non-Renewable Resources Division.

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of August 31, 1976: BPOG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., Shell Canada Ltd. and Home Oil Company Ltd.

D. Hackbarth

EDMONTON

1977

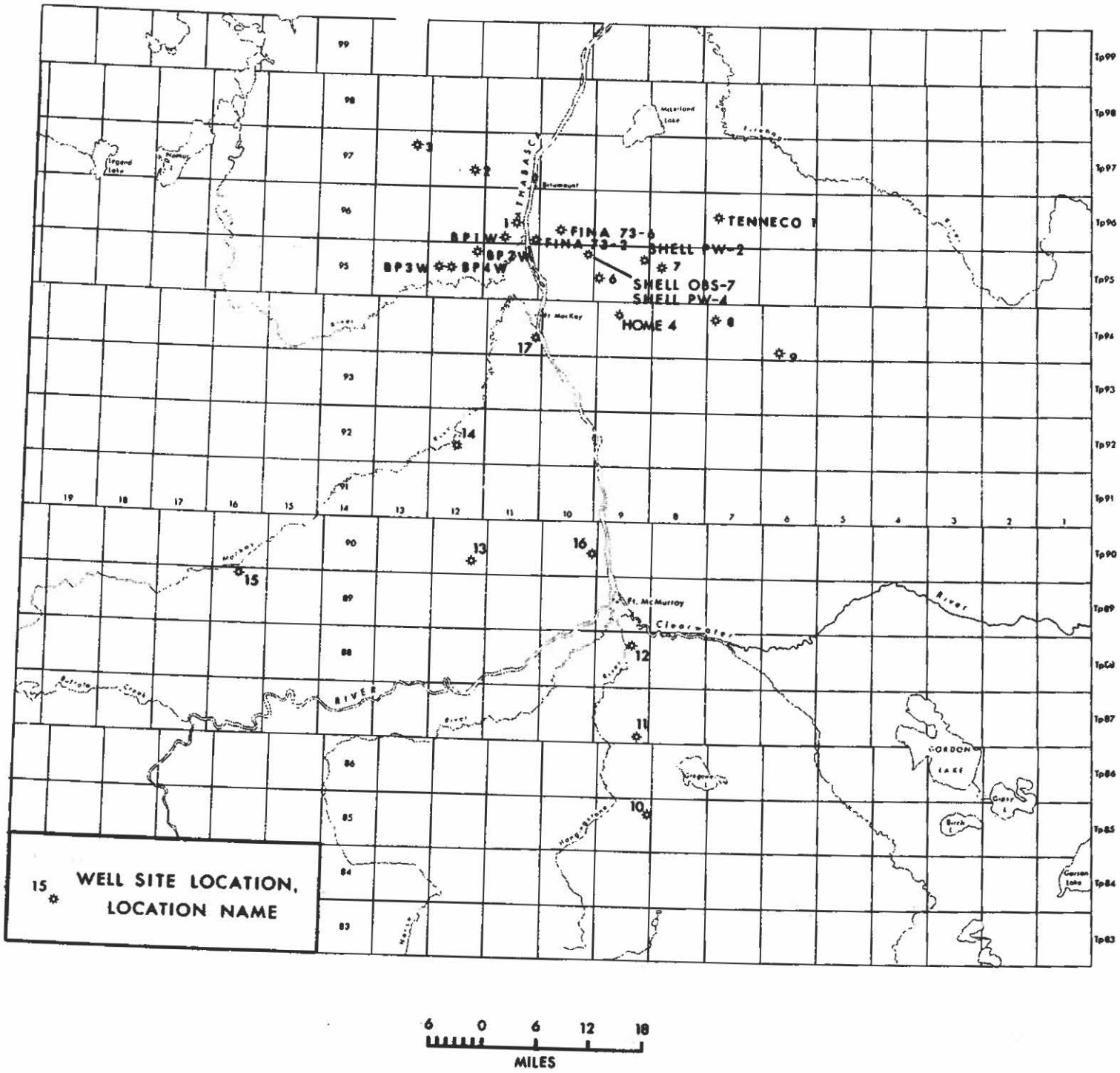



FIGURE 1. Athabasca Oil Sands observation well network, January 1977

Table 1

Athabasca Oil Sands Observation Wells

August 31, 1976

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 9-24-85-9 | 10 |
| Lsd 16-2-87-9 | 11 |
| Lsd 8-27-88-9 | 12 |
| Lsd 8-11-90-12 | 13 |
| Lsd 4-15-92-12 | 14 |
| Lsd 15-33-89-16 | 15 |
| Lsd 6-13-90-10 | 16 |
| Lsd 13-12-94-11 | 17 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |
| Lsd 3-28-94-9 | Home 4 |
| Lsd 10-25-95-10 | Shell PW-4 |
| Lsd 10-24-95-9 | Shell PW-2 |
| Lsd 10-25-95-10 | Shell Obs-7 |

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

| | | |
|---|---|---|
| Well Number | - | the name used for designating the well |
| Subject Code | - | as follows: |
| I | - | Introduction (no site number indicated) |
| L | - | Legend (no site number indicated) |
| G | - | General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents |
| C | - | Well construction details |
| D | - | Drill stem testing |
| A | - | Aquifer testing |
| E | - | Chemical analyses including multielement analyses and routine water analyses |
| H | - | Annual hydrograph |
| W | - | Well history |
| Year of Publication | - | the last two numerals of the year of publication. |

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within the tabbed section for that particular well.

## GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
| | sandstone, arkosic |
| | silt |
| | siltstone |
| | siltstone & sandstone |
| | clay |
| | clay, sandy |
| | claystone, shale |
| | sandstone & shale |
| | oil sand |
| | limestone |
| | limestone, shaley |
| | dolomite |
| | dolomite, argillaceous |
| | rock salt |
| | gypsum & anhydrite |
| | coal |
| | igneous rock |

| Symbol | Stratigraphic Unit |
|---|---|
| | Pleistocene and Recent |
| Qd | Surface deposits |
| | Cretaceous |
| Ks | Smoky Group |
| Klb | La Biche Formation |
| Kd | Dunvegan Formation |
| Ksh | Shaftesbury Formation |
| Kpl | Pelican Formation |
| Kj | Joli Fou Formation |
| Kg | Grand Rapids Formation |
| Kc | Clearwater Formation |
| Kw | Wabiskaw Member |
| Km | McMurray Formation |
| | Devonian |
| Dwd | Woodbend Group |
| Dbl | Beaverhill Lake Formation |
| Dsw | Slave Point Formation & Fort Vermilion Formation & Watt Mountain Formation |
| Dmk | Muskeg Formation |
| Dpe | Prairie Evaporite Formation |
| Dm | Methy Formation (Keg River Formation equivalent) |
| Dmr | McLean River Formation (Chinchaga Formation equivalent) |
| Dl | La Loche Formation |
| | Precambrian |
| Pc | Undivided |

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

1. drill to about 5 feet above the zone
2. land casing and cement to surface
3. drill through the aquifer using very light mud
4. insert a screening device (if necessary)
5. develop the well with air.

The section on "Well Construction" notes any changes from the above procedure. Information such as casing tallies, amounts of cement, types of float equipment and daily drilling precis are not included. This type of information is available from the Engineer's Report on file at the Groundwater Division.

A conventional oil-field cementing unit was utilized to cement casing strings. Cement returns to the surface were observed in nearly every well.

## WELL HISTORY

A record is kept of all major events occurring to each well. This is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling, and any other event of potential hydrogeological interest.

## GENERAL SITE INFORMATION

This section contains:

1) A well site plan showing location within the section and a detail showing the configuration of the individual wells.

2) A geological sample description giving the field description of the actual sample obtained during the drilling of the deepest hole. Samples were usually obtained at 10-foot intervals of drilling.

3) Geophysical and geological logs of the deepest hole. Spontaneous potential, single point resistance, natural gamma, caliper and neutron were the logs run during the 1975-76 drilling. Results of the caliper logs are not presented. The geological log presented represents an interpretation based upon the sample

description and the geophysical logs. The open portion of each well is indicated along the left side of the geological log.

4) A summary of contents page noting the number of pages in each of the subject areas that have been issued for that site. Pages which have been replaced because of errors are noted in the total.

Geological and geophysical logging was not done on every well at a site. It was assumed that geological conditions would be reasonably uniform across the site and that the extra effort was not warranted.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. At present monthly manual measurements are made in those wells where the depth to water exceeds 200 feet.

## AQUIFER AND DRILL STEM TESTING

Soon after completion, some wells were tested for production either by pumping or bailing. Information from these types of tests is presented in the section on "Aquifer Testing".

Many wells, particularly the very deep ones, exhibit very low static heads. This great depth to water made pumping tests impossible because of the nature of the equipment available. Bailing tests on wells with very great depths to water are extremely difficult due to the measuring tape sticking to the wet casing.

Drill stem testing equipment was utilized in two manners during the 1975-76 drilling program. Open hole - bottom hole drill stem tests

were conducted in the Devonian sediments to locate relatively productive zones for well completion. Casing tests were performed on completed wells at Site 10, 11 and 15 because of great depth to water or low permeability in the completion zone.

Information from these drill stem tests is presented under the heading "Drill Stem Testing". Results of open hole - bottom hole tests are presented in the section containing information about the deepest well at the Site as this is the hole in which the tests were conducted. An exception to this is at Site 14 where three tests were conducted on hole 14-699 and six tests performed in 14-1590.

A Horner Plot of shut-in pressure versus the dimensionless $(t + \Delta t)/\Delta t$ is presented. The value of static reservoir pressure is obtained from this procedure. Values of transmissivity and hydraulic conductivity can also be obtained from this plot in the following manner:

$$Q_b = \frac{1440\ V}{t}$$

$$T = \frac{162.6\ Q_b}{M}$$

$$K = \frac{T}{h}$$

where:

$Q_b$ = production rate in barrels per day

V = volume of production into drill collars and stem

t = total flow time of test

T = transmissivity in millidarcy-feet

M = slope of final shut-in pressure plot

K = permeability in millidarcys (1 millidarcy = $10^{-6}$ cm/sec)

h = thickness of the aquifer - usually the length of the tested section.

The results of aquifer testing by pumping or bailing are presented on a semilog or Jacob type plot. Calculations of transmissivity are according to the Modified Nonequilibrium Formula or the analogous Recovery Formula as follows:

$$T = \frac{0.92\ Q \log_{10} (t_2/t_1)}{d_2 - d_1} : \quad \text{(For pumping)}$$

or

$$T = \frac{0.92\ Q \log_{10} \left[\left(\frac{t + t'}{t'}\right)_2 - \left(\frac{t + t'}{t'}\right)_1\right]}{d_2 - d_1} : \quad \text{(For recovery)}$$

where:

$d_2$, $d_1$ = depth to water at corresponding subscripted time (meters) $d_2 > t_1$

$t_2$, $t_1$ = time since pumping started, $t_2 > t_1$

$t$ = length of time pumping

$t'$ = time since pumping stopped: $\left(\frac{t + t'}{t'}\right)_2 > \left(\frac{t + t'}{t'}\right)_1$

$T$ = transmissivity in sequence meters per day

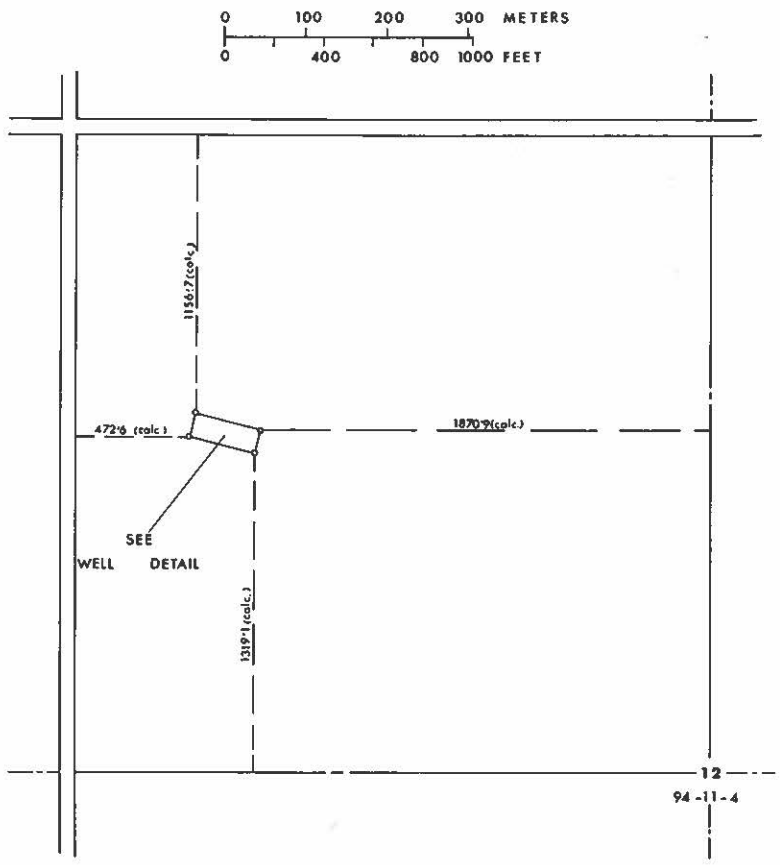
$Q$ = pumping rate in imperial gallons per minute

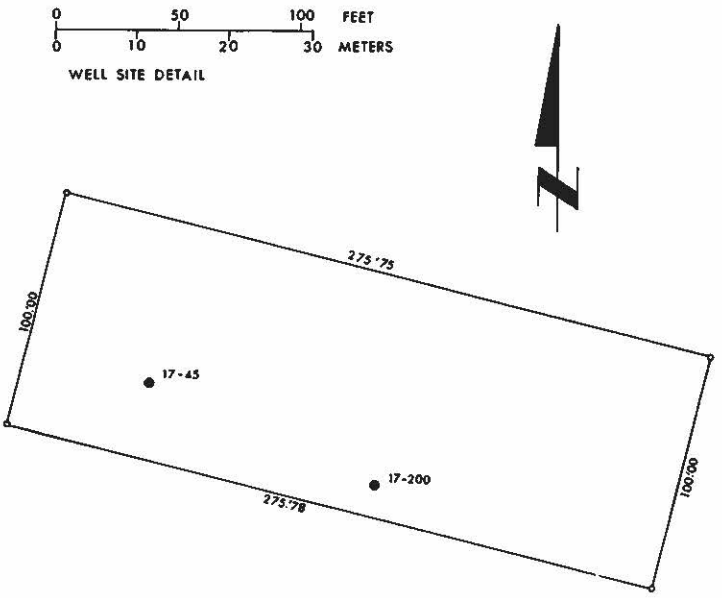
That portion of the drawdown plot used to calculate the transmissivity is indicated on each drawing.

OBSERVATION WELL SITE 17

6-13-96-11 W 4th

ALBERTA RESEARCH COUNCIL



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Seventeen

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Ground elevation 861 Total depth 200 feet

KB elevation 869

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 8 | 10 | Sand, lt brown, fine-coarse grained, angular-subangular, poorly sorted, good-excellent porosity, qtz, fld, cht. Slightly oil stained in the bottom | Drift |
| 10 | 20 | Sand, lt brown, fine-medium grained, subangular, medium sorted, good-excellent porosity, qtz, lt cht, moderately oil stained | McMurray |
| 20 | 30 | Sand, medium grey, coarse grained, subangular, medium sorted, excellent porosity, qtz, lt cht, slightly oil stained. Interbedded siltstone as above | |
| 30 | 40 | Sand, medium-coarse grained as above. No oil stain | |
| | (34) | Limestone, lt grey, argillaceous, fossiliferous | Beaverhill Lake |
| 40 | 70 | Limestone, lt grey, argillaceous (grading to limy shale), fossiliferous (crinoids) | |
| 70 | 90 | Limestone, lt grey, argillaceous, compact | |
| 90 | 120 | Limestone, buff, microgranular, fossiliferous (crinoids, stroms, brac), leaching; calcite recrystallization, poor-fair (90-100 feet depth) vuggy porosity, pyrite traces | |
| 120 | 140 | Limestone, buff, granular, silty, fossiliferous (bioclasts), pyrite | |
| 140 | 160 | Limestone, lt grey, argillaceous (grading to limy shale), pyrite, interbedded with shale, medium grey, calc (up to 50% in the lower part) | |
| 160 | 180 | Shale, limy (marlstone?), lt grey-olive, with limestone, lt grey, shaly, thin beds | |
| 180 | 200 | Limestone, lt grey, argillaceous (grading to limy shale); limy shale, medium grey, bedded | |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 17
## 13-12-94-11-W4th
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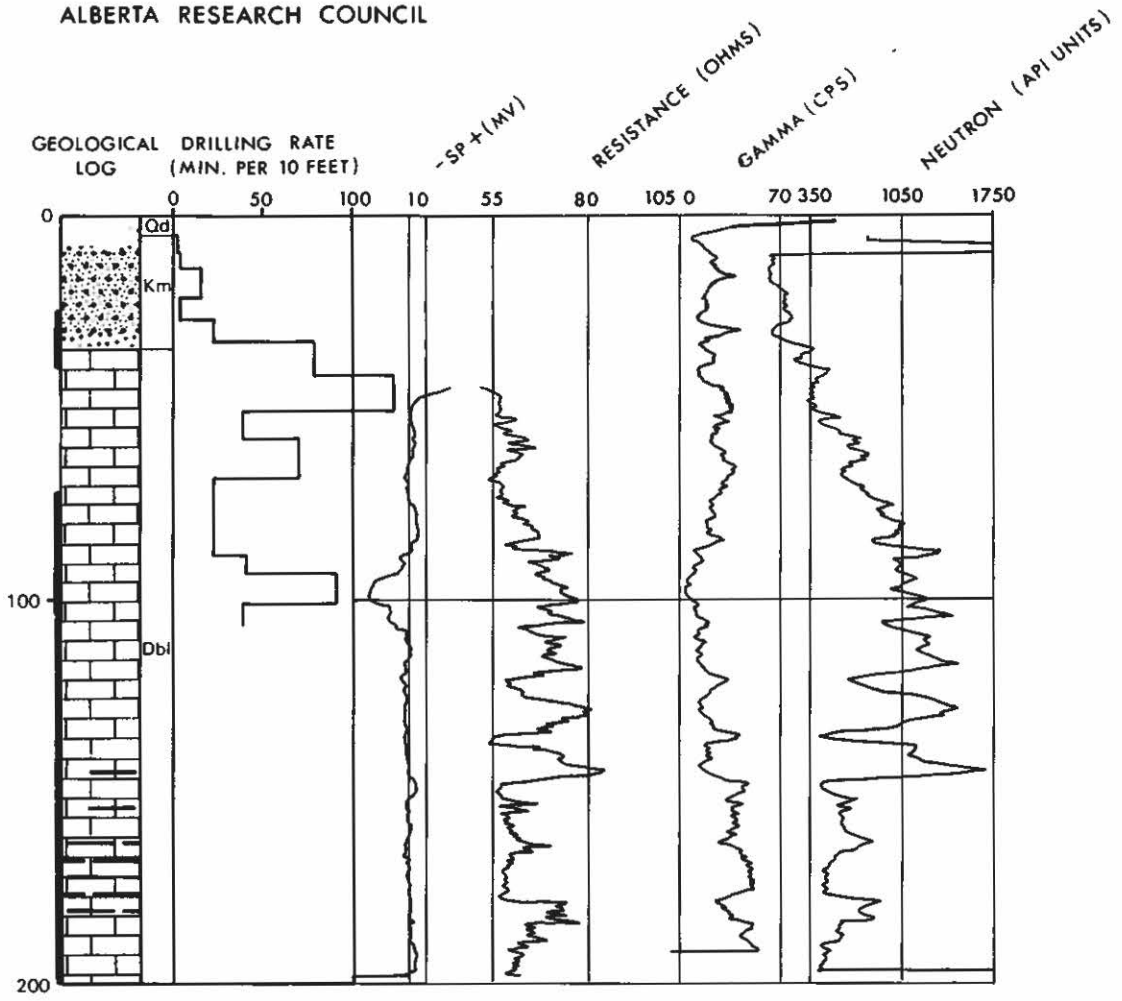
17-G-77



## SUMMARY OF CONTENTS

SITE NUMBER SEVENTEEN

d 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

number of pages distributed for this site in 1977

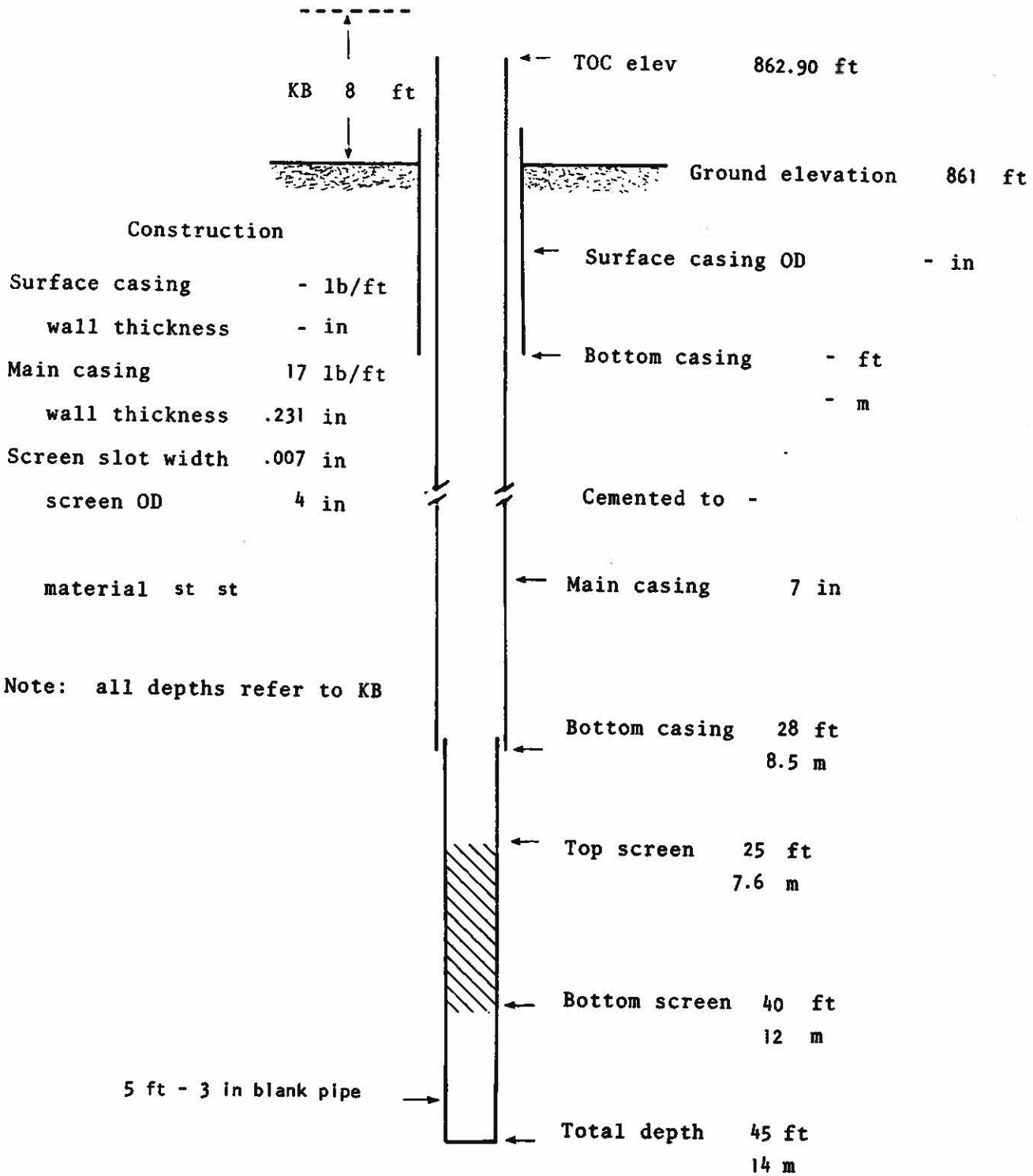
| page title | well name | | |
|---|---|---|---|
| | site | 17-45 | 17-200 |
| Introduction | 4 | — | — |
| Legend | 9 | — | — |
| Site Plan | 1 | — | — |
| Geological Sample Description | 1 | — | — |
| Geophysical and Geological Logs | 1 | — | — |
| Well Construction | — | 1 | 1 |
| Drawdown Plot | — | 1 | 0 |
| Drill Stem Test | — | 0 | 0 |
| Shut-In Pressure Data | — | 0 | 0 |
| Water Analysis | — | 2 | 2 |
| Water Level Hydrograph | — | 1 | 1 |
| Well History | — | 1 | 1 |

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Tp 94 R 11 W 4th

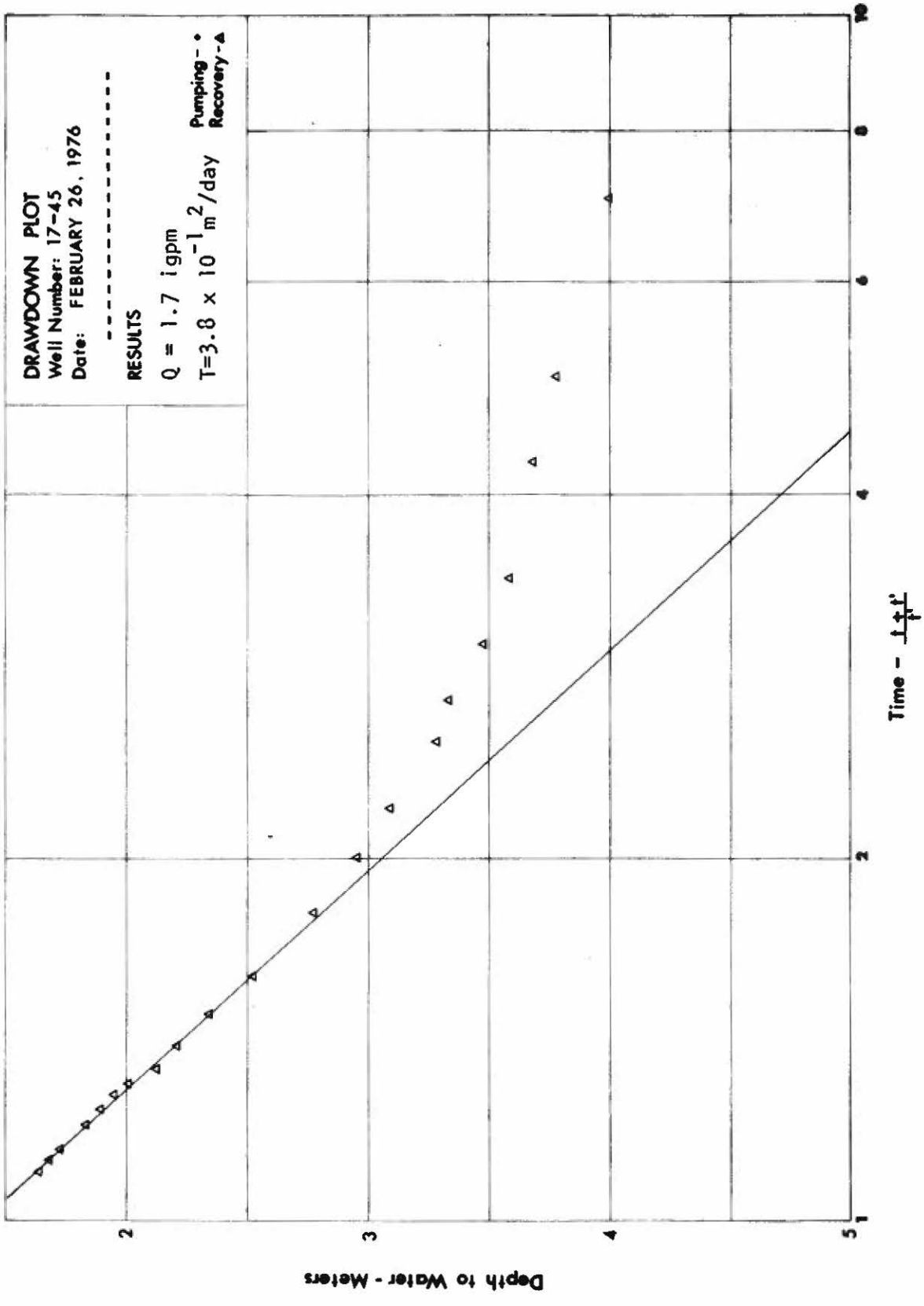
Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | in |
| Main casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Screen slot width | .007 | in |
| screen OD | 4 | in |
| material | st st | |

Note: all depths refer to KB


DRAWDOWN PLOT
Well Number: 17-45
Date: FEBRUARY 26, 1976
RESULTS
Q = 1.7 igpm
T=3.8 x 10⁻¹ m²/day
Pumping - •
Recovery - ▲
Depth to Water - Meters
Time - t+t'/t'

## WATER ANALYSIS

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Sample source Bailed from 17-45

Date sampled February 26, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 67.0 | 3.35 | 44.7 |
| Magnesium ($Mg^{++}$) | 10.4 | 0.87 | 11.6 |
| Sodium ($Na^{+}$) | 75.0 | 3.26 | 43.5 |
| Potassium ($K^{+}$) | 0.8 | 0.02 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 320.0 | 5.25 | 75.3 |
| Sulfate ($SO_4^{=}$) | 12.1 | 0.25 | 3.6 |
| Chloride ($Cl^{-}$) | 52.0 | 1.47 | 21.0 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 0.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 396.0 | | |
| Total Anions (epm) 6.9 | | Total Cations (epm) | 7.2 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | |
| pH | 6.9 | pH | 7.7 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 364 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 56.0 | 2.79 | 26 |
| Magnesium ($Mg^{++}$) | 12.0 | 0.99 | 9 |
| Sodium ($Na^{+}$) | 154.0 | 6.70 | 63 |
| Potassium ($K^{+}$) | 4.2 | 0.11 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 425.0 | 6.97 | 65 |
| Sulfate ($SO_4^{=}$) | 3.3 | 0.07 | 1 |
| Chloride ($Cl^{-}$) | 132.0 | 3.72 | 35 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0 |
| Silica ($SiO_2$) | 4.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 59.4 | | |
| Magnesium (Acidified) | 12.1 | | |
| Total dissolved solids | 596 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 10.77 | Total Cations (epm) | 10.59 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1100 | Temperature (C) | 5.0 | |
| pH | 7.6 | pH | 7.1 | |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 444 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 4, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 53.0 | 2.64 | 18.0 |
| Magnesium ($Mg^{++}$) | 11.8 | 0.97 | 6.6 |
| Sodium ($Na^{+}$) | 176.0 | 7.66 | 52.2 |
| Potassium ($K^{+}$) | 133.0 | 3.40 | 23.2 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 449.0 | 7.36 | 63.0 |
| Sulfate ($SO_4^{=}$) | 20.2 | 0.42 | 3.6 |
| Chloride ($Cl^{-}$) | 138.0 | 3.89 | 33.3 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 0.1 |
| Silica ($SiO_2$) | 6.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 46.0 | | |
| Magnesium (Acidified) | 10.6 | | |
| Total dissolved solids | 668.0 | | |
| Total Anions (epm) | 11.69 | Total Cations (epm) | 14.67 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1000 | Temperature (C) | 7.0 |
| pH | 7.5 | pH | 7.5 |
| Fluoride ($F^{-}$) | 0.4 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 478.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Date sampled: July 13, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .337 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 183 |
| As | <.038 | Ni | <.010 |
| B | .992 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 60.8 | Si | 2.76 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .628 |
| Cr | <.006 | Te | <.065 |
| Cu | .038 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 2.44 | V | <.0008 |
| K | 33 | W | <.078 |
| Mg | 12.65 | Zn | .044 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

17-45-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 04, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 46.0 | 2.30 | 24.1 |
| Magnesium(Mg) | 9.0 | 0.74 | 7.8 |
| Sodium(Na) | 146.0 | 6.35 | 66.7 |
| Potassium(K) | 5.4 | 0.14 | 1.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 415.0 | 6.80 | 68.2 |
| Sulphate(SO4) | 9.6 | 0.20 | 2.0 |
| Chloride(Cl) | 104.0 | 2.93 | 29.4 |
| Nitrate(NO3) | 2.4 | 0.04 | 0.4 |
| Silica(SiO2) | 6.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 48.0 | | |
| Magnesium(Acidified) | 9.8 | | |
| TDS(mg/l) | 514.0 | | |
| Total Anions(epm) | 9.97 | Total Cations(epm) | 9.52 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 805 | | Temperature(C) | 4.00 | |
| pH | 7.0 | | pH | 7.1 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 429 | mg/l |
| | | | Hydroxide(OH) | | |

17-45-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 47.0 | 2.35 | 22.4 |
| Magnesium(Mg) | 8.9 | 0.73 | 7.0 |
| Sodium(Na) | 168.0 | 7.31 | 69.9 |
| Potassium(K) | 2.9 | 0.07 | 0.7 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 359.0 | 5.88 | 57.5 |
| Sulphate(SO4) | 8.1 | 0.17 | 1.6 |
| Chloride(Cl) | 148.0 | 4.17 | 40.8 |
| Nitrate(NO3) | 0.2 | 0.00 | 0.0 |
| Silica(SiO2) | 8.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 61.0 | | |
| Magnesium(Acidified) | 8.1 | | |
| TDS(mg/l) | 546.0 | | |
| Total Anions(epm) | 10.23 | Total Cations(epm) | 10.46 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 900 | Temperature(C) | 6.00 | |
| pH | 7.3 | pH | 7.0 | |
| Fluoride(F) | 0.8 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 390 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 17-45-E-82

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled June 30, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 53.0 | 2.65 | 27.9 |
| Magnesium(Mg) | 18.4 | 1.53 | 16.2 |
| Sodium(Na) | 120.0 | 5.22 | 55.0 |
| Potassium(K) | 3.3 | 0.08 | 0.9 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 356.0 | 5.84 | 65.4 |
| Sulphate(SO4) | 6.0 | 0.13 | 1.4 |
| Chloride(Cl) | 105.0 | 2.96 | 33.2 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 10.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 44.0 | | |
| Magnesium(Acidified) | 8.7 | | |
| TDS(mg/l) | 483.0 | | |
| Total Anions(epm) | 8.92 | Total Cations(epm) | 9.49 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 870 | Temperature | 5.00 | |
| pH | 8.1 | pH | 7.4 | |
| Fluoride | 0.0 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 385 | mg/l |
| | | Hydroxide(OH) | | |

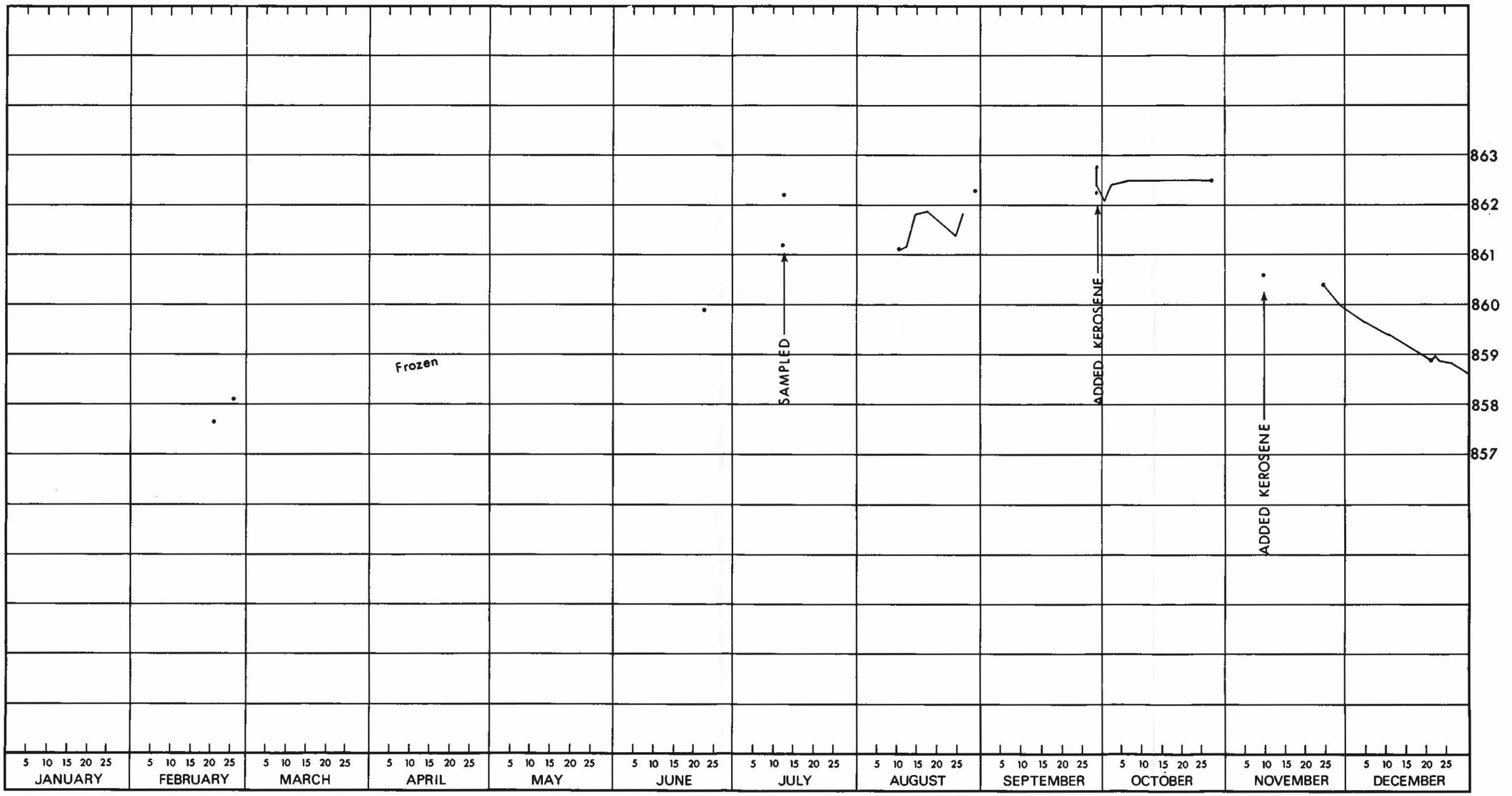
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **17-45**

Lsd **13** Sec **12** Twp **94** R**11** W4th

Alberta Research Council

17 - 45 - H - 77




1976

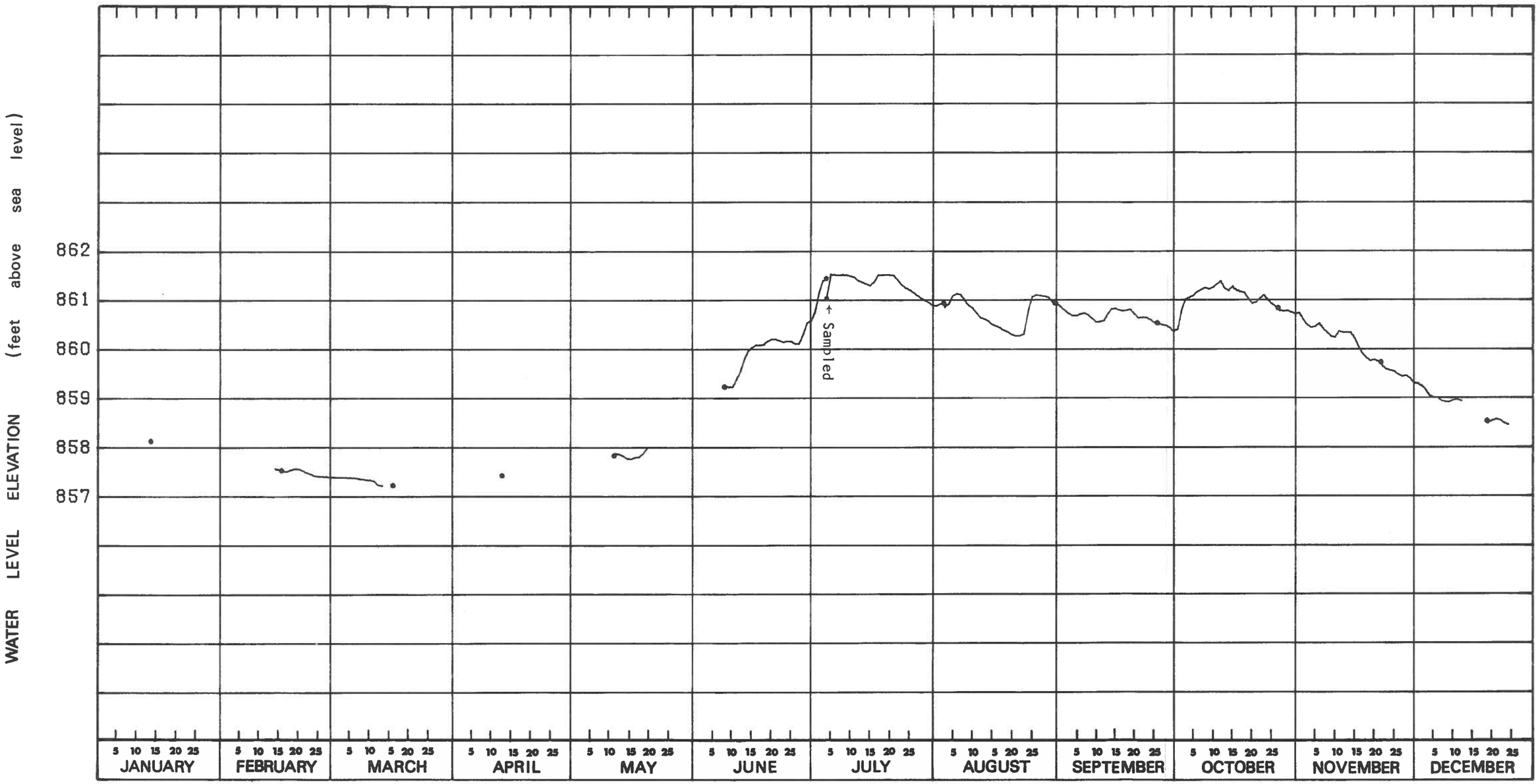
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Twp 94 R 11 W4 th

Alberta Research Council

17-45-H-78




1977

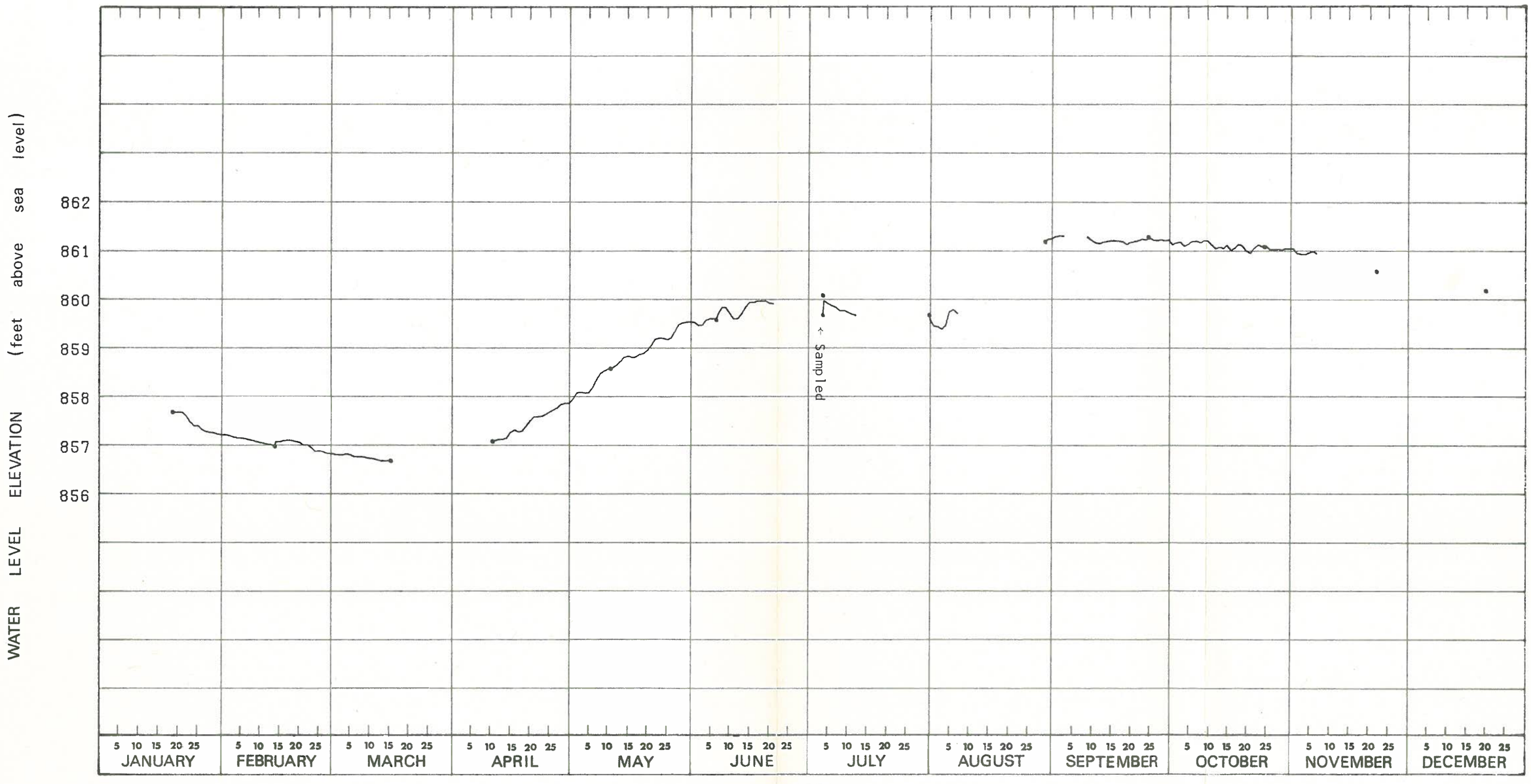
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 17-45

LSD 13 SEC 12 TWP 94 R 11 W4TH

17-45-H-79

Alberta Research Council




1978

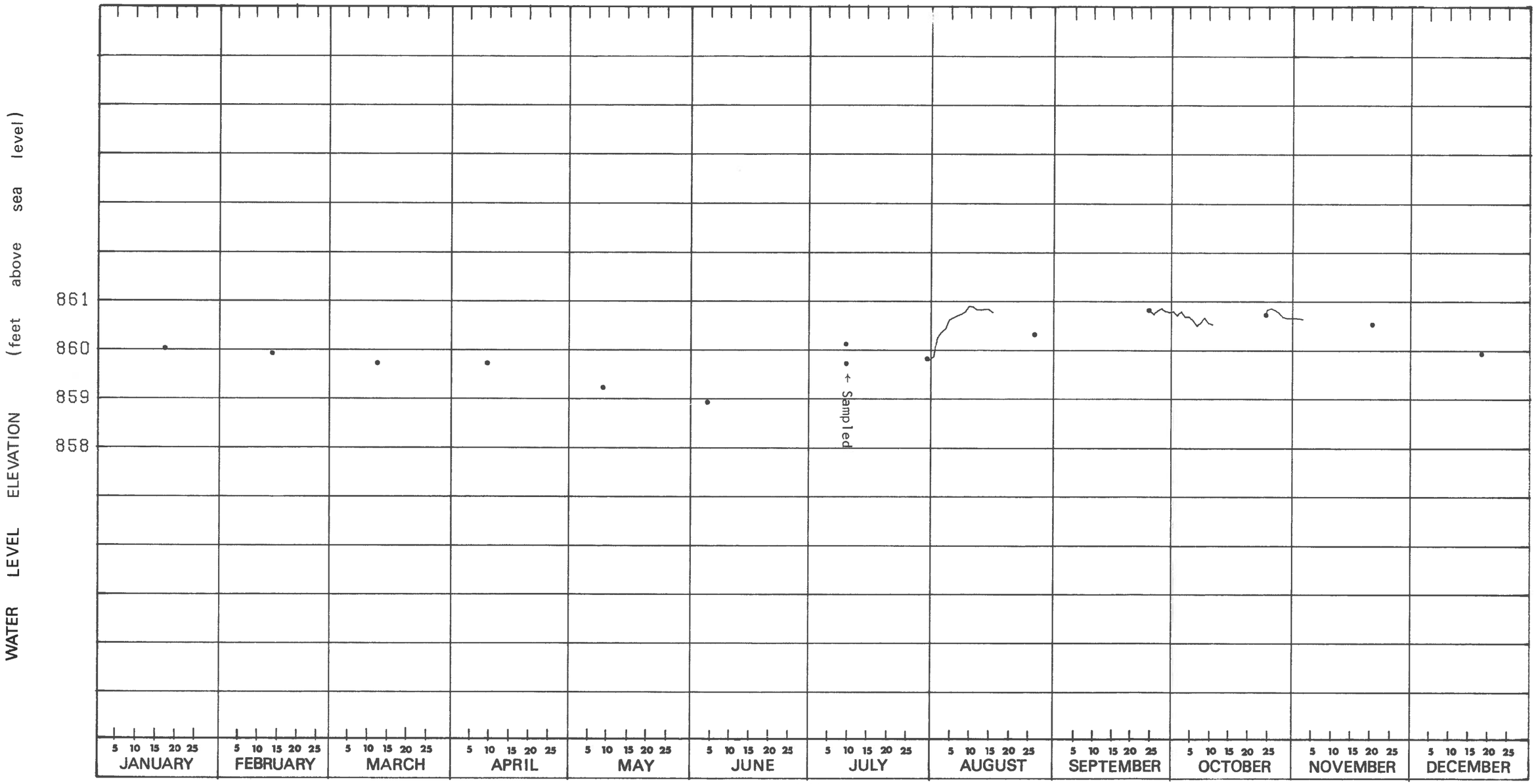
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 17-45

17-45-H-80

Lsd 13 Sec 12 Twp 94 R 11 W4 th

Alberta Research Council



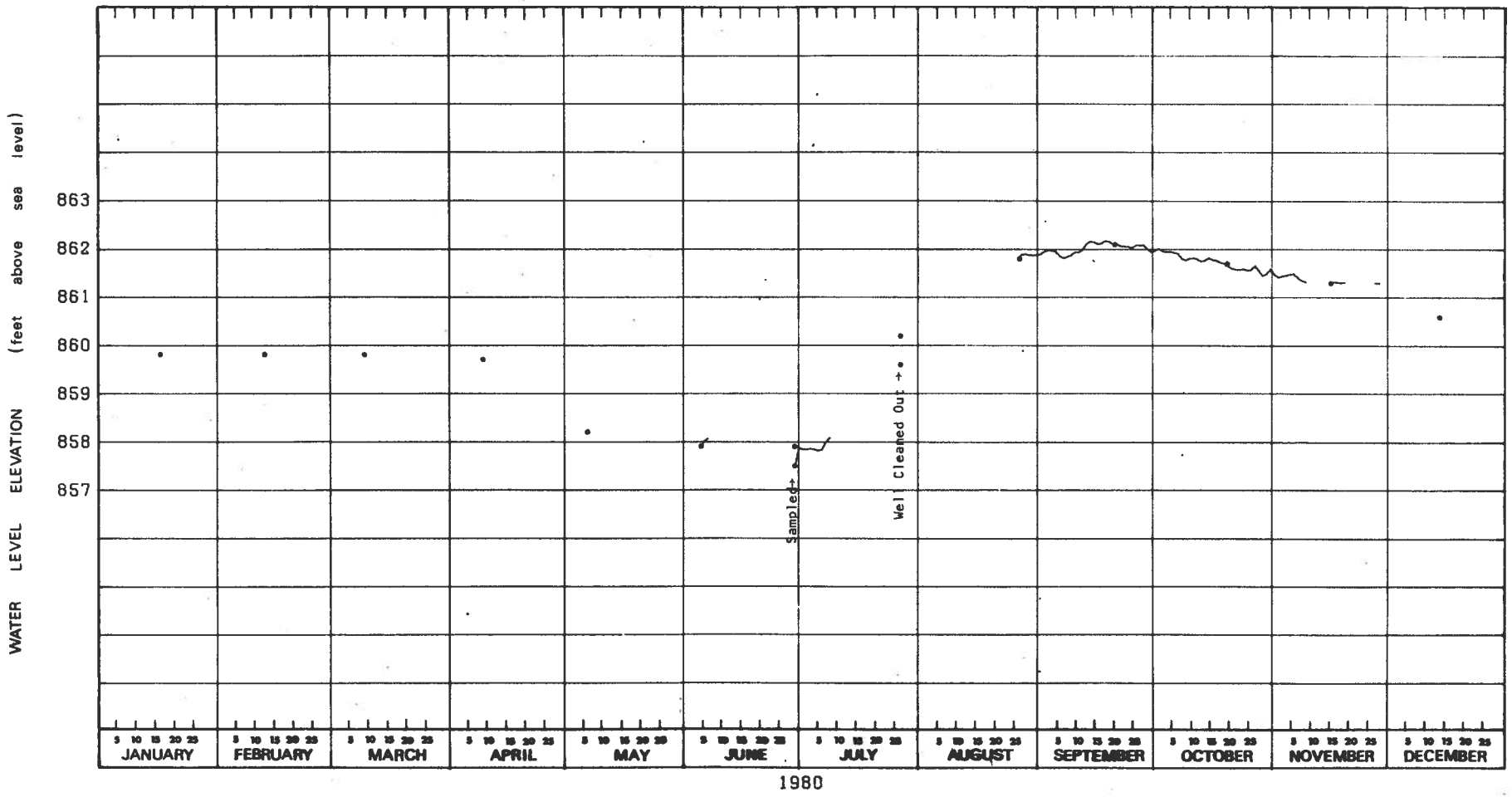
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Twp 94 R 11 W4 th

Alberta Research Council

17-45-H-81



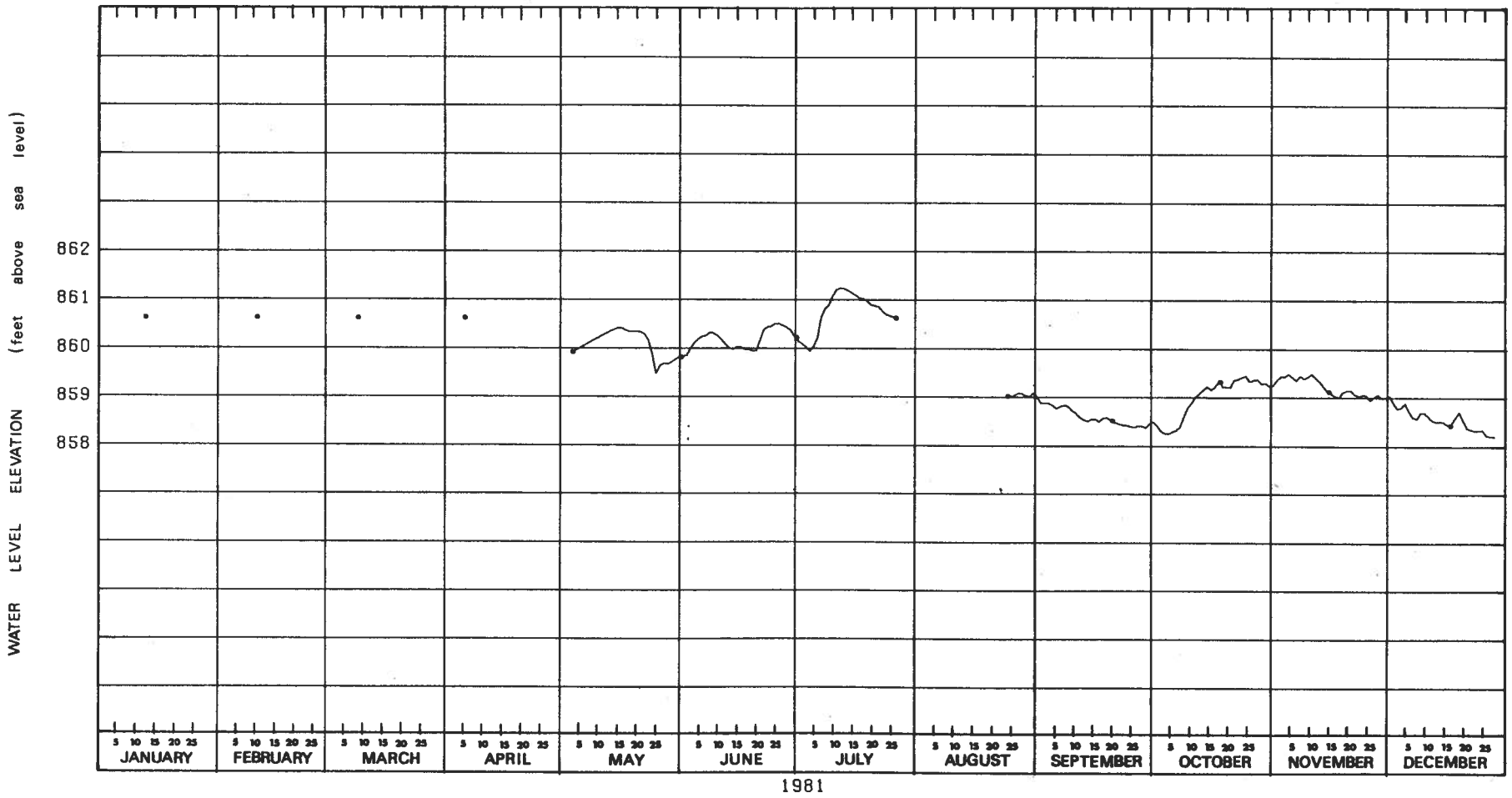
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 17-45

17-45-H-82

Lsd 13 Sec 12 Twp 94 R 11 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 862.90

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 20/76 | | | Well completed; blown with air |
| Feb 21/76 | 1.60 TOC | 857.6 | |
| Feb 26/76 | 1.46 TOC | 858.1 | Bail test, Q = 1.7 IGPM T = 25 IGPD/FT |
| Mar 6/76 | Frozen | | |
| Apr 5/76 | Frozen | | MP = 0.92 m TOC, (865.9) |
| May 7/76 | Frozen | | |
| June 1/76 | Frozen | | |
| June 23/76 | 1.84 MP | 859.9 | |
| July 13/76 | 1.14 MP | 862.2 | |
| | 1.44 MP | 861.2 | After sample; temp. 5°C |
| Aug 11/76 | 1.47 MP | 861.1 | |
| Aug 30/76 | 1.11 MP | 862.3 | |
| Sept 29/76 | 1.12 MP | 862.2 | Added 1 gallon of kerosene; water level elevation adjusted downward by 0.15 ft after this date |
| | TOC | 862.7 | |
| Oct 28/76 | 1.03 MP | 862.5 | |
| Nov 10/76 | 1.17 MP | 860.6 | Frozen; Break ice; Bail water out; added 10 gallons of kerosene water level elevation adjusted downward by 1.5 ft after this date |
| Nov 25/76 | 1.23 MP | 860.4 | |
| Dec 22/76 | 1.69 MP | 858.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 862.90

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 1.92 MP | 858.1 | MP (865.9) water level elevation adjusted downward by 1.5 ft to compensate for kerosene |
| Feb 16/77 | 2.10 MP | 857.5 | |
| Mar 16/77 | 2.18 MP | 857.2 | |
| Apr 13/77 | 2.13 MP | 857.4 | |
| May 11/77 | 2.01 MP | 857.8 | |
| June 8/77 | 1.59 MP | 859.2 | |
| July 4/77 | TOC | 861.4 | |
| | 1.04 MP | 861.0 | After sample; temp. 7°C |
| Aug 3/77 | 1.06 MP | 860.9 | |
| Aug 31/77 | 1.06 MP | 860.9 | |
| Sept 26/77 | 1.16 MP | 860.5 | |
| Oct 27/77 | 1.09 MP | 860.8 | |
| Nov 22/77 | 1.43 MP | 859.7 | |
| Dec 19/77 | 1.81 MP | 858.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 862.90

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 19/78 | 2.05 MP | 857.7 | MP (865.9) Water level elevation adjusted downward by 1.5 ft to compensate for kerosene |
| Feb 14/78 | 2.24 MP | 857.0 | |
| Mar 16/78 | 2.35 MP | 856.7 | |
| Apr 11/78 | 2.22 MP | 857.1 | |
| May 11/78 | 1.77 MP | 858.6 | |
| June 7/78 | 1.45 MP | 859.6 | |
| July 4/78 | 1.32 MP | 860.1 | |
| | 1.37 MP | 859.7 | MP = 0.85m TOC (865.7) After sample; temp 4°C |
| July 31/78 | 1.36 MP | 859.7 | |
| Aug 30/78 | 0.90 MP | 861.2 | |
| Sept 25/78 | 0.87 MP | 861.3 | |
| Oct 25/78 | 0.94 MP | 861.1 | |
| Nov 23/78 | 1.10 MP | 860.6 | Cable on recorder frozen |
| Dec 21/78 | 1.23 MP | 860.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 17-45

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 862.90

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 1.29 MP | 860.0 | MP (865.7) Water level elevation adjusted downward by 1.5 ft to compensate for kerosene |
| Feb 14/79 | 1.32 MP | 859.9 | |
| Mar 13/79 | 1.38 MP | 859.7 | |
| Apr 10/79 | 1.37 MP | 859.7 | |
| May 9/79 | 1.51 MP | 859.2 | |
| June 5/79 | 1.60 MP | 858.9 | |
| July 10/79 | 1.25 MP | 860.1 | |
| | 1.38 MP | 859.7 | After sample; temp. 6°C |
| July 31/79 | 1.34 MP | 859.8 | |
| Aug 27/79 | 1.20 MP | 860.3 | |
| Sept 25/79 | 1.05 MP | 860.8 | |
| Oct 25/79 | 1.06 MP | 860.7 | |
| Nov 21/79 | 1.12 MP | 860.5 | Weights frozen to casing |
| Dec 19/79 | 1.32 MP | 859.9 | Weights frozen to casing |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 17 - 45

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 862.90

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 1.34 MP | 859.8 | |
| Feb 13/80 | 1.35 MP | 859.8 | Ice Level Weights frozen to casing. |
| Mar 10/80 | 1.35 MP | 859.8 | Ice level weights frozen to casing. |
| Apr 10/80 | 1.37 MP | 859.7 | |
| May 7/80 | 1.82 MP | 858.2 | |
| June 6/80 | 1.93 MP | 857.9 | |
| June 30/80 | 1.92 MP | 857.9 | Temp. 5°C |
| | 2.03 MP | 857.5 | After Sample |
| July 10/80 | | | Airlift, 45 mins, sampled t = 5.5°C cond. = 575 |
| July 28/80 | 1.62 MP | 860.2 | 26 cm. kerosene left. |
| Aug 28/80 | 1.14 MP | 861.8 | |
| Sept 22/80 | 1.02 MP | 862.1 | |
| Oct 21/80 | 1.15 MP | 861.7 | |
| Nov 17/80 | 1.28 MP | 861.3 | Weights frozen |
| Dec 15/80 | 1.48 MP | 860.6 | Water frozen |
| Jan 13/81 | 1.49 MP | 860.6 | Water frozen |
| Feb 11/81 | 1.49 MP | 860.6 | Water frozen |
| Mar 9/81 | 1.49 MP | 860.6 | Water frozen |
| Apr 6/81 | 1.49 MP | 860.6 | Water frozen |
| May 4/81 | 1.70 MP | 859.9 | Ice level |
| June 1/81 | 1.74 MP | 859.8 | H20 level |
| July 1/81 | 1.62 MP | 860.2 | |
| July 27/81 | 1.49 MP | 860.6 | |
| Aug 25/81 | 1.99 MP | 859.0 | |
| Sept 21/81 | 2.14 MP | 858.5 | |
| Oct 19/81 | 1.90 MP | 859.3 | |
| Nov 16/81 | 1.95 MP | 859.1 | |
| Dec 17/81 | 2.15 MP | 858.4 | |

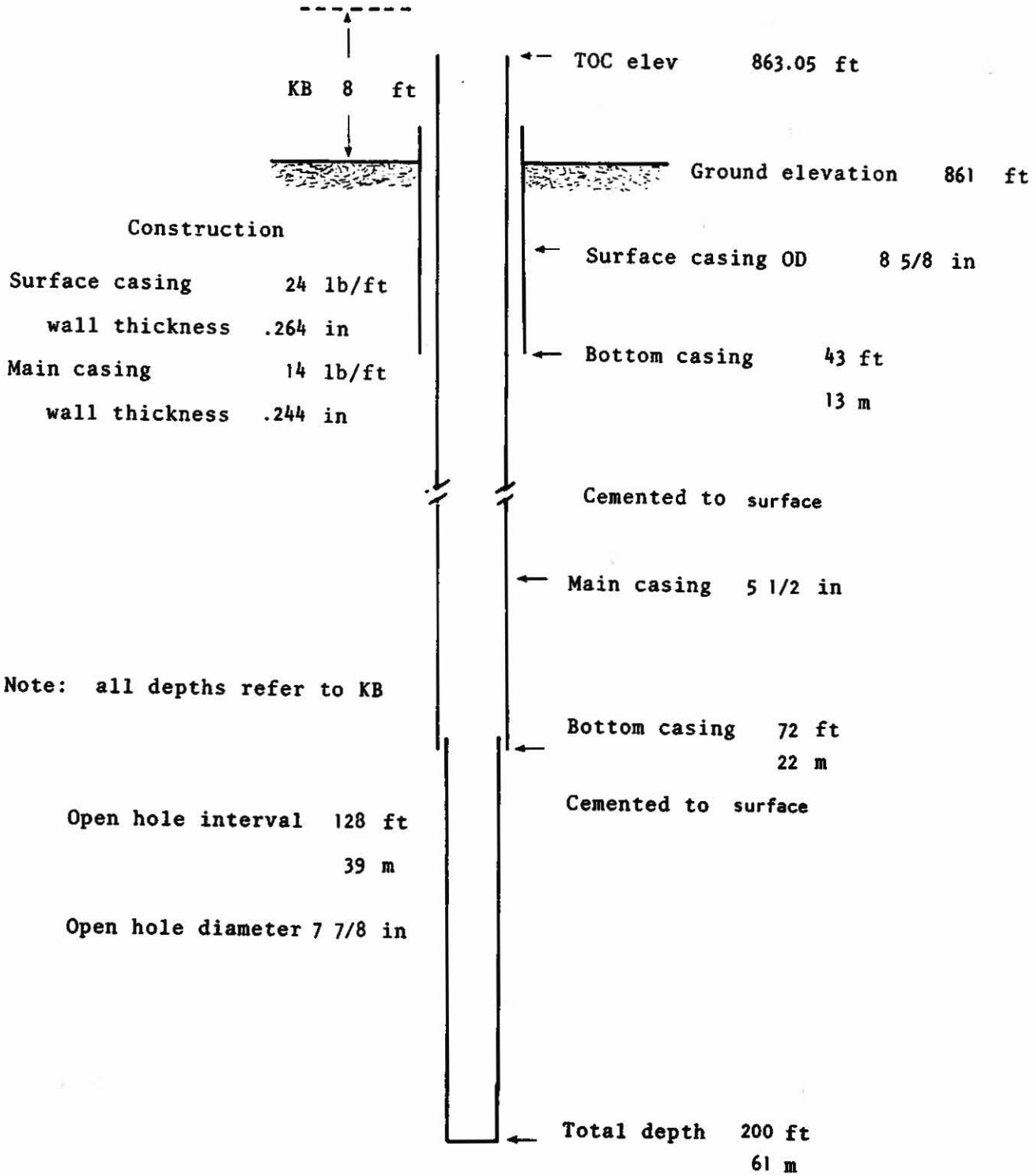
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Tp 94 R 11 W 4th

Alberta Research Council



## WATER ANALYSIS

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Sample source Bailed from 17-200

Date sampled February 23, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 56.0 | 2.79 | 0.8 |
| Magnesium ($Mg^{++}$) | 96.0 | 7.90 | 2.3 |
| Sodium ($Na^{+}$) | 7750.0 | 337.10 | 96.8 |
| Potassium ($K^{+}$) | 11.7 | 0.30 | 0.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1659.0 | 27.19 | 7.3 |
| Sulfate ($SO_4^{=}$) | 87.0 | 1.81 | 0.5 |
| Chloride ($Cl^{-}$) | 12200.0 | 344.05 | 92.2 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 19.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 0.0 | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 19680.0 | | |
| Total Anions (epm) 373.0 | | Total Cations (epm) 348.0 | |

### Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | |
| pH | 8.0 | pH | 8.0 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | 1884 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 20.0 | 1.00 | 0 |
| Magnesium ($Mg^{++}$) | 177.0 | 14.57 | 4 |
| Sodium ($Na^{+}$) | 8750.0 | 380.60 | 96 |
| Potassium ($K^{+}$) | 55.4 | 1.42 | 0 |
| Carbonate ($CO_3^{=}$) | 67.0 | 2.23 | 1 |
| Bicarbonate ($HCO_3^{-}$) | 2096.0 | 34.36 | 9 |
| Sulfate ($SO_4^{=}$) | 71.0 | 1.48 | 0 |
| Chloride ($Cl^{-}$) | 13000.0 | 366.61 | 91 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0 |
| Silica ($SiO_2$) | 8.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 26.4 | | |
| Magnesium (Acidified) | 138.6 | | |
| Total dissolved solids | 22600 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 404.68 | Total Cations (epm) | 397.58 |

### Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 78000 | | Temperature (C) | 6.0 | |
| pH | 8.6 | | pH | 8.3 | |
| Fluoride ($F^{-}$) | 0.4 | Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | | Bicarbonate ($HCO_3^{-}$) | 2269 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 4, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 55.0 | 2.74 | 0.6 |
| Magnesium ($Mg^{++}$) | 160.0 | 13.17 | 3.1 |
| Sodium ($Na^{+}$) | 9300.0 | 404.52 | 95.4 |
| Potassium ($K^{+}$) | 134.0 | 3.43 | 0.8 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 2550.0 | 41.80 | 9.9 |
| Sulfate ($SO_4^{=}$) | 60.0 | 1.25 | 0.3 |
| Chloride ($Cl^{-}$) | 13500.0 | 380.71 | 89.8 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 8.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 50.0 | | |
| Magnesium (Acidified) | 142.0 | | |
| Total dissolved solids | 23984.0 | | |
| Total Anions (epm) | 423.76 | Total Cations (epm) | 423.87 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 4.0 |
| pH | 7.7 | pH | 7.6 |
| Fluoride ($F^{-}$) | 0.3 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 2552.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Date sampled: July 13, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .021 |
| Au | <.003 | Mo | <.006 |
| Al | 0.44 | Na | 8184 |
| As | <.038 | Ni | <.010 |
| B | 3.18 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 19.5 | Si | 4.32 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 5.22 |
| Cr | <.006 | Te | <.065 |
| Cu | .019 | Ti | .003 |
| Eu | <.015 | U | <.020 |
| Fe | 0.11 | V | .012 |
| K | 143 | W | <.078 |
| Mg | 142 | Zn | .077 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 04, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 47.0 | 2.35 | 0.6 |
| Magnesium(Mg) | 140.0 | 11.52 | 2.8 |
| Sodium(Na) | 9250.0 | 402.35 | 96.4 |
| Potassium(K) | 46.7 | 1.19 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 2586.0 | 42.39 | 9.9 |
| Sulphate(SO4) | 66.0 | 1.37 | 0.3 |
| Chloride(Cl) | 13600.0 | 383.53 | 89.8 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 8.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 46.0 | | |
| Magnesium(Acidified) | 146.0 | | |
| TDS(mg/l) | 23870.0 | | |
| Total Anions(epm) | 427.29 | Total Cations(epm) | 417.41 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 32800 | | Temperature(C) | 5.00 | |
| pH | 7.6 | | pH | 7.5 | |
| Fluoride(F) | 0.4 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 2522 | mg/l |
| | | | Hydroxide(OH) | | |

17-200-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 30.0 | 1.50 | 0.4 |
| Magnesium(Mg) | 163.0 | 13.42 | 3.3 |
| Sodium(Na) | 8950.0 | 389.30 | 96.0 |
| Potassium(K) | 45.4 | 1.16 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 2489.0 | 40.80 | 9.7 |
| Sulphate(SO4) | 61.0 | 1.27 | 0.3 |
| Chloride(Cl) | 13400.0 | 377.89 | 90.0 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 7.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 50.0 | | |
| Magnesium(Acidified) | 148.0 | | |
| TDS(mg/l) | 24924.0 | | |
| Total Anions(epm) | 419.96 | Total Cations(epm) | 405.37 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 33500 | Temperature(C) | 5.00 | |
| pH | 8.1 | pH | 7.5 | |
| Fluoride(F) | 0.7 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 2518 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS 17-200-E-82

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled June 30, 1980

## Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 12.0 | 0.60 | 0.1 |
| Magnesium(Mg) | 340.0 | 28.33 | 6.9 |
| Sodium(Na) | 8775.0 | 381.52 | 92.7 |
| Potassium(K) | 45.0 | 1.15 | 0.3 |
| Carbonate(CO3) | 65.0 | 2.17 | 0.5 |
| Bicarbonate(HCO3) | 2257.0 | 37.00 | 9.1 |
| Sulphate(SO4) | 58.0 | 1.21 | 0.3 |
| Chloride(Cl) | 13000.0 | 366.20 | 90.1 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 8.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 46.0 | | |
| Magnesium(Acidified) | 135.0 | | |
| TDS(mg/l) | 24046.0 | | |
| Total Anions(epm) | 406.57 | Total Cations(epm) | 411.61 |

## Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 39600 |
| pH | 8.4 |
| Fluoride | 0.5 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 5.00 | |
| pH | 7.7 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 2542 | mg/l |
| Hydroxide(OH) | | |

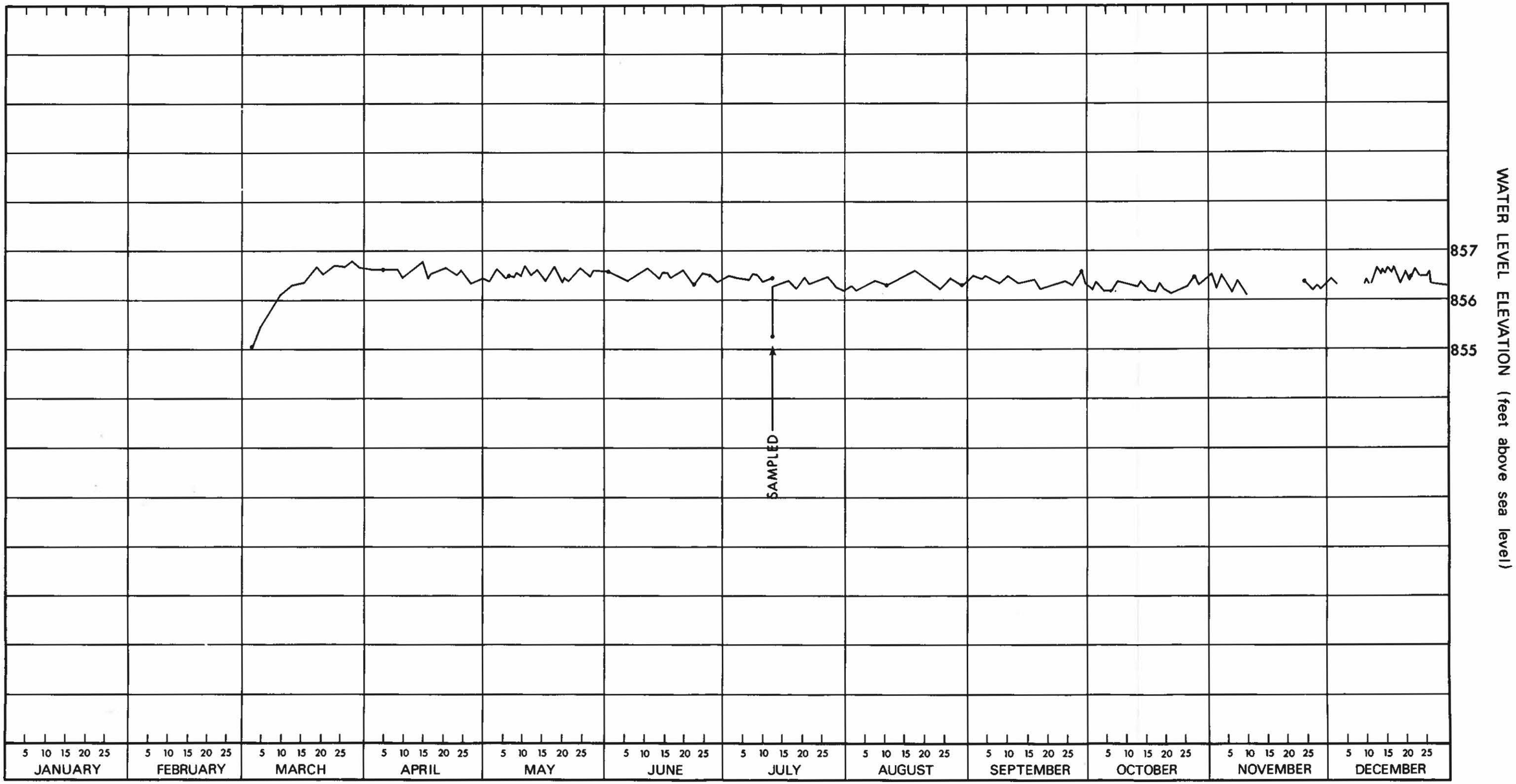
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **17-200**

Lsd **13** Sec **12** Twp **94** R **11** W4th

Alberta Research Council

17 - 200 - H - 77



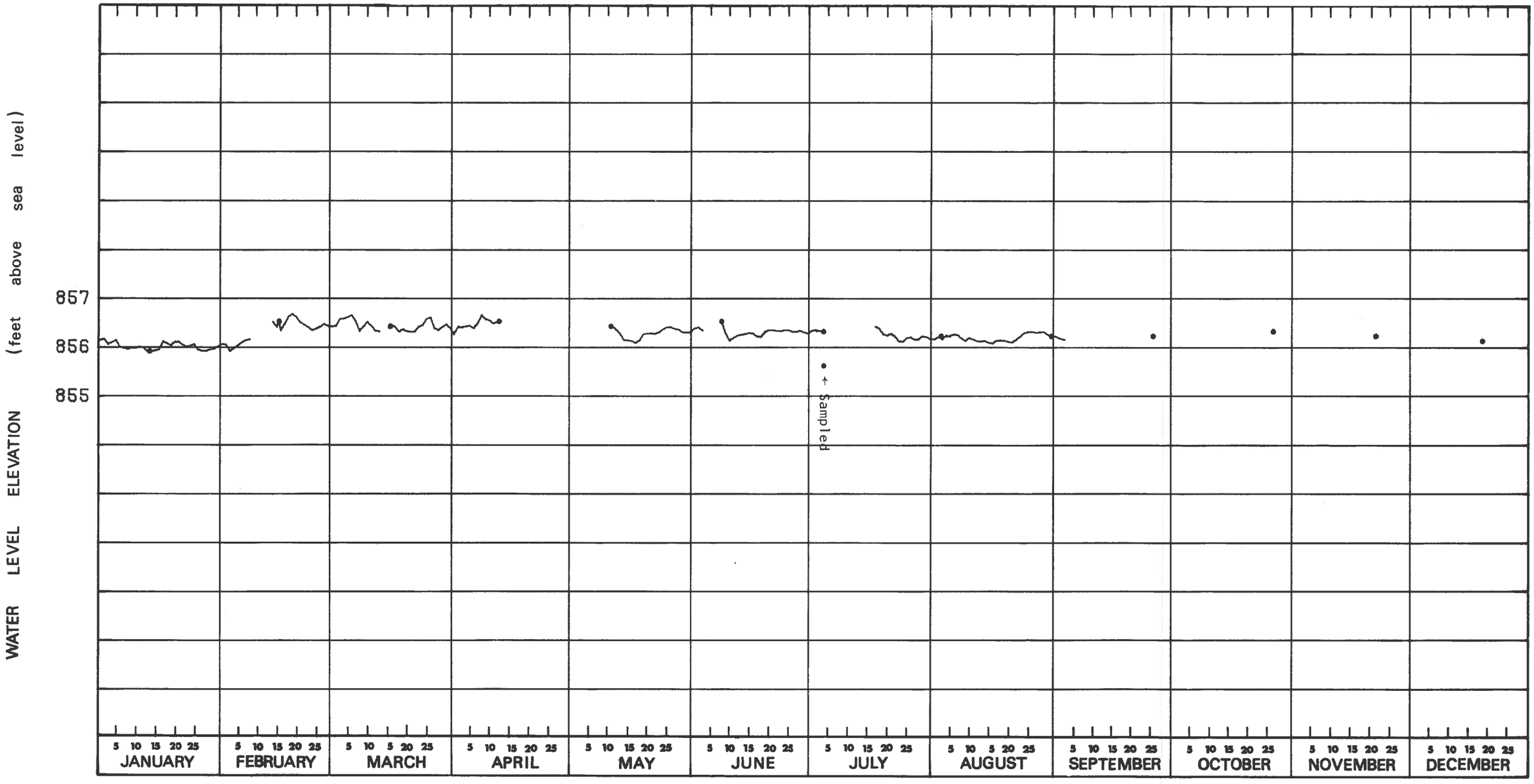
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4 th

Alberta Research Council

17-200-H-78




1977

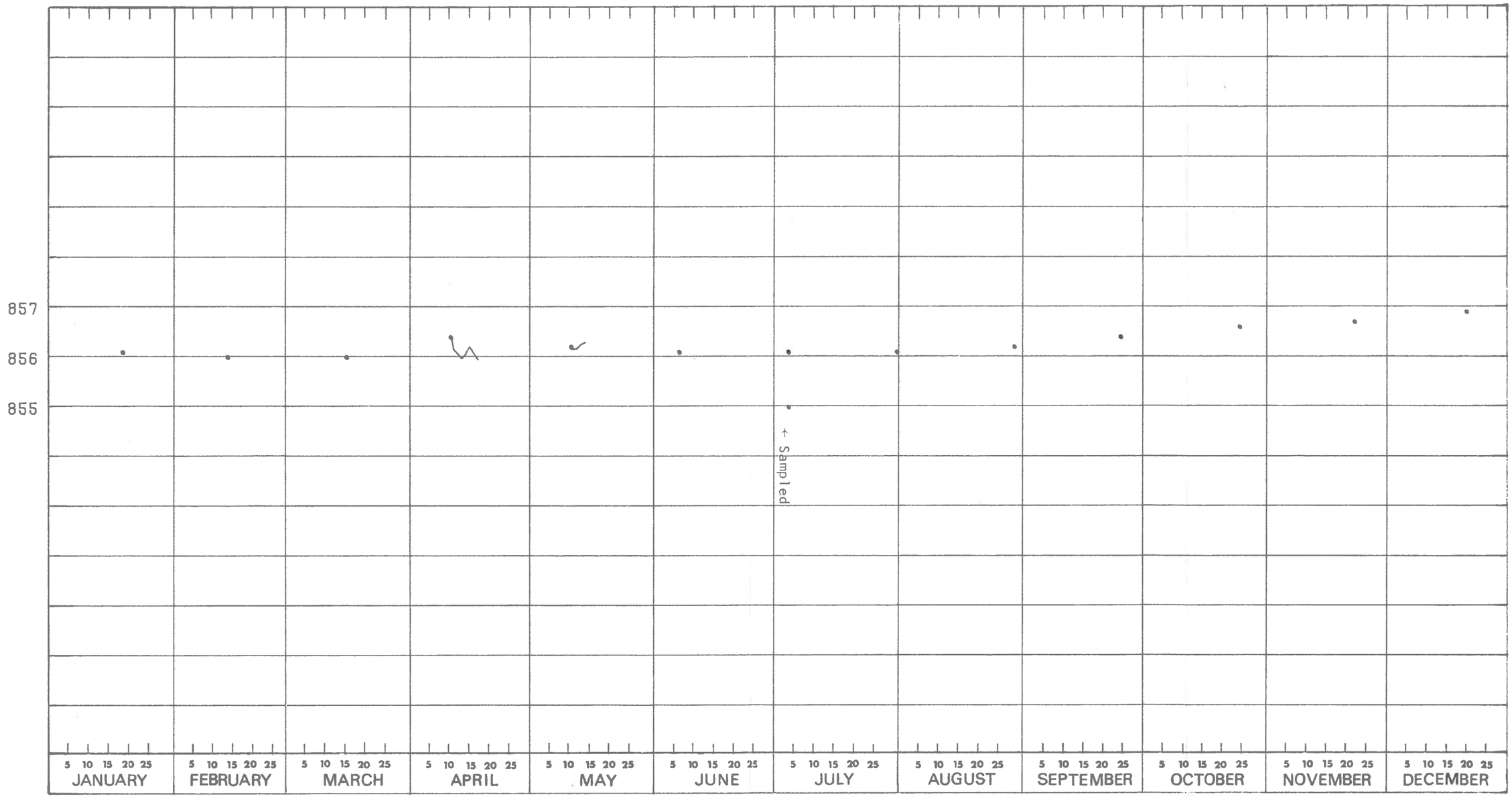
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 17-200

LSD 13 SEC 12 TWP 94 R 11 W4TH

17-200-H-79

Alberta Research Council



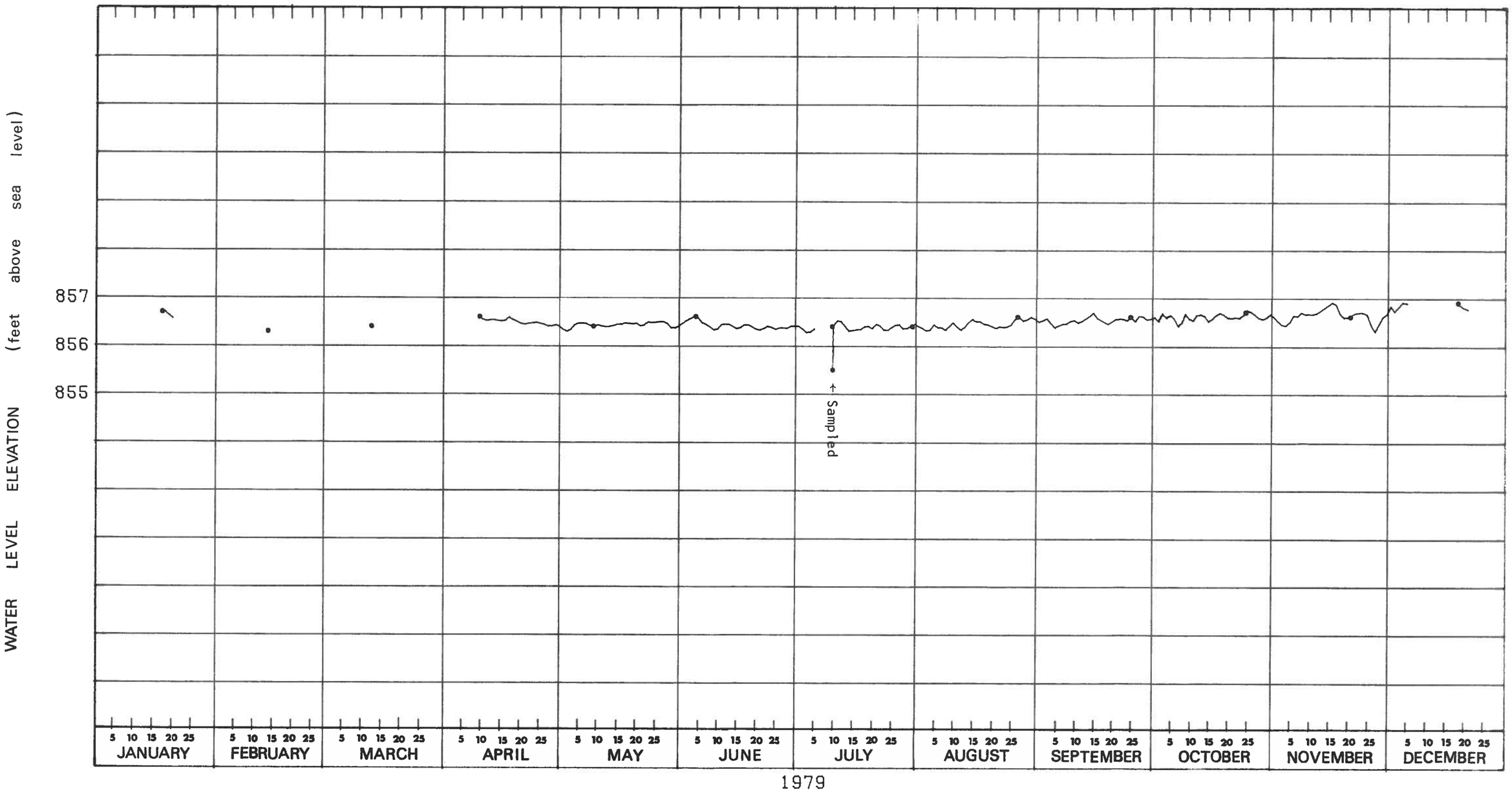
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4 th

Alberta Research Council

17-200-H-80



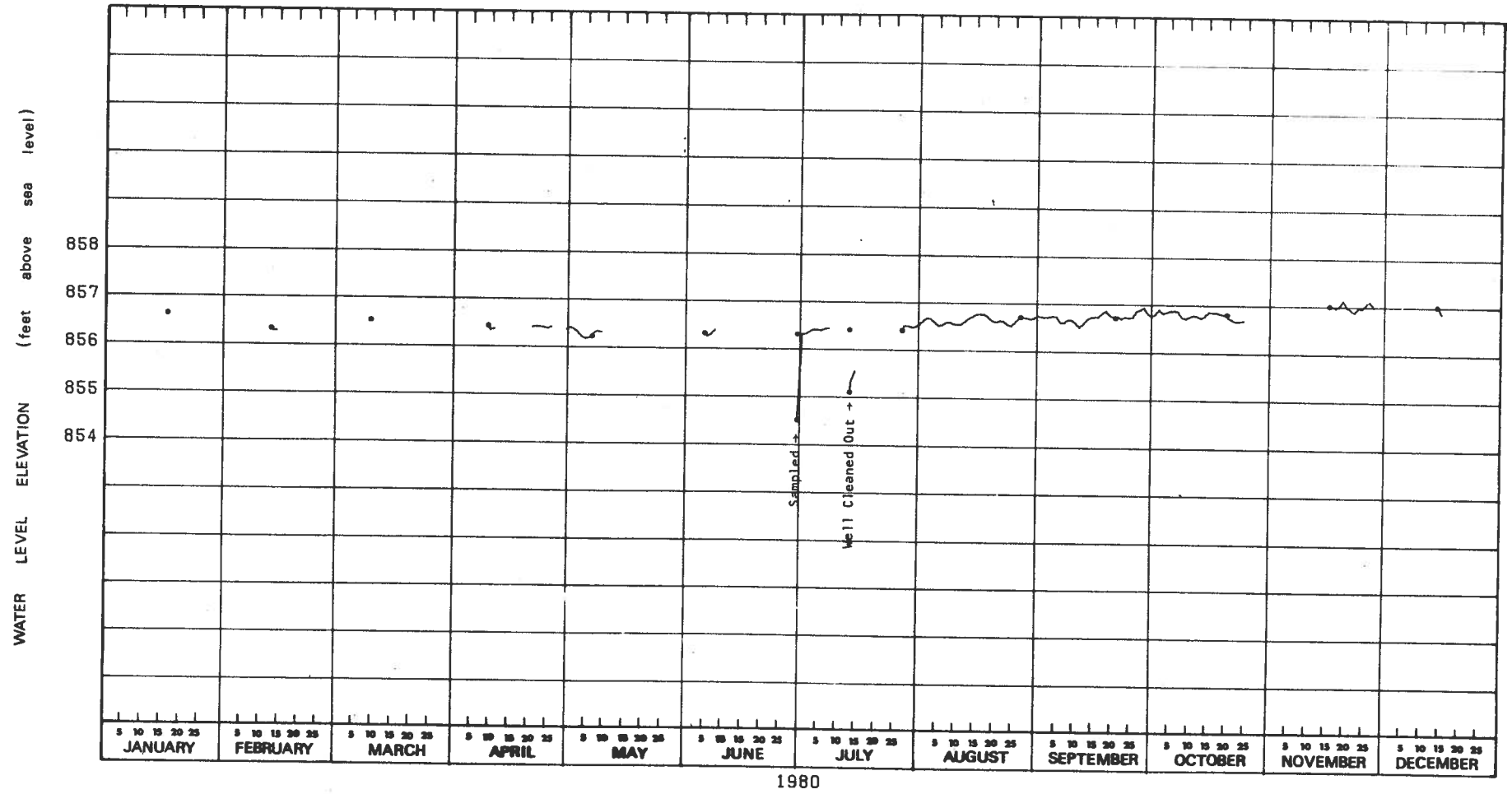
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4 th

Alberta Research Council

17-200-H-81



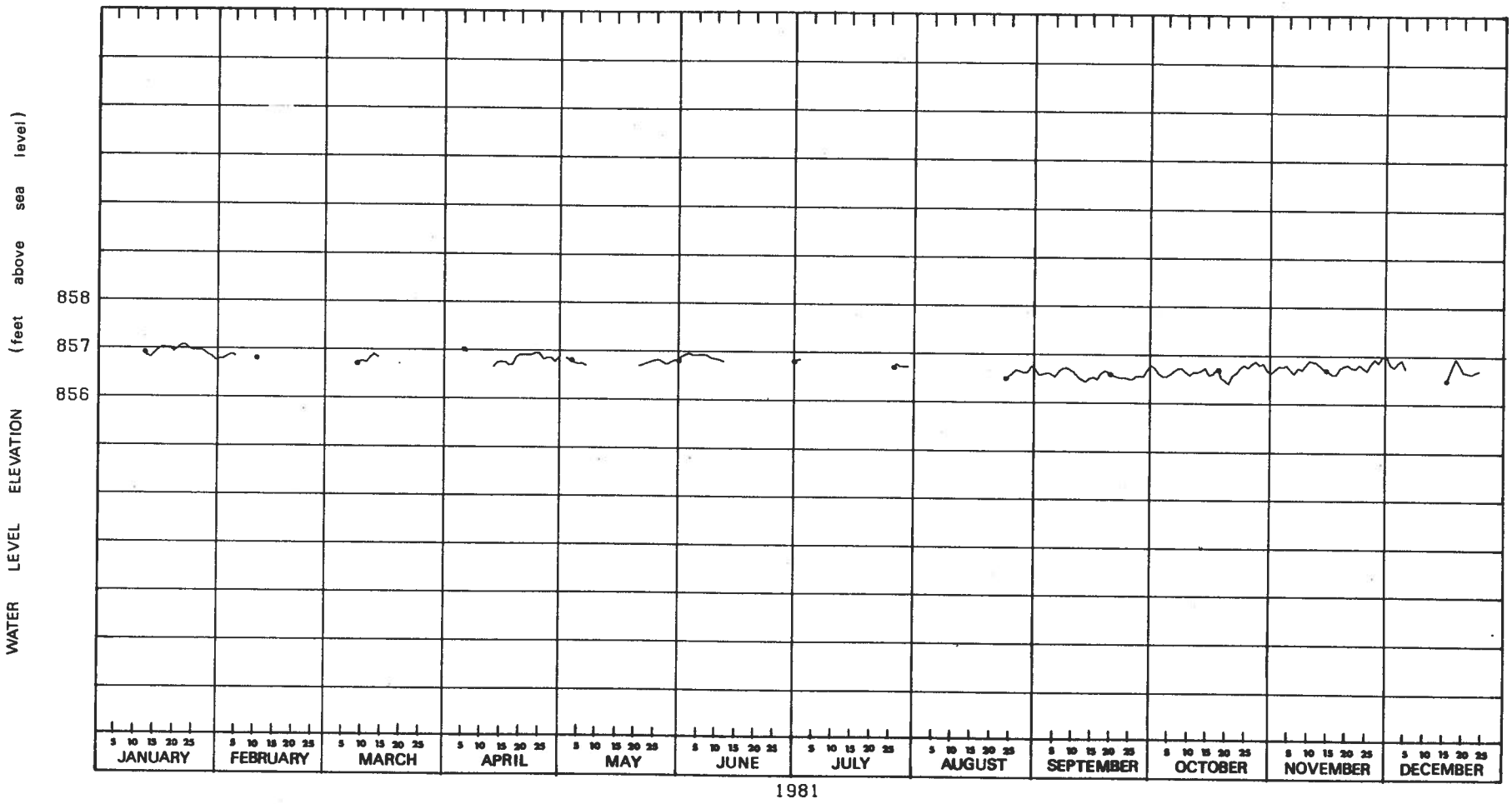
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4 th

Alberta Research Council

17-200-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 863.05

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 19/76 | | | Well completed; blown with air |
| Feb 21/76 | 24.75 TOC | 781.8 | |
| Mar 3/76 | 3.17 MP | 855.0 | |
| Apr 5/76 | 2.69 MP | 856.6 | MP = 0.73 m TOC, (865.4) |
| May 7/76 | 2.73 MP | 856.4 | |
| June 1/76 | 2.70 MP | 856.5 | |
| June 23/76 | 2.78 MP | 856.3 | |
| July 13/76 | 2.74 MP | 856.4 | |
| | 3.10 MP | 855.2 | After sample; temp. 6°C |
| Aug 11/76 | 2.79 MP | 856.2 | |
| Aug 30/76 | 2.79 MP | 856.2 | |
| Sept 29/76 | 2.70 MP | 856.5 | |
| Oct 28/76 | 2.71 MP | 856.5 | |
| Nov 10/76 | | | Bail test |
| Nov 25/76 | 2.73 MP | 856.4 | |
| Dec 22/76 | 2.70 MP | 856.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 863.05

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 14/77 | 2.85 MP | 855.9 | MP (865.3) |
| Feb 16/77 | 2.69 MP | 856.5 | |
| Mar 16/77 | 2.71 MP | 856.4 | |
| Apr 13/77 | 2.69 MP | 856.5 | |
| May 11/77 | 2.70 MP | 856.4 | |
| June 8/77 | 2.68 MP | 856.5 | |
| July 4/77 | 2.73 MP | 856.3 | |
| | 2.96 MP | 855.6 | After sample; temp. 4°C |
| Aug 3/77 | 2.77 MP | 856.2 | |
| Aug 31/77 | 2.78 MP | 856.2 | |
| Sept 26/77 | 2.77 MP | 856.2 | |
| Oct 27/77 | 2.73 MP | 856.3 | |
| Nov 22/77 | 2.78 MP | 856.2 | |
| Dec 19/77 | 2.79 MP | 856.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 863.05

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 19/78 | 2.79 MP | 856.1 | MP (865.3) |
| Feb 14/78 | 2.83 MP | 856.0 | |
| Mar 16/78 | 2.82 MP | 856.0 | |
| Apr 11/78 | 2.72 MP | 856.4 | |
| May 11/78 | 2.77 MP | 856.2 | |
| June 7/78 | 2.79 MP | 856.1 | |
| July 4/78 | 2.79 MP | 856.1 | |
| | 3.13 MP | 855.0 | After sample; temp 5°C |
| July 31/78 | 2.80 MP | 856.1 | |
| Aug 30/78 | 2.78 MP | 856.2 | |
| Sept 25/78 | 2.71 MP | 856.4 | |
| Oct 25/78 | 2.66 MP | 856.6 | |
| Nov 23/78 | 2.63 MP | 856.7 | |
| Dec 21/78 | 2.57 MP | 856.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 17-200

Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 863.05

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/79 | 2.62 MP | 856.7 | MP (865.3) |
| Feb 14/79 | 2.75 MP | 856.3 | |
| Mar 14/79 | 2.70 MP | 856.4 | |
| Apr 10/79 | 2.66 MP | 856.6 | |
| May 9/79 | 2.71 MP | 856.4 | |
| June 5/79 | 2.65 MP | 856.6 | |
| July 10/79 | 2.72 MP | 856.4 | |
| | 2.99 MP | 855.5 | After sample; temp. 5°C |
| July 31/79 | 2.71 MP | 856.4 | |
| Aug 27/79 | 2.66 MP | 856.6 | |
| Sept 25/79 | 2.65 MP | 856.6 | |
| Oct 25/79 | 2.62 MP | 856.7 | |
| Nov 21/79 | 2.66 MP | 856.6 | |
| Dec 19/79 | 2.56 MP | 856.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 17 - 200

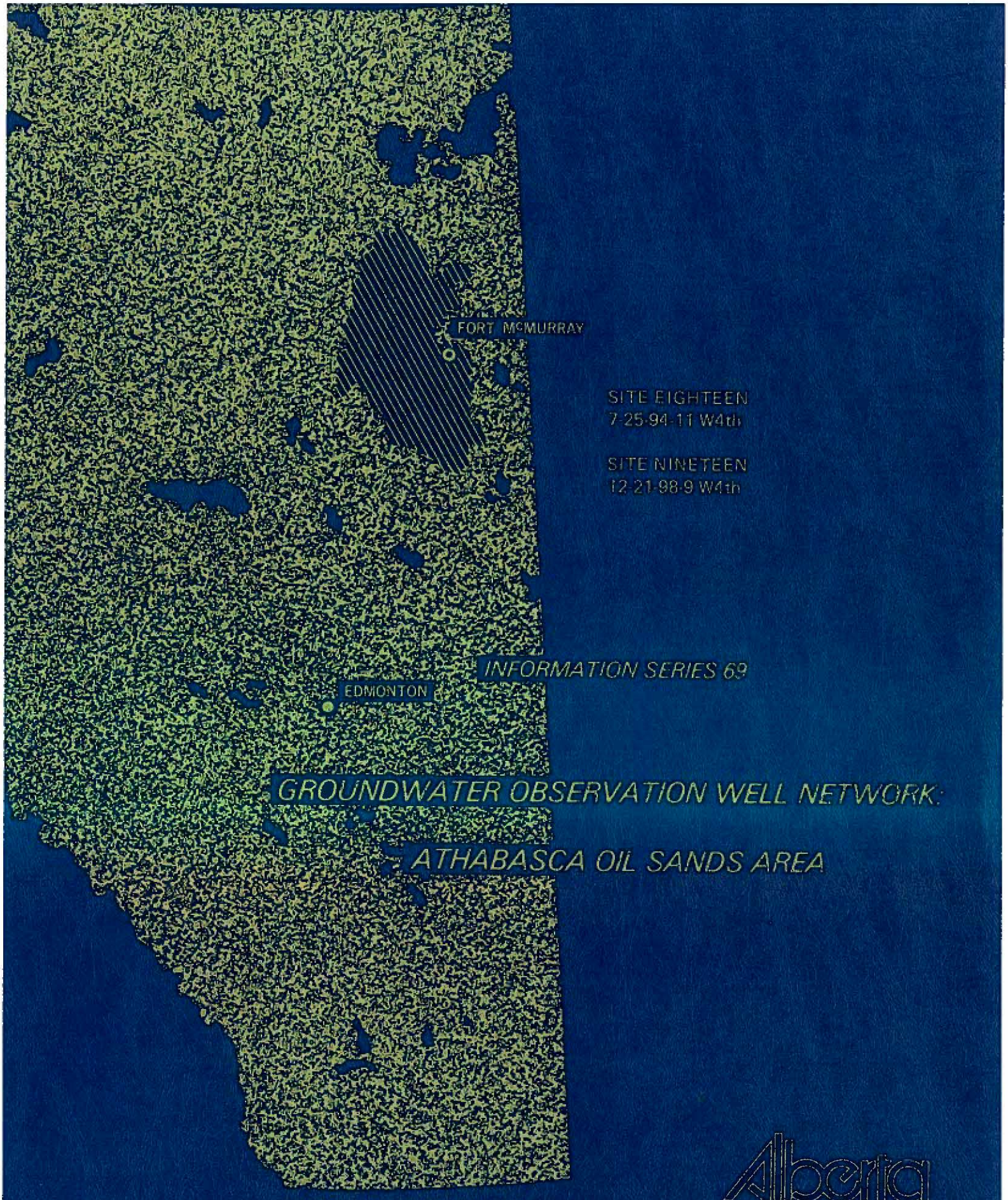
Lsd 13 Sec 12 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 863.05

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 2.64 MP | 856.6 | |
| Feb 13/80 | 2.75 MP | 856.3 | |
| Mar 10/80 | 2.67 MP | 856.5 | |
| Apr 10/80 | 2.71 MP | 856.4 | |
| May 7/80 | 2.76 MP | 856.2 | |
| June 6/80 | 2.74 MP | 856.3 | |
| June 30/80 | 2.73 MP | 856.3 | Surface t=6°C, Cond.= >20000 Ph= 7.95 Bottom hole Sample t=5°C cond.= >20000, ph= 7.90 |
| | 3.29 MP | 854.5 | After Sample |
| July 9/80 | 2.72 MP | 856.4 | Bailed 350 gals. |
| July 10/80 | | | Bailed 135 gals., Sampled t=5°C, Cond. >20000 |
| July 14/80 | 3.10 MP | 855.1 | |
| July 28/80 | 2.72 MP | 856.4 | |
| Aug 28/80 | 2.62 MP | 856.7 | |
| Sept 22/80 | 2.61 MP | 856.7 | |
| Oct 22/80 | 2.58 MP | 856.8 | |
| Nov 17/80 | 2.53 MP | 857.0 | |
| Dec 15/80 | 2.52 MP | 857.0 | |
| Jan 12/81 | 2.57 MP | 856.9 | |
| Feb 11/81 | 2.59 MP | 856.8 | |
| Mar 9/81 | 2.61 MP | 856.7 | |
| Apr 6/81 | 2.53 MP | 857.0 | |
| May 4/81 | 2.59 MP | 856.8 | |
| June 1/81 | 2.59 MP | 856.8 | |
| July 1/81 | 2.60 MP | 856.8 | |
| July 27/81 | 2.61 MP | 856.7 | |
| Aug 25/81 | 2.68 MP | 856.5 | |
| Sept 21/81 | 2.64 MP | 856.6 | |
| Oct 19/81 | 2.61 MP | 856.7 | |
| Nov 16/81 | 2.61 MP | 856.7 | |
| Dec 17/81 | 2.67 MP | 856.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing




INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK: ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

# INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study is to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and processing plants, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground, and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. These observation wells were drilled in groups in order to sample heads and chemistry at various depths below the surface. Seven sites (numbers 1, 2, 3, 6, 7, 8 and 9), containing 37 individual wells, were instrumented in this manner during the winter of 1974-75. Eight sites (numbered 10, 11, 12, 13, 14, 15, 16 and 17), containing 38 individual wells, were instrumented during the winter of 1975-76. One site (numbered 18), containing 3 individual wells, was instrumented during the spring of 1978. Well 19-103 was installed under the auspices of a town-site evaluation program by the Northeast Regional Commissioner's office and subsequently became part of the network as site number 19, in the spring of 1978.

The factual details of this system are important to users for various differing reasons and thus a readily available document outlining these details is warranted. This publication groups the information by site. There is one publication for each well site. Included in each site publication are: 1) geological and geophysical logs; 2) annual hydrographs, 3) drill stem test results, 4) aquifer testing

results, 5) well history, 6) water analyses, and 7) well completion details. The page indexing system is also consistent with the updating process. All update volumes will be noted in the Alberta Research Council List of Publications.

Each site publication is divided into sections dealing with each individual well in addition to this Introduction and a Legend. There are 17 piezometer nests in the system. There are 16 separate site publications in Information Series 69 (site 18 and 19 are together in one site publication). Table 1 lists the location of wells in the system as of January 1, 1979. Figure 1 indicates the location of these wells. Publications are available as of the date of this document for all sites.

Five oil companies have made available a total of twelve wells for inclusion in the system. Data from these wells will be published in the same format as those constructed with government financing.

## ACKNOWLEDGMENTS

The monitoring of the Observation Well Network was funded by Alberta Energy and Natural Resources through a contract with the Research Council.

Mr. G. Jean assisted in the maintaining and monitoring of the wells. His efforts are greatly appreciated.

Various oil companies have contributed to the Observation Well Network through the loan of wells installed by them. These companies were, as of January 1, 1979: BPOG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., Shell Canada Ltd. and Home Oil Company Ltd.

M.E. BRULOTTE

EDMONTON

1979

Table 1

Athabasca Oil Sands Observation Wells

January 1, 1979

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95- 9 | 6 |
| Lsd 13-20-95- 8 | 7 |
| Lsd 5-30-94- 7 | 8 |
| Lsd 1 and Lsd 16- 4-94- 6 | 9 |
| Lsd 9-24-85- 9 | 10 |
| Lsd 16- 2-87- 9 | 11 |
| Lsd 8-27-88- 9 | 12 |
| Lsd 8-11-90-12 | 13 |
| Lsd 4-15-92-12 | 14 |
| Lsd 15-33-89-16 | 15 |
| Lsd 6-13-90-10 | 16 |
| Lsd 13-12-94-11 | 17 |
| Lsd 7-25-94-11 | 18 |
| Lsd 12-21-98- 9 | 19 |
| Lsd 15- 3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1- 1-96-11 | Fina 73-2 |
| Lsd 9- 9-96-10 | Fina 73-6 |
| Lsd 10-20-96- 7 | Tenneco 1 |
| Lsd 3-28-94- 9 | Home 4 |
| Lsd 10-25-95-10 | Shell PW-4 |
| Lsd 10-24-95- 9 | Shell PW-2 |
| Lsd 10-25-95-10 | Shell Obs-7 |

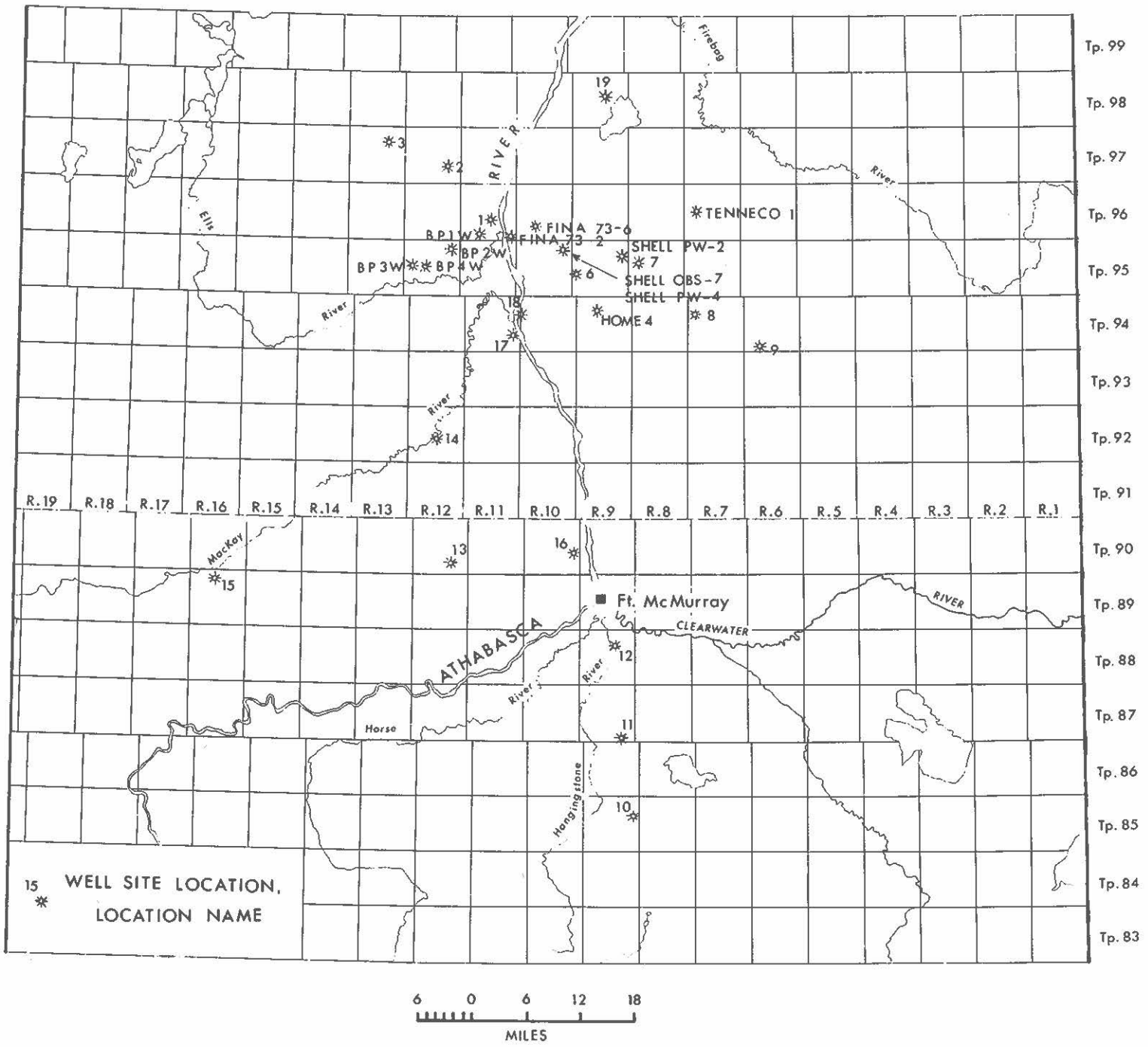



FIGURE 1. Athabasca Oil Sands observation well network, January 1979

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

| | | |
|---|---|---|
| Well Number | - | the name used for designating the well |
| Subject Code | - | as follows: |
| I | - | Introduction (no site number indicated) |
| L | - | Legend (no site number indicated) |
| G | - | General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents |
| C | - | Well construction details |
| D | - | Drill stem testing |
| A | - | Aquifer testing |
| E | - | Chemical analyses including multielement analyses and routine water analyses |
| H | - | Annual hydrograph |
| W | - | Well history |
| Year of Publication | - | the last two numerals of the year of publication. |

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within the tabbed section for that particular well.

GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
| | sandstone, arkosic |
| | silt |
| | siltstone |
| | siltstone & sandstone |
| | clay |
| | clay, sandy |
| | claystone, shale |
| | sandstone & shale |
| | oil sand |
| | limestone |
| | limestone, shaley |
| | dolomite |
| | dolomite, argillaceous |
| | rock salt |
| | gypsum & anhydrite |
| | coal |
| | igneous rock |

| Symbol | Stratigraphic Unit |
|---|---|
| | Pleistocene and Recent |
| Qd | Surface deposits |
| | Cretaceous |
| Ks | Smoky Group |
| Klb | La Biche Formation |
| Kd | Dunvegan Formation |
| Ksh | Shaftesbury Formation |
| Kpl | Pelican Formation |
| Kj | Joli Fou Formation |
| Kg | Grand Rapids Formation |
| Kc | Clearwater Formation |
| Kw | Wabiskaw Member |
| Km | McMurray Formation |
| | Devonian |
| Dwd | Woodbend Group |
| Dbl | Beaverhill Lake Formation |
| Dsw | Slave Point Formation & Fort Vermilion Formation & Watt Mountain Formation |
| Dmk | Muskeg Formation |
| Dpe | Prairie Evaporite Formation |
| Dm | Methy Formation (Keg River Formation equivalent) |
| Dmr | McLean River Formation (Chinchaga Formation equivalent) |
| Dl | La Loche Formation |
| | Precambrian |
| Pc | Undivided |

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

| Symbol | Units or Parameter |
|---|---|
| Sec. | section |
| ss | stainless steel |
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) or time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| WILL | Analysis done at Western Industrial Laboratories Ltd. |
| Wt | weight |

## GEOLOGICAL ABBREVIATIONS

| | |
|---|---|
| biocl | bioclast |
| brac | brachiopod |
| bry | bryozoan |
| calc | calcareous |
| carb | carbonaceous |
| cht | chert |
| fld | feldspar |
| glauc | glauconite, glauconitic |
| gvl | gravel |
| hvy | heavy |
| lt | light |
| mnrls | minerals |
| pbl | pebbles |
| qtz | quartz |
| strgr(s) | stringer(s) |
| stroms | stromotoporoids |
| subang | subangular |
| subrd | subrounded |

## GENERAL INFORMATION

Information included under this subject include:

1) A geological sample description; if one was made available, giving the description of the samples obtained during the drilling of the hole.

2) Geophysical and geological (if available) strip logs of the hole. The open portion of each well is indicated along the left side of the logs.

## CHEMICAL ANALYSES

All wells in the Network will be sampled by bailing at least once a year for the first few years. Most routine water analyses were done at Alberta Research Council.

## WELL HISTORY

A record of all major events occurring to each well is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling and any other event of potential hydrogeological interest.

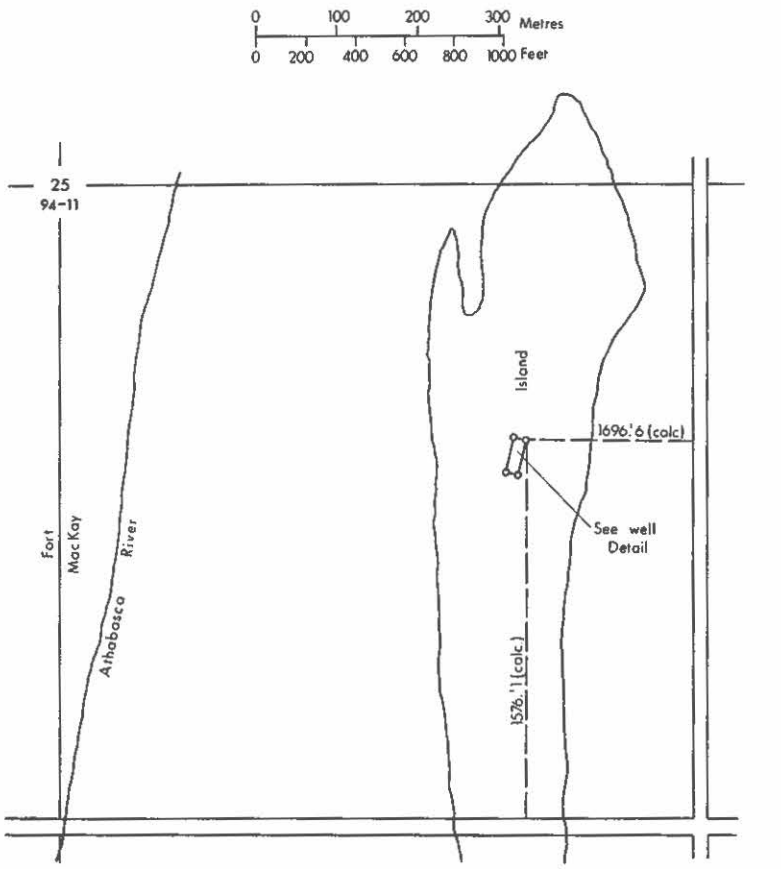
## ANNUAL HYDROGRAPHS

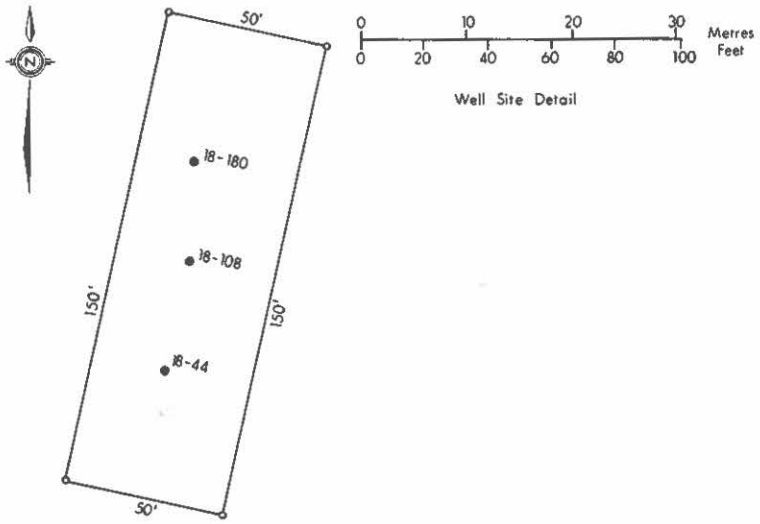
There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. Monthly manual measurements are made at present in those wells where the depth to water exceeds 200 feet.

# OBSERVATION WELL SITE 18

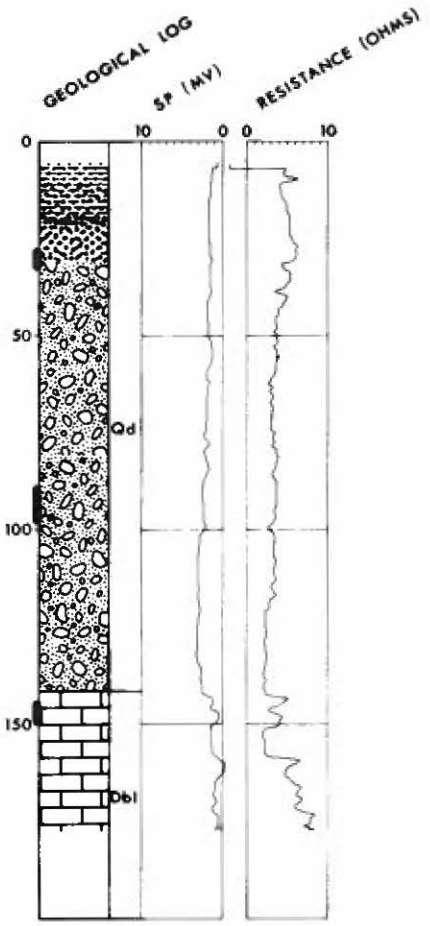
7-25-94-11-W4 th

ALBERTA RESEARCH COUNCIL



# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 18
## 7-25-94-11 W4th
## ALBERTA RESEARCH COUNCIL



GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Eighteen

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Ground elevation 767 Total depth 180 feet

KB elevation

| Interval from (feet below GL) | to | Description | Formation |
|---|---|---|---|
| 0 | 10 | Clay, blue grey. Silt, angular and rounded. Sand, very-fine, qtz, fld, biotite, muscovite. | Drift |
| 10 | 20 | Sand, angular to well-rounded, poorly sorted, clear and smoky, qtz, few granules of qtz, biotite, muscovite. Clay, medium grey, iron-stained. Silt. | |
| 20 | 30 | Sand, clear and smoky, qtz, fld, fine to medium angular to subrd, poorly sorted. Some clastic fld particles, biotite, muscovite. | |
| 30 | 40 | Sand, medium to coarse, subang, clear, qtz. Gravel, medium, granite fragments. Limestone fragments, subang, lt grey, oil stained. Sandstone, very fine-grained, brown. Siltstone, well cemented. Biotite, muscovite. | |
| 40 | 50 | Gravel, medium to coarse, angular to rounded, pink, clear, and smoky qtz, some cht granules. Some broken fragments of qtz and granite. Sand, fine to medium, poorly sorted. Limestone, lt grey, slightly oil stained, small particles of limonite on limestone. Sandstone, fine-grained, brown, silicious cement. Some particles of oil sands. Biotite, muscovite. | |
| 50 | 60 | Sand, fine to medium angular to poorly rounded, qtz. Some gravel size particles. Limestone, subang, oil stained, fragments of limonite. Few fld and granite fragments. Particles of fine-grained oil sands. Sandstone, brown, hard, fine-grained. Sandstone, pink, coarse-grained, hard, well sorted, silicious cement, well rounded, qtz, (quartzite?). Biotite, muscovite. | |

GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Eighteen (continued)

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below GL) | to | Description | Formation |
|---|---|---|---|
| 60 | 70 | Limestone, lt grey, subang, few particles of dolomite. Sand, medium, angular to poorly rounded, qtz. Gravel, broken granules. Small fragments of coal. Some fine-grained oil sand particles. Biotite, gypsum. | |
| 70 | 80 | Limestone, broken fragments, angular, oil stained. Gravel, pink, clear, and smoky qtz. Cht fragments and fld. Granite, granules. Sand, poorly sorted, poorly rounded, qtz. Oil sands, fine-grained. Coal, muscovite, gypsum. Sandstone, hard, coarse grained, well sorted, well cemented, brown, (quartzite?). | |
| 80 | 90 | Limestone, angular, lt grey. Gravel, qtz, clear, smoky, fld. Granite fragments. Sand, poorly rounded, poorly sorted, fine-medium. Oil sands, fine-grained. Sandstone, fine-grained, hard, brown. Sandstone, coarse-grained, well sorted, silicious cement, (quartzite?). Biotite, muscovite. | |
| 90 | 100 | Limestone, lt grey, angular, oil stained. Gravel, qtz, smoky, fld. Sand, fine to medium, poorly to well rounded, clear qtz. Some clastic fld fragments. Cht breccia. Oil sands, fine-grained. Few oil impregnated bands of white sandstone, fine-grained. Sandstone, medium, well sorted, qtz, silicious cement? Biotite, muscovite, gypsum. | |
| 100 | 110 | No sample. All cuttings passed through household sieve. | |
| 110 | 120 | Limestone, angular and broken fragments, oil stained, lt grey. Few dolomite fragments, pyrite crystals. Sand, medium to coarse, poorly to well rounded, clear and smoky, qtz. Sandstone, fine-grained, well-cemented. Sandstone, coarse-grained, poorly cemented, (calcite?), qtz and granite fragments. Cht breccia, muscovite, biotite. Oil sands, fine-grained. | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Eighteen (continued)

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below GL) | to | Description | Formation |
|---|---|---|---|
| 120 | 140 | No sample. All cuttings pass through household sieve. | |
| 140 | 150 | Limestone, large fragments, copper sulfate, pyrite, fossil fragments, slight oil staining. Gravel, large angular, cht pebbles, qtz, granite fragments. Sandstone, red, coarse-grained, hard, well-sorted. Sandstone, brown, fine-grained, hard. | Beaverhill Lake |
| 150 | 160 | Limestone, large angular, lt grey, fossil fragments, pyrite. Sandstone coarse, qtz, well-sorted, pink, (quartzite?). Cht pebbles, muscovite, gypsum. Sandstone, brown, fine-grained. Sandstone, medium to coarse, qtz, oil impregnated. | |
| 160 | 170 | Limestone, large angular fragments, copper sulfate stains, fossil fragments, lt grey, pyrite crystals. Gypsum, magnesite, muscovite. Cht pebbles, fld crystals. Fragments of oil impregnated. coarse, sandstone. | |
| 170 | 180 | Limestone, broken fragments, angular, lt grey, pyrite, fossil fragments, slight oil staining. Dolomite, few fld crystals, gypsum. Sandstone, coarse, hard, brown. | |

# SUMMARY OF CONTENTS

SITE NUMBER EIGHTEEN
Lsd 7 Sec 25 Twp 94 R 11 W4th

SITE NUMBER NINETEEN
Lsd 12 Sec 21 Twp 98 R 9 W4th

Alberta Research Council

number of pages distributed for these sites in 1979

| Page Title | Well Name | | | | | |
|---|---|---|---|---|---|---|
| | Site Eighteen | | | | Site Nineteen | |
| | Site | 18-44 | 18-108 | 18-180 | Site | 19-103 |
| Introduction | 4* | - | - | - | - | - |
| Legend | 4* | - | - | - | - | - |
| Site Plan | 1 | - | - | - | - | - |
| Geological Sample Description | 3 | - | - | - | 1 | - |
| Geophysical and Geological Logs | 1 | - | - | - | - | - |
| Well Construction | - | 1 | 1 | 1 | - | 1 |
| Drawdown Plot | - | - | - | - | - | 3 |
| Water Analysis | - | 1 | 2 | 2 | - | 2 |
| Hydrograph | - | 1 | 1 | 1 | - | 1 |
| Well History | - | 1 | 1 | 1 | - | 1 |

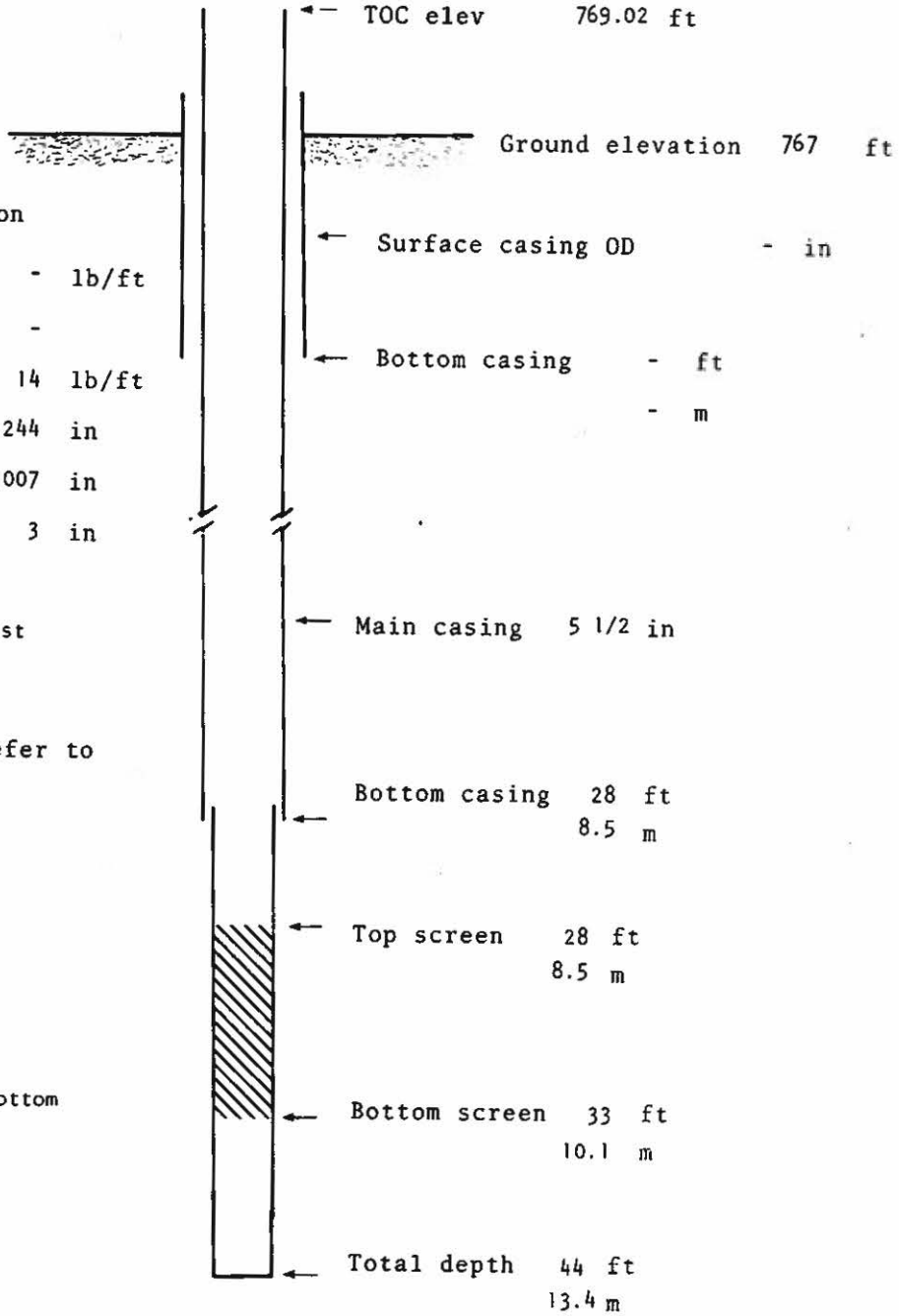
* For Both Sites

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 18-44

Lsd 7 Sec 25 Tp 94 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 3 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to ground

Screen welded to bottom of casing

18-44-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 18-44

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled March 21, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 82.0 | 4.09 | 23.4 |
| Magnesium(Mg) | 16.4 | 1.35 | 7.7 |
| Sodium(Na) | 275.0 | 11.96 | 68.4 |
| Potassium(K) | 3.3 | 0.08 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 281.0 | 4.61 | 27.8 |
| Sulphate(SO4) | 175.0 | 3.64 | 22.0 |
| Chloride(Cl) | 294.0 | 8.29 | 50.1 |
| Nitrate(NO3) | 1.3 | 0.02 | 0.1 |
| Silica(SiO2) | 6.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 1036.0 | | |
| Total Anions(epm) | 16.56 | Total Cations(epm) | 17.49 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1790 | Temperature(C) | |
| pH | 8.0 | pH | |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

18-44-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 18-44

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 140.0 | 6.99 | 19.7 |
| Magnesium(Mg) | 43.0 | 3.54 | 10.0 |
| Sodium(Na) | 570.0 | 24.79 | 70.0 |
| Potassium(K) | 4.6 | 0.12 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 468.0 | 7.67 | 20.7 |
| Sulphate(SO4) | 338.0 | 7.04 | 19.0 |
| Chloride(Cl) | 790.0 | 22.28 | 60.2 |
| Nitrate(NO3) | 3.2 | 0.05 | 0.1 |
| Silica(SiO2) | 5.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 134.0 | | |
| Magnesium(Acidified) | 42.0 | | |
| TDS(mg/l) | 2146.0 | | |
| Total Anions(epm) | 37.04 | Total Cations(epm) | 35.44 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3240 | Temperature(C) | 4.00 | |
| pH | 7.0 | pH | 7.1 | |
| Fluoride(F) | 0.5 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 512 | mg/l |
| | | Hydroxide(OH) | | |

18-44-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 18-44

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 9, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 63.0 | 3.14 | 8.3 |
| Magnesium(Mg) | 39.0 | 3.21 | 8.5 |
| Sodium(Na) | 723.0 | 31.45 | 82.9 |
| Potassium(K) | 5.0 | 0.13 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 290.0 | 4.75 | 11.9 |
| Sulphate(SO4) | 299.0 | 6.23 | 15.6 |
| Chloride(Cl) | 1020.0 | 28.76 | 72.2 |
| Nitrate(NO3) | 4.8 | 0.08 | 0.2 |
| Silica(SiO2) | 2.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 50.0 | | |
| Magnesium(Acidified) | 35.0 | | |
| TDS(mg/l) | 2228.0 | | |
| Total Anions(epm) | 39.82 | Total Cations(epm) | 37.93 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3450 | | Temperature(C) | 4.50 | |
| pH | 8.3 | | pH | 8.3 | |
| Fluoride(F) | 0.3 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 312 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 18-44-E-82

OBSERVATION WELL NUMBER 18-44

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 9, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 34.0 | 1.70 | 8.9 |
| Magnesium(Mg) | 11.0 | 0.92 | 4.8 |
| Sodium(Na) | 373.0 | 16.22 | 85.3 |
| Potassium(K) | 6.7 | 0.17 | 0.9 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 146.0 | 2.39 | 11.5 |
| Sulphate(SO4) | 235.0 | 4.90 | 23.6 |
| Chloride(Cl) | 478.0 | 13.46 | 64.8 |
| Nitrate(NO3) | 0.8 | 0.01 | 0.1 |
| Silica(SiO2) | 2.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 25.9 | | |
| Magnesium(Acidified) | 14.5 | | |
| TDS(mg/l) | 1224.0 | | |
| Total Anions(epm) | 20.77 | Total Cations(epm) | 19.01 |

Other Constituents

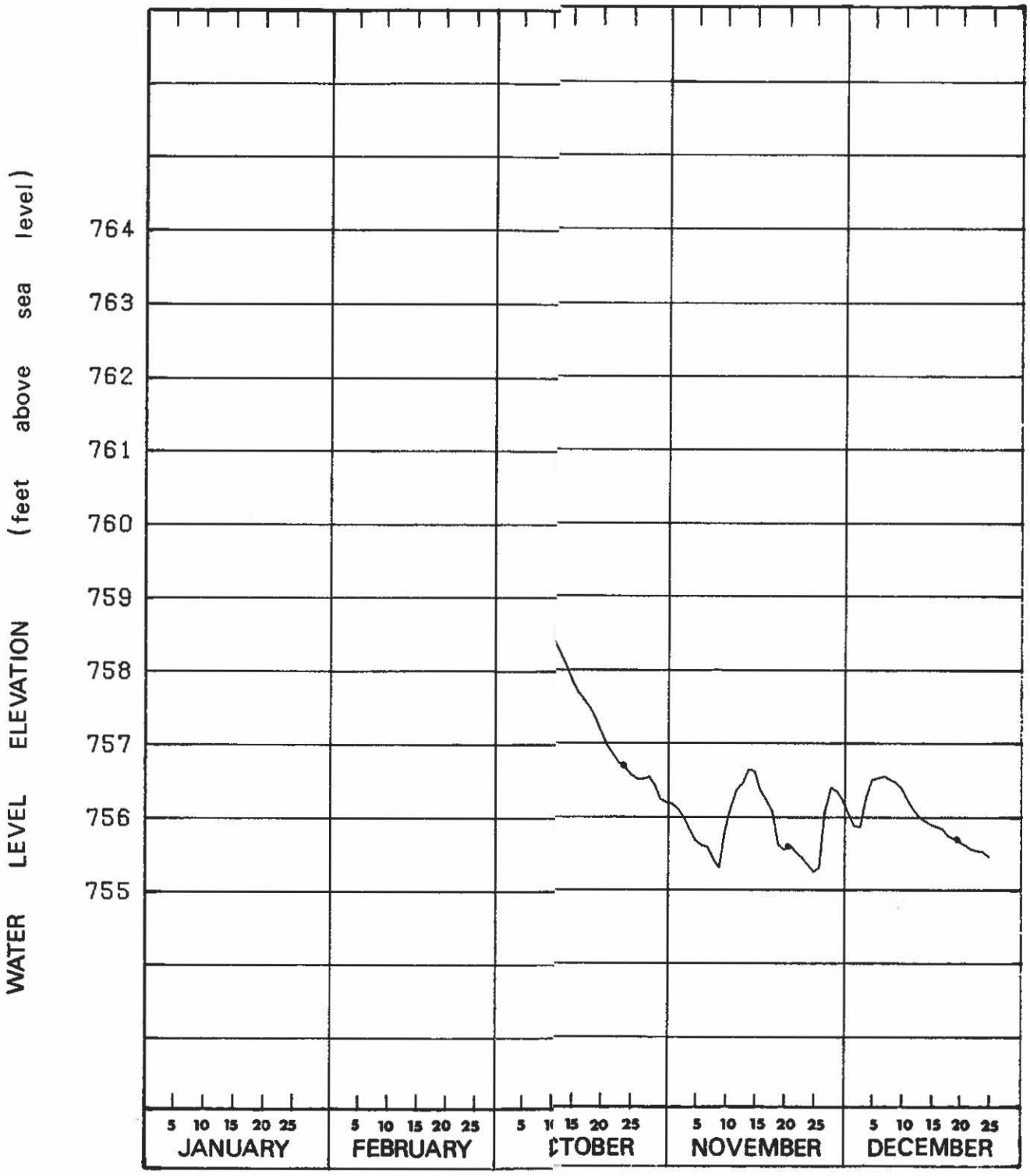
| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2300 | Temperature | 5.00 | |
| pH | 8.2 | pH | 8.1 | |
| Fluoride | 0.4 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 161 | mg/l |
| | | Hydroxide(OH) | | |

WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1E 18-44-H-79

LSD 7 SEC 25 TWP 94 R 11

Alberta Research Council



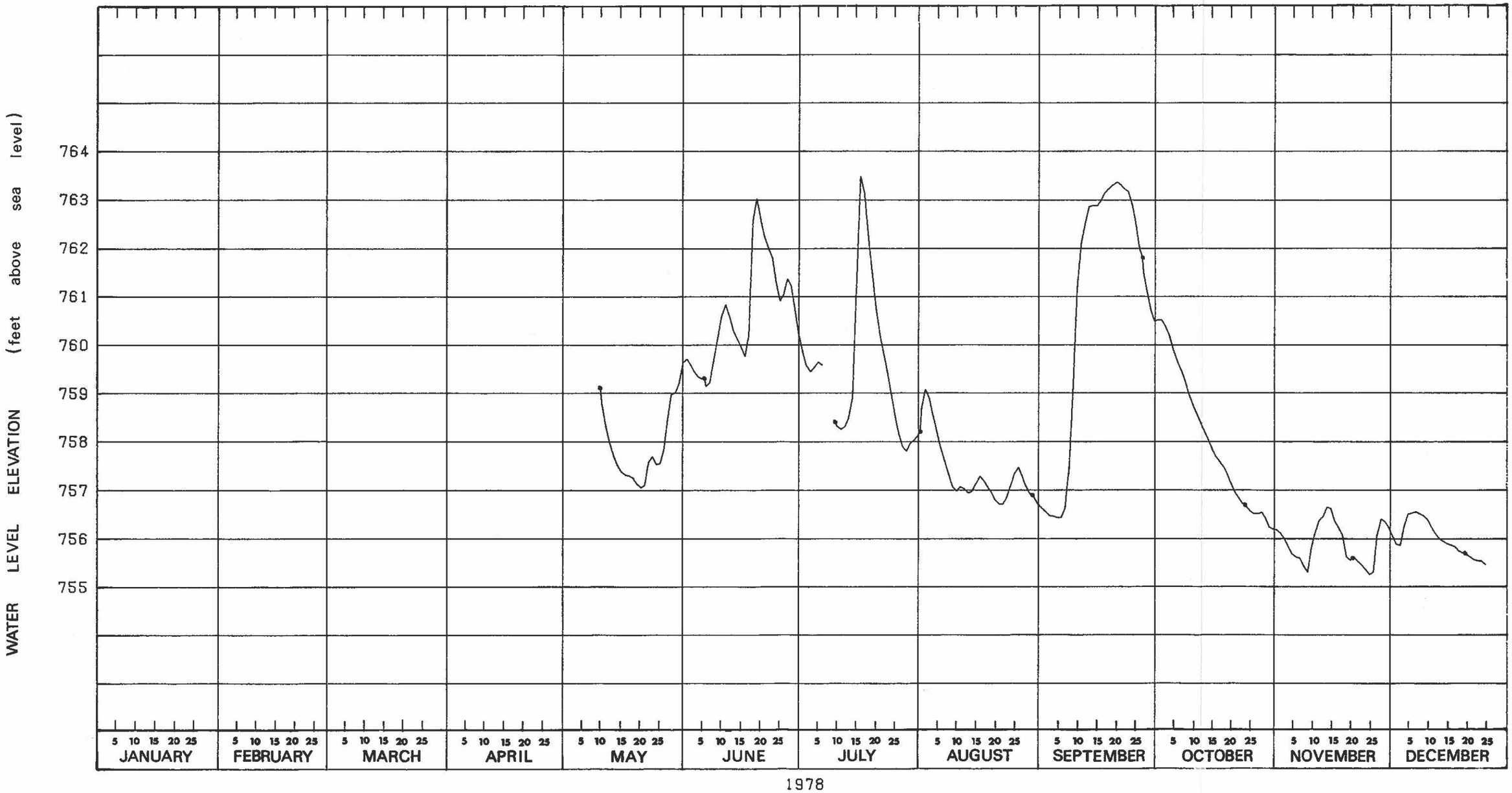
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-44

LSD 7 SEC 25 TWP 94 R 11 W4TH

18-44-H-79

Alberta Research Council



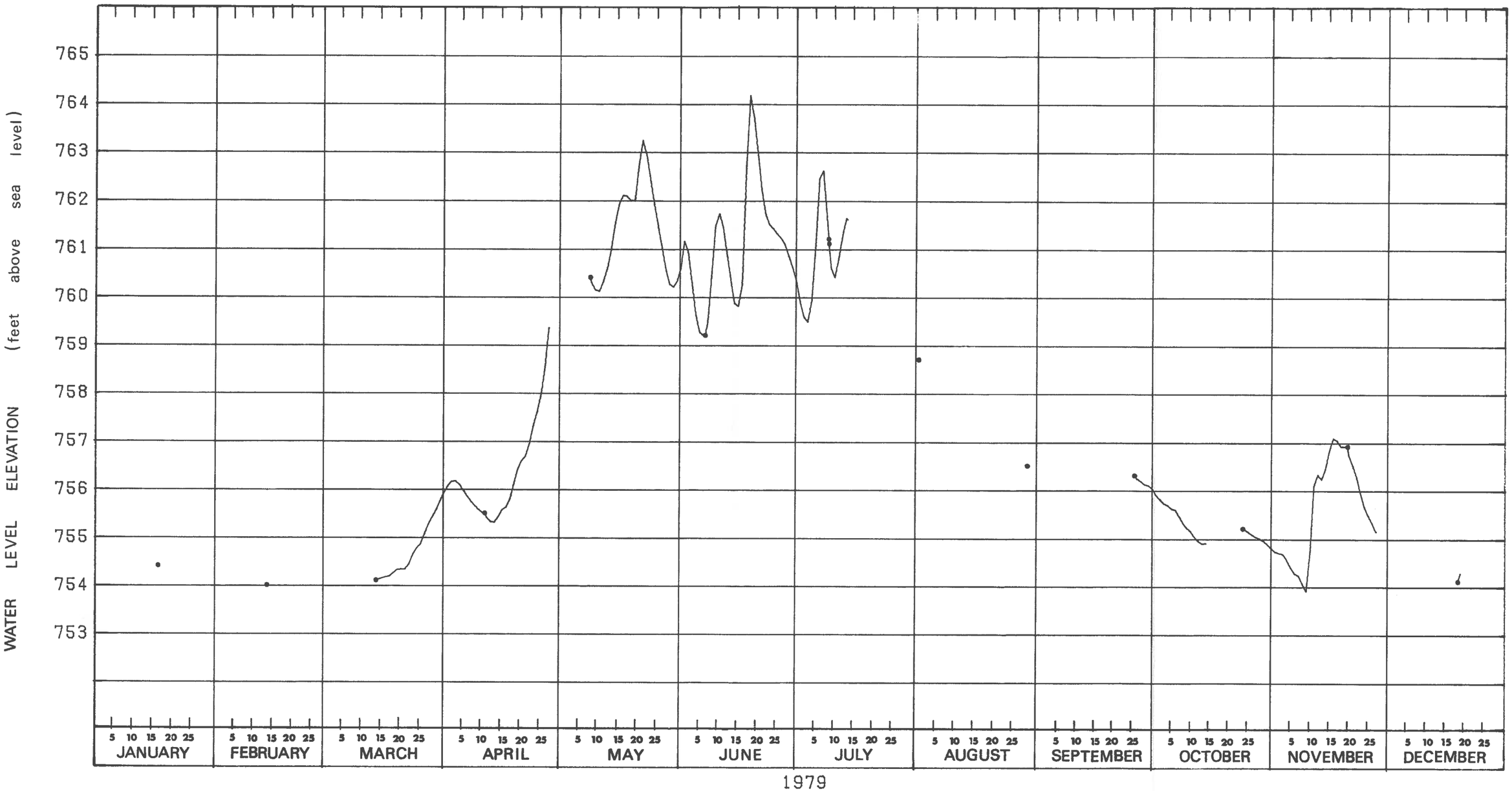
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-44

Lsd 7 Sec 25 Twp 94 R 11 W4 th

Alberta Research Council

18-44-H-80



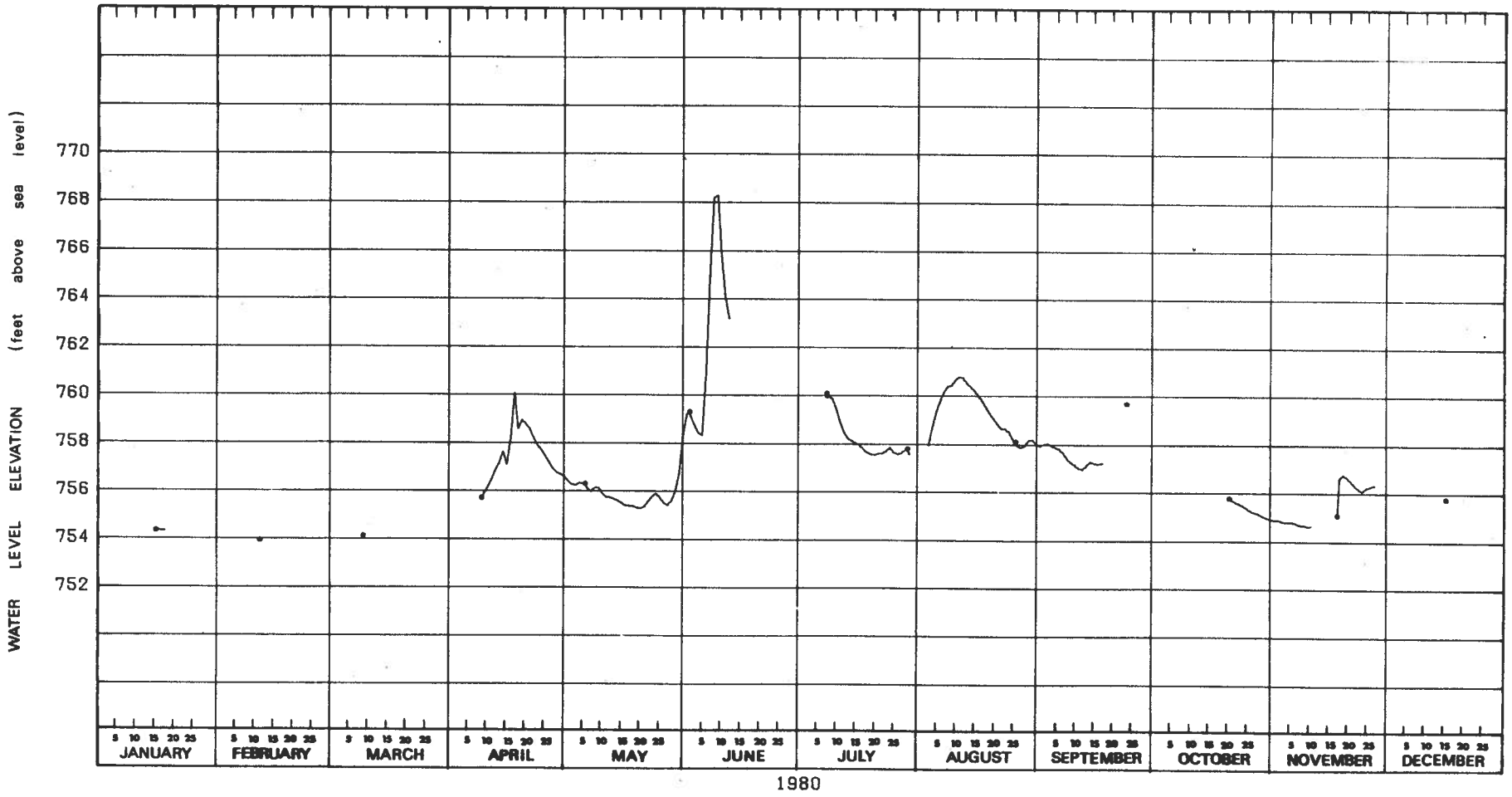
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-44

Lsd 7 Sec 25 Twp 94 R 11 W4 th

Alberta Research Council

18-44-H-81



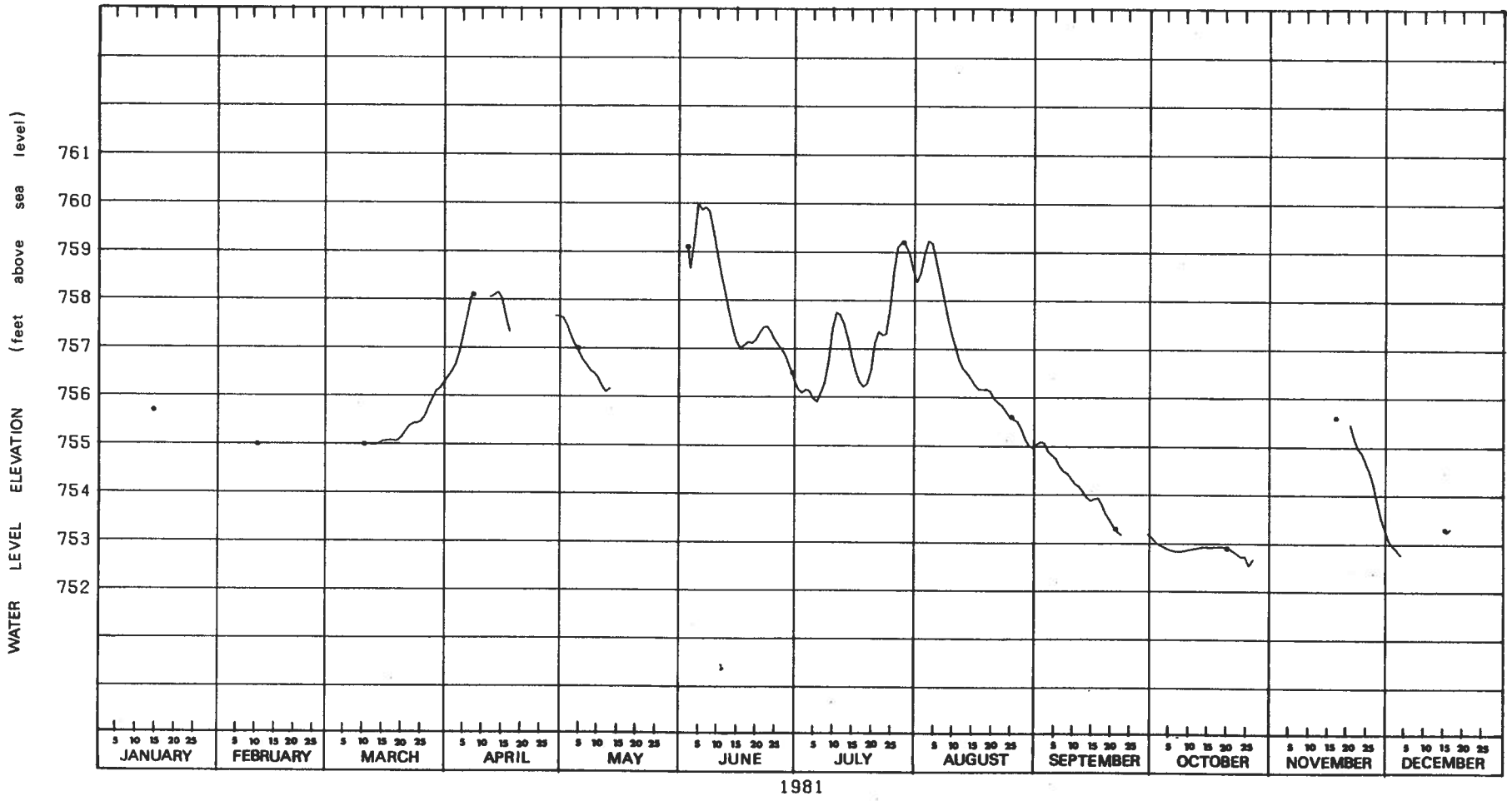
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-44

Lsd 7 Sec 25 Twp 94 R 11 W4 th

Alberta Research Council

18-44-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 18-44

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 769.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar /78 | | | Well completed |
| Apr 13/78 | 4.14 MP | 757.7 | MP = 0.70m TOC (771.3) |
| May 10/78 | 3.71 MP | 759.1 | |
| June 6/78 | 3.67 MP | 759.3 | |
| July 10/78 | 3.94 MP | 758.4 | |
| | 3.94 MP | 758.4 | After sample; temp 4°C |
| Aug 1/78 | 4.00 MP | 758.2 | |
| Aug 30/78 | 4.38 MP | 756.9 | |
| Sept 27/78 | 2.90 MP | 761.8 | |
| Oct 24/78 | 4.44 MP | 756.7 | |
| Nov 21/78 | 4.79 MP | 755.6 | |
| Dec 20/78 | 4.76 MP | 755.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 18-44

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 769.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 5.15 MP | 754.4 | MP (771.3) |
| Feb 14/79 | 5.26 MP | 754.0 | |
| Mar 14/79 | 5.24 MP | 754.1 | |
| Apr 11/79 | 4.81 MP | 755.5 | |
| May 8/79 | 3.32 MP | 760.4 | |
| June 7/79 | 3.69 MP | 759.2 | |
| July 9/79 | 3.09 MP | 761.2 | |
| | 3.10 MP | 761.1 | After sample; temp. 4.5°C |
| Aug 1/79 | 3.83 MP | 758.7 | |
| Aug 29/79 | 4.52 MP | 756.5 | |
| Sept 26/79 | 4.58 MP | 756.3 | |
| Oct 24/79 | 4.92 MP | 755.2 | |
| Nov 20/79 | 4.39 MP | 756.9 | |
| Dec 19/79 | 5.25 MP | 754.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 18 - 44

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 769.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 5.17 MP | 754.3 | |
| Feb 12/80 | 5.29 MP | 753.9 | |
| Mar 10/80 | 5.23 MP | 754.1 | |
| Apr 10/80 | 4.75 MP | 755.7 | |
| May 7/80 | 4.56 MP | 756.3 | |
| June 3/80 | 3.65 MP | 759.3 | |
| July 9/80 | 3.40 MP | 760.1 | Temp. 5°C |
| | 3.45 MP | 760.0 | After Sample |
| July 30/80 | 4.12 MP | 757.8 | |
| Aug 27/80 | 4.02 MP | 758.1 | |
| Sept 25/80 | 3.53 MP | 759.7 | |
| Oct 22/80 | 4.74 MP | 755.8 | |
| Nov 19/80 | 4.93 MP | 755.1 | |
| Dec 17/80 | 4.74 MP | 755.8 | |
| Jan 15/81 | 4.77 MP | 755.7 | |
| Feb 11/81 | 4.97 MP | 755.0 | |
| Mar 11/81 | 4.98 MP | 755.0 | |
| Apr 8/81 | 4.02 MP | 758.1 | |
| May 5/81 | 4.36 MP | 757.0 | |
| June 3/81 | 3.72 MP | 759.1 | |
| June 30/81 | 4.51 MP | 756.5 | |
| July 29/81 | 3.68 MP | 759.2 | |
| Aug 26/81 | 4.79 MP | 755.6 | |
| Sept 22/81 | 5.44 MP | 753.5 | |
| Oct 21/81 | 5.62 MP | 752.9 | |
| Nov 18/81 | 4.80 MP | 755.6 | |
| Dec 16/81 | 5.48 MP | 753.3 | |

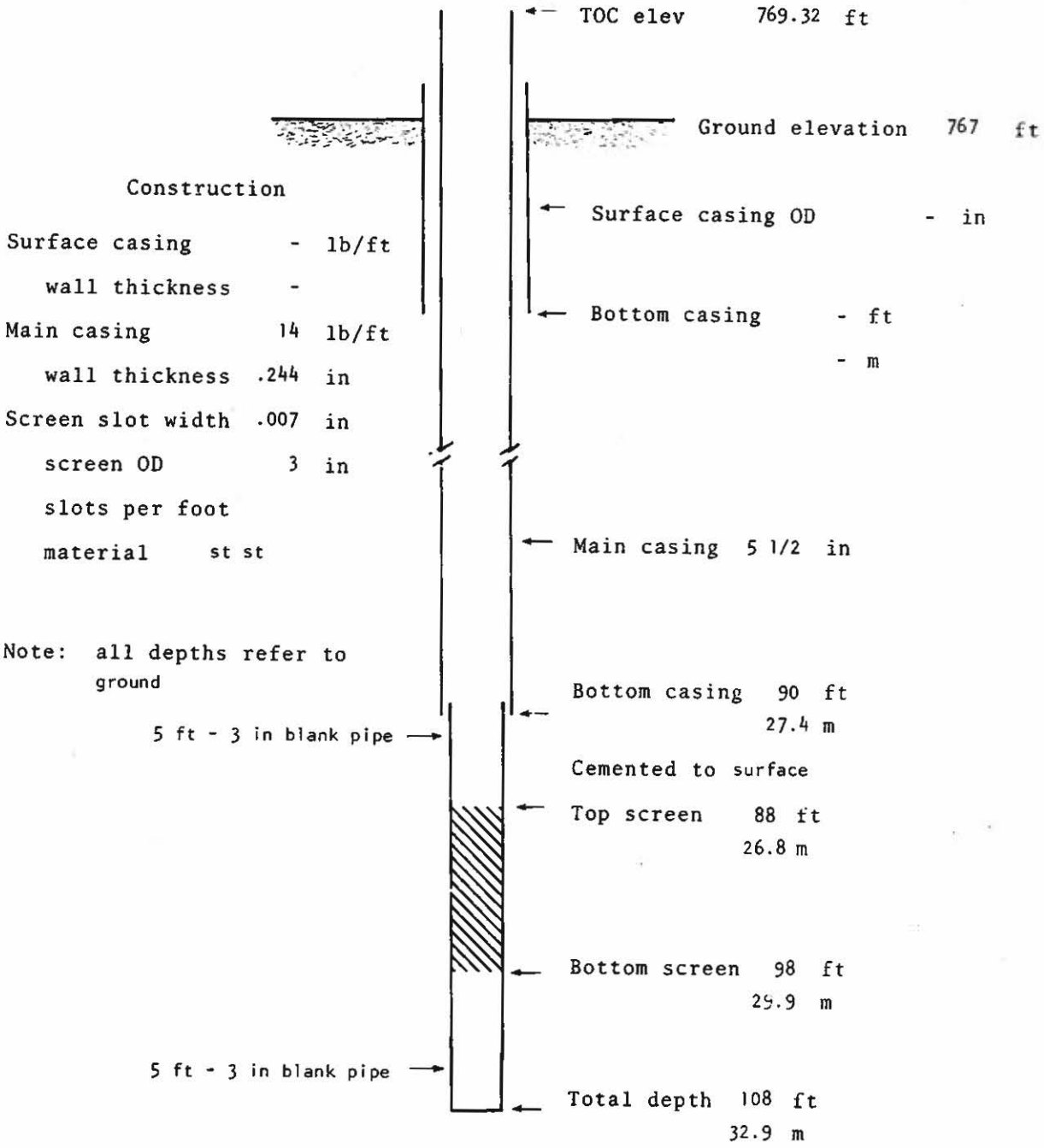
MP - Depth from measuring point
TOC - Depth from top of casing

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 18-108

Lsd 7 Sec 25 Tp 94 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 3 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to ground

WATER ANALYSIS

OBSERVATION WELL NUMBER 18-108

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled March 21, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 750.0 | 37.43 | 7.2 |
| Magnesium(Mg) | 223.0 | 18.35 | 3.5 |
| Sodium(Na) | 10656.0 | 463.51 | 89.1 |
| Potassium(K) | 32.1 | 0.82 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 431.0 | 7.06 | 1.4 |
| Sulphate(SO4) | 1730.0 | 36.02 | 6.9 |
| Chloride(Cl) | 17000.0 | 479.41 | 91.8 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 8.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 690.0 | | |
| Magnesium(Acidified) | 196.0 | | |
| TDS(mg/l) | 30956.0 | | |
| Total Anions(epm) | 522.50 | Total Cations(epm) | 520.11 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 45800 | Temperature(C) |
| pH | 7.6 | pH |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) |
| | | Bicarbonate(HCO3) |
| | | Hydroxide(OH) |

18-108-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER 18-108

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 665.0 | 33.18 | 6.5 |
| Magnesium(Mg) | 98.0 | 8.07 | 1.6 |
| Sodium(Na) | 10750.0 | 467.59 | 91.6 |
| Potassium(K) | 55.0 | 1.41 | 0.3 |
| Carbonate(CO3) | 14.4 | 0.48 | 0.1 |
| Bicarbonate(HCO3) | 39.0 | 0.64 | 0.1 |
| Sulphate(SO4) | 1785.0 | 37.16 | 7.1 |
| Chloride(Cl) | 17300.0 | 487.87 | 92.7 |
| Nitrate(NO3) | 2.2 | 0.04 | 0.0 |
| Silica(SiO2) | 0.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 635.0 | | |
| Magnesium(Acidified) | 89.0 | | |
| TDS(mg/l) | 35200.0 | | |
| Total Anions(epm) | 526.19 | Total Cations(epm) | 510.25 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 41400 | | Temperature(C) | 5.00 | |
| pH | 8.8 | | pH | 9.7 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | 28 | mg/l |
| | | | Bicarbonate(HCO3) | | |
| | | | Hydroxide(OH) | 1 | mg/l |

WATER ANALYSIS

OBSERVATION WELL NUMBER 18-108

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 9, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 730.0 | 36.43 | 6.5 |
| Magnesium(Mg) | 103.0 | 8.48 | 1.5 |
| Sodium(Na) | 11800.0 | 513.27 | 91.7 |
| Potassium(K) | 67.0 | 1.71 | 0.3 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 54.0 | 0.89 | 0.2 |
| Sulphate(SO4) | 1685.0 | 35.08 | 6.3 |
| Chloride(Cl) | 18500.0 | 521.71 | 93.5 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 1.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 775.0 | | |
| Magnesium(Acidified) | 90.0 | | |
| TDS(mg/l) | 32868.0 | | |
| Total Anions(epm) | 557.69 | Total Cations(epm) | 559.89 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 41900 | | Temperature(C) | 5.50 | |
| pH | 7.7 | | pH | 6.3 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 39 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 18-108-E-82

OBSERVATION WELL NUMBER 18-108

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 9, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 4770.0 | 238.50 | 28.9 |
| Magnesium(Mg) | 1400.0 | 116.67 | 14.1 |
| Sodium(Na) | 10800.0 | 469.57 | 56.8 |
| Potassium(K) | 55.0 | 1.41 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 1800.0 | 37.50 | 7.3 |
| Chloride(Cl) | 17000.0 | 478.87 | 92.7 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 0.4 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 6500.0 | | |
| Magnesium(Acidified) | 61.0 | | |
| TDS(mg/l) | 31886.0 | | |
| Total Anions(epm) | 516.37 | Total Cations(epm) | 826.14 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 50000 |
| pH | 4.3 |
| Fluoride | 0.2 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 6.00 | |
| pH | 6.0 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 39 | mg/l |
| Hydroxide(OH) | | |

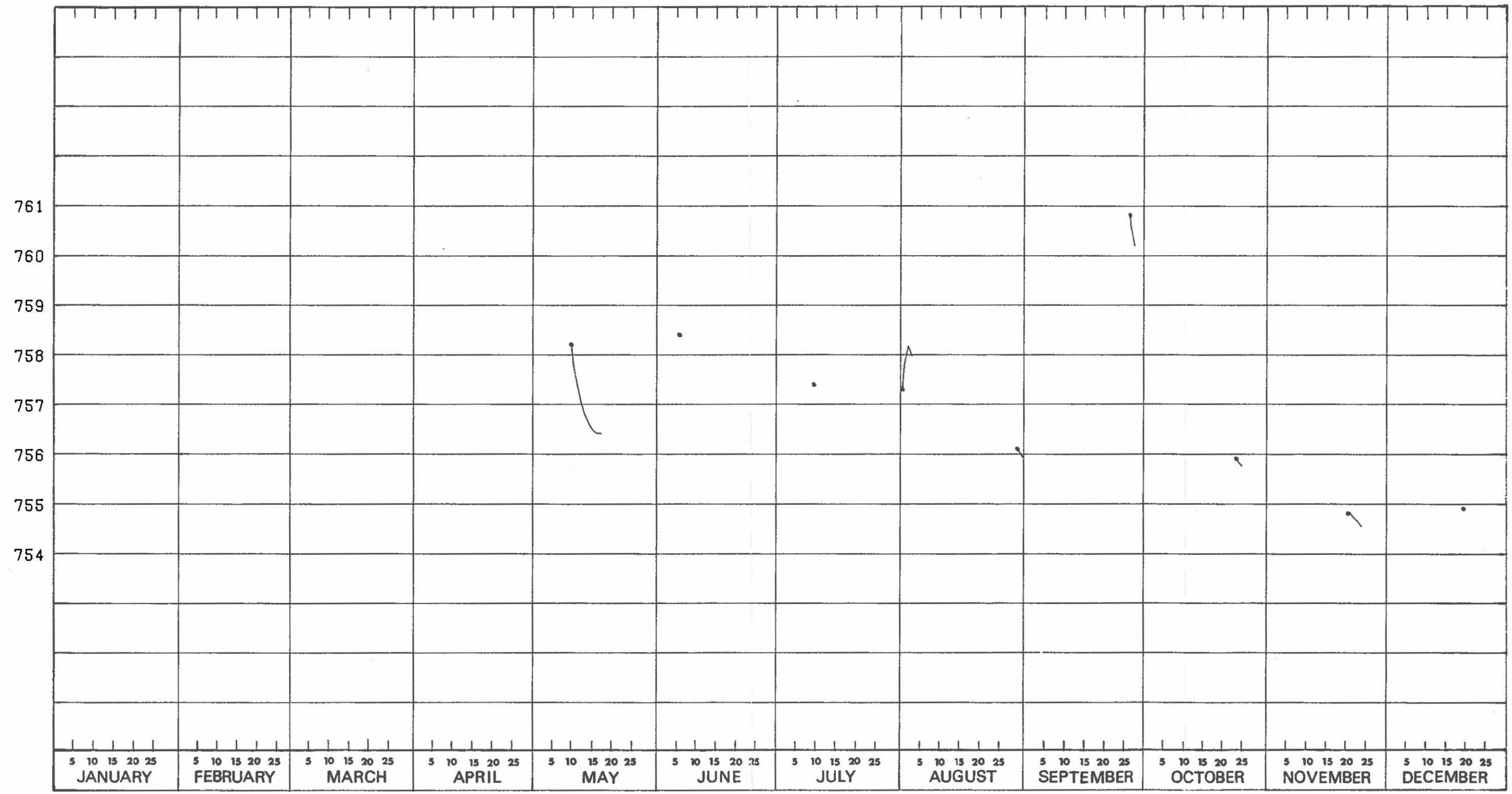
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-108

LSD 7 SEC 25 TWP 94 R 11 W4TH

18-108-H-79

Alberta Research Council




1978

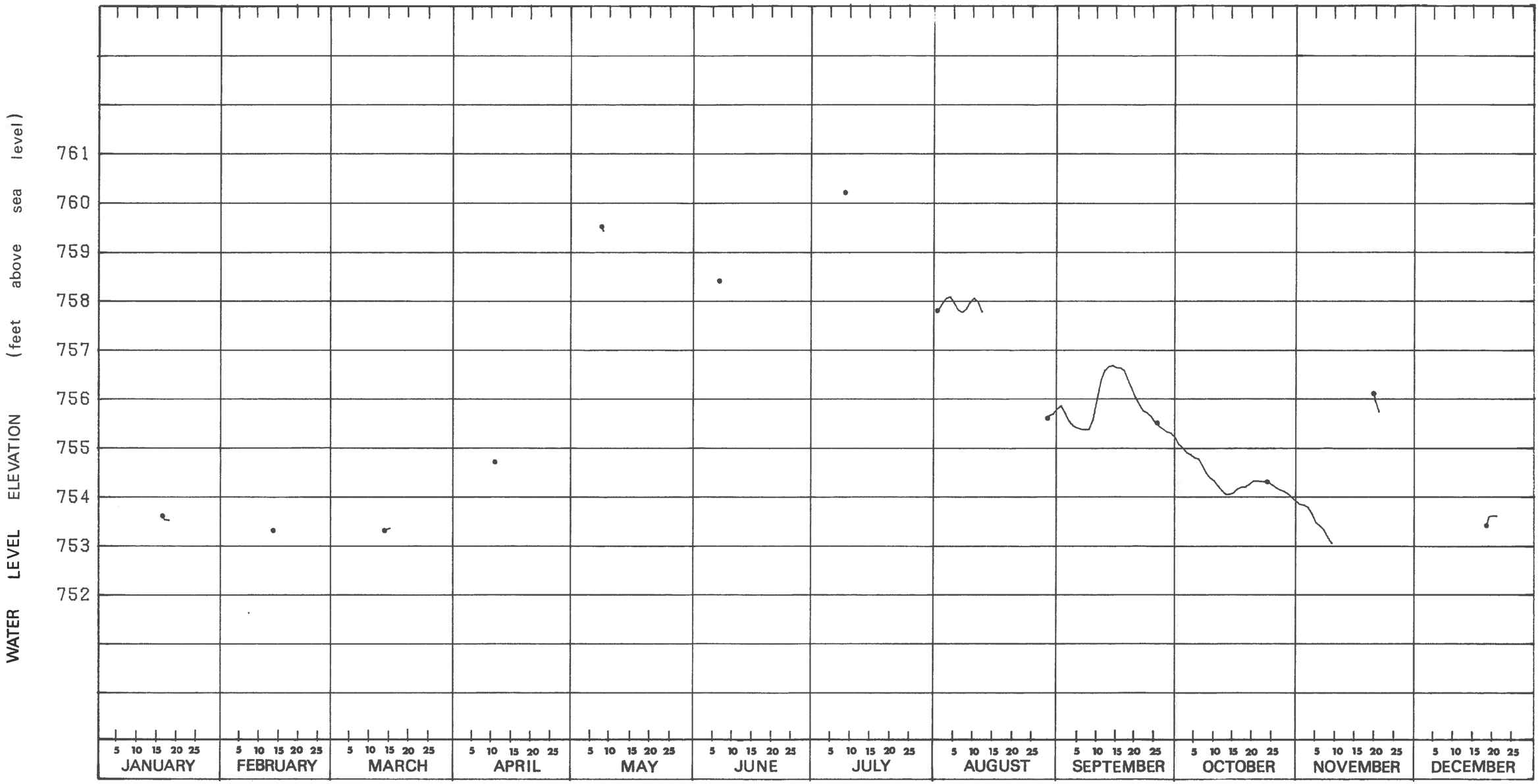
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-108

18-108-H-80

Lsd 7 Sec 25 Twp 94 R 11 W4 th

Alberta Research Council



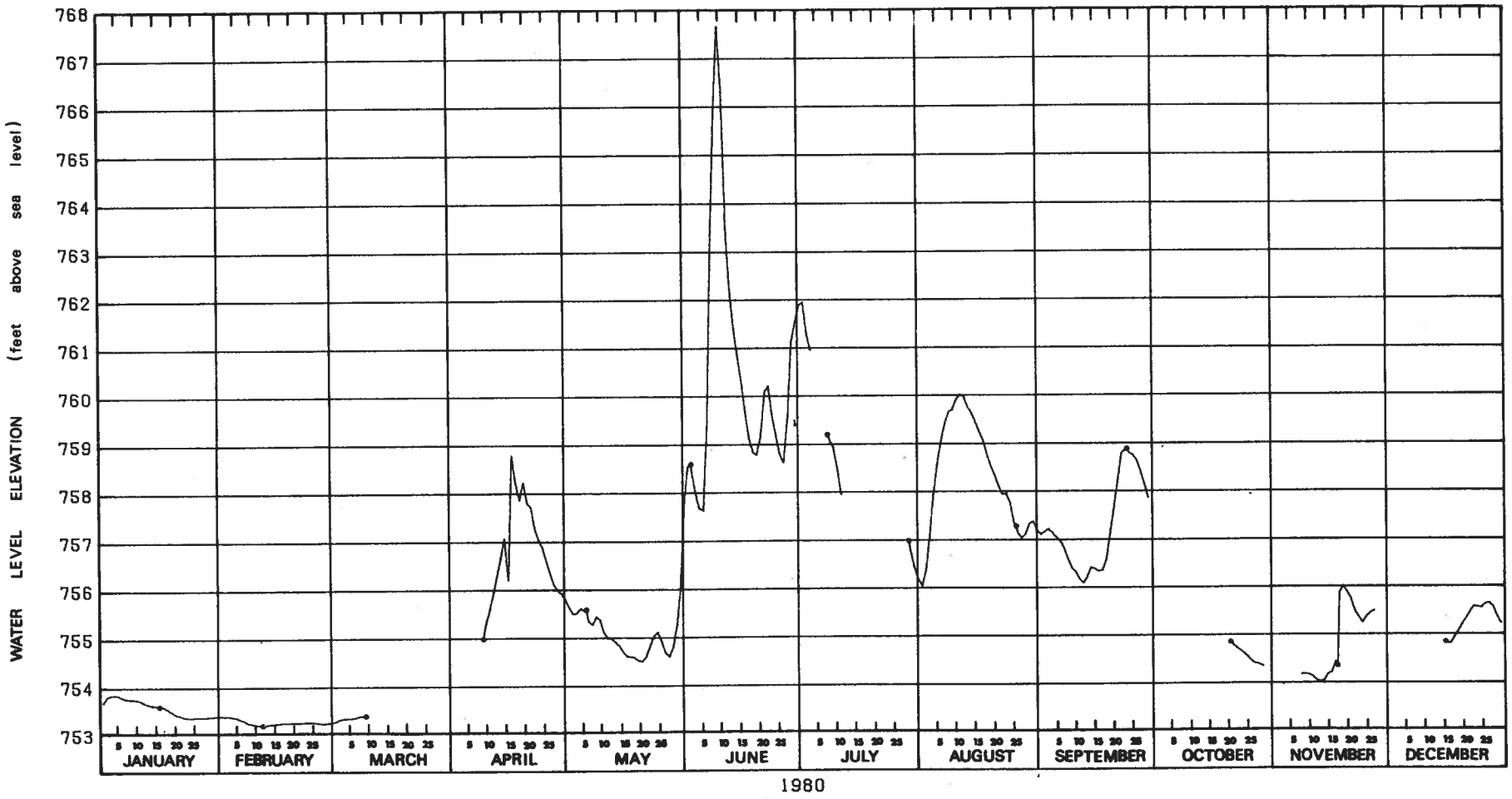
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-108

Lsd 7 Sec 25 Twp 94 R 11 W4 th

Alberta Research Council

18-108-H-81



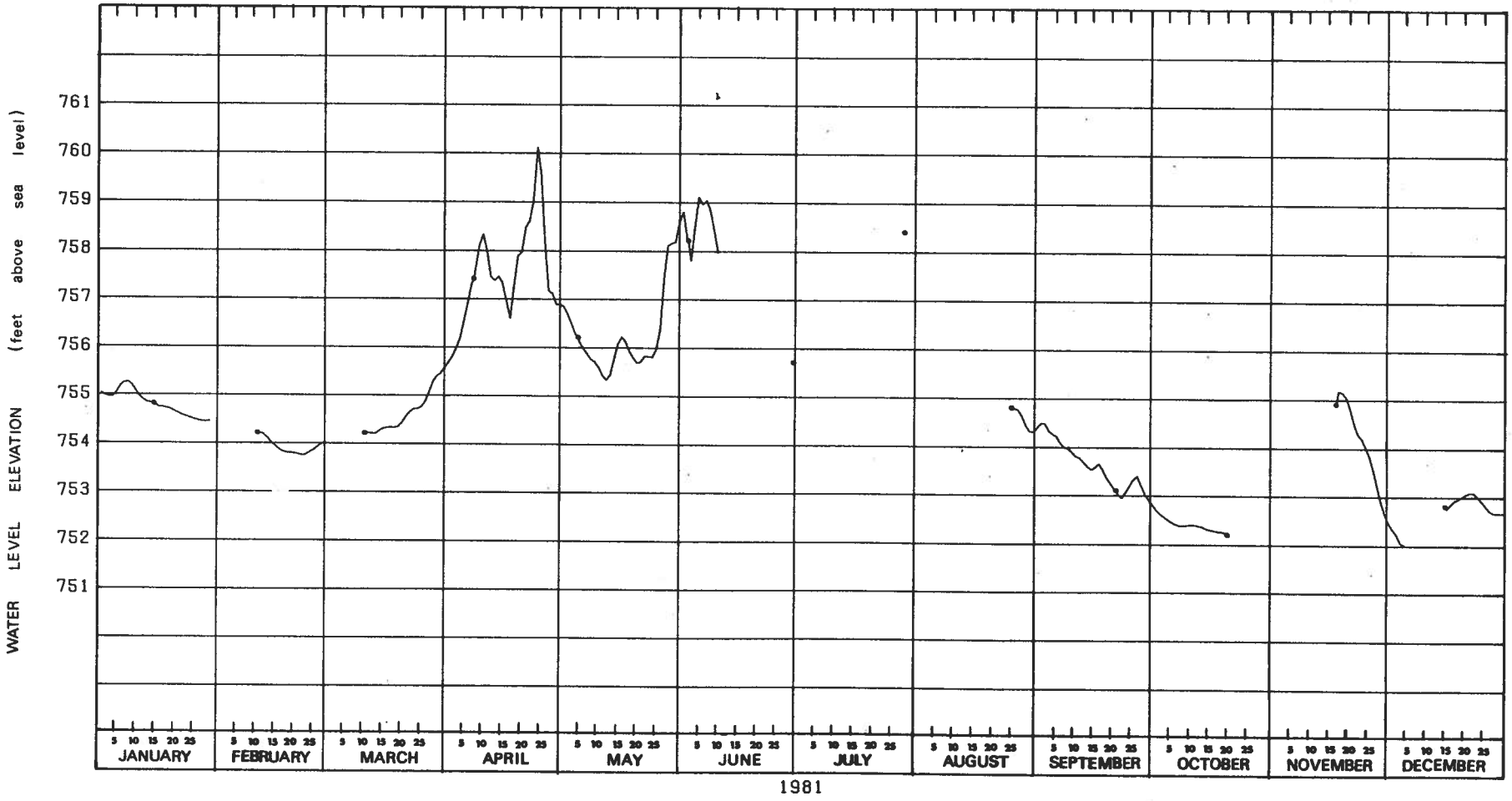
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-108

Lsd 7 Sec 25 Twp 94 R 11 W4 th

Alberta Research Council

18-108-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 18-108

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 769.32

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar /78 | | | Well completed |
| Apr 13/78 | 4.40 MP | 756.9 | MP = 0.62m TOC (771.4) |
| May 10/78 | 4.00 MP | 758.2 | |
| June 6/78 | 3.96 MP | 758.4 | |
| July 10/78 | 4.24 MP | 757.4 | |
| | 4.24 MP | 757.4 | After sample; temp 5°C |
| Aug 1/78 | 4.29 MP | 757.3 | |
| Aug 30/78 | 4.66 MP | 756.1 | |
| Sept 27/78 | 3.22 MP | 760.8 | |
| Oct 24/78 | 4.72 MP | 755.9 | |
| Nov 21/78 | 5.06 MP | 754.8 | |
| Dec 20/78 | 5.03 MP | 754.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 18-108

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 769.32

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 5.42 MP | 753.6 | MP (771.4) |
| Feb 14/79 | 5.52 MP | 753.3 | |
| Mar 14/79 | 5.53 MP | 753.3 | |
| Apr 11/79 | 5.08 MP | 754.7 | |
| May 8/79 | 3.63 MP | 759.5 | |
| June 7/79 | 3.96 MP | 758.4 | |
| July 9/79 | 3.40 MP | 760.2 | |
| | 3.41 MP | 760.2 | After sample; temp. 5.5°C |
| Aug 1/79 | 4.13 MP | 757.8 | |
| Aug 29/79 | 4.81 MP | 755.6 | |
| Sept 26/79 | 4.86 MP | 755.5 | |
| Oct 24/79 | 5.20 MP | 754.3 | |
| Nov 20/79 | 4.67 MP | 756.1 | |
| Dec 19/79 | 5.50 MP | 753.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 18 - 108

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 769.32

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 5.44 MP | 753.6 | |
| Feb 12/80 | 5.54 MP | 753.2 | |
| Mar 10/80 | 5.49 MP | 753.4 | |
| Apr 10/80 | 5.00 MP | 755.0 | |
| May 7/80 | 4.83 MP | 755.6 | |
| June 3/80 | 3.91 MP | 758.6 | |
| July 9/80 | 3.72 MP | 759.2 | Temp. 6°C |
| | 3.72 MP | 759.2 | After Sample |
| July 30/80 | 4.40 MP | 757.0 | |
| Aug 27/80 | 4.31 MP | 757.3 | |
| Sept 25/80 | 3.80 MP | 758.9 | |
| Oct 22/80 | 5.02 MP | 754.9 | |
| Nov 19/80 | 5.17 MP | 754.4 | |
| Dec 17/80 | 5.02 MP | 754.9 | |
| Jan 15/81 | 5.06 MP | 754.8 | |
| Feb 11/81 | 5.23 MP | 754.2 | |
| Mar 11/81 | 5.23 MP | 754.2 | |
| Apr 8/81 | 4.28 MP | 757.4 | |
| May 5/81 | 4.64 MP | 756.2 | |
| June 3/81 | 4.01 MP | 758.2 | |
| June 30/81 | 4.79 MP | 755.7 | |
| July 29/81 | 3.96 MP | 758.4 | |
| Aug 26/81 | 5.06 MP | 754.8 | |
| Sept 22/81 | 5.59 MP | 753.1 | |
| Oct 21/81 | 5.86 MP | 752.2 | |
| Nov 18/81 | 5.03 MP | 754.9 | |
| Dec 16/81 | 5.68 MP | 752.8 | |

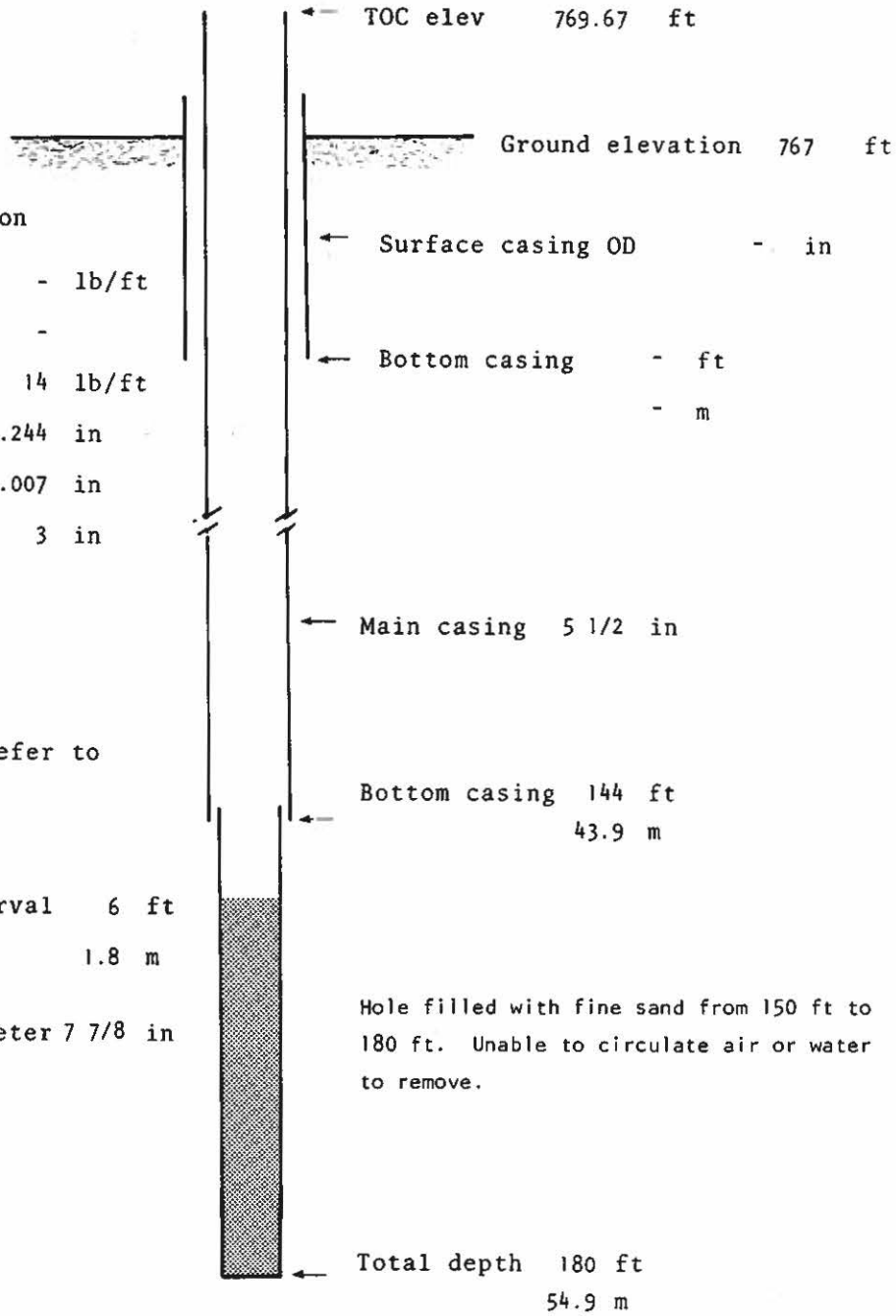
MP - Depth from measuring point
TOC - Depth from top of casing

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 18-180

Lsd 7 Sec 25 Tp 94 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 14 | lb/ft |
| wall thickness | .244 | in |
| Screen slot width | .007 | in |
| screen OD | 3 | in |
| slots per foot | | |
| material | st st | |

Note: all depths refer to ground

Open hole interval 6 ft
1.8 m

Open hole diameter 7 7/8 in

WATER ANALYSIS

OBSERVATION WELL NUMBER 18-180

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled May 11, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 695.0 | 34.68 | 7.2 |
| Magnesium(Mg) | 230.0 | 18.93 | 3.9 |
| Sodium(Na) | 9875.0 | 429.53 | 88.8 |
| Potassium(K) | 30.0 | 0.77 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 278.0 | 4.56 | 0.9 |
| Sulphate(SO4) | 1760.0 | 36.64 | 7.4 |
| Chloride(Cl) | 16100.0 | 454.03 | 91.7 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 3.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 29954.0 | | |
| Total Anions(epm) | 495.23 | Total Cations(epm) | 483.91 |

Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 40000 | |
| pH | 7.2 | |
| Fluoride(F) | 0.2 mg/l | |

Field:

| | |
|---|---|
| Temperature(C) | |
| pH | |
| Carbonate(CO3) | |
| Bicarbonate(HCO3) | |
| Hydroxide(OH) | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 18-180

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 10, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 795.0 | 39.67 | 7.0 |
| Magnesium(Mg) | 325.0 | 26.75 | 4.7 |
| Sodium(Na) | 11500.0 | 500.22 | 88.1 |
| Potassium(K) | 40.8 | 1.04 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 273.0 | 4.47 | 0.7 |
| Sulphate(SO4) | 2280.0 | 47.47 | 7.4 |
| Chloride(Cl) | 20800.0 | 586.58 | 91.9 |
| Nitrate(NO3) | 2.9 | 0.05 | 0.0 |
| Silica(SiO2) | 3.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 715.0 | | |
| Magnesium(Acidified) | 295.0 | | |
| TDS(mg/l) | 38820.0 | | |
| Total Anions(epm) | 638.57 | Total Cations(epm) | 567.68 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 45300 | | Temperature(C) | 6.00 | |
| pH | 6.8 | | pH | 6.5 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 224 | mg/l |
| | | | Hydroxide(OH) | | |

18-180-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 18-180

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 9, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 800.0 | 39.92 | 6.5 |
| Magnesium(Mg) | 310.0 | 25.51 | 4.2 |
| Sodium(Na) | 12500.0 | 543.71 | 89.1 |
| Potassium(K) | 37.1 | 0.95 | 0.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 188.0 | 3.08 | 0.5 |
| Sulphate(SO4) | 2050.0 | 42.68 | 6.7 |
| Chloride(Cl) | 20900.0 | 589.40 | 92.8 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 3.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 740.0 | | |
| Magnesium(Acidified) | 295.0 | | |
| TDS(mg/l) | 36574.0 | | |
| Total Anions(epm) | 635.17 | Total Cations(epm) | 610.10 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 45000 | | Temperature(C) | 5.50 | |
| pH | 7.4 | | pH | 6.5 | |
| Fluoride(F) | 0.1 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 434 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 18-180-E-82

OBSERVATION WELL NUMBER 18-180

Lsd 7 Sec 25 Rge 11 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 9, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 8660.0 | 433.00 | 31.9 |
| Magnesium(Mg) | 3500.0 | 291.67 | 21.5 |
| Sodium(Na) | 14500.0 | 630.43 | 46.5 |
| Potassium(K) | 37.5 | 0.96 | 0.1 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 0.0 | 0.0 | 0.0 |
| Sulphate(SO4) | 2750.0 | 57.29 | 8.1 |
| Chloride(Cl) | 23000.0 | 647.89 | 91.9 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 2.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 7500.0 | | |
| Magnesium(Acidified) | 273.0 | | |
| TDS(mg/l) | 44106.0 | | |
| Total Anions(epm) | 705.18 | Total Cations(epm) | 1356.06 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 63999 | Temperature | 6.00 | |
| pH | 2.9 | pH | 6.0 | |
| Fluoride | 0.0 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 136 | mg/l |
| | | Hydroxide(OH) | | |

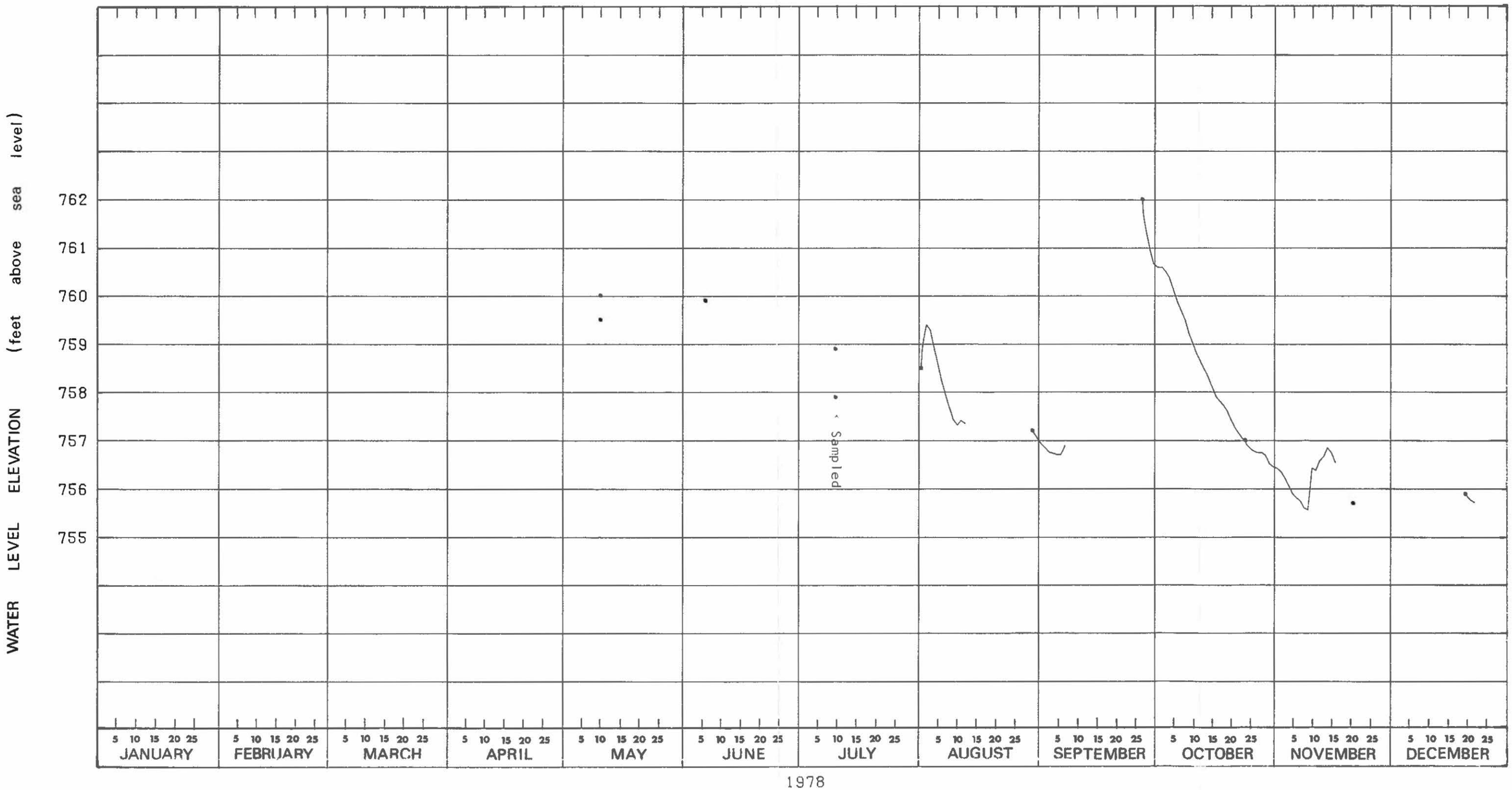
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-180

LSD 7 SEC 25 TWP 94 R 11 W4TH

18-180-H-79

Alberta Research Council



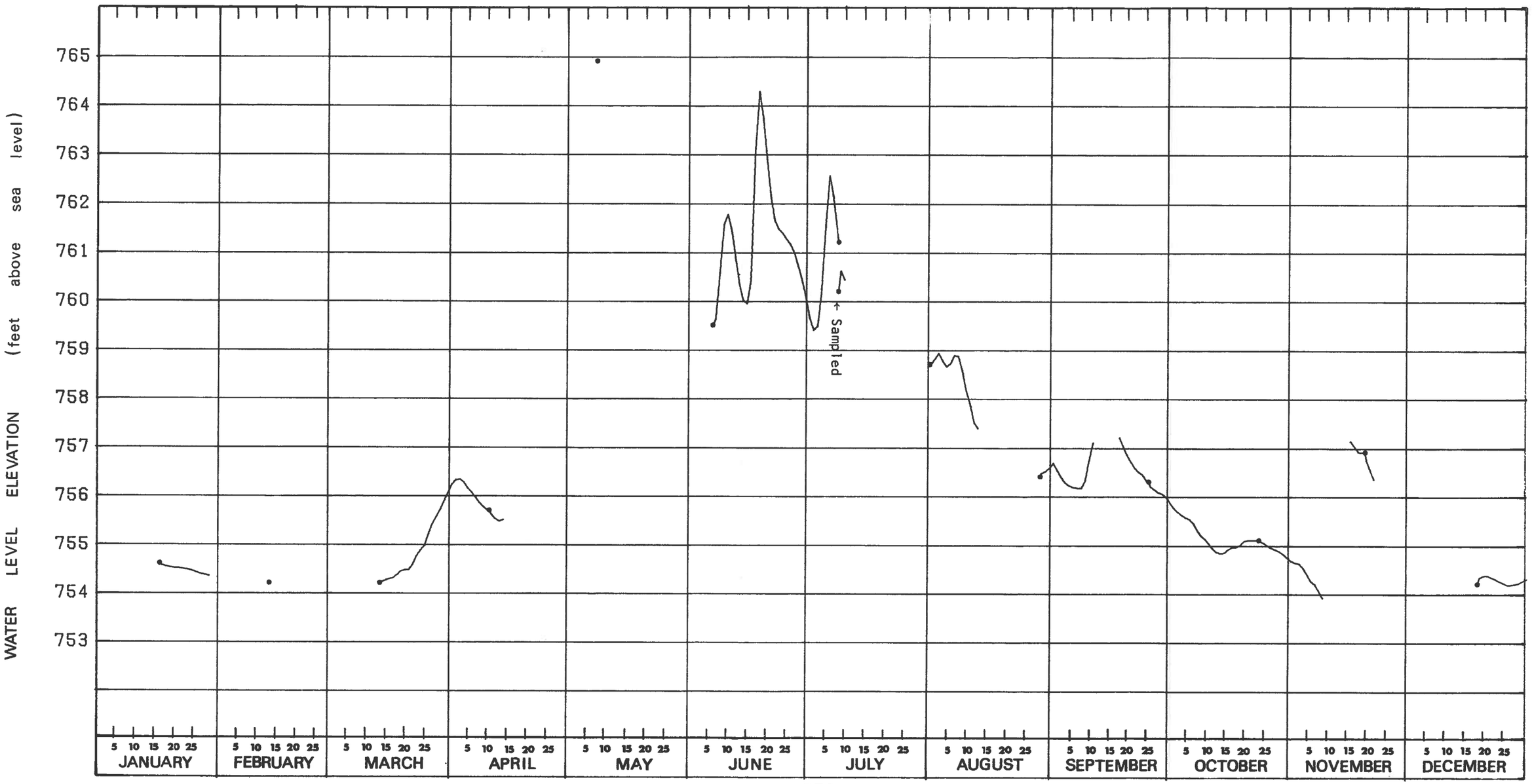
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-180

Lsd 7 Sec 25 Twp 94 R 11 W4 th

Alberta Research Council

18-180-H-80




1979

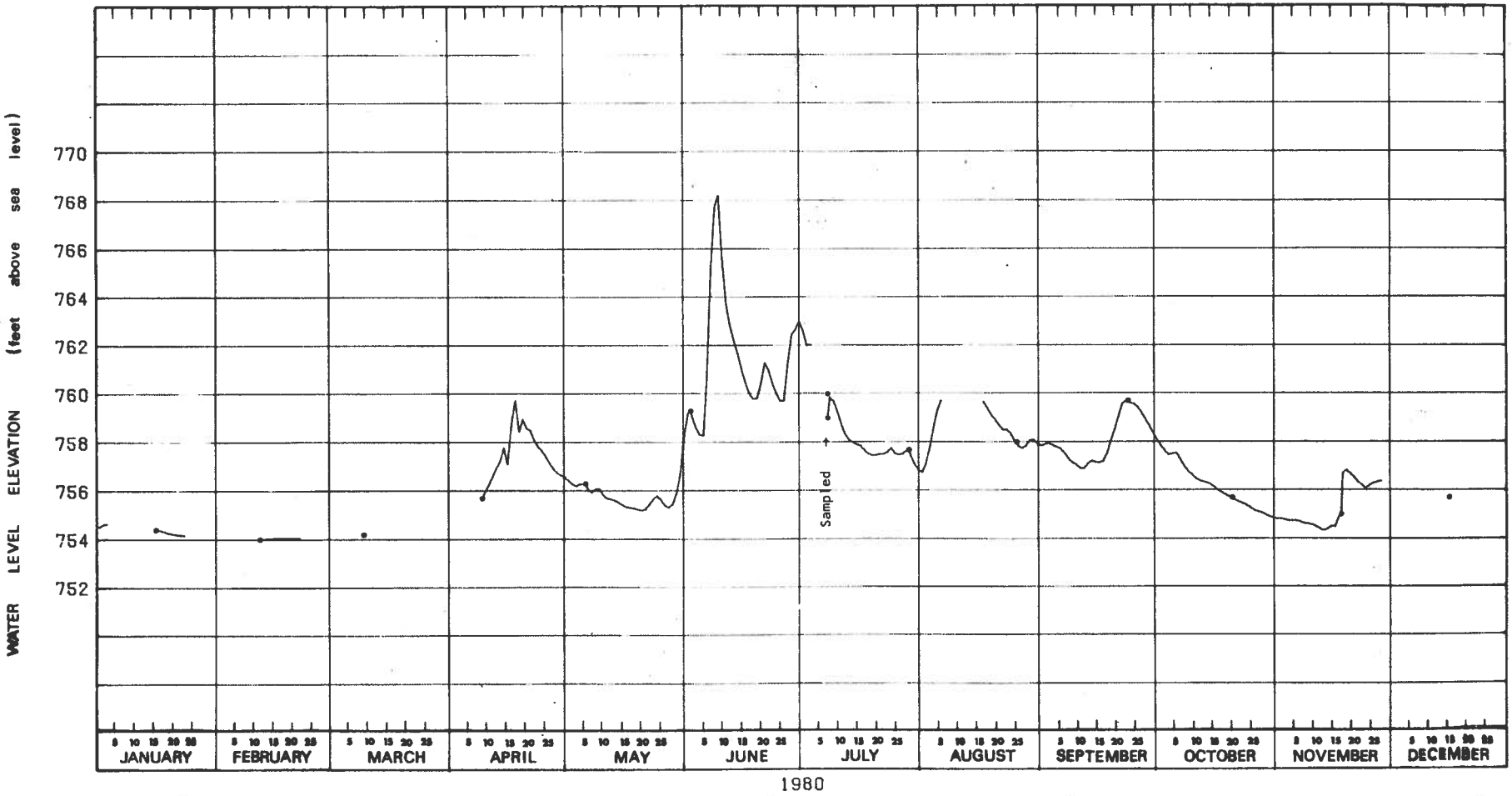
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-180

18-180-H-81

Lsd 7 Sec 25 Twp 94 R 11 W4 th

Alberta Research Council



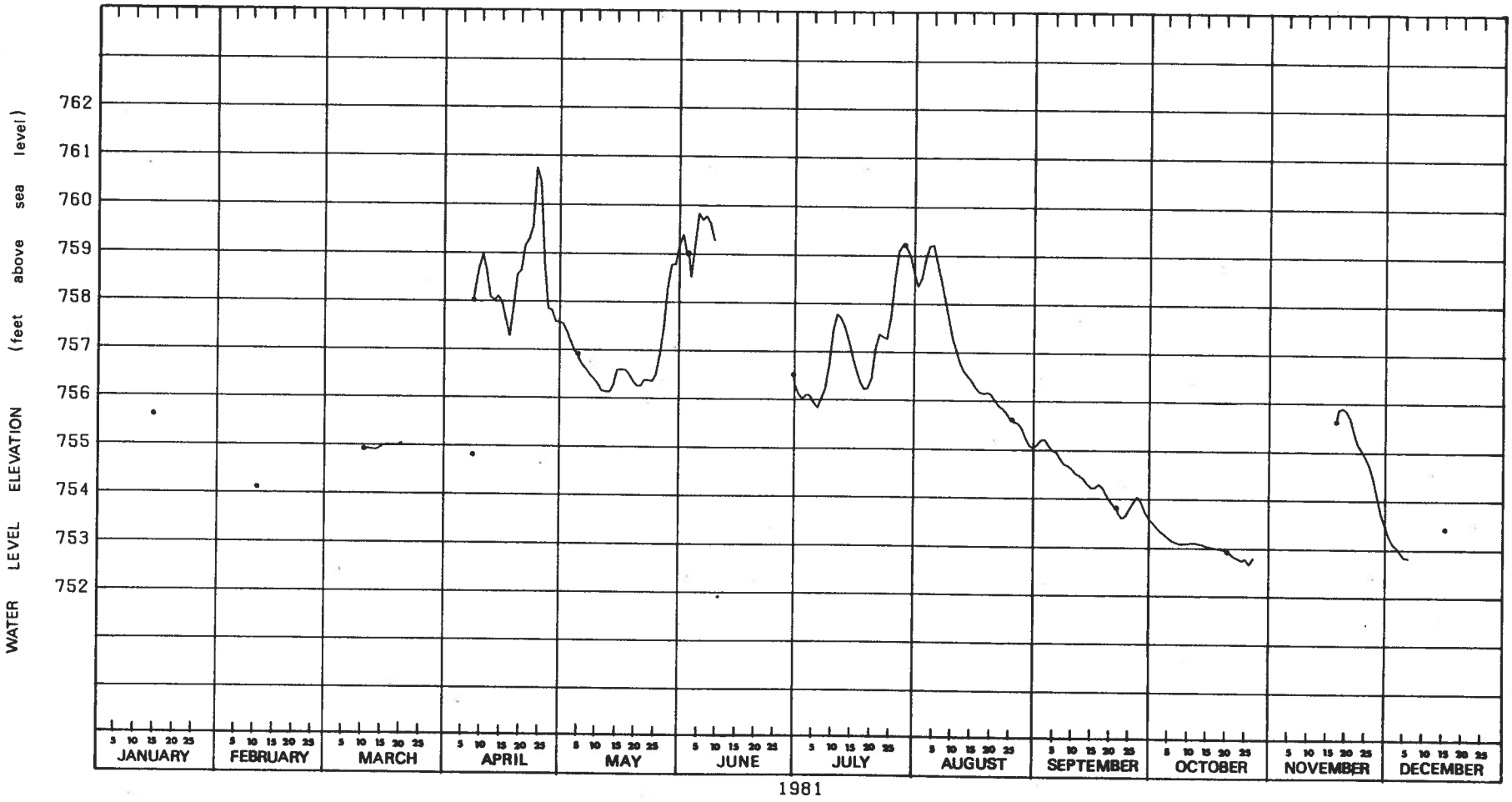
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 18-180

Lsd 7 Sec 25 Twp 94 R 11 W4 th

Alberta Research Council

18-180-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 18-180

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 769.67

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar /78 | | | Well completed |
| Apr 13/78 | 3.88 MP | 759.0 | MP = 0.63m TOC (771.7) |
| May 10/78 | 3.58 MP | 760.0 | |
| | 3.72 MP | 759.5 | After sample |
| June 6/78 | 3.60 MP | 759.9 | |
| July 10/78 | 3.92 MP | 758.9 | |
| | 4.23 MP | 757.9 | After sample; temp 6°C |
| Aug 1/78 | 4.03 MP | 758.5 | |
| Aug 30/78 | 4.42 MP | 757.2 | |
| Sept 27/78 | 2.95 MP | 762.0 | |
| Oct 24/78 | 4.48 MP | 757.0 | |
| Nov 21/78 | 4.87 MP | 755.7 | |
| Dec 20/78 | 4.82 MP | 755.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 18-180

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 769.67

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 5.22 MP | 754.6 | MP (771.7) |
| Feb 14/79 | 5.33 MP | 754.2 | |
| Mar 14/79 | 5.32 MP | 754.2 | |
| Apr 11/79 | 4.88 MP | 755.7 | |
| May 8/79 | 2.08 MP | 764.9 | |
| June 7/79 | 3.72 MP | 759.5 | |
| July 9/79 | 3.20 MP | 761.2 | |
| | 3.51 MP | 760.2 | After sample; temp. 5.5°C |
| Aug 1/79 | 3.95 MP | 758.7 | |
| Aug 29/79 | 4.65 MP | 756.4 | |
| Sept 26/79 | 4.69 MP | 756.3 | |
| Oct 24/79 | 5.05 MP | 755.1 | |
| Nov 20/79 | 4.51 MP | 756.9 | |
| Dec 19/79 | 5.34 MP | 754.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 18 - 180

Lsd 7 Sec 25 Twp 94 R 11 W4th

Alberta Research Council

Elevation of top of casing 769.67

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 5.28 MP | 754.4 | |
| Feb 12/80 | 5.39 MP | 754.0 | |
| Mar 10/80 | 5.34 MP | 754.2 | |
| Apr 10/80 | 4.88 MP | 755.7 | |
| May 7/80 | 4.68 MP | 756.3 | |
| June 6/80 | 3.77 MP | 759.3 | |
| July 9/80 | 3.57 MP | 760.0 | Temp. 6°C |
| | 3.86 MP | 759.0 | After Sample |
| July 30/80 | 4.27 MP | 757.7 | |
| Aug 27/80 | 4.17 MP | 758.0 | |
| Sept 25/80 | 3.67 MP | 759.7 | |
| Oct 22/80 | 4.87 MP | 755.7 | |
| Nov 19/80 | 5.10 MP | 755.0 | |
| Dec 17/80 | 4.87 MP | 755.7 | |
| Jan 15/81 | 4.90 MP | 755.6 | |
| Feb 11/81 | 5.35 MP | 754.1 | |
| Mar 11/81 | 5.11 MP | 754.9 | |
| Apr 8/81 | 4.16 MP | 758.0 | |
| May 5/81 | 4.51 MP | 756.9 | |
| June 3/81 | 3.86 MP | 759.0 | |
| June 30/81 | 4.63 MP | 756.5 | |
| July 29/81 | 3.82 MP | 759.2 | |
| Aug 26/81 | 4.92 MP | 755.6 | |
| Sept 22/81 | 5.32 MP | 754.3 | |
| Oct 21/81 | 5.73 MP | 752.9 | |
| Nov 18/81 | 4.91 MP | 755.6 | |
| Dec 16/81 | 5.59 MP | 753.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER Nineteen

Lsd 12 Sec 21 Twp 98 R 9 W4th

Alberta Research Council

Ground elevation 979.8 Total depth

| Interval from | to | Description | Formation |
|---|---|---|---|
| 0 | 1.5 | Topsoil. | |
| 1.5 | 30 | Sand, whitish, brown, fine grained trace of oil. | |
| 30 | 37.5 | Sand, brown, fine-grained, trace of oil. | |
| 37.5 | 47 | Sand, grey, fine to medium grained, trace of silt. | |
| 47 | 115 | Sand, grey, fine grained, trace of silt, bituminous layers, clay and silt at 95-100, pinkish clay at 110-115. | |
| | | Geophysical logging not done. | |

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 19-103

Lsd 12 Sec 21 Tp 98 R 9 Mer W4th

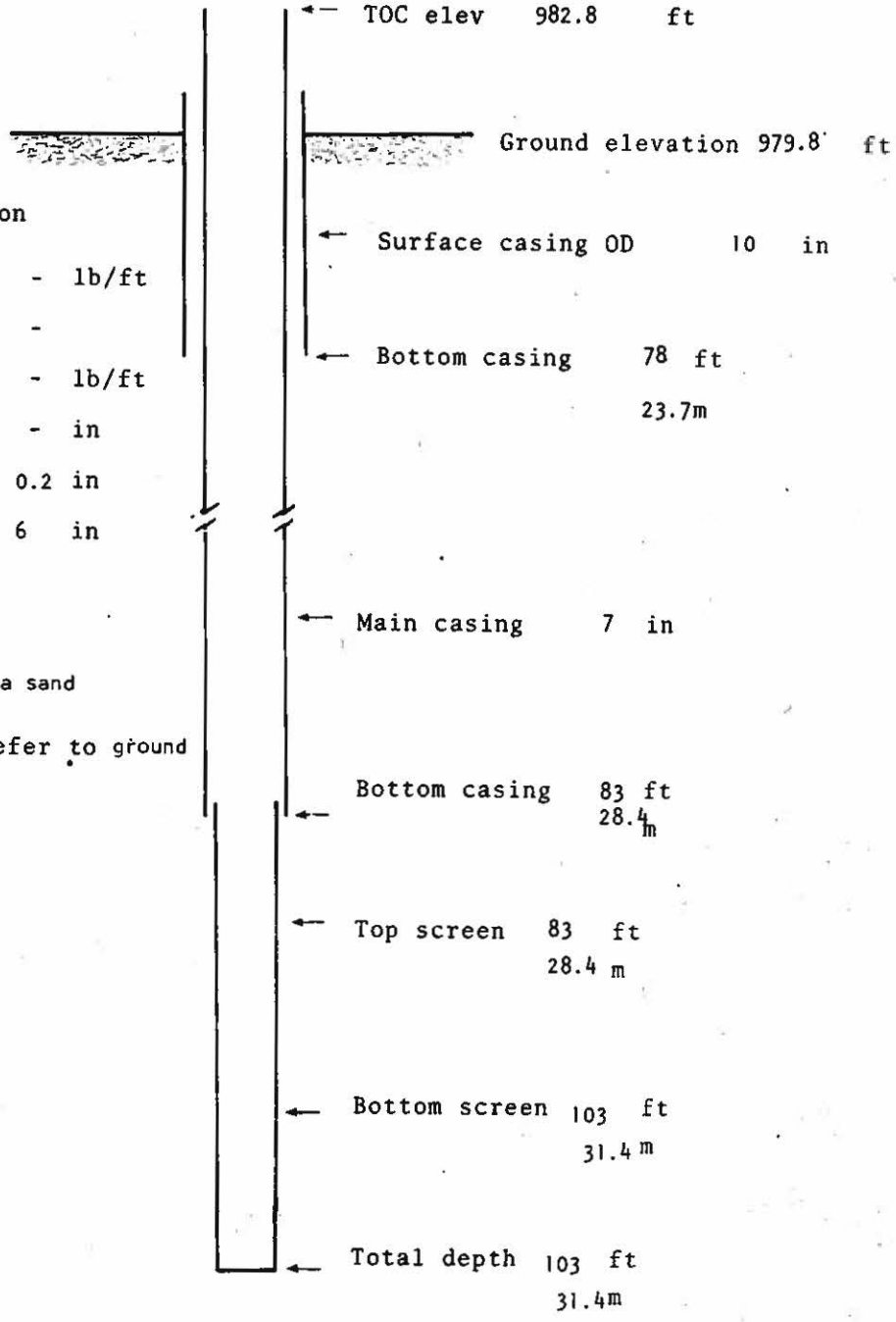
Alberta Research Council

Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | - | lb/ft |
| wall thickness | - | in |
| Screen slot width | 0.2 | in |
| screen OD | 6 | in |
| slots per foot | | |
| material | ss | |

Sand pack 10-20 Silica sand
78-103'

Note: all depths refer to ground



DRAWDOWN PLOT

OBSERVATION WELL SITE 19

March 16, 1978

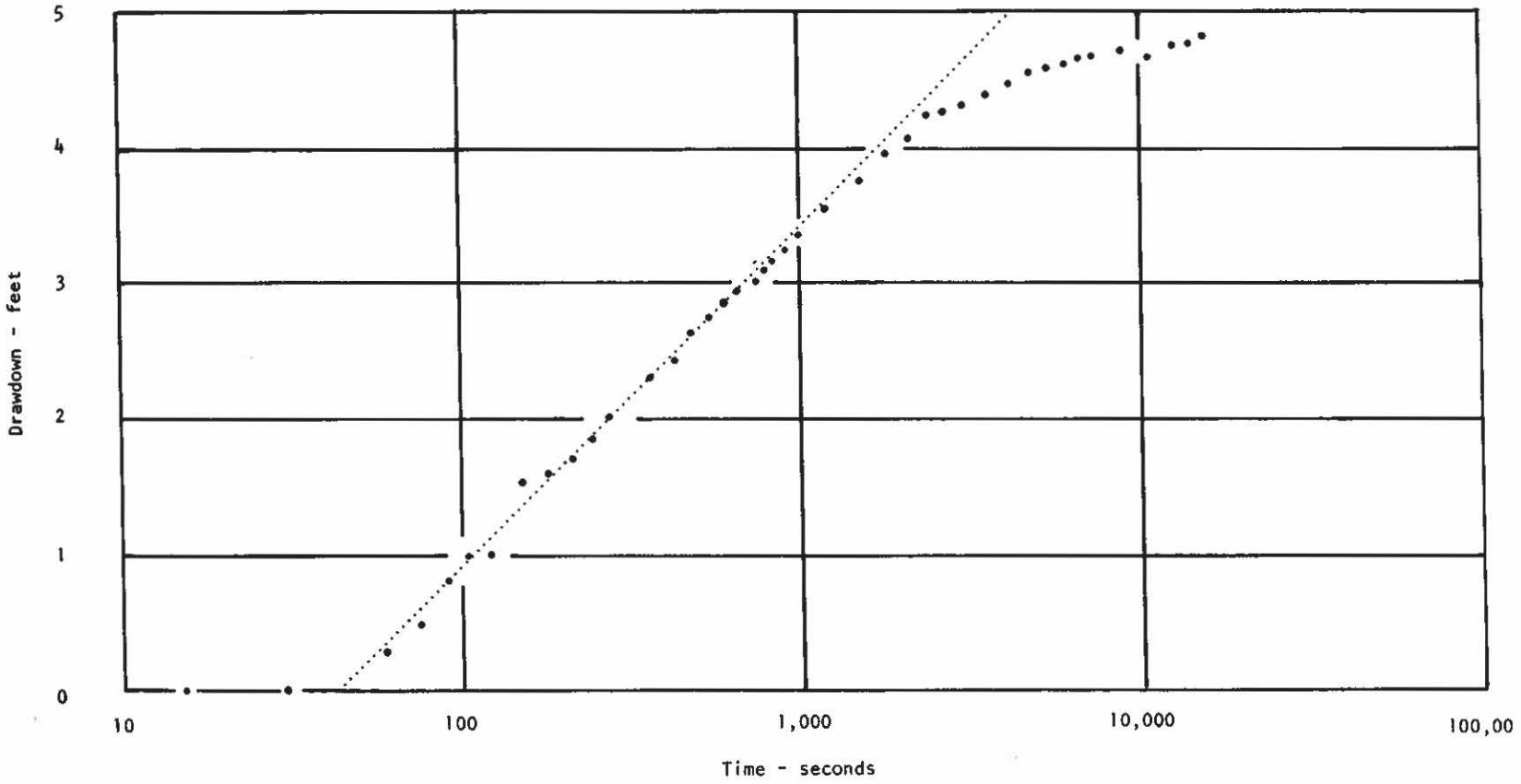
Drawdown at a well 100 ft from well 19-103

Results:

Q = 42 igpm

T = 8197 igpd/ft

S = $4.6 \times 10^{-5}$




19-103-A-79

DRAWDOWN PLOT

OBSERVATION WELL SITE 19

March 16, 1978

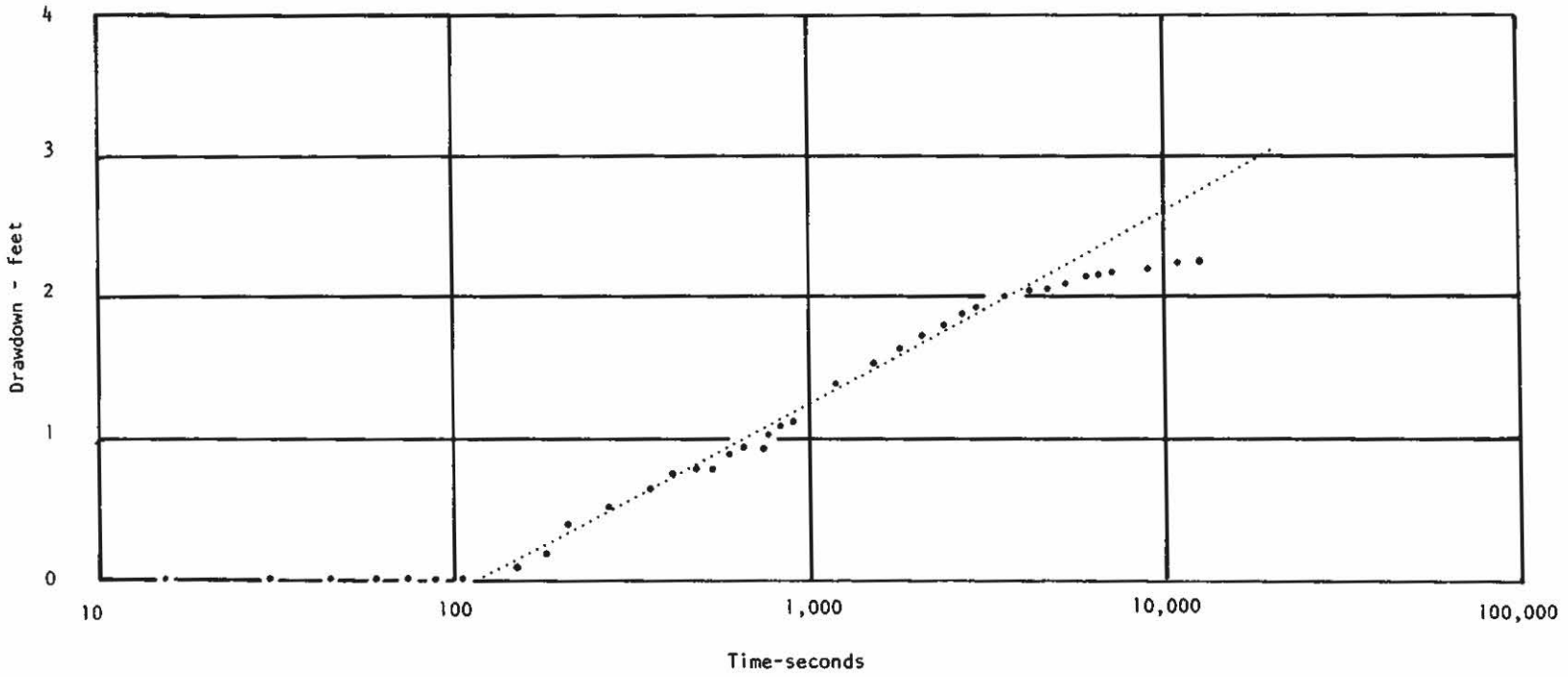
Drawdown at a well 50 ft from well 19-103

Results:

Q = 42 igpm

T = 4427 igpd/ft

S = $3.6 \times 10^{-5}$




19-103-A-79

DRAWDOWN PLOT

OBSERVATION WELL SITE 19

March 16, 1978

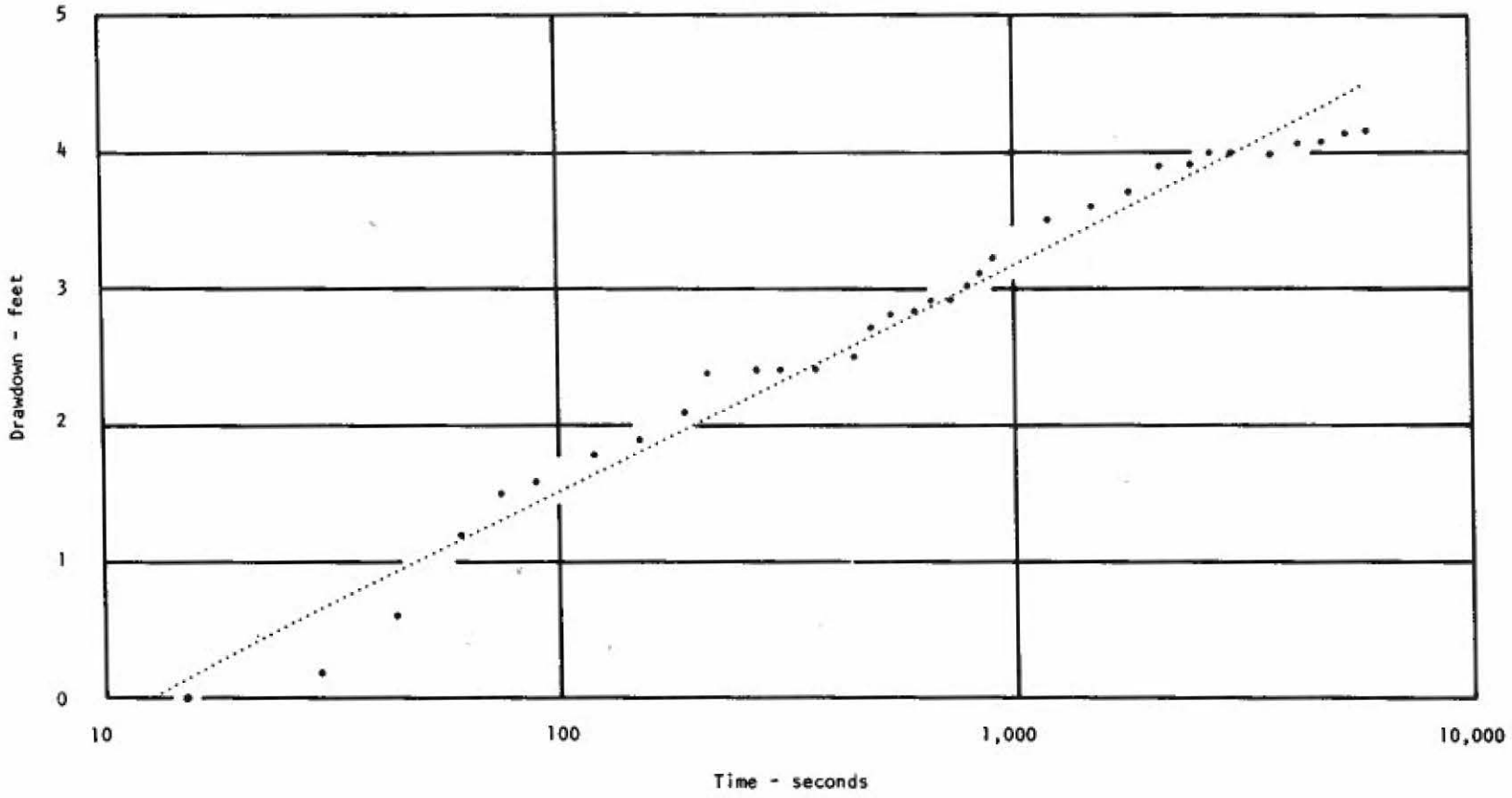
Drawdown at a well 25 ft from well 19-103

Results:

Q = 42 igpm

T = 6510 igpd/ft

S = $6 \times 10^{-5}$




19-103-A-79

ATER ANALYSIS

OBSERVATION WELL NUMBER 19-103

Lsd 12 Sec 21 Rge 9 Twp 98 W4th

Alberta Research Council

Sample Source BAILED

Date sampled March 17, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 42.0 | 2.10 | 74.0 |
| Magnesium(Mg) | 5.9 | 0.49 | 17.1 |
| Sodium(Na) | 5.0 | 0.22 | 7.7 |
| Potassium(K) | 1.3 | 0.03 | 1.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 144.0 | 2.36 | 97.4 |
| Sulphate(SO4) | 3.0 | 0.06 | 2.6 |
| Chloride(Cl) | 0.0 | 0.00 | 0.0 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 7.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 130.0 | | |
| Total Anions(epm) | 2.42 | Total Cations(epm) | 2.83 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 245 | Temperature(C) | 0.00 |
| pH | 7.7 | pH | 0.0 |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) | |
| | | Bicarbonate(HCO3) | |
| | | Hydroxide(OH) | |

WATER ANALYSIS

OBSERVATION WELL NUMBER 19-103

Lsd 12 Sec 21 Rge 9 Twp 98 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 36.0 | 1.80 | 60.0 |
| Magnesium(Mg) | 6.2 | 0.51 | 17.1 |
| Sodium(Na) | 15.0 | 0.65 | 21.8 |
| Potassium(K) | 1.3 | 0.03 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 159.0 | 2.61 | 84.2 |
| Sulphate(SO4) | 4.5 | 0.09 | 3.0 |
| Chloride(Cl) | 12.0 | 0.34 | 10.9 |
| Nitrate(NO3) | 3.5 | 0.06 | 1.8 |
| Silica(SiO2) | 5.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 32.0 | | |
| Magnesium(Acidified) | 6.0 | | |
| TDS(mg/l) | 166.0 | | |
| Total Anions(epm) | 3.09 | Total Cations(epm) | 2.99 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 256 | Temperature(C) | 6.00 | |
| pH | 6.6 | pH | 7.8 | |
| Fluoride(F) | 0.1 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 141 | mg/l |
| | | Hydroxide(OH) | | |

19-103-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER 19-103

Lsd 12 Sec 21 Rge 9 Twp 98 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 9, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 42.0 | 2.10 | 80.9 |
| Magnesium(Mg) | 4.7 | 0.39 | 14.9 |
| Sodium(Na) | 2.5 | 0.11 | 4.2 |
| Potassium(K) | 0.0 | 0.00 | 0.0 |
| Carbonate(CO3) | 4.8 | 0.16 | 5.7 |
| Bicarbonate(HCO3) | 146.0 | 2.39 | 85.4 |
| Sulphate(SO4) | 3.7 | 0.08 | 2.8 |
| Chloride(Cl) | 6.0 | 0.17 | 6.0 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.1 |
| Silica(SiO2) | 10.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 38.0 | | |
| Magnesium(Acidified) | 5.8 | | |
| TDS(mg/l) | 138.0 | | |
| Total Anions(epm) | 2.80 | Total Cations(epm) | 2.59 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 215 | | Temperature(C) | 5.00 | |
| pH | 8.6 | | pH | 7.9 | |
| Fluoride(F) | 0.0 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 385 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS 19-103-E-82

OBSERVATION WELL NUMBER 19-103

Lsd 12 Sec 21 Rge 9 Twp 98 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 9, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 28.0 | 1.40 | 62.0 |
| Magnesium(Mg) | 6.0 | 0.50 | 22.1 |
| Sodium(Na) | 7.0 | 0.30 | 13.5 |
| Potassium(K) | 2.1 | 0.05 | 2.4 |
| Carbonate(CO3) | 4.8 | 0.16 | 5.8 |
| Bicarbonate(HCO3) | 151.0 | 2.48 | 89.2 |
| Sulphate(SO4) | 6.0 | 0.13 | 4.5 |
| Chloride(Cl) | 0.5 | 0.01 | 0.5 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 8.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 33.0 | | |
| Magnesium(Acidified) | 5.7 | | |
| TDS(mg/l) | 146.0 | | |
| Total Anions(epm) | 2.77 | Total Cations(epm) | 2.26 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 278 |
| pH | 8.5 |
| Fluoride | 0.2 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 5.50 | |
| pH | 7.1 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 166 | mg/l |
| Hydroxide(OH) | | |

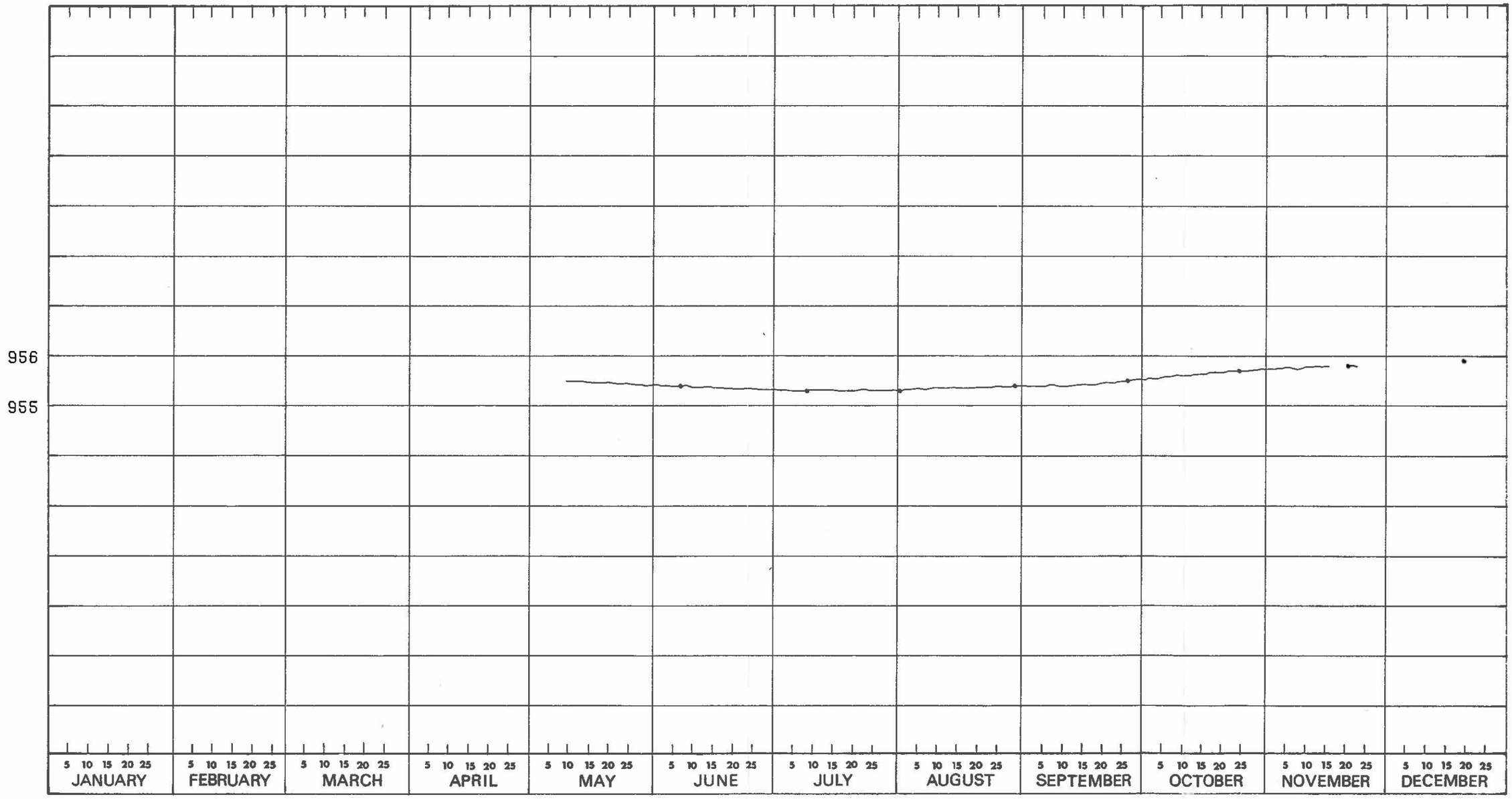
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 19-103

LSD 12 SEC 21 TWP 98 R 9 W4TH

19-103-H-79

Alberta Research Council




1978

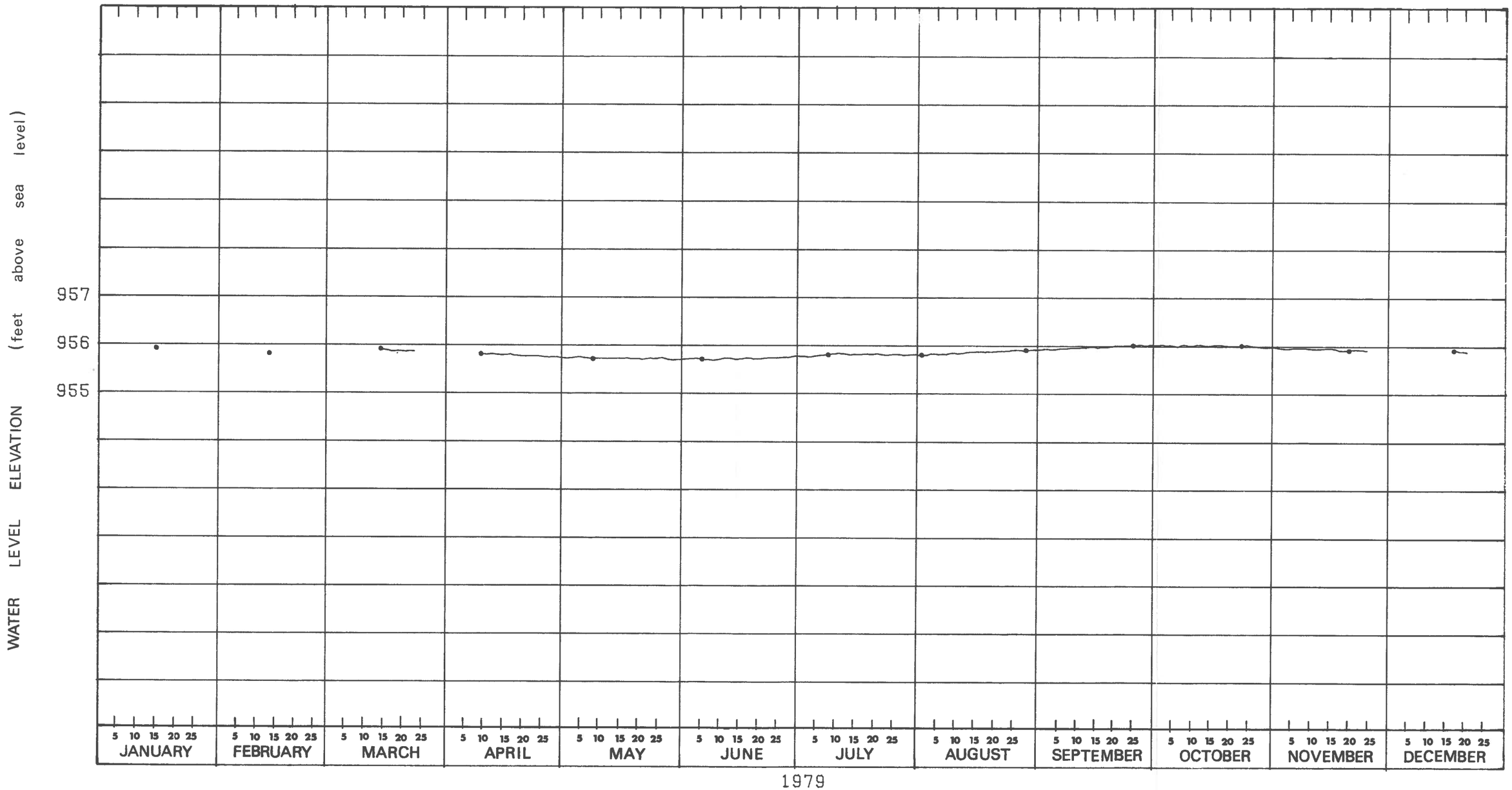
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 19-103

Lsd 12 Sec 21 Twp 98 R 9 W4 th

Alberta Research Council

19-103-H-80



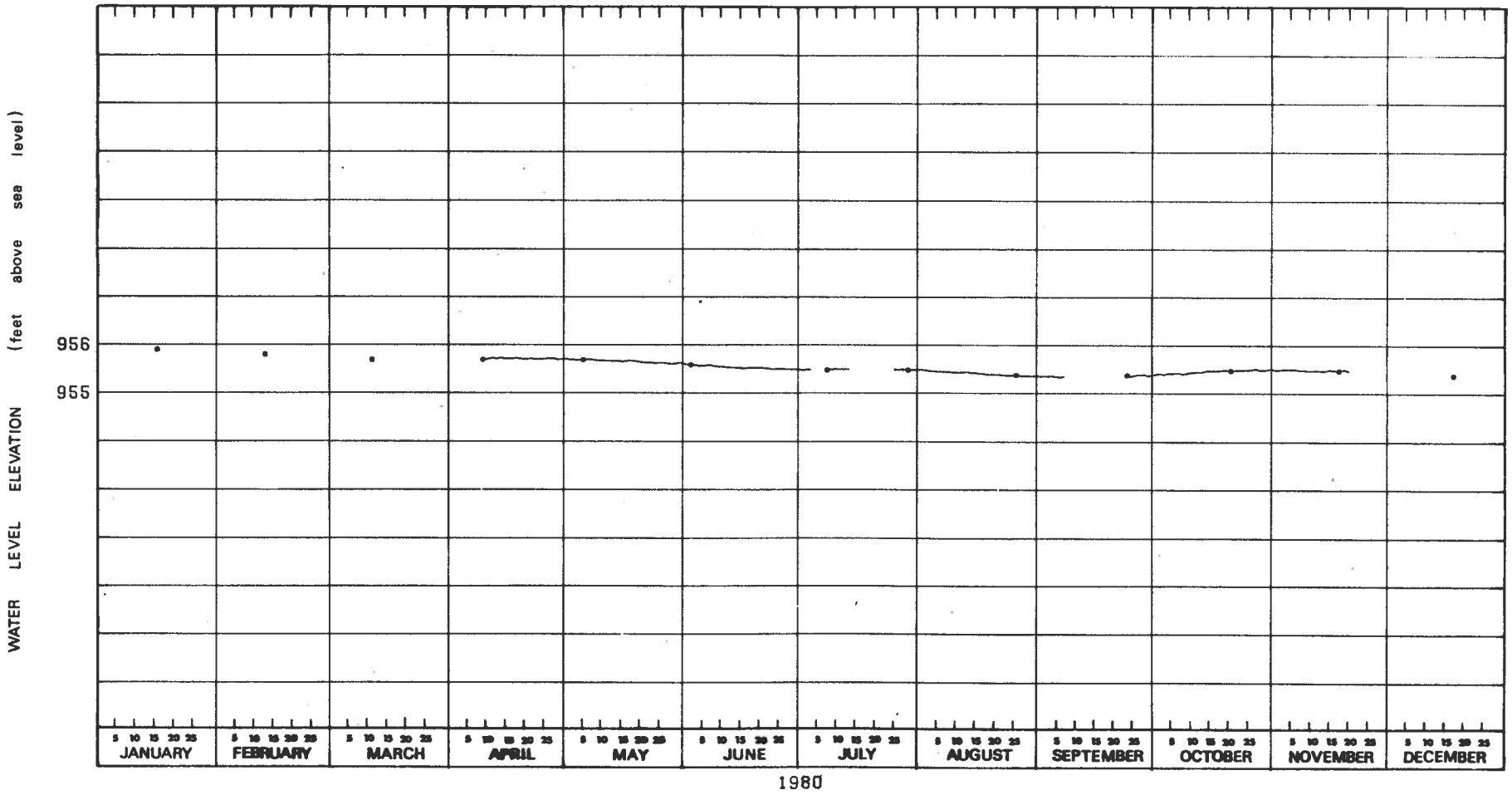
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 19-103

Lsd 12 Sec 21 Twp 98 R 9 W4 th

Alberta Research Council

19-103-H-81



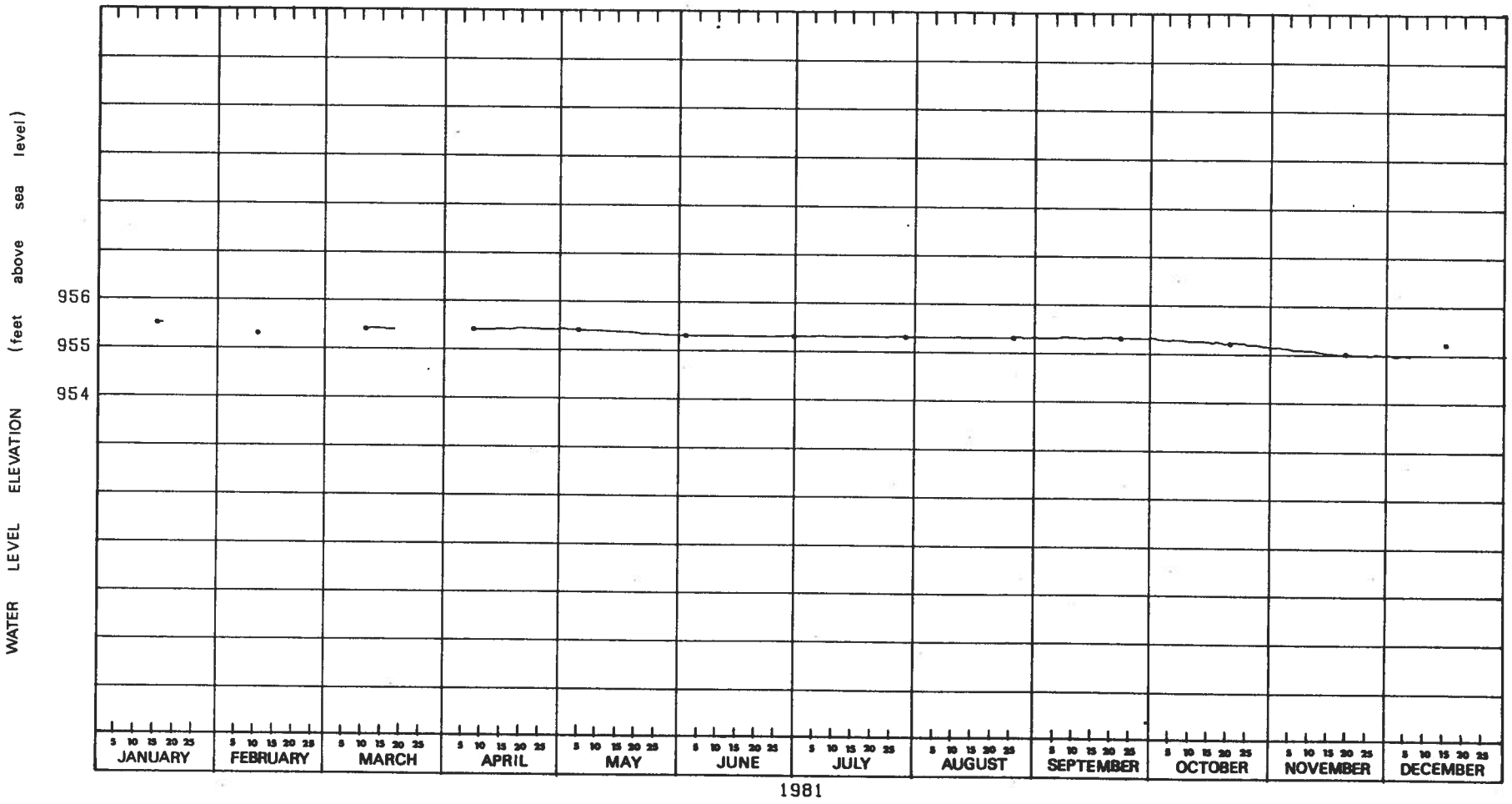
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 19-103

Lsd 12 Sec 21 Twp 98 R 9 W4 th

Alberta Research Council

19-103-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER 19-103

Lsd 12 Sec 21 Twp 98 R 9 W4th

Alberta Research Council

Elevation of top of casing 982.8

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar /78 | | | Well completed; pump test @ 42 igpm: 1425 minutes; T = 6375 IGPD/FT (average of 3 observation wells) |
| Apr 13/78 | 8.87 MP | 955.5 | Install shelter; MP = 0.55m TOC (984.6) |
| May 10/78 | 8.88 MP | 955.5 | |
| June 7/78 | 8.90 MP | 955.4 | |
| July 9/78 | 8.92 MP | 955.3 | |
| | 8.92 MP | 955.3 | After sample; temp 6°C |
| Aug 1/78 | 8.93 MP | 955.3 | |
| Aug 30/78 | 8.91 MP | 955.4 | |
| Sept 27/78 | 8.88 MP | 955.5 | |
| Oct 25/78 | 8.82 MP | 955.7 | |
| Nov 21/78 | 8.78 MP | 955.8 | |
| Dec 20/78 | 8.76 MP | 955.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 19-103

Lsd 12 Sec 21 Twp 98 R 9 W4th

Alberta Research Council

Elevation of top of casing 982.8

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 8.75 MP | 955.9 | MP (984.6) |
| Feb 14/79 | 8.77 MP | 955.8 | |
| Mar 15/79 | 8.76 MP | 955.9 | |
| Apr 10/79 | 8.78 MP | 955.8 | |
| May 9/79 | 8.80 MP | 955.7 | |
| June 6/79 | 8.80 MP | 955.7 | |
| July 9/79 | 8.79 MP | 955.8 | |
| | 8.79 MP | 955.8 | After sample; temp. 5°C |
| Aug 2/79 | 8.77 MP | 955.8 | |
| Aug 29/79 | 8.74 MP | 955.9 | |
| Sept 26/79 | 8.73 MP | 956.0 | |
| Oct 24/79 | 8.73 MP | 956.0 | |
| Nov 21/79 | 8.74 MP | 955.9 | |
| Dec 18/79 | 8.74 MP | 955.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER 19 - 103

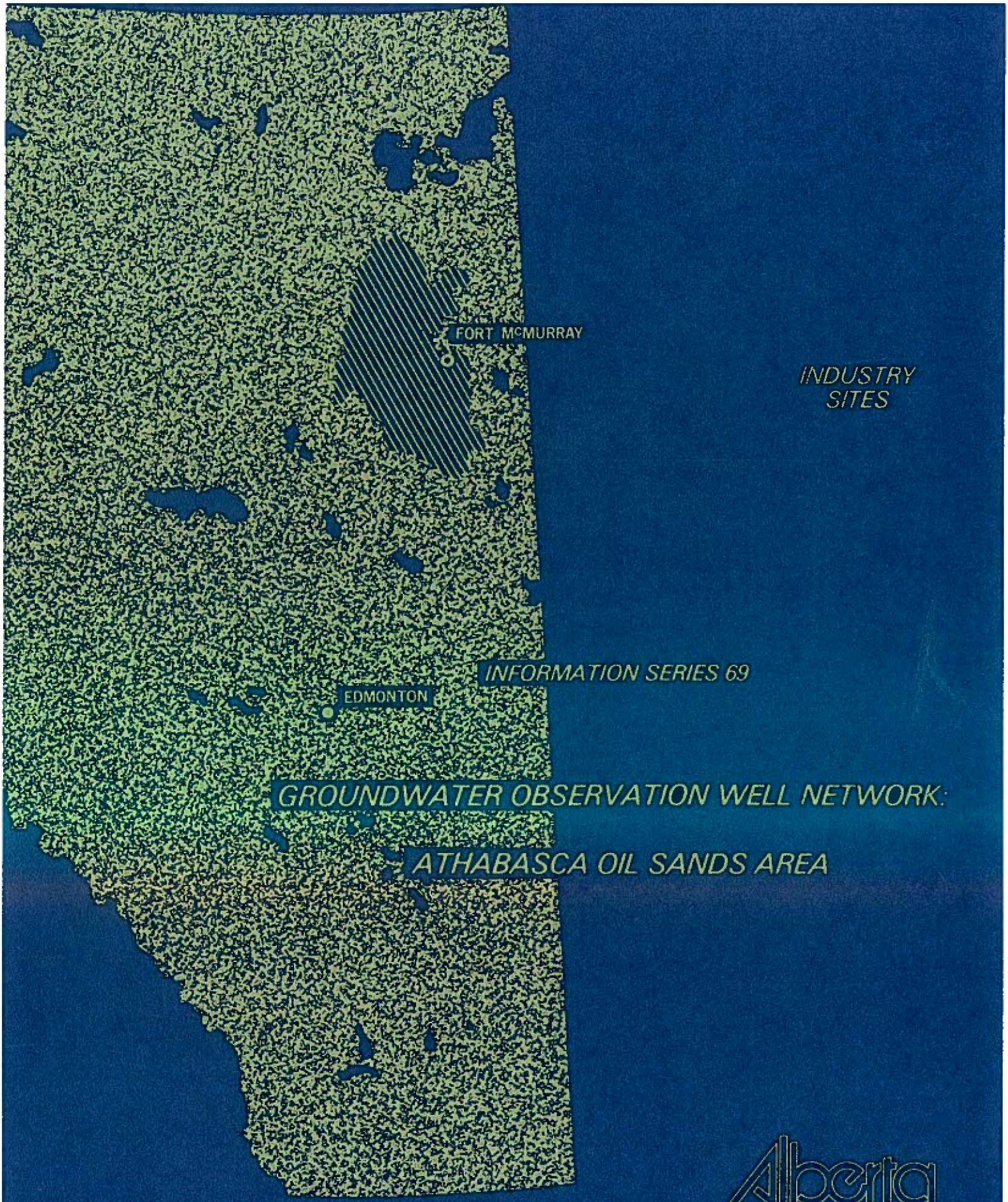
Lsd 12 Sec 21 Twp 98 R 9 W4th

Alberta Research Council

Elevation of top of casing 982.8

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 8.76 MP | 955.9 | |
| Feb 13/80 | 8.79 MP | 955.8 | |
| Mar 12/80 | 8.80 MP | 955.7 | |
| Apr 10/80 | 8.82 MP | 955.7 | |
| May 6/80 | 8.82 MP | 955.7 | |
| June 3/80 | 8.84 MP | 955.6 | |
| July 9/80 | 8.88 MP | 955.5 | Temp. 5.5°C |
| | 8.88 MP | 955.5 | After Sample |
| July 30/80 | 8.88 MP | 955.5 | |
| Aug 27/80 | 8.90 MP | 955.4 | |
| Sept 25/80 | 8.90 MP | 955.4 | |
| Oct 22/80 | 8.88 MP | 955.5 | |
| Nov 19/80 | 8.88 MP | 955.5 | |
| Dec 19/80 | 8.89 MP | 955.4 | |
| Jan 16/81 | 8.87 MP | 955.5 | |
| Feb 11/81 | 8.92 MP | 955.3 | |
| Mar 11/81 | 8.90 MP | 955.4 | |
| Apr 8/81 | 8.91 MP | 955.4 | |
| May 5/81 | 8.91 MP | 955.4 | |
| June 2/81 | 8.92 MP | 955.3 | |
| June 30/81 | 8.93 MP | 955.3 | |
| July 29/81 | 8.93 MP | 955.3 | |
| Aug 26/81 | 8.93 MP | 955.3 | |
| Sept 23/81 | 8.93 MP | 955.3 | |
| Oct 21/81 | 8.95 MP | 955.2 | |
| Nov 20/81 | 9.03 MP | 955.0 | |
| Dec 16/81 | 8.95 MP | 955.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing




INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

## INTRODUCTION

The Groundwater Division of Alberta Research Council undertook, in 1974, to investigate the regional hydrogeology of the Athabasca Oil Sands. The purpose of this study was to develop a hydrogeological model of the area for use in technical and environmental planning. Some examples of potential uses of the model are: locating water supplies for towns and industry, planning dewatering schemes in the vicinity of mines, determining the position of storage sites for solid and liquid industrial waste on the surface or underground and planning restoration of disturbed land.

Groundwater data is not abundant in the area, so installation of groundwater observation wells was necessary. Alberta Energy and Natural Resources provided money to allow the installation of 74 wells at 15 individual sites as noted on figure 1 and table 1.

Individual companies, conducting work on oil extraction, have installed groundwater observation wells for their own purposes at various times. Five of these companies have consented that their wells be included in the monitoring and data analysis. These companies were, as of January 1, 1977: BPOG Operations Ltd., Home Oil Company Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., and Shell Canada Ltd.

The companies have permitted publication of information about their wells which is pertinent to hydrogeology. The information supplied by the companies is presented here in the same format as that collected from the majority of wells in the Observation Well Network. The information supplied for each well is as follows: 1) geological and geophysical logs; 2) annual hydrographs, 3) aquifer testing results, 4) well history, 5) water analyses, and 6) well completion details. Table 2 summarizes the number of pages issued for each well in 1977.

The loose-leaf format has been chosen to facilitate periodic updating with such information as hydrographs, water analyses and well history. The page indexing system is also consistent with the updating process. All updating packages will be noted in the Alberta Research Council List of Publications.

## ACKNOWLEDGEMENTS

This project was financed through Alberta Energy and Natural Resources.

Council personnel working on the project were M. Brulotte, G. Jean, N. Nastasa, G. Sjostrom and M. Walls. Their dedicated work is greatly appreciated.

BPOG Operations Ltd., Home Oil Company Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., and Shell Canada Ltd. allowed use of their wells and provided the information contained in this publication.

D. HACKBARTH

EDMONTON

1977

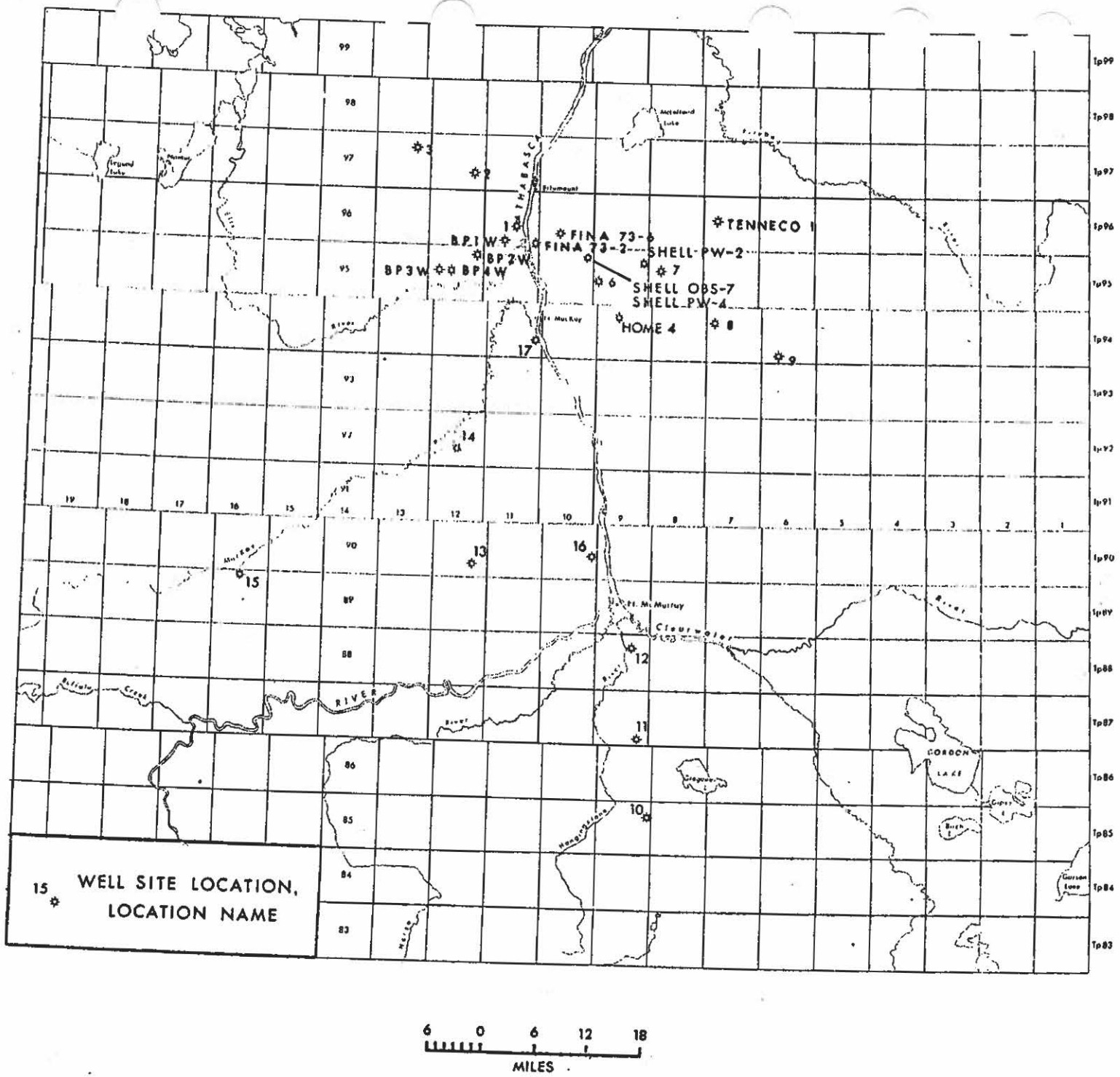



FIGURE 1. Athabasca Oil Sands observation well network, January 1977

Table 1

Athabasca Oil Sands Observation Wells

August 31, 1976

| Location (W 4th) | Site Number |
|---|---|
| Lsd 8-15-96-11 | 1 |
| Lsd 1-11-97-12 | 2 |
| Lsd 9-26-97-13 | 3 |
| Lsd 2-18-95-9 | 6 |
| Lsd 13-20-95-8 | 7 |
| Lsd 5-30-94-7 | 8 |
| Lsd 1 and Lsd 16-4-94-6 | 9 |
| Lsd 9-24-85-9 | 10 |
| Lsd 16-2-87-9 | 11 |
| Lsd 8-27-88-9 | 12 |
| Lsd 8-11-90-12 | 13 |
| Lsd 4-15-92-12 | 14 |
| Lsd 15-33-89-16 | 15 |
| Lsd 6-13-90-10 | 16 |
| Lsd 13-12-94-11 | 17 |
| Lsd 15-3-96-11 | BP-1W |
| Lsd 14-36-95-12 | BP-2WA |
| Lsd 5-21-95-12 | BP-3W |
| Lsd 9-20-95-12 | BP-4W |
| Lsd 1-1-96-11 | Fina 73-2 |
| Lsd 9-9-96-10 | Fina 73-6 |
| Lsd 10-20-96-7 | Tenneco 1 |
| Lsd 3-28-94-9 | Home 4 |
| Lsd 10-25-95-10 | Shell PW-4 |
| Lsd 10-24-95-9 | Shell PW-2 |
| Lsd 10-25-95-10 | Shell Obs-7 |

## GENERAL INFORMATION

Information included under this subject include:

1) A geological sample description; if one was made available, giving the description of the samples obtained during the drilling of the hole.

2) Geophysical and geological (if available) strip logs of the hole. The open portion of each well is indicated along the left side of the logs.

## CHEMICAL ANALYSES

All wells in the Network will be sampled by bailing at least once a year for the first few years. Most routine water analyses were done at Alberta Research Council. Spectral emission estimates were done at commercial laboratories.

## WELL HISTORY

A record of all major events occurring to each well is presented in the "Well History". Included in this tabulation are manual measurements of water level, pumping tests, water sampling and any other event of potential hydrogeological interest.

## ANNUAL HYDROGRAPHS

There are two methods for monitoring of water levels in the Observation Well Network; either by continuous recorder or by monthly manual measurements. Wells in which the depth to water is less than about 200 feet are usually instrumented with a Stevens Type F recorder equipped with a 32 day clock. If the depth to water exceeds about 200 feet this type of recording procedure is not adequate. Monthly manual measurements are made at present in those wells where the depth to water exceeds 200 feet.

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

| | | |
|---|---|---|
| Well Number | - | the name used for designating the well |
| Subject Code | - | as follows: |
| I | - | Introduction (no site number indicated) |
| L | - | Legend (no site number indicated) |
| G | - | General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents |
| C | - | Well construction details |
| D | - | Drill stem testing |
| A | - | Aquifer testing |
| E | - | Chemical analyses including multielement analyses and routine water analyses |
| H | - | Annual hydrograph |
| W | - | Well history |
| Year of Publication | - | the last two numerals of the year of publication. |

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within tha tabbed section for that particular well.

# GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
| | sandstone, arkosic |
| | silt |
| | siltstone |
| | siltstone & sandstone |
| | clay |
| | clay, sandy |
| | claystone, shale |
| | sandstone & shale |
| | oil sand |
| | limestone |
| | limestone, shaley |
| | dolomite |
| | dolomite, argillaceous |
| | rock salt |
| | gypsum & anhydrite |
| | coal |
| | igneous rock |

| Symbol | Stratigraphic Unit |
|---|---|
| | Pleistocene and Recent |
| Qd | Surface deposits |
| | Cretaceous |
| Ks | Smoky Group |
| Klb | La Biche Formation |
| Kd | Dunvegan Formation |
| Ksh | Shaftesbury Formation |
| Kpl | Pelican Formation |
| Kj | Joli Fou Formation |
| Kg | Grand Rapids Formation |
| Kc | Clearwater Formation |
| Kw | Wabiskaw Member |
| Km | McMurray Formation |
| | Devonian |
| Dwd | Woodbend Group |
| Dbl | Beaverhill Lake Formation |
| Dsw | Slave Point Formation & Fort Vermilion Formation & Watt Mountain Formation |
| Dmk | Muskeg Formation |
| Dpe | Prairie Evaporite Formation |
| Dm | Methy Formation (Keg River Formation equivalent) |
| Dmr | McLean River Formation (Chinchaga Formation equivalent) |
| Dl | La Loche Formation |
| | Precambrian |
| Pc | Undivided |

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

| Symbol | Units or Parameter |
|---|---|
| Sec. | section |
| ss | stainless steel |
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) or time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| WILL | Analysis done at Western Industrial Laboratories Ltd. |
| Wt | weight |

## GEOLOGICAL ABBREVIATIONS

| | |
|---|---|
| biocl | bioclast |
| brac | brachiopod |
| bry | bryozoan |
| calc | calcareous |
| carb | carbonaceous |
| cht | chert |
| fld | feldspar |
| glauc | glauconite, glauconitic |
| gvl | gravel |
| hvy | heavy |
| lt | light |
| mnrls | minerals |
| pbl | pebbles |
| qtz | quartz |
| strgr(s) | stringer(s) |
| stroms | stromotoporoids |
| subang | subangular |
| subrd | subrounded |

SUMMARY OF CONTENTS

INDUSTRY WELLS

Number of pages issued for these wells in 1977

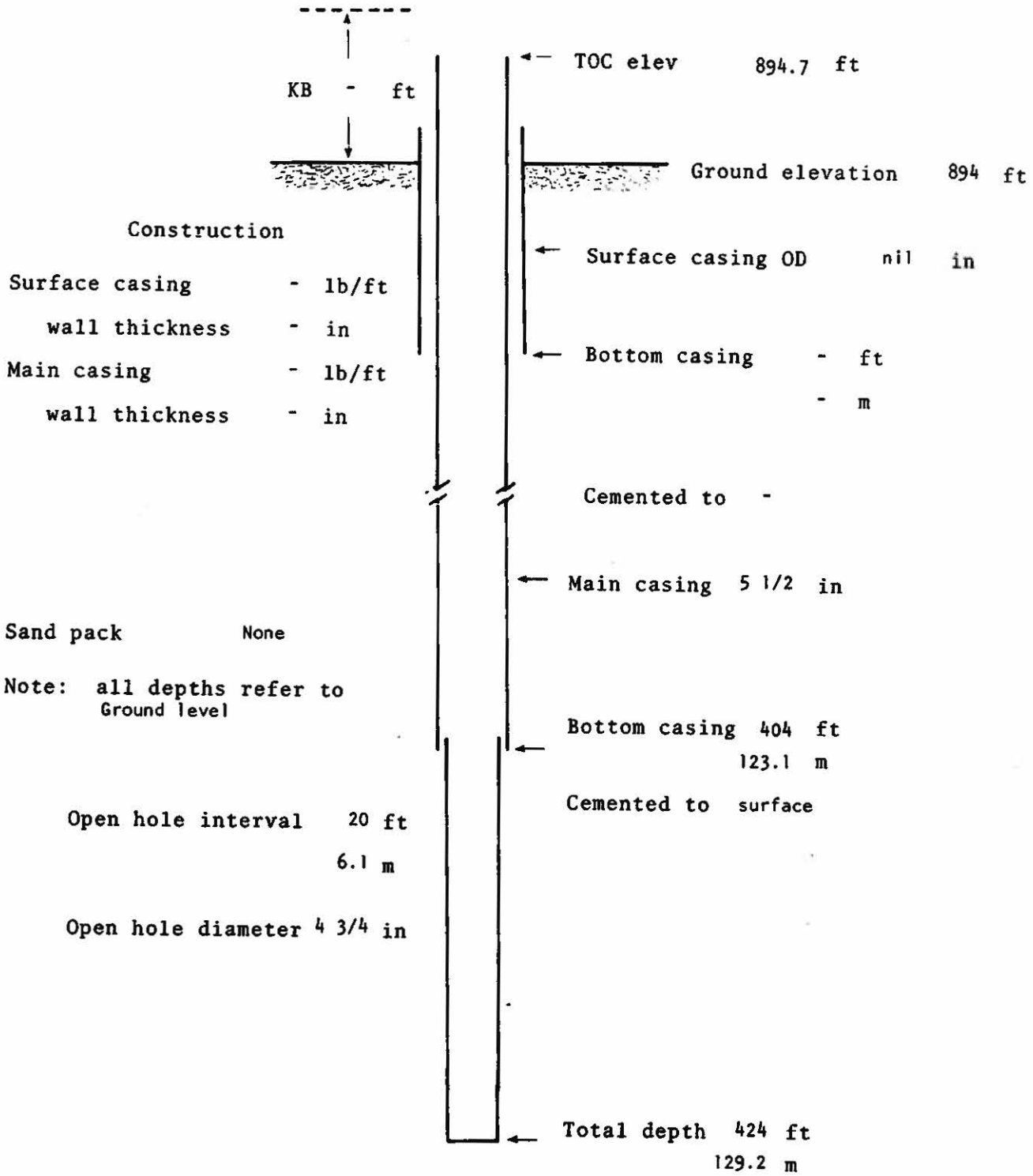
| Well name / page title | BP-1W | BP-2W | BP-2WA | BP-3W | BP-4WA | HOME 4 | FINA 73-6 | FINA 73-2 | TENNECO 1 | SHELL OBS-7 | SHELL PW-4 | SHELL PW-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site Plan | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| Geological Sample Description | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 0 | 0 |
| Geophysical and Geological Logs | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| Well Construction | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| Water Analysis | 4 | 1 | 9 | 1 | 2 | 4 | 4 | 1 | 4 | 2 | 2 | 3 |
| Spectral Emission Estimates | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Water Level Hydrograph | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| Well History | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER BP - 1W

Lsd 15 Sec 3 Tp 96 R 11 W4th

Alberta Research Council



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER BP - 1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Ground elevation 893.7 Total depth 424

KB elevation Unknown
All depths refer to ground level

| Interval from | to | Description | Formation |
|---|---|---|---|
| 0 | 5 | Clay, silty, some fine sand, greyish brown to brown, some limestone boulders | Drift |
| 5 | 10 | Sand, fine grained, silty, brown, with hard rusty iron rich sandy inclusions | |
| 10 | 25 | Clay, silty, hard, dark grey | |
| 25 | 30 | Shale, (clay) grey, some silt, soft thinly stratified (¼" - ½") slightly weathered | McMurray |
| 30 | 43 | Shale, silty, dark grey, thinly laminated | |
| 43 | 52 | Tar sand, (sandstone) silty, fine grained rusty, oil-bearing | |
| 52 | 58 | Siltstone, clayey, light grey | |
| 58 | 67 | Tar sand, (sandstone) fine grained, light brown, oil-bearing | |
| 67 | 70 | Tar sand, oil-rich fine grained sandstone, light brown, oil-bearing | |
| 70 | 100 | Tar sand, (sandstone) fine grained, chocolate brown with inclusions or layers of medium to coarse grained sand, oil-bearing | |
| 100 | 109 | Shale, (clay) grey, interbedded with fine grained sandstone | |
| 109 | 123 | Tar sand, (sandstone) silty, poorly cemented, dark brown, some oil | |
| 123 | 130 | Claystone, silty, soft, grey, some oil | |
| 130 | 154 | Tar sand, (sandstone) fine grained, silty, greyish, brown, some oil | |
| 154 | 155 | Tar sand, fine grained silicous sandstone, light grey, strong | |
| 155 | 184 | Tar sand, fine grained, grey brown, some silt, traces of oil | |
| 184 | 196 | Tar sand, fine to medium grained, dark brown, containing sericite, oil-bearing | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER BP - 1W (continued)

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

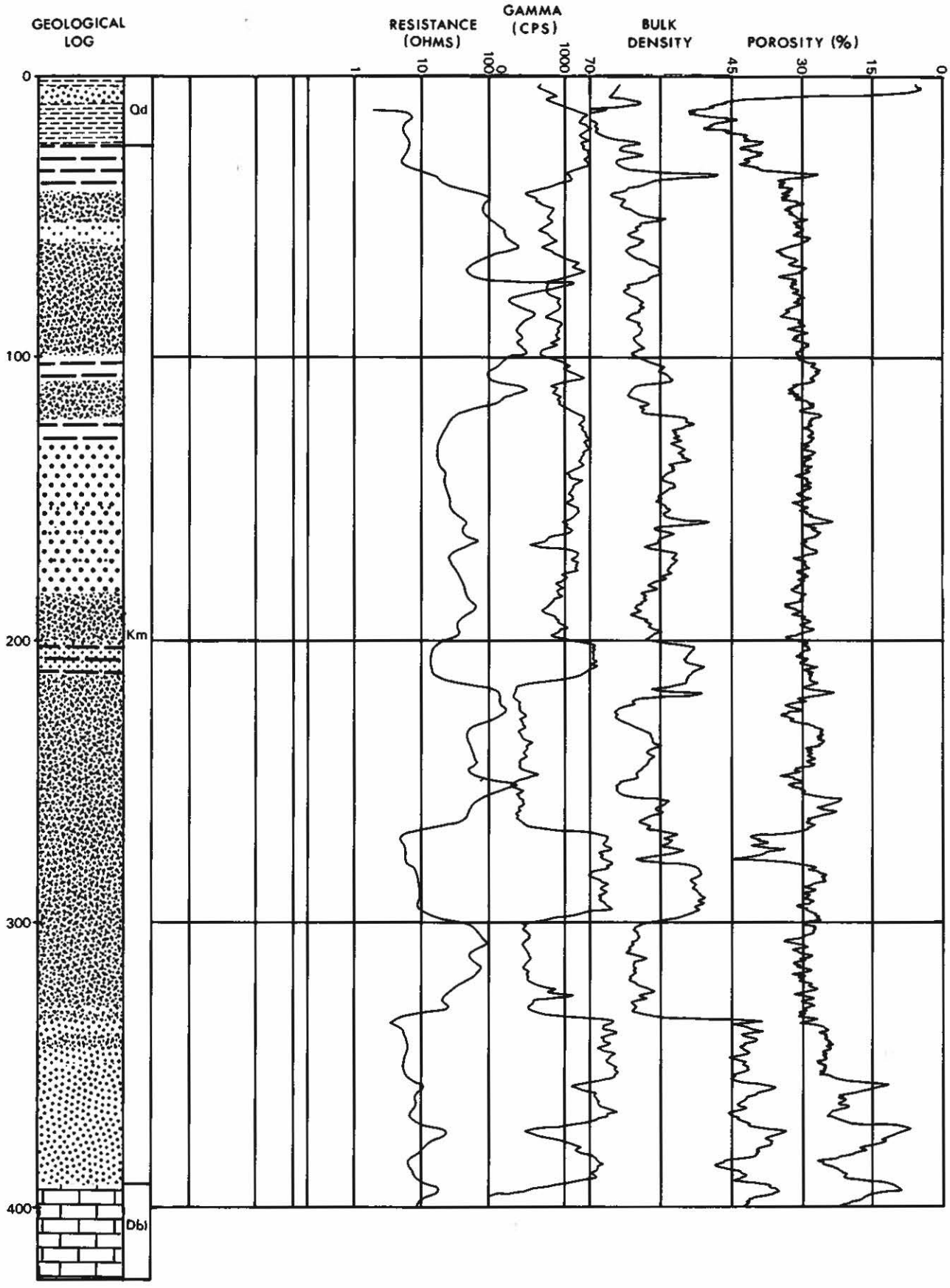
Ground elevation Total depth

KB elevation

| Interval from | to | Description | Formation |
|---|---|---|---|
| 196 | 202 | Tar sand, fine grained, silty, greyish brown, some oil | |
| 202 | 212 | Shale, silty, low to moderate consolidation, light grey to grey, no apparent lamination | |
| 212 | 214 | Tar sand (sandstone) fine grained, brownish, oil-bearing | |
| 214 | 215 | Tar sand fine grained, grey, silicous cemented | |
| 215 | 222 | Tar sand fine grained, brownish, poor cementation, some oil | |
| 222 | 253 | Tar sand medium grained, dark brown, some coarser transparent silica grains, poorly cemented, oil-bearing | |
| 253 | 328 | Tar sand coarse grained, light to dark brown, with silica grains up to 4 mm in diameter, poorly cemented, oil-bearing | |
| 328 | 350 | Tar sand coarse grained sand, some oil | |
| 350 | 395 | Sand, soft fragments of calcareous rock | |
| 395 | 424 | Limestone, light grey, hard, fresh with white and pink crystalline veins | Beaverhill Lake |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE BP- 1W
## 15 - 3 - 96 - 11 - W4 th
ALBERTA RESEARCH COUNCIL

BP-1W-G-77



## WATER ANALYSIS

OBSERVATION WELL NUMBER BP - 1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Sample source Air-lift pumping; after 3 hours (C & GLL)

Date sampled March 1, 1975

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 61 | 3.0 | 0.7 |
| Magnesium ($Mg^{++}$) | 366 | 30.1 | 7.4 |
| Sodium ($Na^{+}$) | 8500 | 369.8 | 90.9 |
| Potassium ($K^{+}$) | 150 | 3.8 | 0.9 |
| Carbonate ($CO_3^{=}$) | 0 | 0.0 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1787 | 29.3 | 6.6 |
| Sulfate ($SO_4^{=}$) | 152 | 3.2 | 0.7 |
| Chloride ($Cl^{-}$) | 14600 | 411.7 | 92.7 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | 25.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 26070 | | |
| Total Anions (epm) | 444.2 | Total Cations (epm) | 406.7 |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 32,500 |
| pH | 8.3 |
| Fluoride ($F^{-}$) | 0.37 ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 9.0 |
| Carbonate ($CO_3^{=}$) | 437 ppm |
| Bicarbonate ($HCO_3^{-}$) | 1153 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | 41,700 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP - 1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed (C & GLL)

Date sampled March 18, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 191 | 9.5 | 2.3 |
| Magnesium ($Mg^{++}$) | 344 | 28.5 | 6.9 |
| Sodium ($Na^{+}$) | 8425 | 366.5 | 89.8 |
| Potassium ($K^{+}$) | 142.5 | 3.6 | 0.8 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.0 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 2274 | 37.3 | 8.5 |
| Sulfate ($SO_4^{=}$) | 156 | 3.2 | 0.7 |
| Chloride ($Cl^{-}$) | 14300 | 403.3 | 91.5 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | 32 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 25950 | | |
| Total Anions (epm) 440.8 | | Total Cations (epm) 408.1 | |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 33,000 |
| pH | 7.2 |
| Fluoride ($F^{-}$) | 0.78 ppm |

Field:

- Temperature (C)
- pH
- Carbonate ($CO_3^{=}$)
- Bicarbonate ($HCO_3^{-}$)
- Hydroxide ($OH^{-}$)
- Conductivity

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 11, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 165 | 8.23 | 2 |
| Magnesium ($Mg^{++}$) | 352 | 28.95 | 7 |
| Sodium ($Na^{+}$) | 8906 | 387.39 | 91 |
| Potassium ($K^{+}$) | 94 | 2.40 | 1 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 2203 | 36.11 | 8 |
| Sulfate ($SO_4^{=}$) | 15.2 | 0.32 | 0 |
| Chloride ($Cl^{-}$) | 15598 | 439.88 | 92 |
| Nitrate ($NO_3^{=}$) | 1.4 | 0.02 | 0 |
| Silica ($SiO_2$) | 18.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 167 | | |
| Magnesium (Acidified) | 322 | | |
| Total dissolved solids | 25816 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 476.33 | Total Cations (epm) | 426.97 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | 3.5 |
| pH | 7.2 | pH | 7.2 |
| Fluoride ($F^{-}$) | 0.3 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 2318 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 94.0 | 4.69 | 1 |
| Magnesium ($Mg^{++}$) | 450.0 | 37.04 | 8 |
| Sodium ($Na^{+}$) | 10125.0 | 440.41 | 91 |
| Potassium ($K^{+}$) | 113.0 | 2.89 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1459.0 | 23.91 | 5 |
| Sulfate ($SO_4^{=}$) | 4.3 | 0.09 | 0 |
| Chloride ($Cl^{-}$) | 17000.0 | 479.41 | 95 |
| Nitrate ($NO_3^{=}$) | 2.2 | 0.04 | 0 |
| Silica ($SiO_2$) | 18.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 0.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 14195 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 503.45 | Total Cations (epm) | 485.03 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 6.0 | |
| pH | 7.9 | pH | 7.2 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 1708 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 6, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 82.0 | 4.09 | 0.9 |
| Magnesium ($Mg^{++}$) | 360.0 | 29.63 | 6.7 |
| Sodium ($Na^{+}$) | 9375.0 | 407.79 | 91.8 |
| Potassium ($K^{+}$) | 101.0 | 2.58 | 0.6 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1728.0 | 28.32 | 6.5 |
| Sulfate ($SO_4^{=}$) | 3.8 | 0.08 | 0.0 |
| Chloride ($Cl^{-}$) | 14400.8 | 406.09 | 93.5 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 5.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 75.0 | | |
| Magnesium (Acidified) | 390.0 | | |
| Total dissolved solids | 27358.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 434.49 | Total Cations (epm) | 444.09 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 6.0 |
| pH | 7.7 | pH | 7.4 |
| Fluoride ($F^{-}$) | 0.2 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 1674.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER BP - 1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Date sampled: July 16, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .069 |
| Au | <.003 | Mo | <.006 |
| Al | 1.32 | Na | 9416 |
| As | <.038 | Ni | <.010 |
| B | 4.16 | P | <.110 |
| Ba | 23.9 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 83.4 | Si | 8.78 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 16.9 |
| Cr | <.006 | Te | <.065 |
| Cu | .024 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 1.37 | V | .019 |
| K | 198 | W | <.078 |
| Mg | 400 | Zn | .198 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 116.0 | 5.79 | 1.2 |
| Magnesium(Mg) | 428.0 | 35.23 | 7.1 |
| Sodium(Na) | 10350.0 | 450.20 | 91.2 |
| Potassium(K) | 100.0 | 2.56 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1745.0 | 28.60 | 5.6 |
| Sulphate(SO4) | 10.2 | 0.21 | 0.0 |
| Chloride(Cl) | 17000.0 | 479.41 | 94.3 |
| Nitrate(NO3) | 2.4 | 0.04 | 0.0 |
| Silica(SiO2) | 11.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 101.0 | | |
| Magnesium(Acidified) | 319.0 | | |
| TDS(mg/l) | 280000.0 | | |
| Total Anions(epm) | 508.27 | Total Cations(epm) | 493.77 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 40500 | | Temperature(C) | 7.00 | |
| pH | 7.7 | | pH | 6.9 | |
| Fluoride(F) | 0.3 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 1781 | mg/l |
| | | | Hydroxide(OH) | | |

BP-1W-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 6, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 107.0 | 5.34 | 1.1 |
| Magnesium(Mg) | 465.0 | 38.27 | 8.0 |
| Sodium(Na) | 10000.0 | 434.97 | 90.4 |
| Potassium(K) | 98.0 | 2.51 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1645.0 | 26.96 | 5.2 |
| Sulphate(SO4) | 6.0 | 0.12 | 0.0 |
| Chloride(Cl) | 17500.0 | 493.51 | 94.8 |
| Nitrate(NO3) | 1.2 | 0.02 | 0.0 |
| Silica(SiO2) | 11.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 102.0 | | |
| Magnesium(Acidified) | 406.0 | | |
| TDS(mg/l) | 26840.0 | | |
| Total Anions(epm) | 520.62 | Total Cations(epm) | 481.09 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 36900 | Temperature(C) | 6.00 | |
| pH | 7.8 | pH | 7.3 | |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 1659 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS BP-1W-E-82

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 1, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 106.0 | 5.30 | 1.1 |
| Magnesium(Mg) | 451.0 | 37.58 | 7.6 |
| Sodium(Na) | 10281.0 | 447.00 | 90.8 |
| Potassium(K) | 101.0 | 2.59 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 1515.0 | 24.84 | 5.0 |
| Sulphate(SO4) | 1.0 | 0.02 | 0.0 |
| Chloride(Cl) | 16750.0 | 471.83 | 95.0 |
| Nitrate(NO3) | 0.7 | 0.01 | 0.0 |
| Silica(SiO2) | 5.8 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 92.0 | | |
| Magnesium(Acidified) | 357.0 | | |
| TDS(mg/l) | 29024.0 | | |
| Total Anions(epm) | 496.70 | Total Cations(epm) | 492.47 |

Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 45000 | |
| pH | 8.0 | |
| Fluoride | 0.2 | mg/l |

Field:

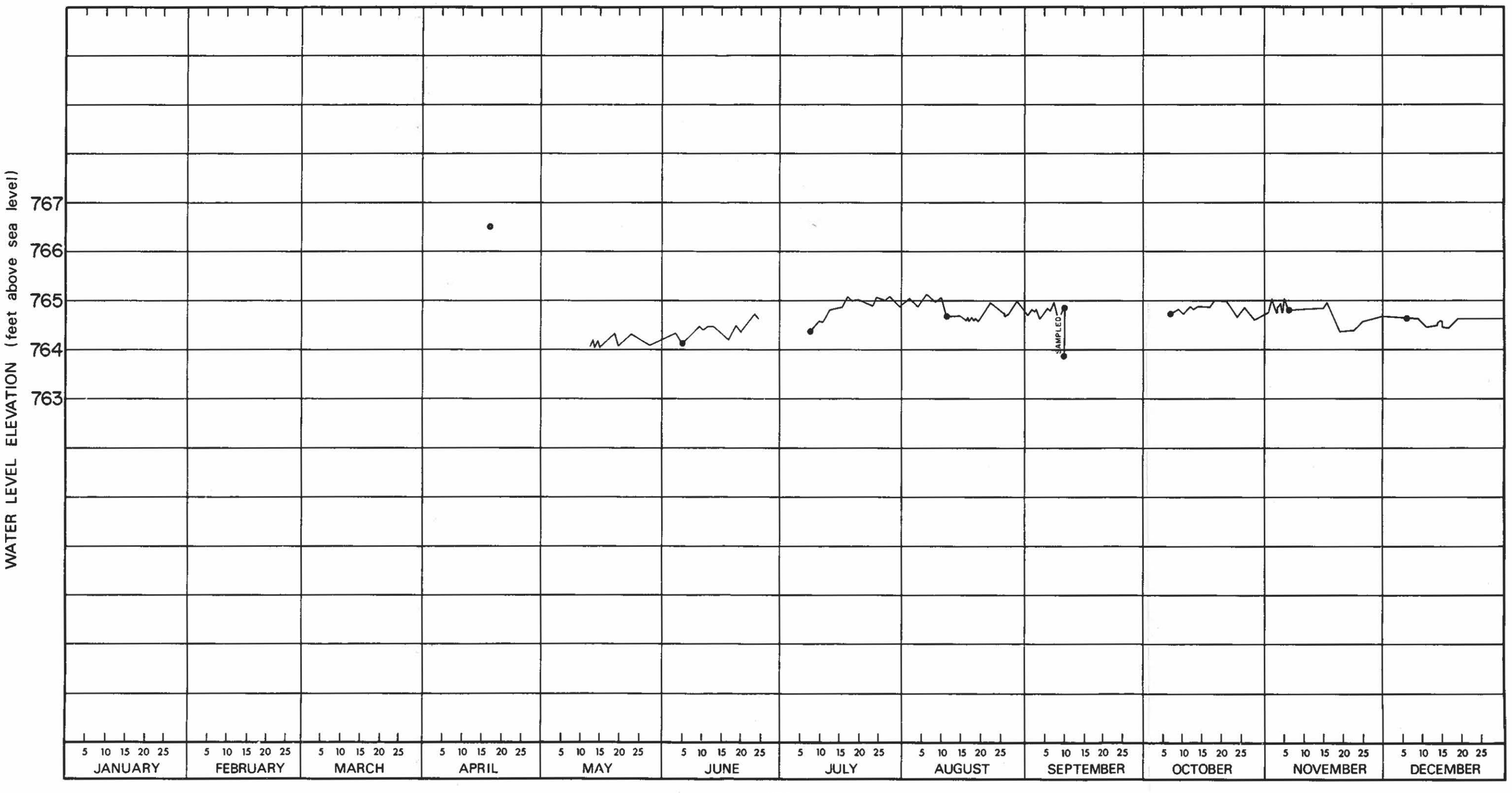
| | | |
|---|---|---|
| Temperature | 4.00 | |
| pH | 7.3 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 1610 | mg/l |
| Hydroxide(OH) | | |

WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP - 1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

BP-1W-H-77



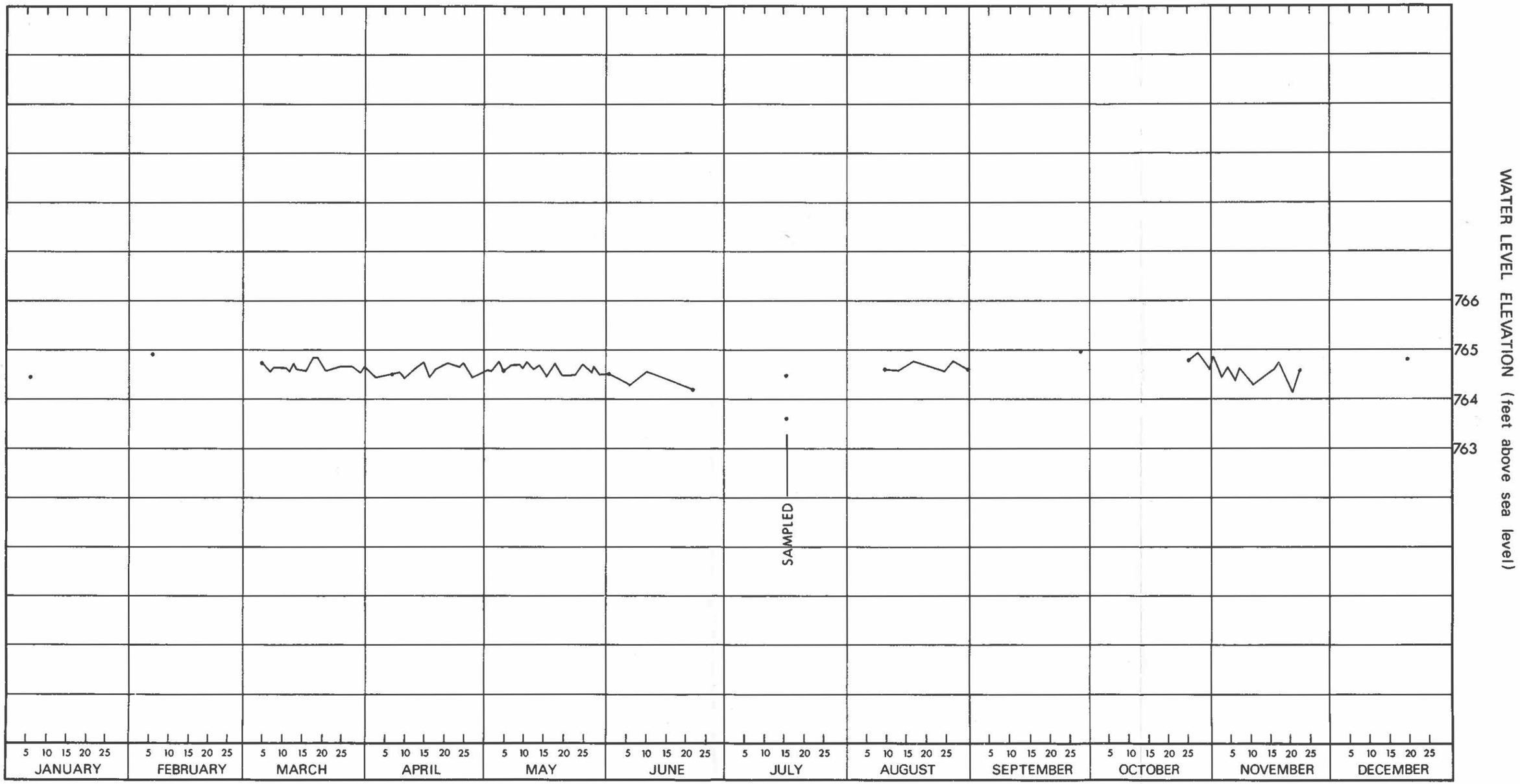
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

BP - 1W - H - 77




1976

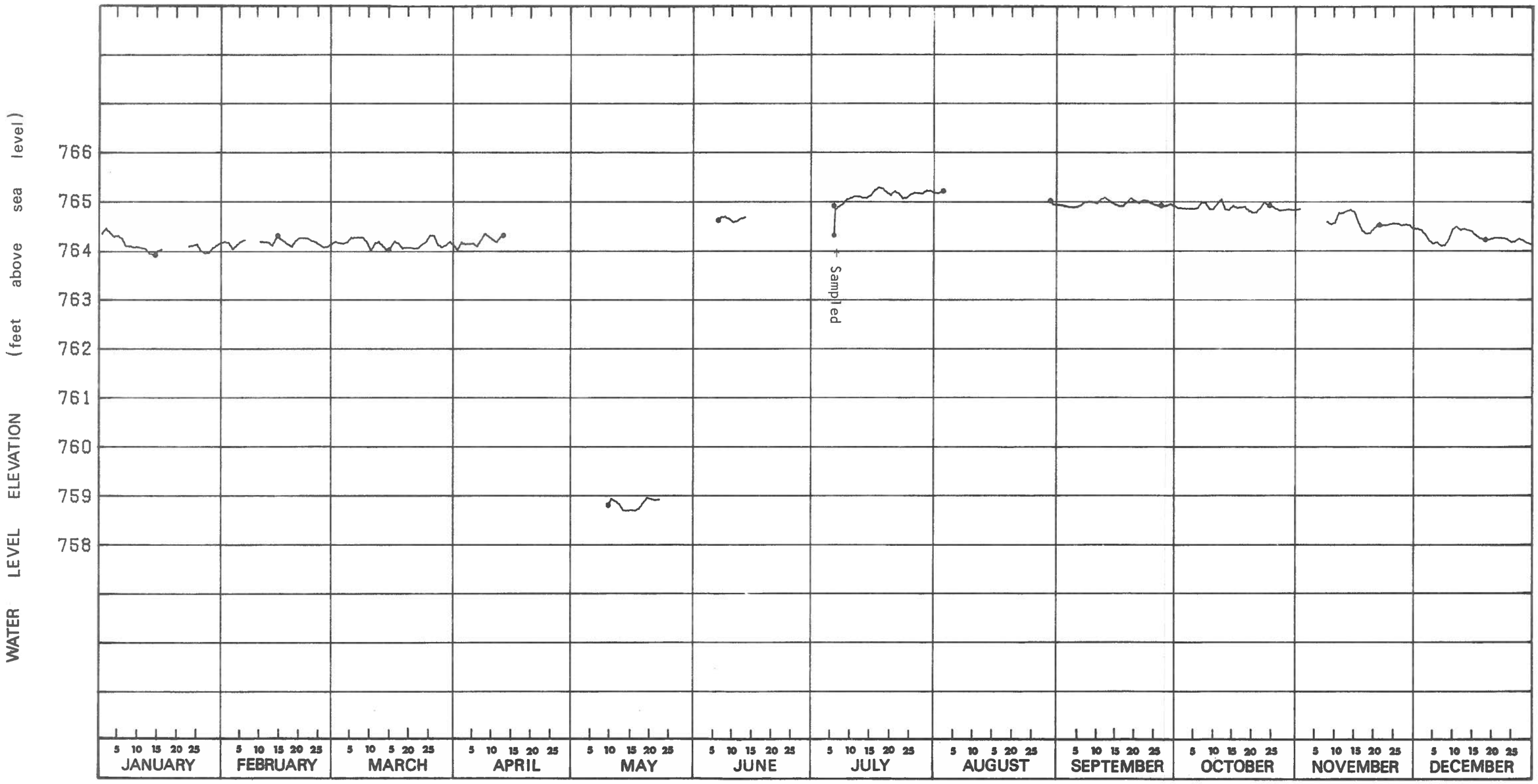
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Twp 96 R 11 W4 th

Alberta Research Council

BP-1W-H-78



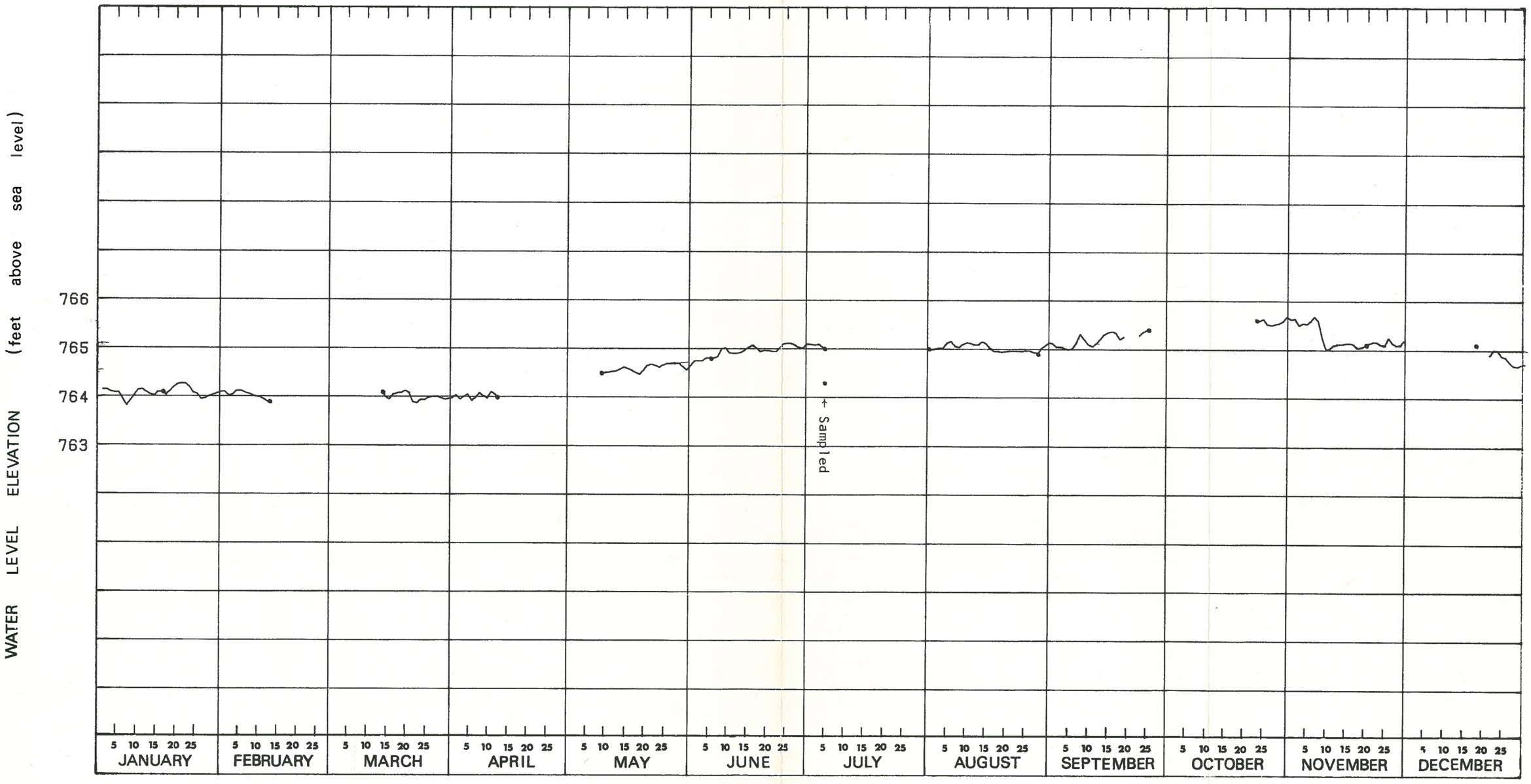
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-1W

LSD 15 SEC 3 TWP 96 R 11 W4TH

Alberta Research Council

BP-1W-H-79




1978

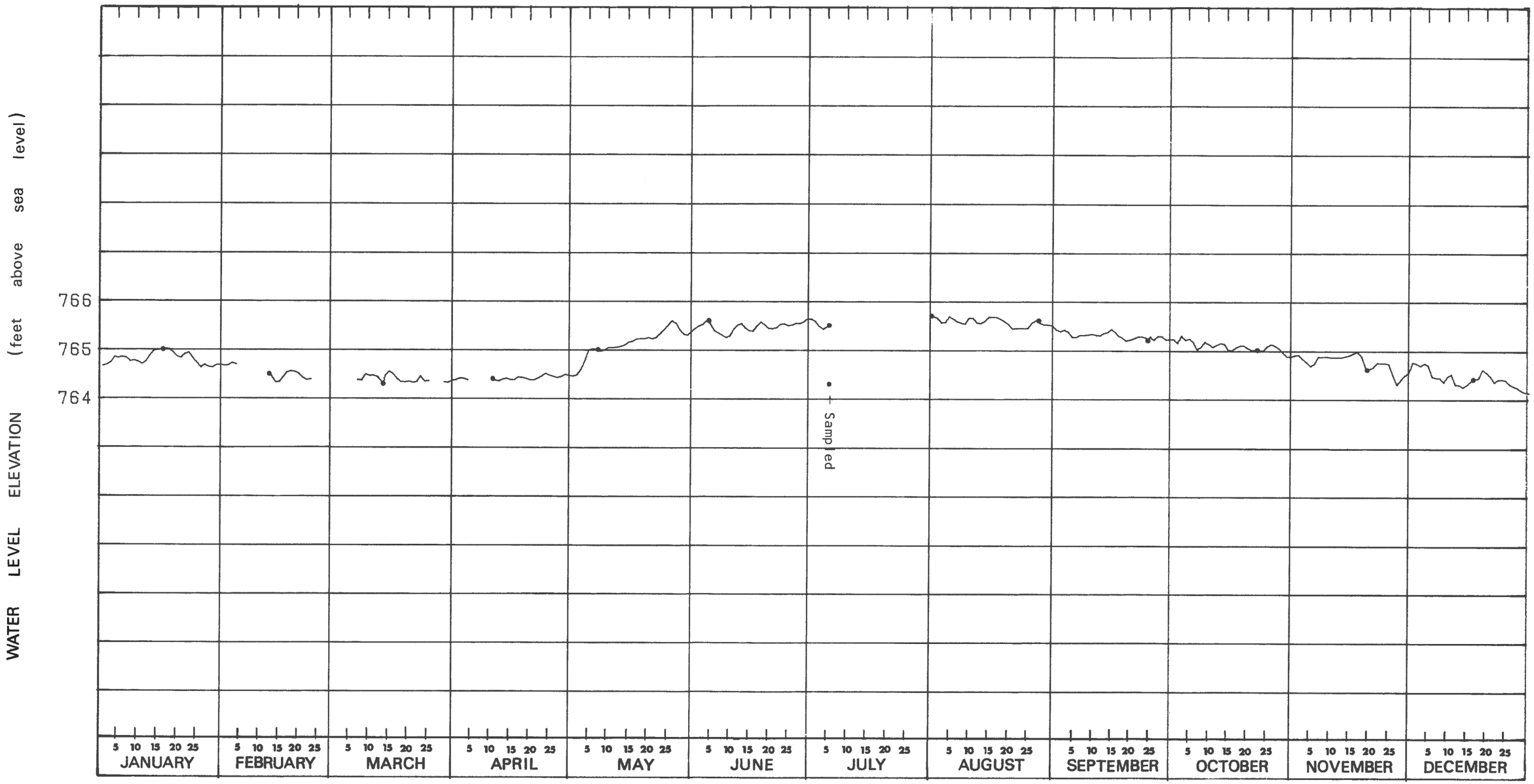
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-1W

BP-1W-H-80

Lsd 15 Sec 3 Twp 96 R 11 W4 th

Alberta Research Council



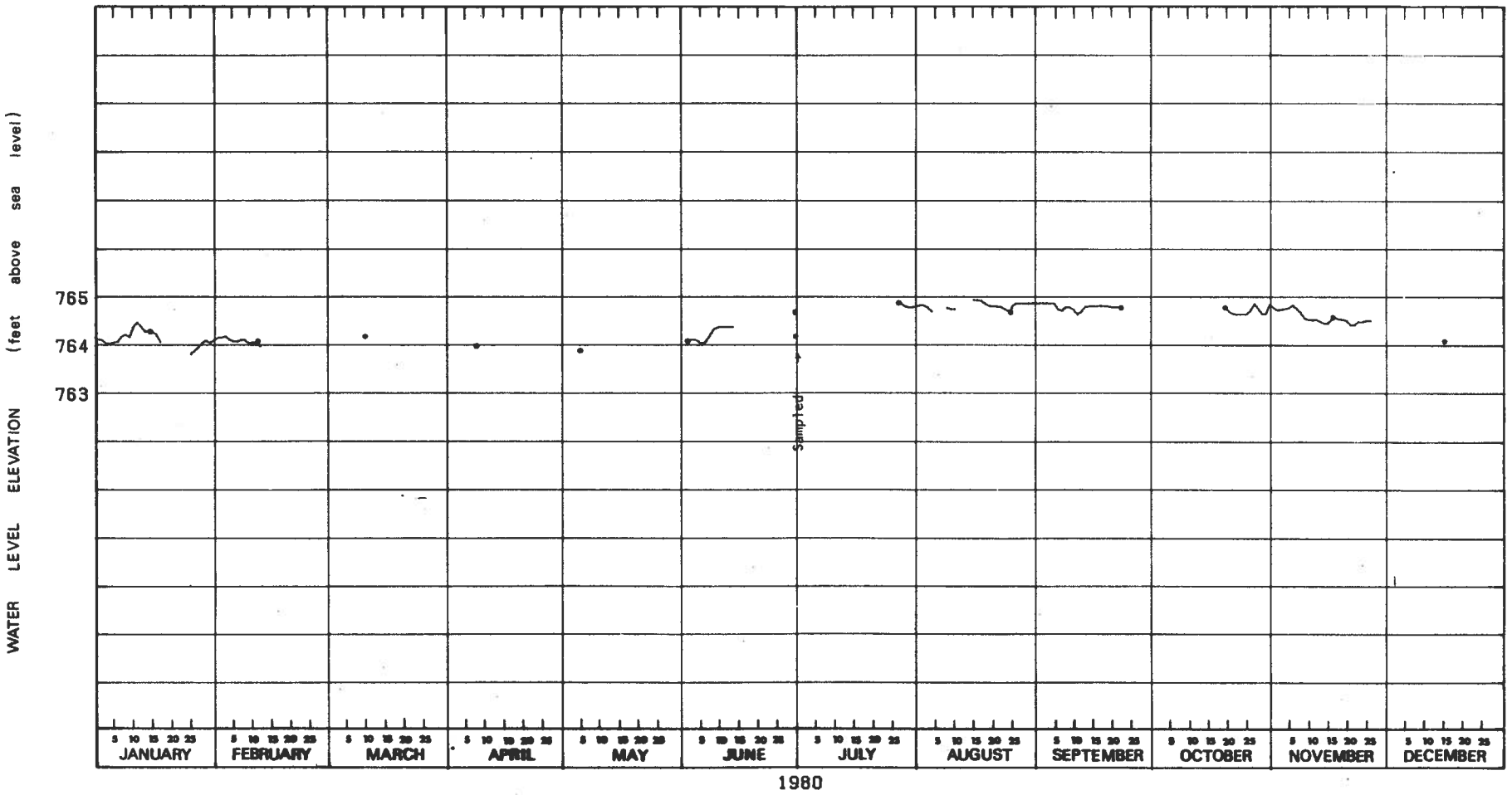
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Twp 96 R 11 W4 th

Alberta Research Council

BP-1W-H-81



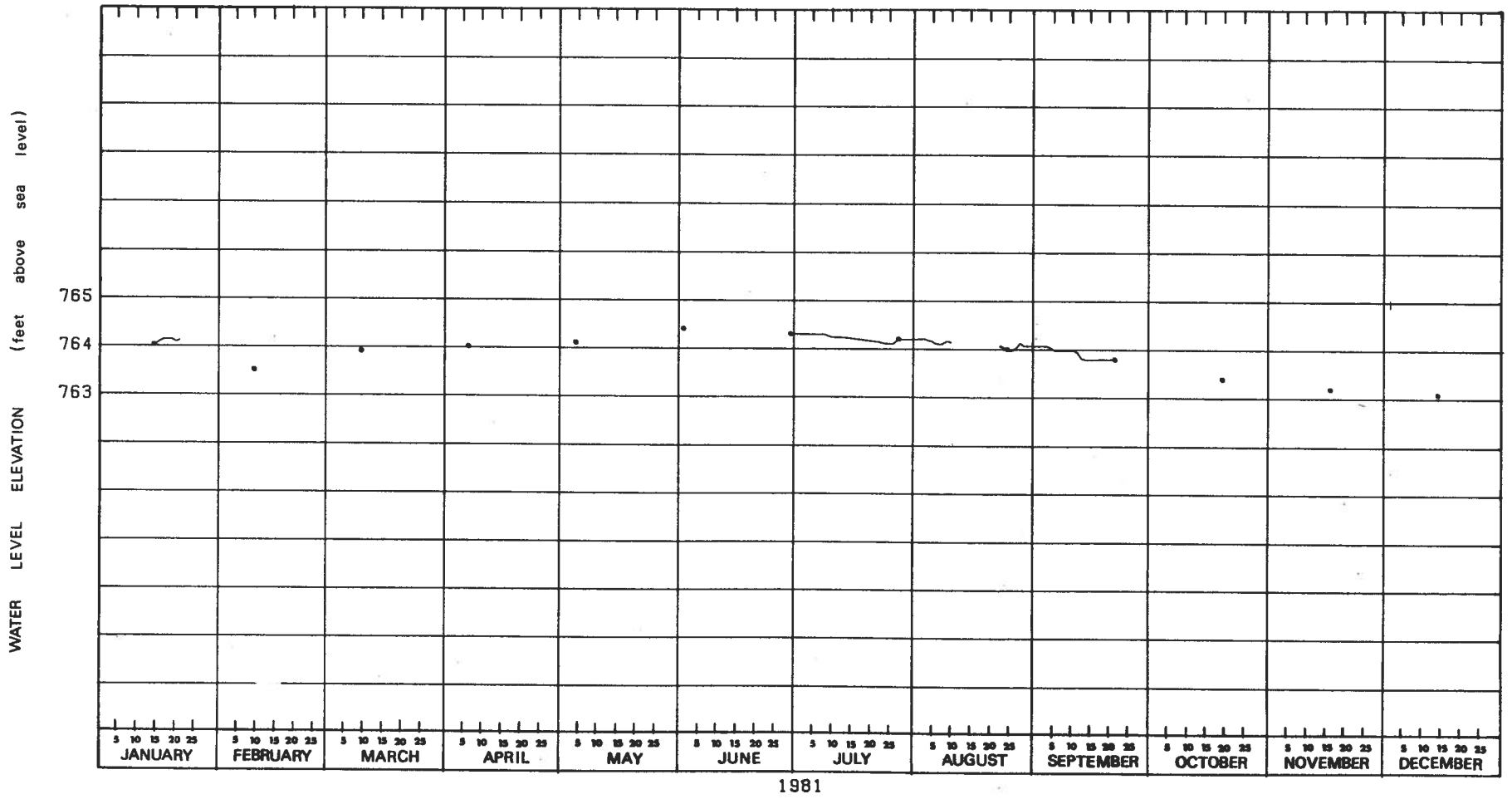
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-1W

BP-1W-H-82

Lsd 15 Sec 3 Twp 96 R 11 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER BP - 1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 894.7

| Date | Depth to water (meters) | Water level elevation (feet) , | Comments |
|---|---|---|---|
| Mar 1/75 | | | Well completed; pump test |
| Mar 2/75 | 41.92 TOC | 757.2 | |
| Mar 3/75 | 40.72 TOC | 761.1 | |
| Mar 5/75 | 40.17 TOC | 762.9 | |
| Mar 6/75 | 40.08 TOC | 763.2 | |
| Mar 8/75 | 40.08 TOC | 763.2 | |
| Mar 11/75 | 39.86 TOC | 764.0 | |
| Mar /75 | 39.98 TOC | 763.6 | Water sample |
| Mar 31/75 | 40.02 TOC | 763.4 | |
| Apr 17/75 | 39.88 TOC | 766.7 | MP = 34.25" TOC, (897.5) |
| May 12/75 | 40.23 MP | 765.5 | |
| June 9/75 | 40.67 MP | 764.1 | |
| July 9/75 | 40.59 MP | 764.4 | |
| Aug 13/75 | 40.52 MP | 764.6 | |
| Sept 11/75 | 40.49 MP | 764.7 | |
| | 40.76 MP | 763.8 | After sample; temp. 3.5°C |
| Oct 7/75 | 40.50 MP | 764.7 | |
| Nov 6/75 | 40.48 MP | 764.7 | |
| Dec 6/75 | 40.53 MP | 764.6 | |
| Jan 6/76 | 40.57 MP | 764.4 | |
| Feb 6/76 | 40.44 MP | 764.9 | |
| Mar 5/76 | 40.49 MP | 764.7 | |
| Apr 7/76 | 40.56 MP | 764.5 | |
| May 5/76 | 40.54 MP | 764.5 | |
| June 1/76 | 40.56 MP | 764.5 | |
| June 22/76 | 40.65 MP | 764.2 | |
| July 16/76 | 40.57 MP | 764.4 | |
| | 40.83 MP | 763.6 | After sample; temp. 6°C |
| Aug 10/76 | 40.53 MP | 764.6 | |
| Aug 31/76 | 40.53 MP | 764.6 | |
| Sept 28/76 | 40.42 MP | 764.9 | |
| Oct 26/76 | 40.45 MP | 764.8 | |
| Nov 23/76 | 40.52 MP | 764.6 | |
| Dec 20/76 | 40.46 MP | 764.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 894.7

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 40.73 MP | 763.9 | MP (897.5) |
| Feb 15/77 | 40.62 MP | 764.3 | |
| Mar 15/77 | 40.85 MP | 763.5 | Measurement probably incorrect recorder shows water level elevation of 764.0 |
| Apr 13/77 | 40.63 MP | 764.3 | |
| May 10/77 | 42.30 MP | 758.8 | Measurement questionable |
| June 7/77 | 40.53 MP | 764.6 | |
| July 6/77 | 40.42 MP | 764.9 | |
| | 40.61 MP | 764.3 | After sample; temp. 6°C |
| Aug 3/77 | 40.34 MP | 765.2 | |
| Aug 30/77 | 40.39 MP | 765.0 | |
| Sept 27/77 | 40.43 MP | 764.9 | |
| Oct 25/77 | 40.41 MP | 764.9 | |
| Nov 22/77 | 40.54 MP | 764.5 | |
| Dec 19/77 | 40.64 MP | 764.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 894.7

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 40.66 MP | 764.1 | MP (897.5) |
| Feb 13/78 | 40.72 MP | 763.9 | |
| Mar 14/78 | 40.66 MP | 764.1 | |
| Apr 12/78 | 40.70 MP | 764.0 | |
| May 9/78 | 40.56 MP | 764.5 | |
| June 6/78 | 40.48 MP | 764.8 | MP = 0.90m TOC (897.6) |
| July 5/78 | 40.42 MP | 765.0 | |
| | 40.63 MP | 764.3 | After sample; temp. 7°C |
| Aug 1/78 | 40.42 MP | 765.0 | |
| Aug 29/78 | 40.45 MP | 764.9 | |
| Sept 26/78 | 40.31 MP | 765.4 | |
| Oct 24/78 | 40.25 MP | 765.6 | |
| Nov 21/78 | 40.40 MP | 765.1 | |
| Dec 19/78 | 40.39 MP | 765.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-1W

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 894.7

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 40.44 MP | 765.0 | MP (897.6) |
| Feb 13/79 | 40.58 MP | 764.5 | |
| Mar 14/79 | 40.64 MP | 764.3 | |
| Apr 11/79 | 40.62 MP | 764.4 | |
| May 8/79 | 40.44 MP | 765.0 | |
| June 5/79 | 40.02 MP | 765.6 | New MP 0.68m TOC (896.9) |
| July 6/79 | 40.06 MP | 765.5 | |
| | 40.42 MP | 764.3 | After sample; temp. 6°C |
| Aug 1/79 | 40.00 MP | 765.7 | |
| Aug 28/79 | 40.04 MP | 765.6 | |
| Sept 25/79 | 40.16 MP | 765.2 | |
| Oct 23/79 | 40.22 MP | 765.0 | |
| Nov 20/79 | 40.33 MP | 764.6 | |
| Dec 17/79 | 40.38 MP | 764.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER BP - IW

Lsd 15 Sec 3 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 894.7

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 40.41 MP | 764.3 | |
| Feb 12/80 | 40.48 MP | 764.1 | |
| Mar 11/80 | 40.47 MP | 764.2 | |
| Apr 9/80 | 40.53 MP | 764.0 | |
| May 6/80 | 40.54 MP | 763.9 | |
| June 3/80 | 40.49 MP | 764.1 | |
| July 1/80 | 40.29 MP | 764.7 | Temp. 4°C |
| | 40.45 MP | 764.2 | After Sample |
| July 28/80 | 40.24 MP | 764.9 | |
| Aug 26/80 | 40.29 MP | 764.7 | |
| Sept 24/80 | 40.27 MP | 764.8 | |
| Oct 21/80 | 40.28 MP | 764.8 | |
| Nov 18/80 | 40.34 MP | 764.6 | |
| Dec 17/80 | 40.49 MP | 764.1 | |
| Jan 15/81 | 40.52 MP | 764.0 | |
| Feb 10/81 | 40.67 MP | 763.5 | |
| Mar 10/81 | 40.56 MP | 763.9 | |
| Apr 7/81 | 40.51 MP | 764.0 | |
| May 4/81 | 40.48 MP | 764.1 | |
| June 2/81 | 40.41 MP | 764.4 | |
| June 30/81 | 40.42 MP | 764.3 | |
| July 28/81 | 40.46 MP | 764.2 | |
| Aug 25/81 | 40.53 MP | 764.0 | |
| Sept 22/81 | 40.58 MP | 763.8 | |
| Oct 20/81 | 40.70 MP | 763.4 | |
| Nov 17/81 | 40.76 MP | 763.2 | |
| Dec 15/81 | 40.78 MP | 763.1 | |

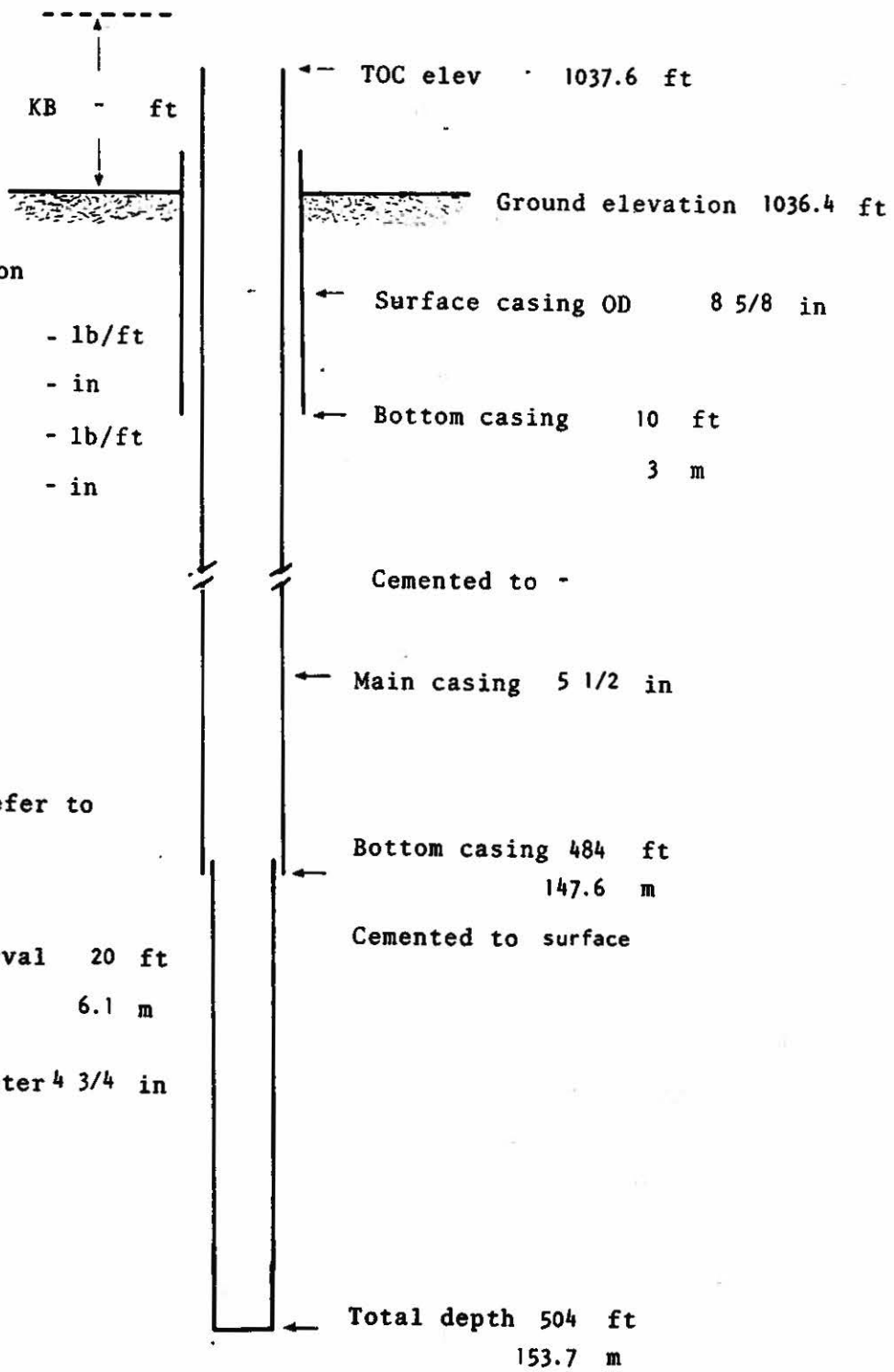
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER BP - 2W

Lsd 14 Sec 36 Tp 95 R 12 W4th

Alberta Research Council




Construction

Surface casing - lb/ft

wall thickness - in

Main casing - lb/ft

wall thickness - in

Sand pack None

Note: all depths refer to Ground

Open hole interval 20 ft
6.1 m

Open hole diameter 4 3/4 in

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-2W

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 115.0 | 5.74 | 2 |
| Magnesium ($Mg^{++}$) | 206.0 | 16.95 | 5 |
| Sodium ($Na^{+}$) | 7313.0 | 318.09 | 93 |
| Potassium ($K^{+}$) | 63.0 | 1.61 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1059.0 | 17.36 | 5 |
| Sulfate ($SO_4^{=}$) | 2550.0 | 53.09 | 15 |
| Chloride ($Cl^{-}$) | 10000.0 | 282.01 | 80 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 94.6 | | |
| Magnesium (Acidified) | 440.0 | | |
| Total dissolved solids | 20896 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 352.47 | Total Cations (epm) | 342.40 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 8.0 | |
| pH | 8.0 | pH | 7.3 | |
| Fluoride ($F^{-}$) | 0.6 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 1118 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

BP-2W-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER BP-2W

Lsd 14 Sec 36 Rge 12 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 38.0 | 1.90 | 0.6 |
| Magnesium(Mg) | 167.0 | 13.74 | 4.2 |
| Sodium(Na) | 7125.0 | 309.92 | 94.7 |
| Potassium(K) | 63.0 | 1.61 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1649.0 | 27.03 | 7.8 |
| Sulphate(SO4) | 1358.0 | 28.27 | 8.2 |
| Chloride(Cl) | 10300.0 | 290.47 | 84.0 |
| Nitrate(NO3) | 0.3 | 0.00 | 0.0 |
| Silica(SiO2) | 2.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 91.0 | | |
| Magnesium(Acidified) | 154.0 | | |
| TDS(mg/l) | 19380.0 | | |
| Total Anions(epm) | 345.78 | Total Cations(epm) | 327.17 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 27300 | | Temperature(C) | 0.00 | |
| pH | 8.3 | | pH | 7.6 | |
| Fluoride(F) | 0.9 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 1742 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS

BP-2W-E-82

OBSERVATION WELL NUMBER BP-2W

Lsd 14 Sec 36 Rge 12 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 39.0 | 1.95 | 0.6 |
| Magnesium(Mg) | 152.0 | 12.67 | 3.8 |
| Sodium(Na) | 7312.0 | 317.91 | 95.1 |
| Potassium(K) | 66.0 | 1.69 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 1659.0 | 27.20 | 7.7 |
| Sulphate(SO4) | 1700.0 | 35.42 | 10.1 |
| Chloride(Cl) | 10250.0 | 288.73 | 82.2 |
| Nitrate(NO3) | 1.0 | 0.02 | 0.0 |
| Silica(SiO2) | 1.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 34.0 | | |
| Magnesium(Acidified) | 138.0 | | |
| TDS(mg/l) | 19684.0 | | |
| Total Anions(epm) | 351.36 | Total Cations(epm) | 334.22 |

Other Constituents

Lab:

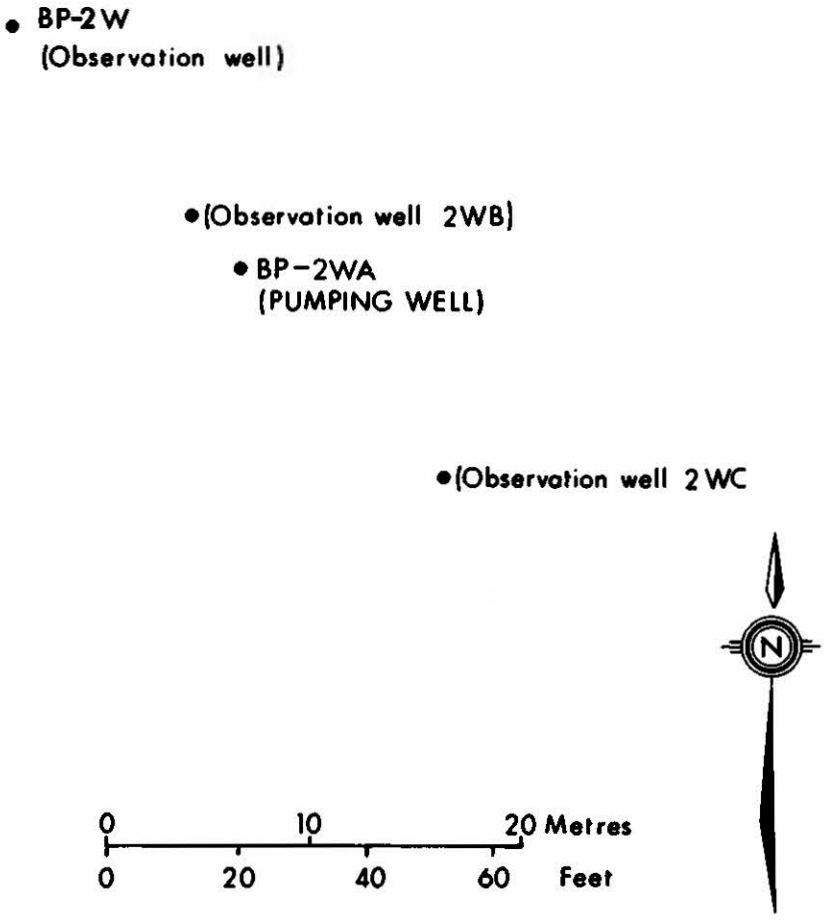
| | |
|---|---|
| Conductivity | 31300 |
| pH | 8.3 |
| Fluoride | 0.7 mg/l |

Field:

| | | |
|---|---|---|
| Temperature | 10.00 | |
| pH | 7.5 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 1830 | mg/l |
| Hydroxide(OH) | | |

# OBSERVATION WELL NUMBERS BP2W, BP2WA
## 14-36-95-12-W4th
### ALBERTA RESEARCH COUNCIL

## WELL SITE DETAIL



# GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER BP - 2W

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Ground elevation 1036.4 Total depth 504

KB elevation Unknown
All depths refer to ground level

| Interval from | to | Description | Formation |
|---|---|---|---|
| 0 | 8 | Silt, light brown, boulder of granitic rock | Drift |
| 8 | 18 | Clay (till) silty, pinkish grey, hard | |
| 18 | 22 | Clay, hard, dark grey, some limestone pebbles, sandstone fragments | |
| 22 | 38 | Shale, (clay) dark grey, weathered | Clearwater |
| 38 | 40 | Sandstone, medium grained calcareous, white, poorly cemented | |
| 40 | 65 | Shale, (clay) dark grey, laminated at 1/8 - 1/2", fresh | |
| 65 | 76 | Shale silty, dark grey, sandy layers | |
| 76 | 77 | Shale, interbedded with white fine grained sandstone, well cemented | |
| 77 | 84 | Shale, dark grey, thinly laminated | |
| 84 | 90 | Tar sand, (sandstone) clayey, silty, greyish brown, traces of oil | McMurray |
| 90 | 127 | Tar sand, fine grained, silty, dark brown, poorly cemented, containing sericite, traces of oil | |
| 127 | 159 | Tar sand, fine grained, chocolate brown, oil-bearing | |
| 159 | 166 | Shale, (clay) silty and sandy inclusions, dark grey | |
| 166 | 199 | Tar sand, (sandstone) silty, fine grained, greyish brown, poorly cemented, traces of oil | |
| 199 | 210 | Siltstone, brownish to grey, poorly cemented | |
| 210 | 222 | Tar sand, fine grained, dark brown, poorly cemented, traces of oil | |
| 222 | 237 | Tar sand, fine grained sand grading to sandstone, greyish brown some oil | |
| 237 | 246 | Tar sand, medium to coarse grained, dark brown, some oil | |
| 246 | 249 | Tar sand, some silty clay, fragment of limestone | |
| 249 | 251 | Tar sand fine to medium grained sandstone, dark | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER BP - 2W (continued)

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from | to | Description | Formation |
|---|---|---|---|
| 251 | 253 | Tar sand, fine grained, silty, brown, interbedded with white to light grey silty clay | |
| 253 | 256 | Tar sand, fine grained, dark brown, some coarser grains, some oil | |
| 256 | 264 | Tar sand, light clayey and silty layers, fragment of calcareous rock | |
| 264 | 292 | Sandstone, laminated | |
| 292 | 295 | Sand, fine grained, dark brown, poorly cemented | |
| 295 | 297 | Sand, coarse grained, white and transparent angular silica grains 1-3 mm ø | |
| 297 | 299 | Shale, (clay) silty, brownish grey | |
| 299 | 306 | Sand, unsorted, grain size up to 2 mm, fine to medium, greyish brown | |
| 306 | 307 | Shale, (clay) silty, dark grey, whitish layers inclusions | |
| 307 | 309 | Tar sand, (sandstone) chocolate brown, fine grained, some oil | |
| 309 | 311 | Shale, (clay) silty, grey to dark grey | |
| 311 | 313 | Sand, silty, clayey, brownish grey, some coarser grains | |
| 313 | 316 | Sand, fine grained, dark brown | |
| 316 | 319 | Sand, silty, light brown to brown | |
| 319 | 325 | Sand, some clayey inclusions, dark brown to greyish brown | |
| 325 | 331 | Sand, fine to medium grained silica | |
| 331 | 336 | Sand, medium to coarse grained, silica grains up to 2.5 mm, angular | |
| 336 | 343 | Sand, unsorted sand and silt, greyish colour | |
| 343 | 387 | Sandstone, medium to coarse grained, poorly cemented, some fine sand and silt | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER BP - 2W (continued)

Lsd 14 Sec 36 Twp 95 R 12 W4th

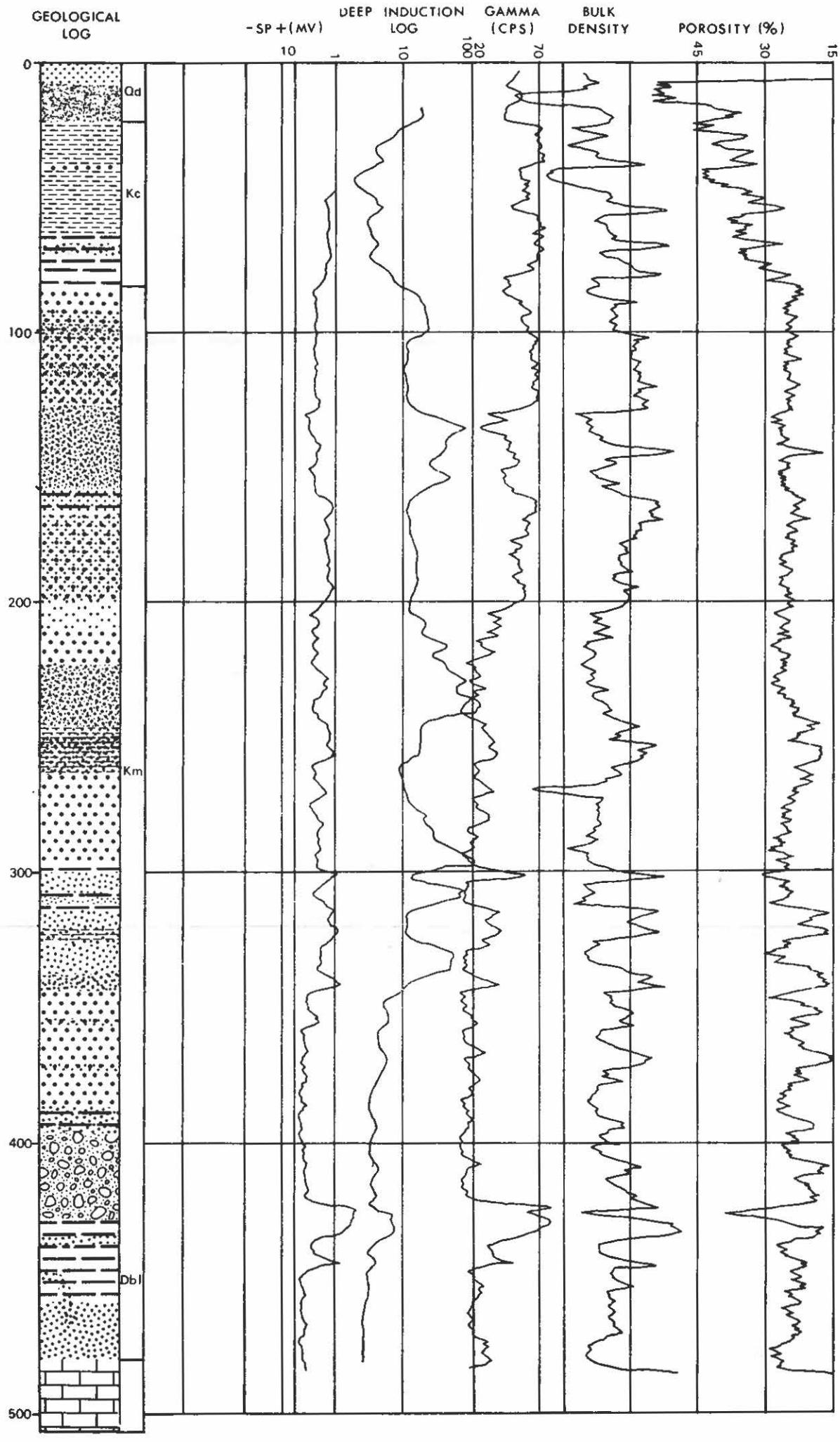
Alberta Research Council

Ground elevation Total depth

KB elevation

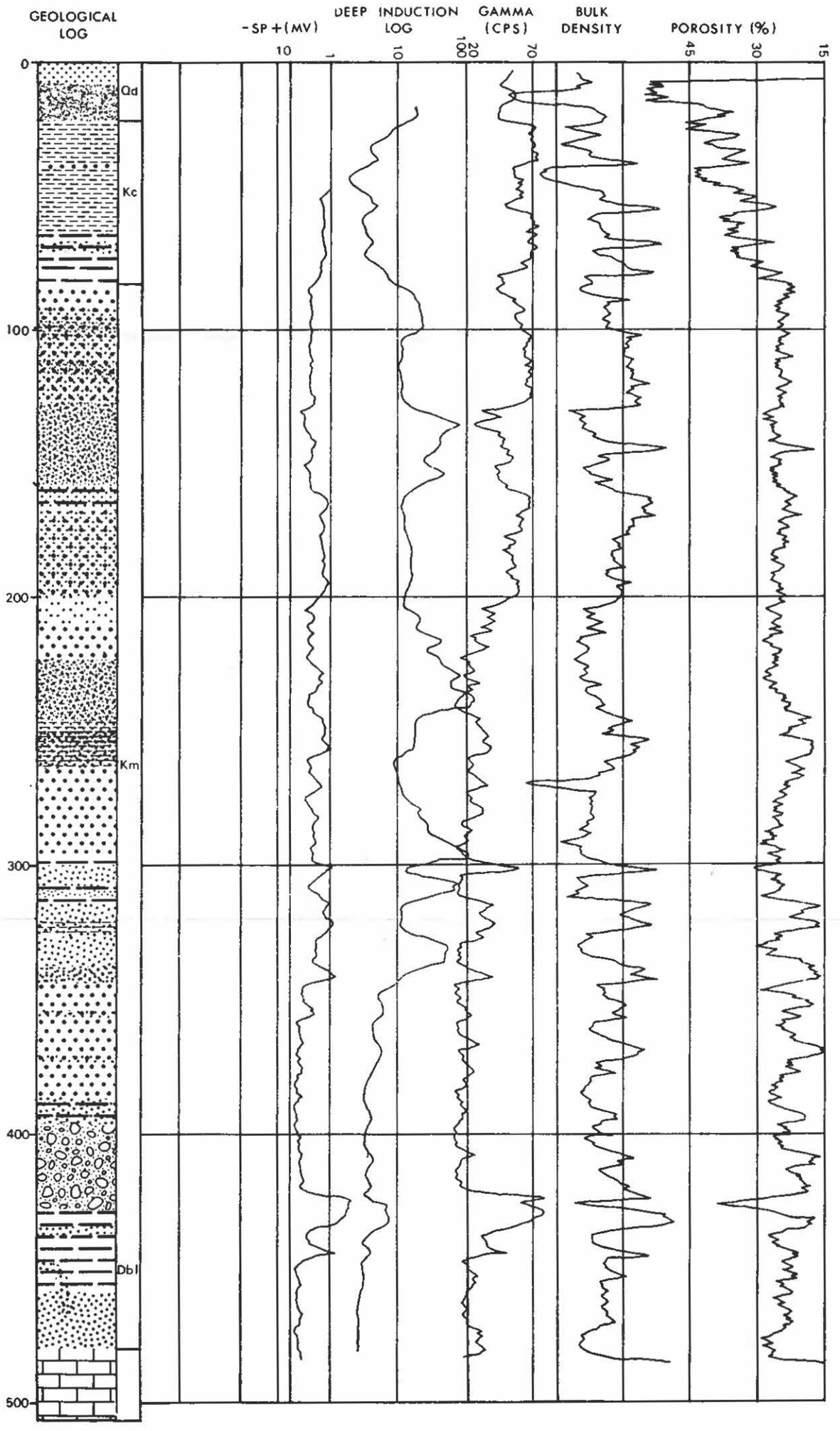
| Interval from | to | Description | Formation |
|---|---|---|---|
| 387 | 390 | Sand, silty, coarse grains, inclusions or layers of silty shale, greyish | |
| 390 | 395 | Sand, fine to coarse sand, inclusions of clayey silt | |
| 395 | 427 | Sand, coarse grained silica sand and gravel up to 7 mm in diameter | |
| 427 | 457 | Shale, (clay) silty, some fine sand, dark grey, soft | |
| 457 | 458 | Sand, fine to medium grained, silty | |
| 458 | 479 | Sand, coarse grained silica sand | |
| 479 | 504 | Limestone, light grey, fresh | Beaverhill Lake |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE BP-2W
## 14-36-95-12-W4 th
### ALBERTA RESEARCH COUNCIL




BP-2W-G-77

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE BP-2W
## 14-36-95-12-W4 th
ALBERTA RESEARCH COUNCIL




BP-2W-G-77

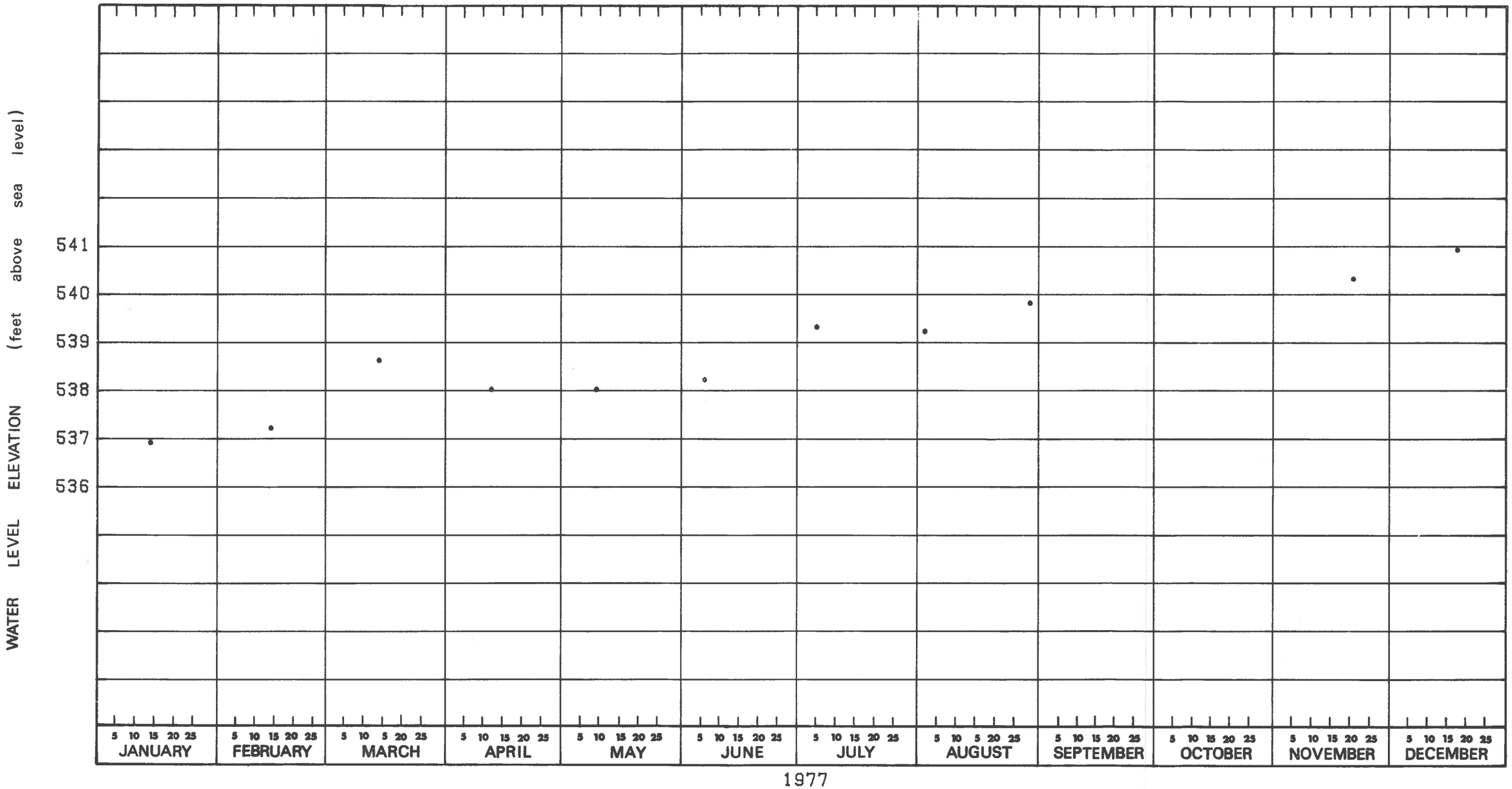
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-2W

BP-2W-H-78

Lsd 14 Sec 36 Twp 95 R 12 W4 th

Alberta Research Council




1977

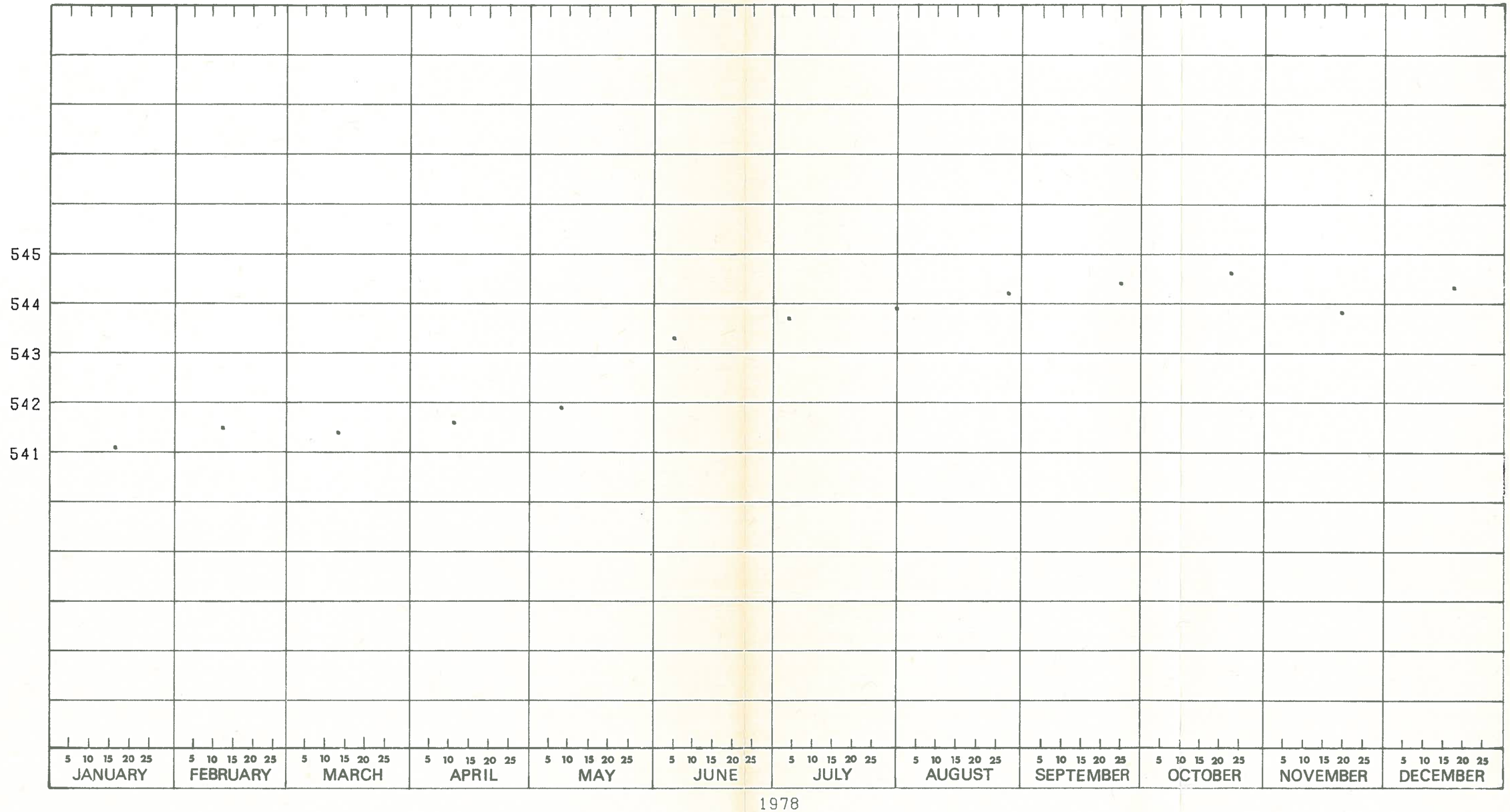
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-2W

LSD 14 SEC 36 TWP 95 R 12 W4TH

BP-2W-H-79

Alberta Research Council




1978

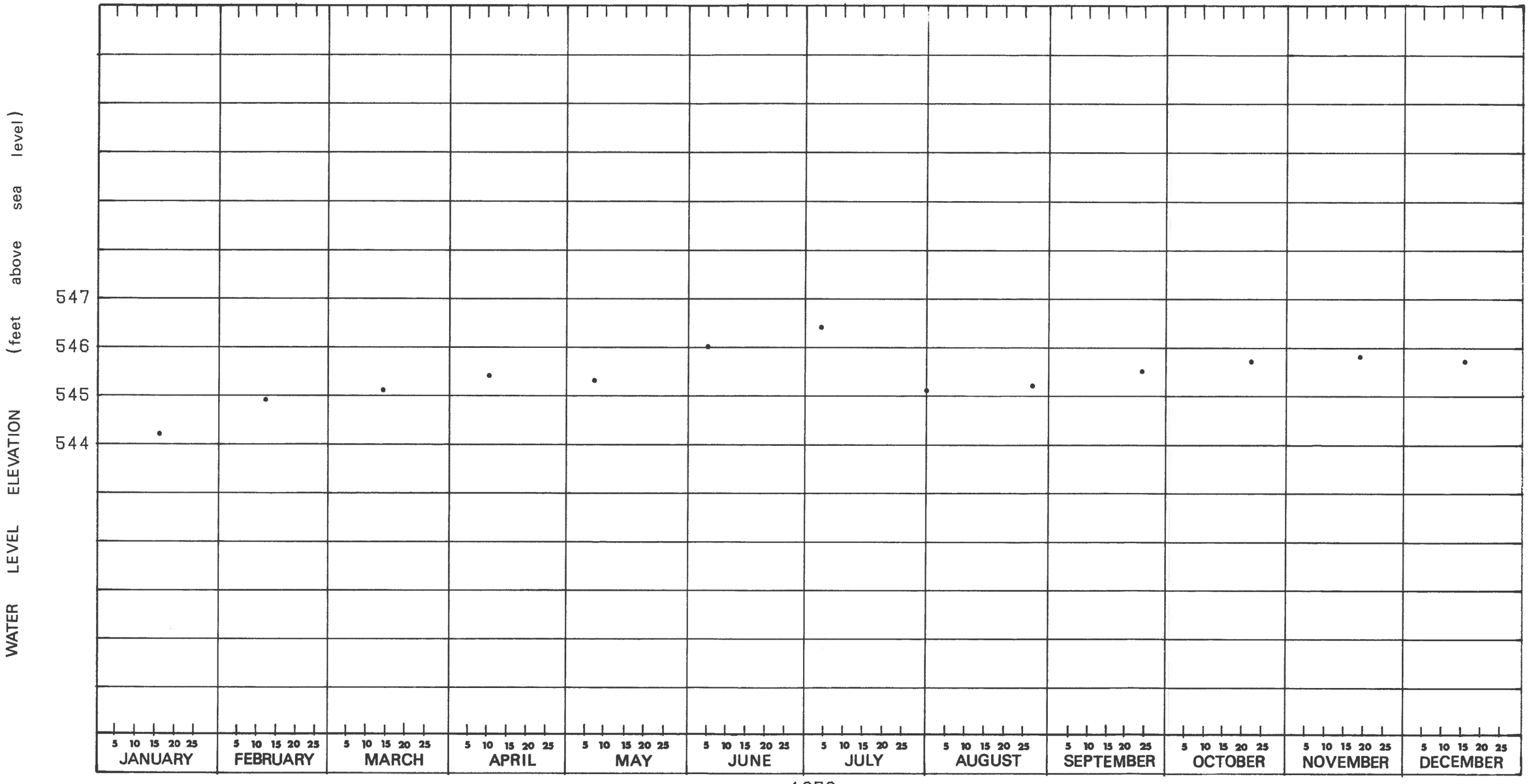
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-2W

BP-2W-H-80

Lsd 14 Sec 36 Twp 95 R 12 W4 th

Alberta Research Council



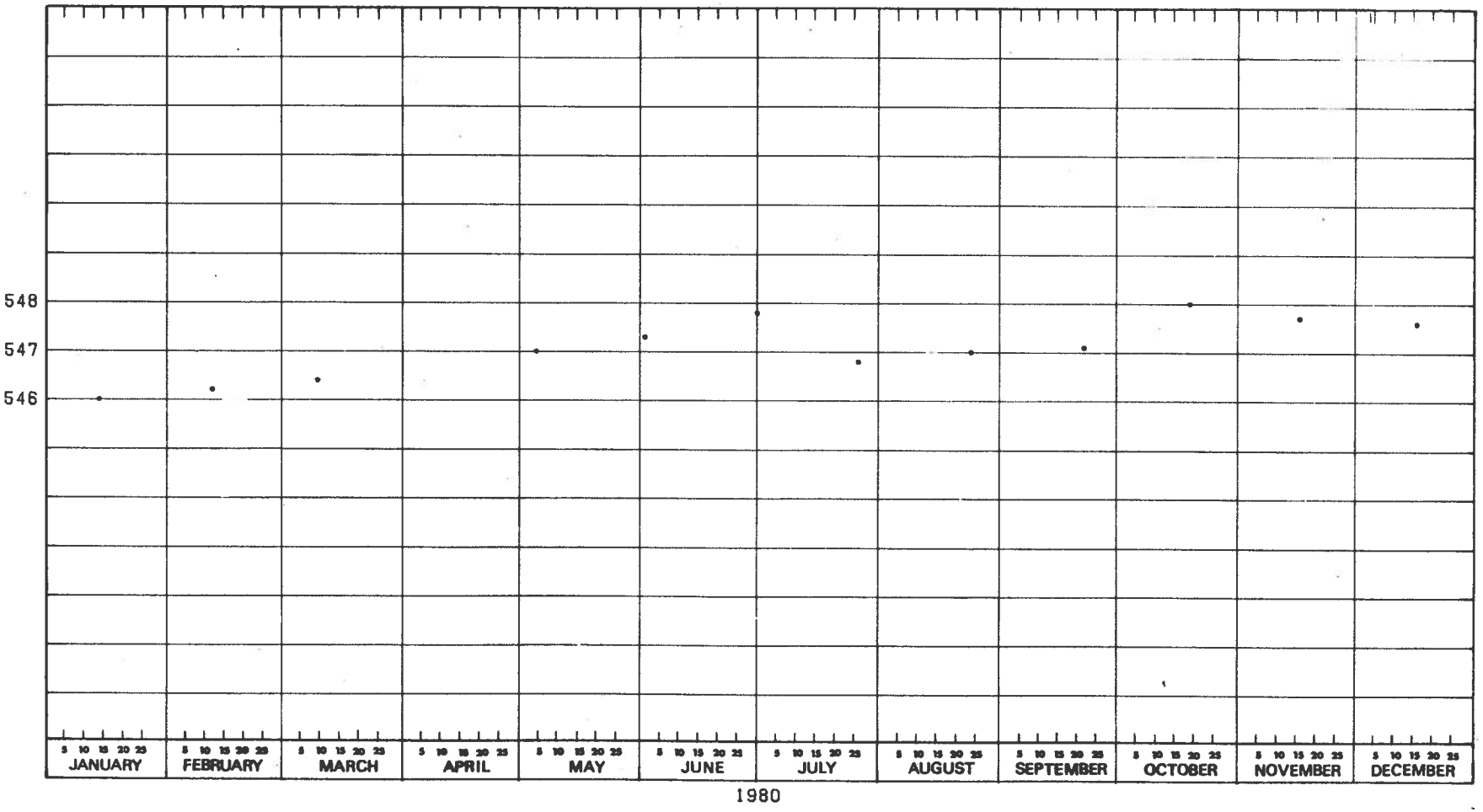
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-2W

BP-2W-H-81

Lsd 14 Sec 36 Twp 95 R 12 W4 th

Alberta Research Council



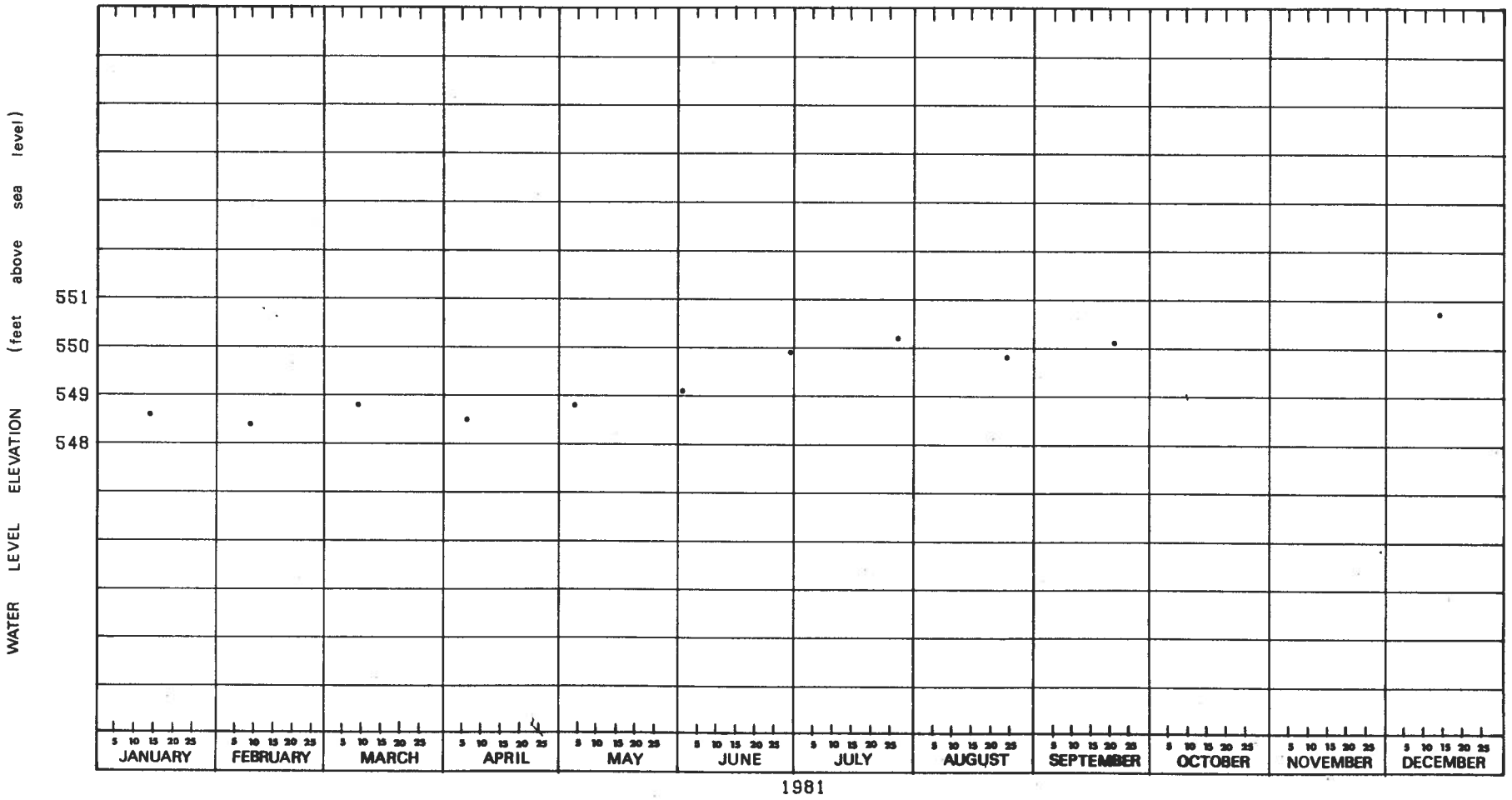
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-2W

BP-2W-H-82

Lsd 14 Sec 36 Twp 95 R 12 W4 th

Alberta Research Council



WELL HISTORY

OBSERVATION WELL NUMBER BP - 2W

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1037.6

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar 5/75 | | | Well completed T.D. 504' blown dry |
| May 12/75 | 151.8 TOC | 539.6 | |
| Dec 6/75 | 152.64 TOC | 536.9 | |
| Jan 6/76 | 154.42 TOC | 531.1 | |
| Feb 6/76 | 154.35 TOC | 531.3 | |
| Mar 5/76 | 154.23 TOC | 531.7 | |
| Apr 7/76 | 154.11 TOC | 532.1 | |
| May 5/76 | 153.14 TOC | 535.3 | |
| June 1/76 | 153.06 TOC | 535.6 | |
| June 22/76 | 153.65 MP | 535.7 | MP = 0.64 m TOC, (1039.7) |
| July 16/76 | 153.57 MP | 536.0 | Could not get all of sample; water level too low |
| Aug 10/76 | 153.67 MP | 535.7 | |
| Aug 31/76 | 153.61 MP | 535.9 | |
| Sept 28/76 | 153.55 MP | 536.1 | |
| Oct 27/76 | 153.47 MP | 536.3 | |
| Nov 23/76 | 153.41 MP | 536.5 | |
| Dec 20/76 | 153.36 MP | 536.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-2W

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1037.6

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 153.29 MP | 536.9 | MP (1039.7) |
| Feb 15/77 | 153.21 MP | 537.2 | |
| Mar 15/77 | 152.76 MP | 538.6 | |
| Apr 13/77 | 152.96 MP | 538.0 | |
| May 10/77 | 152.97 MP | 538.0 | |
| June 7/77 | 152.89 MP | 538.2 | |
| July 6/77 | 152.56 MP | 539.3 | Could not sample, not enough water |
| Aug 3/77 | 152.60 MP | 539.2 | |
| Aug 30/77 | 152.41 MP | 539.8 | |
| Sept 27/77 | | | Could not measure |
| Oct 25/77 | Dry | | |
| Nov 22/77 | 152.24 MP | 540.3 | |
| Dec 19/77 | 152.08 MP | 540.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-2W

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1037.6

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 152.00 MP | 541.1 | MP (1039.7) |
| Feb 13/78 | 151.90 MP | 541.5 | |
| Mar 14/78 | 151.93 MP | 541.4 | |
| Apr 12/78 | 151.85 MP | 541.6 | |
| May 9/78 | 151.76 MP | 541.9 | |
| June 6/78 | 151.33 MP | 543.3 | |
| July 5/78 | 151.21 MP | 543.7 | Not enough water to sample |
| Aug 1/78 | 151.15 MP | 543.9 | |
| Aug 29/78 | 151.08 MP | 544.2 | |
| Sept 26/78 | 151.00 MP | 544.4 | |
| Oct 24/78 | 150.93 MP | 544.6 | |
| Nov 21/78 | 151.20 MP | 543.8 | |
| Dec 19/78 | 151.04 MP | 544.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-2W

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1037.6

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 151.06 MP | 544.2 | MP (1039.7) |
| Feb 13/79 | 150.86 MP | 544.9 | |
| Mar 15/79 | 150.78 MP | 545.1 | |
| Apr 11/79 | 150.70 MP | 545.4 | |
| May 8/79 | 150.73 MP | 545.3 | |
| June 6/79 | 150.50 MP | 546.0 | |
| July 5/79 | 150.40 MP | 546.4 | Sampled |
| Aug 1/79 | 150.78 MP | 545.1 | |
| Aug 28/79 | 150.76 MP | 545.2 | |
| Sept 25/79 | 150.68 MP | 545.5 | |
| Oct 23/79 | 150.62 MP | 545.7 | |
| Nov 20/79 | 150.57 MP | 545.8 | |
| Dec 17/79 | 150.60 MP | 545.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-2W

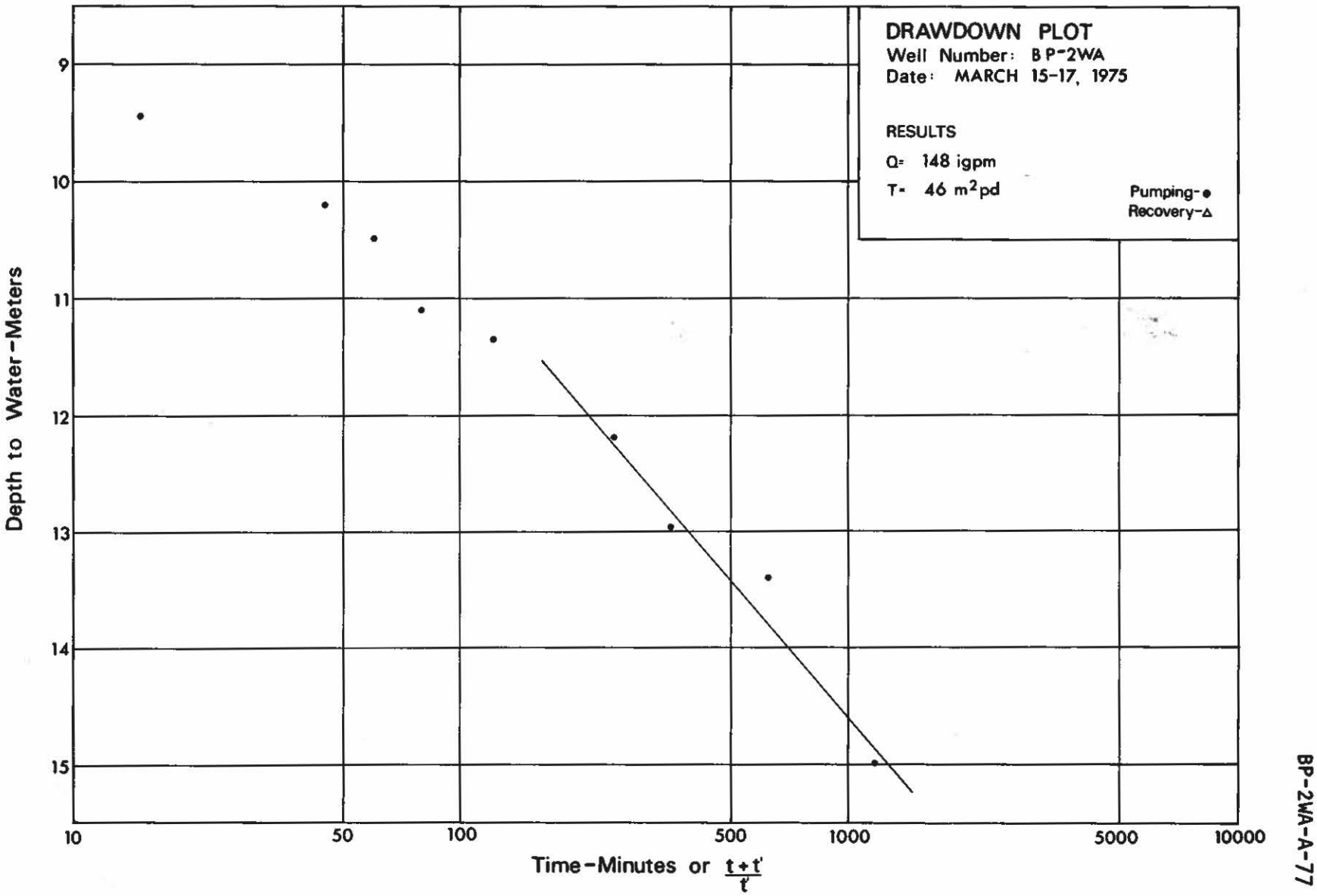
Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1037.6

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 150.53 MP | 546.0 | |
| Feb 13/80 | 150.45 MP | 546.2 | |
| Mar 11/80 | 150.40 MP | 546.4 | |
| Apr 9/80 | | | Could not measure |
| May 6/80 | 150.20 MP | 547.0 | |
| June 3/80 | 150.12 MP | 547.3 | |
| July 2/80 | 149.98 MP | 547.8 | Temp. 10°C |
| July 28/80 | 150.27 MP | 546.8 | |
| Aug 26/80 | 150.21 MP | 547.0 | |
| Sept 24/80 | 150.17 MP | 547.1 | |
| Oct 21/80 | 149.92 MP | 548.0 | |
| Nov 18/80 | 150.01 MP | 547.7 | |
| Dec 18/80 | 150.02 MP | 547.6 | |
| Jan 15/81 | 149.77 MP | 548.6 | |
| Feb 10/81 | 149.78 MP | 548.4 | |
| Mar 10/81 | 149.66 MP | 548.8 | |
| Apr 7/81 | 149.76 MP | 548.5 | |
| May 5/81 | 149.67 MP | 548.8 | |
| June 2/81 | 149.58 MP | 549.1 | |
| June 30/81 | 149.32 MP | 549.9 | |
| July 28/81 | 149.25 MP | 550.2 | |
| Aug 25/81 | 149.35 MP | 549.8 | |
| Sept 22/81 | 149.28 MP | 550.1 | |
| Oct 20/81 | DRY | | |
| Nov 17/81 | DRY | | |
| Dec 15/81 | 149.10 MP | 550.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing


DRAWDOWN PLOT
Well Number: B P-2WA
Date: MARCH 15-17, 1975
RESULTS
Q= 148 igpm
T= 46 m²pd
Pumping-●
Recovery-△
Depth to Water-Meters
9
10
11
12
13
14
15
10
50
100
500
1000
5000
10000
Time-Minutes or (t+t')/t'

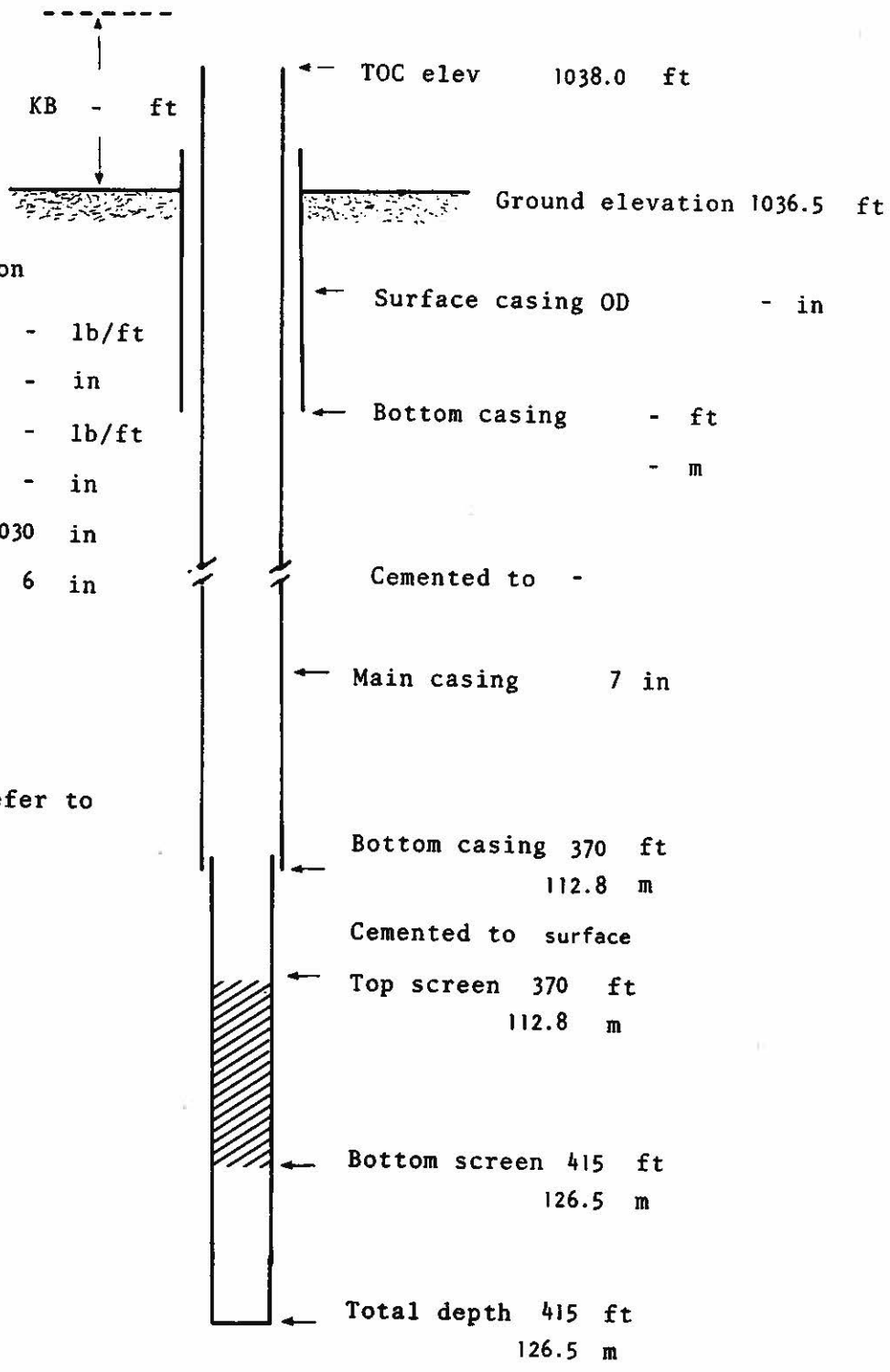
BP-2WA-A-77

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER BP - 2WA

Lsd 14 Sec 36 Tp 95 R 12 W4th

Alberta Research Council




Construction

Surface casing - lb/ft

wall thickness - in

Main casing - lb/ft

wall thickness - in

Screen slot width 0.030 in

screen OD 6 in

slots per foot

material ss

Sand pack None

Note: all depths refer to Ground

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source Air Lift Pump Test BP-2WA

Date sampled March 8/75

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 162 | 8.09 | 2.6 |
| Magnesium ($Mg^{++}$) | 220 | 18.08 | 5.8 |
| Sodium ($Na^{+}$) | 6625 | 288.19 | 91.0 |
| Potassium ($K^{+}$) | 72.5 | 1.86 | 0.6 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 3721 | 61.02 | 17.6 |
| Sulfate ($SO_4^{=}$) | 25 | 0.51 | 0.2 |
| Chloride ($Cl^{-}$) | 10100 | 284.82 | 82.2 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | 2.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 19435 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 316.22 | Total Cations (epm) | 346.35 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | | Temperature (C) |
| pH | 7.5 | pH |
| Fluoride ($F^{-}$) | 0.66 ppm | Carbonate ($CO_3^{=}$) |
| Iodine | 1.5 ppm | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source Pump test (after 2 hours) BP-2WA

Date sampled March 15, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 93 | 4.64 | 1.4 |
| Magnesium ($Mg^{++}$) | 215 | 17.66 | 5.5 |
| Sodium ($Na^{+}$) | 6875 | 299.06 | 92.5 |
| Potassium ($K^{+}$) | 72.5 | 1.86 | 0.6 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 3386 | 55.52 | 16.3 |
| Sulfate ($SO_4^{=}$) | 144 | 3.00 | 0.9 |
| Chloride ($Cl^{-}$) | 10050 | 283.41 | 82.9 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | 5.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 19110 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 323.22 | Total Cations (epm) | 341.93 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 25400 | Temperature (C) | 5.2 | |
| pH | 7.4 | pH | 7.4 | |
| Fluoride ($F^{-}$) | 0.19 Mg/L | Carbonate ($CO_3^{=}$) | 0 | Mg/L |
| Bromide | 19.4 | Bicarbonate ($HCO_3^{-}$) | 3140 | Mg/L |
| Iodine | 2.2 | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | 34000 | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source Pump test on BP-2WA

Date sampled March 15, 1975

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 12 | 0.6 | 0.2 |
| Magnesium ($Mg^{++}$) | 204 | 17.0 | 5.4 |
| Sodium ($Na^{+}$) | 6775 | 294.6 | 94.0 |
| Potassium ($K^{+}$) | 52 | 1.3 | 0.4 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 3196 | 52.4 | 15.5 |
| Sulfate ($SO_4^{=}$) | 7.3 | 0.2 | 0.1 |
| Chloride ($Cl^{-}$) | 10120 | 285.0 | 84.4 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 5.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 19150 | | |
| Total Anions (epm) | 337.6 | Total Cations (epm) | 313.5 |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 8000+ |
| pH | 8.2 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | 6.9 |
| Carbonate ($CO_3^{=}$) | 0 |
| Bicarbonate ($HCO_3^{-}$) | 3806 |
| Hydroxide ($OH^{-}$) | |
| Conductivity | 8000+ |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source Pump test (after 12 hours) BP-2WA (C & GLL)

Date sampled March 15, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 82 | 4.10 | 1.2 |
| Magnesium ($Mg^{++}$) | 221 | 18.18 | 5.5 |
| Sodium ($Na^{+}$) | 7125 | 309.84 | 92.7 |
| Potassium ($K^{+}$) | 73 | 1.87 | 0.6 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 3318 | 54.42 | 15.7 |
| Sulfate ($SO_4^{=}$) | 49 | 1.02 | 0.3 |
| Chloride ($Cl^{-}$) | 10360 | 292.15 | 84.0 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) soluable | 15.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 19975 | | |
| Total Anions (epm) 333.99 | | Total Cations (epm) 347.59 | |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | |
| pH | 7.8 |
| Fluoride ($F^{-}$) | 0.46 |
| Manganese | 0.05 |

Field:

| |
|---|
| Temperature (C) |
| pH |
| Carbonate ($CO_3^{=}$) |
| Bicarbonate ($HCO_3^{-}$) |
| Hydroxide ($OH^{-}$) |
| Conductivity |

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER BP 2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source Pump Test on B P Well 2WA

Date of sampling March 15, 1975

Total dissolved solids 19,150 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | .01 |
| Al | ND | Mg | M |
| As | <.01 | Mn | ND |
| B | .02 | Mo | ND |
| Ba | .005 | Ni | ND |
| Be | ND | Pb | ND |
| Bi | ND | Sb | ND |
| Ca | .04 | Si | .004 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | .001 | V | ND |
| Fe | ND | Zn | <.005 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP - 2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source Pump test (after 24 hours) BP - 2WA (C & GLL)

Date sampled March 16, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 165 | 8.23 | 2.6 |
| Magnesium ($Mg^{++}$) | 227 | 18.66 | 6.0 |
| Sodium ($Na^{+}$) | 6550 | 284.93 | 90.8 |
| Potassium ($K^{+}$) | 71.3 | 1.83 | 0.6 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 3721 | 61.02 | 17.7 |
| Sulfate ($SO_4^{=}$) | 107 | 2.23 | 0.7 |
| Chloride ($Cl^{-}$) | 10020 | 282.56 | 81.7 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | 1.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 20460 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 313.65 | Total Cations (epm) | 345.81 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | 26 mmho | Temperature (C) |
| pH | 6.7 | pH |
| Fluoride ($F^{-}$) | 0.84 ppm | Carbonate ($CO_3^{=}$) |
| Bromide | 15.1 ppm | Bicarbonate ($HCO_3^{-}$) |
| Iodine | 1.5 ppm | Hydroxide ($OH^{-}$) |
| Iron | 1.0 ppm | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source After 36 hours of pumping (C&GLL)

Date sampled March 16, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 60 | 3.0 | 1 |
| Magnesium ($Mg^{++}$) | 206 | 17.0 | 5 |
| Sodium ($Na^{+}$) | 7085 | 308.2 | 93 |
| Potassium ($K^{+}$) | 69 | 1.8 | 1 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 3294 | 54.0 | 15 |
| Sulfate ($SO_4^{=}$) | 58 | 1.2 | 0 |
| Chloride ($Cl^{-}$) | 10440 | 294.4 | 84 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | 7.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 19765 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 349.6 | Total Cations (epm) | 330 |

Other Constituents

| Lab: | | Field: |
|---|---|---|
| Conductivity | | Temperature (C) |
| pH | 7.9 | pH |
| Fluoride ($F^{-}$) | 0.59 mg/l | Carbonate ($CO_3^{=}$) |
| | | Bicarbonate ($HCO_3^{-}$) |
| | | Hydroxide ($OH^{-}$) |
| | | Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP - 2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source After 48 hours of pumping (C & GLL)

Date sampled March 17, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 179 | 9 | 2.5 |
| Magnesium ($Mg^{++}$) | 218 | 17.9 | 4.9 |
| Sodium ($Na^{+}$) | 7750 | 337.1 | 92.0 |
| Potassium ($K^{+}$) | 90 | 2.3 | 0.6 |
| Carbonate ($CO_3^{=}$) | 0 | 0.0 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 3660 | 60.0 | 16.8 |
| Sulfate ($SO_4^{=}$) | 210 | 4.4 | 1.2 |
| Chloride ($Cl^{-}$) | 10420 | 293.8 | 82.0 |
| Nitrate ($NO_3^{=}$) | | | |
| Silica ($SiO_2$) | 6.65 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 21900 | | |
| Total Anions (epm) 358.2 | | Total Cations (epm) | 366.3 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 29,000 |
| pH | 7.1 |
| Fluoride ($F^{-}$) | 0.48 ppm |

Field:

| |
|---|
| Temperature (C) |
| pH |
| Carbonate ($CO_3^{=}$) |
| Bicarbonate ($HCO_3^{-}$) |
| Hydroxide ($OH^{-}$) |
| Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP - 2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 11, 1975

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 142 | 7.09 | 2 |
| Magnesium ($Mg^{++}$) | 205 | 16.86 | 5 |
| Sodium ($Na^{+}$) | 6550 | 284.91 | 92 |
| Potassium ($K^{+}$) | 59 | 1.51 | 1 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 3738 | 61.27 | 22 |
| Sulfate ($SO_4^{=}$) | 16.3 | 0.34 | 0 |
| Chloride ($Cl^{-}$) | 7600 | 214.33 | 78 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 6.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 138 | | |
| Magnesium (Acidified) | 175 | | |
| Total dissolved solids | 19088 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 275.94 | Total Cations (epm) | 310.37 |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | |
| pH | |
| Fluoride ($F^{-}$) | 0.5 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 3.0 |
| pH | 7.3 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 3928 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 142.0 | 7.09 | 2 |
| Magnesium ($Mg^{++}$) | 194.0 | 15.97 | 5 |
| Sodium ($Na^{+}$) | 6813.0 | 296.35 | 92 |
| Potassium ($K^{+}$) | 60.0 | 1.53 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 3672.0 | 60.19 | 18 |
| Sulfate ($SO_4^{=}$) | 3.0 | 0.06 | 0 |
| Chloride ($Cl^{-}$) | 9540.0 | 269.04 | 82 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0 |
| Silica ($SiO_2$) | 6.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 145.2 | | |
| Magnesium (Acidified) | 191.4 | | |
| Total dissolved solids | 18816 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 329.29 | Total Cations (epm) | 320.93 |

Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 78000 | |
| pH | 7.4 | |
| Fluoride ($F^{-}$) | 0.4 | Mg/L |

Field:

| | | |
|---|---|---|
| Temperature (C) | 5.0 | |
| pH | 7.0 | |
| Carbonate ($CO_3^{=}$) | | |
| Bicarbonate ($HCO_3^{-}$) | 3953 | Mg/L |
| Hydroxide ($OH^{-}$) | | |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 6, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 110.0 | 5.49 | 1.6 |
| Magnesium ($Mg^{++}$) | 191.0 | 15.72 | 4.6 |
| Sodium ($Na^{+}$) | 7375.0 | 320.79 | 93.4 |
| Potassium ($K^{+}$) | 53.0 | 1.36 | 0.4 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 3670.0 | 60.15 | 17.8 |
| Sulfate ($SO_4^{=}$) | 23.3 | 0.49 | 0.1 |
| Chloride ($Cl^{-}$) | 9800.0 | 276.37 | 82.0 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0.0 |
| Silica ($SiO_2$) | 3.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 108.0 | | |
| Magnesium (Acidified) | 174.0 | | |
| Total dissolved solids | 18386.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 337.03 | Total Cations (epm) | 343.36 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 6.0 |
| pH | 7.0 | pH | 7.2 |
| Fluoride ($F^{-}$) | 0.3 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 3855.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER BP - 2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Date sampled: July 16, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .651 |
| Au | <.003 | Mo | <.006 |
| Al | 0.66 | Na | 6996 |
| As | <.038 | Ni | <.010 |
| B | 5.35 | P | 1.1 |
| Ba | 1.98 | Pb | <.088 |
| Be | .002 | Se | <.060 |
| Ca | 132 | Si | 4.19 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 10.20 |
| Cr | <.006 | Te | <.065 |
| Cu | .021 | Ti | .003 |
| Eu | <.015 | U | <.020 |
| Fe | 86.6 | V | .022 |
| K | 198 | W | <.078 |
| Mg | 202.4 | Zn | .165 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

BP-2WA-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Rge 12 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 95.0 | 4.74 | 1.5 |
| Magnesium(Mg) | 173.0 | 14.24 | 4.6 |
| Sodium(Na) | 6600.0 | 287.08 | 93.4 |
| Potassium(K) | 50.0 | 1.28 | 0.4 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 3672.0 | 60.19 | 18.8 |
| Sulphate(SO4) | 5.1 | 0.11 | 0.0 |
| Chloride(Cl) | 9200.0 | 259.45 | 81.1 |
| Nitrate(NO3) | 0.0 | 0.00 | 0.0 |
| Silica(SiO2) | 12.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 112.0 | | |
| Magnesium(Acidified) | 168.0 | | |
| TDS(mg/l) | 18190.0 | | |
| Total Anions(epm) | 319.74 | Total Cations(epm) | 307.34 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 25600 | | Temperature(C) | 5.50 | |
| pH | 7.3 | | pH | 7.3 | |
| Fluoride(F) | 0.3 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 3723 | mg/l |
| | | | Hydroxide(OH) | | |

BP-2WA-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Rge 12 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 5, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 44.0 | 2.20 | 0.8 |
| Magnesium(Mg) | 163.0 | 13.42 | 4.6 |
| Sodium(Na) | 6250.0 | 271.86 | 94.1 |
| Potassium(K) | 51.0 | 1.30 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 3245.0 | 53.19 | 16.8 |
| Sulphate(SO4) | 11.2 | 0.23 | 0.1 |
| Chloride(Cl) | 9300.0 | 262.27 | 83.1 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 8.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 41.0 | | |
| Magnesium(Acidified) | 148.0 | | |
| TDS(mg/l) | 17280.0 | | |
| Total Anions(epm) | 315.69 | Total Cations(epm) | 288.77 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 25400 | Temperature(C) | 6.00 | |
| pH | 8.3 | pH | 7.4 | |
| Fluoride(F) | 0.4 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 3235 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS BP-2WA-E-82

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Rge 12 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 74.0 | 3.70 | 1.3 |
| Magnesium(Mg) | 167.0 | 13.92 | 4.8 |
| Sodium(Na) | 6281.0 | 273.09 | 93.4 |
| Potassium(K) | 63.0 | 1.62 | 0.6 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 3304.0 | 54.16 | 18.4 |
| Sulphate(SO4) | 4.0 | 0.08 | 0.0 |
| Chloride(Cl) | 8550.0 | 240.85 | 81.6 |
| Nitrate(NO3) | 1.4 | 0.02 | 0.0 |
| Silica(SiO2) | 5.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 81.0 | | |
| Magnesium(Acidified) | 141.0 | | |
| TDS(mg/l) | 16928.0 | | |
| Total Anions(epm) | 295.11 | Total Cations(epm) | 292.32 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 27400 | Temperature | 4.50 | |
| pH | 8.0 | pH | 7.3 | |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 3636 | mg/l |
| | | Hydroxide(OH) | | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER BP - 2WA (continued)

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from | to | Description | Formation |
|---|---|---|---|
| 363 | 368 | Sandstone, silty, greyish | |
| 368 | 390 | Sand, unsorted, some silt, coarsed grains up to 4 mm in diameter, no traces of bitumen | |
| 390 | 398 | Sand, unsorted sand and fine gravel angular grains up to 6 mm in diameter, no traces of bitumen | |
| 398 | 415 | Sand, thin layers of coaly hard bitumen | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER BP - 2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Ground elevation 1036.5 Total depth 415

KB elevation

All depths refer to ground

| Interval from | to | Description | Formation |
|---|---|---|---|
| 0 | 10 | Silt, sandy, light brown to brown | Drift |
| 10 | 22 | Clay, (till) hard, dark grey, some silt, some limestone pebbles, sandstone fragments | |
| 22 | 39 | Shale, (clay) dark grey, weathered shale, dark grey, thinly laminated | Clearwater |
| 39 | 40 | Sandstone, medium grained, calcareous, white, poorly cemented | |
| 40 | 65 | Shale, (clay) dark grey, thinly laminated, fresh, silty and clayey, dark | |
| 65 | 66 | Shale, grey, with sandy layers, dark grey, thinly laminated | |
| 66 | 85 | Shale, (clay) interbedded with white fine grained sandstone, well cemented | |
| 85 | 92 | Tar sand, (sandstone) greyish brown, traces of oil | McMurray |
| 92 | 115 | Tar sand, fine grained, silty, dark brown, poorly cemented, containing sericite, traces of oil | |
| 115 | 126 | Siltstone, clayey, some fine grained sandstone, grey brown, containing sericite | |
| 126 | 140 | Tar sand, (sandstone) chocolate brown, oil-bearing | |
| 140 | 158 | Tar sand, (sandstone), fine grained, silty, chocolate brown, poorly cemented, oil-bearing | |
| 158 | 166 | Shale, (clay) silty and sandy inclusions, dark grey | |
| 166 | 210 | Tar sand, (sandstone) fine grained, dark or greyish brown, poorly cemented, some oil | |
| 210 | 220 | Tar sand, fine grained, some medium grains, greyish brown, some oil | |
| 220 | 237 | Tar sand, medium to coarse grained, dark brown, some oil | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER BP - 2WA (continued)

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

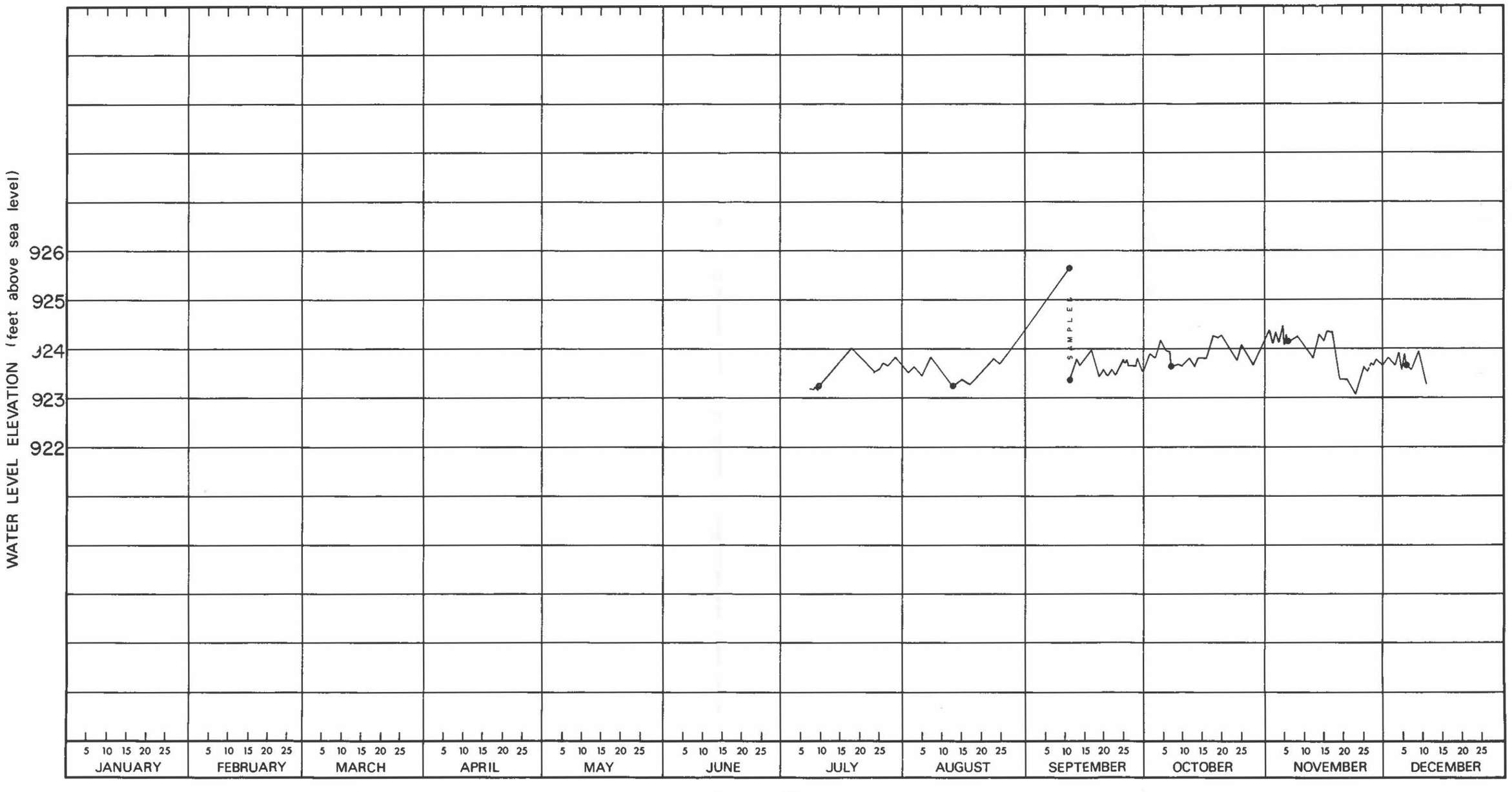
| Interval from | to | Description | Formation |
|---|---|---|---|
| 237 | 246 | Tar sand, some silty clay inclusions | |
| 246 | 249 | Tar sand, medium grained, some fine fine sand, dark brown | |
| 249 | 251 | Tar sand, fine grained, brown | |
| 251 | 253 | Tar sand, interbedded with white to light grey silty clay | |
| 253 | 256 | Tar sand, fine grained, dark brown, some coarser grains, some oil | |
| 256 | 265 | Tar sand, fine to medium grained sandstone, dark brown, with silty inclusions or layers | |
| 265 | 275 | Sandstone, medium grained | |
| 275 | 285 | Sandstone, medium to coarse grained with fine sand and silt inclusions | |
| 285 | 292 | Sandstone, medium grained, some fine sand | |
| 292 | 301 | Sandstone, fine grained, dark brown, some silt, poorly cemented | |
| 301 | 306 | Sandstone, fine to medium grained, greyish brown | |
| 306 | 307 | Shale, (clay) silty, dark grey inclusions | |
| 307 | 311 | Tar sand, (sandstone) sand, fine grained, chocolate brown, some oil | |
| 311 | 316 | Sand, clayey and silty, some coarser grains, brownish grey | |
| 316 | 336 | Sand, fine grained, dark brown medium to coarse grained, some fines | |
| 336 | 343 | Sand, unsorted silt to very coarse sand, greyish colour | |
| 343 | 363 | Sandstone medium to coarse grained, poorly cemented, some fine sand and silt | |

WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP - 2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

BP-2WA-H-77



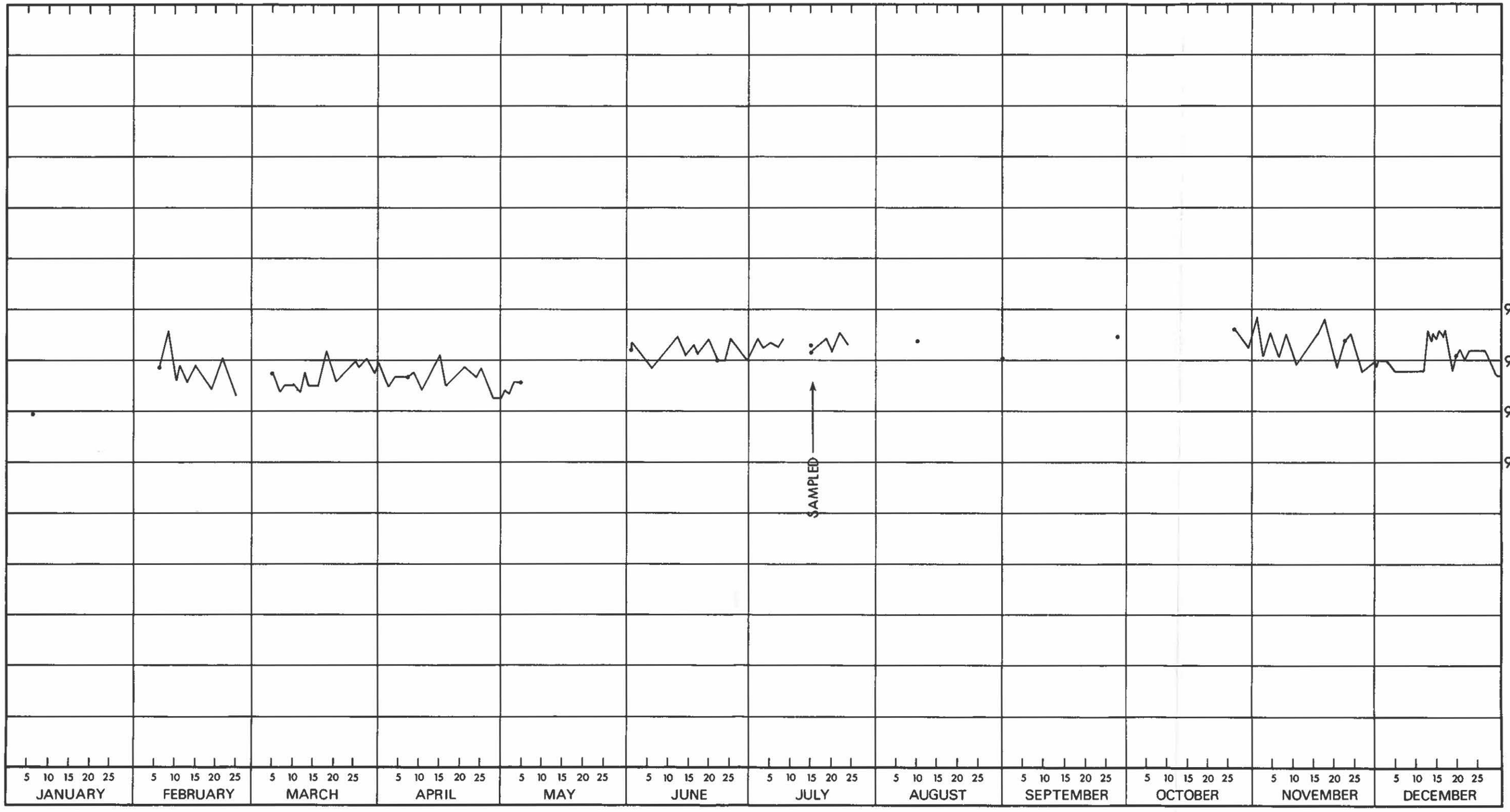
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

BP - 2WA - H - 77




1976

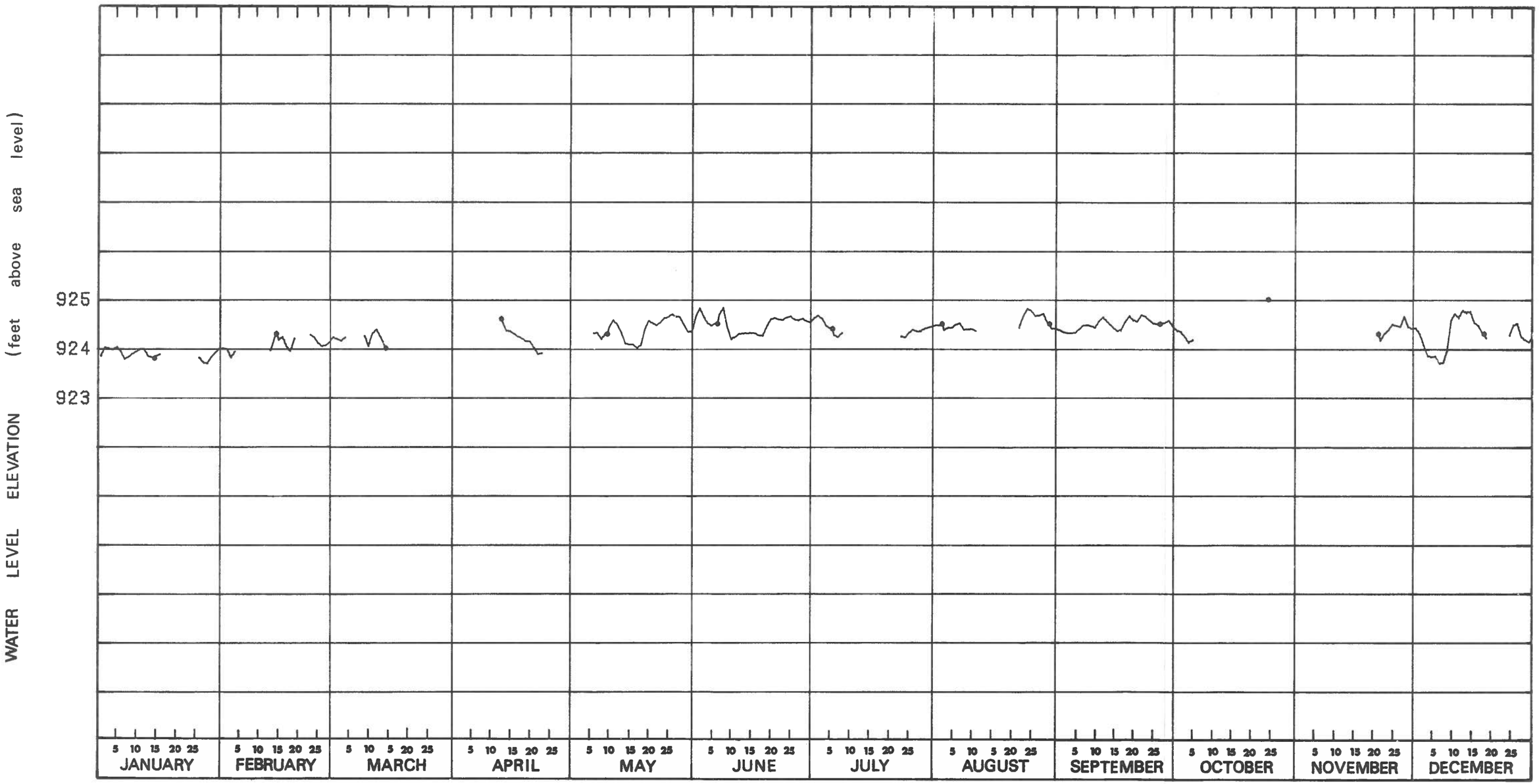
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4 th

Alberta Research Council

BP-2WA-H-78




1977

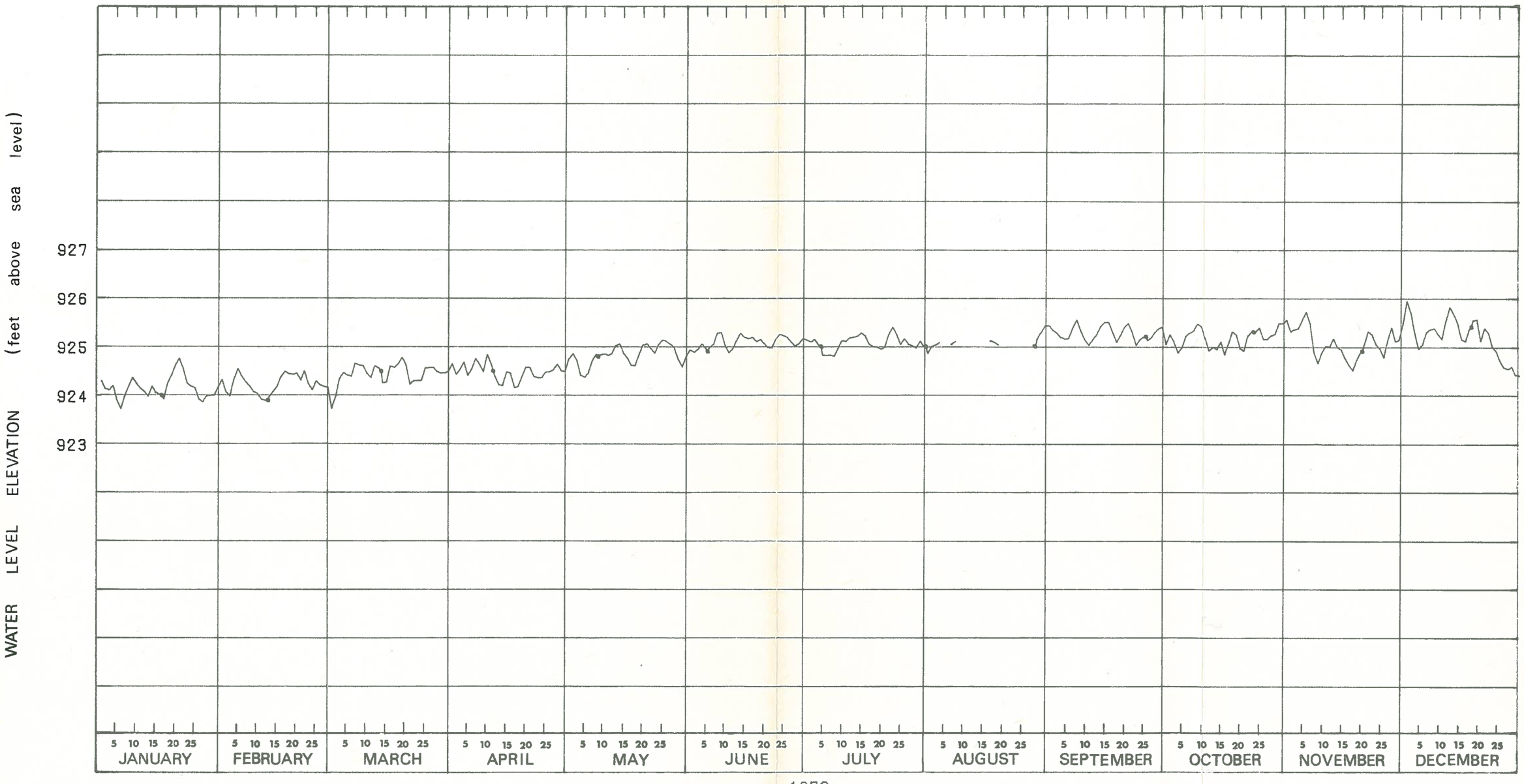
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-2WA

LSD 14 SEC 36 TWP 95 R 12 W4TH

BP-2WA-H-79

Alberta Research Council




1978

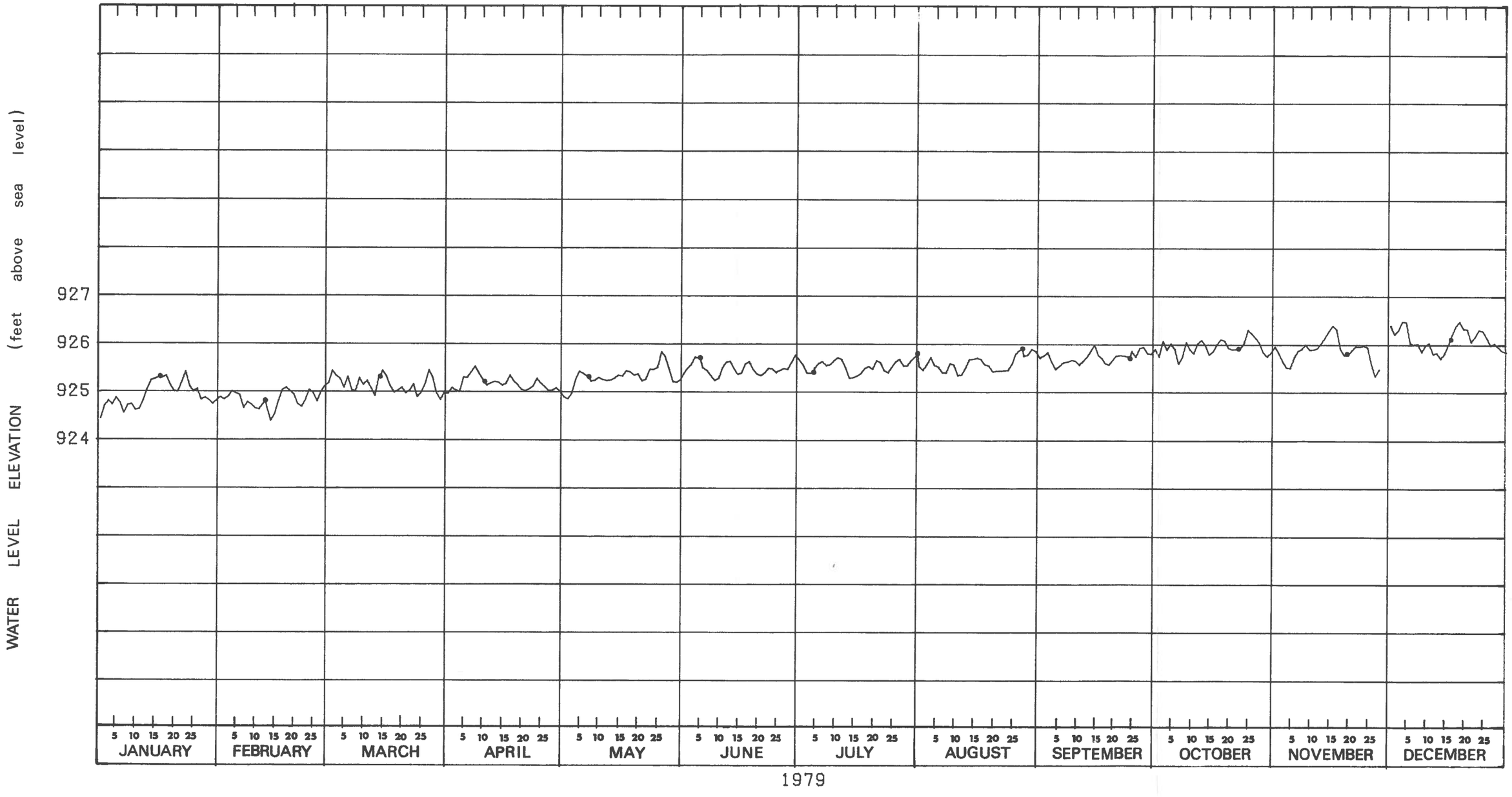
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4 th

Alberta Research Council

BP-2WA-H-80



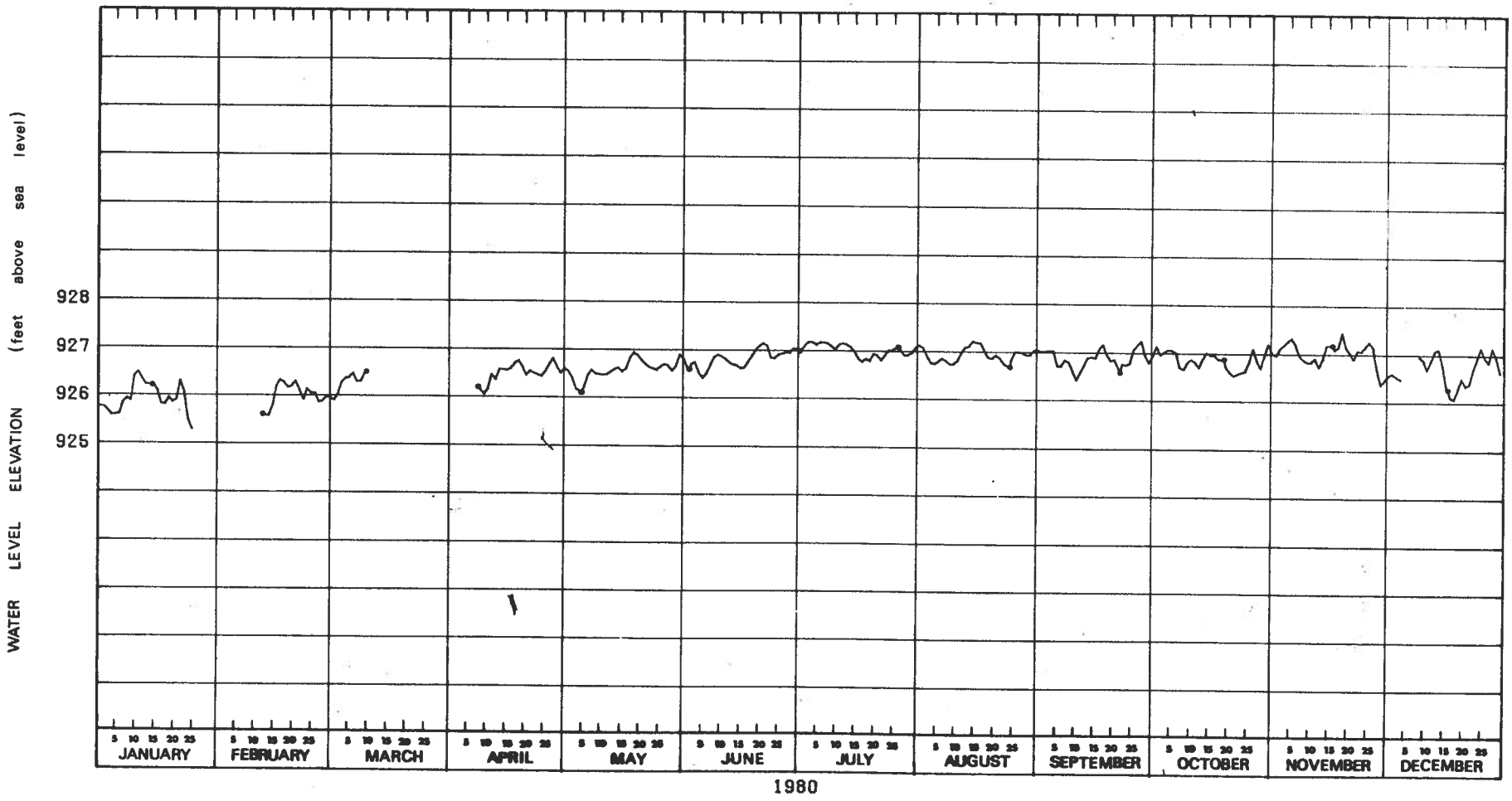
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4 th

Alberta Research Council

BP-2WA-H-81



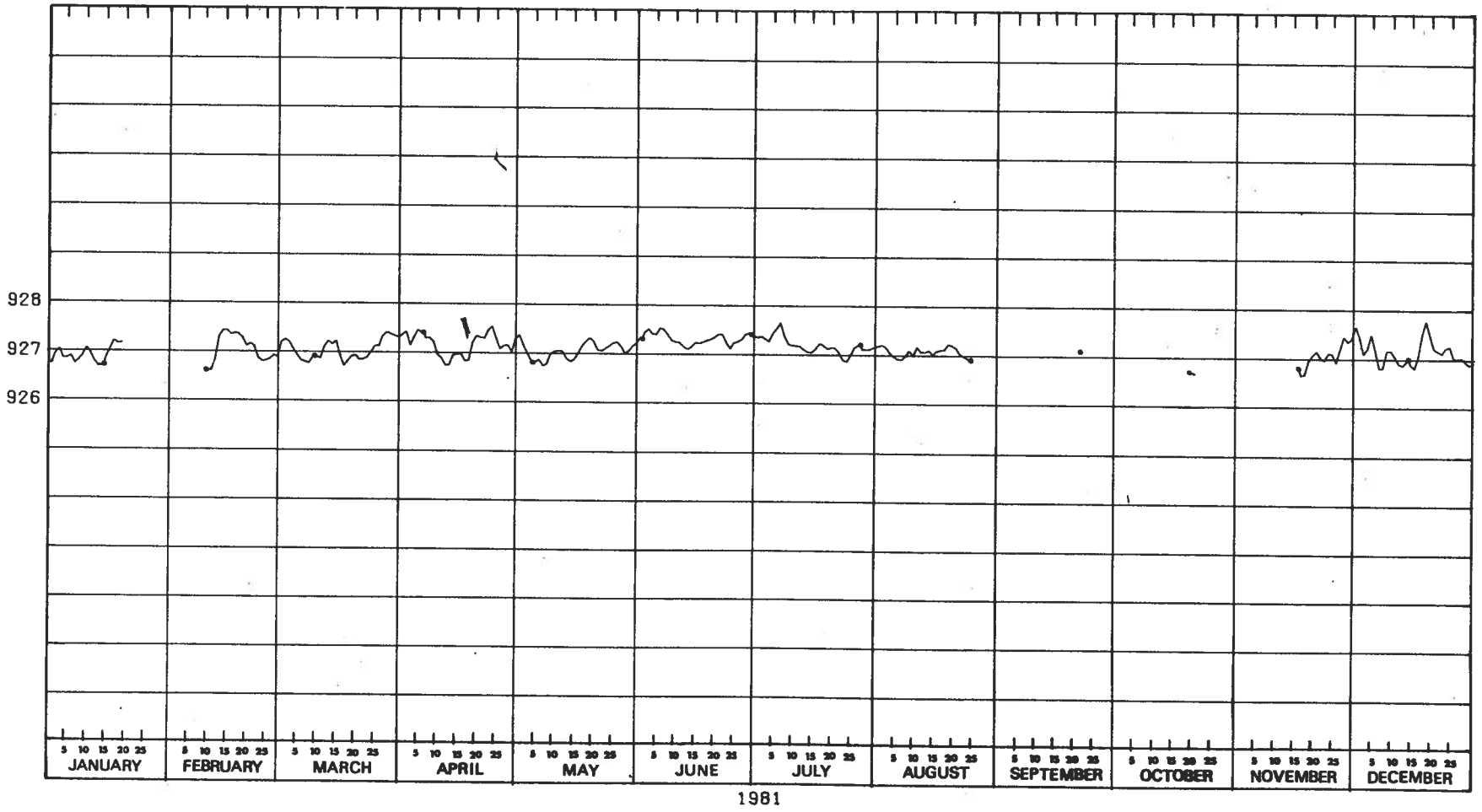
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4 th

Alberta Research Council

BP-2WA-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1038.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar 5/75 | | | Well completed |
| Mar 15/75 | 35.02 TOC | 923.1 | Pump test; Water samples<br>T = 7000 to 14000 IGPD/FT<br>S = 4 to 7 x $10^{-4}$ |
| Mar 20/75 | 37.01 TOC | 916.6 | |
| Mar 31/75 | 35.96 TOC | 920.0 | |
| Apr 16/75 | 35.32 TOC | 922.1 | |
| May 12/75 | 34.85 MP | 926.3 | MP = 2.58' TOC, (1040.6) |
| June 10/75 | 35.79 MP | 923.2 | |
| July 9/75 | 35.80 MP | 923.2 | |
| Aug 13/75 | 35.77 MP | 923.3 | |
| Sept 11/75 | 35.04 MP | 925.7 | |
| | 35.74 MP | 923.4 | After sample; temp. 3°C |
| Oct 7/75 | 35.66 MP | 923.6 | |
| Nov 6/75 | 35.51 MP | 924.1 | |
| Dec 6/75 | 35.66 MP | 923.6 | |
| Jan 6/76 | 35.86 MP | 923.0 | |
| Feb 6/76 | 35.58 MP | 923.9 | |
| Mar 5/76 | 35.62 MP | 923.8 | |
| Apr 7/76 | 35.64 MP | 923.7 | |
| May 5/76 | 35.67 MP | 923.6 | New MP = 0.83 m TOC, (1040.7) |
| June 1/76 | 35.52 MP | 924.2 | |
| June 22/76 | 35.58 MP | 924.0 | |
| July 15/76 | 35.54 MP | 924.1 | |
| | 35.49 MP | 924.3 | After sample; temp. 5°C |
| Aug 10/76 | 35.47 MP | 924.4 | |
| Aug 31/76 | 35.57 MP | 924.0 | |
| Sept 28/76 | 35.44 MP | 924.5 | |
| Oct 27/76 | 35.40 MP | 924.6 | |
| Nov 23/76 | 35.47 MP | 924.4 | |
| Dec 20/76 | 35.54 MP | 924.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1038.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 35.65 MP | 923.8 | MP (1040.7) |
| Feb 15/77 | 35.49 MP | 924.3 | |
| Mar 15/77 | 35.58 MP | 924.0 | |
| Apr 13/77 | 35.39 MP | 924.6 | |
| May 10/77 | 35.41 MP | 924.3 | New MP = 0.75 m TOC, (1040.5) |
| June 7/77 | 35.44 MP | 924.5 | |
| July 6/77 | 35.39 MP | 924.4 | |
| | 35.39 MP | 924.4 | After sample; temp. 6°C |
| Aug 3/77 | 35.36 MP | 924.5 | |
| Aug 30/77 | 35.35 MP | 924.5 | |
| Sept 27/77 | 35.35 MP | 924.5 | |
| Oct 25/77 | 35.20 MP | 925.0 | |
| Nov 22/77 | 35.42 MP | 924.3 | |
| Dec 19/77 | 35.44 MP | 924.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1038.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 35.53 MP | 924.0 | MP (1040.5) |
| Feb 13/78 | 35.54 MP | 923.9 | |
| Mar 14/78 | 35.36 MP | 924.5 | |
| Apr 12/78 | 35.36 MP | 924.5 | |
| May 9/78 | 35.27 MP | 924.8 | |
| June 6/78 | 35.25 MP | 924.9 | |
| July 5/78 | 35.20 MP | 925.0 | |
| | 35.20 MP | 925.0 | After sample; temp 5.5°C |
| Aug 1/78 | 35.21 MP | 925.0 | |
| Aug 29/78 | 35.20 MP | 925.0 | |
| Sept 26/78 | 35.14 MP | 925.2 | |
| Oct 24/78 | 35.05 MP | 925.3 | MP = 0.70m TOC (1040.3) |
| Nov 21/78 | 35.19 MP | 924.9 | |
| Dec 19/78 | 35.03 MP | 925.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1038.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 35.05 MP | 925.3 | MP (1040.3) |
| Feb 13/79 | 35.21 MP | 924.8 | |
| Mar 15/79 | 35.05 MP | 925.3 | |
| Apr 11/79 | 35.10 MP | 925.2 | |
| May 8/79 | 35.06 MP | 925.3 | |
| June 6/79 | 34.94 MP | 925.7 | |
| July 5/79 | 35.03 MP | 925.4 | |
| | 35.03 MP | 925.4 | After sample; temp. 6°C |
| Aug 1/79 | 34.91 MP | 925.8 | |
| Aug 28/79 | 34.87 MP | 925.9 | |
| Sept 25/79 | 34.93 MP | 925.7 | |
| Oct 23/79 | 34.89 MP | 925.9 | |
| Nov 20/79 | 34.90 MP | 925.8 | |
| Dec 17/79 | 34.82 MP | 926.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

BP-2WA-W-82

## WELL HISTORY

OBSERVATION WELL NUMBER BP-2WA

Lsd 14 Sec 36 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1038.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 34.77 MP | 926.2 | |
| Feb 13/80 | 34.97 MP | 925.6 | |
| Mar 11/80 | 34.70 MP | 926.5 | |
| Apr 9/80 | 34.78 MP | 926.2 | |
| May 6/80 | 34.87 MP | 926.1 | New MP 0.77 m TOC (1040.5) |
| June 3/80 | 34.72 MP | 926.6 | |
| July 2/80 | 34.60 MP | 927.0 | Temp. 4.5°C |
| | 34.60 MP | 927.0 | After Sample |
| July 28/80 | 34.58 MP | 927.1 | |
| Aug 26/80 | 34.69 MP | 926.7 | |
| Sept 24/80 | 34.71 MP | 926.6 | |
| Oct 21/80 | 34.62 MP | 926.9 | |
| Nov 18/80 | 34.55 MP | 927.2 | |
| Dec 18/80 | 34.81 MP | 926.3 | |
| Jan 15/81 | 34.70 MP | 926.7 | |
| Feb 10/81 | 34.73 MP | 926.6 | |
| Mar 10/81 | 34.73 MP | 926.9 | |
| Apr 7/81 | 34.49 MP | 927.4 | |
| May 5/81 | 34.65 MP | 926.8 | |
| June 2/81 | 34.51 MP | 927.3 | |
| June 30/81 | 34.49 MP | 927.4 | |
| July 30/81 | 34.54 MP | 927.2 | |
| Aug 25/81 | 34.62 MP | 926.9 | |
| Sept 22/81 | 34.56 MP | 927.1 | |
| Oct 20/81 | 34.69 MP | 926.7 | |
| Nov 17/81 | 34.66 MP | 926.8 | |
| Dec 15/81 | 34.60 MP | 927.0 | |

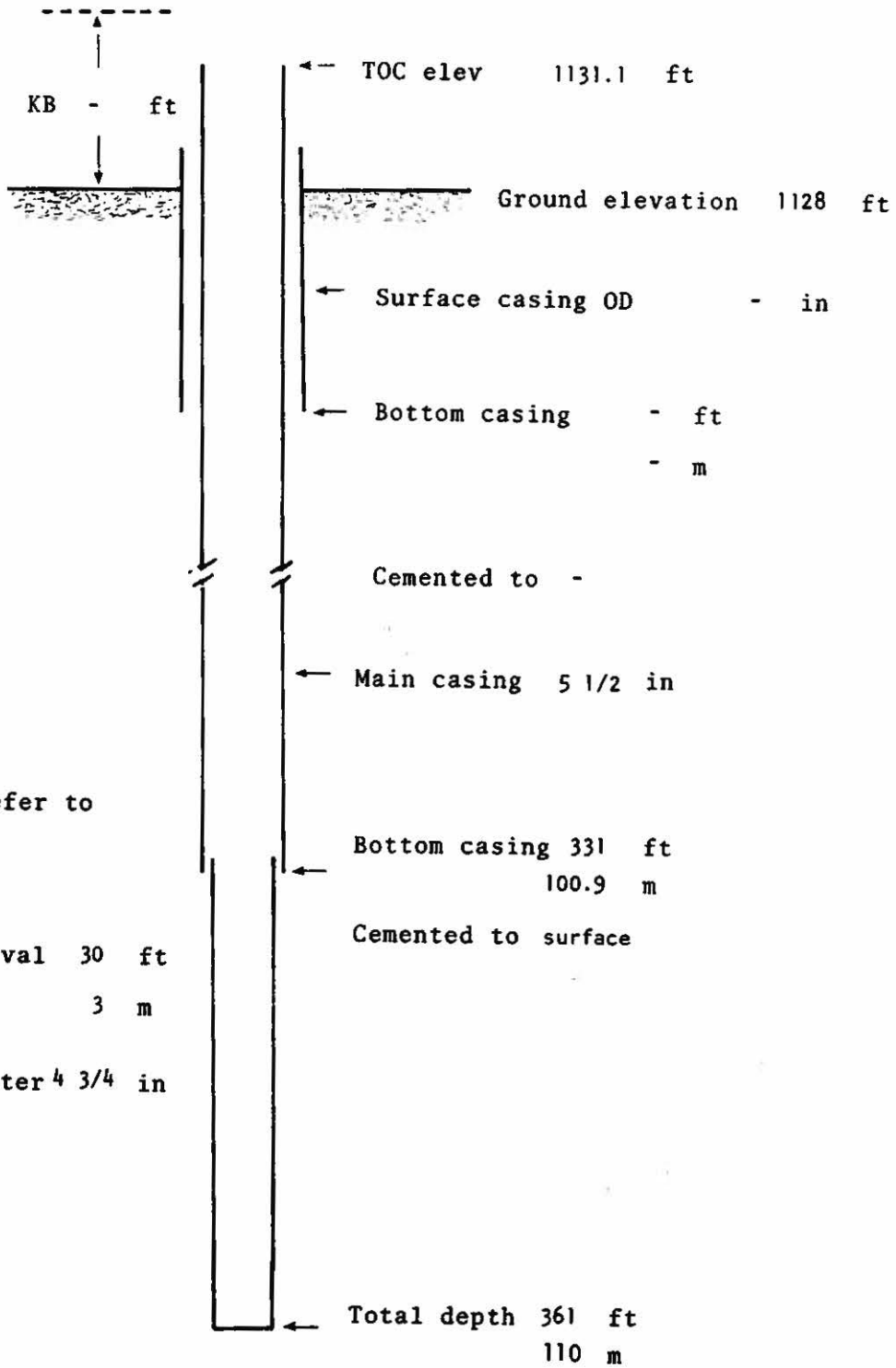
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER BP - 3W

Lsd 5 Sec 21 Tp 95 R 12 Mer 4

Alberta Research Council




Note: all depths refer to Ground

Open hole interval 30 ft
3 m

Open hole diameter 4 3/4 in

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-3W

Lsd 5 Sec 21 Twp 95 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 15, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 43.0 | 2.15 | 3 |
| Magnesium ($Mg^{++}$) | 42.0 | 3.46 | 4 |
| Sodium ($Na^{+}$) | 1650.0 | 71.77 | 92 |
| Potassium ($K^{+}$) | 17.9 | 0.46 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 947.0 | 15.52 | 19 |
| Sulfate ($SO_4^{=}$) | 39.7 | 0.83 | 1 |
| Chloride ($Cl^{-}$) | 2340.0 | 65.99 | 80 |
| Nitrate ($NO_3^{=}$) | 1.4 | 0.02 | 0 |
| Silica ($SiO_2$) | 15.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 44.0 | | |
| Magnesium (Acidified) | 37.4 | | |
| Total dissolved solids | 4420 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 82.36 | Total Cations (epm) | 77.83 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 8000 | Temperature (C) | 6.0 | |
| pH | 7.8 | pH | 7.4 | |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 1039 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-3W

Lsd 5 Sec 21 Twp 95 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 6, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 17.1 | 0.85 | 29.0 |
| Magnesium ($Mg^{++}$) | 4.4 | 0.36 | 12.3 |
| Sodium ($Na^{+}$) | 38.8 | 1.69 | 57.3 |
| Potassium ($K^{+}$) | 1.7 | 0.04 | 1.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 85.0 | 1.39 | 46.0 |
| Sulfate ($SO_4^{=}$) | 50.0 | 1.04 | 34.4 |
| Chloride ($Cl^{-}$) | 18.0 | 0.51 | 16.7 |
| Nitrate ($NO_3^{=}$) | 5.5 | 0.09 | 2.9 |
| Silica ($SiO_2$) | 1.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 15.9 | | |
| Magnesium (Acidified) | 4.2 | | |
| Total dissolved solids | 230.0 | | |
| Total Anions (epm) | 3.03 | Total Cations (epm) | 2.95 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 290 |
| pH | 7.4 |
| Fluoride ($F^{-}$) | 0.1 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 6.0 |
| pH | 8.0 |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | 88.0 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER BP - 3W

Lsd 5 Sec 21 Twp 95 R 12 W4th

Alberta Research Council

Date sampled: July 15, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .199 |
| Au | <.003 | Mo | <.006 |
| Al | 0.11 | Na | 1870 |
| As | <.038 | Ni | <.010 |
| B | 1.32 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 47.8 | Si | 3.35 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 1.32 |
| Cr | <.006 | Te | <.065 |
| Cu | .015 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 0.14 | V | .006 |
| K | <.150 | W | <.078 |
| Mg | 35.3 | Zn | .165 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER BP-3W

Lsd 5 Sec 21 Rge 12 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 05, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 14.0 | 0.70 | 1.7 |
| Magnesium(Mg) | 14.8 | 1.22 | 3.0 |
| Sodium(Na) | 870.0 | 37.84 | 94.7 |
| Potassium(K) | 8.3 | 0.21 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 527.0 | 8.64 | 20.1 |
| Sulphate(SO4) | 26.2 | 0.55 | 1.3 |
| Chloride(Cl) | 1200.0 | 33.84 | 78.6 |
| Nitrate(NO3) | 2.4 | 0.04 | 0.1 |
| Silica(SiO2) | 3.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 12.2 | | |
| Magnesium(Acidified) | 13.0 | | |
| TDS(mg/l) | 2460.0 | | |
| Total Anions(epm) | 43.06 | Total Cations(epm) | 39.97 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 4000 | | Temperature(C) | 7.00 | |
| pH | 8.0 | | pH | 8.0 | |
| Fluoride(F) | 0.2 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 620 | mg/l |
| | | | Hydroxide(OH) | | |

BP-3W-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER BP-3W

Lsd 14 Sec 36 Rge 12 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 4, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 6.9 | 0.34 | 3.8 |
| Magnesium(Mg) | 2.2 | 0.18 | 2.0 |
| Sodium(Na) | 195.0 | 8.48 | 94.1 |
| Potassium(K) | 0.4 | 0.01 | 0.1 |
| Carbonate(CO3) | 31.2 | 1.04 | 10.9 |
| Bicarbonate(HCO3) | 56.0 | 0.92 | 9.6 |
| Sulphate(SO4) | 27.0 | 0.56 | 5.9 |
| Chloride(Cl) | 250.0 | 7.05 | 73.7 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 0.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 7.7 | | |
| Magnesium(Acidified) | 2.4 | | |
| TDS(mg/l) | 544.0 | | |
| Total Anions(epm) | 9.57 | Total Cations(epm) | 9.02 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 910 | Temperature(C) | 5.00 | |
| pH | 9.7 | pH | 10.0 | |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) | 43 | mg/l |
| | | Bicarbonate(HCO3) | 34 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS BP-3W-E-82

OBSERVATION WELL NUMBER BP-3W

Lsd 5 Sec 21 Rge 12 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 13.0 | 0.65 | 1.5 |
| Magnesium(Mg) | 12.0 | 1.00 | 2.3 |
| Sodium(Na) | 975.0 | 42.39 | 95.8 |
| Potassium(K) | 9.0 | 0.23 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 464.0 | 7.61 | 17.0 |
| Sulphate(SO4) | 36.0 | 0.75 | 1.7 |
| Chloride(Cl) | 1290.0 | 36.34 | 81.1 |
| Nitrate(NO3) | 7.0 | 0.11 | 0.3 |
| Silica(SiO2) | 1.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 6.6 | | |
| Magnesium(Acidified) | 9.9 | | |
| TDS(mg/l) | 2576.0 | | |
| Total Anions(epm) | 44.81 | Total Cations(epm) | 44.27 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4550 | Temperature | 5.50 | |
| pH | 8.4 | pH | 9.0 | |
| Fluoride | 0.3 mg/l | Carbonate(CO3) | 43 | mg/l |
| | | Bicarbonate(HCO3) | 424 | mg/l |
| | | Hydroxide(OH) | | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER BP - 3W

Lsd 5 Sec 21 Twp 95 R 12 W4th

Alberta Research Council

Ground elevation 1128.4 Total depth 361

KB elevation Unknown
All depths refer to ground level

| Interval from | to | Description | Formation |
|---|---|---|---|
| 0 | 3 | Silt, clayey, light brown, rock fragments | Drift |
| 3 | 10 | Clay, silty, light brown, rock fragments | |
| 10 | 13 | Clay, silty, grey, some gravel | |
| 13 | 15 | Clay, silty, grey to brown, some gravel | |
| 15 | 30 | Clay, silty, greyish brown, some sand | |
| 30 | 37 | Silt, clayey, grey, some fine gravel | |
| 37 | 52 | Shale, (clay) dark grey | Clearwater |
| 52 | 54 | Shale, sandy, dark grey | |
| 54 | 61 | Shale, silty, dark grey | |
| 61 | 90 | Shale, dark grey | |
| 90 | 141 | Shale, silty and sandy, dark grey | |
| 141 | 176 | Shale, silty, dark grey | |
| 176 | 182 | Tar sand, (sandstone) silty, some coarser grains, brownish grey, oil-bearing | McMurray |
| 182 | 193 | Siltstone, light brown | |
| 193 | 195 | Shale, (clay) silty, dark grey | |
| 195 | 197 | Siltstone, clayey, light brown to brown | |
| 197 | 201 | Tar sand, (sandstone) some silt, fine grained, brown, oil-bearing | |
| 201 | 207 | Siltstone, greyish brown, clayey | |
| 207 | 210 | Tar sand, (sandstone) silty, brown, oil-bearing | |
| 210 | 215 | Tar sand, some fine sand, brownish, oil-bearing | |
| 215 | 218 | Tar sand, fine grained sandstone, brown to dark brown, oil-bearing | |
| 218 | 245 | Tar sand, siltstone, some fine sand brownish grey, containing sericite, oil-bearing | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER BP - 3W (continued)

Lsd 5 Sec 21 Twp 95 R 12 W4th

Alberta Research Council

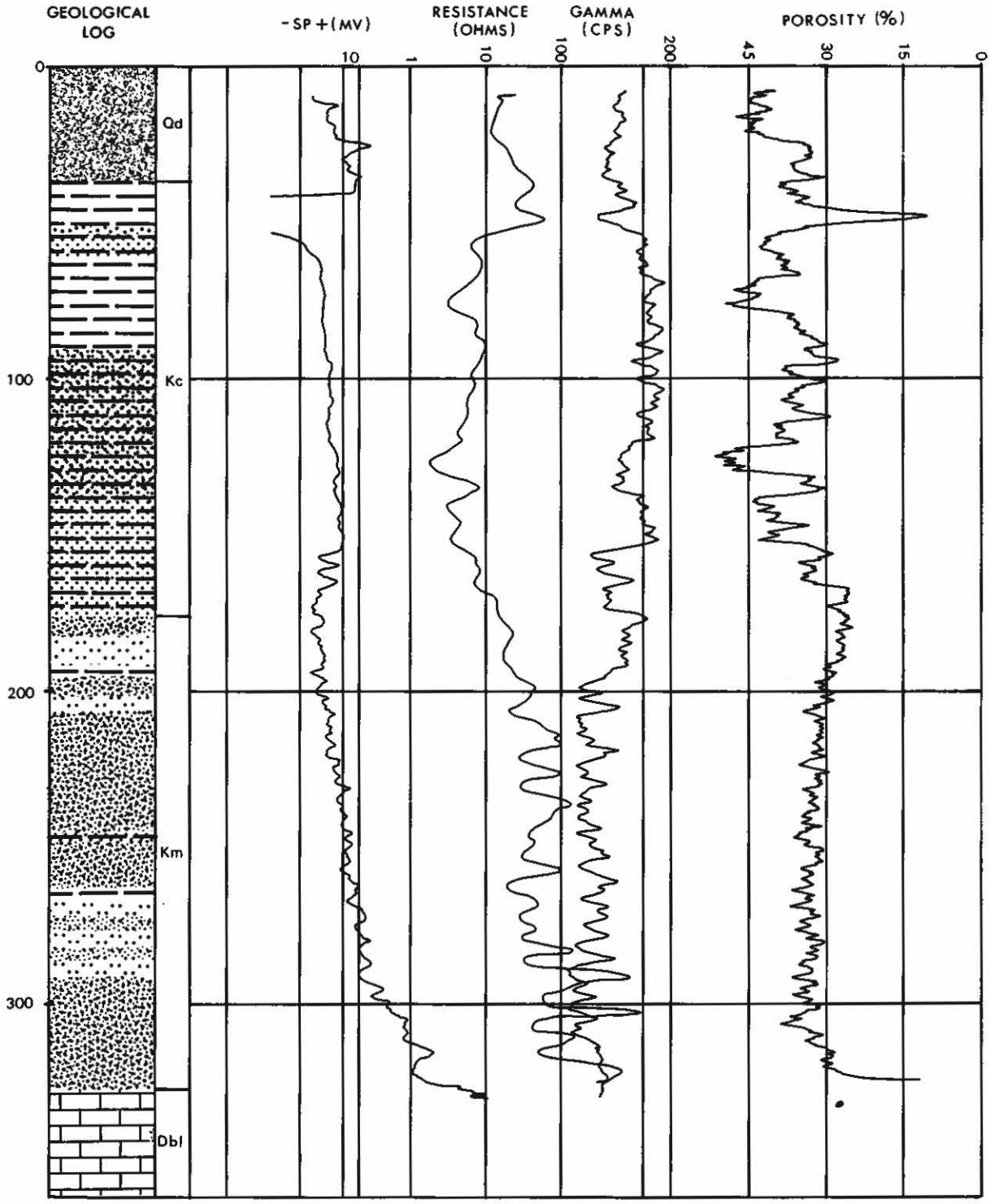
Ground elevation Total depth

KB elevation

| Interval from | to | Description | Formation |
|---|---|---|---|
| 245 | 248 | Shale, (clay) silty, dark grey | |
| 248 | 263 | Tar sand, (siltstone) greyish brown, containing sericite, some oil | |
| 263 | 267 | Shale, (clay) silty, greyish brown, traces of oil | |
| 267 | 280 | Tar sand, (sandstone) greyish brown, traces of oil | |
| 280 | 292 | Tar sand, greyish brown, traces of oil | |
| 292 | 302 | Tar sand, fine grained sandstone, dark brown, containing sericite, some oil | |
| 302 | 320 | Tar sand, very fine grained, silty, brownish grey, some oil | |
| 320 | 325 | Tar sand, fine grained, oil-bearing | |
| 325 | 326 | Limestone, greyish white, weathered | Beaverhill Lake |
| 326 | 361 | Limestone, light grey or whitish, fresh | |

BP-3W-G-77

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE BP-3W
## 5-21-95-12-W4 th
ALBERTA RESEARCH COUNCIL

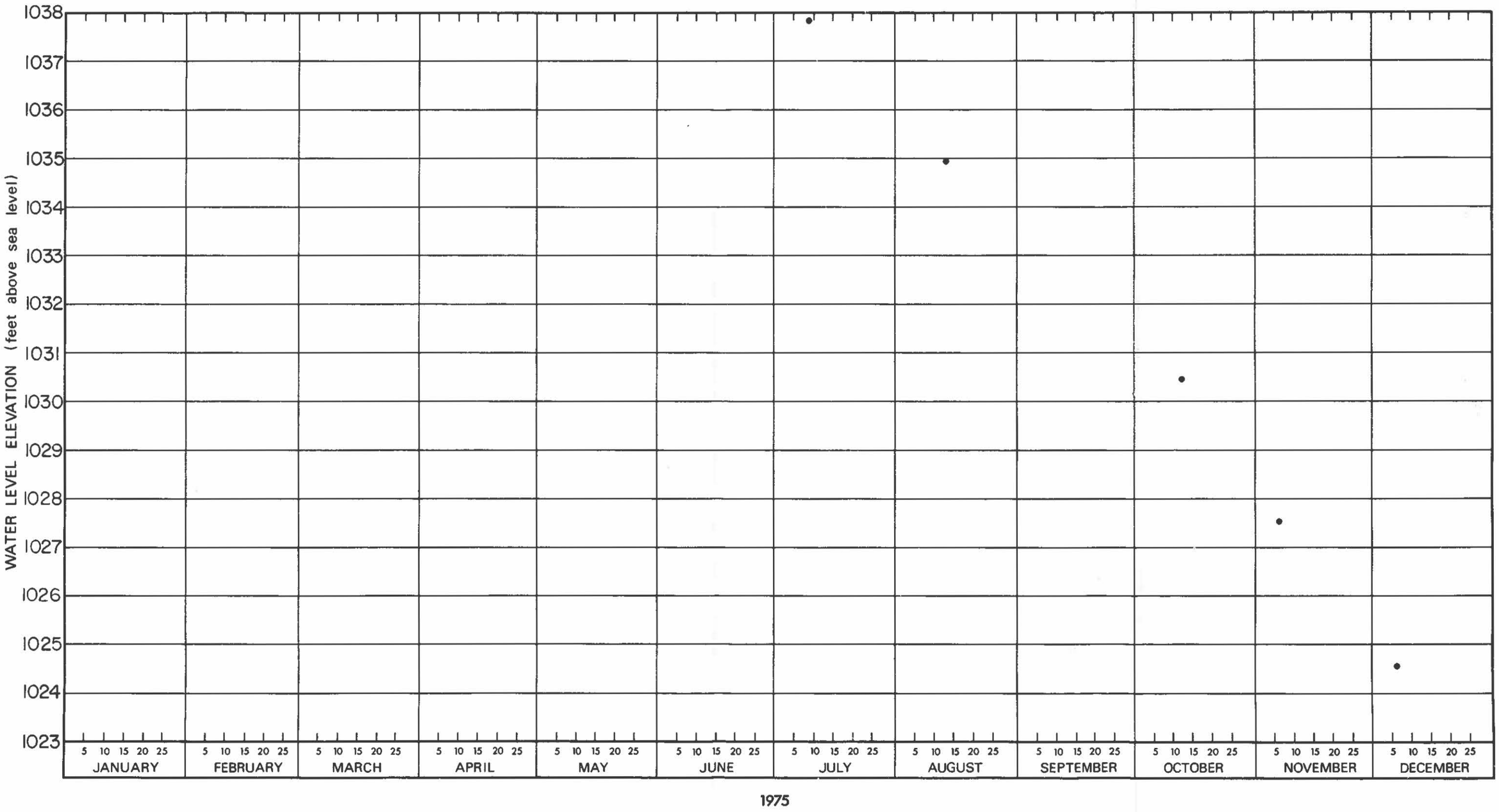


WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP - 3W

Lsd 5 Sec 21 Twp 95 R 12 W4th

BP-3W-H-77




1975

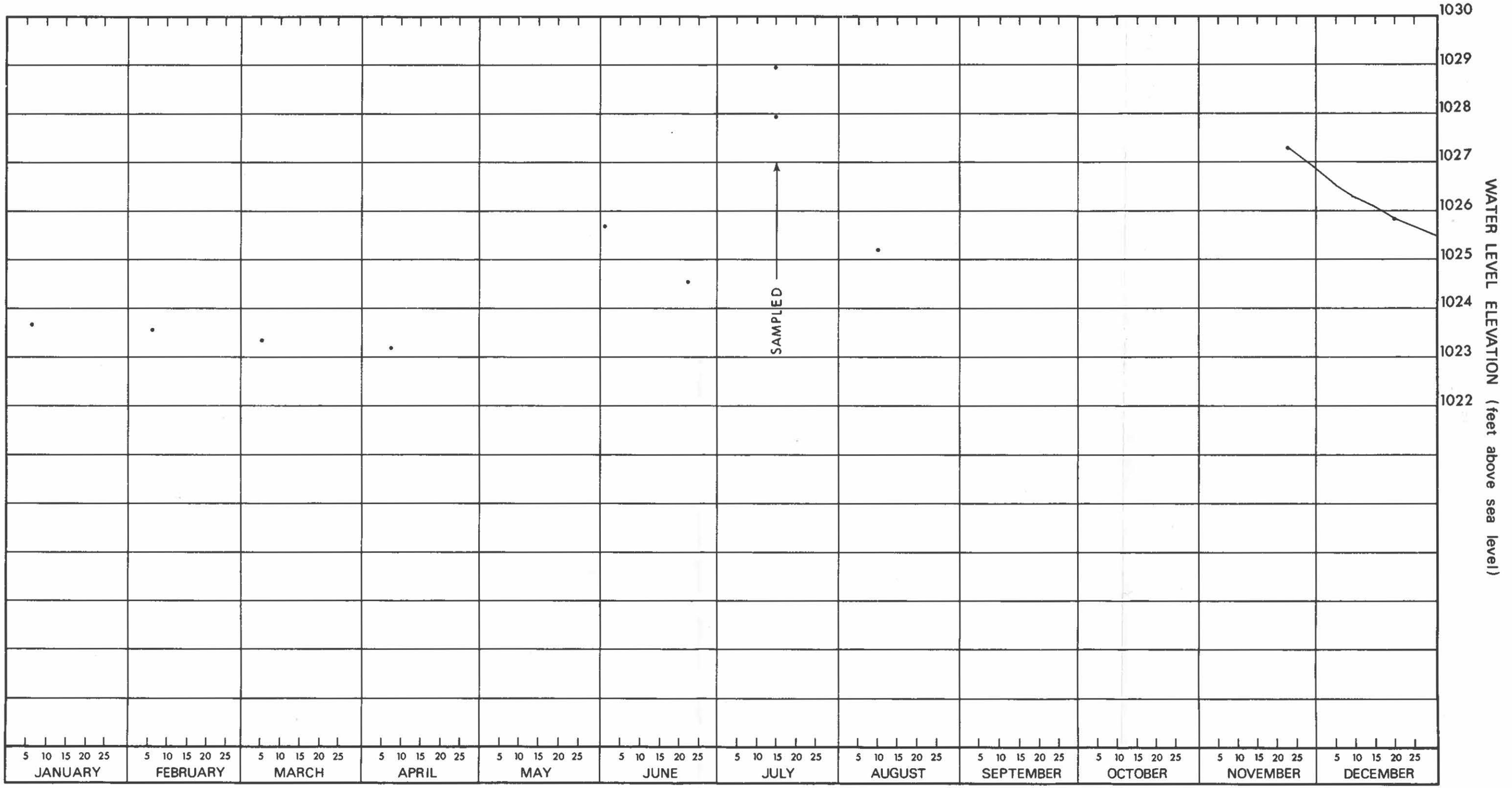
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-3W

BP - 3W - H - 77

Lsd 5 Sec 21 Twp 95 R 12 W4th

Alberta Research Council




1976

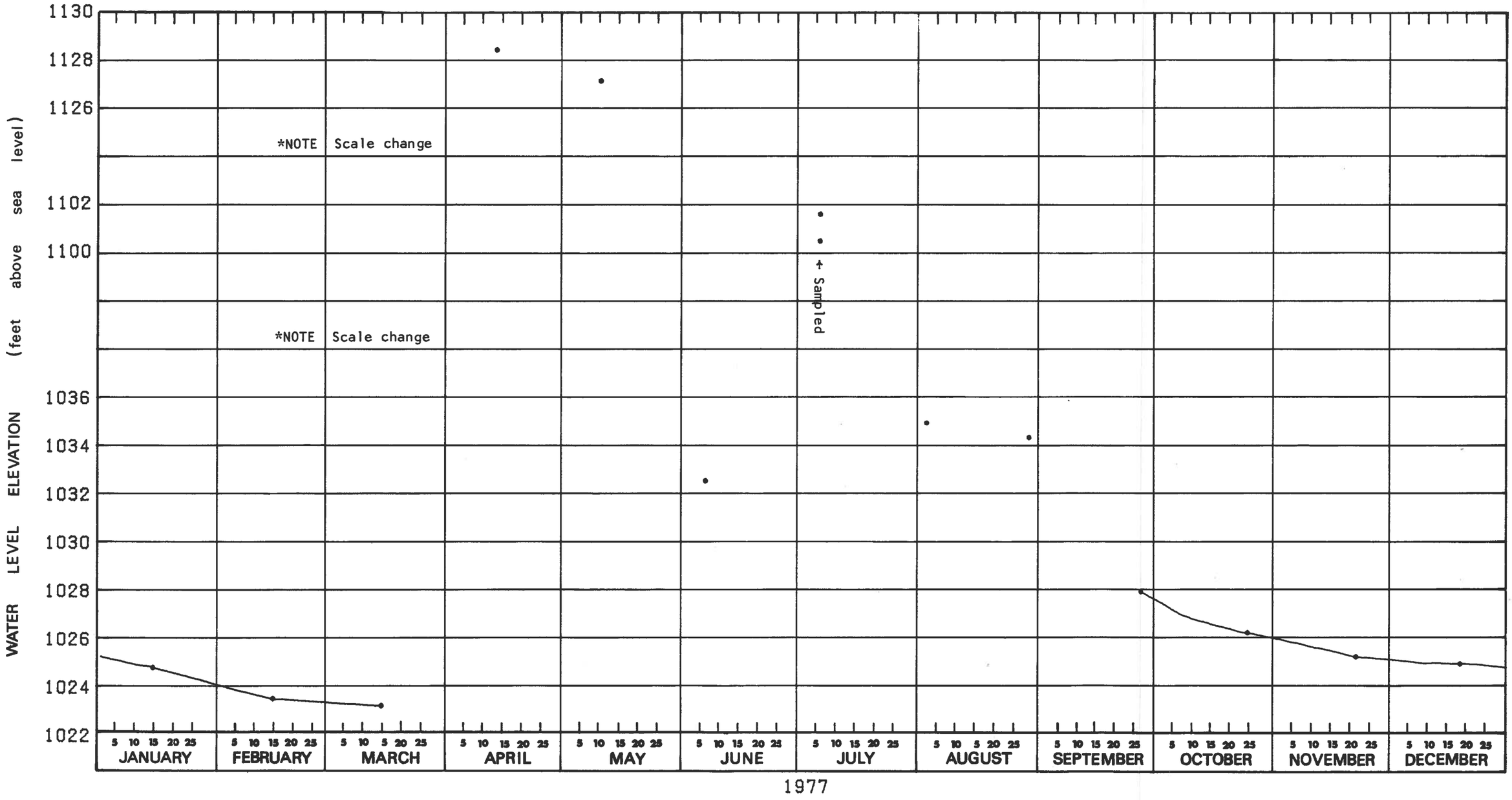
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-3W

Lsd 5 Sec 21 Twp 95 R 12 W4 th

Alberta Research Council

BP-3W-H-78



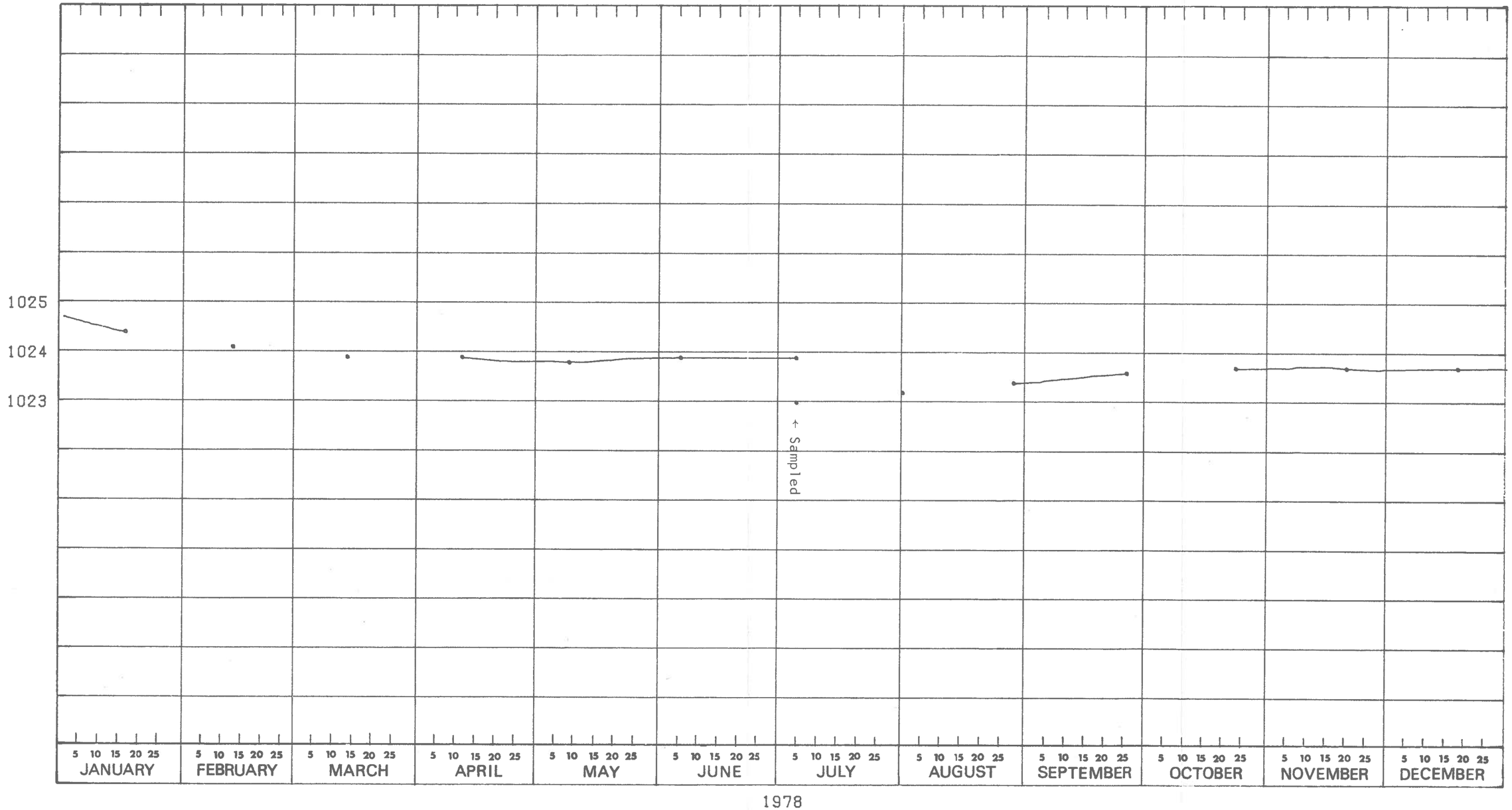
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-3W

LSD 5 SEC 21 TWP 95 R 12 W4TH

Alberta Research Council

BP-3W-H-79



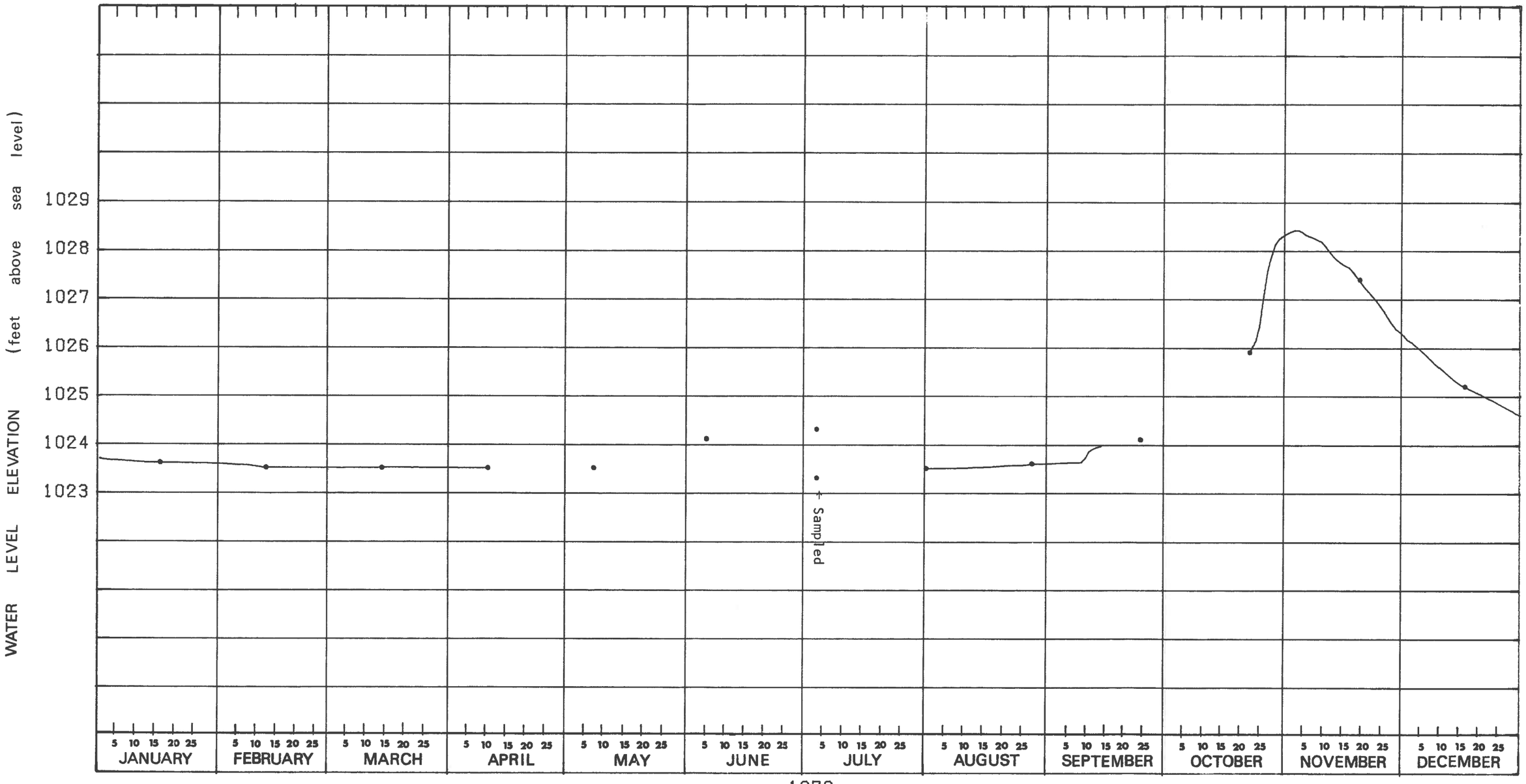
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-3W

Lsd 5 Sec 21 Twp 95 R 12 W4 th

Alberta Research Council

BP-3W-H-80



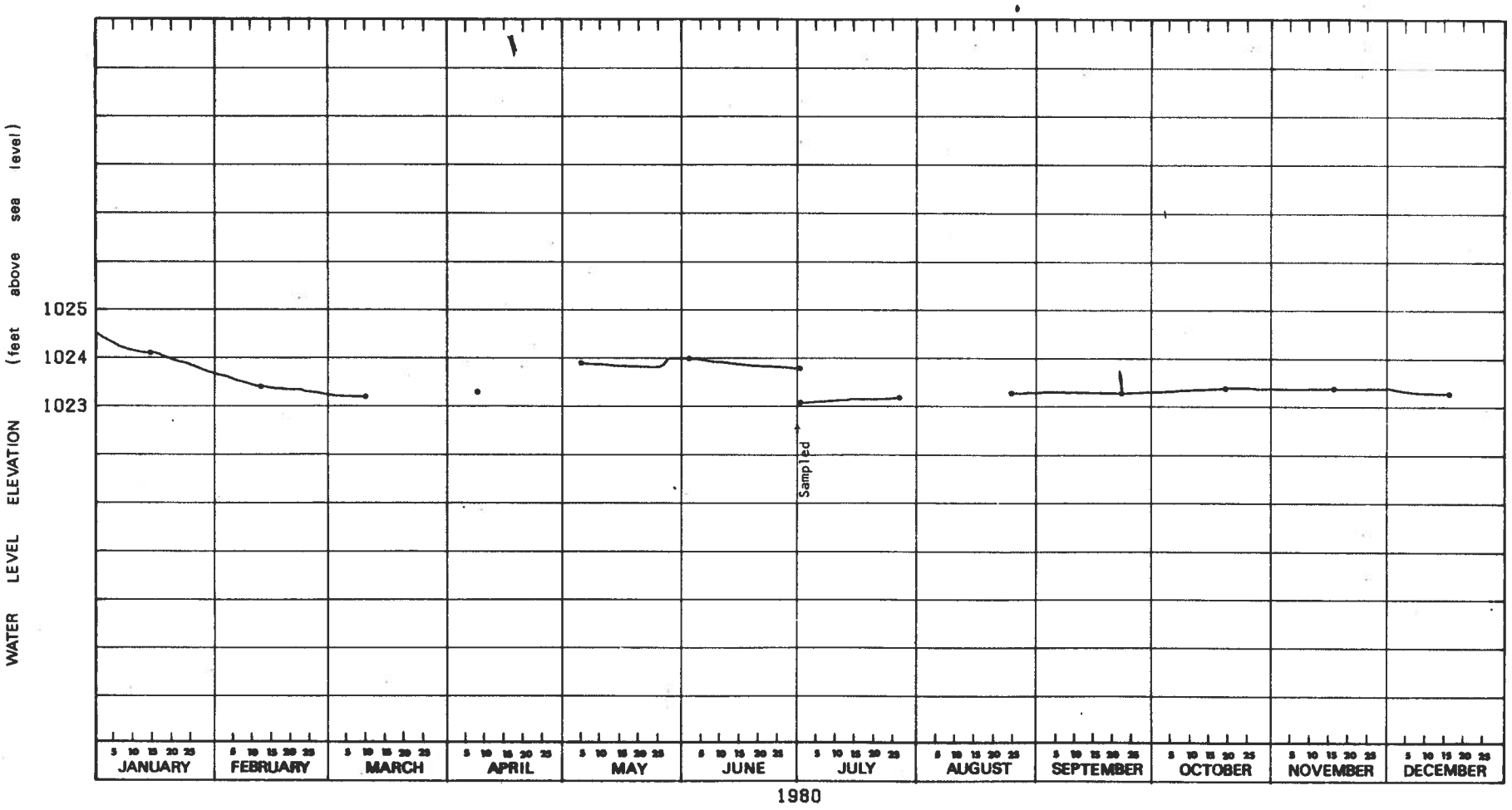
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-3W

Lsd 5 Sec 21 Twp 95 R 12 W4 th

Alberta Research Council

BP-3W-H-81



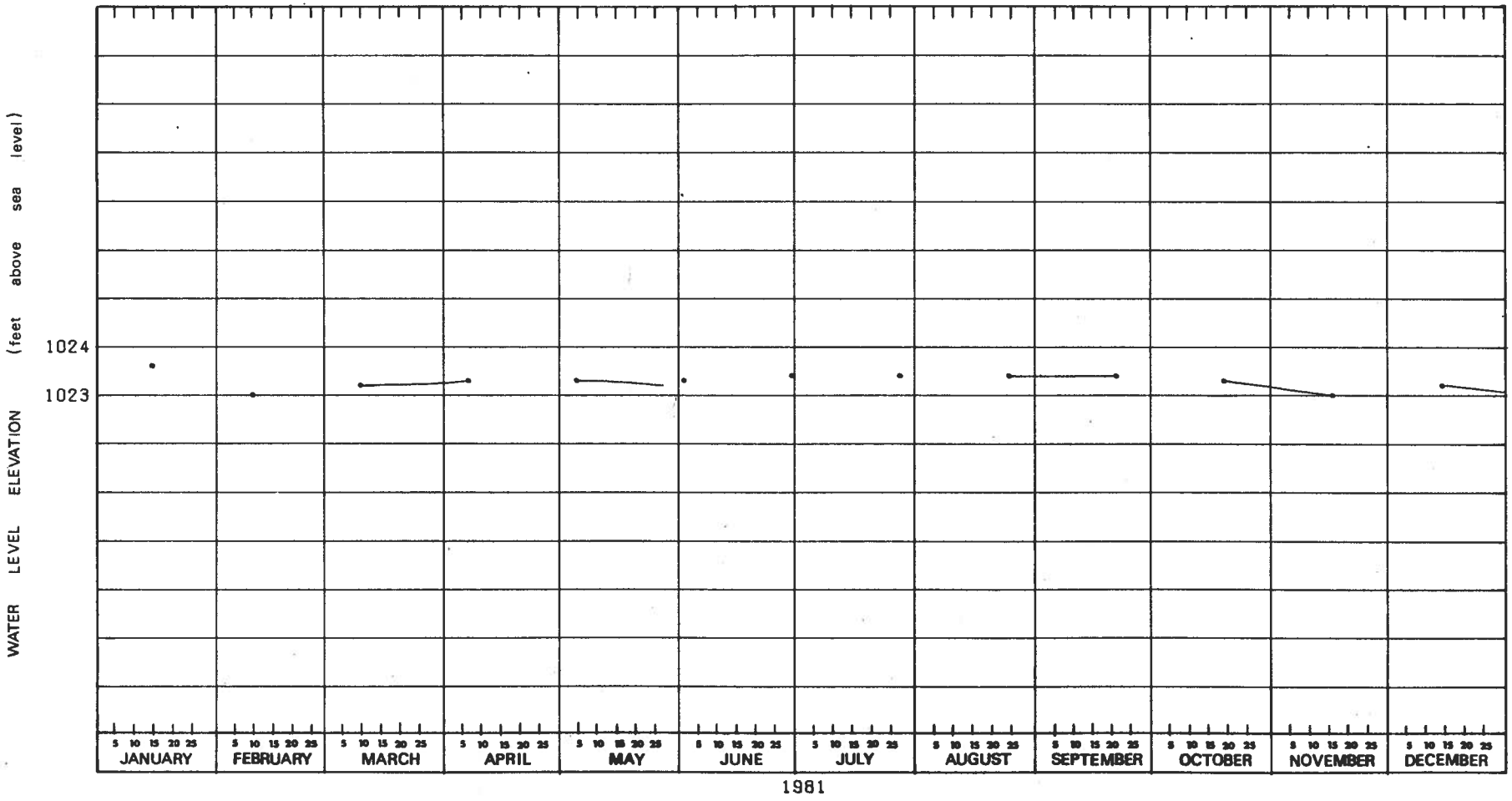
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-3W

BP-3W-H-82

Lsd 5 Sec 21 Twp 95 R 12 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER BP - 3W

Lsd 5 Sec 21 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1131.1 (Until May 5/76)
1127.26 (After May 5/76)

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| | | | Well completed |
| Mar 19/75 | 41.9 TOC | 993.7 | |
| Mar 20/75 | 39.0 TOC | 1003.2 | |
| May 12/75 | 36.8 TOC | 1010.4 | |
| May 21/75 | 36.6 TOC | 1011.0 | |
| July 9/75 | 28.42 TOC | 1037.9 | |
| Aug 13/75 | 29.31 TOC | 1035.0 | |
| Sept 11/75 | 14.39 TOC | 1083.9 | Measurement questionable |
| Oct 7/75 | 30.67 TOC | 1030.5 | |
| Nov 6/75 | 31.57 TOC | 1027.5 | |
| Dec 6/75 | 32.96 MP | 1024.6 | MP = 0.48 m TOC, (1132.7) |
| Jan 6/76 | 33.24 MP | 1023.7 | |
| Feb 6/76 | 33.28 MP | 1023.5 | |
| Mar 5/76 | 33.35 MP | 1023.3 | |
| Apr 7/76 | 33.40 MP | 1023.1 | |
| May 5/76 | 29.95 MP | 1034.5 | 1.17 m of casing broken off |
| June 1/76 | 32.17 MP | 1025.6 | New MP = 1.18 m TOC, (1131.1) |
| June 22/76 | 32.52 MP | 1024.4 | |
| July 15/76 | 31.18 MP | 1028.8 | |
| | 31.49 MP | 1027.8 | After sample; temp. 6°C |
| Aug 10/76 | 32.33 MP | 1025.1 | |
| Aug 31/76 | 8.71 MP | 1102.5 | Rain water could have infiltrated into the casing |
| Sept 28/76 | 30.48 MP | 1031.1 | Float out of well |
| Oct 26/76 | 28.12 MP | 1038.9 | |
| Nov 23/76 | 31.69 MP | 1027.2 | |
| Dec 20/76 | 32.14 MP | 1025.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-3W

Lsd 5 Sec 21 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1127.26 until August 29, 1977
1131.0 after August 29, 1977

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 32.41 MP | 1024.8 | MP (1131.1) |
| Feb 15/77 | 32.80 MP | 1023.5 | |
| Mar 15/77 | 32.90 MP | 1023.2 | |
| Apr 13/77 | 0.87 MP | 1128.3 | Water above the top of the casing inside the shelter (spring runoff) |
| May 10/77 | 1.25 MP | 1127.0 | |
| June 7/77 | 30.07 MP | 1032.5 | |
| July 6/77 | 9.04 MP | 1101.4 | |
| | 9.40 MP | 1100.3 | After sample; temp. 6°C |
| Aug 3/77 | 29.28 MP | 1034.9 | |
| Aug 29/77 | 30.03 MP | 1032.6 | Added casing |
| | 30.18 MP | 1034.3 | New MP = 0.69 m TOC, (1133.3) Elevation survey from BP-4WA indicates that previous elevation for TOC was in error due to damage to well head after original survey |
| Sept 27/77 | 35.12 MP | 1027.9 | |
| Oct 25/77 | 32.66 MP | 1026.2 | |
| Nov 22/77 | 32.95 MP | 1025.2 | |
| Dec 19/77 | 33.06 MP | 1024.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-3W

Lsd 5 Sec 21 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1131.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 33.20 MP | 1024.4 | MP (1133.3) |
| Feb 13/78 | 33.30 MP | 1024.1 | |
| Mar 14/78 | 33.34 MP | 1023.9 | |
| Apr 12/78 | 33.35 MP | 1023.9 | |
| May 9/78 | 33.38 MP | 1023.8 | |
| June 6/78 | 33.36 MP | 1023.9 | |
| July 5/78 | 33.35 MP | 1023.9 | |
| | 33.63 MP | 1023.0 | After sample; temp 7°C |
| Aug 1/78 | 33.56 MP | 1023.2 | |
| Aug 29/78 | 33.49 MP | 1023.4 | |
| Sept 26/78 | 33.44 MP | 1023.6 | |
| Oct 24/78 | 33.41 MP | 1023.7 | |
| Nov 21/78 | 33.42 MP | 1023.7 | |
| Dec 19/78 | 33.41 MP | 1023.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-3W

Lsd 5 Sec 21 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1131.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 33.44 MP | 1023.6 | MP (1133.3) |
| Feb 13/79 | 33.46 MP | 1023.5 | |
| Mar 15/79 | 33.47 MP | 1023.5 | |
| Apr 11/79 | 33.48 MP | 1023.5 | |
| May 8/79 | 33.46 MP | 1023.5 | |
| June 6/79 | 33.30 MP | 1024.1 | |
| July 4/79 | 33.24 MP | 1024.3 | |
| | 33.55 MP | 1023.3 | After sample; temp. 5°C |
| Aug 1/79 | 33.47 MP | 1023.5 | |
| Aug 28/79 | 33.45 MP | 1023.6 | |
| Sept 25/79 | 33.29 MP | 1024.1 | |
| Oct 23/79 | 32.75 MP | 1025.9 | |
| Nov 20/79 | 32.28 MP | 1027.4 | |
| Dec 17/79 | 32.97 MP | 1025.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP - 3W

Lsd 5 Sec 21 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1131.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 33.29 MP | 1024.1 | |
| Feb 13/80 | 33.49 MP | 1023.4 | |
| Mar 11/80 | 33.58 MP | 1023.2 | |
| Apr 9/80 | 33.55 MP | 1023.3 | |
| May 6/80 | 33.34 MP | 1023.9 | |
| June 3/80 | 33.32 MP | 1024.0 | |
| July 2/80 | 33.38 MP | 1023.8 | Temp. 5.5°C |
| | 33.61 MP | 1023.1 | After Sample |
| July 28/80 | 33.58 MP | 1023.2 | |
| Aug 26/80 | 33.52 MP | 1023.3 | |
| Sept 24/80 | 33.52 MP | 1023.3 | |
| Oct 21/80 | 33.51 MP | 1023.4 | |
| Nov 18/80 | 33.51 MP | 1023.4 | |
| Dec 18/80 | 33.54 MP | 1023.3 | |
| Jan 15/81 | 33.46 MP | 1023.6 | |
| Feb 10/81 | 33.64 MP | 1023.0 | |
| Mar 10/81 | 33.56 MP | 1023.2 | |
| Apr 7/81 | 33.55 MP | 1023.3 | |
| May 5/81 | 33.55 MP | 1023.3 | |
| June 2/81 | 33.53 MP | 1023.3 | |
| June 30/81 | 33.51 MP | 1023.4 | |
| July 28/81 | 33.52 MP | 1023.4 | |
| Aug 25/81 | 33.52 MP | 1023.4 | |
| Sept 22/81 | 33.52 MP | 1023.4 | |
| Oct 20/81 | 33.55 MP | 1023.3 | |
| Nov 17/81 | 33.64 MP | 1023.0 | |
| Dec 15/81 | 33.58 MP | 1023.2 | |

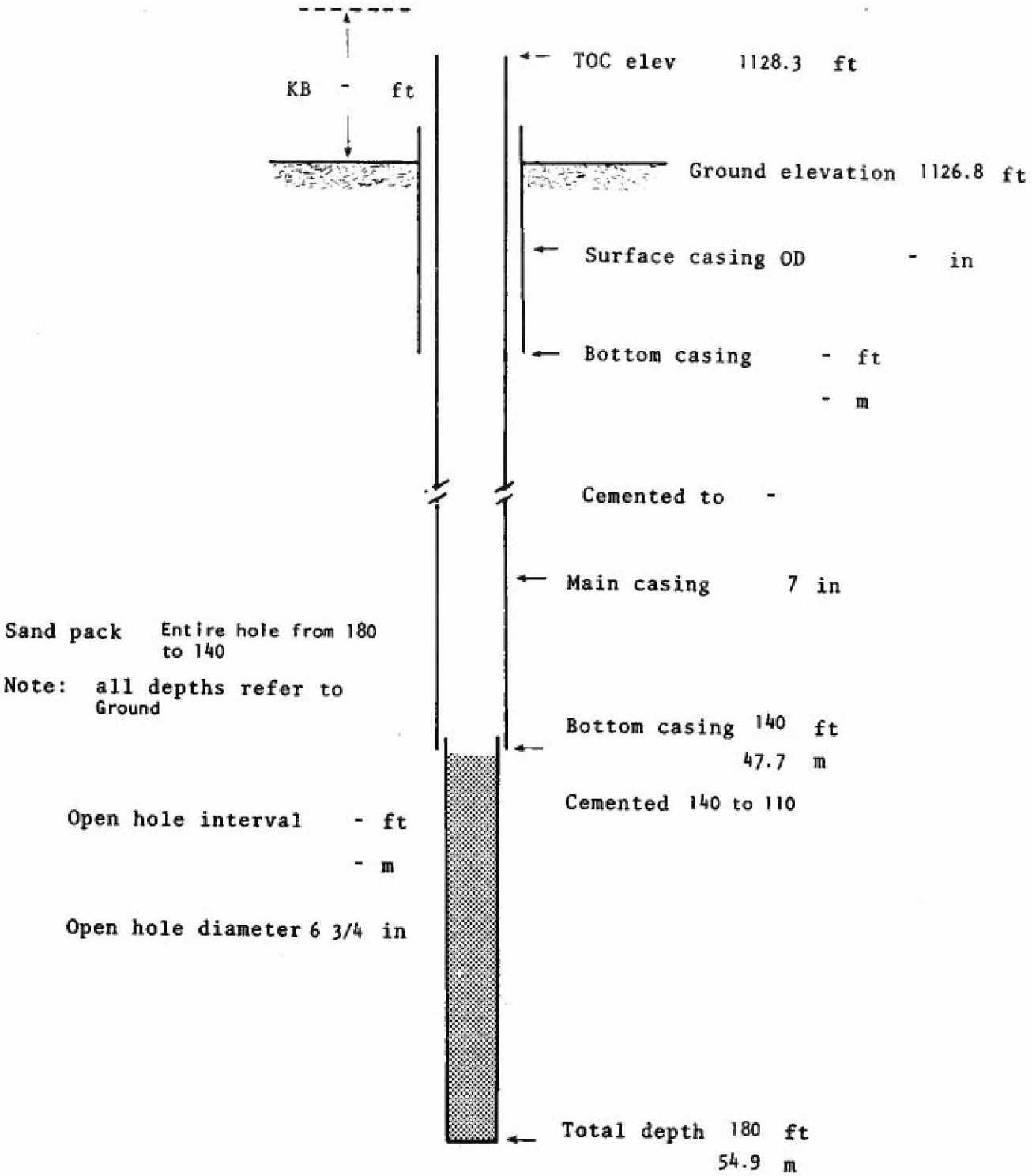
MP - Depth from measuring point
TOC - Depth from top of casing

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER BP - 4WA

Lsd 9 Sec 20 Tp 95 R 12 Mer 4

Alberta Research Council



## WATER ANALYSIS

OBSERVATION WELL NUMBER BP - 4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 11, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 165 | 8.23 | 20 |
| Magnesium ($Mg^{++}$) | 0 | 0 | 0 |
| Sodium ($Na^{+}$) | 713 | 31.01 | 77 |
| Potassium ($K^{+}$) | 42.1 | 1.08 | 3 |
| Carbonate ($CO_3^{=}$) | 132 | 4.40 | 10 |
| Bicarbonate ($HCO_3^{-}$) | 0 | 0 | 0 |
| Sulfate ($SO_4^{=}$) | 97 | 2.02 | 5 |
| Chloride ($Cl^{-}$) | 998 | 28.14 | 67 |
| Nitrate ($NO_3^{=}$) | 16 | 0.26 | 1 |
| Silica ($SiO_2$) | 15 | | |
| Hydroxide ($OH^{-}$) | 118 | 6.94 | 17 |
| Calcium (Acidified) | 232 | | |
| Magnesium (Acidified) | 6.4 | | |
| Total dissolved solids | 2822 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 41.76 | Total Cations (epm) | 40.32 |

Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | 7000 | |
| pH | 11.5 | |
| Fluoride ($F^{-}$) | 0.5 | ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | 3.0 | |
| pH | 12 | |
| Carbonate ($CO_3^{=}$) | 169 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 0 | ppm |
| Hydroxide ($OH^{-}$) | 279 | ppm |
| Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.7 | 0.13 | 0 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 1100.0 | 47.85 | 98 |
| Potassium ($K^{+}$) | 37.5 | 0.96 | 2 |
| Carbonate ($CO_3^{=}$) | 295.0 | 9.83 | 22 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 234.0 | 4.87 | 11 |
| Chloride ($Cl^{-}$) | 960.0 | 27.07 | 61 |
| Nitrate ($NO_3^{=}$) | 6.9 | 0.11 | 0 |
| Silica ($SiO_2$) | 18.0 | | |
| Hydroxide ($OH^{-}$) | 44.8 | 2.63 | 5.9 |
| Calcium (Acidified) | 7.7 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 3010 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 44.52 | Total Cations (epm) | 48.94 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 5400 | | Temperature (C) | 5.0 | |
| pH | 11.6 | | pH | 10.4 | |
| Fluoride ($F^{-}$) | 0.4 | Mg/L | Carbonate ($CO_3^{=}$) | 307 | Mg/L |
| | | | Bicarbonate ($HCO_3^{-}$) | | |
| | | | Hydroxide ($OH^{-}$) | 67 | Mg/L |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.7 | 0.13 | 0 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 1100.0 | 47.85 | 98 |
| Potassium ($K^{+}$) | 37.5 | 0.96 | 2 |
| Carbonate ($CO_3^{=}$) | 295.0 | 9.83 | 21 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 234.0 | 4.87 | 10 |
| Chloride ($Cl^{-}$) | 960.0 | 27.07 | 57 |
| Nitrate ($NO_3^{=}$) | 6.9 | 0.11 | 0 |
| Silica ($SiO_2$) | 18.0 | | |
| Hydroxide ($OH^{-}$) | 93.0 | 5.47 | 11 |
| Calcium (Acidified) | 7.7 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 3010 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 47.36 | Total Cations (epm) | 48.94 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 5400 | | Temperature (C) | 5.0 | |
| pH | 11.6 | | pH | 10.4 | |
| Fluoride ($F^{-}$) | 0.4 | Mg/L | Carbonate ($CO_3^{=}$) | 307 | Mg/L |
| | | | Bicarbonate ($HCO_3^{-}$) | | |
| | | | Hydroxide ($OH^{-}$) | 67 | Mg/L |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 6, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.5 | 0.12 | 0.3 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0.0 |
| Sodium ($Na^{+}$) | 938.0 | 40.80 | 97.7 |
| Potassium ($K^{+}$) | 32.1 | 0.82 | 2.0 |
| Carbonate ($CO_3^{=}$) | 341.0 | 11.37 | 27.1 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 268.0 | 5.58 | 13.3 |
| Chloride ($Cl^{-}$) | 554.0 | 15.62 | 37.2 |
| Nitrate ($NO_3^{=}$) | 4.0 | 0.06 | 0.2 |
| Silica ($SiO_2$) | 6.5 | | |
| Hydroxide ($OH^{-}$) | 159.0 | 9.35 | 22.3 |
| Calcium (Acidified) | 5.5 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 2334.0 | | |
| Total Anions (epm) | 41.98 | Total Cations (epm) | 41.75 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 6000 |
| pH | 11.8 |
| Fluoride ($F^{-}$) | 0.3 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 5.0 |
| pH | 12.1 |
| Carbonate ($CO_3^{=}$) | 293.0 ppm |
| Bicarbonate ($HCO_3^{-}$) | |
| Hydroxide ($OH^{-}$) | 186.0 ppm |
| Conductivity | |

WATER ANALYSIS

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Rge 12 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 06, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.7 | 0.08 | 0.4 |
| Magnesium(Mg) | 0.3 | 0.02 | 0.1 |
| Sodium(Na) | 481.0 | 20.92 | 96.9 |
| Potassium(K) | 22.1 | 0.57 | 2.6 |
| Carbonate(CO3) | 293.0 | 9.77 | 41.1 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 101.0 | 2.10 | 8.9 |
| Chloride(Cl) | 158.0 | 4.46 | 18.8 |
| Nitrate(NO3) | 1.1 | 0.02 | 0.1 |
| Silica(SiO2) | 7.1 | | |
| Hydroxide(OH) | 126.0 | 7.41 | 31.2 |
| Calcium(Acidified) | 1.4 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 1198.0 | | |
| Total Anions(epm) | 23.75 | Total Cations(epm) | 21.60 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2800 | Temperature(C) | 5.00 | |
| pH | 11.5 | pH | 12.1 | |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) | 245 | mg/l |
| | | Bicarbonate(HCO3) | | |
| | | Hydroxide(OH) | 154 | mg/l |

BP-4WA-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Rge 12 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 4, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 1.3 | 0.06 | 0.4 |
| Magnesium(Mg) | 0.1 | 0.01 | 0.1 |
| Sodium(Na) | 345.0 | 15.01 | 96.8 |
| Potassium(K) | 16.3 | 0.42 | 2.7 |
| Carbonate(CO3) | 242.0 | 8.07 | 50.1 |
| Bicarbonate(HCO3) | 0.0 | 0.00 | 0.0 |
| Sulphate(SO4) | 113.0 | 2.35 | 14.6 |
| Chloride(Cl) | 80.0 | 2.26 | 14.0 |
| Nitrate(NO3) | 0.7 | 0.01 | 0.1 |
| Silica(SiO2) | 8.1 | | |
| Hydroxide(OH) | 58.0 | 3.41 | 21.2 |
| Calcium(Acidified) | 3.0 | | |
| Magnesium(Acidified) | 0.1 | | |
| TDS(mg/l) | 882.0 | | |
| Total Anions(epm) | 16.10 | Total Cations(epm) | 15.50 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1860 | Temperature(C) | 6.50 | |
| pH | 11.3 | pH | 11.7 | |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) | 231 | mg/l |
| | | Bicarbonate(HCO3) | | |
| | | Hydroxide(OH) | 71 | mg/l |

WATER ANALYSIS

BP-4WA-E-82

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Rge 12 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3.2 | 0.16 | 1.1 |
| Magnesium(Mg) | 2.2 | 0.18 | 1.2 |
| Sodium(Na) | 331.0 | 14.39 | 94.5 |
| Potassium(K) | 19.0 | 0.49 | 3.2 |
| Carbonate(CO3) | 137.0 | 4.57 | 32.6 |
| Bicarbonate(HCO3) | 264.0 | 4.33 | 30.9 |
| Sulphate(SO4) | 7.5 | 0.16 | 1.1 |
| Chloride(Cl) | 176.0 | 4.96 | 35.4 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 2.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | | | |
| Magnesium(Acidified) | | | |
| TDS(mg/l) | 1032.0 | | |
| Total Anions(epm) | 14.01 | Total Cations(epm) | 15.22 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1500 | Temperature | 5.00 | |
| pH | 9.4 | pH | 11.1 | |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | 302 | mg/l |
| | | Bicarbonate(HCO3) | 44 | mg/l |
| | | Hydroxide(OH) | | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER BP - 4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

Alberta Research Council

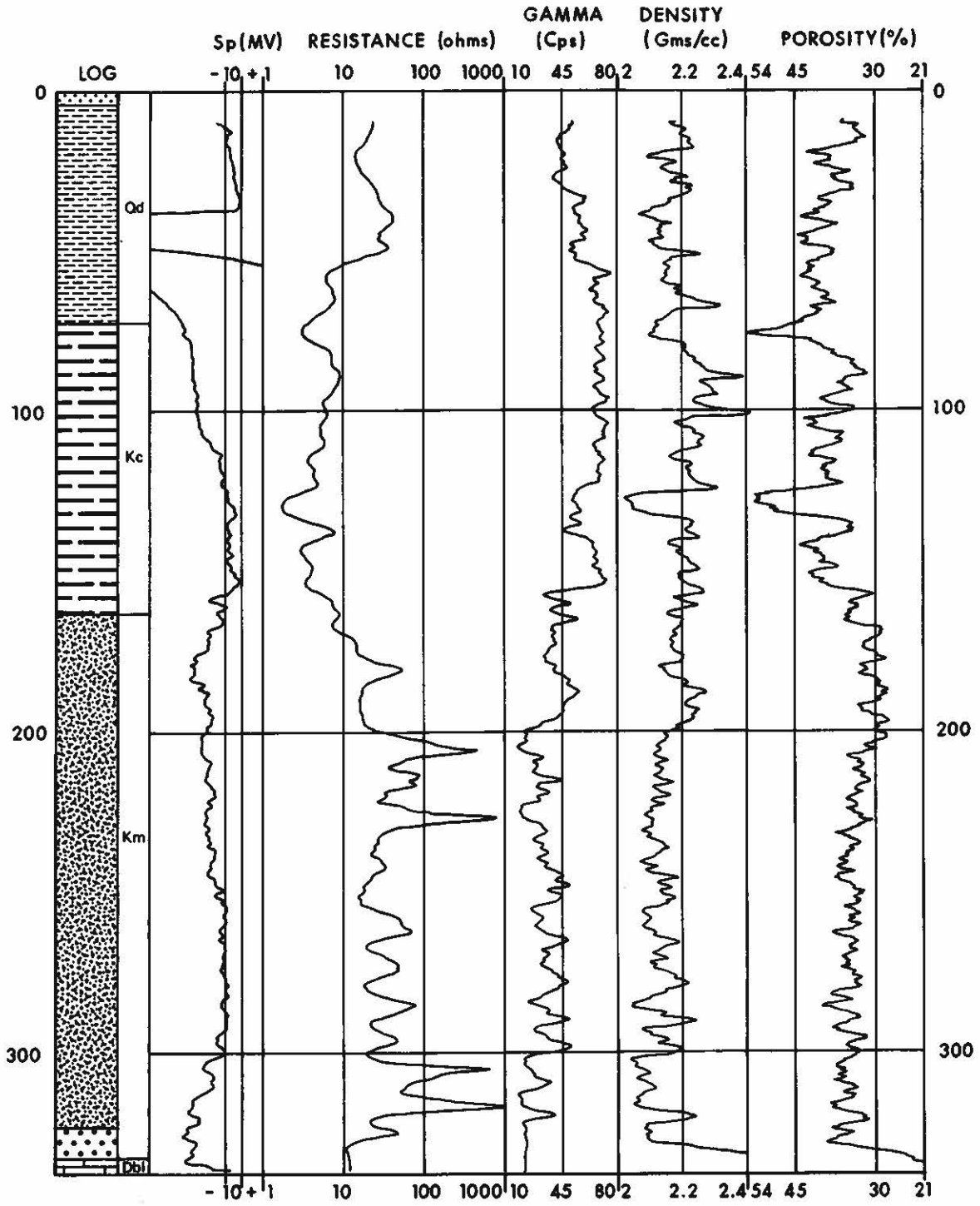
Ground elevation 1126.8 Total depth 180

KB elevation

Depths refer to ground level

| Interval from | to | Description | Formation |
|---|---|---|---|
| 0 | 4 | Silt, sandy, light brown | Drift |
| 4 | 12 | Clay, (till) silty, sandy, light brown to grey, fragments and pebbles of quartz and limestone | |
| 12 | 40 | Clay, silty, sandy, grey, with rock fragments, pebbles and boulders | |
| 40 | 47 | Clay, sandy, silty, dark grey, some fine gravel | |
| 47 | 65 | Clay, sandy, silty, dark grey, angular to rounded fine gravel | |
| 65 | 72 | Clay, silty, traces of sand, rock fragments | |
| 72 | 80 | Shale, (clay) silty, dark grey, weathered | Clearwater |
| 80 | 140 | Shale, dark grey, thinly laminated fresh | |
| 140 | 157 | Shale, dark grey, silty, fine sandy layers | |
| 157 | 159 | Shale, dark grey to black, interbedded siltstone and fine grained sandstone | |
| 159 | 163 | Shale, silty, dark grey, traces of bitumen | |
| 163 | 180 | Tar sand, (sandstone) silty, dark grey, fine grained, oil-bearing | McMurray |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE BP-4WA
## 9-20-95-12-W4
## ALBERTA RESEACH COUNCIL

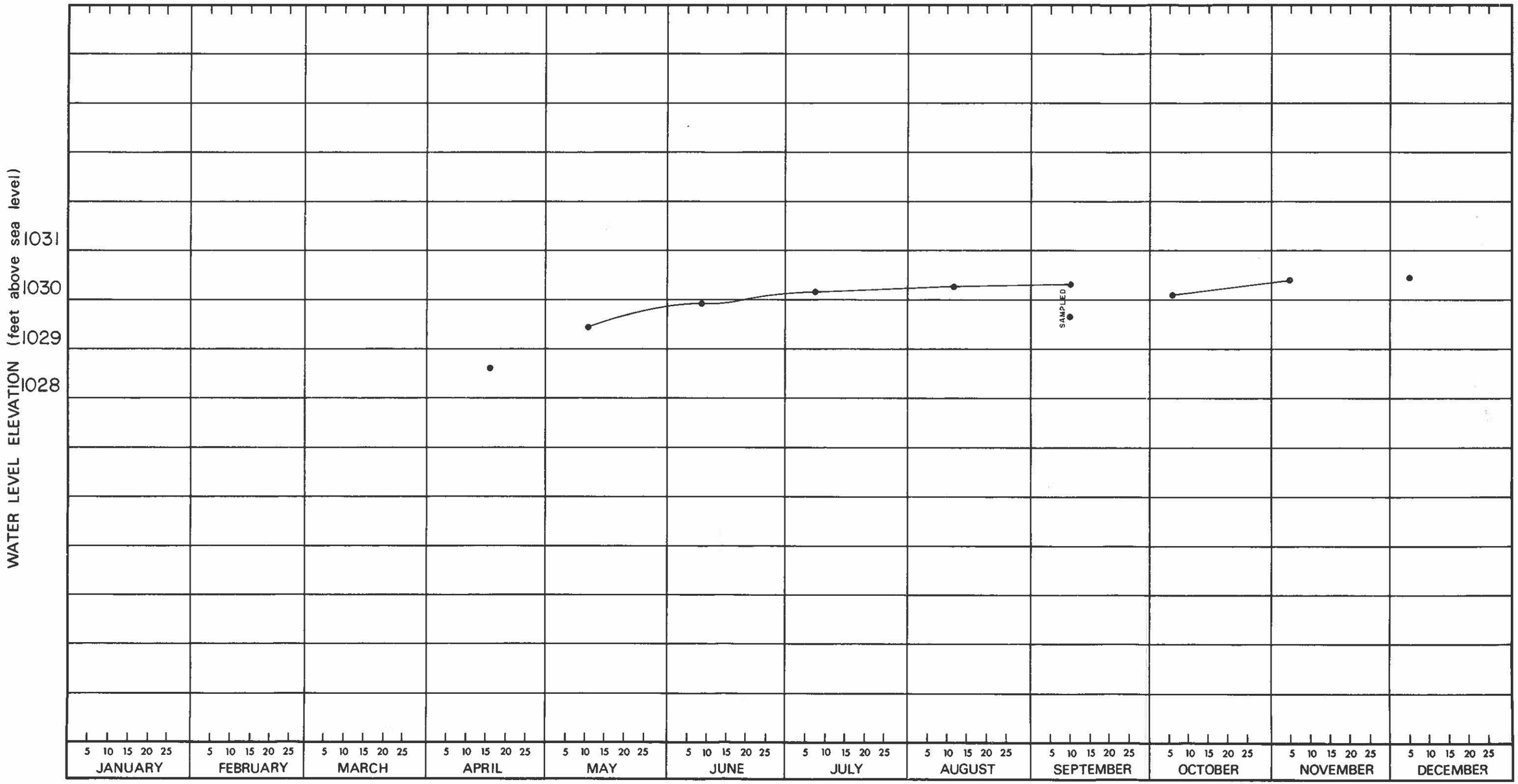


## WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP - 4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

BP-4WA-H-77



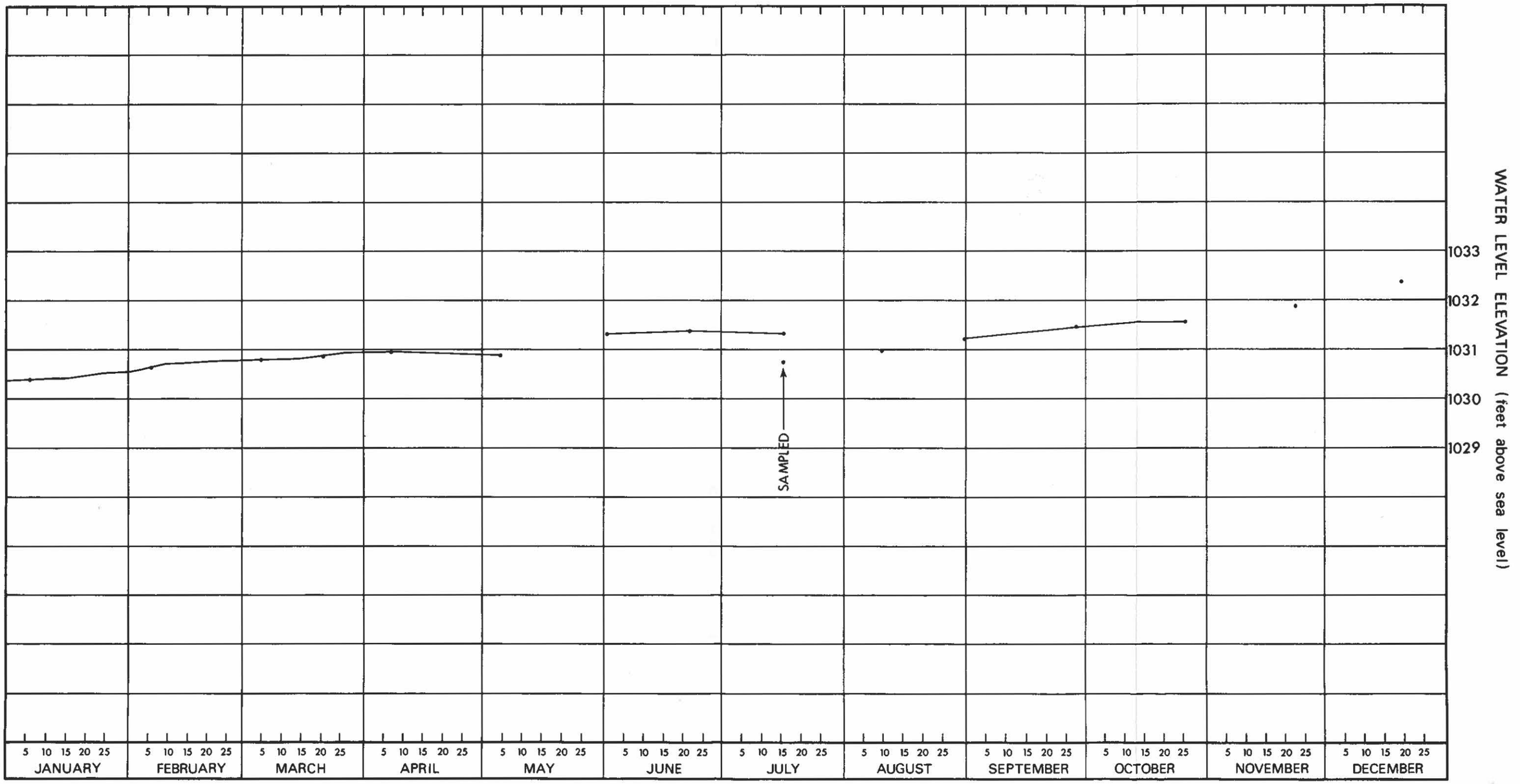
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

Alberta Research Council

BP-4WA-H-77




1976

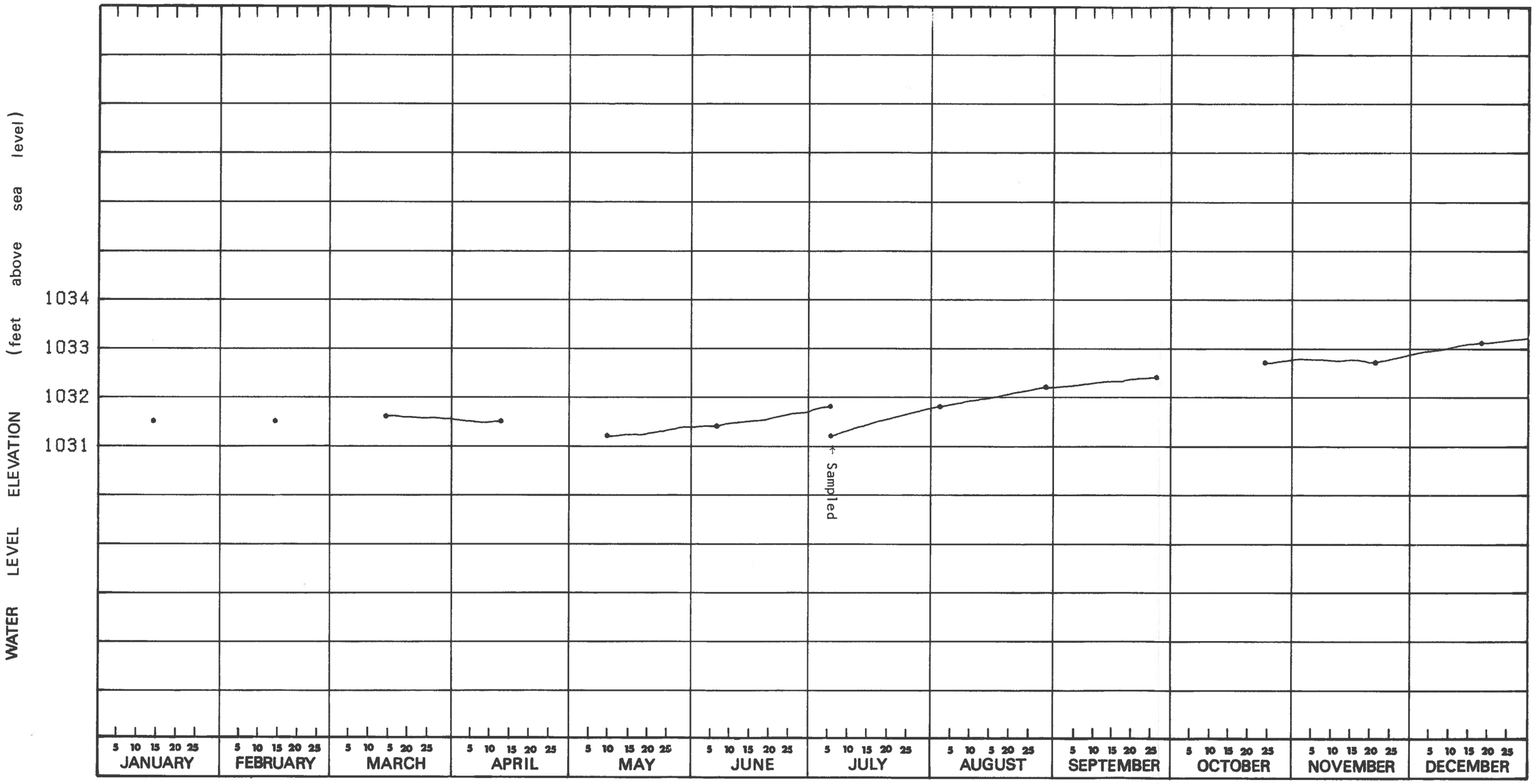
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-4WA

BP-4WA-H-78

Lsd 9 Sec 20 Twp 95 R 12 W4 th

Alberta Research Council




1977

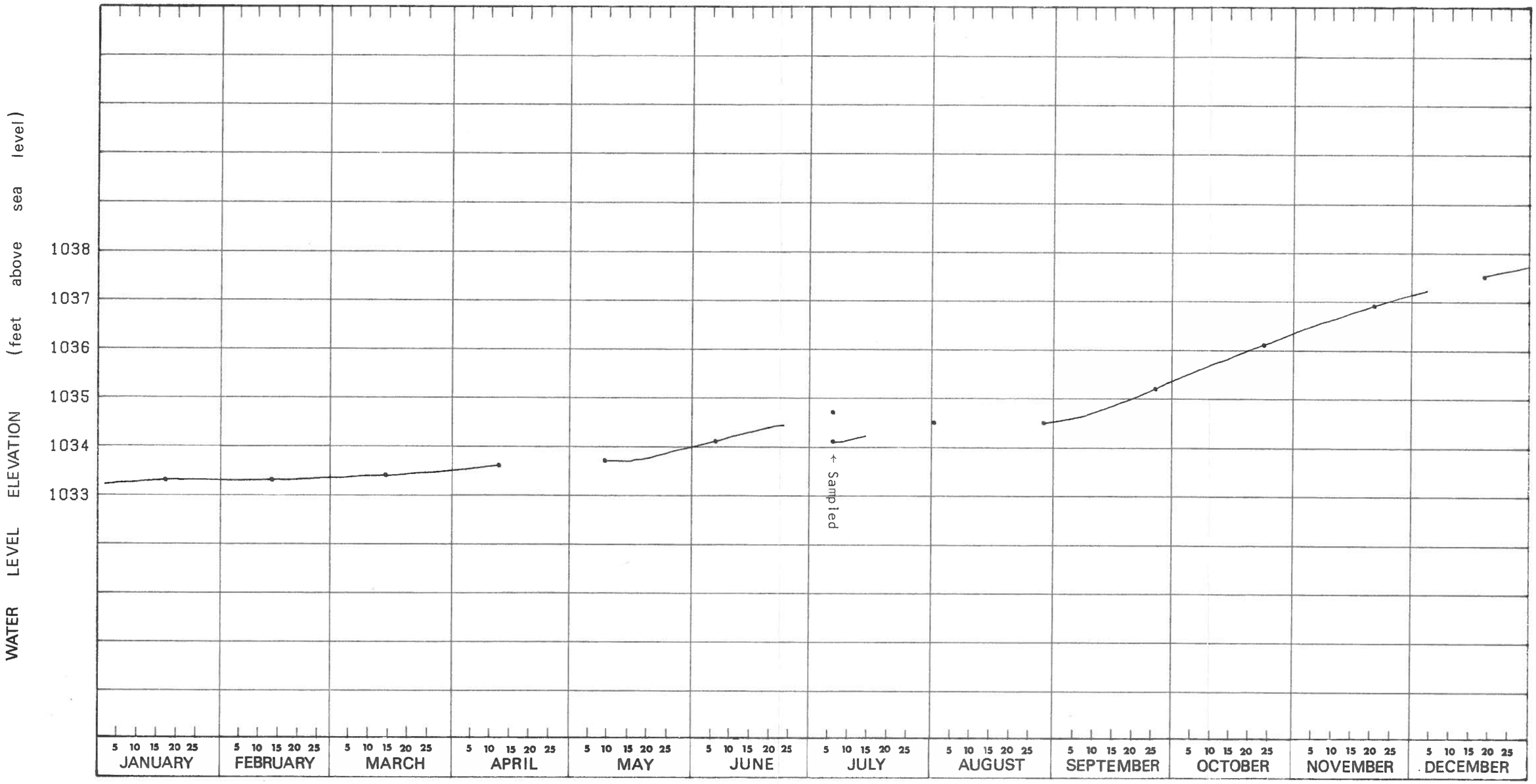
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-4WA

LSD 9 SEC 20 TWP 95 R 12 W 4TH

Alberta Research Council

BP-4WA-H-79



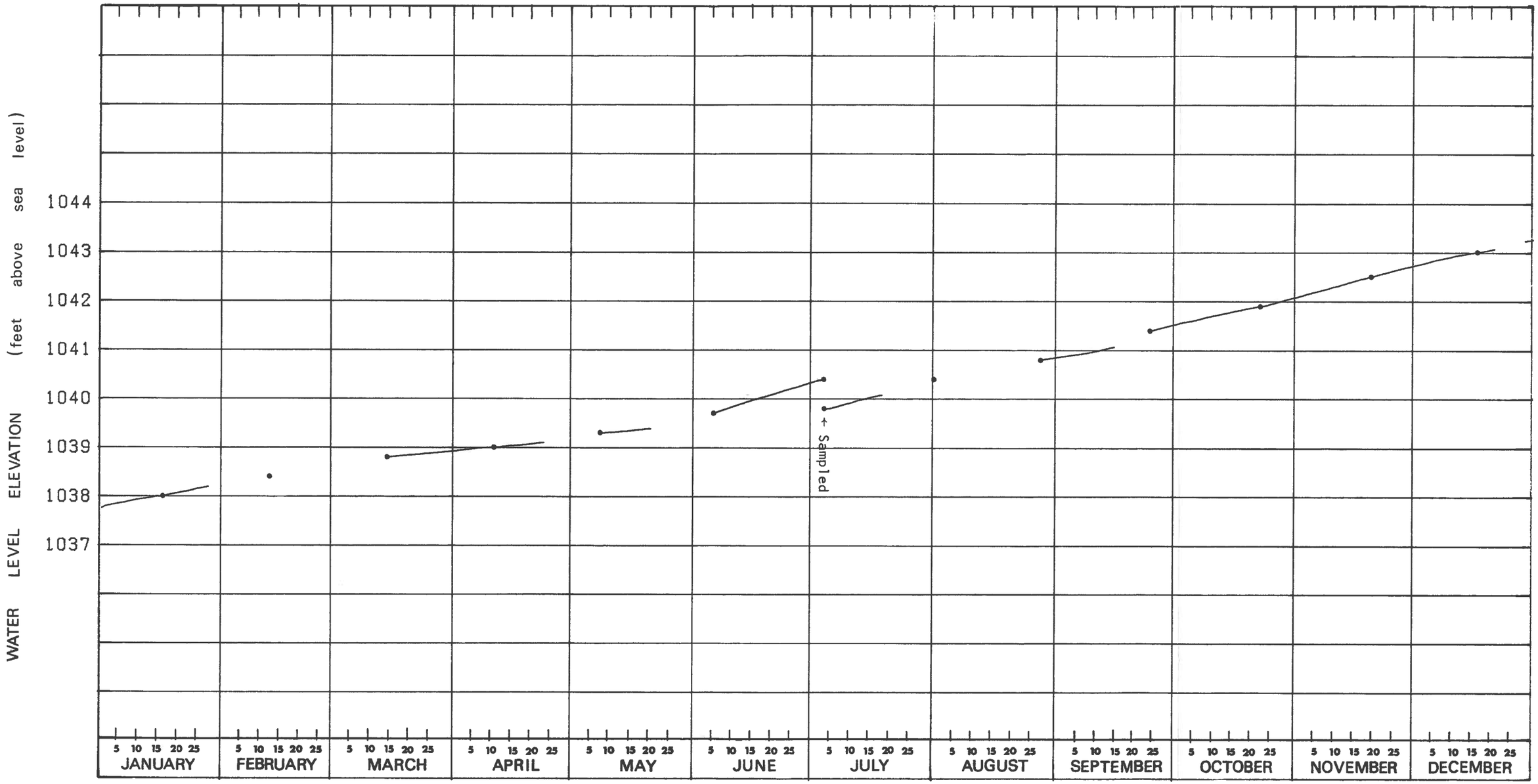
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Twp 95 R 12 W4 th

Alberta Research Council

BP-4WA-H-80



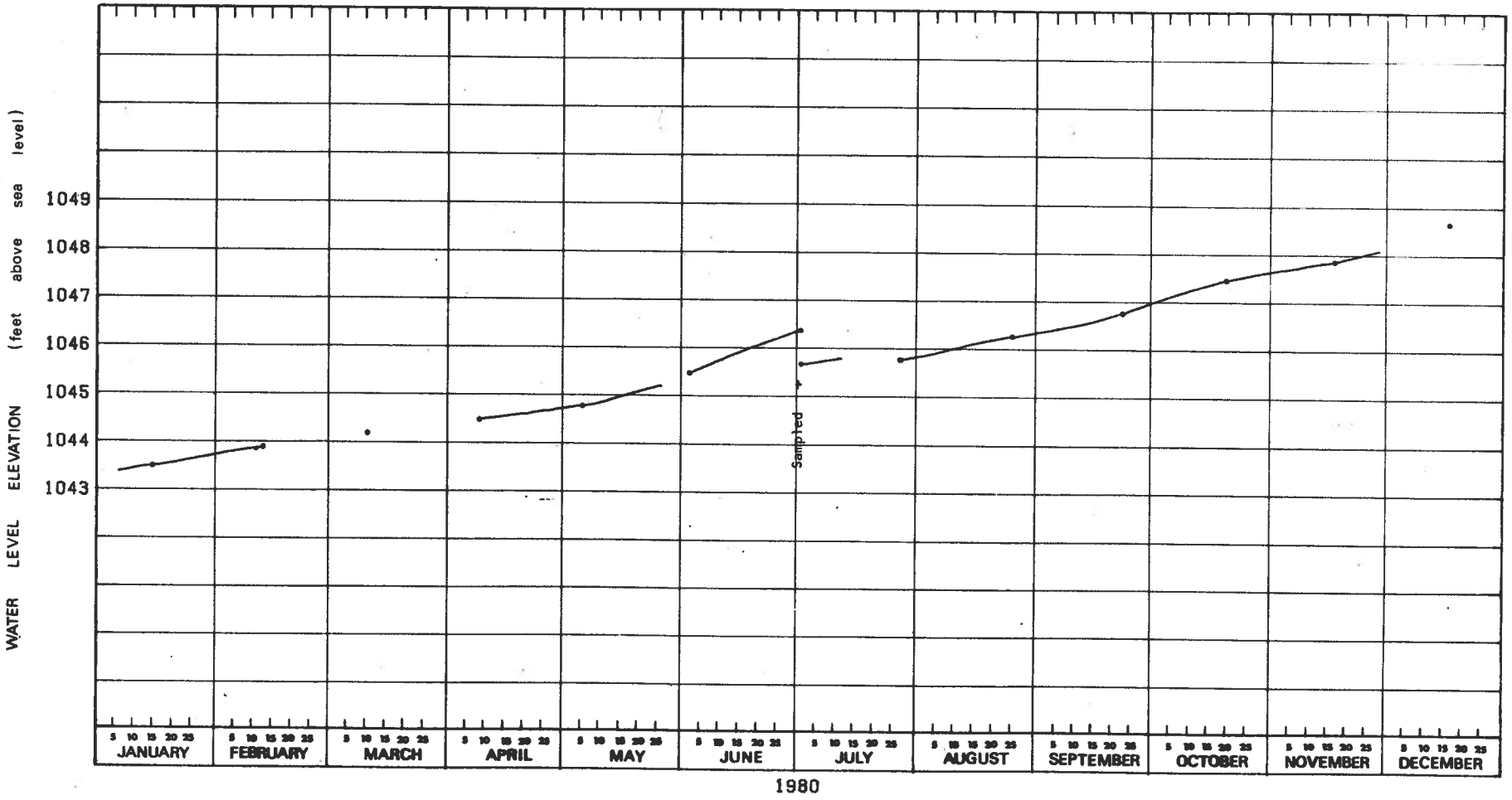
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-4HA

Lsd 9 Sec 20 Twp 95 R 12 W4 th

Alberta Research Council

BP-4HA-H-81



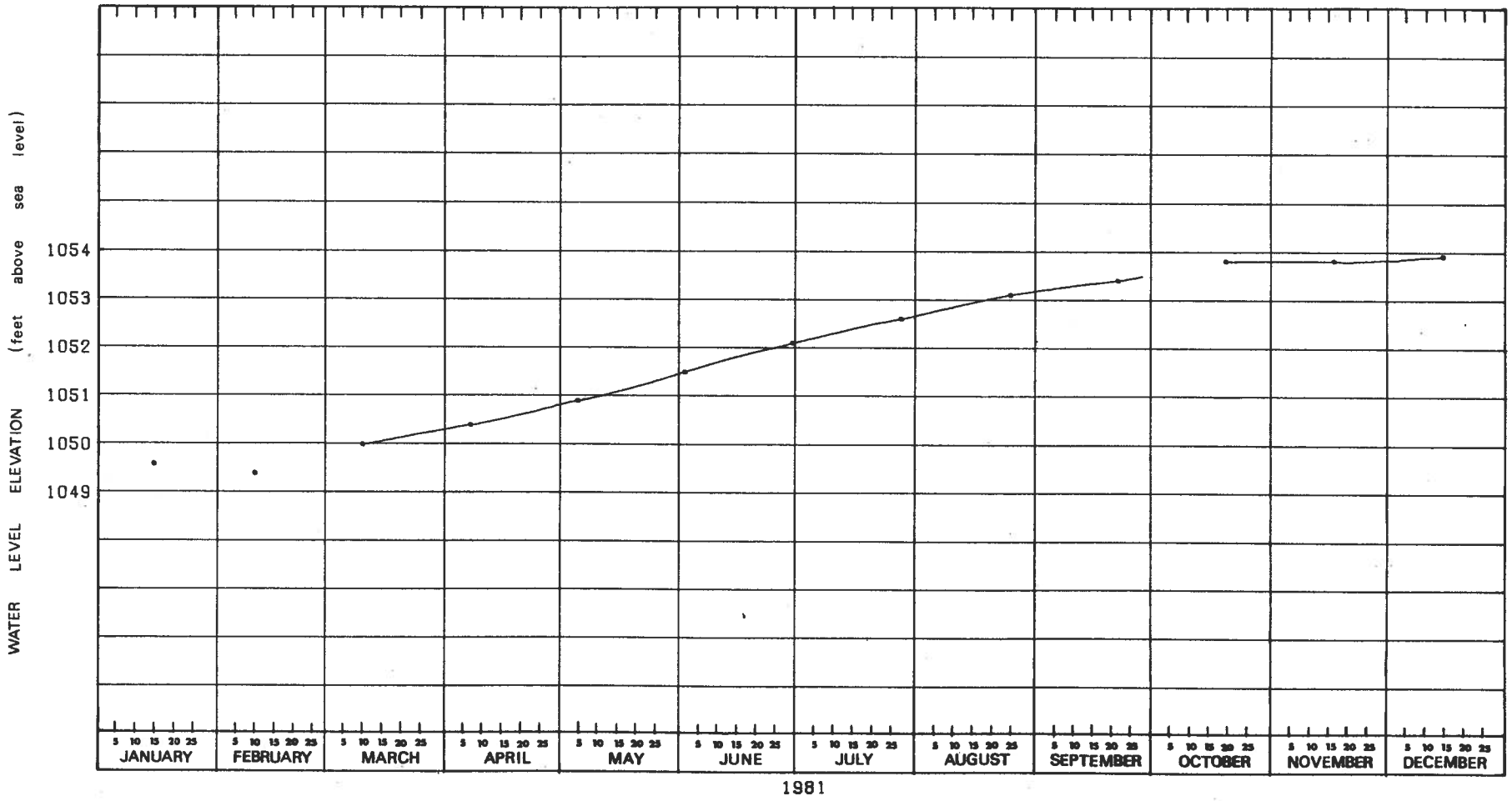
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Tw. 95 R 12 W4 th

Alberta Research Council

BP-4WA-H-82



## WELL HISTORY

OBSERVATION WELL NUMBER BP - 4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1128.3

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar 19/75 | | | Well completed |
| Mar 20/75 | 31.39 TOC | 1025.3 | |
| Apr 17/75 | 30.44 TOC | 1028.5 | |
| May 12/75 | 31.09 MP | 1029.7 | MP = 3.38' TOC, (1131.7) |
| June 10/75 | 31.06 MP | 1029.8 | |
| July 9/75 | 30.98 MP | 1030.1 | |
| Aug 13/75 | 30.93 MP | 1030.2 | |
| Sept 11/75 | 30.91 MP | 1030.3 | |
| | 31.11 MP | 1029.7 | After sample; temp. 3°C |
| Oct 7/75 | 30.98 MP | 1030.1 | |
| Nov 6/75 | 30.88 MP | 1030.4 | |
| Dec 6/75 | 30.87 MP | 1030.4 | |
| Jan 6/76 | 30.87 MP | 1030.4 | |
| Feb 6/76 | 30.79 MP | 1030.7 | |
| Mar 5/76 | 30.75 MP | 1030.8 | |
| Apr 7/76 | 30.70 MP | 1031.0 | |
| May 5/76 | 30.72 MP | 1030.9 | |
| June 1/76 | 30.59 MP | 1031.4 | |
| June 22/76 | 30.57 MP | 1031.4 | |
| July 16/76 | 30.59 MP | 1031.4 | |
| | 30.77 MP | 1030.8 | After sample; temp. 5°C |
| Aug 10/76 | 30.69 MP | 1031.0 | |
| Aug 31/76 | 30.62 MP | 1031.3 | |
| Sept 28/76 | 30.55 MP | 1031.5 | |
| Oct 26/76 | 30.51 MP | 1031.6 | |
| Nov 23/76 | 30.44 MP | 1031.9 | |
| Dec 20/76 | 30.28 MP | 1032.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1128.3

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 30.56 MP | 1031.5 | MP (1131.7) |
| Feb 15/77 | 30.56 MP | 1031.5 | |
| Mar 15/77 | 30.52 MP | 1031.6 | |
| Apr 13/77 | 30.54 MP | 1031.5 | |
| May 10/77 | 30.64 MP | 1031.2 | |
| June 7/77 | 30.57 MP | 1031.4 | |
| July 6/77 | 30.45 MP | 1031.8 | |
| | 30.65 MP | 1031.2 | After sample; temp. 5°C |
| Aug 3/77 | 30.44 MP | 1031.8 | |
| Aug 30/77 | 30.33 MP | 1032.2 | |
| Sept 27/77 | 30.27 MP | 1032.4 | |
| Oct 25/77 | 30.19 MP | 1032.7 | |
| Nov 22/77 | 30.18 MP | 1032.7 | |
| Dec 19/77 | 30.07 MP | 1033.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1128.3

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/78 | 30.01 MP | 1033.3 | MP (1131.7) |
| Feb 13/78 | 29.99 MP | 1033.3 | |
| Mar 14/78 | 29.96 MP | 1033.4 | |
| Apr 12/78 | 29.91 MP | 1033.6 | |
| May 9/78 | 29.89 MP | 1033.7 | |
| June 6/78 | 29.74 MP | 1034.1 | |
| July 6/78 | 29.56 MP | 1034.7 | |
| | 29.76 MP | 1034.1 | After sample; temp 5°C |
| Aug 1/78 | 29.64 MP | 1034.5 | |
| Aug 29/78 | 29.39 MP | 1034.5 | MP = 0.79m TOC (1130.9) |
| Sept 26/78 | 29.17 MP | 1035.2 | |
| Oct 24/78 | 28.90 MP | 1036.1 | |
| Nov 21/78 | 28.67 MP | 1036.9 | |
| Dec 19/78 | 28.48 MP | 1037.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER BP-4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1128.3

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/79 | 28.32 MP | 1038.0 | MP (1130.9) |
| Feb 13/79 | 28.21 MP | 1038.4 | |
| Mar 15/79 | 28.09 MP | 1038.8 | |
| Apr 11/79 | 28.03 MP | 1039.0 | |
| May 8/79 | 27.93 MP | 1039.3 | |
| June 6/79 | 27.80 MP | 1039.7 | |
| July 4/79 | 27.58 MP | 1040.4 | |
| | 27.78 MP | 1039.8 | After sample; temp. 6.5°C |
| Aug 1/79 | 27.58 MP | 1040.4 | |
| Aug 28/79 | 27.46 MP | 1040.8 | |
| Sept 25/79 | 27.30 MP | 1041.4 | |
| Oct 23/79 | 27.13 MP | 1041.9 | |
| Nov 20/79 | 26.95 MP | 1042.5 | |
| Dec 17/79 | 26.79 MP | 1043.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER BP - 4WA

Lsd 9 Sec 20 Twp 95 R 12 W4th

Alberta Research Council

Elevation of top of casing 1128.3

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 26.64 MP | 1043.5 | |
| Feb 13/80 | 26.53 MP | 1043.9 | |
| Mar 11/80 | 26.43 MP | 1044.2 | |
| Apr 9/80 | 26.34 MP | 1044.5 | |
| May 6/80 | 26.24 MP | 1044.8 | |
| June 3/80 | 26.05 MP | 1045.5 | |
| July 2/80 | 25.76 MP | 1046.4 | Temp. 5°C |
| | 25.98 MP | 1045.7 | After Sample |
| July 28/80 | 25.95 MP | 1045.8 | |
| Aug 26/80 | 25.79 MP | 1046.3 | |
| Sept 24/80 | 25.64 MP | 1046.8 | |
| Oct 21/80 | 25.43 MP | 1047.5 | |
| Nov 18/80 | 25.32 MP | 1047.9 | |
| Dec 18/80 | 25.06 MP | 1048.7 | |
| Jan 15/81 | 24.80 MP | 1049.6 | |
| Feb 10/81 | 24.84 MP | 1049.4 | |
| Mar 10/81 | 24.65 MP | 1050.0 | |
| Apr 7/81 | 24.53 MP | 1050.4 | |
| May 5/81 | 24.39 MP | 1050.9 | |
| June 2/81 | 24.21 MP | 1051.5 | |
| June 30/81 | 24.03 MP | 1052.1 | |
| July 28/81 | 23.88 MP | 1052.6 | |
| Aug 25/81 | 23.73 MP | 1053.1 | |
| Sept 22/81 | 23.64 MP | 1053.4 | |
| Oct 20/81 | 23.52 MP | 1053.8 | |
| Nov 17/81 | 23.50 MP | 1053.8 | |
| Dec 15/81 | 23.48 MP | 1053.9 | |

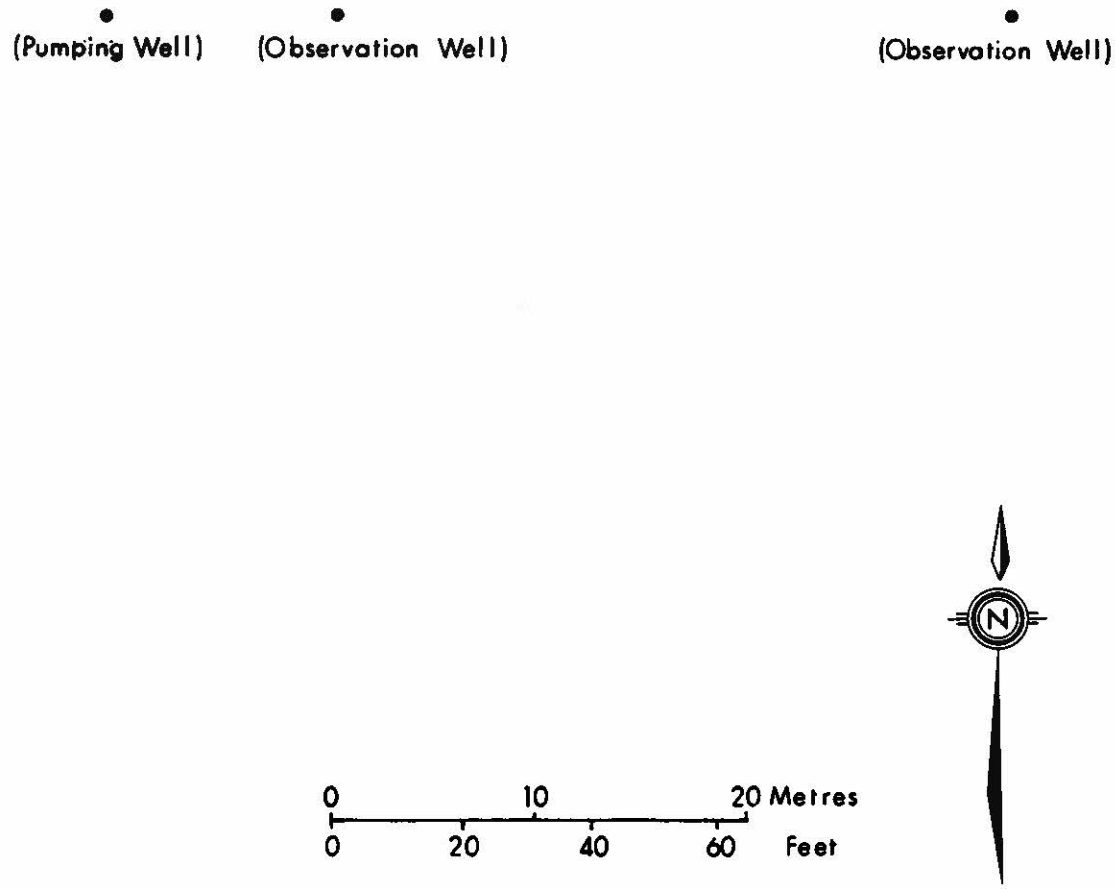
MP - Depth from measuring point
TOC - Depth from top of casing

# OBSERVATION WELL NUMBER FINA 73-6

9 9 96 10 W4th

ALBERTA RESEARCH COUNCIL

## WELL SITE DETAIL

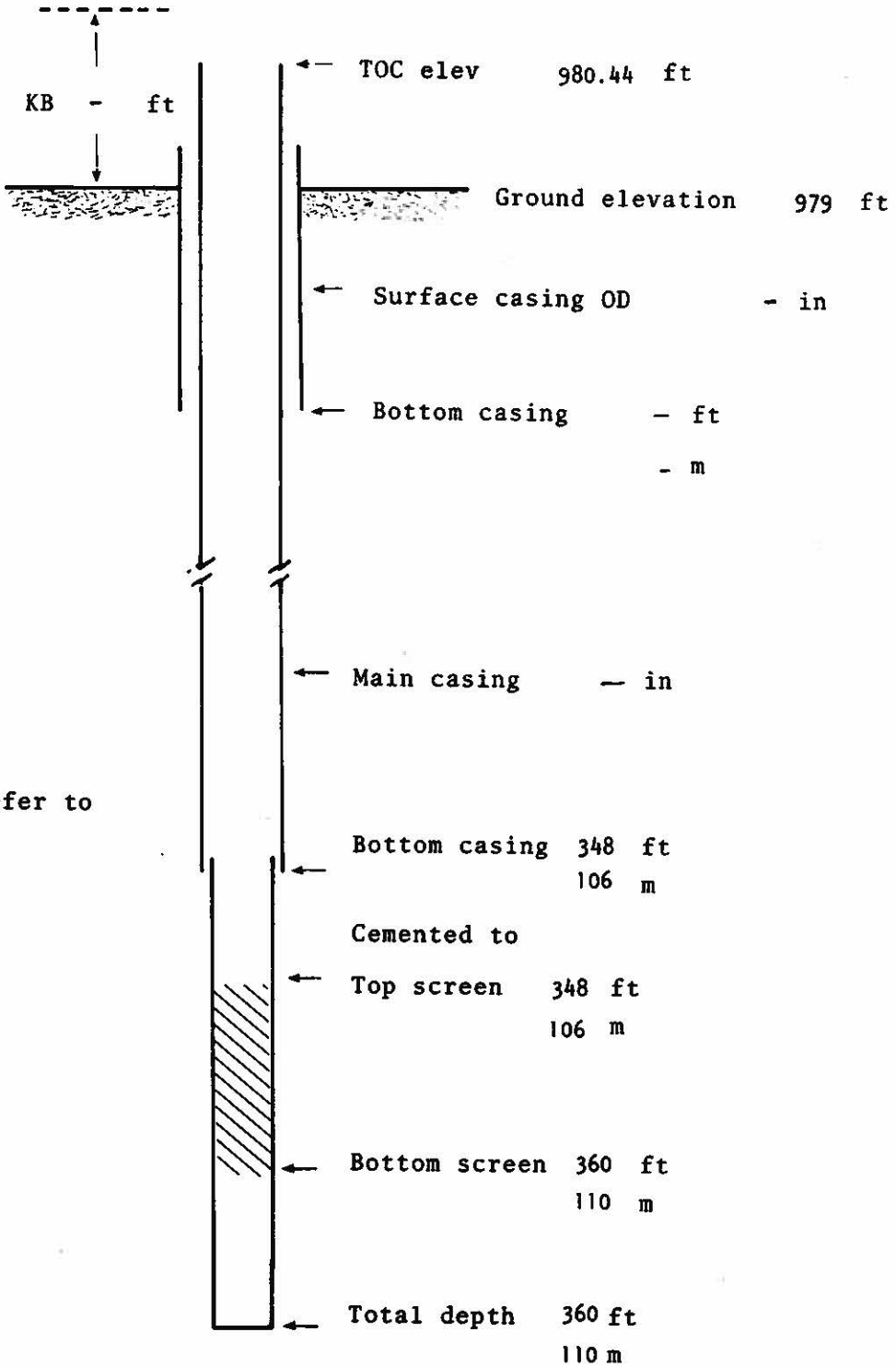


## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Tp 96 R 10 Mer 4th

Alberta Research Council




Note: all depths refer to ground

N.B. This well was designated as the pumping well during test of March 23/74

# GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Ground elevation 979 Total depth 483

KB elevation

| Interval from | to | Description | Formation |
|---|---|---|---|
| 0 | 45 | Not logged | |
| 45 | 68 | Oilsand, very good bitumen, fine grained, some clay | |
| 68 | 78 | Oilsand, good bitumen, fine grained, some clay | |
| 78 | 88 | Oilsand, excellent bitumen, fine grained | |
| 88 | 96 | Oilsand, good bitumen, fine grained, some clay | |
| 96 | 100 | Water sand | |
| 100 | 127 | Oilsand, excellent bitumen, fine grained | |
| 127 | 158 | Oilsand, medium grained, good bitumen | |
| 158 | 166 | Oilsand, fair bitumen, medium grained, some clay | |
| 166 | 171 | Oilsand, excellent bitumen, medium grained | |
| 171 | 181 | 50% oilsand, fair bitumen & 50% dark clay | |
| 181 | 186 | Oilsand, fair bitumen, medium grained, some clay | |
| 186 | 195 | Dark clay, patches of bitumen | |
| 195 | 209 | Grey clay | |
| 209 | 224 | Oilsand, fine grained, moderate bitumen | |
| 224 | 254 | Oilsand, good bitumen, medium grained, traces of dark clay | |
| 254 | 270 | Oilsand, fair bitumen, medium grained, patches of dark clay | |
| 270 | 282 | Grey clay | |
| 282 | 287 | Silt with trace bitumen | |
| 287 | 306 | Grey-green clay | |
| 306 | 331 | Grey clay | |
| 331 | 336 | Grey clay & silt | |
| 336 | 428 | Water sand | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

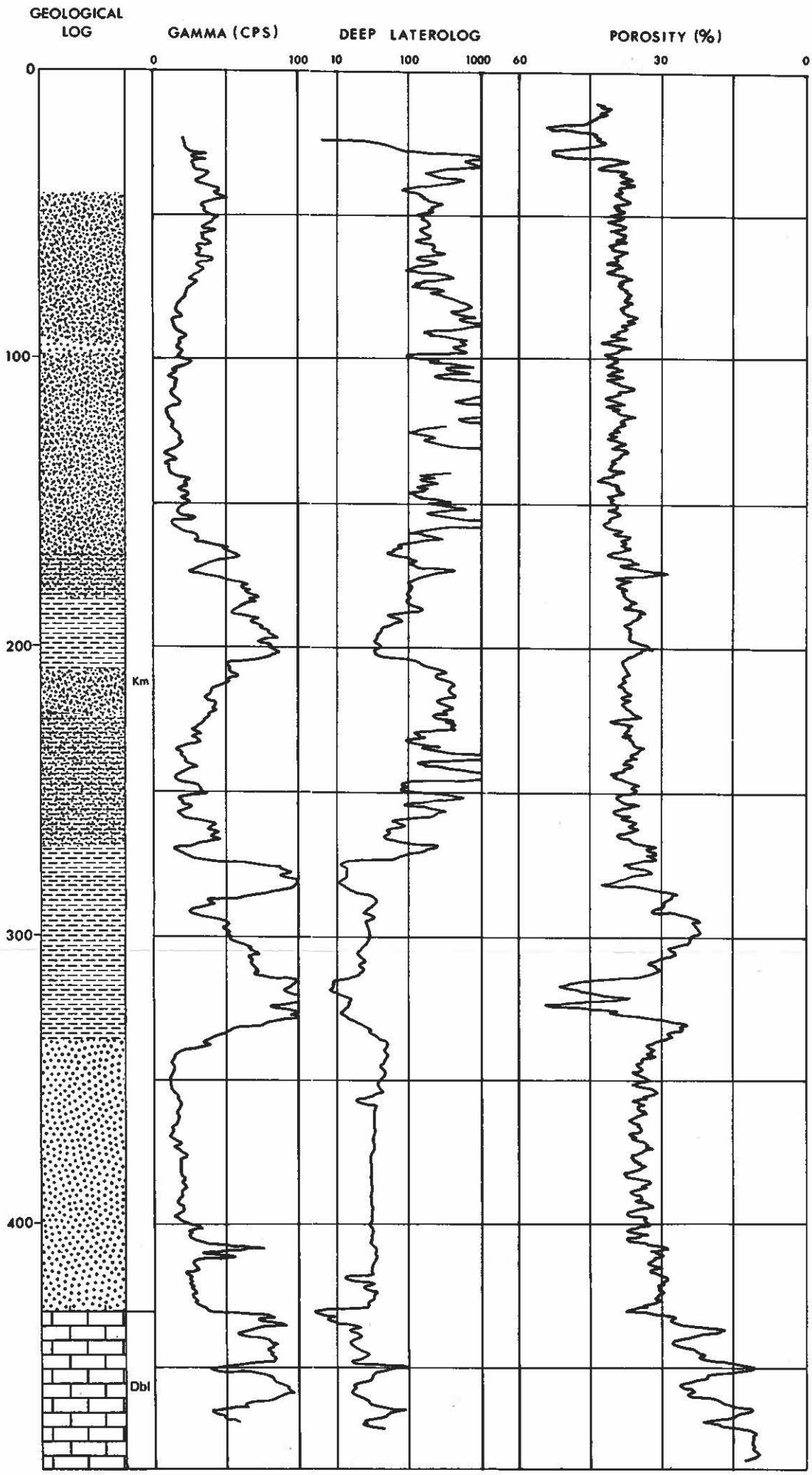
Alberta Research Council

Ground elevation Total depth

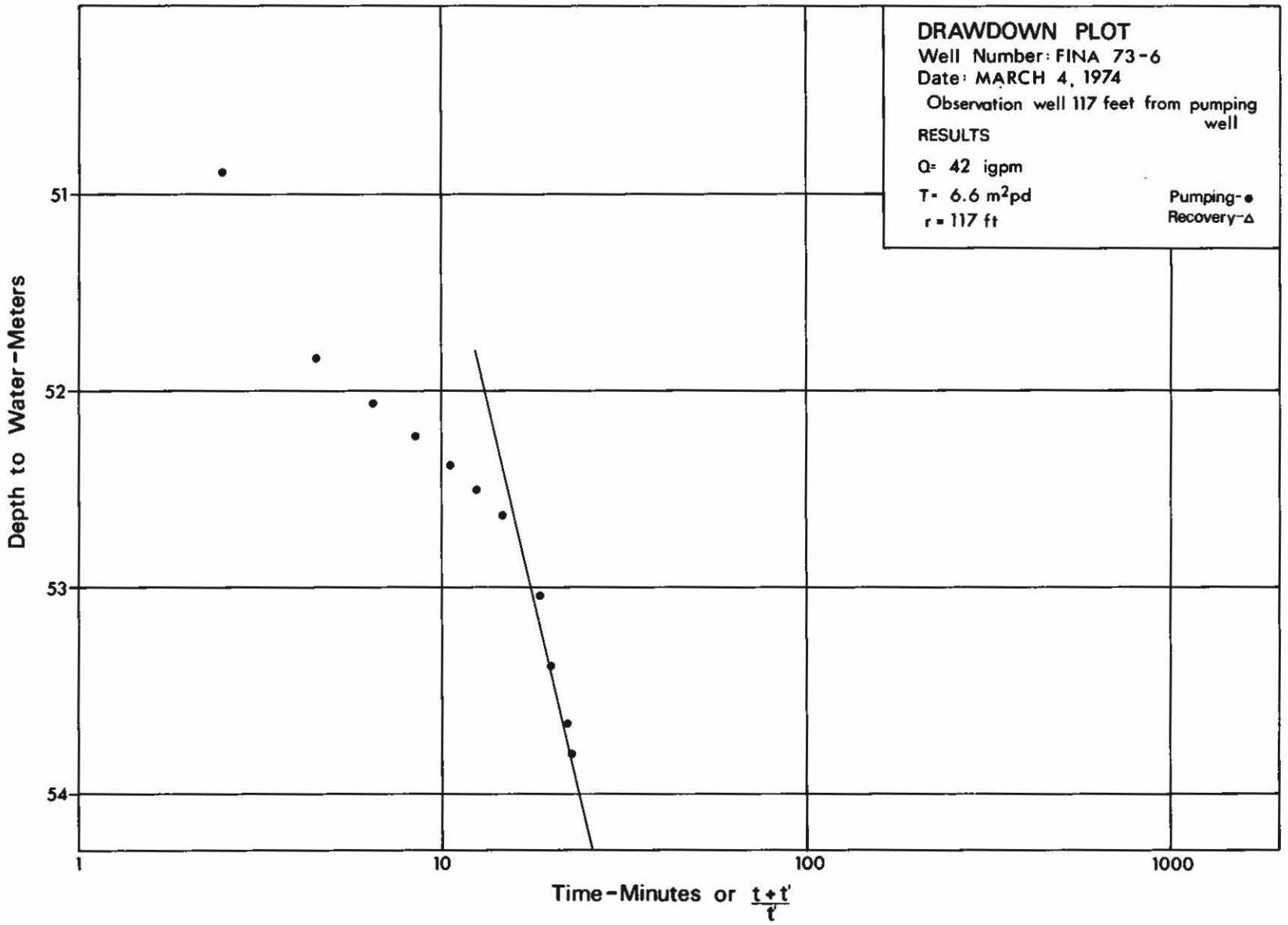
KB elevation

| Interval from | to | Description | Formation |
|---|---|---|---|
| 428 | 458 | Limestone, very argillaceous, tight | |
| 458 | 467 | Limestone, becoming harder, less argillaceous, trace pyrite | |
| 467 | 483 | Limestone, argillaceous, tight | |

GEOPHYSICAL AND GEOLOGICAL LC
OBSERVATION WELL SITE FINA 73-6
9-9-96-10-W4 th
ALBERTA RESEARCH COUNCIL




FINA 73-6-G-77


DRAWDOWN PLOT
Well Number: FINA 73-6
Date: MARCH 4, 1974
Observation well 117 feet from pumping well
RESULTS
Q= 42 igpm
T= 6.6 m²pd
r = 117 ft
Pumping-●
Recovery-△
Depth to Water-Meters
51
52
53
54
1
10
100
1000
Time-Minutes or (t+t')/t'

FINA 73-6-A-77

DRAWDOWN PLOT
Well Number: FINA 73-6
Date: March 23/24, 1974

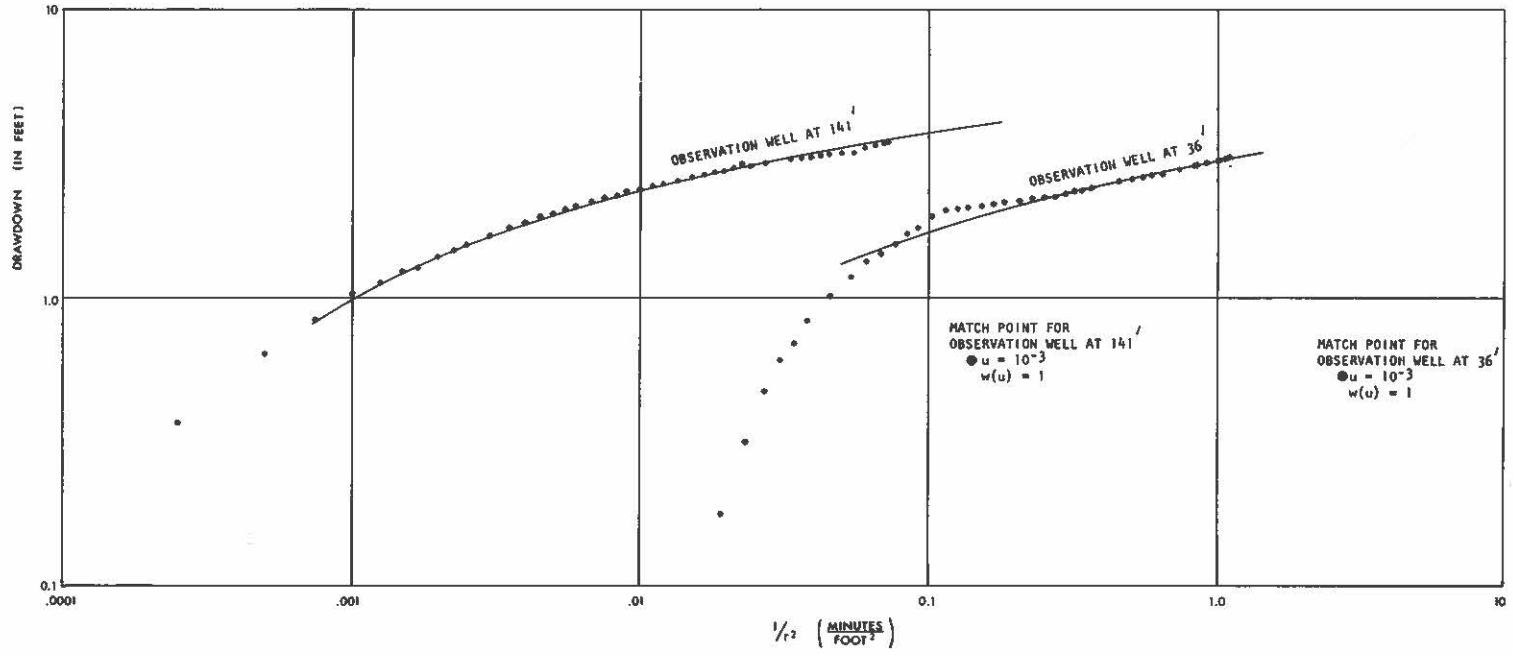
- - - - - - - - - - - - - - - -

RESULTS

Q = 47 IGPM

T = 134 $M^2$/DAY (141' well)
150 $M^2$/DAY (36' well)

Storage coefficient = 0.0007 (141' well)
= 0.0120 (36' well)




FINA 73-6-A-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Sample source Pump test on FINA 73-6 @ 3 hours

Date sampled March 23/74

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 49.9 | 2.49 | 7.5 |
| Magnesium ($Mg^{++}$) | 27.0 | 2.22 | 6.7 |
| Sodium ($Na^{+}$) | 631 | 27.44 | 83.2 |
| Potassium ($K^{+}$) | 33 | 0.84 | 2.6 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1139.9 | 18.68 | 56.4 |
| Sulfate ($SO_4^{=}$) | 16.0 | 0.33 | 1.0 |
| Chloride ($Cl^{-}$) | 500 | 14.10 | 42.6 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0 | 0 |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1828 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 33.12 | Total Cations (epm) | 32.99 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | 3.8 |
| pH | 7.7 | pH | |
| Fluoride ($F^{-}$) | 1.3 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | 2700 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Sample source Test on FINA 73-6 @ 22 hours

Date sampled Mar 24/74

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 48.7 | 2.43 | 7.4 |
| Magnesium ($Mg^{++}$) | 27.0 | 2.22 | 6.7 |
| Sodium ($Na^{+}$) | 631 | 27.44 | 83.3 |
| Potassium ($K^{+}$) | 33.0 | 0.84 | 2.6 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1144.7 | 18.76 | 56.8 |
| Sulfate ($SO_4^{=}$) | 19.0 | 0.40 | 1.2 |
| Chloride ($Cl^{-}$) | 492 | 13.88 | 42.0 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0 | 0 |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 1748 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 33.04 | Total Cations (epm) | 32.93 |

### Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | 4.0 |
| pH | 7.6 | pH | |
| Fluoride ($F^{-}$) | 1.2 | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | 3300 |

## WATER ANALYSIS

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 11, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 12 | 0.60 | 2 |
| Magnesium ($Mg^{++}$) | 21.6 | 1.78 | 6 |
| Sodium ($Na^{+}$) | 613 | 26.66 | 91 |
| Potassium ($K^{+}$) | 13.8 | 0.35 | 1 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1037 | 17.00 | 54 |
| Sulfate ($SO_4^{=}$) | 5 | 0.10 | 0 |
| Chloride ($Cl^{-}$) | 518 | 14.61 | 46 |
| Nitrate ($NO_3^{=}$) | 1.5 | 0.02 | 0 |
| Silica ($SiO_2$) | 3.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 16 | | |
| Magnesium (Acidified) | 22.2 | | |
| Total dissolved solids | 1708 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 31.73 | Total Cations (epm) | 29.39 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 3400 |
| pH | 7.9 |
| Fluoride ($F^{-}$) | 1.1 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 3.0 |
| pH | 8.8 |
| Carbonate ($CO_3^{=}$) | 72 ppm |
| Bicarbonate ($HCO_3^{-}$) | 936 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 6.8 | 0.34 | 1 |
| Magnesium ($Mg^{++}$) | 18.1 | 1.49 | 4 |
| Sodium ($Na^{+}$) | 713.0 | 31.01 | 93 |
| Potassium ($K^{+}$) | 14.6 | 0.37 | 1 |
| Carbonate ($CO_3^{=}$) | 14.4 | 0.48 | 2 |
| Bicarbonate ($HCO_3^{-}$) | 1057.0 | 17.33 | 56 |
| Sulfate ($SO_4^{=}$) | 6.0 | 0.12 | 0 |
| Chloride ($Cl^{-}$) | 456.0 | 12.86 | 42 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 4.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 11.5 | | |
| Magnesium (Acidified) | 17.0 | | |
| Total dissolved solids | 1710 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 30.80 | Total Cations (epm) | 33.22 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3100 | Temperature (C) | 4.0 | |
| pH | 8.4 | pH | 8.8 | |
| Fluoride ($F^{-}$) | 1.1 Mg/L | Carbonate ($CO_3^{=}$) | 101 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 932 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.2 | 0.11 | 0.3 |
| Magnesium ($Mg^{++}$) | 15.7 | 1.29 | 3.5 |
| Sodium ($Na^{+}$) | 800.0 | 34.80 | 95.1 |
| Potassium ($K^{+}$) | 14.6 | 0.37 | 1.0 |
| Carbonate ($CO_3^{=}$) | 254.0 | 8.47 | 23.5 |
| Bicarbonate ($HCO_3^{-}$) | 866.0 | 14.19 | 39.4 |
| Sulfate ($SO_4^{=}$) | 20.0 | 0.42 | 1.2 |
| Chloride ($Cl^{-}$) | 460.0 | 12.97 | 36.0 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 5.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 5.3 | | |
| Magnesium (Acidified) | 15.9 | | |
| Total dissolved solids | 2002.0 | | |
| Total Anions (epm) | 36.06 | Total Cations (epm) | 36.57 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 3600 |
| pH | 9.6 |
| Fluoride ($F^{-}$) | 2.0 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 6.0 |
| pH | 9.7 |
| Carbonate ($CO_3^{=}$) | 288.0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 805.0 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Date sampled: July 16, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .007 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 704 |
| As | <.038 | Ni | <.010 |
| B | 2.02 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 16.3 | Si | 2.58 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 0.76 |
| Cr | <.006 | Te | <.065 |
| Cu | .011 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .033 | V | <.0008 |
| K | <.150 | W | <.078 |
| Mg | 23.3 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

FINA 73-6-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Rge 10 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3.9 | 0.19 | 0.6 |
| Magnesium(Mg) | 17.8 | 1.47 | 4.7 |
| Sodium(Na) | 663.0 | 28.84 | 93.3 |
| Potassium(K) | 15.8 | 0.40 | 1.3 |
| Carbonate(CO3) | 84.0 | 2.80 | 8.9 |
| Bicarbonate(HCO3) | 932.0 | 15.28 | 48.6 |
| Sulphate(SO4) | 5.2 | 0.11 | 0.3 |
| Chloride(Cl) | 470.0 | 13.25 | 42.2 |
| Nitrate(NO3) | 0.1 | 0.00 | 0.0 |
| Silica(SiO2) | 3.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 8.6 | | |
| Magnesium(Acidified) | 17.2 | | |
| TDS(mg/l) | 1682.0 | | |
| Total Anions(epm) | 31.44 | Total Cations(epm) | 30.90 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2680 | | Temperature(C) | 5.00 | |
| pH | 9.0 | | pH | 9.1 | |
| Fluoride(F) | 1.2 | mg/l | Carbonate(CO3) | 137 | mg/l |
| | | | Bicarbonate(HCO3) | 834 | mg/l |
| | | | Hydroxide(OH) | | |

FINA 73-6-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Rge 10 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 6, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 3.7 | 0.18 | 0.6 |
| Magnesium(Mg) | 18.8 | 1.55 | 5.1 |
| Sodium(Na) | 655.0 | 28.49 | 93.2 |
| Potassium(K) | 13.3 | 0.34 | 1.1 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1203.0 | 19.72 | 58.5 |
| Sulphate(SO4) | 20.5 | 0.43 | 1.3 |
| Chloride(Cl) | 480.0 | 13.54 | 40.2 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 3.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 6.3 | | |
| Magnesium(Acidified) | 18.0 | | |
| TDS(mg/l) | 1790.0 | | |
| Total Anions(epm) | 33.69 | Total Cations(epm) | 30.56 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2520 | | Temperature(C) | 5.50 | |
| pH | 8.3 | | pH | 9.1 | |
| Fluoride(F) | 1.1 | mg/l | Carbonate(CO3) | 130 | mg/l |
| | | | Bicarbonate(HCO3) | 1020 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS FINA 73-6-E-82

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Rge 10 Twp 96 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 8.5 | 0.42 | 1.4 |
| Magnesium(Mg) | 20.0 | 1.67 | 5.6 |
| Sodium(Na) | 625.0 | 27.17 | 91.6 |
| Potassium(K) | 15.0 | 0.38 | 1.3 |
| Carbonate(CO3) | 43.0 | 1.43 | 4.7 |
| Bicarbonate(HCO3) | 1008.0 | 16.52 | 53.8 |
| Sulphate(SO4) | 10.0 | 0.21 | 0.7 |
| Chloride(Cl) | 446.0 | 12.56 | 40.9 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.0 |
| Silica(SiO2) | 2.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 13.1 | | |
| Magnesium(Acidified) | 18.2 | | |
| TDS(mg/l) | 1652.0 | | |
| Total Anions(epm) | 30.74 | Total Cations(epm) | 29.65 |

Other Constituents

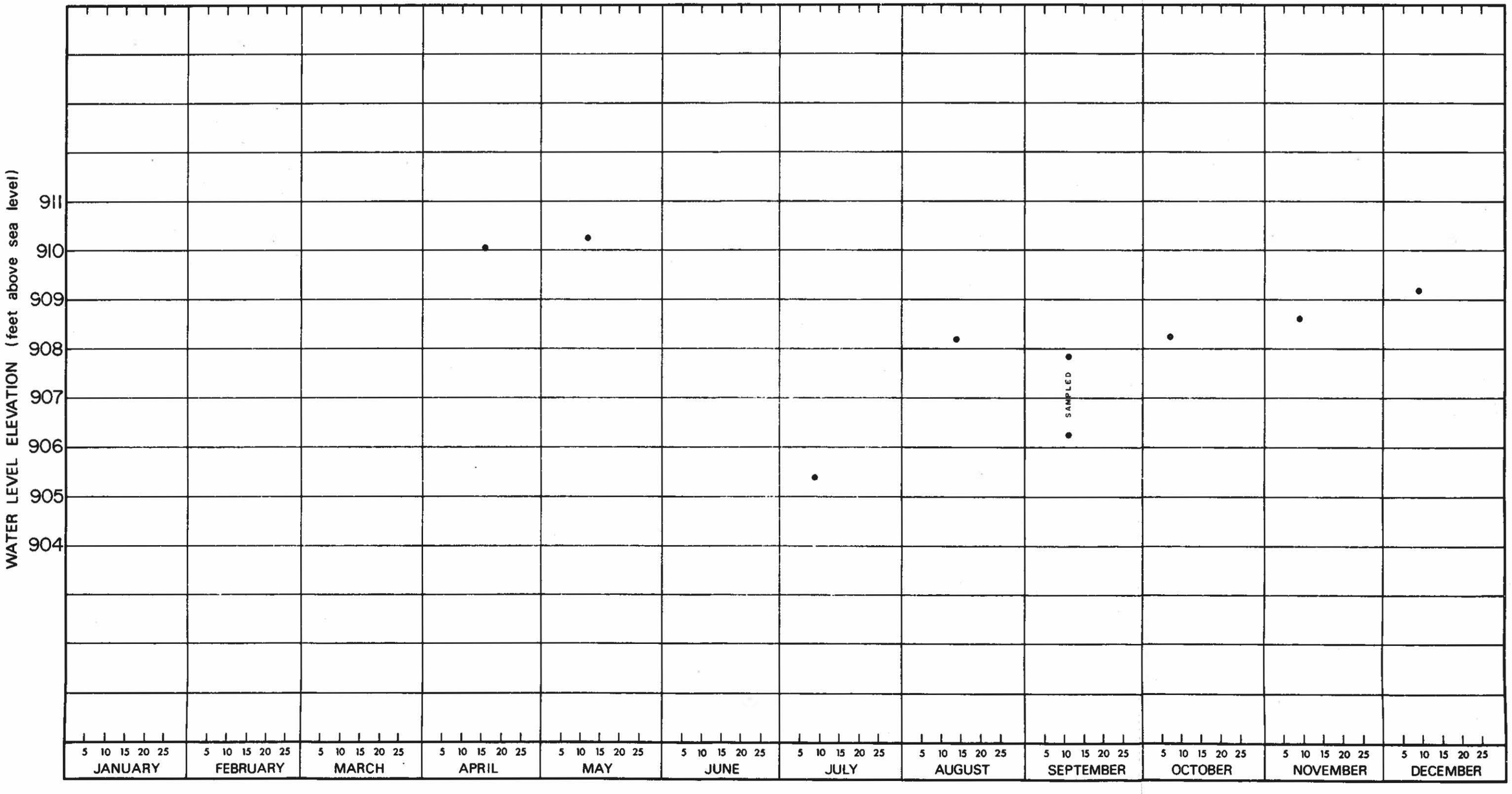
| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2850 | Temperature | 5.00 | |
| pH | 8.6 | pH | 8.9 | |
| Fluoride | 1.1 mg/l | Carbonate(CO3) | 72 | mg/l |
| | | Bicarbonate(HCO3) | 966 | mg/l |
| | | Hydroxide(OH) | | |

WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

FINA 73-6-H-77



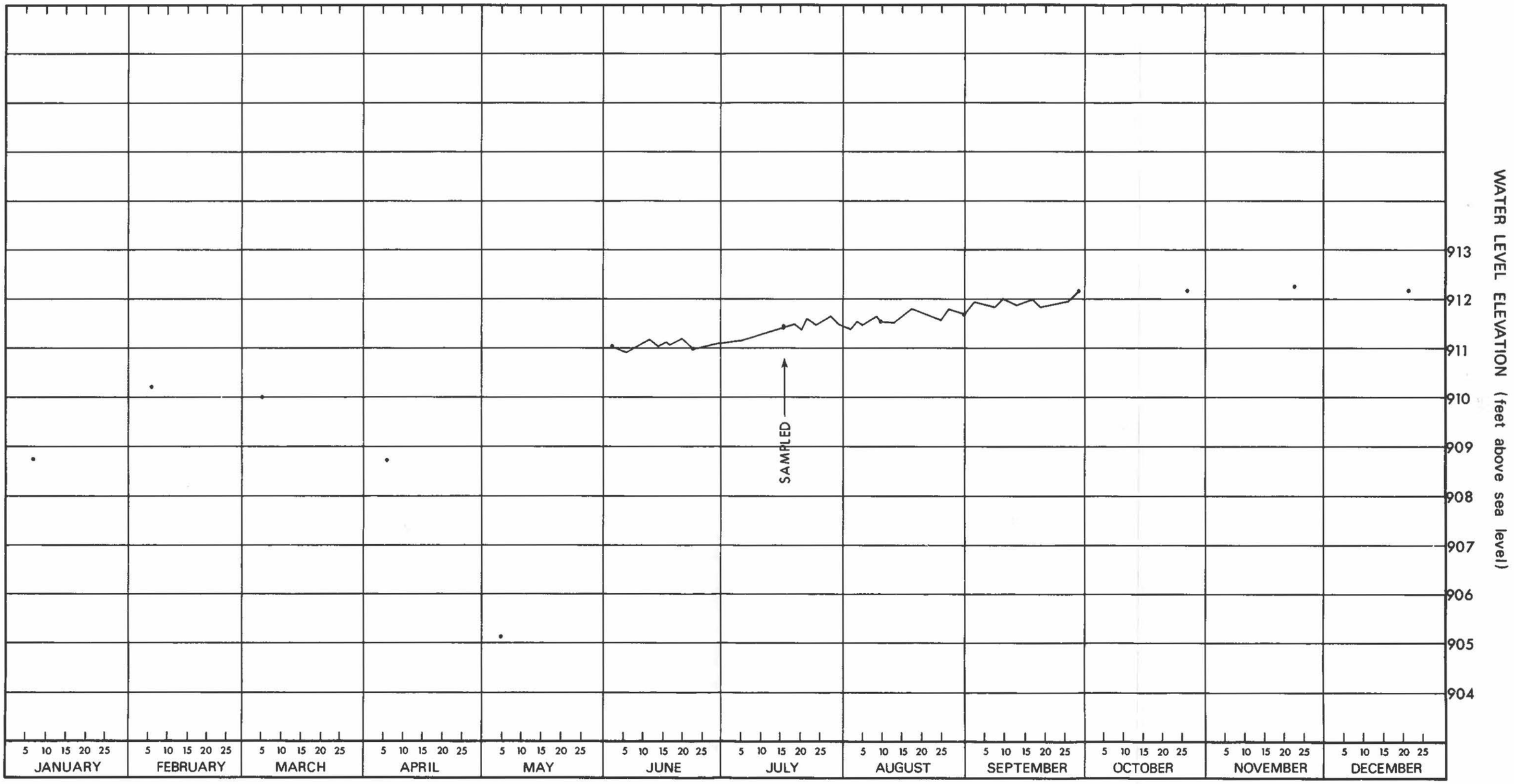
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER Fina 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Fina 73 - 6 - H - 77




1976

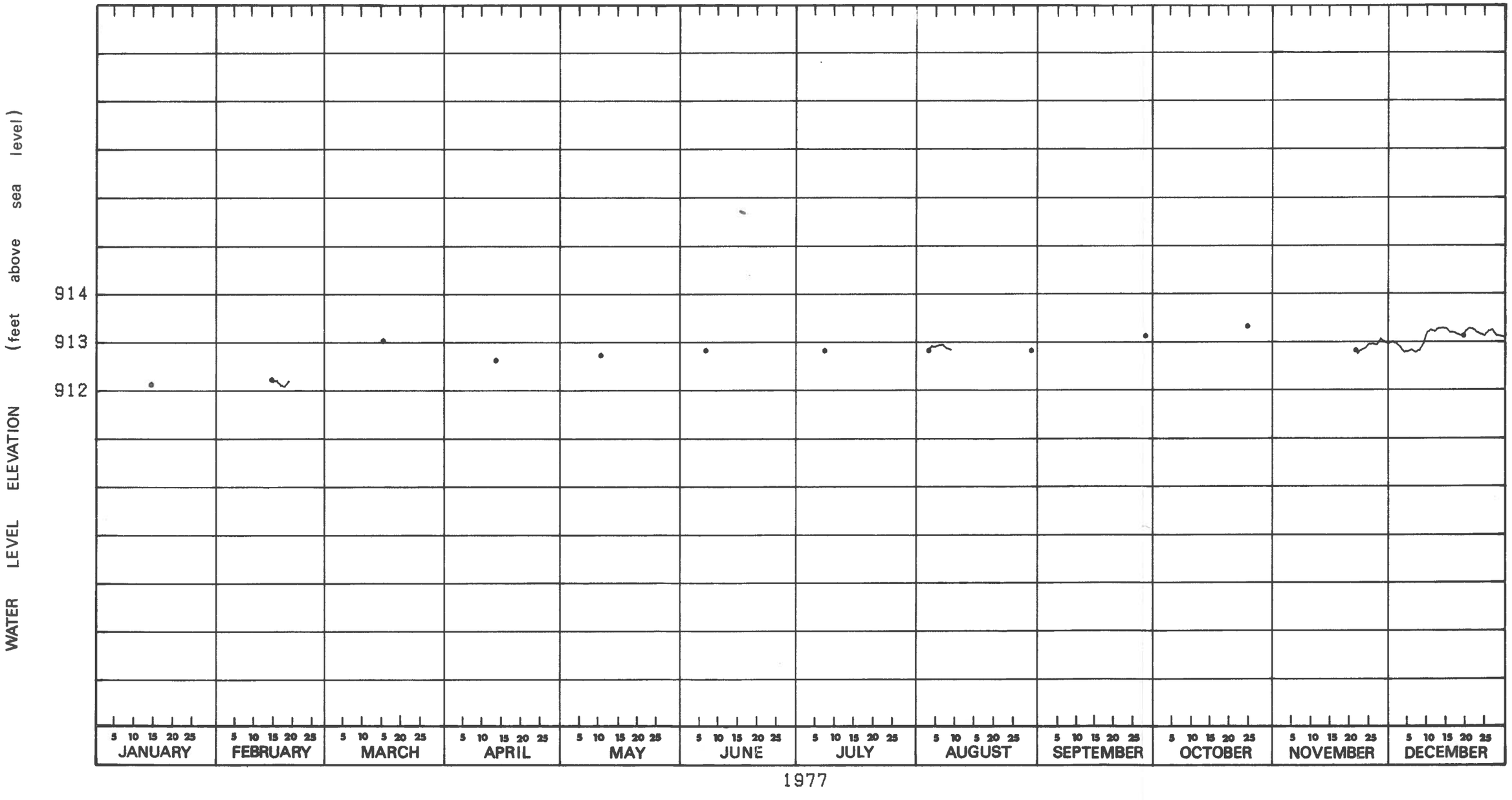
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-6

FINA 73-6-H-78

Lsd 9 Sec 9 Twp 96 R 10 W4 th

Alberta Research Council



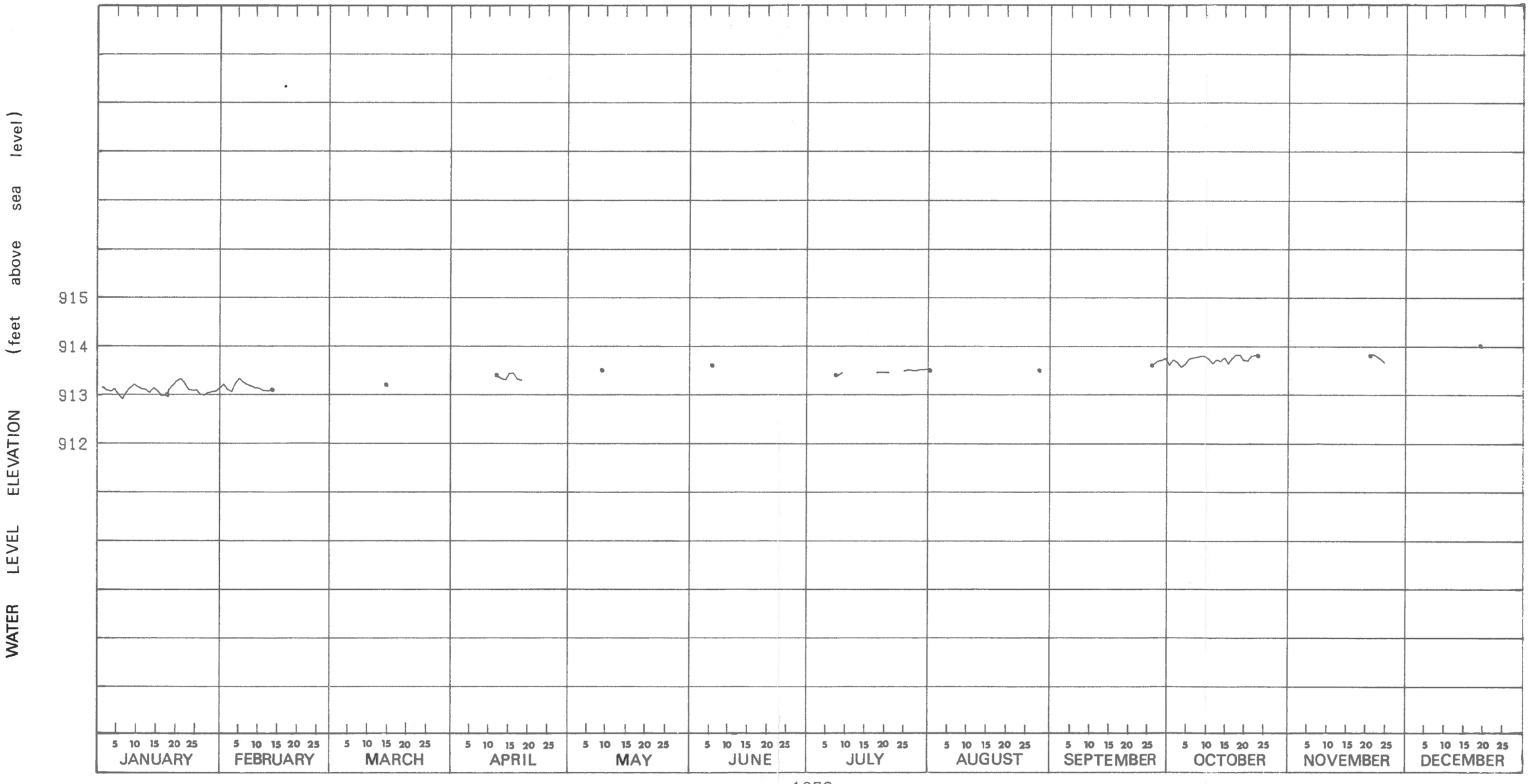
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-6

LSD 9 SEC 9 TWP 96 R 10 W4TH

FINA 73-6-H-79

Alberta Research Council




1978

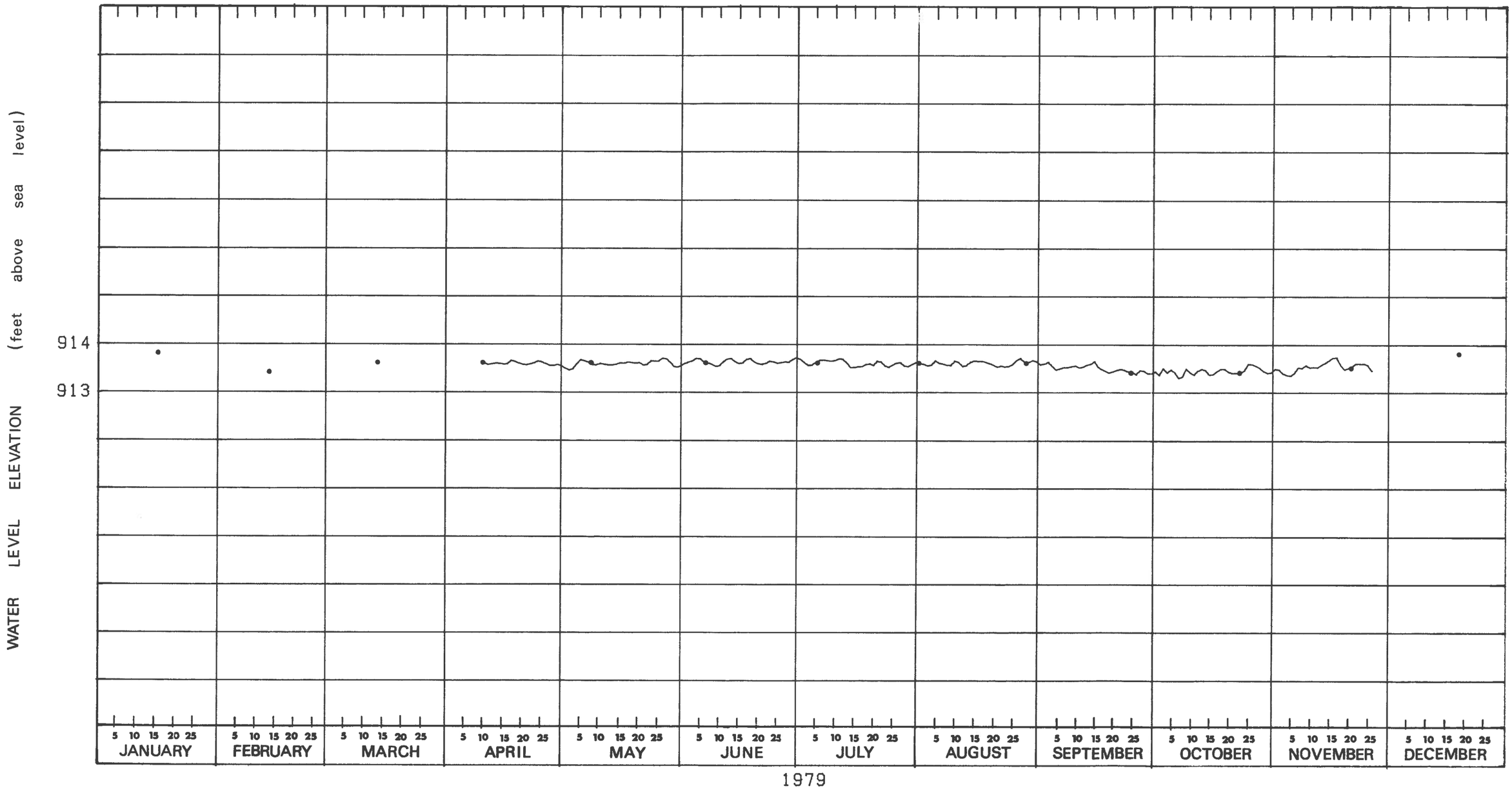
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-6

FINA 73-6-H-80

Lsd 9 Sec 9 Twp 96 R 10 W4 th

Alberta Research Council



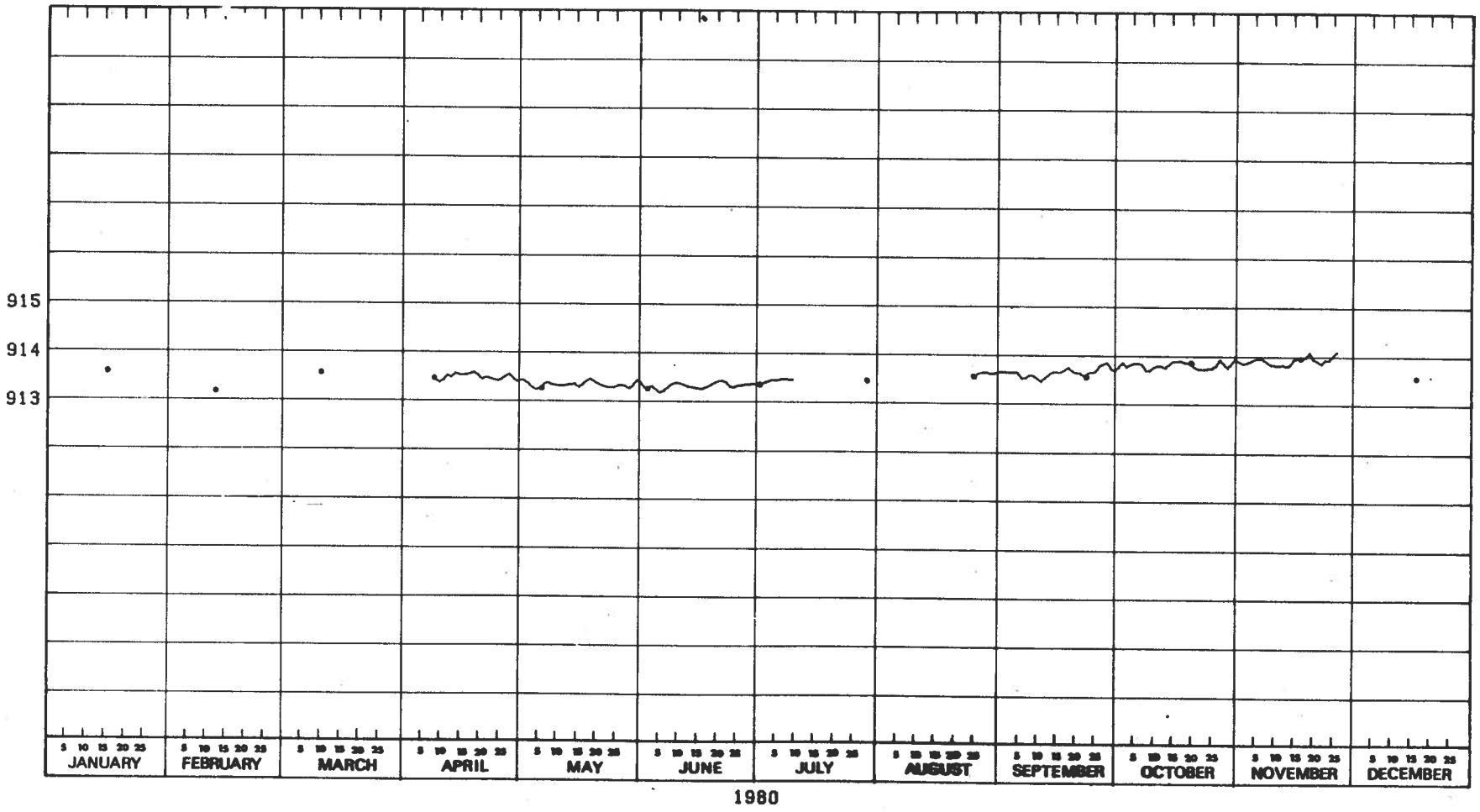
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4 th

Alberta Research Council

FINA 73-6-H-81



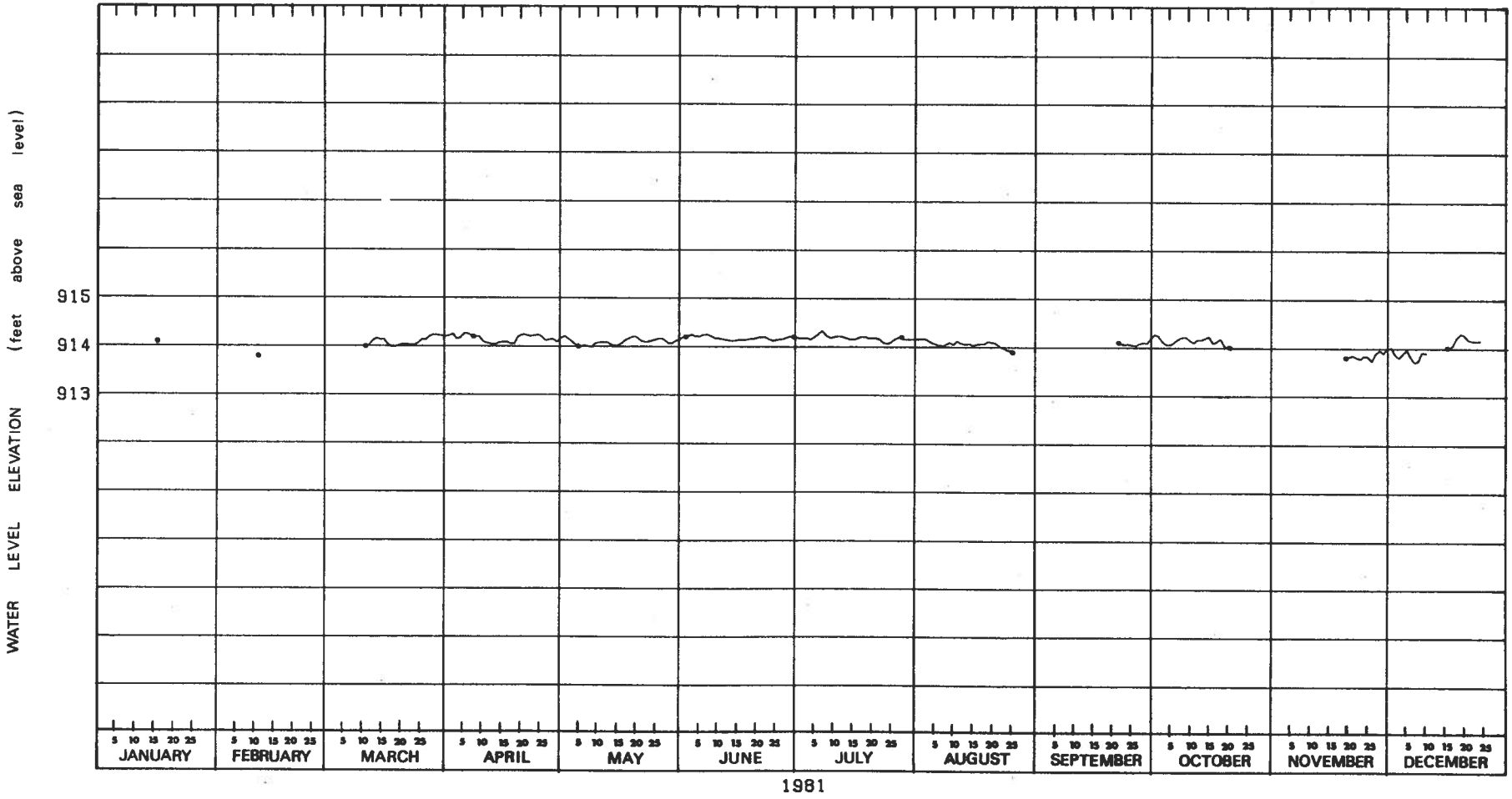
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-6

FINA 73-6-H-82

Lsd 9 Sec 9 Twp 96 R 10 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER Fina 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Elevation of top of casing 980.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 26/74 | | | Well completed |
| Mar 23/74 | 20.05 TOC | 914.6 | Pump test; 1440 min; T = 9533, S = 0.009 |
| Mar 25/74 | | | Water sample |
| Mar 15/75 | 21.97 MP | 910.7 | Recorder & shelter installed; MP = 2.35' TOC, (982.8) |
| Apr 16/75 | 22.18 MP | 910.0 | |
| May 12/75 | 22.10 MP | 910.3 | |
| June 9/75 | 25.38 MP | 899.5 | |
| July 9/75 | 23.61 MP | 905.4 | |
| Aug 14/75 | 22.75 MP | 908.2 | |
| Sept 11/75 | 22.86 MP | 907.8 | |
| | 23.31 MP | 906.3 | After sample; temp. 3°C |
| Oct 7/75 | 22.73 MP | 908.2 | |
| Nov 7/75 | 22.62 MP | 908.6 | |
| Dec 7/75 | 22.45 MP | 909.2 | |
| Jan 7/76 | 22.56 MP | 908.8 | |
| Feb 6/76 | 22.11 MP | 910.3 | |
| Mar 5/76 | 22.18 MP | 910.0 | |
| Apr 6/76 | 22.57 MP | 908.8 | |
| May 5/76 | 23.67 MP | 905.2 | |
| June 2/76 | 21.87 MP | 911.1 | |
| June 23/76 | 21.88 MP | 911.0 | |
| July 16/76 | 21.75 MP | 911.5 | |
| | 21.75 MP | 911.5 | After sample; temp. 4°C |
| Aug 10/76 | 21.72 MP | 911.6 | |
| Aug 31/76 | 21.68 MP | 911.7 | |
| Sept 29/76 | 21.53 MP | 912.2 | |
| Oct 27/76 | 21.51 MP | 912.2 | |
| Nov 23/76 | 21.50 MP | 912.3 | |
| Dec 22/76 | 21.52 MP | 912.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Elevation of top of casing 980.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 21.55 MP | 912.1 | MP (982.8) |
| Feb 15/77 | 21.53 MP | 912.2 | |
| Mar 16/77 | 21.27 MP | 913.0 | |
| Apr 14/77 | 21.39 MP | 912.6 | |
| May 11/77 | 21.38 MP | 912.7 | |
| June 7/77 | 21.35 MP | 912.8 | |
| July 8/77 | 21.33 MP | 912.8 | |
| | 21.33 MP | 912.8 | After sample; temp. 6°C |
| Aug 4/77 | 21.34 MP | 912.8 | |
| Aug 30/77 | 21.33 MP | 912.8 | |
| Sept 29/77 | 21.24 MP | 913.1 | |
| Oct 25/77 | 21.20 MP | 913.3 | |
| Nov 22/77 | 21.35 MP | 912.8 | |
| Dec 20/77 | 21.25 MP | 913.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER FINA 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Elevation of top of casing 980.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 21.28 MP | 913.0 | MP (982.8) |
| Feb 14/78 | 21.24 MP | 913.1 | |
| Mar 15/78 | 21.21 MP | 913.2 | |
| Apr 12/78 | 21.17 MP | 913.4 | |
| May 9/78 | 21.12 MP | 913.5 | |
| June 6/78 | 21.11 MP | 913.6 | |
| July 8/78 | 21.16 MP | 913.4 | |
| | 21.16 MP | 913.4 | After sample; temp 5°C |
| Aug 1/78 | 21.13 MP | 913.5 | |
| Aug 29/78 | 20.94 MP | 913.5 | MP = 0.55m TOC (982.2) |
| Sept 27/78 | 20.90 MP | 913.6 | |
| Oct 24/78 | 20.84 MP | 913.8 | |
| Nov 25/78 | 20.84 MP | 913.8 | |
| Dec 20/78 | 20.80 MP | 914.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER Fina 73-6

Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Elevation of top of casing 980.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 20.85 MP | 913.8 | MP (982.2) |
| Feb 14/79 | 20.97 MP | 913.4 | |
| Mar 14/79 | 20.91 MP | 913.6 | |
| Apr 10/79 | 20.91 MP | 913.6 | |
| May 8/79 | 20.91 MP | 913.6 | |
| June 7/79 | 20.92 MP | 913.6 | |
| July 6/79 | 20.92 MP | 913.6 | |
| | 20.92 MP | 913.6 | After sample; temp. 5.5°C |
| Aug 1/79 | 20.92 MP | 913.6 | |
| Aug 29/79 | 20.90 MP | 913.6 | |
| Sept 25/79 | 20.97 MP | 913.4 | |
| Oct 23/79 | 20.96 MP | 913.4 | |
| Nov 21/79 | 20.94 MP | 913.5 | |
| Dec 19/79 | 20.86 MP | 913.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER FINA 73-6

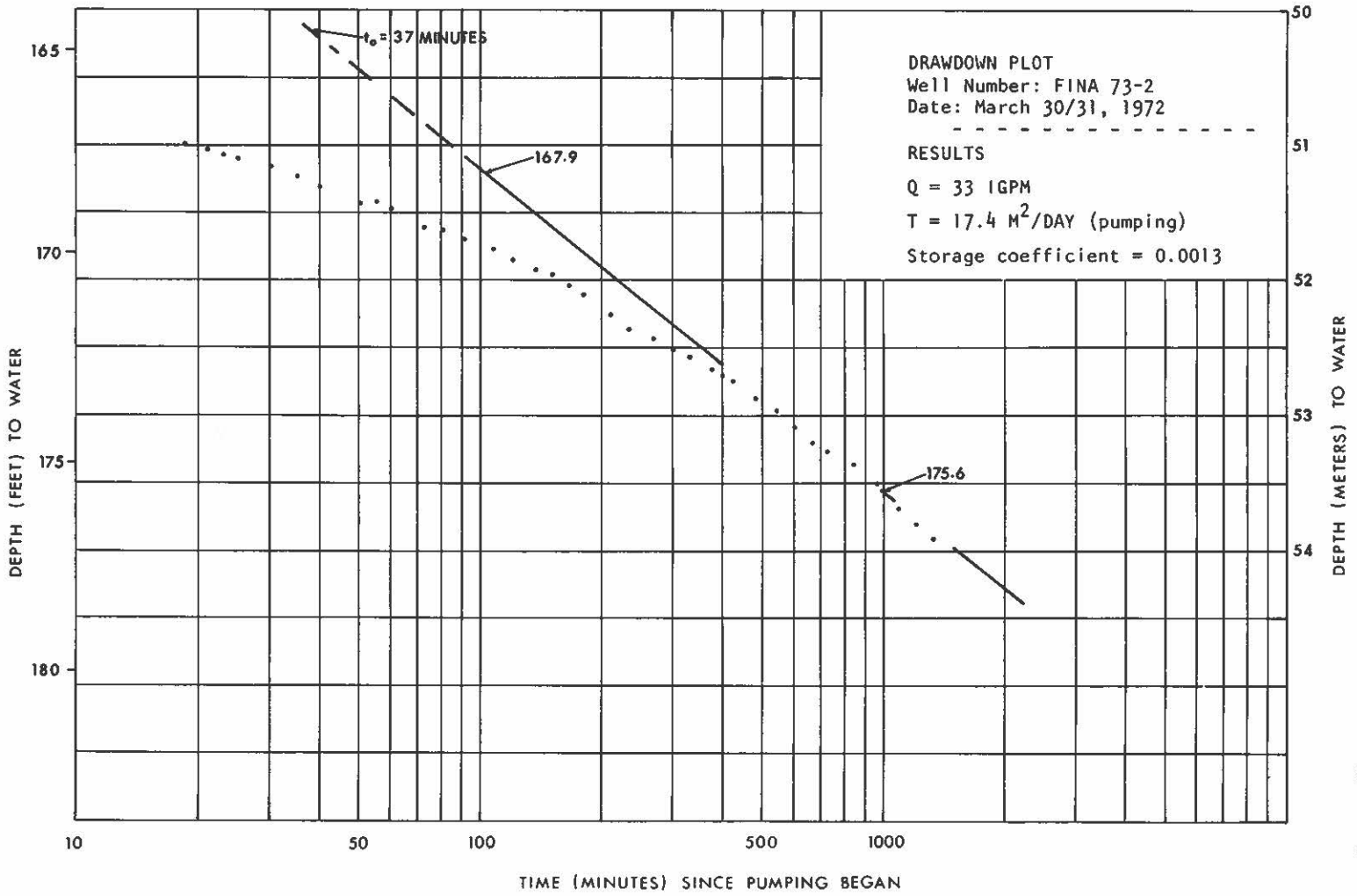
Lsd 9 Sec 9 Twp 96 R 10 W4th

Alberta Research Council

Elevation of top of casing 980.44

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 20.90 MP | 913.6 | |
| Feb 13/80 | 21.02 MP | 913.2 | |
| Mar 11/80 | 20.90 MP | 913.6 | |
| Apr 9/80 | 20.95 MP | 913.5 | |
| May 7/80 | 20.99 MP | 913.3 | |
| June 3/80 | 20.99 MP | 913.3 | |
| July 2/80 | 20.97 MP | 913.4 | Temp. 5°C |
| | 20.98 MP | 913.4 | After Sample |
| July 30/80 | 20.93 MP | 913.5 | |
| Aug 26/80 | 20.90 MP | 913.6 | |
| Sept 24/80 | 20.90 MP | 913.6 | |
| Oct 21/80 | 20.83 MP | 913.9 | |
| Nov 18/80 | 20.79 MP | 914.0 | |
| Dec 18/80 | 20.92 MP | 913.6 | |
| Jan 16/81 | 20.77 MP | 914.1 | |
| Feb 11/81 | 20.85 MP | 913.8 | |
| Mar 11/81 | 20.78 MP | 914.0 | |
| Apr 8/81 | 20.73 MP | 914.2 | |
| May 5/81 | 20.80 MP | 914.0 | |
| June 2/81 | 20.73 MP | 914.2 | |
| June 30/81 | 20.74 MP | 914.2 | |
| July 28/81 | 20.73 MP | 914.2 | |
| Aug 26/81 | 20.81 MP | 913.9 | |
| Sept 22/81 | 20.77 MP | 914.1 | |
| Oct 21/81 | 20.78 MP | 914.0 | |
| Nov 20/81 | 20.85 MP | 913.8 | |
| Dec 16/81 | 20.79 MP | 914.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing


DRAWDOWN PLOT
Well Number: FINA 73-2
Date: March 30/31, 1972
RESULTS
Q = 33 IGPM
T = 17.4 M²/DAY (pumping)
Storage coefficient = 0.0013
$t_o$ = 37 MINUTES
167.9
175.6
165
170
175
180
50
51
52
53
54
10
50
100
500
1000
DEPTH (FEET) TO WATER
DEPTH (METERS) TO WATER
TIME (MINUTES) SINCE PUMPING BEGAN

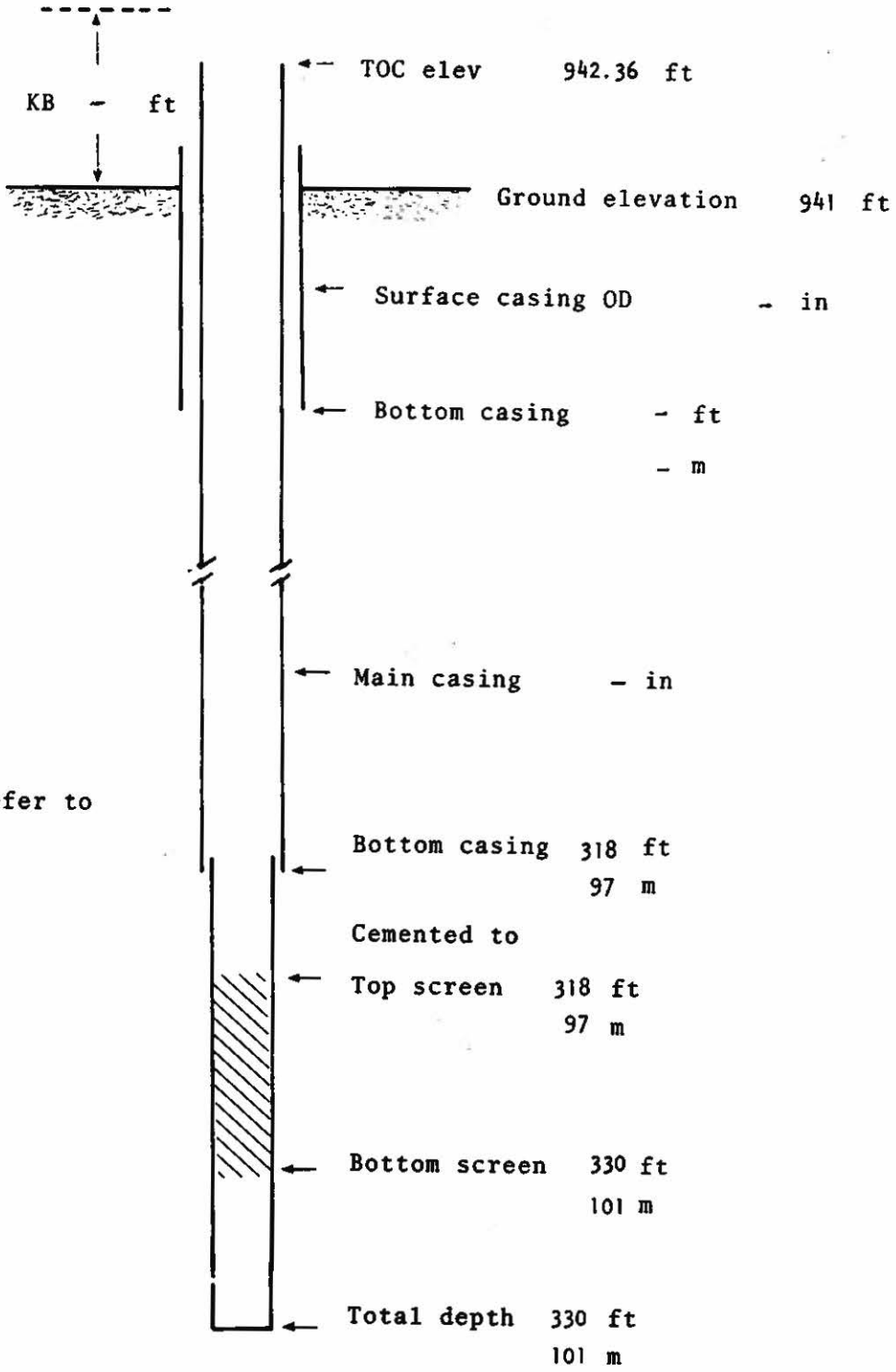
FINA 73-2-A-77

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Tp 96 R 11 Mer 4th

Alberta Research Council




Note: all depths refer to ground

N.B. This well was designated the "89 foot observation well during the test of March 30, 1974.

## WATER ANALYSIS

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1.1 | 0.05 | 0 |
| Magnesium ($Mg^{++}$) | 11.2 | 0.92 | 2 |
| Sodium ($Na^{+}$) | 850.0 | 36.97 | 97 |
| Potassium ($K^{+}$) | 13.8 | 0.35 | 1 |
| Carbonate ($CO_3^{=}$) | 38.4 | 1.28 | 4 |
| Bicarbonate ($HCO_3^{-}$) | 1488.0 | 24.39 | 68 |
| Sulfate ($SO_4^{=}$) | 3.0 | 0.06 | 0 |
| Chloride ($Cl^{-}$) | 360.0 | 10.15 | 28 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 5.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1.3 | | |
| Magnesium (Acidified) | 12.5 | | |
| Total dissolved solids | 1998 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 35.90 | Total Cations (epm) | 38.30 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3500 | | Temperature (C) | 5.0 | |
| pH | 8.6 | | pH | 8.8 | |
| Fluoride ($F^{-}$) | 0.8 | Mg/L | Carbonate ($CO_3^{=}$) | 86 | Mg/L |
| | | | Bicarbonate ($HCO_3^{-}$) | 1401 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 6, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.9 | 0.19 | 0.5 |
| Magnesium ($Mg^{++}$) | 10.8 | 0.89 | 2.2 |
| Sodium ($Na^{+}$) | 888.0 | 38.63 | 96.4 |
| Potassium ($K^{+}$) | 14.6 | 0.37 | 0.9 |
| Carbonate ($CO_3^{=}$) | 57.6 | 1.92 | 5.1 |
| Bicarbonate ($HCO_3^{-}$) | 1510.0 | 24.75 | 65.2 |
| Sulfate ($SO_4^{=}$) | 5.8 | 0.12 | 0.3 |
| Chloride ($Cl^{-}$) | 396.0 | 11.17 | 29.4 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 2.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 3.8 | | |
| Magnesium (Acidified) | 10.8 | | |
| Total dissolved solids | 2106.0 | | |
| Total Anions (epm) | 37.96 | Total Cations (epm) | 40.08 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 4000 | Temperature (C) | 4.0 |
| pH | 8.7 | pH | 8.8 |
| Fluoride ($F^{-}$) | 0.7 ppm | Carbonate ($CO_3^{=}$) | 91.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 1420.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4th

Alberta Research Council

Date sampled: July 17, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | <.001 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 803 |
| As | <.038 | Ni | <.010 |
| B | 3.38 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 1.72 | Si | 2.61 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .361 |
| Cr | <.006 | Te | <.065 |
| Cu | .027 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .044 | V | <.0008 |
| K | <.150 | W | <.078 |
| Mg | 13.5 | Zn | .022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4th

Alberta Research Council

Date sampled: July 17, 1976
(duplicate of other sample of this date)

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | <.001 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 830 |
| As | <.038 | Ni | <.010 |
| B | 3.49 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 1.91 | Si | 2.67 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .374 |
| Cr | <.006 | Te | <.065 |
| Cu | <.0004 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .033 | V | <.0008 |
| K | <.150 | W | <.078 |
| Mg | 12.7 | Zn | .37 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.6 | 0.13 | 0.4 |
| Magnesium(Mg) | 9.9 | 0.81 | 2.3 |
| Sodium(Na) | 788.0 | 34.28 | 96.3 |
| Potassium(K) | 15.0 | 0.38 | 1.1 |
| Carbonate(CO3) | 72.0 | 2.40 | 6.7 |
| Bicarbonate(HCO3) | 1398.0 | 22.91 | 63.6 |
| Sulphate(SO4) | 11.4 | 0.24 | 0.7 |
| Chloride(Cl) | 370.0 | 10.43 | 29.0 |
| Nitrate(NO3) | 1.4 | 0.02 | 0.1 |
| Silica(SiO2) | 5.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 3.4 | | |
| Magnesium(Acidified) | 9.8 | | |
| TDS(mg/l) | 1970.0 | | |
| Total Anions(epm) | 36.01 | Total Cations(epm) | 35.60 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 2930 | | Temperature(C) | 6.00 | |
| pH | 8.8 | | pH | 8.9 | |
| Fluoride(F) | 0.9 | mg/l | Carbonate(CO3) | 125 | mg/l |
| | | | Bicarbonate(HCO3) | 1327 | mg/l |
| | | | Hydroxide(OH) | | |

FINA 73-2-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 6, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 28.0 | 1.40 | 6.2 |
| Magnesium(Mg) | 28.0 | 2.30 | 10.2 |
| Sodium(Na) | 430.0 | 18.70 | 82.5 |
| Potassium(K) | 10.8 | 0.28 | 1.2 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1049.0 | 17.19 | 73.3 |
| Sulphate(SO4) | 10.3 | 0.21 | 0.9 |
| Chloride(Cl) | 214.0 | 6.03 | 25.7 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.0 |
| Silica(SiO2) | 4.7 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 26.0 | | |
| Magnesium(Acidified) | 29.0 | | |
| TDS(mg/l) | 1226.0 | | |
| Total Anions(epm) | 23.45 | Total Cations(epm) | 22.68 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1720 | | Temperature(C) | 8.50 | |
| pH | 8.0 | | pH | 7.3 | |
| Fluoride(F) | 0.6 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 1069 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS FINA 73-2-E-82

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Rge 11 Twp 96 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 2, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 11.0 | 0.55 | 4.8 |
| Magnesium(Mg) | 21.0 | 1.75 | 15.3 |
| Sodium(Na) | 203.0 | 8.83 | 77.3 |
| Potassium(K) | 11.3 | 0.29 | 2.5 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 647.0 | 10.61 | 87.6 |
| Sulphate(SO4) | 6.0 | 0.13 | 1.0 |
| Chloride(Cl) | 49.0 | 1.38 | 11.4 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 4.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 18.2 | | |
| Magnesium(Acidified) | 30.0 | | |
| TDS(mg/l) | 643.0 | | |
| Total Anions(epm) | 12.11 | Total Cations(epm) | 11.42 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1180 | Temperature | 4.00 | |
| pH | 8.3 | pH | 7.8 | |
| Fluoride | 0.5 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 669 | mg/l |
| | | Hydroxide(OH) | | |

# OBSERVATION WELL NUMBER FINA 73-2

1-1-96-11 W4th

ALBERTA RESEARCH COUNCIL

## WELL SITE DETAIL

• (Observation Well)

• (Pumping Well)

• FINA 73-2
(Observation Well)

0 10 20 Metres

0 20 40 60 Feet

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER FINA 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4th

Alberta Research Council

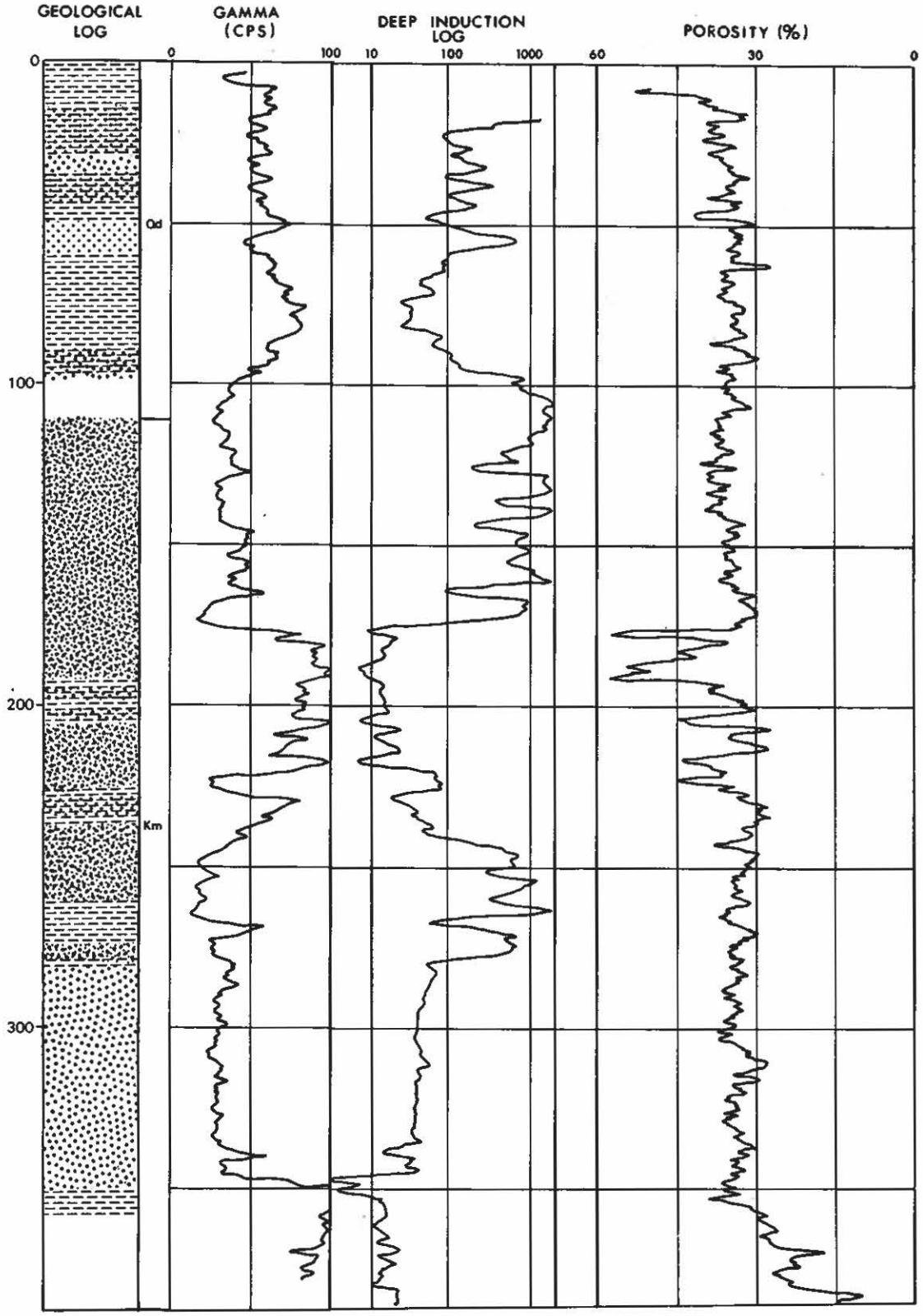
Ground elevation 942 Total depth 330

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 0 | 15 | Clay | Drift |
| 15 | 30 | Clayey silt | |
| 30 | 35 | Fine sand, some clay | |
| 35 | 45 | Clayey silt | |
| 45 | 50 | Silty clay | |
| 50 | 60 | Silt, fine grained sand | |
| 60 | 90 | Clay - some silt | |
| 90 | 100 | Fine sand, clayey | |
| 100 | 112 | No recovery | |
| 112 | 193 | Bituminous sand, fine grained | McMurray |
| 193 | 207 | Grey clay, some fine grained sand | |
| 207 | 227 | Bituminous sand, fine grained | |
| 227 | 239 | Grey clay, some silt and fine grained sand | |
| 239 | 259 | Bituminous sand | |
| 259 | 275 | Clay | |
| 275 | 278 | Bituminous sand, coarse grained | |
| 278 | 282 | Clay | |
| 282 | 352 | Water bearing sand, traces of clay | |
| 352 | 259 | Green clay | |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE FINA 73-2
## 1- 1 - 96-11-W4
### ALBERTA RESEARCH COUNCIL

FINA 73-2-G-77

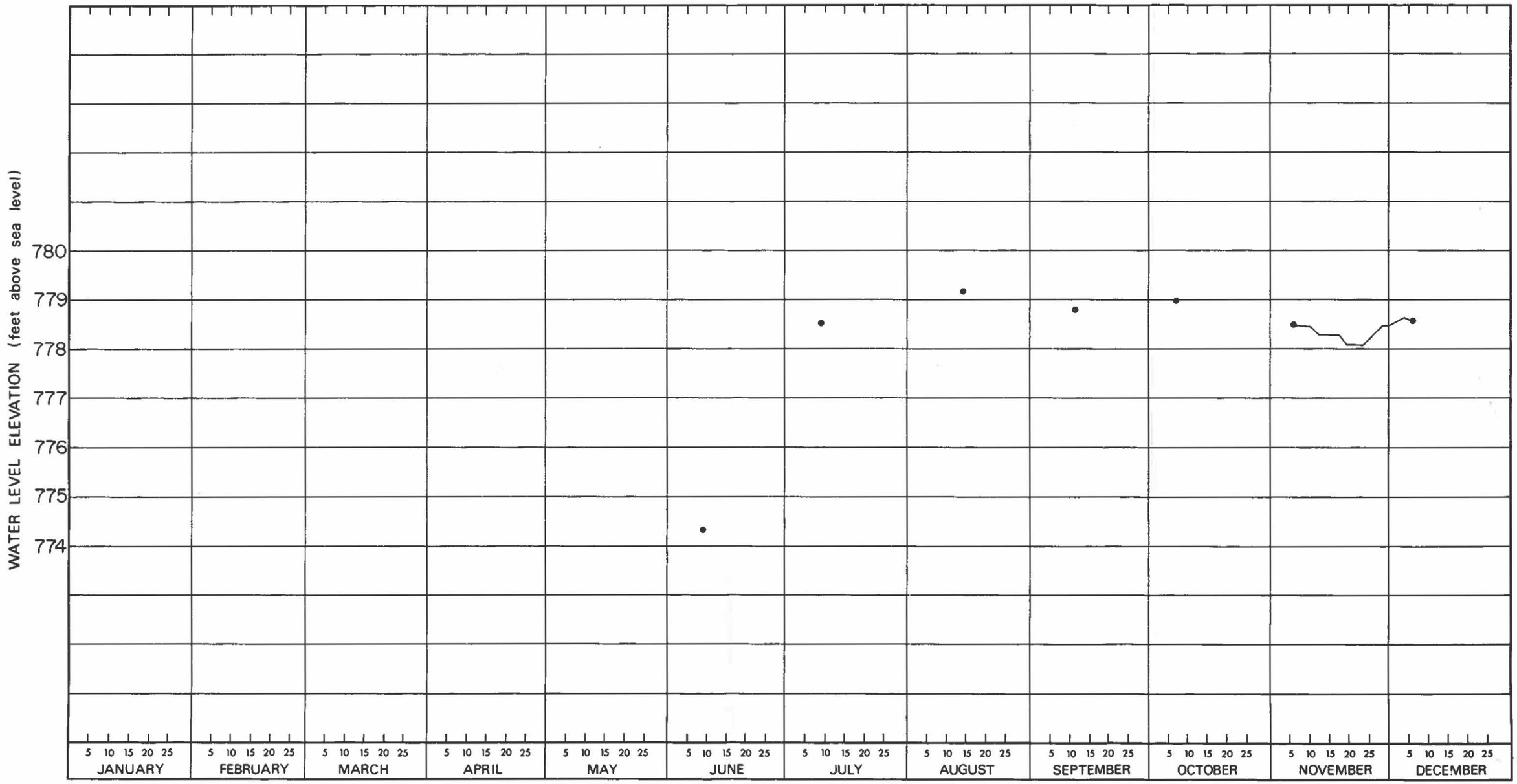


WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4th

FINA 73-2-H-77



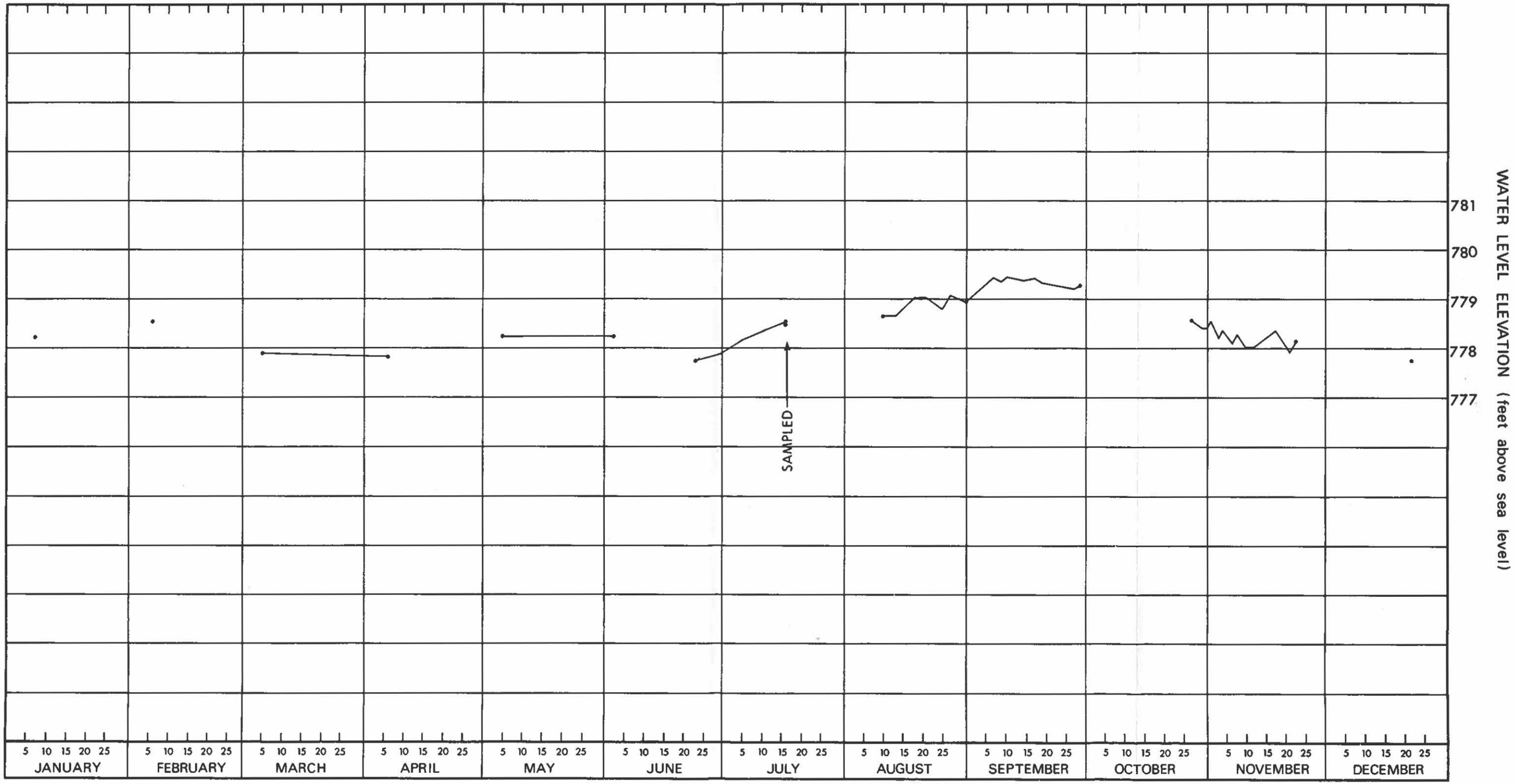
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER Fina 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4th

Alberta Research Council

Fina 73-2 - H - 77




1976

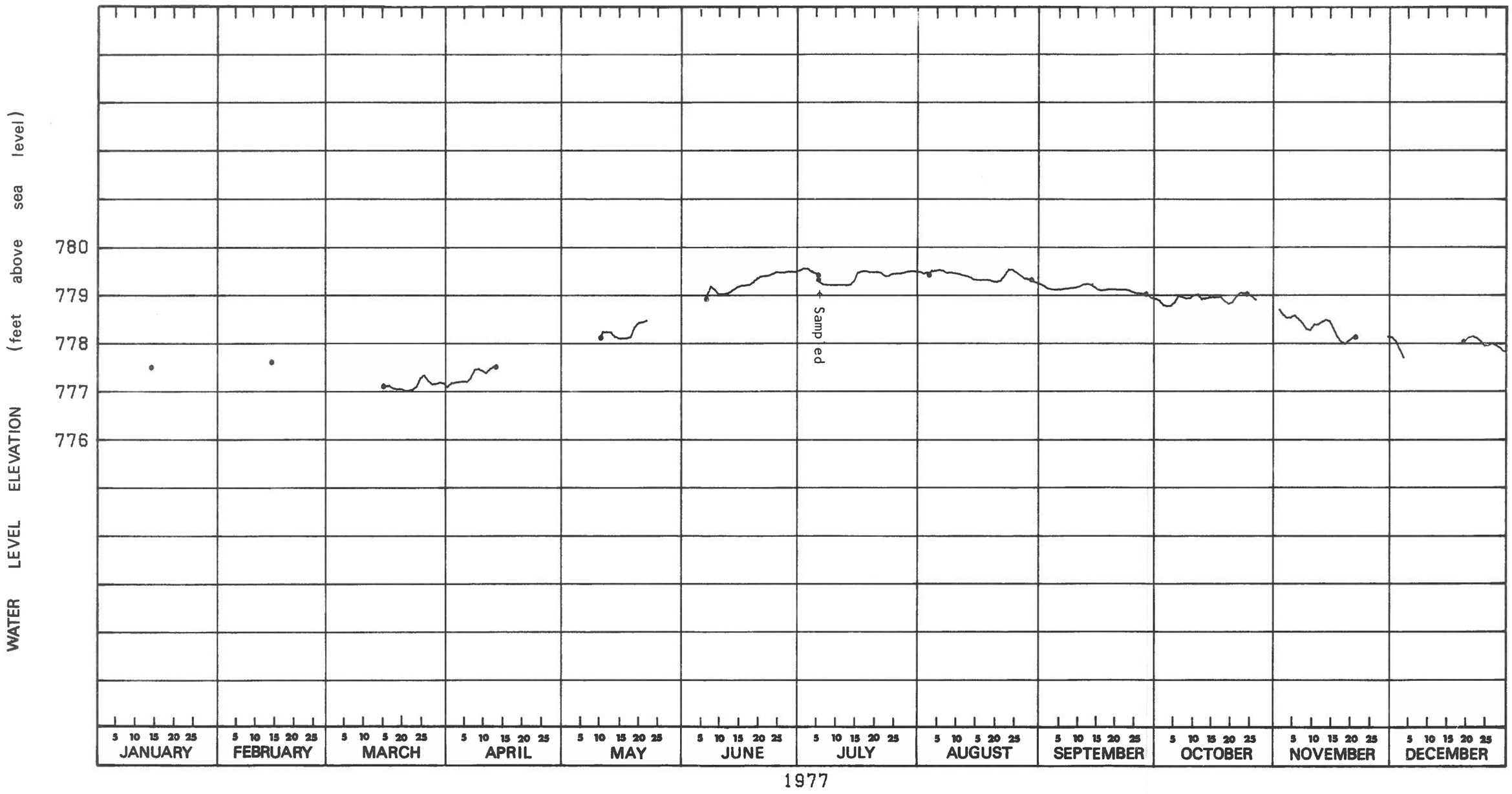
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-2

FINA 73-2-H-78

Lsd 1 Sec 1 Twp 96 R 11 W4 th

Alberta Research Council




1977

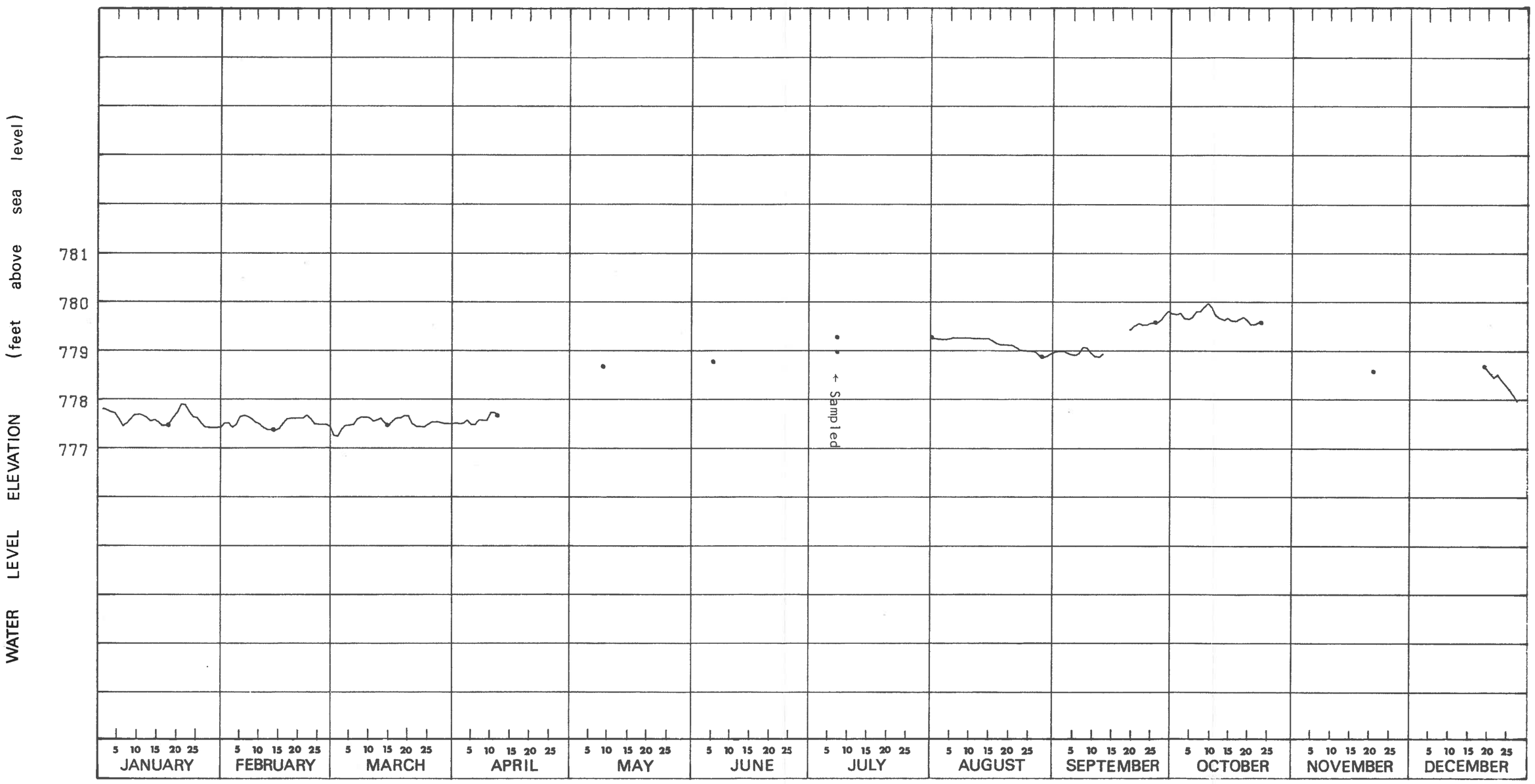
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-2

LSD 1 SEC 1 TWP 96 R 11 W4TH

FINA 73-2-H-79

Alberta Research Council




1978

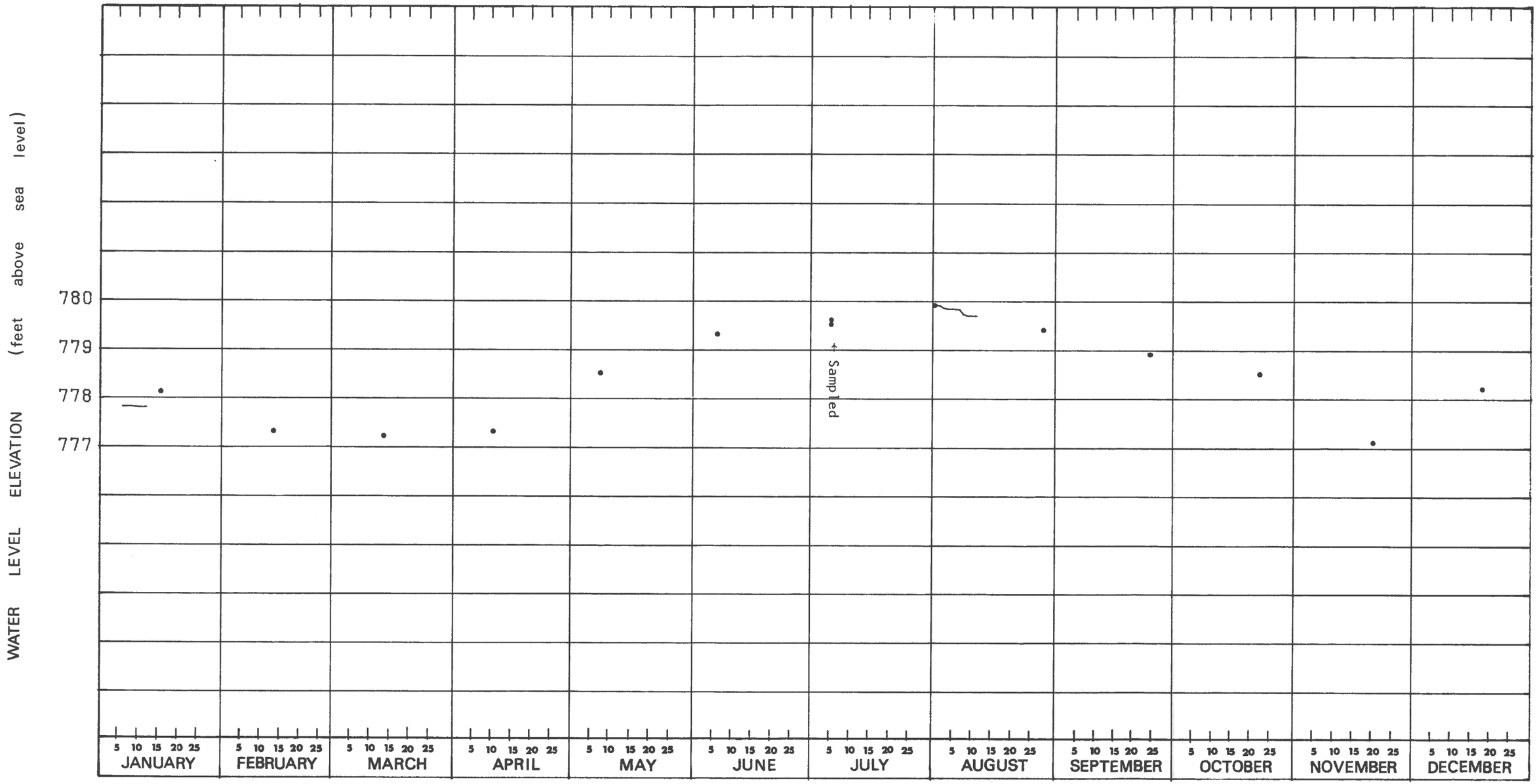
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-2

FINA 73-2-H-80

Lsd 1 Sec 1 Twp 96 R 11 W4 th

Alberta Research Council




1979

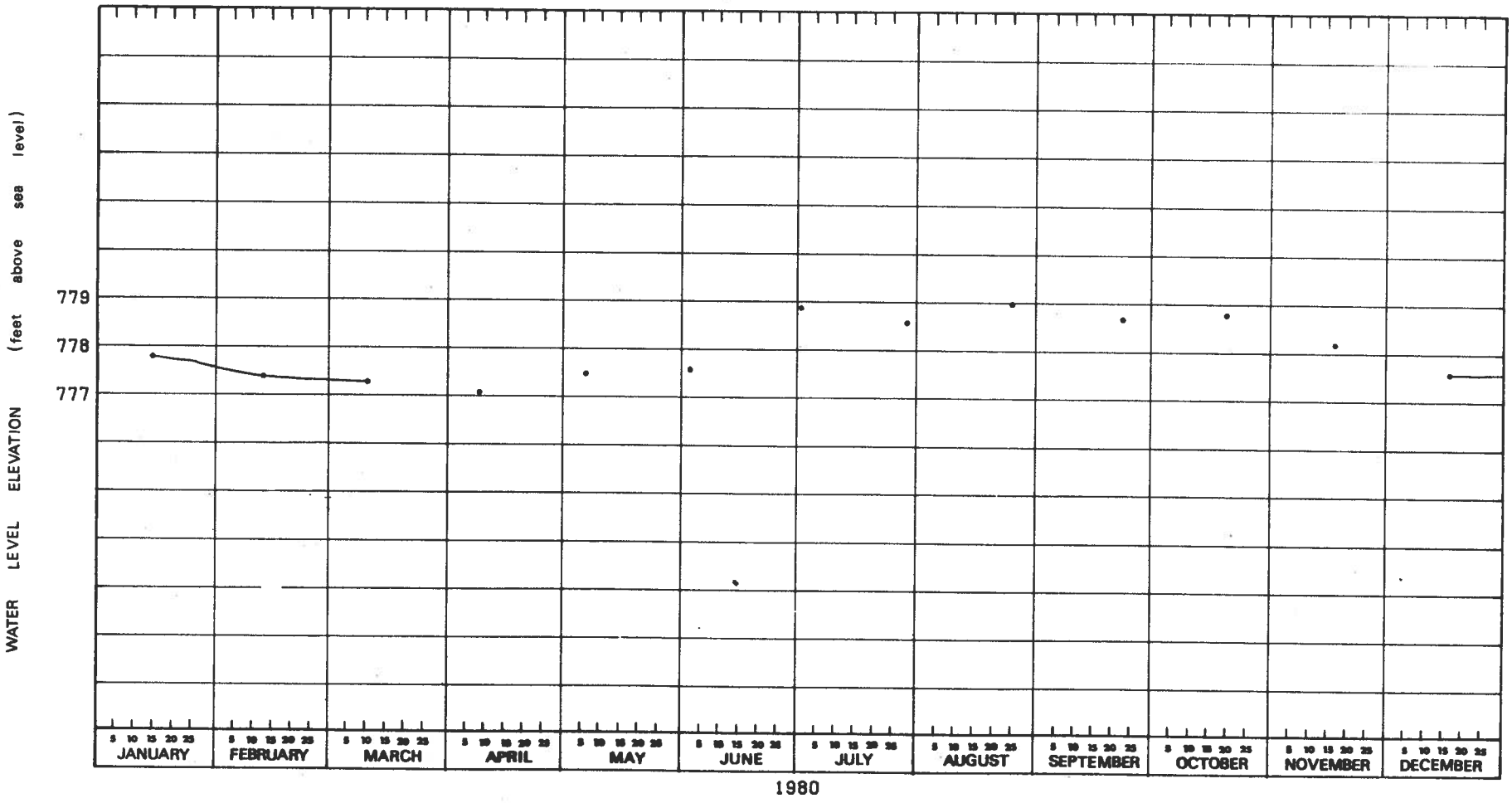
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4 th

Alberta Research Council

FINA 73-2-H-81



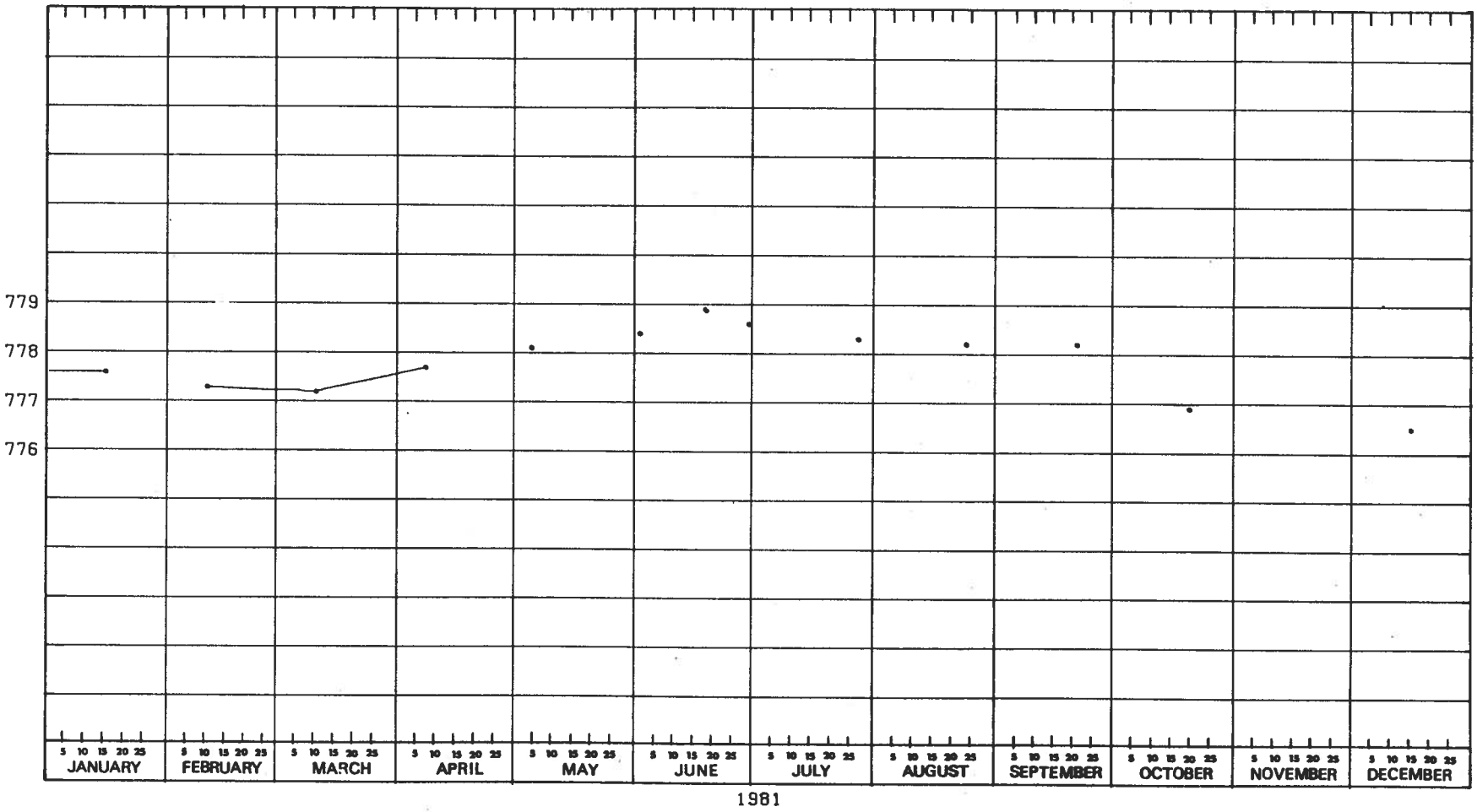
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER FINA 73-2

FINA 73-2-H-82

Lsd 1 Sec 1 Twp 96 R 11 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER Fina 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 942.36

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 26/74 | | | Well completed |
| Mar 30/74 | 50.14 TOC | 777.9 | Pump test; T = 1254, S = 0.006; water sample |
| Apr 16/75 | 66.95 TOC | 875.4 | Measurement questionable; MP = 2.50' TOC, (944.9) |
| May 12/75 | 51.2 MP | 777 | |
| June 9/75 | 52 MP | 774 | |
| July 9/75 | 50.72 MP | 778.5 | Counter weight off |
| Aug 14/75 | 50.53 MP | 779.2 | Fish out weight & float; reinstall recorder |
| Sept 11/75 | 50.64 MP | 778.8 | Too wet to sample |
| Oct 7/75 | 50.58 MP | 779.0 | |
| Nov 6/75 | 50.73 MP | 778.5 | |
| Dec 7/75 | 50.71 MP | 778.6 | |
| Jan 7/76 | 50.76 MP | 778.4 | |
| Feb 6/76 | 50.69 MP | 778.6 | |
| Mar 5/76 | 50.89 MP | 778.0 | |
| Apr 6/76 | 50.91 MP | 777.9 | |
| May 5/76 | 50.79 MP | 778.3 | |
| June 2/76 | 50.79 MP | 778.3 | |
| June 23/76 | 50.93 MP | 777.8 | |
| July 16/76 | 50.70 MP | 778.6 | |
| | 50.71 MP | 778.6 | After sample; temp. 5°C |
| Aug 10/76 | 50.66 MP | 778.7 | |
| Aug 31/76 | 50.57 MP | 779.0 | |
| Sept 29/76 | 50.47 MP | 779.4 | |
| Oct 27/76 | 50.69 MP | 778.6 | |
| Nov 23/76 | 50.82 MP | 778.2 | |
| Dec 22/76 | 50.95 MP | 777.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 942.36

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 51.04 MP | 777.5 | MP (944.9) |
| Feb 15/77 | 51.00 MP | 777.6 | |
| Mar 16/77 | 51.17 MP | 777.1 | |
| Apr 14/77 | 51.05 MP | 777.5 | |
| May 11/77 | 50.84 MP | 778.1 | |
| June 6/77 | 50.60 MP | 778.9 | |
| July 6/77 | 50.45 MP | 779.4 | |
| | 50.49 MP | 779.3 | After sample; temp. 4°C |
| Aug 4/77 | 50.45 MP | 779.4 | |
| Aug 30/77 | 50.48 MP | 779.3 | |
| Sept 29/77 | 50.58 MP | 779.0 | |
| Oct 25/77 | 50.57 MP | 779.0 | |
| Nov 22/77 | 50.86 MP | 778.1 | |
| Dec 20/77 | 50.88 MP | 778.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER FINA 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 942.36

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 51.05 MP | 777.5 | MP (944.9) |
| Feb 14/78 | 51.07 MP | 777.4 | |
| Mar 15/78 | 51.03 MP | 777.5 | |
| Apr 12/78 | 50.97 MP | 777.7 | |
| May 9/78 | 50.67 MP | 778.7 | |
| June 6/78 | 50.63 MP | 778.8 | |
| July 8/78 | 50.50 MP | 779.3 | |
| | 50.58 MP | 779.0 | After sample; temp 6°C |
| Aug 1/78 | 50.50 MP | 779.3 | |
| Aug 30/78 | 50.33 MP | 778.9 | MP = 0.51m TOC (944.0) |
| Sept 27/78 | 50.12 MP | 779.6 | |
| Oct 24/78 | 50.12 MP | 779.6 | |
| Nov 22/78 | 50.41 MP | 778.6 | |
| Dec 20/78 | 50.40 MP | 778.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER Fina 73-2

Lsd 1 Sec 1 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 942.36

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 50.59 MP | 778.1 | MP (944.0) |
| Feb 14/79 | 50.83 MP | 777.3 | |
| Mar 14/79 | 50.84 MP | 777.2 | |
| Apr 11/79 | 50.81 MP | 777.3 | |
| May 8/79 | 50.47 MP | 778.5 | |
| June 7/79 | 50.21 MP | 779.3 | |
| July 6/79 | 50.14 MP | 779.5 | |
| | 50.12 MP | 779.6 | After sample; temp. 8.5°C |
| Aug 1/79 | 50.02 MP | 779.9 | |
| Aug 29/79 | 50.17 MP | 779.4 | |
| Sept 25/79 | 50.32 MP | 778.9 | |
| Oct 23/79 | 50.47 MP | 778.5 | |
| Nov 21/79 | 50.87 MP | 777.1 | |
| Dec 19/79 | 50.55 MP | 778.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER FINA 73-2

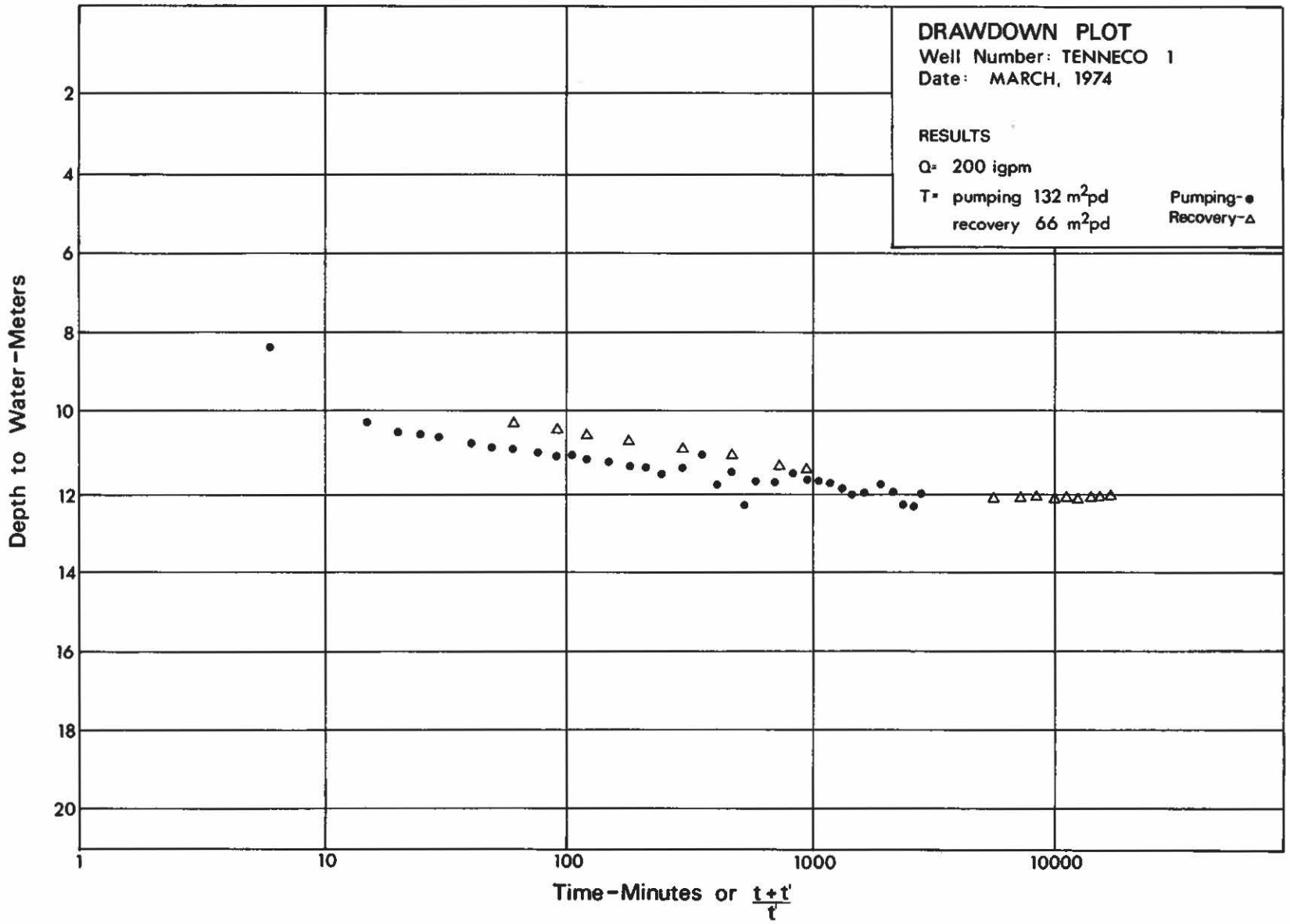
Lsd 1 Sec 1 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 942.36

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/80 | 50.68 MP | 777.8 | |
| Feb 13/80 | 50.78 MP | 777.4 | |
| Mar 11/80 | 50.81 MP | 777.3 | |
| Apr 9/80 | 50.88 MP | 777.1 | |
| May 7/80 | 50.75 MP | 777.5 | |
| June 3/80 | 50.72 MP | 777.6 | |
| July 2/80 | 50.34 MP | 778.9 | Temp. 4°C |
| | 50.34 MP | 778.9 | After Sample |
| July 30/80 | 50.44 MP | 778.6 | |
| Aug 26/80 | 50.30 MP | 779.0 | |
| Sept 24/80 | 50.40 MP | 778.7 | |
| Oct 21/80 | 50.38 MP | 778.8 | |
| Nov 18/80 | 50.54 MP | 778.2 | |
| Dec 18/80 | 50.74 MP | 777.6 | |
| Jan 16/81 | 50.72 MP | 777.6 | |
| Feb 11/81 | 50.83 MP | 777.3 | |
| Mar 11/81 | 50.84 MP | 777.2 | |
| Apr 8/81 | 50.71 MP | 777.7 | |
| May 5/81 | 50.57 MP | 778.1 | |
| June 2/81 | 50.49 MP | 778.4 | |
| June 30/81 | 50.43 MP | 778.6 | |
| July 28/81 | 50.51 MP | 778.3 | |
| Aug 26/81 | 50.54 MP | 778.2 | |
| Sept 22/81 | 50.56 MP | 778.2 | |
| Oct 21/81 | 50.95 MP | 776.9 | |
| Nov 19/81 | | | Could not measure |
| Dec 16/81 | 51.07 MP | 776.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing



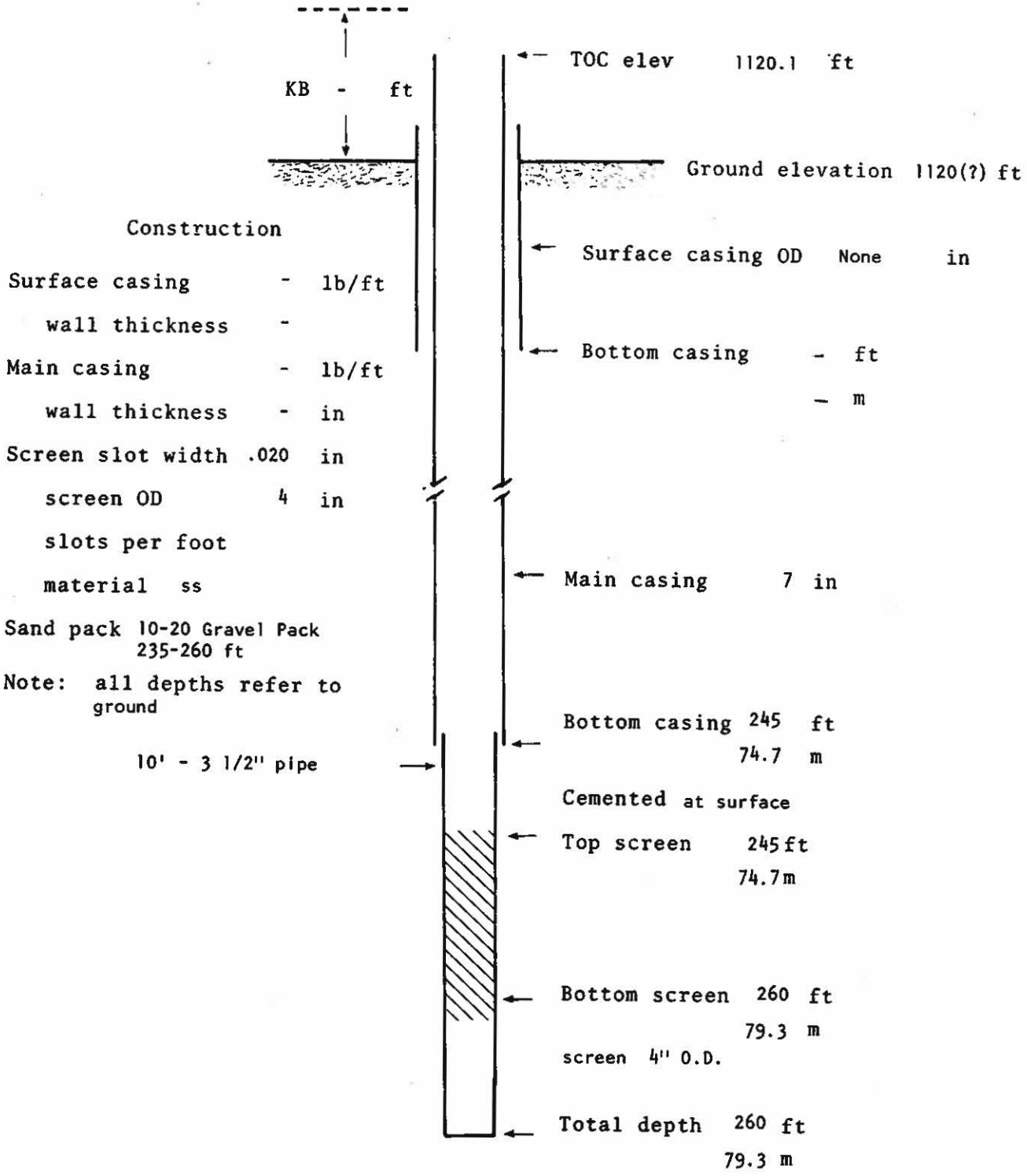

TENNECO 1-A-77

**WELL CONSTRUCTION.**

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Tp 96 R 7 Mer 4th

Alberta Research Council




Construction

Surface casing - lb/ft

wall thickness -

Main casing - lb/ft

wall thickness - in

Screen slot width .020 in

screen OD 4 in

slots per foot

material ss

Sand pack 10-20 Gravel Pack
235-260 ft

Note: all depths refer to ground

N.B.: Gravel Pack washed with 100 pounds sodium acid pyrophosphate

## WATER ANALYSIS

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Sample source TENNECO 1

Date sampled March 6, 1974 - start of pump test

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 41 | 2.05 | 24.2 |
| Magnesium ($Mg^{++}$) | 15 | 1.25 | 14.7 |
| Sodium ($Na^{+}$) | 114 | 4.96 | 58.4 |
| Potassium ($K^{+}$) | 9 | 0.23 | 2.7 |
| Carbonate ($CO_3^{=}$) | 31 | 1.03 | 11.8 |
| Bicarbonate ($HCO_3^{-}$) | 453 | 7.43 | 84.9 |
| Sulfate ($SO_4^{=}$) | 9 | 0.19 | 2.1 |
| Chloride ($Cl^{-}$) | 2 | 0.06 | 0.6 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.04 | 0.5 |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 446 | | |
| Total Anions (epm) | 8.49 | Total Cations (epm) | 8.75 |

Other Constituents

Lab:

- Conductivity
- pH 8.1
- Fluoride ($F^{-}$)

Field:

- Temperature (C)
- pH
- Carbonate ($CO_3^{=}$)
- Bicarbonate ($HCO_3^{-}$)
- Hydroxide ($OH^{-}$)
- Conductivity

## WATER ANALYSIS

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Sample source TENNECO 1

Date sampled March 6, 1974 End of pump test

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 43 | 2.15 | 25.0 |
| Magnesium ($Mg^{++}$) | 15 | 1.25 | 14.6 |
| Sodium ($Na^{+}$) | 114 | 4.96 | 57.7 |
| Potassium ($K^{+}$) | 9 | 0.23 | 2.7 |
| Carbonate ($CO_3^{=}$) | 37 | 9.02 | 13.7 |
| Bicarbonate ($HCO_3^{-}$) | 462 | 7.57 | 84.0 |
| Sulfate ($SO_4^{=}$) | 7 | 0.15 | 1.6 |
| Chloride ($Cl^{-}$) | 1 | 0.04 | 0.4 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.03 | 0.3 |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 462 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 8.59 | Total Cations (epm) | 9.02 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | |
| pH | 8.2 |
| Fluoride ($F^{-}$) | |

Field:

| | |
|---|---|
| Temperature (C) | |
| pH | |
| Carbonate ($CO_3^{=}$) | |
| Bicarbonate ($HCO_3^{-}$) | |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 11, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 31 | 1.55 | 19 |
| Magnesium ($Mg^{++}$) | 17.1 | 1.41 | 18 |
| Sodium ($Na^{+}$) | 111 | 4.83 | 60 |
| Potassium ($K^{+}$) | 8.8 | 0.23 | 3 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 461 | 7.56 | 96 |
| Sulfate ($SO_4^{=}$) | 4.3 | 0.09 | 1 |
| Chloride ($Cl^{-}$) | 6 | 0.17 | 2 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0 |
| Silica ($SiO_2$) | 3.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 32 | | |
| Magnesium (Acidified) | 15 | | |
| Total dissolved solids | 412 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 7.83 | Total Cations (epm) | 8.01 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 760 |
| pH | 7.1 |
| Fluoride ($F^{-}$) | 1.4 ppm |

Field:

| | |
|---|---|
| Temperature (C) | 2.5 |
| pH | 7.8 |
| Carbonate ($CO_3^{=}$) | 0 ppm |
| Bicarbonate ($HCO_3^{-}$) | 415 ppm |
| Hydroxide ($OH^{-}$) | |
| Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 24.0 | 1.20 | 15 |
| Magnesium ($Mg^{++}$) | 16.5 | 1.36 | 17 |
| Sodium ($Na^{+}$) | 116.0 | 5.05 | 64 |
| Potassium ($K^{+}$) | 9.6 | 0.25 | 3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 444.0 | 7.28 | 94 |
| Sulfate ($SO_4^{=}$) | 3.8 | 0.08 | 1 |
| Chloride ($Cl^{-}$) | 14.0 | 0.39 | 5 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0 |
| Silica ($SiO_2$) | 1.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 26.4 | | |
| Magnesium (Acidified) | 17.3 | | |
| Total dissolved solids | 384 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 7.76 | Total Cations (epm) | 7.85 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 690 | Temperature (C) | 5.0 | |
| pH | 7.9 | pH | 7.9 | |
| Fluoride ($F^{-}$) | 1.2 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 473 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 10, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 33.0 | 1.65 | 18.3 |
| Magnesium ($Mg^{++}$) | 16.6 | 1.37 | 15.2 |
| Sodium ($Na^{+}$) | 131.0 | 5.70 | 63.5 |
| Potassium ($K^{+}$) | 10.4 | 0.27 | 3.0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 512.0 | 8.39 | 95.9 |
| Sulfate ($SO_4^{=}$) | 9.1 | 0.19 | 2.2 |
| Chloride ($Cl^{-}$) | 6.0 | 0.17 | 1.9 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 2.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 36.0 | | |
| Magnesium (Acidified) | 17.9 | | |
| Total dissolved solids | 472.0 | | |
| Total Anions (epm) | 8.75 | Total Cations (epm) | 8.98 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 820 | Temperature (C) | 6.0 |
| pH | 7.7 | pH | 7.3 |
| Fluoride ($F^{-}$) | 1.7 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 517.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Date sampled: July 17, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .058 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 113 |
| As | <.038 | Ni | <.010 |
| B | 1.03 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 33.9 | Si | 1.11 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 0.825 |
| Cr | <.006 | Te | <.065 |
| Cu | <.0004 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 0.37 | V | <.0008 |
| K | <.150 | W | <.078 |
| Mg | 19.6 | Zn | 0.022 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER TENNECO-1

Lsd 10 Sec 20 Rge 7 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 09, 1978

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 5.8 | 0.29 | 4.6 |
| Magnesium(Mg) | 11.0 | 0.91 | 14.5 |
| Sodium(Na) | 111.0 | 4.83 | 77.4 |
| Potassium(K) | 8.3 | 0.21 | 3.4 |
| Carbonate(CO3) | 33.6 | 1.12 | 17.1 |
| Bicarbonate(HCO3) | 322.0 | 5.28 | 80.6 |
| Sulphate(SO4) | 5.9 | 0.12 | 1.9 |
| Chloride(Cl) | 0.0 | 0.00 | 0.0 |
| Nitrate(NO3) | 1.7 | 0.03 | 0.4 |
| Silica(SiO2) | 0.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 5.5 | | |
| Magnesium(Acidified) | 10.3 | | |
| TDS(mg/l) | 340.0 | | |
| Total Anions(epm) | 6.55 | Total Cations(epm) | 6.24 |

## Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 540 | | Temperature(C) | 4.00 | |
| pH | 8.8 | | pH | 9.4 | |
| Fluoride(F) | 1.6 | mg/l | Carbonate(CO3) | 62 | mg/l |
| | | | Bicarbonate(HCO3) | 254 | mg/l |
| | | | Hydroxide(OH) | | |

TENNECO-1-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER TENNECO-1

Lsd 10 Sec 20 Rge 7 Twp 96 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 7, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 9.0 | 0.45 | 7.7 |
| Magnesium(Mg) | 0.6 | 0.05 | 0.9 |
| Sodium(Na) | 118.0 | 5.13 | 88.5 |
| Potassium(K) | 6.7 | 0.17 | 3.0 |
| Carbonate(CO3) | 4.8 | 0.16 | 2.6 |
| Bicarbonate(HCO3) | 356.0 | 5.84 | 94.1 |
| Sulphate(SO4) | 6.7 | 0.14 | 2.2 |
| Chloride(Cl) | 2.0 | 0.06 | 0.9 |
| Nitrate(NO3) | 0.8 | 0.01 | 0.2 |
| Silica(SiO2) | 0.5 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 7.6 | | |
| Magnesium(Acidified) | 0.7 | | |
| TDS(mg/l) | 366.0 | | |
| Total Anions(epm) | 6.20 | Total Cations(epm) | 5.80 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 525 | | Temperature(C) | 5.00 | |
| pH | 8.5 | | pH | 9.4 | |
| Fluoride(F) | 1.0 | mg/l | Carbonate(CO3) | 67 | mg/l |
| | | | Bicarbonate(HCO3) | 244 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS

TENNECO -1-E-82

OBSERVATION WELL NUMBER TENNECO -1

Lsd 10 Sec 20 Rge 7 Twp 96 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 8, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 7.3 | 0.37 | 5.6 |
| Magnesium(Mg) | 16.0 | 1.33 | 20.4 |
| Sodium(Na) | 106.0 | 4.61 | 70.4 |
| Potassium(K) | 9.2 | 0.24 | 3.6 |
| Carbonate(CO3) | 14.4 | 0.48 | 7.5 |
| Bicarbonate(HCO3) | 342.0 | 5.61 | 88.1 |
| Sulphate(SO4) | 7.0 | 0.15 | 2.3 |
| Chloride(Cl) | 4.0 | 0.11 | 1.8 |
| Nitrate(NO3) | 1.0 | 0.02 | 0.3 |
| Silica(SiO2) | 3.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 36.0 | | |
| Magnesium(Acidified) | 14.7 | | |
| TDS(mg/l) | 0.0 | | |
| Total Anions(epm) | 6.36 | Total Cations(epm) | 6.54 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 600 |
| pH | 8.7 |
| Fluoride | 1.5 mg/l |

Field:

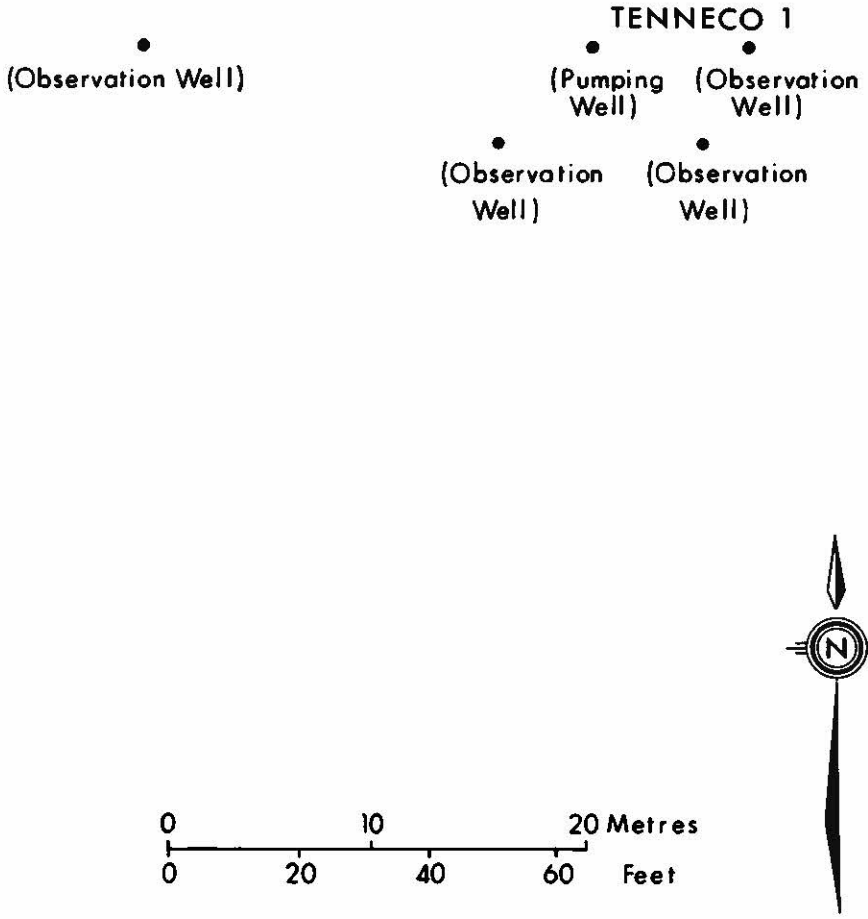
| | | |
|---|---|---|
| Temperature | 5.00 | |
| pH | 7.6 | |
| Carbonate(CO3) | 0 | mg/l |
| Bicarbonate(HCO3) | 478 | mg/l |
| Hydroxide(OH) | | |

# OBSERVATION WELL NUMBER TENNECO 1

10-20-96-7 W4th

ALBERTA RESEARCH COUNCIL

## WELL SITE DETAIL



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

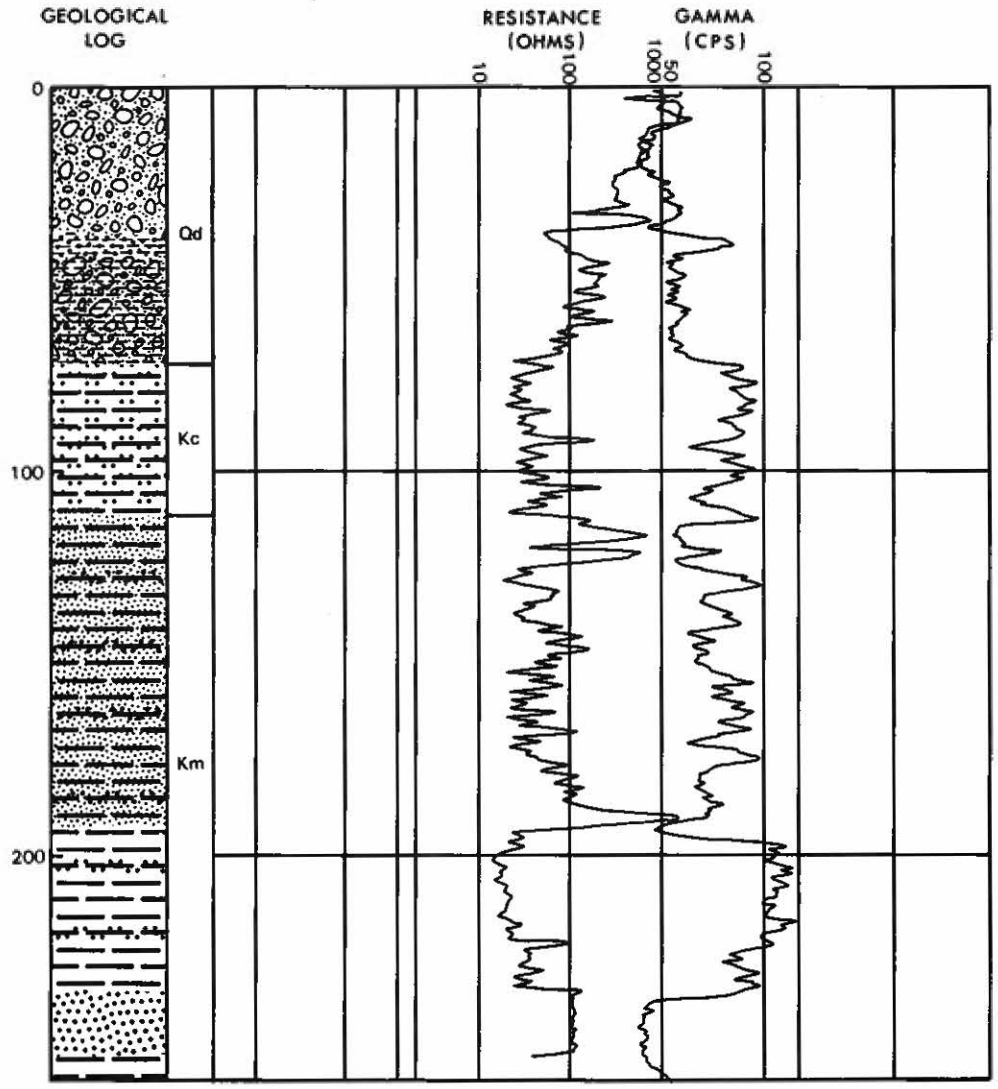
Alberta Research Council

Ground elevation 1120 Total depth 260

KB elevation

| Interval from | to | Description | Formation |
|---|---|---|---|
| 0 | 38 | Clayey sand and gravel, some clay stringers | Drift |
| 38 | 44 | Sandy clay | |
| 44 | 72 | Clayey sand & gravel, some clay stringers - some bitumen | |
| 72 | 111 | Gray shale with siltstone stringers | Clearwater |
| 111 | 192 | Bituminous sand, some shale, siltstone and water bearing sand stringers | McMurray |
| 192 | 234 | Shale with siltstone stringers | |
| 234 | 259 | Water bearing sand | |
| 260 | | Shale | |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE TENNECO 1
## 10-20-96-7-W4 th
### ALBERTA RESEARCH COUNCIL

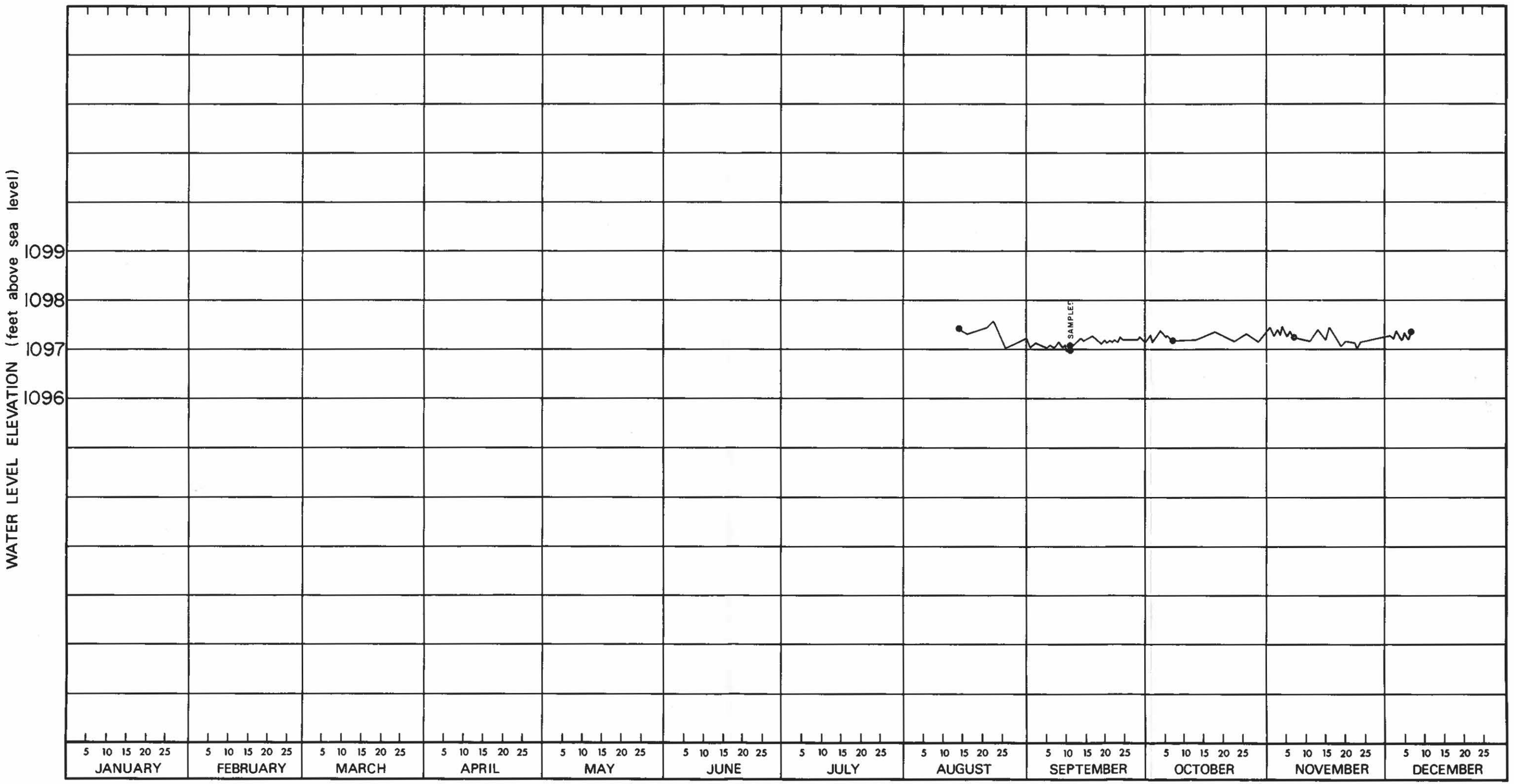


WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

TENNECO 1-H-77




1975

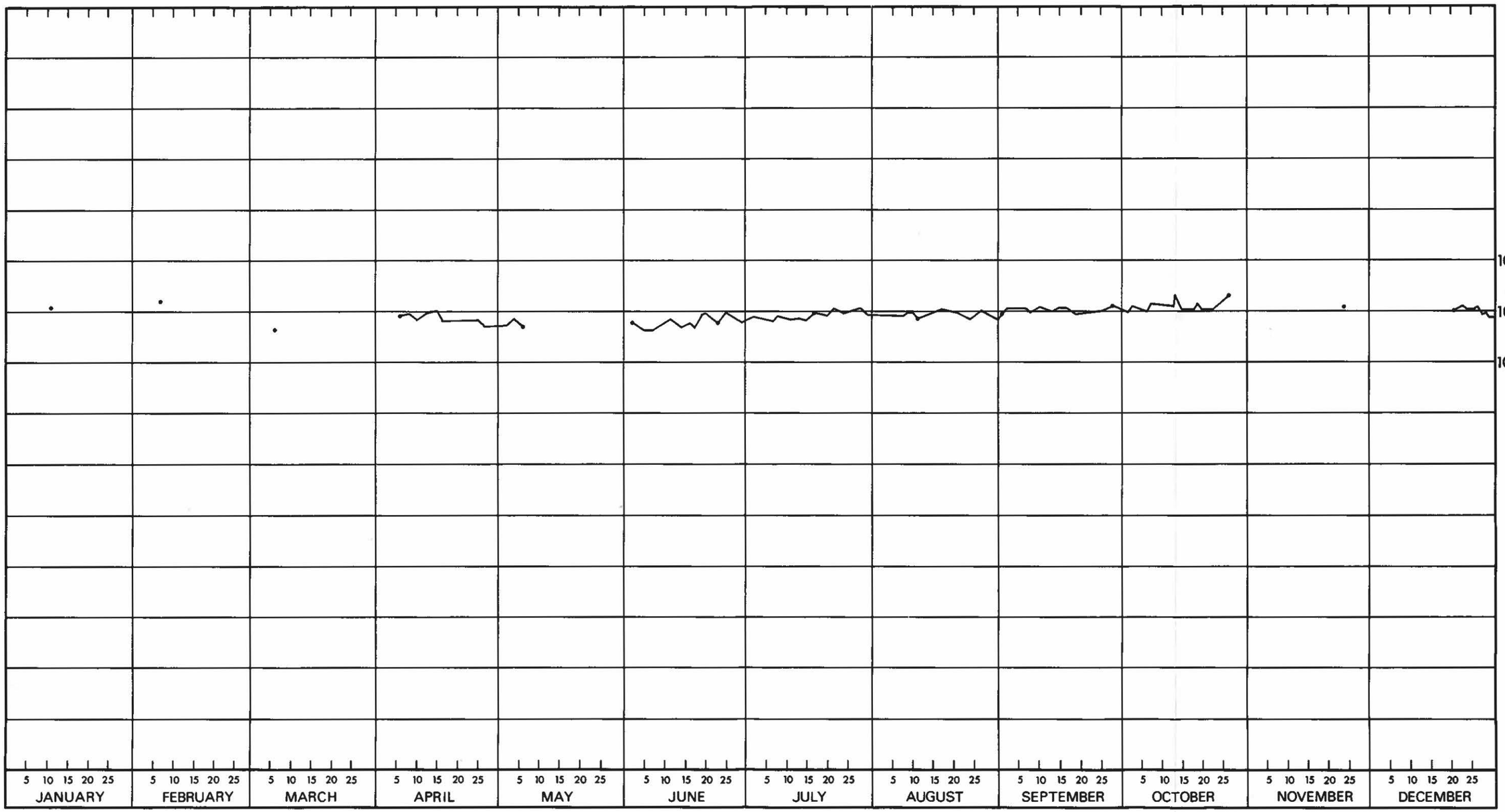
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER Tenneco 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Tenneco 1 - H - 77




1976

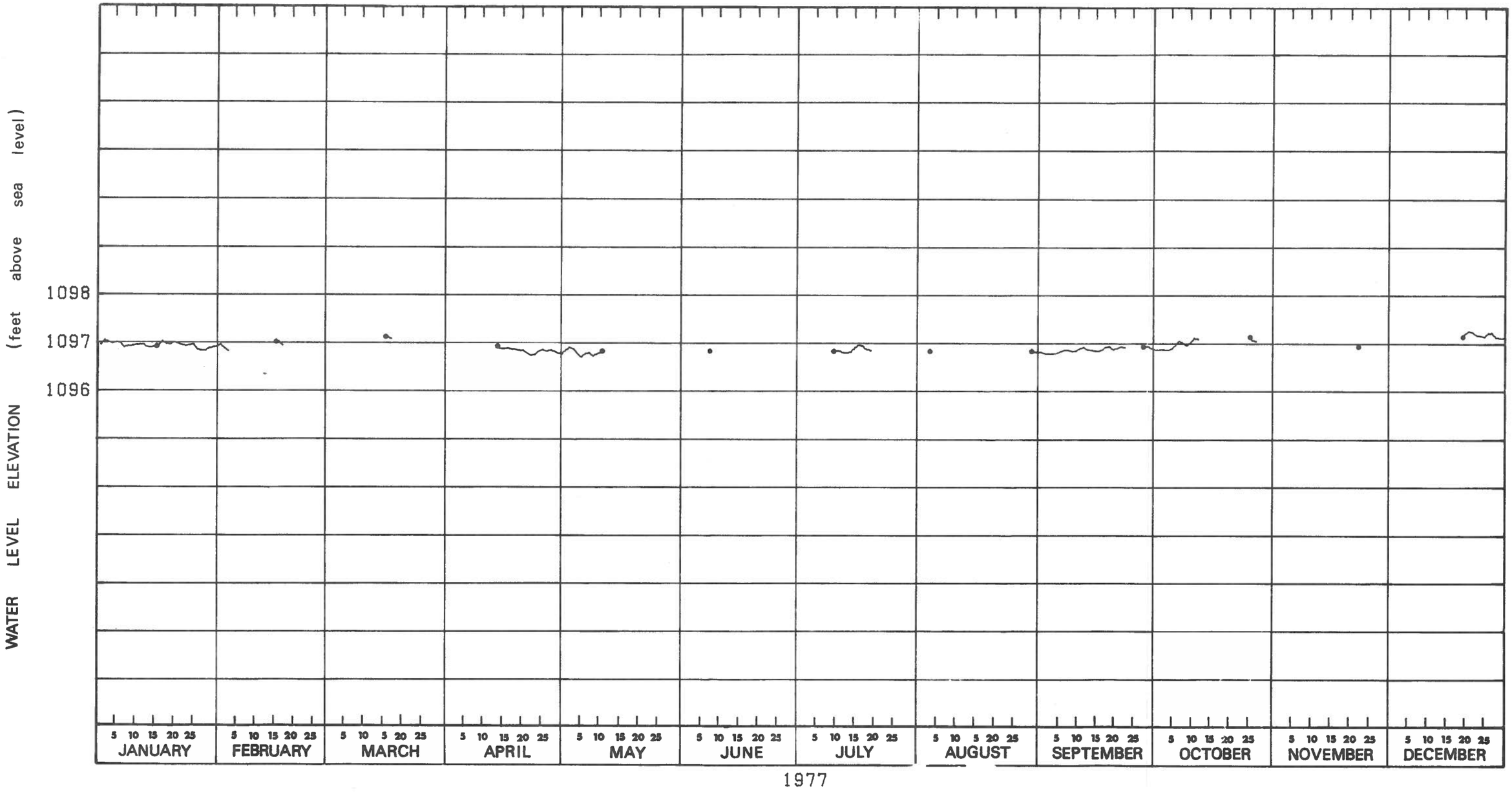
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4 th

Alberta Research Council

TENNECO 1-H-78



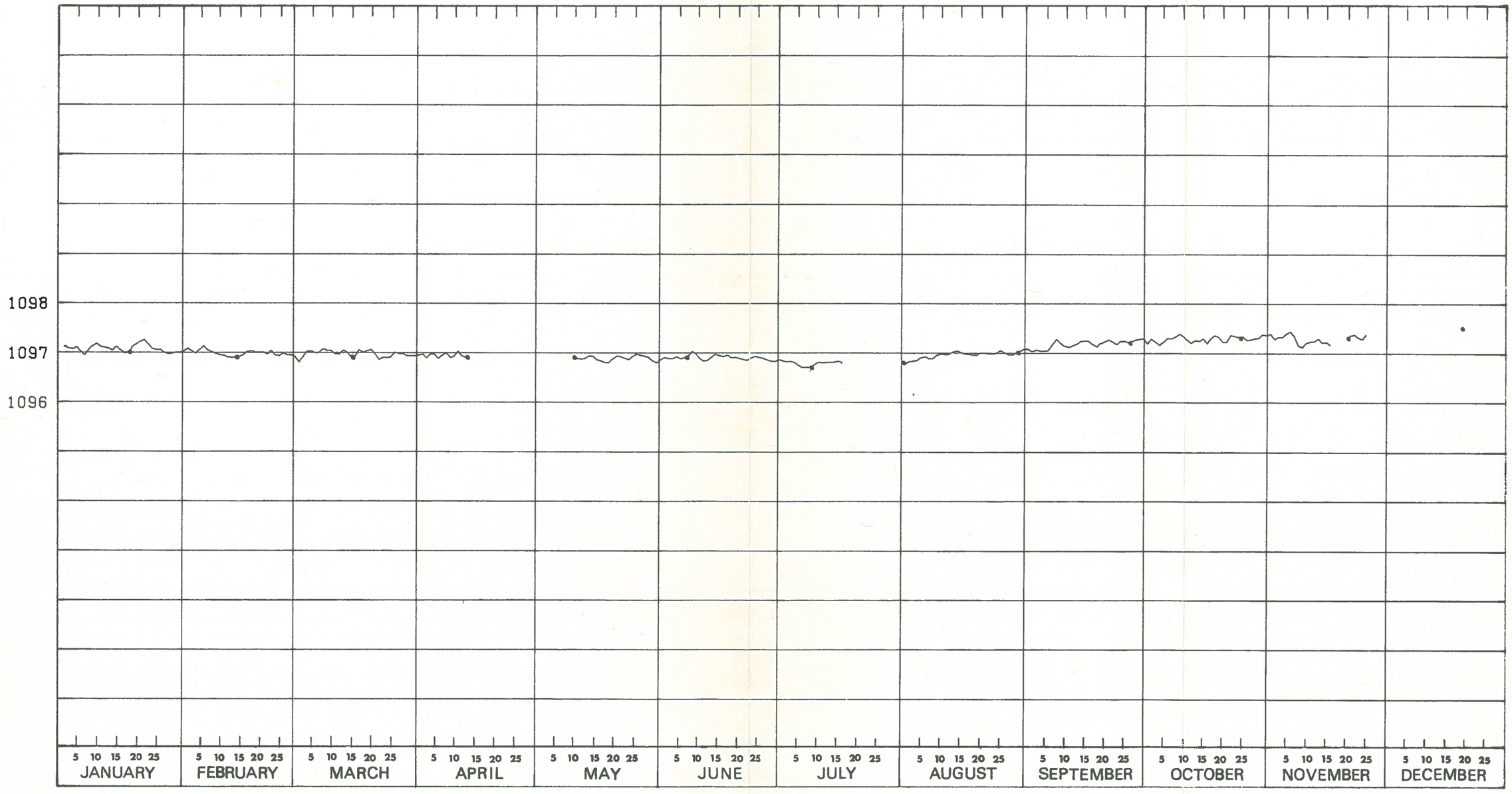
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER TENNECO 1

LSD 10 SEC 20 TWP 96 R 7 W4TH

Alberta Research Council

TENNECO 1-H-79



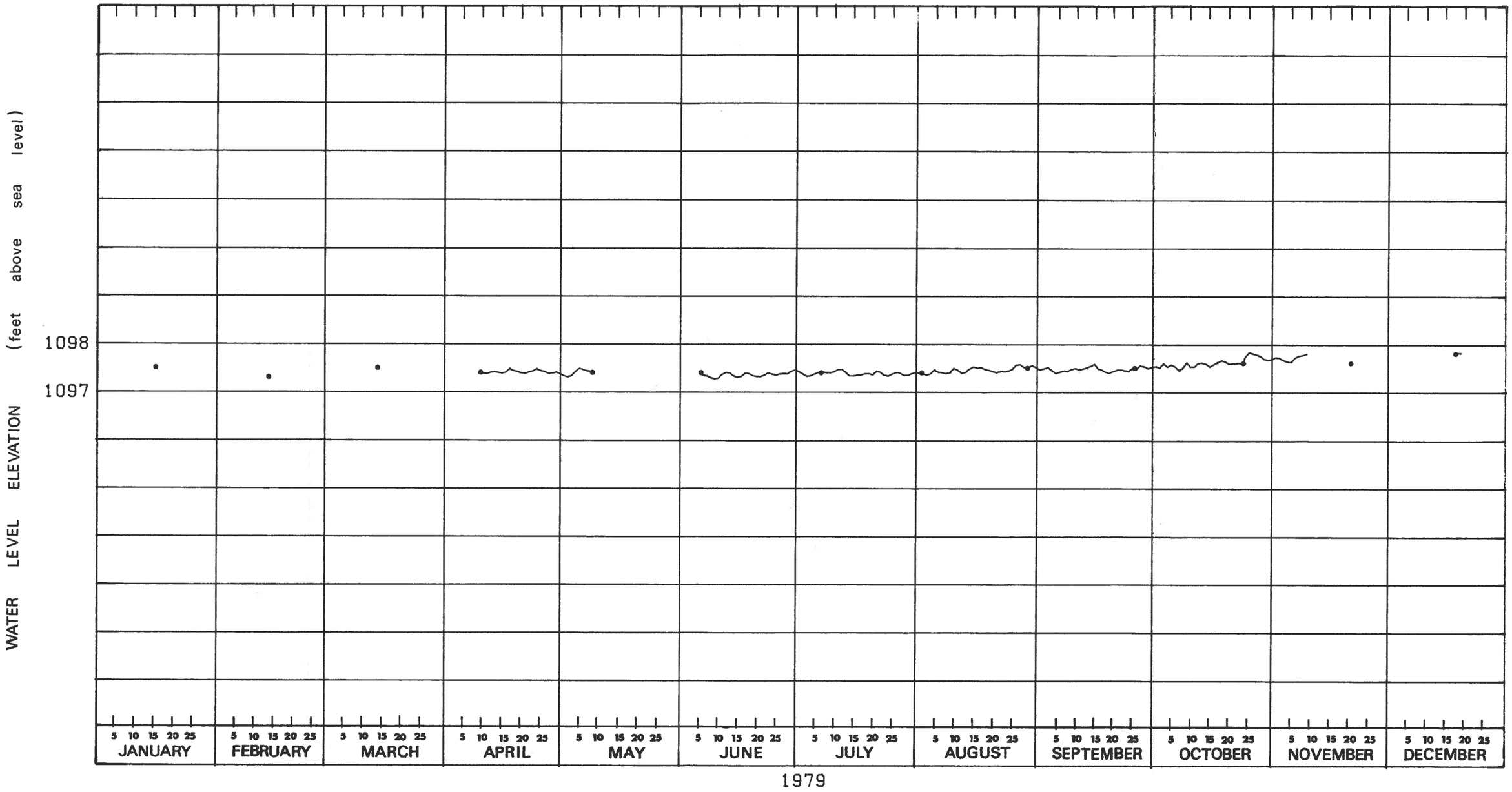
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4 th

Alberta Research Council

TENNECO 1-H-80



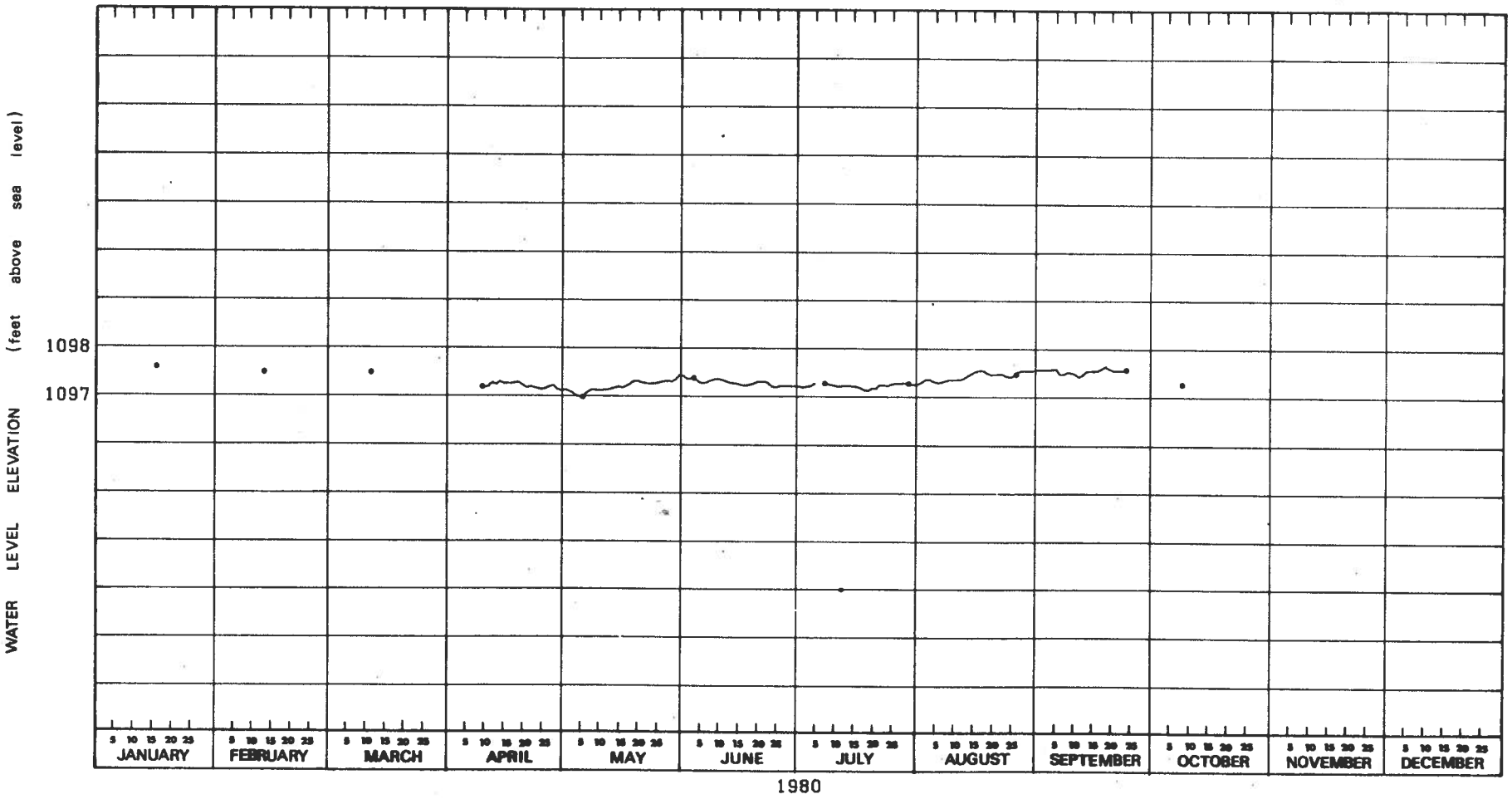
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4 th

Alberta Research Council

TENNECO 1-H-81



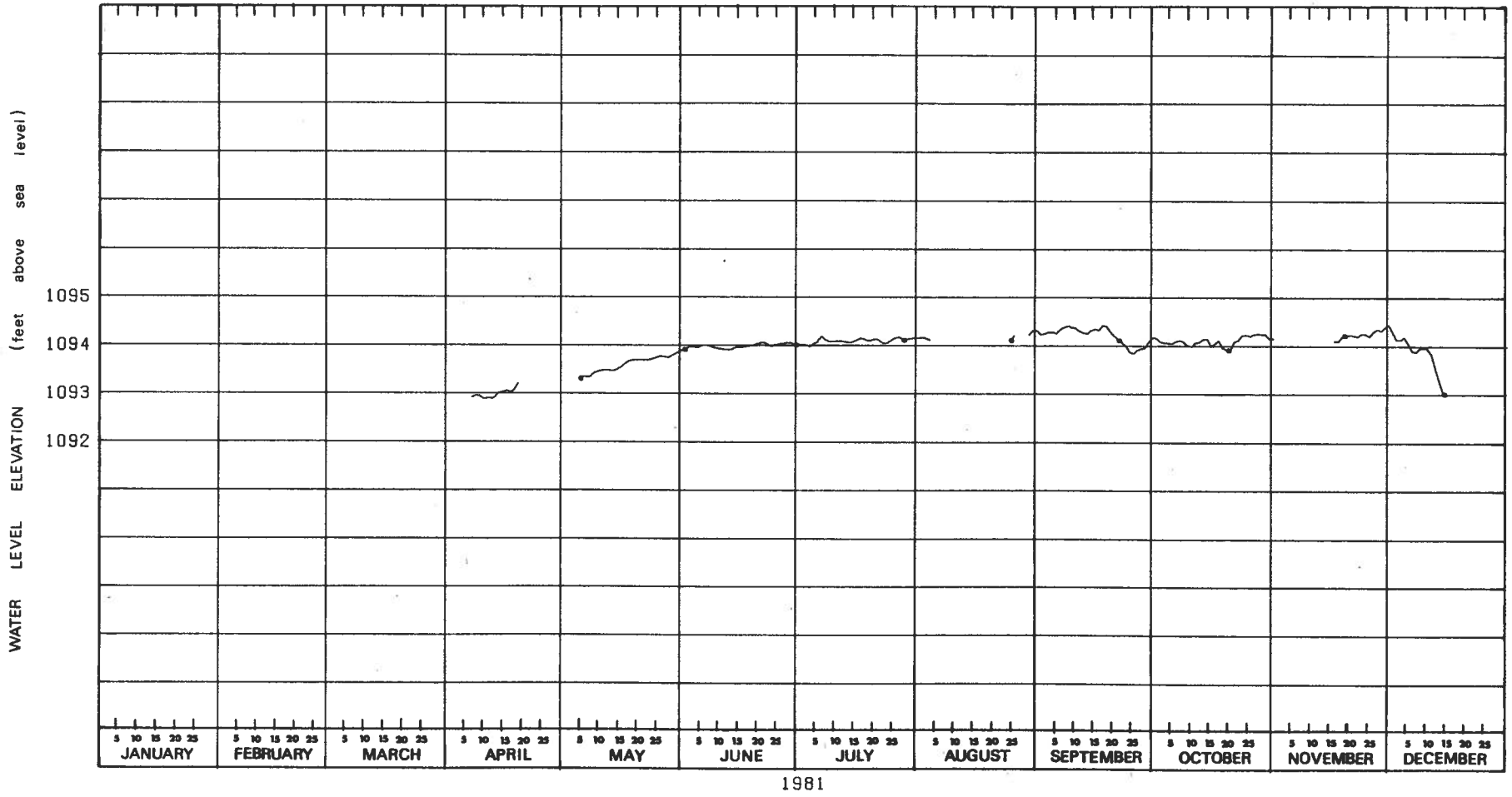
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER TENNECO 1

TENNECO 1-H-82

Lsd 10 Sec 20 Twp 96 R 7 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Elevation of top of casing 1120.1

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Mar 2/74 | | | Well completed 260' T.D. |
| Mar 6-7/74 | 7.03 TOC | 1097.0 | 48 hour pump test 208 IGPM |
| July 10/75 | 7.05 TOC | 1097.0 | |
| Aug 14/75 | 7.07 MP | 1099.5 | Install recorder & shelter; MP = 2.65' TOC, (1122.7) |
| Sept 11/75 | 7.83 MP | 1097.0 | |
| | 7.81 MP | 1097.1 | After sample; temp. 2.5°C |
| Oct 7/75 | 7.79 MP | 1097.1 | |
| Nov 7/75 | 7.77 MP | 1097.2 | |
| Dec 7/75 | 7.74 MP | 1097.3 | |
| Jan 11/76 | 7.82 MP | 1097.1 | |
| Feb 7/76 | 7.78 MP | 1097.2 | |
| Mar 6/76 | 7.95 MP | 1096.6 | |
| Apr 6/76 | 7.87 MP | 1096.9 | |
| May 6/76 | 7.94 MP | 1096.7 | |
| June 2/76 | 7.92 MP | 1096.7 | |
| June 23/76 | 7.92 MP | 1096.7 | |
| July 17/76 | 7.87 MP | 1096.9 | |
| | 7.85 MP | 1097.0 | After sample; temp. 5°C |
| Aug 11/76 | 7.89 MP | 1096.8 | |
| Sept 1/76 | 7.87 MP | 1096.9 | |
| Sept 28/76 | 7.82 MP | 1097.1 | |
| Oct 27/76 | 7.75 MP | 1097.3 | |
| Nov 24/76 | 7.79 MP | 1097.1 | |
| Dec 21/76 | 7.82 MP | 1097.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Elevation of top of casing 1120.1

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 7.86 MP | 1096.9 | MP (1122.7) |
| Feb 16/77 | 7.83 MP | 1097.0 | |
| Mar 16/77 | 7.80 MP | 1097.1 | |
| Apr 14/77 | 7.86 MP | 1096.9 | |
| May 11/77 | 7.88 MP | 1096.8 | |
| June 8/77 | 7.88 MP | 1096.8 | |
| July 10/77 | 7.88 MP | 1096.8 | |
| | 7.90 MP | 1096.8 | After sample; temp. 6°C |
| Aug 4/77 | 7.90 MP | 1096.8 | |
| Aug 30/77 | 7.88 MP | 1096.8 | |
| Sept 27/77 | 7.85 MP | 1096.9 | |
| Oct 26/77 | 7.79 MP | 1097.1 | |
| Nov 23/77 | 7.85 MP | 1096.9 | |
| Dec 20/77 | 7.81 MP | 1097.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Elevation of top of casing 1120.1

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 7.84 MP | 1097.0 | MP (1122.7) |
| Feb 14/78 | 7.85 MP | 1096.9 | |
| Mar 15/78 | 7.86 MP | 1096.9 | |
| Apr 13/78 | 7.86 MP | 1096.9 | |
| May 10/78 | 7.85 MP | 1096.9 | |
| June 7/78 | 7.85 MP | 1096.9 | |
| July 9/78 | 7.91 MP | 1096.7 | |
| | 7.91 MP | 1096.7 | After sample; temp. 4°C |
| Aug 1/78 | 7.89 MP | 1096.8 | |
| Aug 30/78 | 7.83 MP | 1097.0 | |
| Sept 27/78 | 7.77 MP | 1097.2 | MP = 0.55m TOC (1121.9) |
| Oct 25/78 | 7.49 MP | 1097.3 | |
| Nov 21/78 | 7.50 MP | 1097.3 | |
| Dec 20/78 | 7.43 MP | 1097.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Elevation of top of casing 1120.1

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 7.43 MP | 1097.5 | MP (1121.9) |
| Feb 14/79 | 7.50 MP | 1097.3 | |
| Mar 14/79 | 7.44 MP | 1097.5 | |
| Apr 10/79 | 7.46 MP | 1097.4 | |
| May 9/79 | 7.48 MP | 1097.4 | |
| June 6/79 | 7.46 MP | 1097.4 | |
| July 7/79 | 7.47 MP | 1097.4 | |
| | 7.47 MP | 1097.4 | After sample; temp. 5°C |
| Aug 2/79 | 7.47 MP | 1097.4 | |
| Aug 29/79 | 7.45 MP | 1097.5 | |
| Sept 27/79 | 7.44 MP | 1097.5 | |
| Oct 24/79 | 7.42 MP | 1097.6 | |
| Nov 21/79 | 7.41 MP | 1097.6 | |
| Dec 18/79 | 7.34 MP | 1097.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER TENNECO 1

Lsd 10 Sec 20 Twp 96 R 7 W4th

Alberta Research Council

Elevation of top of casing 1120.1

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/80 | 7.41 MP | 1097.6 | |
| Feb 13/80 | 7.45 MP | 1097.5 | |
| Mar 12/80 | 7.45 MP | 1097.5 | |
| Apr 10/80 | 7.53 MP | 1097.2 | |
| May 6/80 | 7.58 MP | 1097.0 | |
| June 4/80 | 7.51 MP | 1097.4 | New MP 0.59 m TOC (1122.0) |
| July 8/80 | 7.54 MP | 1097.3 | Temp. 5°C |
| | 7.54 MP | 1097.3 | After Sample |
| July 30/80 | 7.52 MP | 1097.3 | |
| Aug 27/80 | 7.48 MP | 1097.5 | |
| Sept 25/80 | 7.44 MP | 1097.6 | |
| Oct 9/80 | 7.53 MP | 1097.3 | Static Water Level Before Pump Test |
| Jan 14/81 | 8.64 MP | 1093.7 | |
| Mar 11/81 | 8.87 MP | 1092.9 | |
| Apr 8/81 | 8.88 MP | 1092.9 | Reinstalled Recorder |
| May 6/81 | 8.74 MP | 1093.3 | |
| June 2/81 | 8.56 MP | 1093.9 | |
| July 1/81 | 8.54 MP | 1094.0 | |
| July 29/81 | 8.52 MP | 1094.1 | |
| Aug 26/81 | 8.52 MP | 1094.1 | |
| Sept 23/81 | 8.52 MP | 1094.1 | |
| Oct 21/81 | 8.57 MP | 1093.9 | |
| Nov 20/81 | 8.47 MP | 1094.2 | |
| Dec 16/81 | 8.83 MP | 1093.0 | |

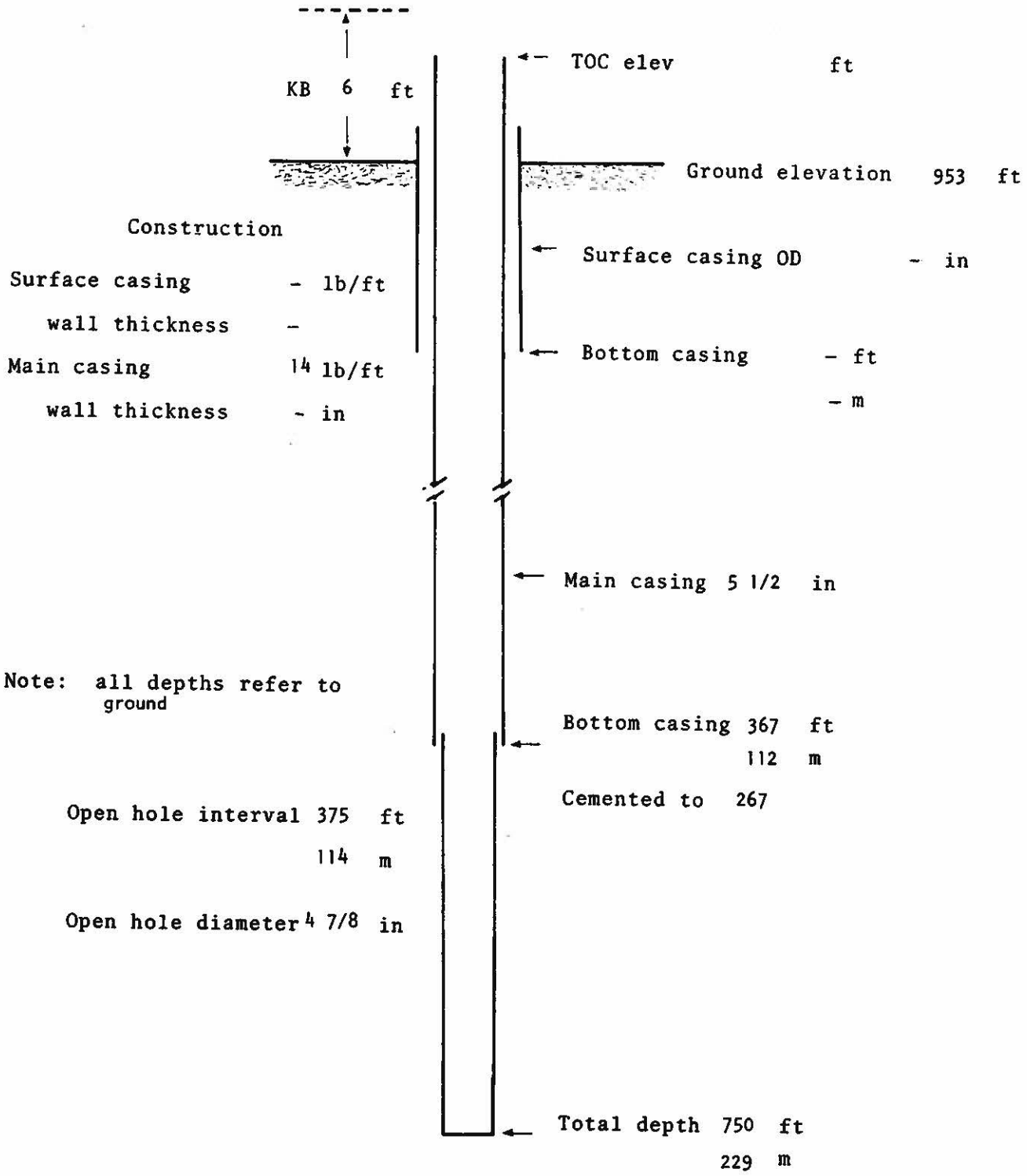
MP - Depth from measuring point
TOC - Depth from top of casing

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Tp 95 R 10 Mer 4th

Alberta Research Council




Construction

Surface casing - lb/ft

wall thickness -

Main casing 14 lb/ft

wall thickness - in

Note: all depths refer to ground

Open hole interval 375 ft

114 m

Open hole diameter 4 7/8 in

N.B.: Well was drilled to 983 ft and plugged back with cement to 750'

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Ground elevation 953 Total depth 750

KB elevation

All depths refer to ground level

| Interval from | to | Description | Formation |
|---|---|---|---|
| 0 | 310 | No report | |
| 310 | 380 | Calcareous grey/green soft shale - no shows | Waterways (Beaverhill Lake) |
| 380 | 405 | Limestone, no shows, argillaceous | |
| 405 | 445 | Soft grey shale | |
| 445 | 475 | Limestone - no shows - oil staining along hairline fractures | |
| 475 | 480 | Soft grey shale | |
| 480 | 500 | Limestone, no shows, silty | |
| 500 | 510 | Anhydritic, limy dolomite no shows | |
| 510 | 565 | Interbedded shale, gypsum and anhydrite beds with minor limestone | Elk Point (Prairie Evaporite |
| 565 | 575 | 80% gypsum and anhydrite with dark brown oil stain lining gypsum sealed fractures and vugs - bleeding small drops of tar | |
| 575 | 590 | 50% gypsum and anhydrite, 25% shale, 25% dolomite trace C with small drops of bleeding tar | |
| 590 | 595 | Soft grey shale | |
| 595 | 615 | Limy dolomite trace C with scattered brown oil stain | Methy |
| 615 | 620 | Dolomitic limestone trace C with scattered oil stain and bleeding drops of tar | |
| 620 | 625 | Dolomitic limestone with scattered dark brown oil stain along gypsum sealed fractures | |
| 625 | 630 | Limestone mottled dark brown oil staining with trace limestone, uniform dark brown oil stain. Bleeding drops of tar and possibly small amount of lighter gravity oil | |
| 630 | 635 | Limestone with 10% anhydrite (fracture and vug filling?). Oil stain in vugs - bleeding drops of tar | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER SHELL OBS-7 (Continued)

Lsd Sec Twp R W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from | to | Description | Formation |
|---|---|---|---|
| 635 | 640 | Limestone, no shows - interbedded anhydrite | |
| 640 | 643 | No samples taken. Established stabilized water production rate with air lift at 30 gpm. Salinity by $AgNO_3$ titration is 24,000 ppm NaCl | |
| 643 | 983 | Drilled without regaining circulation or cutting samples | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Sample source SHELL OBS-7 (SCL)

Date sampled August 17, 1972

### Major Constituents

| | | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|---|
| Calcium ($Ca^{++}$) | | 1032 | 51.50 | 13.7 |
| Magnesium ($Mg^{++}$) | | 271 | 22.29 | 6.0 |
| Sodium ($Na^{+}$) | | | | |
| Potassium ($K^{+}$) | Na + K | 6960 | 302.63 | 80.4 |
| Carbonate ($CO_3^{=}$) | | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | | 390 | 6.39 | 1.7 |
| Sulfate ($SO_4^{=}$) | | 2944 | 61.32 | 16.3 |
| Chloride ($Cl^{-}$) | | 10947 | 308.71 | 82.0 |
| Nitrate ($NO_3^{=}$) | | | | |
| Silica ($SiO_2$) | | | | |
| Hydroxide ($OH^{-}$) | | | | |
| Calcium (Acidified) | | | | |
| Magnesium (Acidified) | | | | |
| Total dissolved solids | | 22544 calculated | | |
| Total Anions (epm) | | Total Cations (epm) | | |

### Other Constituents

Lab:

| | |
|---|---|
| Conductivity | |
| pH | 7.1 |
| Fluoride ($F^{-}$) | |
| $H_2S$ | None |

Field:

| |
|---|
| Temperature (C) |
| pH |
| Carbonate ($CO_3^{=}$) |
| Bicarbonate ($HCO_3^{-}$) |
| Hydroxide ($OH^{-}$) |
| Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 5.5 | 0.27 | 4 |
| Magnesium ($Mg^{++}$) | 2.3 | 0.19 | 3 |
| Sodium ($Na^{+}$) | 158.0 | 6.87 | 92 |
| Potassium ($K^{+}$) | 5.0 | 0.13 | 2 |
| Carbonate ($CO_3^{=}$) | 7.2 | 0.24 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 142.0 | 2.33 | 32 |
| Sulfate ($SO_4^{=}$) | 13.6 | 0.28 | 4 |
| Chloride ($Cl^{-}$) | 160.0 | 4.51 | 61 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0 |
| Silica ($SiO_2$) | 0.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 5.4 | | |
| Magnesium (Acidified) | 2.5 | | |
| Total dissolved solids | 380 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 7.37 | Total Cations (epm) | 7.46 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 730 | | Temperature (C) | 6.0 | |
| pH | 8.4 | | pH | 9.0 | |
| Fluoride ($F^{-}$) | 0.6 | Mg/L | Carbonate ($CO_3^{=}$) | 53 | Mg/L |
| | | | Bicarbonate ($HCO_3^{-}$) | 68 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 8.8 | 0.44 | 2.5 |
| Magnesium ($Mg^{++}$) | 8.6 | 0.71 | 4.0 |
| Sodium ($Na^{+}$) | 378.0 | 16.44 | 92.0 |
| Potassium ($K^{+}$) | 10.8 | 0.28 | 1.5 |
| Carbonate ($CO_3^{=}$) | 7.2 | 0.24 | 1.3 |
| Bicarbonate ($HCO_3^{-}$) | 224.0 | 3.67 | 20.1 |
| Sulfate ($SO_4^{=}$) | 28.1 | 0.59 | 3.2 |
| Chloride ($Cl^{-}$) | 488.0 | 13.76 | 75.3 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0.1 |
| Silica ($SiO_2$) | 0.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 8.3 | | |
| Magnesium (Acidified) | 8.5 | | |
| Total dissolved solids | 1036.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 18.27 | Total Cations (epm) | 17.87 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2000 | Temperature (C) | 7.0 |
| pH | 8.5 | pH | |
| Fluoride ($F^{-}$) | 1.2 ppm | Carbonate ($CO_3^{=}$) | 24.0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 195.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Date sampled: July 16, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | <.001 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 144 |
| As | <.038 | Ni | <.010 |
| B | .334 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 7.30 | Si | .40 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .130 |
| Cr | <.006 | Te | <.065 |
| Cu | .008 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | .033 | V | <.0008 |
| K | <.150 | W | <.078 |
| Mg | 2.38 | Zn | <.002 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

SHELLOBS-7-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER SHELLOBS-7

Lsd 10 Sec 25 Rge 10 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 15.0 | 0.75 | 2.5 |
| Magnesium(Mg) | 20.0 | 1.65 | 5.5 |
| Sodium(Na) | 619.0 | 26.92 | 90.5 |
| Potassium(K) | 17.1 | 0.44 | 1.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 344.0 | 5.64 | 17.7 |
| Sulphate(SO4) | 36.3 | 0.76 | 2.4 |
| Chloride(Cl) | 905.0 | 25.52 | 79.9 |
| Nitrate(NO3) | 1.7 | 0.03 | 0.1 |
| Silica(SiO2) | 1.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 14.4 | | |
| Magnesium(Acidified) | 18.7 | | |
| TDS(mg/l) | 1742.0 | | |
| Total Anions(epm) | 31.94 | Total Cations(epm) | 29.76 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3030 | | Temperature(C) | 6.00 | |
| pH | 7.8 | | pH | 8.4 | |
| Fluoride(F) | 1.0 | mg/l | Carbonate(CO3) | 14 | mg/l |
| | | | Bicarbonate(HCO3) | 307 | mg/l |
| | | | Hydroxide(OH) | | |

SHELL OBS7-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL OBS7

Lsd 10 Sec 25 Rge 10 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 6, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 18.9 | 0.94 | 2.7 |
| Magnesium(Mg) | 22.0 | 1.81 | 5.3 |
| Sodium(Na) | 715.0 | 31.10 | 90.6 |
| Potassium(K) | 18.8 | 0.48 | 1.4 |
| Carbonate(CO3) | 12.0 | 0.40 | 1.1 |
| Bicarbonate(HCO3) | 288.0 | 4.72 | 12.8 |
| Sulphate(SO4) | 36.2 | 0.75 | 2.0 |
| Chloride(Cl) | 1100.0 | 31.02 | 84.1 |
| Nitrate(NO3) | 0.7 | 0.01 | 0.0 |
| Silica(SiO2) | 1.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 17.9 | | |
| Magnesium(Acidified) | 24.0 | | |
| TDS(mg/l) | 1964.0 | | |
| Total Anions(epm) | 36.91 | Total Cations(epm) | 34.34 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3160 | | Temperature(C) | 8.00 | |
| pH | 8.5 | | pH | 8.7 | |
| Fluoride(F) | 0.8 | mg/l | Carbonate(CO3) | 19 | mg/l |
| | | | Bicarbonate(HCO3) | 283 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS

SHELL OBS7-E-82

OBSERVATION WELL NUMBER SHELL OBS7

Lsd 10 Sec 25 Rge 10 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 8.5 | 0.42 | 3.9 |
| Magnesium(Mg) | 5.3 | 0.44 | 4.1 |
| Sodium(Na) | 226.0 | 9.83 | 90.7 |
| Potassium(K) | 5.4 | 0.14 | 1.3 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 73.0 | 1.20 | 11.0 |
| Sulphate(SO4) | 7.0 | 0.15 | 1.3 |
| Chloride(Cl) | 340.0 | 9.58 | 87.7 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 0.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 6.9 | | |
| Magnesium(Acidified) | 4.9 | | |
| TDS(mg/l) | 0.0 | | |
| Total Anions(epm) | 10.92 | Total Cations(epm) | 10.83 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 1300 |
| pH | 7.7 |
| Fluoride | 0.2 mg/l |

Field:

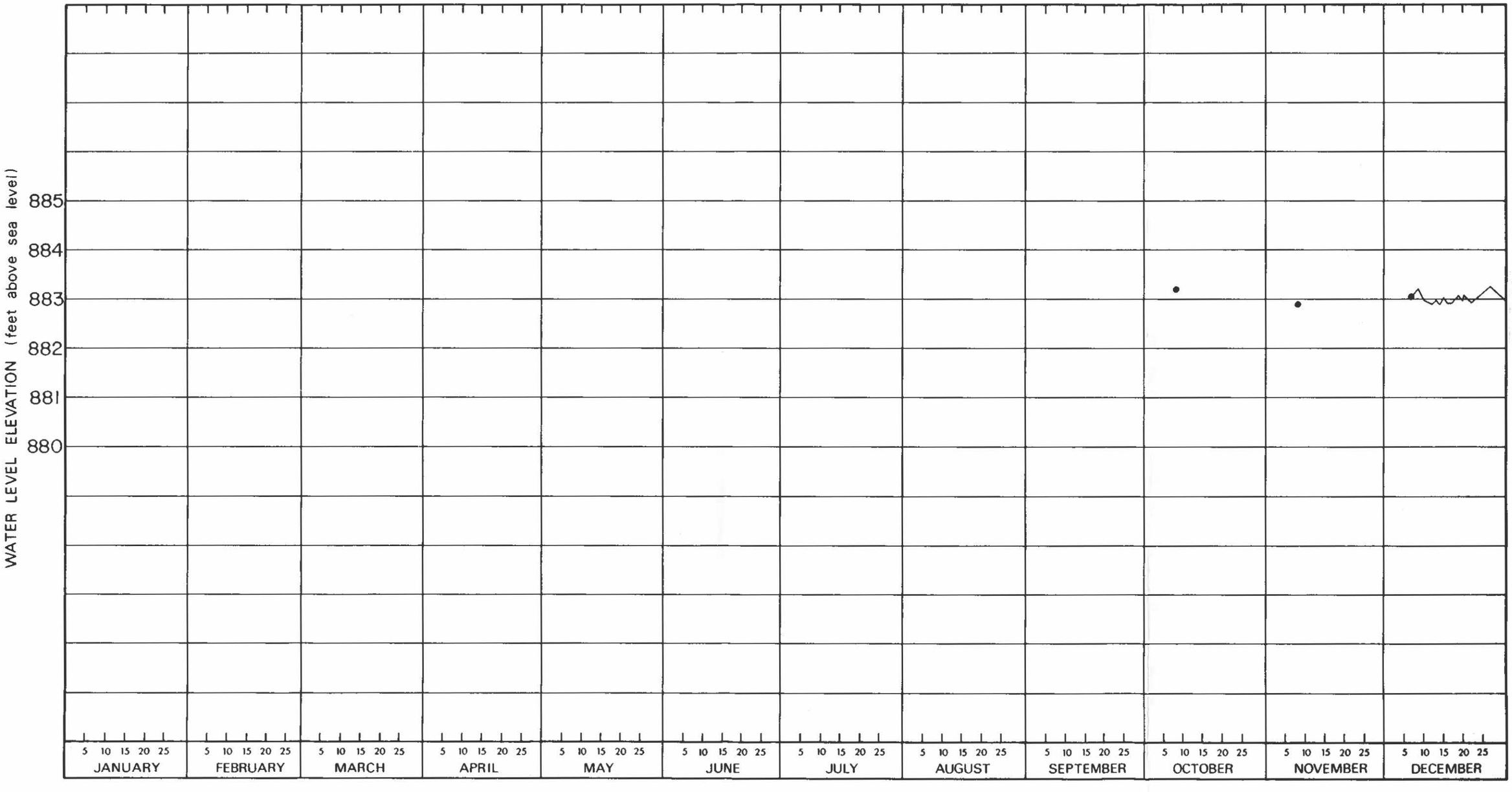
| | | |
|---|---|---|
| Temperature | 5.50 | |
| pH | 9.5 | |
| Carbonate(CO3) | 24 | mg/l |
| Bicarbonate(HCO3) | 24 | mg/l |
| Hydroxide(OH) | | |

WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4th

SHELL OBS-7-H-77



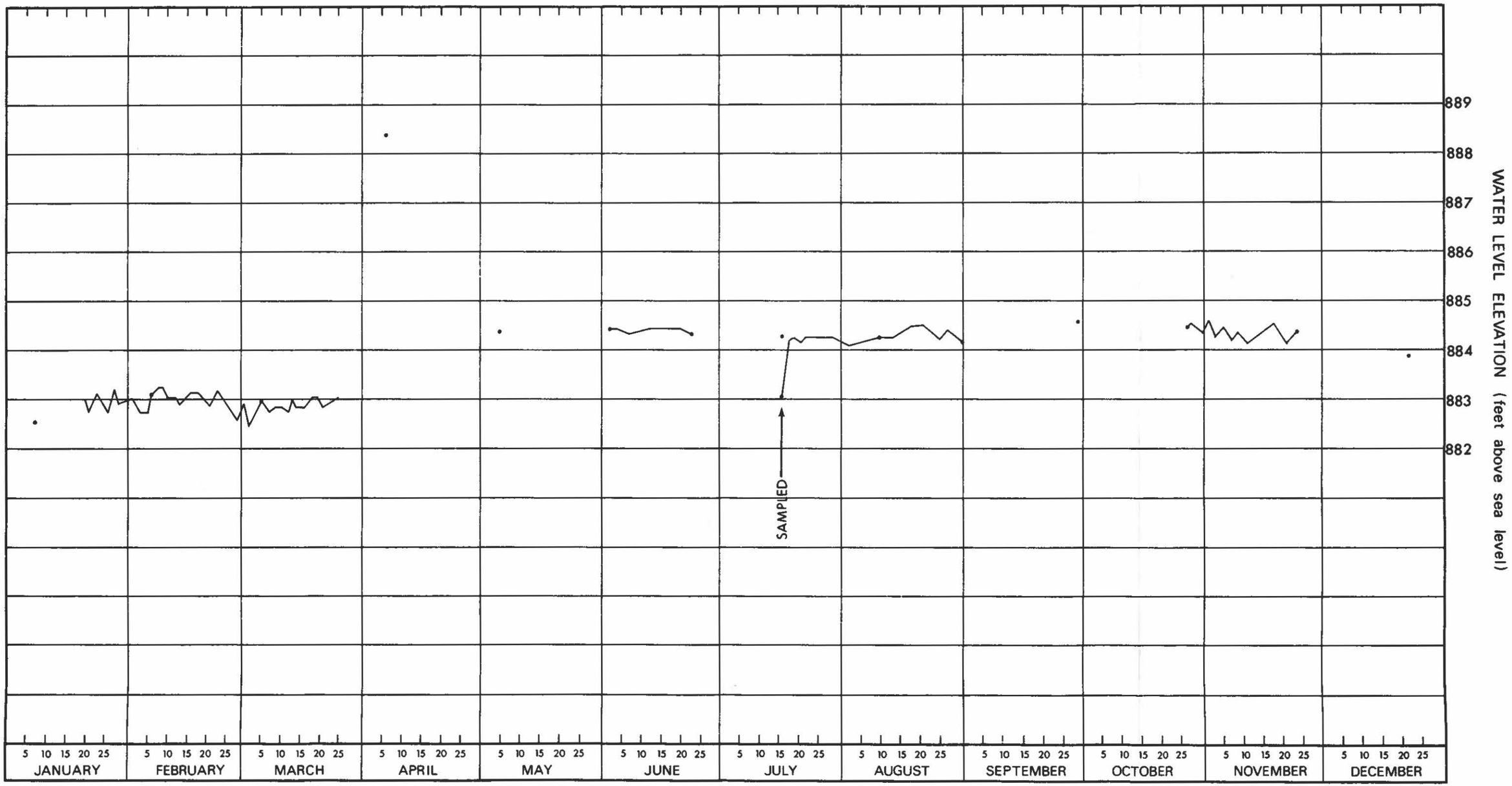
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

SHELL OBS - 7 - H - 77




1976

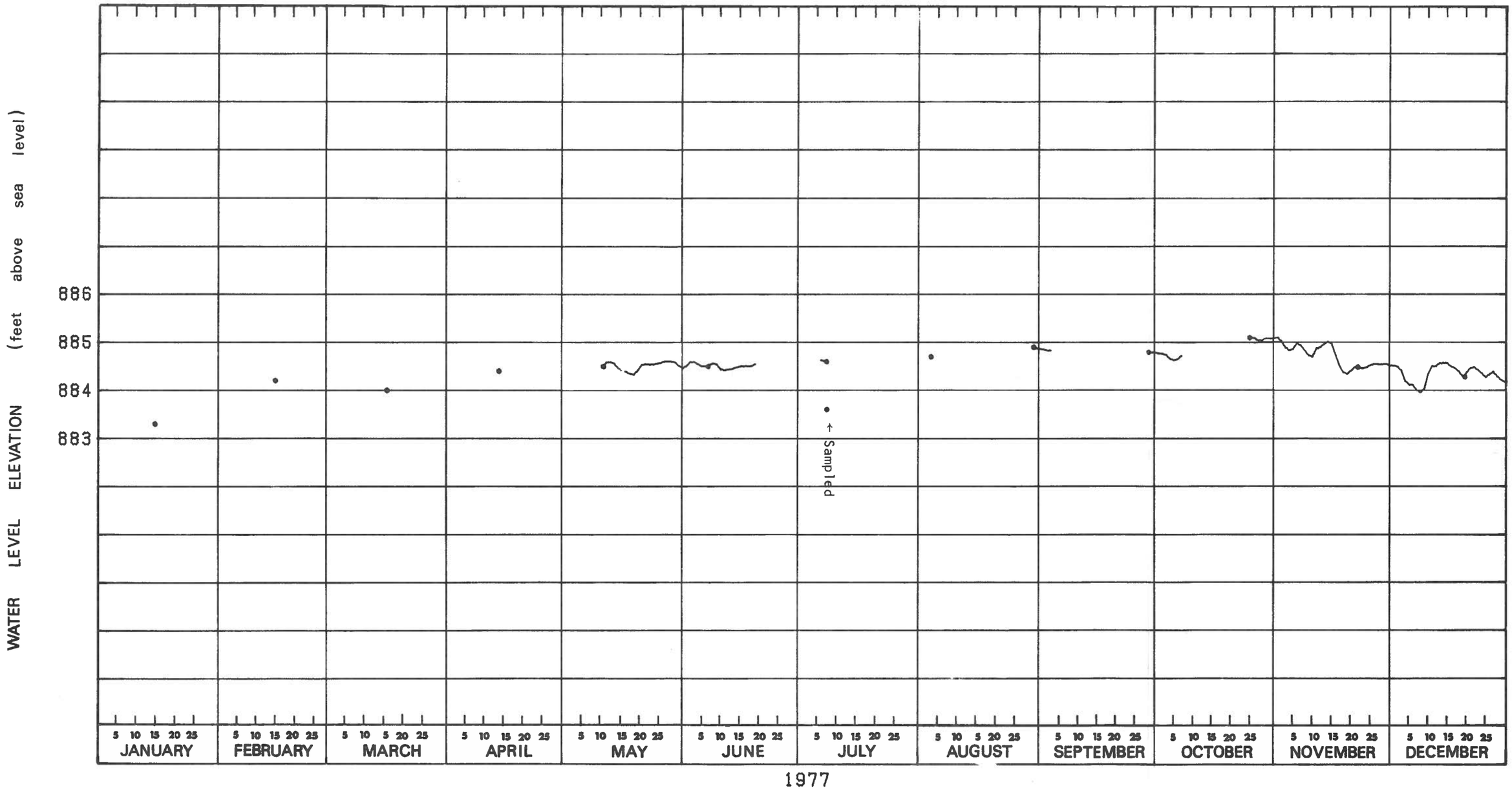
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL OBS-7

SHELL OBS-7-H-78

Lsd 10 Sec 25 Twp 95 R 10 W4 th

Alberta Research Council



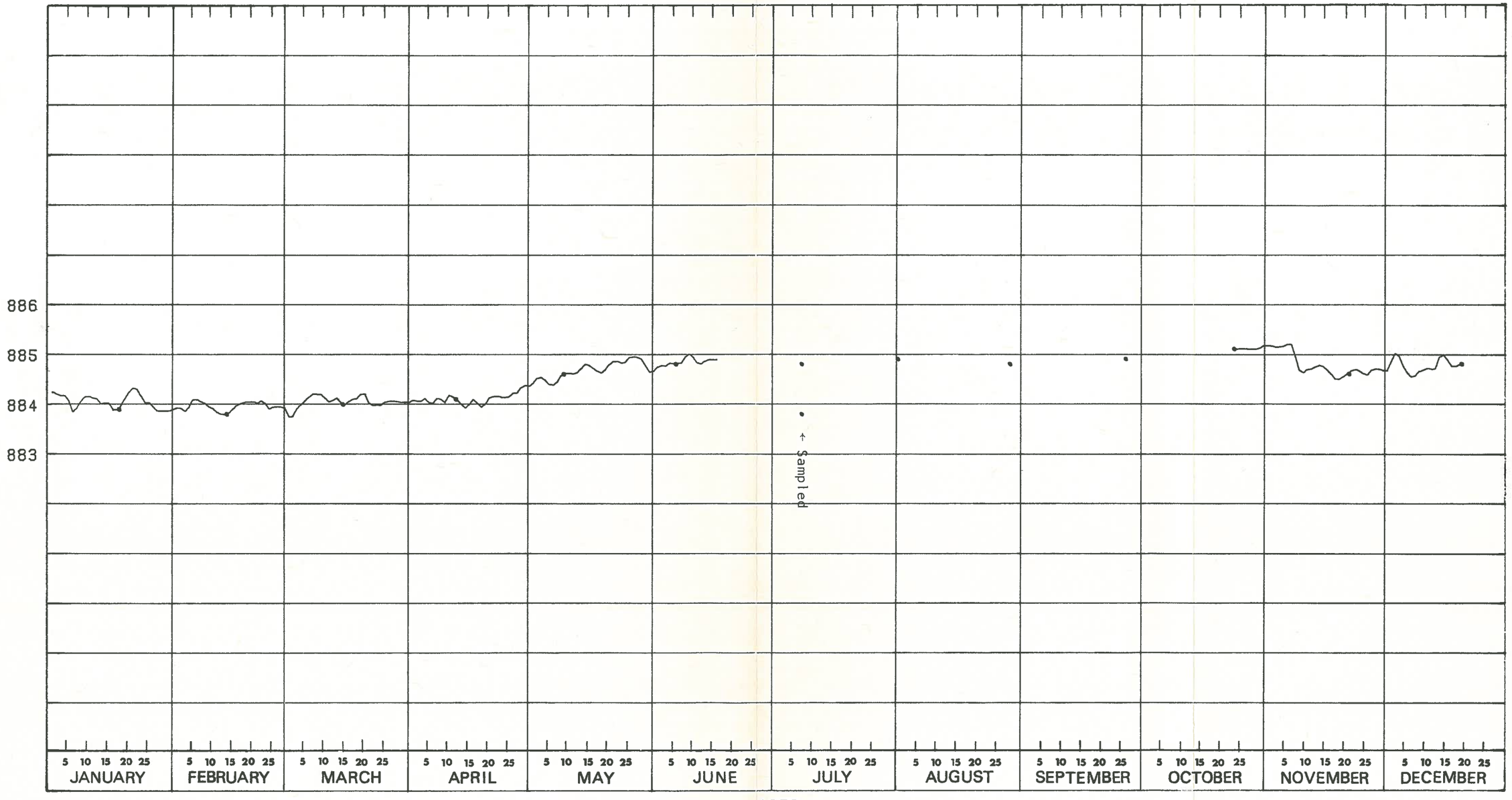
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL OBS-7

SHELL OBS-7-H-79

LSD 10 SEC 25 TWP 95 R 10 W4TH

Alberta Research Council




1978

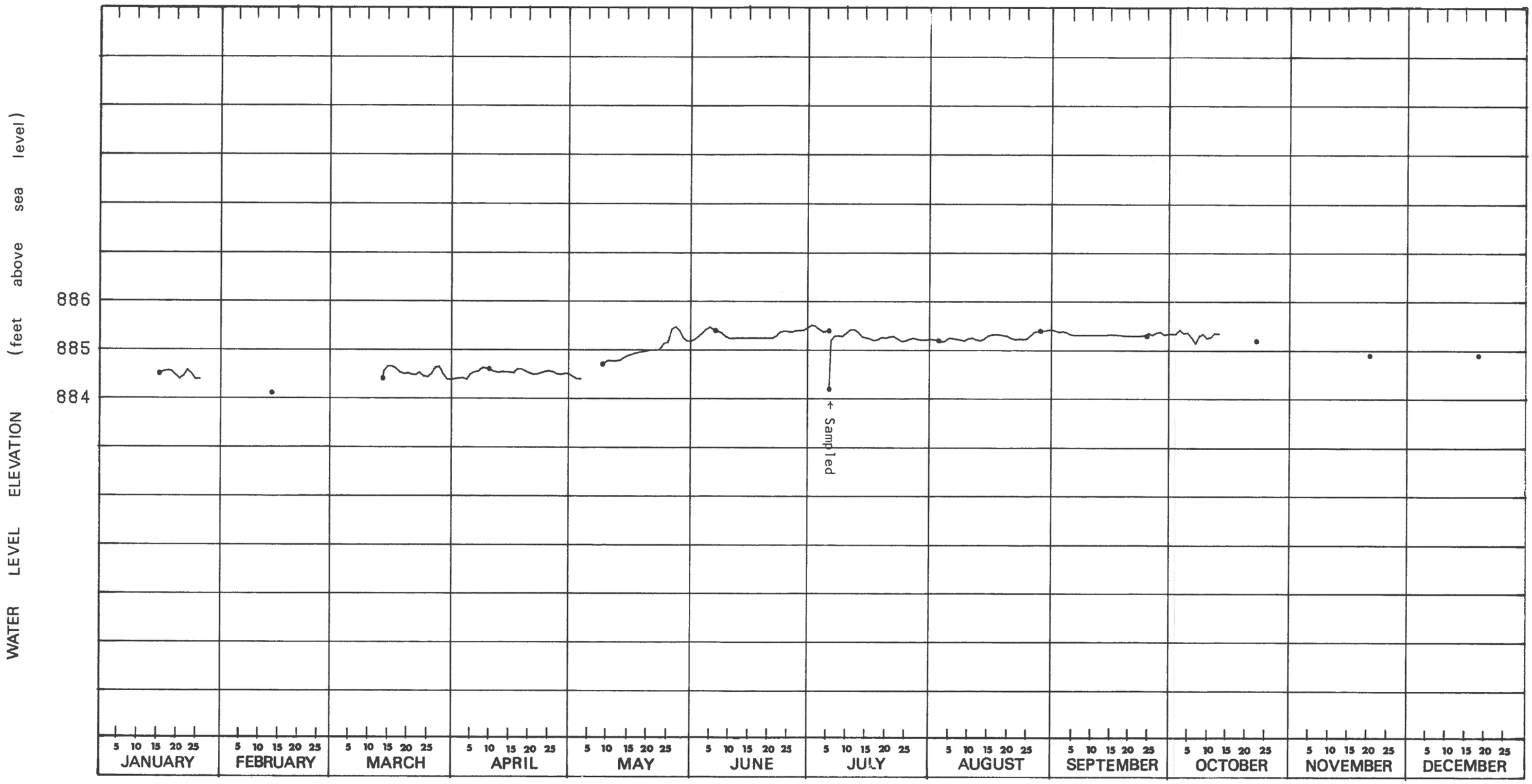
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4 th

Alberta Research Council

SHELL OBS-7-H-80



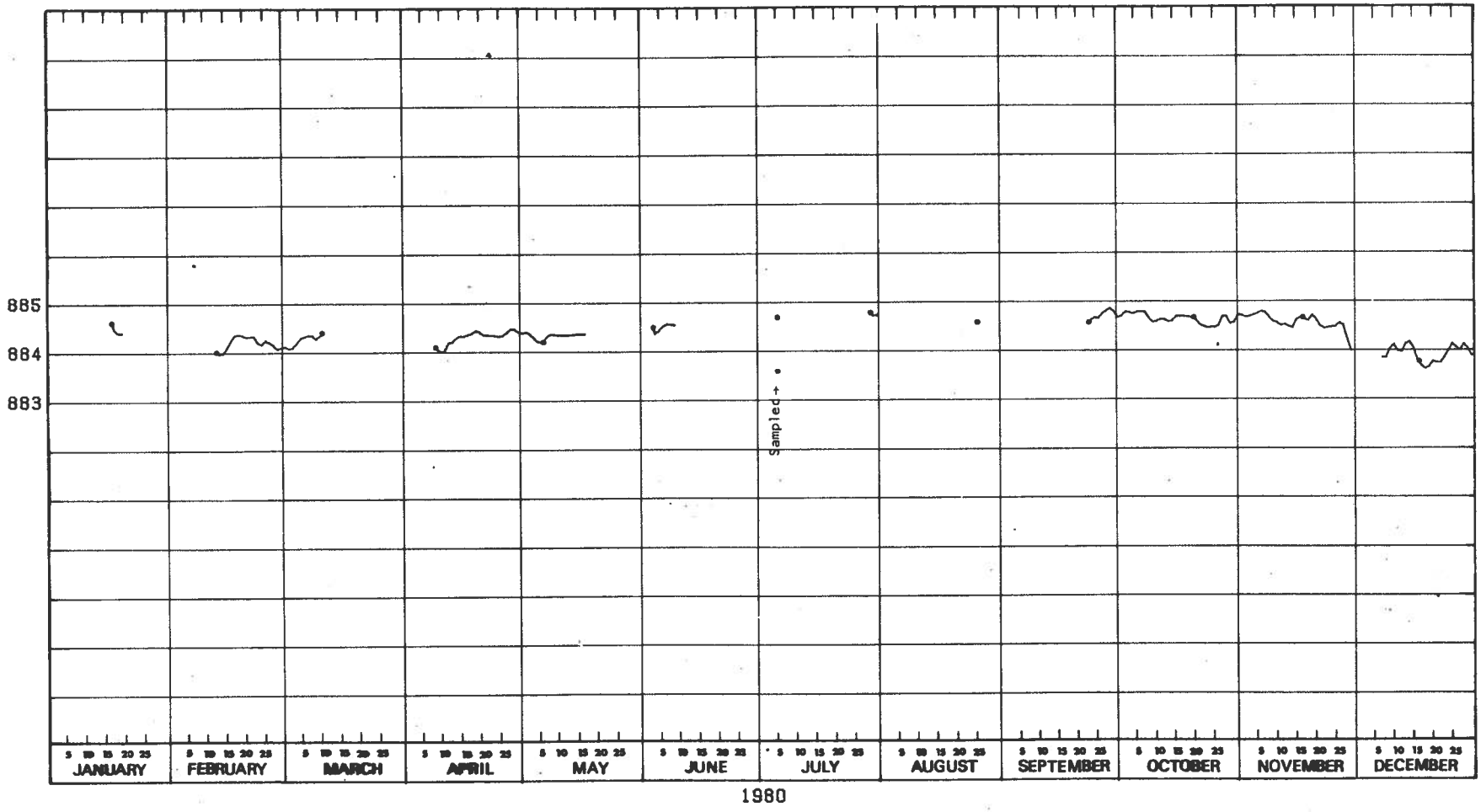
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL OBS-7

SHELL OBS-7-H-81

Lsd 10 Sec 25 Twp 95 R 10 W4 th

Alberta Research Council



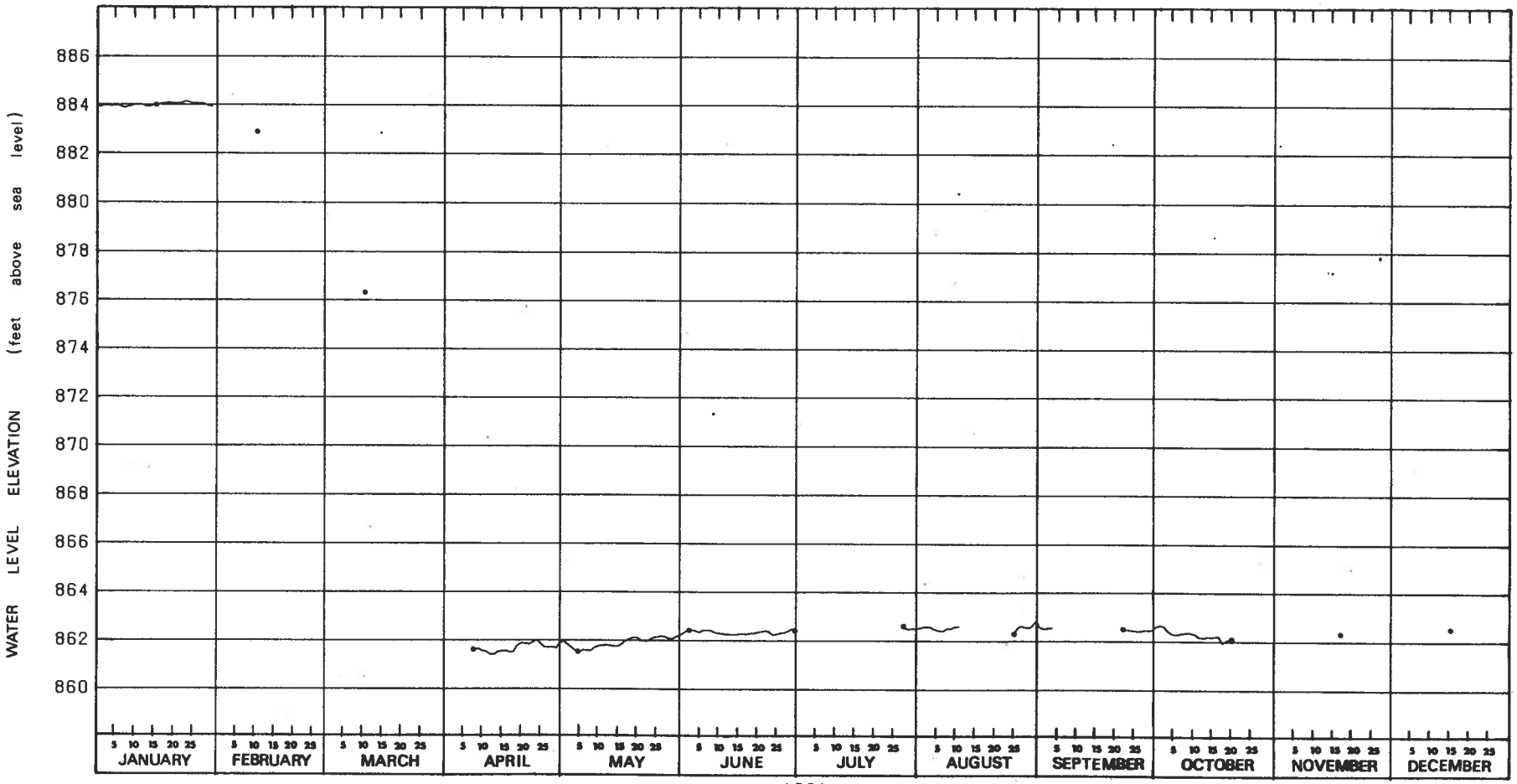
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL OBS-7

SHELL OBS-7-H-82

Lsd 10 Sec 25 Twp 95 R 10 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Elevation of top of casing 953.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Aug 24/72 | 23.80 TOC | 878 | Well completed - plugged to 750' |
| Sept 3/72 | 22.34 TOC | 883 | Ground level |
| Oct 8/75 | 21.75 TOC | 881.7 | |
| Nov 17/75 | 22.54 MP | 882.9 | MP = 1.16 m TOC, (956.8) |
| Dec 7/75 | 22.50 MP | 883.0 | |
| Jan 7/76 | 22.65 MP | 882.5 | |
| Feb 6/76 | 22.47 MP | 883.1 | |
| Mar 5/76 | 22.51 MP | 883.0 | |
| Apr 6/76 | 20.86 MP | 888.4 | |
| May 5/76 | 22.08 MP | 884.4 | |
| June 2/76 | 22.06 MP | 884.4 | |
| June 23/76 | 22.09 MP | 884.3 | |
| July 16/76 | 21.78 MP | 884.3 | New MP = 0.83 m TOC, (955.7) |
| | 22.15 MP | 883.0 | After sample; temp. 6°C |
| Aug 10/76 | 21.79 MP | 884.2 | |
| Aug 31/76 | 21.82 MP | 884.1 | |
| Sept 29/76 | 21.69 MP | 884.6 | |
| Oct 27/76 | 21.70 MP | 884.5 | |
| Nov 24/76 | 21.73 MP | 884.4 | |
| Dec 22/76 | 21.88 MP | 883.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Elevation of top of casing 953.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 22.07 MP | 883.3 | MP (955.7) |
| Feb 15/77 | 21.80 MP | 884.2 | |
| Mar 16/77 | 21.87 MP | 884.0 | |
| Apr 14/77 | 21.75 MP | 884.4 | |
| May 11/77 | 21.70 MP | 884.5 | |
| June 7/77 | 21.70 MP | 884.5 | |
| July 8/77 | 21.67 MP | 884.6 | |
| | 21.98 MP | 883.6 | After sample; temp. 7°C |
| Aug 4/77 | 21.65 MP | 884.7 | |
| Aug 30/77 | 21.59 MP | 884.9 | |
| Sept 29/77 | 21.61 MP | 884.8 | |
| Oct 25/77 | 21.53 MP | 885.1 | |
| Nov 22/77 | 21.72 MP | 884.5 | |
| Dec 20/77 | 21.76 MP | 884.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Elevation of top of casing 953.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 21.89 MP | 883.9 | MP (955.7) |
| Feb 14/78 | 21.91 MP | 883.8 | |
| Mar 15/78 | 21.87 MP | 884.0 | |
| Apr 12/78 | 21.82 MP | 884.1 | |
| May 9/78 | 21.68 MP | 884.6 | |
| June 6/78 | 21.62 MP | 884.8 | |
| July 8/78 | 21.60 MP | 884.8 | |
| | 21.93 MP | 883.8 | After sample; temp 6°C |
| Aug 1/78 | 21.59 MP | 884.9 | |
| Aug 29/78 | 21.60 MP | 884.8 | |
| Sept 27/78 | 21.57 MP | 884.9 | |
| Oct 24/78 | 21.52 MP | 885.1 | |
| Nov 22/78 | 21.68 MP | 884.6 | |
| Dec 20/78 | 21.60 MP | 884.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER SHELL OBS-7

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Elevation of top of casing 953.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 21.70 MP | 884.5 | MP (955.7) |
| Feb 14/79 | 21.82 MP | 884.1 | |
| Mar 14/79 | 21.75 MP | 884.4 | |
| Apr 10/79 | 21.67 MP | 884.6 | |
| May 9/79 | 21.64 MP | 884.7 | |
| June 7/79 | 21.43 MP | 885.4 | |
| July 6/79 | 21.44 MP | 885.4 | |
| | 21.79 MP | 884.2 | After sample; temp. 8°C |
| Aug 3/79 | 21.48 MP | 885.2 | |
| Aug 29/79 | 21.42 MP | 885.4 | |
| Sept 25/79 | 21.46 MP | 885.3 | |
| Oct 23/79 | 21.49 MP | 885.2 | |
| Nov 21/79 | 21.58 MP | 884.9 | |
| Dec 19/79 | 21.59 MP | 884.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER SHELL OBS7

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Elevation of top of casing 953.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 21.69 MP | 884.6 | |
| Feb 13/80 | 21.85 MP | 884.0 | |
| Mar 11/80 | 21.74 MP | 884.4 | |
| Apr 9/80 | 21.83 MP | 884.1 | |
| May 7/80 | 21.79 MP | 884.2 | |
| June 4/80 | 21.70 MP | 884.5 | |
| July 6/80 | 21.65 MP | 884.7 | Temp. 5.5°C |
| | 21.97 MP | 883.6 | After Sample |
| July 30/80 | 21.61 MP | 884.8 | |
| Aug 26/80 | 21.67 MP | 884.6 | |
| Sept 24/80 | 21.67 MP | 884.6 | |
| Oct 21/80 | 21.64 MP | 884.7 | |
| Nov 21/80 | 21.66 MP | 884.7 | |
| Dec 18/80 | 21.91 MP | 883.8 | |
| Jan 16/81 | 21.87 MP | 884.0 | |
| Feb 11/81 | 22.19 MP | 882.9 | |
| Mar 11/81 | 21.91 MP | 876.3 | |
| Apr 8/81 | 26.40 MP | 861.6 | |
| May 5/81 | 26.42 MP | 861.5 | |
| June 3/81 | 26.15 MP | 862.4 | |
| June 30/81 | 26.15 MP | 862.4 | |
| July 28/81 | 26.11 MP | 862.6 | |
| Aug 26/81 | 26.20 MP | 862.3 | |
| Sept 23/81 | 26.13 MP | 862.5 | |
| Oct 21/81 | 26.24 MP | 862.1 | |
| Nov 18/81 | 26.18 MP | 862.3 | |
| Dec 16/81 | 26.12 MP | 862.5 | |

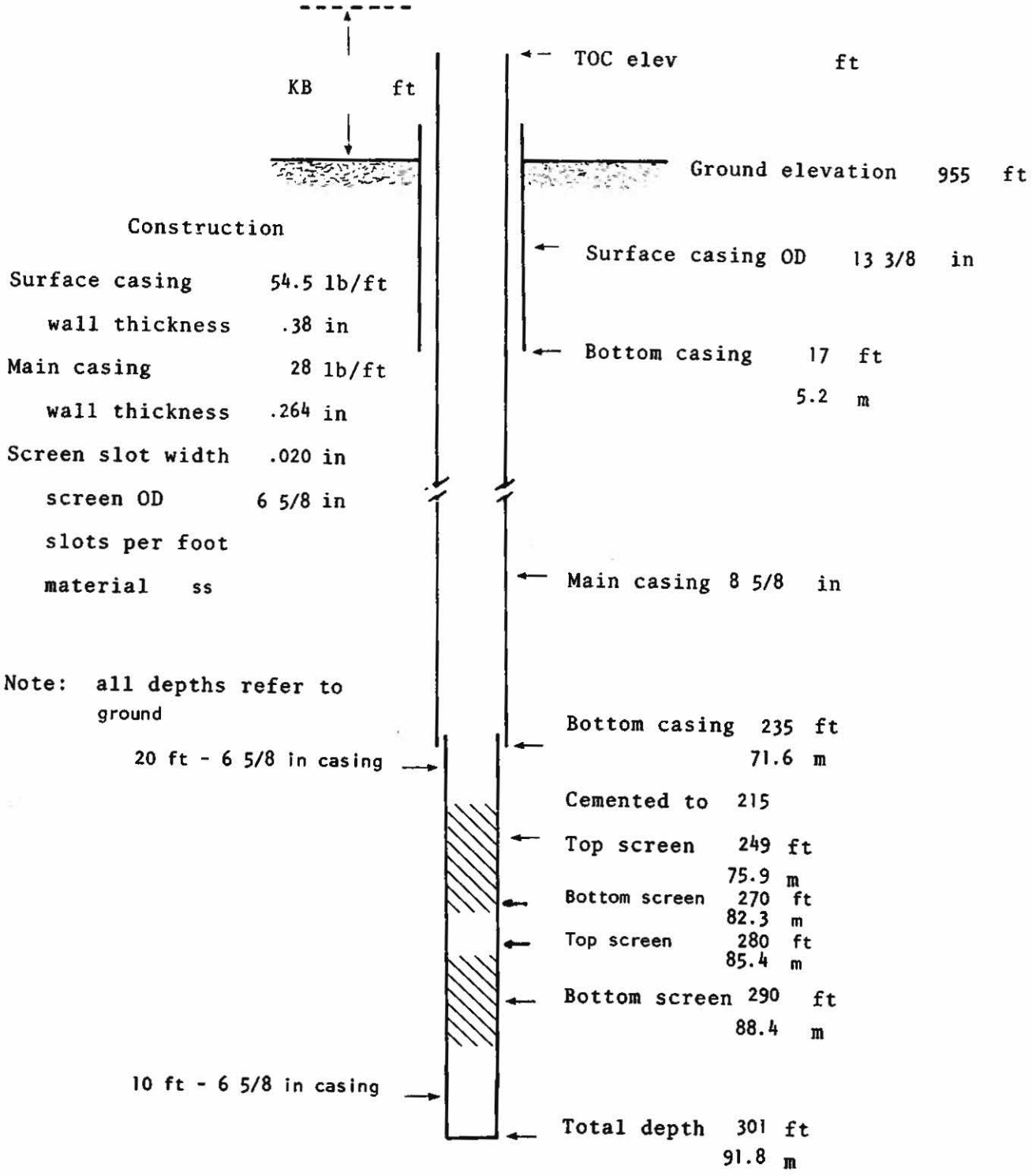
MP - Depth from measuring point
TOC - Depth from top of casing

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Tp 95 R 10 Mer 4th

Alberta Research Council



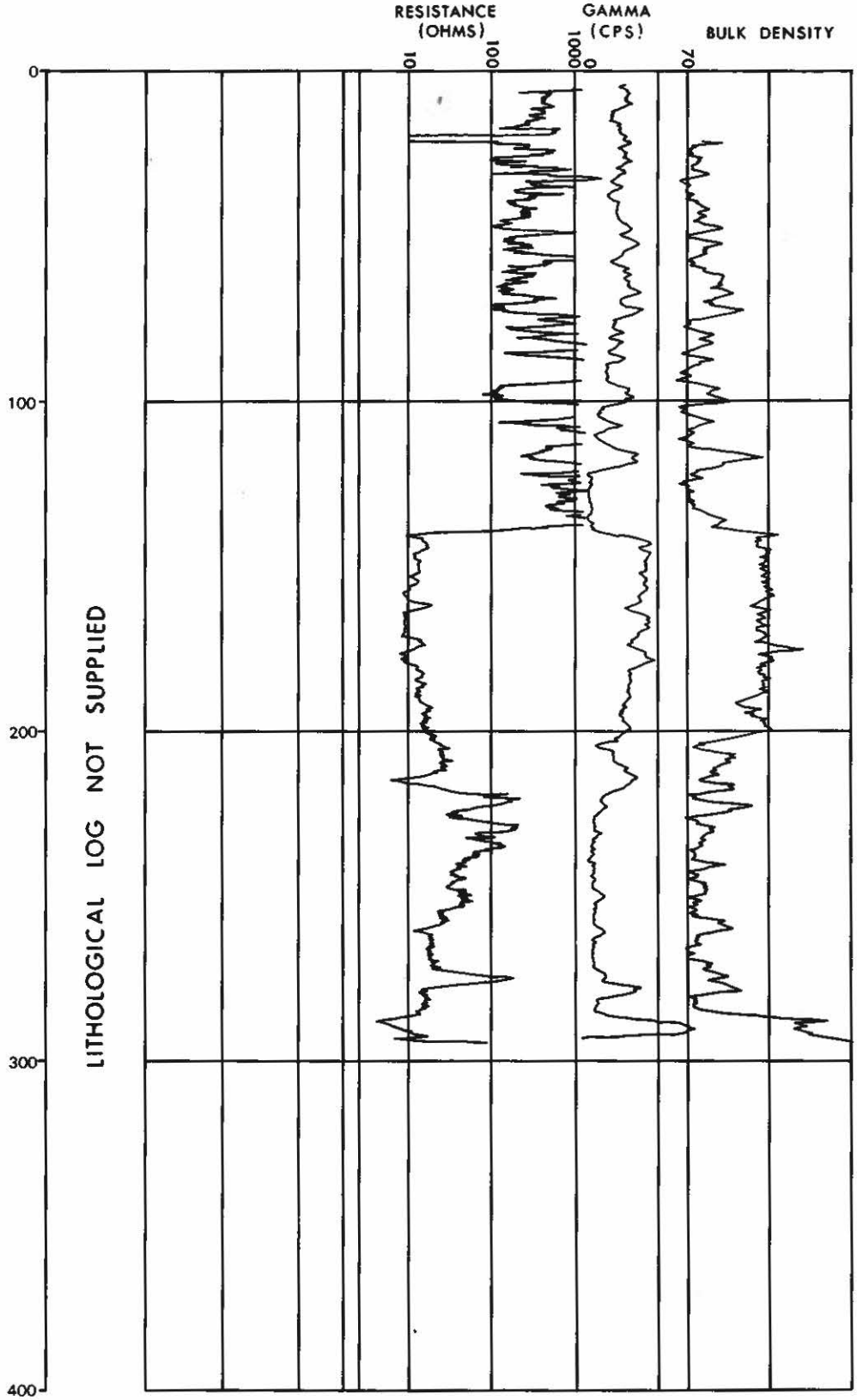

Construction

| | |
|---|---|
| Surface casing | 54.5 lb/ft |
| wall thickness | .38 in |
| Main casing | 28 lb/ft |
| wall thickness | .264 in |
| Screen slot width | .020 in |
| screen OD | 6 5/8 in |
| slots per foot | |
| material | ss |

Note: all depths refer to ground

GEOPHYSICAL AND GEOLOGICAL LOGS
OBSERVATION WELL SITE SHELL PW-4
10-25-95-10-W4 th
ALBERTA RESEARCH COUNCIL

SHELL PW-4-G-77



## WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Sample source SHELL PW-4 (SCL)

Date sampled February 2, 1975 Time

Major Constituents

| | | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|---|
| Calcium ($Ca^{++}$) | | 19 | 0.95 | |
| Magnesium ($Mg^{++}$) | | 25 | 2.06 | |
| Sodium ($Na^{+}$) | Na + K | 1130 | 49.17 | |
| Potassium ($K^{+}$) | | | | |
| Carbonate ($CO_3^{=}$) | | 0 | 0 | |
| Bicarbonate ($HCO_3^{-}$) | | 1327 | 21.75 | |
| Sulfate ($SO_4^{=}$) | | 39 | 0.81 | |
| Chloride ($Cl^{-}$) | | 1050 | 29.62 | |
| Nitrate ($NO_3^{=}$) | | | | |
| Silica ($SiO_2$) | | | | |
| Hydroxide ($OH^{-}$) | | | | |
| Calcium (Acidified) | | | | |
| Magnesium (Acidified) | | | | |
| Total dissolved solids | | 3590 calculated | | |
| Total Anions (epm) | | | Total Cations (epm) | |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | |
| pH | 8.18 |
| Fluoride ($F^{-}$) | |
| Iron | 0 |
| $H_2S$ | 0 |

Field:

| |
|---|
| Temperature (C) |
| pH |
| Carbonate ($CO_3^{=}$) |
| Bicarbonate ($HCO_3^{-}$) |
| Hydroxide ($OH^{-}$) |
| Conductivity |

## WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 58.0 | 2.89 | 5 |
| Magnesium ($Mg^{++}$) | 31.0 | 2.55 | 5 |
| Sodium ($Na^{+}$) | 1113.0 | 48.41 | 89 |
| Potassium ($K^{+}$) | 15.8 | 0.40 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1388.0 | 22.75 | 44 |
| Sulfate ($SO_4^{=}$) | 36.7 | 0.76 | 2 |
| Chloride ($Cl^{-}$) | 1010.0 | 28.48 | 55 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 0 |
| Silica ($SiO_2$) | 4.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 60.5 | | |
| Magnesium (Acidified) | 33.0 | | |
| Total dissolved solids | 7910 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 52.01 | Total Cations (epm) | 54.26 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 5200 | Temperature (C) | 6.0 | |
| pH | 7.5 | pH | 7.2 | |
| Fluoride ($F^{-}$) | 1.5 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 1449 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 51.0 | 2.54 | 4.8 |
| Magnesium ($Mg^{++}$) | 29.0 | 2.39 | 4.5 |
| Sodium ($Na^{+}$) | 1088.0 | 47.32 | 89.8 |
| Potassium ($K^{+}$) | 16.3 | 0.42 | 0.8 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1430.0 | 23.44 | 44.1 |
| Sulfate ($SO_4^{=}$) | 27.8 | 0.58 | 1.1 |
| Chloride ($Cl^{-}$) | 1032.0 | 29.10 | 54.8 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 4.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 48.0 | | |
| Magnesium (Acidified) | 27.0 | | |
| Total dissolved solids | 2928.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 53.12 | Total Cations (epm) | 52.67 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 5500 | Temperature (C) | 7.0 |
| pH | 7.4 | pH | 7.5 |
| Fluoride ($F^{-}$) | 2.3 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 1449.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Date sampled: July 16, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .100 |
| Au | <.003 | Mo | <.006 |
| Al | 0.22 | Na | 1028 |
| As | <.038 | Ni | <.010 |
| B | 1.67 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 58.2 | Si | 2.76 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 1.45 |
| Cr | <.006 | Te | <.065 |
| Cu | .019 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 0.79 | V | 0.009 |
| K | 99 | W | <.078 |
| Mg | 28.9 | Zn | 0.077 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

SHELL PW-4-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Rge 10 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 43.0 | 2.15 | 4.3 |
| Magnesium(Mg) | 26.0 | 2.14 | 4.2 |
| Sodium(Na) | 1050.0 | 45.67 | 90.7 |
| Potassium(K) | 16.3 | 0.42 | 0.8 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1379.0 | 22.60 | 42.9 |
| Sulphate(SO4) | 28.5 | 0.59 | 1.1 |
| Chloride(Cl) | 1045.0 | 29.47 | 55.9 |
| Nitrate(NO3) | 0.8 | 0.01 | 0.0 |
| Silica(SiO2) | 4.6 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 27.0 | | |
| Magnesium(Acidified) | 20.0 | | |
| TDS(mg/l) | 2850.0 | | |
| Total Anions(epm) | 52.68 | Total Cations(epm) | 50.37 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 4560 | | Temperature(C) | 6.00 | |
| pH | 7.5 | | pH | 7.5 | |
| Fluoride(F) | 1.8 | mg/l | Carbonate(CO3) | | |
| | | | Bicarbonate(HCO3) | 1400 | mg/l |
| | | | Hydroxide(OH) | | |

SHELL PW4-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL PW4

Lsd 10 Sec 25 Rge 10 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 6, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 8.9 | 0.44 | 1.0 |
| Magnesium(Mg) | 16.3 | 1.34 | 2.9 |
| Sodium(Na) | 1015.0 | 44.15 | 95.2 |
| Potassium(K) | 16.7 | 0.43 | 0.9 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1135.0 | 18.60 | 37.1 |
| Sulphate(SO4) | 26.0 | 0.54 | 1.1 |
| Chloride(Cl) | 1100.0 | 31.02 | 61.8 |
| Nitrate(NO3) | 0.5 | 0.01 | 0.0 |
| Silica(SiO2) | 2.9 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 8.9 | | |
| Magnesium(Acidified) | 15.7 | | |
| TDS(mg/l) | 2648.0 | | |
| Total Anions(epm) | 50.17 | Total Cations(epm) | 46.36 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 3880 | | Temperature(C) | 7.00 | |
| pH | 8.2 | | pH | 9.0 | |
| Fluoride(F) | 1.6 | mg/l | Carbonate(CO3) | 101 | mg/l |
| | | | Bicarbonate(HCO3) | 942 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS SHELL-PW4-E-82

OBSERVATION WELL NUMBER SHELL-PW4

Lsd 10 Sec 25 Rge 10 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 24.0 | 1.20 | 2.3 |
| Magnesium(Mg) | 22.0 | 1.83 | 3.6 |
| Sodium(Na) | 1100.0 | 47.83 | 93.3 |
| Potassium(K) | 16.7 | 0.43 | 0.8 |
| Carbonate(CO3) | 0.0 | 0.0 | 0.0 |
| Bicarbonate(HCO3) | 1005.0 | 16.48 | 33.6 |
| Sulphate(SO4) | 210.0 | 4.38 | 8.9 |
| Chloride(Cl) | 1000.0 | 28.17 | 57.5 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 1.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 35.0 | | |
| Magnesium(Acidified) | 20.7 | | |
| TDS(mg/l) | 0.0 | | |
| Total Anions(epm) | 49.02 | Total Cations(epm) | 51.29 |

Other Constituents

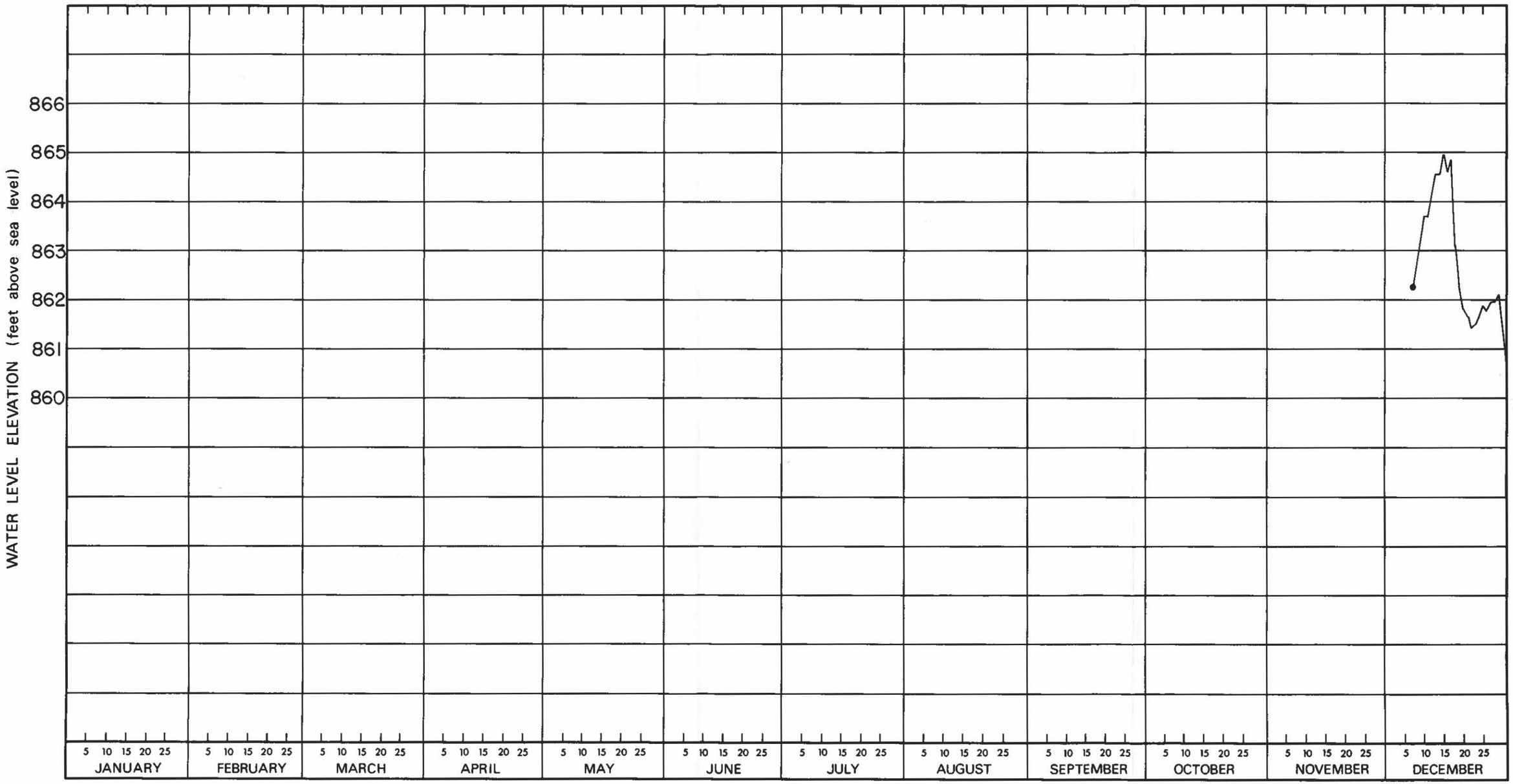
| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 5150 | Temperature | 5.50 | |
| pH | 8.0 | pH | 7.7 | |
| Fluoride | 1.6 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 1313 | mg/l |
| | | Hydroxide(OH) | | |

WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4th

SHELL PW-4-H-77




1975

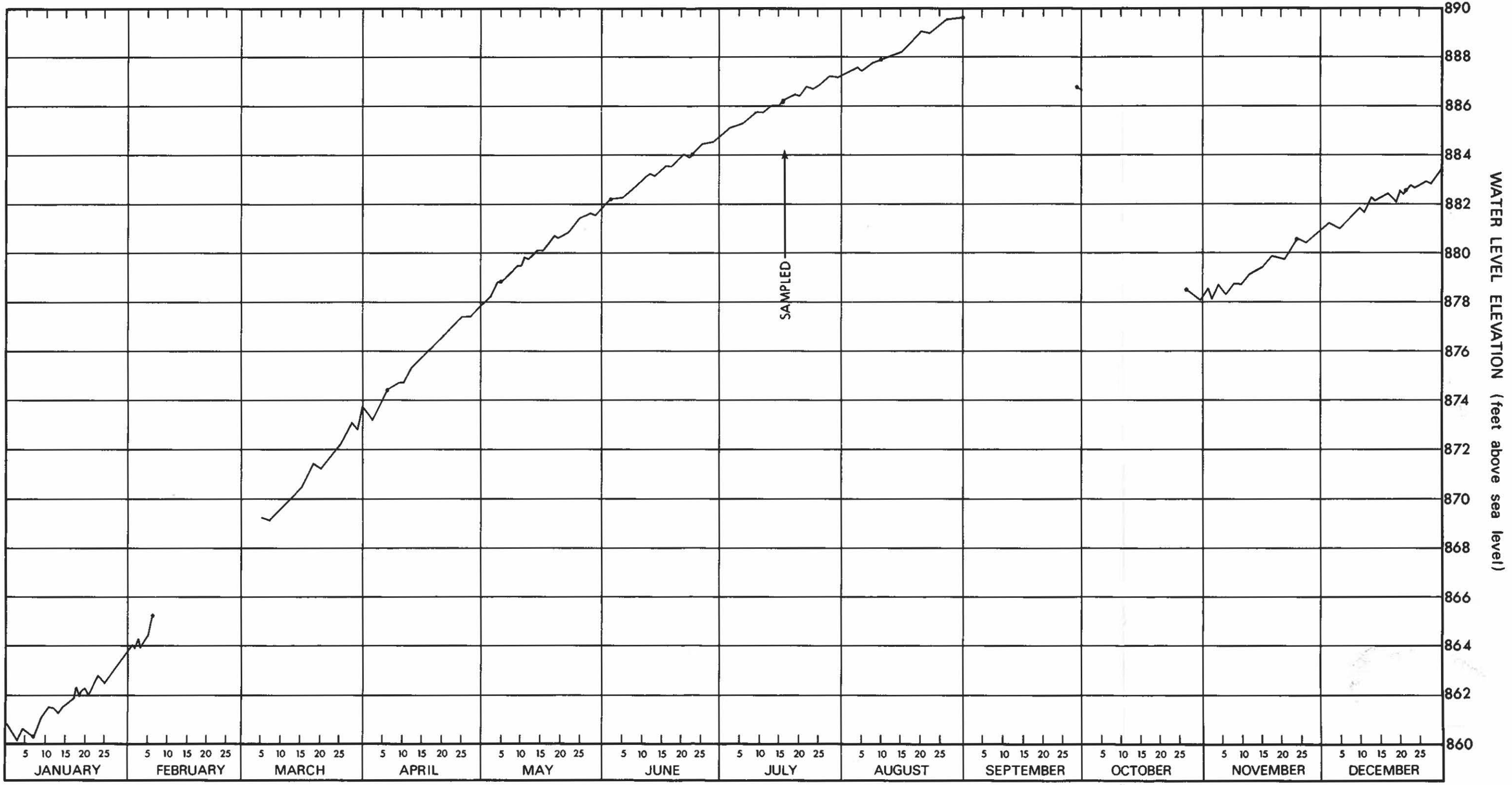
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

SHELL PW - 4 - H - 77




1976

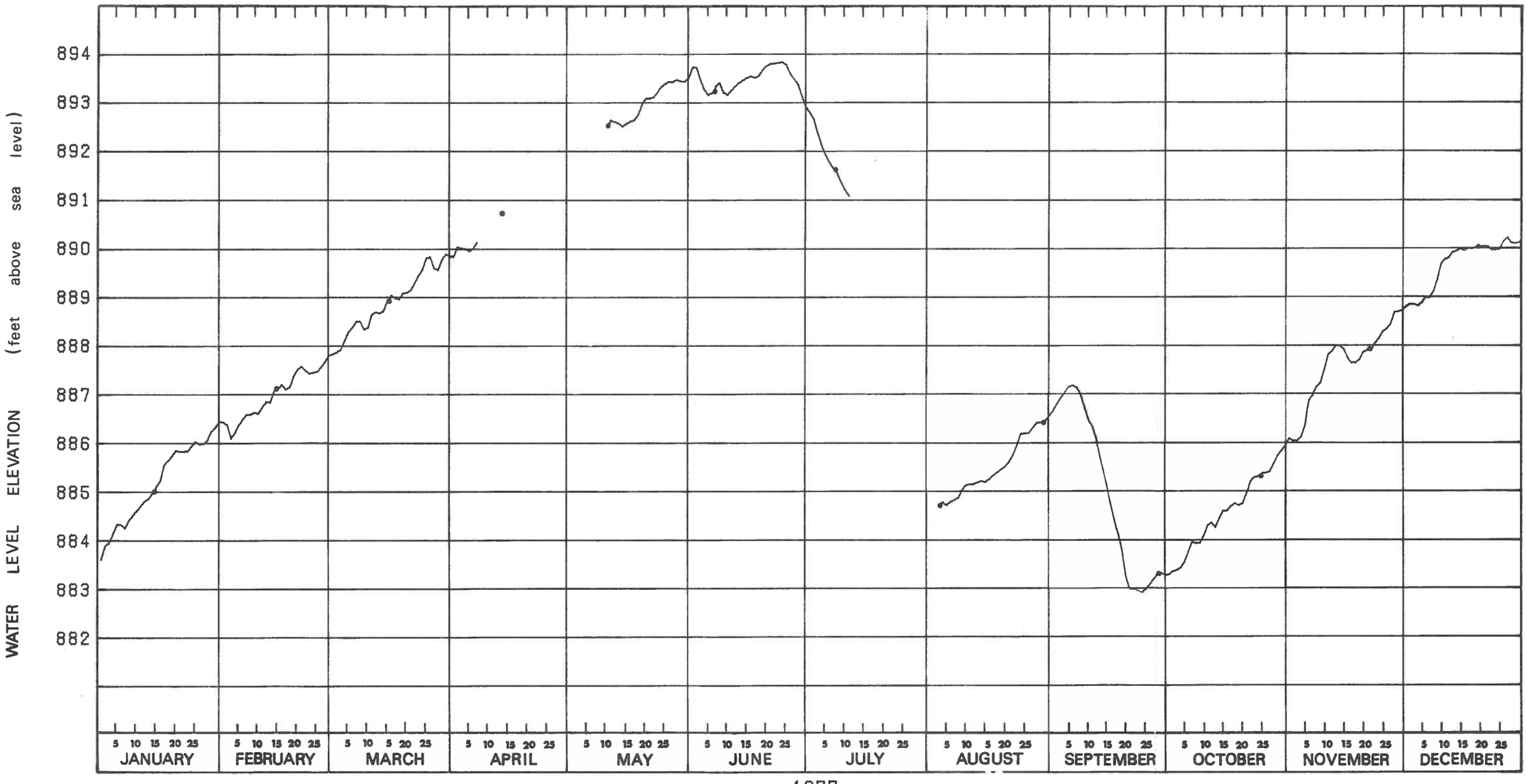
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL PW-4

SHELL PW-4-H-78

Lsd 10 Sec 25 Twp 95 R 10 W4 th

Alberta Research Council




1977

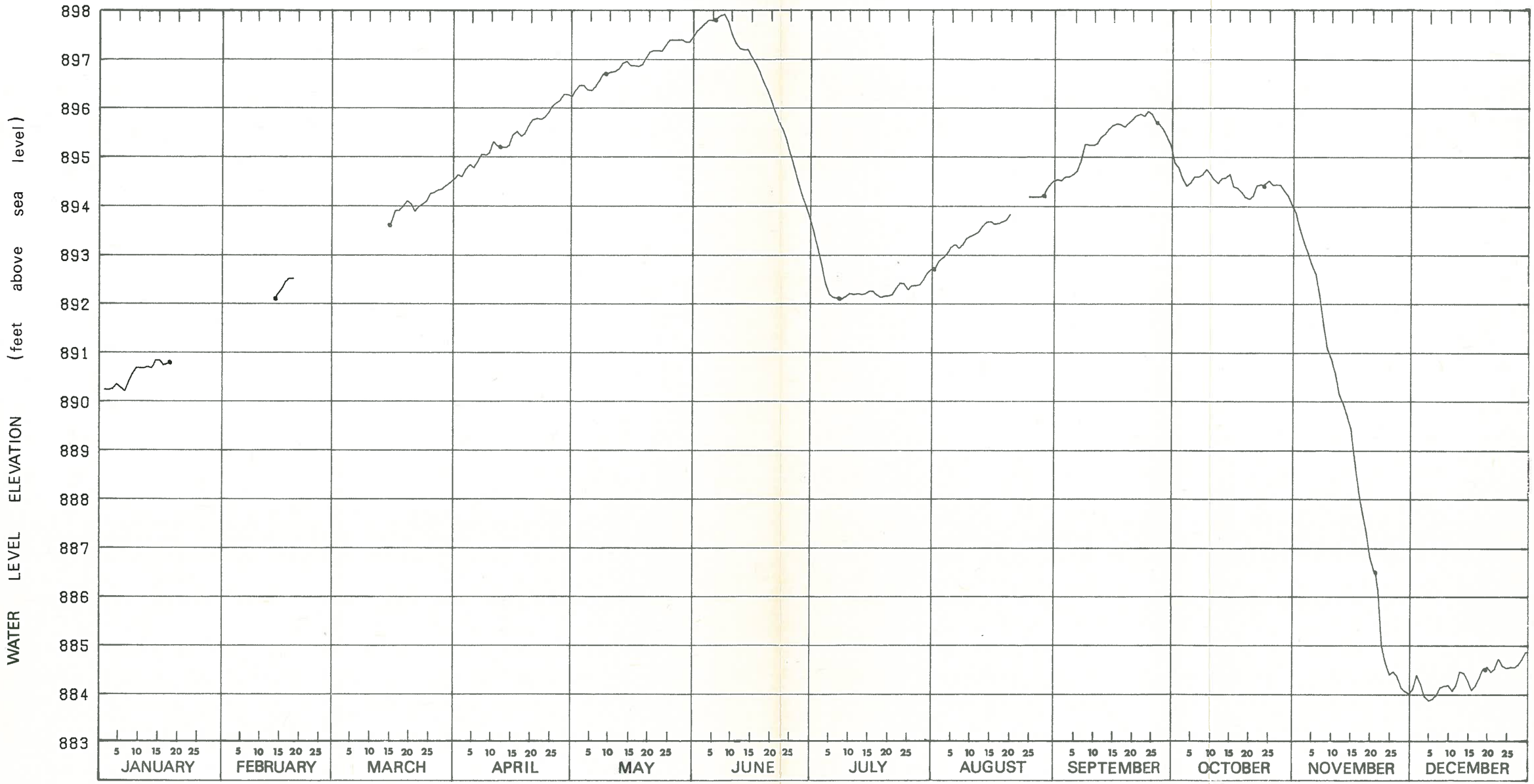
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL PW-4

LSD 10 SEC 25 TWP 95 R 10 W4TH

SHELL PW-4-H-79

Alberta Research Council




1978

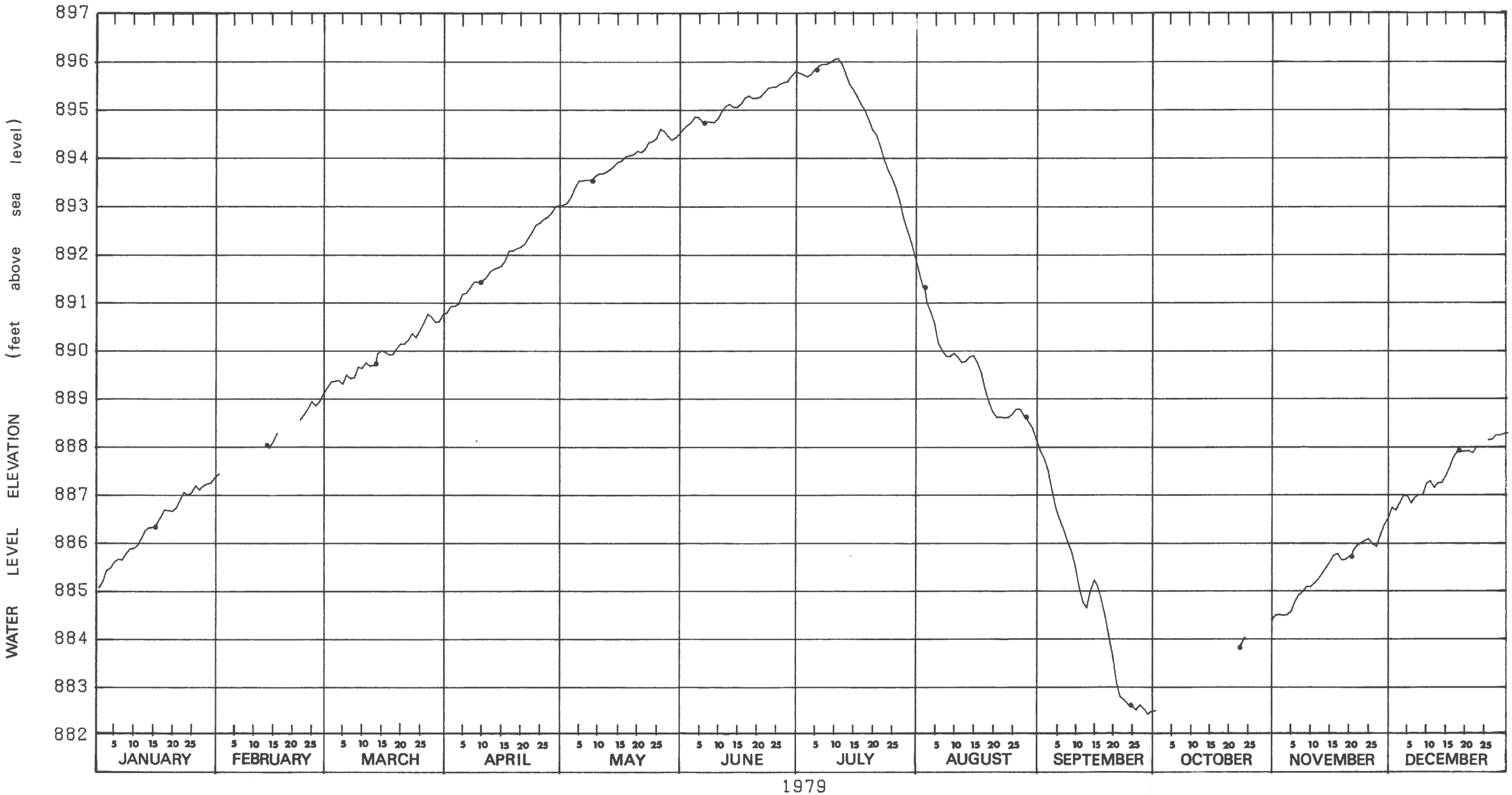
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL PW-4

SHELL PW-4-H-80

Lsd 10 Sec 25 Twp 95 R 10 W4 th

Alberta Research Council



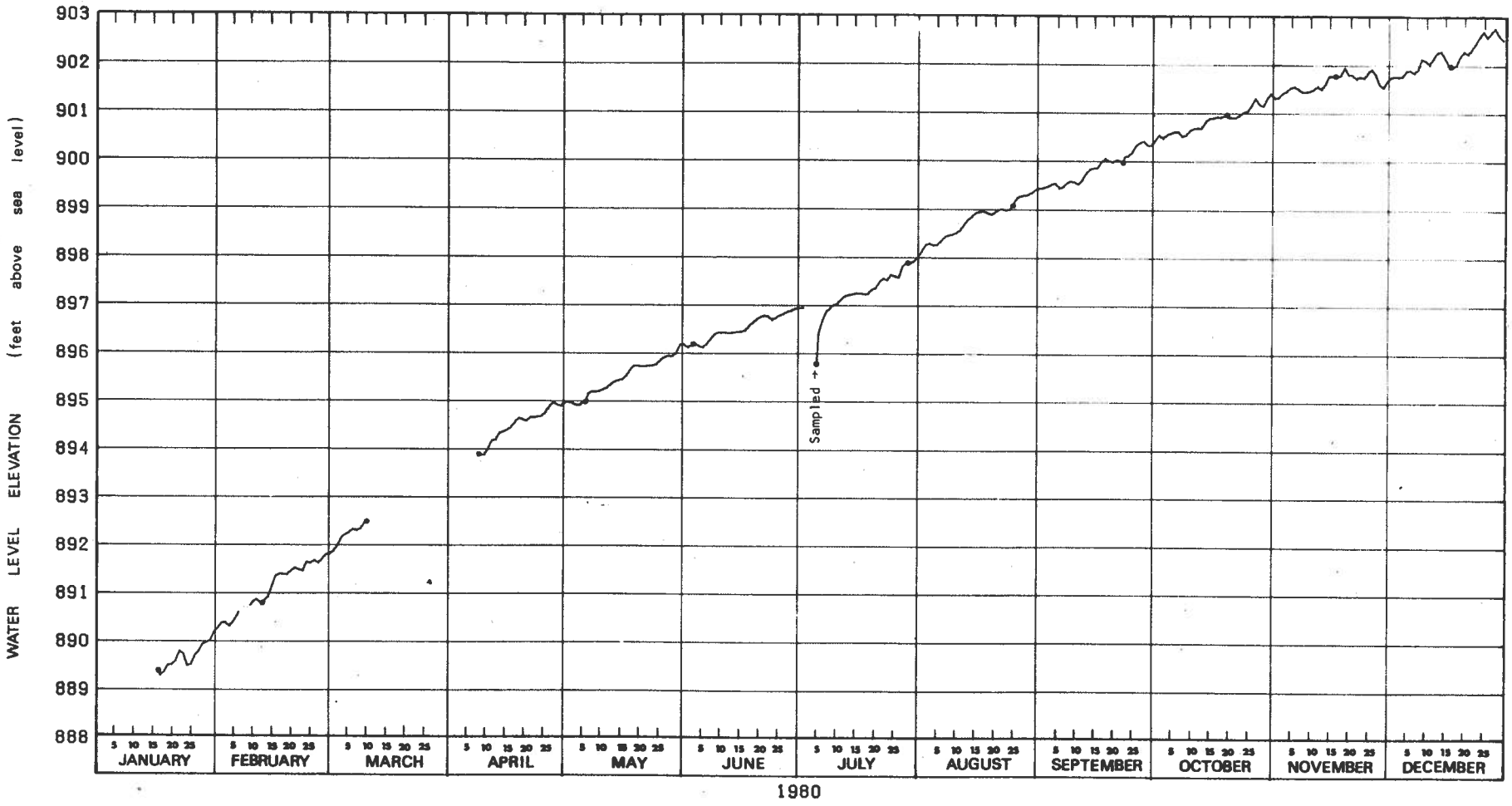
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4 th

Alberta Research Council

SHELL PW-4-H-81



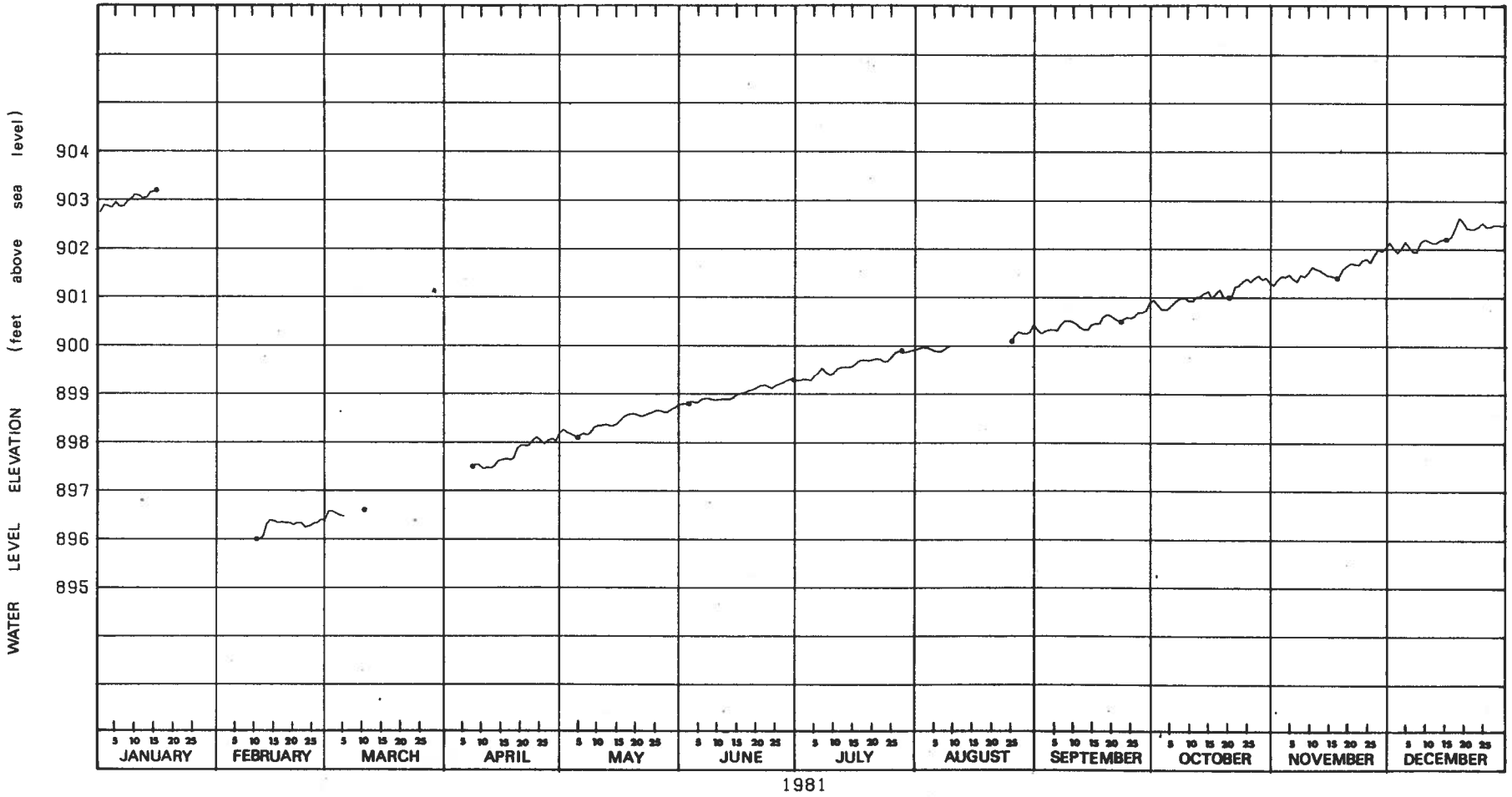
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL PW-4

SHELL PW-4-H-82

Lsd 10 Sec 25 Twp 95 R 10 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Elevation of top of casing 955.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 1/75 | | | Well completed 301' T.D. |
| Oct 8/75 | 42.55 TOC | 815.4 | |
| Nov 17/75 | 32.18 MP | 851.9 | MP = 0.76 m TOC, (957.5) |
| Dec 7/75 | 29.03 MP | 862.3 | |
| Jan 7/76 | 29.62 MP | 860.3 | |
| Feb 6/76 | 28.14 MP | 865.2 | |
| Mar 5/76 | 26.92 MP | 869.2 | |
| Apr 6/76 | 25.33 MP | 874.4 | |
| May 5/76 | 23.98 MP | 878.8 | |
| June 2/76 | 22.95 MP | 882.2 | |
| June 23/76 | 22.39 MP | 884.0 | New MP = 0.73 m TOC, (957.4) |
| July 16/76 | 21.71 MP | 886.2 | |
| | 21.72 MP | 886.2 | After sample; temp. 6°C |
| Aug 10/76 | 21.18 MP | 887.9 | |
| Aug 31/76 | 20.67 MP | 889.6 | |
| Sept 29/76 | 21.51 MP | 886.8 | |
| Oct 27/76 | 24.06 MP | 878.5 | |
| Nov 24/76 | 23.40 MP | 880.6 | |
| Dec 22/76 | 22.84 MP | 882.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Elevation of top of casing 955.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 15/77 | 22.06 MP | 885.0 | MP (957.4) |
| Feb 15/77 | 21.44 MP | 887.1 | |
| Mar 16/77 | 20.90 MP | 888.9 | |
| Apr 14/77 | 20.32 MP | 890.7 | |
| May 11/77 | 19.77 MP | 892.5 | |
| June 7/77 | 19.58 MP | 893.2 | |
| July 8/77 | 20.06 MP | 891.6 | |
| | 20.07 MP | 891.6 | After sample; temp. 7°C |
| Aug 4/77 | 22.15 MP | 884.7 | |
| Aug 30/77 | 21.63 MP | 886.4 | |
| Sept 29/77 | 22.59 MP | 883.3 | |
| Oct 25/77 | 21.99 MP | 885.3 | |
| Nov 22/77 | 21.18 MP | 887.9 | |
| Dec 20/77 | 20.56 MP | 890.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Elevation of top of casing 955.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 20.29 MP | 890.8 | MP (957.4) |
| Feb 14/78 | 19.91 MP | 892.1 | |
| Mar 15/78 | 19.45 MP | 893.6 | |
| Apr 12/78 | 18.95 MP | 895.2 | |
| May 9/78 | 18.51 MP | 896.7 | |
| June 6/78 | 18.17 MP | 897.8 | |
| July 8/78 | 19.91 MP | 892.1 | |
| | 19.92 MP | 892.1 | After sample; temp 6°C |
| Aug 1/78 | 19.73 MP | 892.7 | |
| Aug 29/78 | 19.28 MP | 894.2 | |
| Sept 27/78 | 18.82 MP | 895.7 | |
| Oct 24/78 | 19.22 MP | 894.4 | |
| Nov 22/78 | 21.61 MP | 886.5 | |
| Dec 20/78 | 22.21 MP | 884.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Elevation of top of casing 955.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 21.67 MP | 886.3 | MP (957.4) |
| Feb 14/79 | 21.17 MP | 888.0 | |
| Mar 14/79 | 20.64 MP | 889.7 | |
| Apr 10/79 | 20.11 MP | 891.4 | |
| May 9/79 | 19.47 MP | 893.5 | |
| June 7/79 | 19.10 MP | 894.7 | |
| July 6/79 | 18.79 MP | 895.8 | |
| | 18.79 MP | 895.8 | After sample; temp. 7°C |
| Aug 3/79 | 20.14 MP | 891.3 | |
| Aug 29/79 | 20.98 MP | 888.6 | |
| Sept 25/79 | 22.81 MP | 882.6 | |
| Oct 23/79 | 22.45 MP | 883.8 | |
| Nov 21/79 | 21.85 MP | 885.7 | |
| Dec 19/79 | 21.19 MP | 887.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER SHELL PW-4

Lsd 10 Sec 25 Twp 95 R 10 W4th

Alberta Research Council

Elevation of top of casing 955.0

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 20.73 MP | 889.4 | |
| Feb 13/80 | 20.30 MP | 890.8 | |
| Mar 11/80 | 19.77 MP | 892.5 | |
| Apr 9/80 | 19.35 MP | 893.9 | |
| May 7/80 | 19.02 MP | 895.0 | |
| June 4/80 | 18.67 MP | 896.2 | |
| July 6/80 | 18.78 MP | 895.8 | Temp. 5.5°C |
| | 18.79 MP | 895.8 | After Sample |
| July 30/80 | 18.15 MP | 897.9 | |
| Aug 26/80 | 17.78 MP | 899.1 | |
| Sept 24/80 | 17.49 MP | 900.0 | |
| Oct 21/80 | 17.20 MP | 901.0 | |
| Nov 18/80 | 16.94 MP | 901.8 | |
| Dec 18/80 | 16.88 MP | 902.0 | |
| Jan 16/81 | 16.53 MP | 903.2 | |
| Feb 11/81 | 16.38 MP | 896.0 | |
| Mar 11/81 | 16.18 MP | 896.6 | |
| Apr 8/81 | 15.91 MP | 897.5 | |
| May 5/81 | 15.74 MP | 898.1 | |
| June 3/81 | 15.51 MP | 898.8 | |
| June 30/81 | 15.37 MP | 899.3 | |
| July 28/81 | 15.19 MP | 899.9 | |
| Aug 26/81 | 15.12 MP | 900.1 | |
| Sept 23/81 | 14.99 MP | 900.5 | |
| Oct 21/81 | 14.84 MP | 901.0 | |
| Nov 18/81 | 14.73 MP | 901.4 | |
| Dec 16/81 | 14.48 MP | 902.2 | |

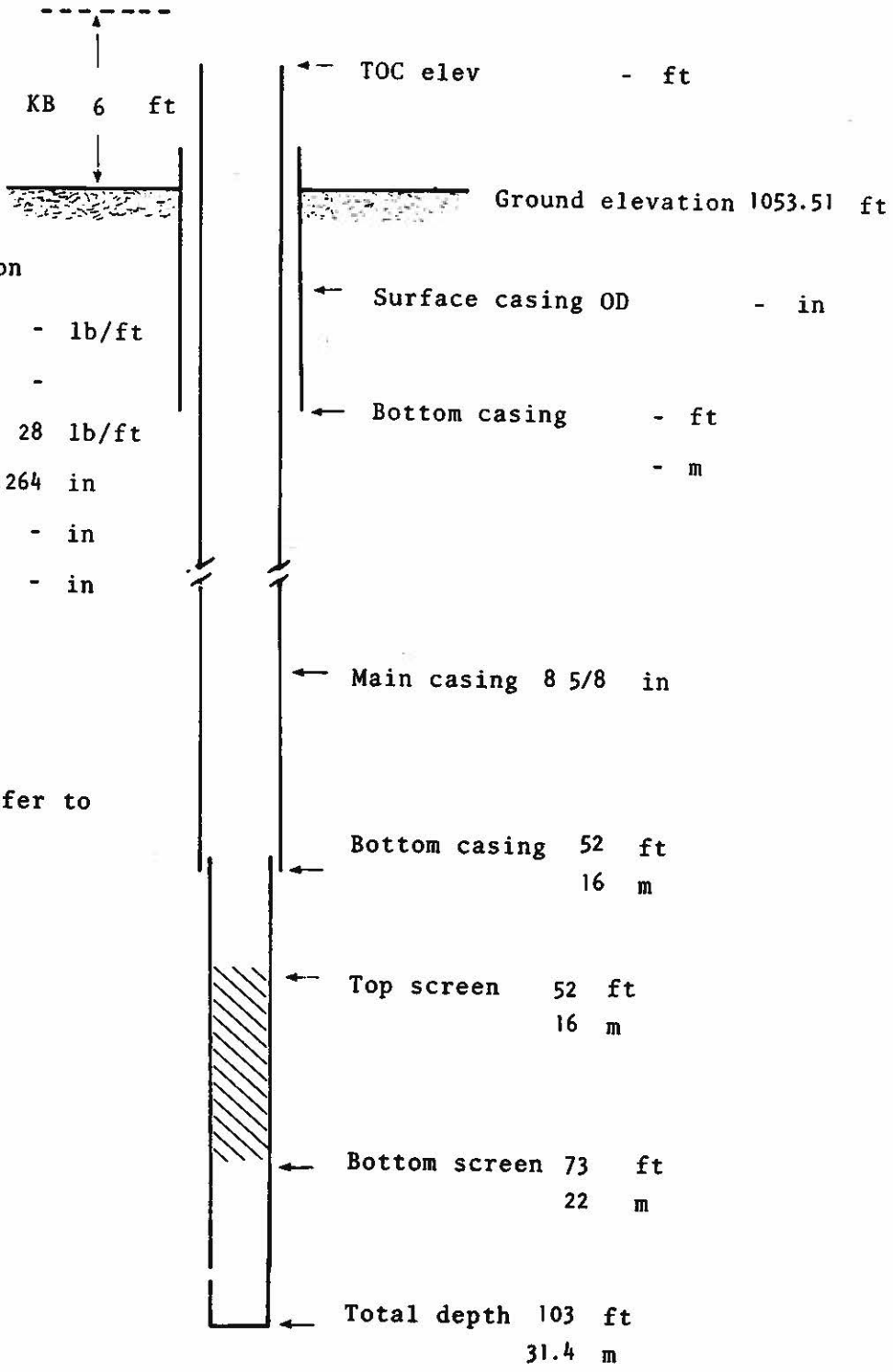
MP - Depth from measuring point
TOC - Depth from top of casing

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Tp 95 R 9 Mer 4th

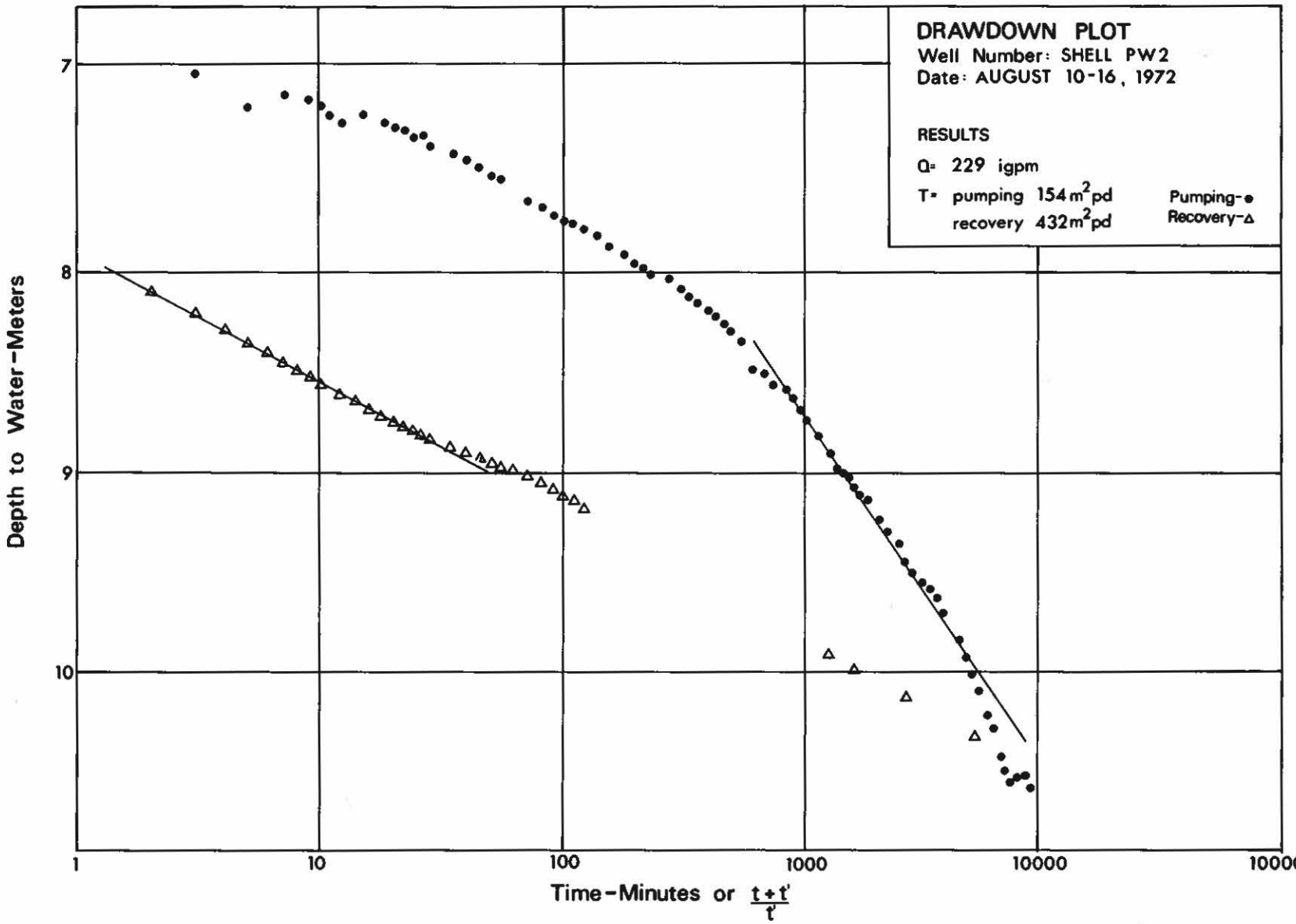
Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | - | lb/ft |
| wall thickness | - | |
| Main casing | 28 | lb/ft |
| wall thickness | .264 | in |
| Screen slot width | - | in |
| screen OD | - | in |
| slots per foot | | |
| material | ss | |
| Sand pack | 26-103 | |

Note: all depths refer to ground




SHELL PW-2-A-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Twp 95 R 9 W4th

Alberta Research Council

Sample source SHELL PW-2 @ 12 hours pumping @ 275 igpm SCL

Date sampled August 10, 1972 Time 11.45 pm

Major Constituents

| | | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|---|
| Calcium ($Ca^{++}$) | | 106 | 5.29 | 67.3 |
| Magnesium ($Mg^{++}$) | | 17 | 1.40 | 17.8 |
| Sodium ($Na^{+}$) | | | | |
| Potassium ($K^{+}$) | Na + K | 27 | 1.17 | 14.9 |
| Carbonate ($CO_3^{=}$) | | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | | 439 | 7.20 | 91.6 |
| Sulfate ($SO_4^{=}$) | | 2 | 0.04 | 0.5 |
| Chloride ($Cl^{-}$) | | 22 | 0.62 | 7.9 |
| Nitrate ($NO_3^{=}$) | | | | |
| Silica ($SiO_2$) | | | | |
| Hydroxide ($OH^{-}$) | | | | |
| Calcium (Acidified) | | | | |
| Magnesium (Acidified) | | | | |
| Total dissolved solids | | 613 calculated | | |
| Total Anions (epm) | | Total Cations (epm) | | |

Other Constituents

Lab:

- Conductivity
- pH 7.4
- Fluoride ($F^{-}$)

Field:

- Temperature (C)
- pH
- Carbonate ($CO_3^{=}$)
- Bicarbonate ($HCO_3^{-}$)
- Hydroxide ($OH^{-}$)
- Conductivity

## WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Twp 95 R 9 W4th

Alberta Research Council

Sample source SHELL PW-2 @ 146 hours @ 275 igpm SCL

Date sampled August 16, 1972 Time 1.30 pm

### Major Constituents

| | | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|---|
| Calcium ($Ca^{++}$) | | 105 | 5.24 | 65.3 |
| Magnesium ($Mg^{++}$) | | 20 | 1.64 | 20.4 |
| Sodium ($Na^{+}$) | | | | |
| Potassium ($K^{+}$) | Na + K | 26 | 1.15 | 14.3 |
| Carbonate ($CO_3^{=}$) | | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | | 451 | 7.39 | 82.0 |
| Sulfate ($SO_4^{=}$) | | 1 | 0.02 | 0.2 |
| Chloride ($Cl^{-}$) | | 22 | 0.62 | 7.7 |
| Nitrate ($NO_3^{=}$) | | | | |
| Silica ($SiO_2$) | | | | |
| Hydroxide ($OH^{-}$) | | | | |
| Calcium (Acidified) | | | | |
| Magnesium (Acidified) | | | | |
| Total dissolved solids | | 625 calculated | | |
| Total Anions (epm) | | | Total Cations (epm) | |

### Other Constituents

Lab:

- Conductivity
- pH 7.3
- Fluoride ($F^{-}$)

Field:

- Temperature (C)
- pH
- Carbonate ($CO_3^{=}$)
- Bicarbonate ($HCO_3^{-}$)
- Hydroxide ($OH^{-}$)
- Conductivity

## WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 102.0 | 5.09 | 71 |
| Magnesium ($Mg^{++}$) | 16.4 | 1.35 | 19 |
| Sodium ($Na^{+}$) | 15.0 | 0.65 | 9 |
| Potassium ($K^{+}$) | 2.5 | 0.06 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 388.0 | 6.36 | 96 |
| Sulfate ($SO_4^{=}$) | 4.3 | 0.09 | 1 |
| Chloride ($Cl^{-}$) | 6.0 | 0.17 | 3 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0 |
| Silica ($SiO_2$) | 14.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 101.2 | | |
| Magnesium (Acidified) | 17.6 | | |
| Total dissolved solids | 384 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 6.64 | Total Cations (epm) | 7.16 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 600 | | Temperature (C) | 5.0 | |
| pH | 7.6 | | pH | 6.5 | |
| Fluoride ($F^{-}$) | 0.2 | Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | | Bicarbonate ($HCO_3^{-}$) | 478 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 105.0 | 5.24 | 75.9 |
| Magnesium ($Mg^{++}$) | 16.5 | 1.36 | 19.7 |
| Sodium ($Na^{+}$) | 6.3 | 0.27 | 4.0 |
| Potassium ($K^{+}$) | 1.3 | 0.03 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 434.0 | 7.11 | 96.7 |
| Sulfate ($SO_4^{=}$) | 8.0 | 0.17 | 2.3 |
| Chloride ($Cl^{-}$) | 2.0 | 0.06 | 0.8 |
| Nitrate ($NO_3^{=}$) | 1.3 | 0.02 | 0.3 |
| Silica ($SiO_2$) | 17.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 95.0 | | |
| Magnesium (Acidified) | 16.1 | | |
| Total dissolved solids | 444.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 7.36 | Total Cations (epm) | 6.91 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 670 | Temperature (C) | 5.0 |
| pH | 6.8 | pH | 6.8 |
| Fluoride ($F^{-}$) | 0.3 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 512.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

# MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Twp 95 R 9 W4th

Alberta Research Council

Date sampled: July 17, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .775 |
| Au | <.003 | Mo | <.006 |
| Al | <.002 | Na | 14.5 |
| As | <.038 | Ni | <.010 |
| B | .194 | P | 0.66 |
| Ba | <.200 | Pb | <.088 |
| Be | .002 | Se | <.060 |
| Ca | 126.5 | Si | 10.5 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | .303 |
| Cr | <.006 | Te | <.065 |
| Cu | .025 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 33.8 | V | .013 |
| K | 66.0 | W | <.078 |
| Mg | 19.4 | Zn | .077 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

SHELL PW-2-E-79

WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 107.0 | 5.34 | 76.1 |
| Magnesium(Mg) | 17.3 | 1.42 | 20.3 |
| Sodium(Na) | 5.0 | 0.22 | 3.1 |
| Potassium(K) | 1.3 | 0.03 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 415.0 | 6.80 | 99.5 |
| Sulphate(SO4) | 0.0 | 0.00 | 0.0 |
| Chloride(Cl) | 0.0 | 0.00 | 0.0 |
| Nitrate(NO3) | 2.0 | 0.03 | 0.5 |
| Silica(SiO2) | 17.2 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 91.0 | | |
| Magnesium(Acidified) | 16.1 | | |
| TDS(mg/l) | 426.0 | | |
| Total Anions(epm) | 6.83 | Total Cations(epm) | 7.01 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 570 | Temperature(C) | 4.00 | |
| pH | 6.9 | pH | 6.7 | |
| Fluoride(F) | 0.3 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 507 | mg/l |
| | | Hydroxide(OH) | | |

SHELL PW2-E-80

WATER ANALYSIS

OBSERVATION WELL NUMBER SHELL PW2

Lsd 10 Sec 24 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 6, 1979

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 91.0 | 4.54 | 70.8 |
| Magnesium(Mg) | 16.4 | 1.35 | 21.0 |
| Sodium(Na) | 11.3 | 0.49 | 7.7 |
| Potassium(K) | 1.3 | 0.03 | 0.5 |
| Carbonate(CO3) | 2.4 | 0.08 | 1.2 |
| Bicarbonate(HCO3) | 373.0 | 6.11 | 89.1 |
| Sulphate(SO4) | 16.5 | 0.34 | 5.0 |
| Chloride(Cl) | 10.0 | 0.28 | 4.1 |
| Nitrate(NO3) | 2.6 | 0.04 | 0.6 |
| Silica(SiO2) | 13.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 88.0 | | |
| Magnesium(Acidified) | 15.8 | | |
| TDS(mg/l) | 370.0 | | |
| Total Anions(epm) | 6.86 | Total Cations(epm) | 6.42 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 478 | Temperature(C) | 7.00 | |
| pH | 8.4 | pH | 6.8 | |
| Fluoride(F) | 0.2 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 478 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS SHELL-PW2-E-82

OBSERVATION WELL NUMBER SHELL-PW2

Lsd 10 Sec 24 Rge 9 Twp 95 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 9, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 85.0 | 4.25 | 75.6 |
| Magnesium(Mg) | 15.0 | 1.25 | 22.2 |
| Sodium(Na) | 1.3 | 0.06 | 1.0 |
| Potassium(K) | 2.5 | 0.06 | 1.1 |
| Carbonate(CO3) | 4.8 | 0.16 | 2.8 |
| Bicarbonate(HCO3) | 327.0 | 5.36 | 94.3 |
| Sulphate(SO4) | 7.0 | 0.15 | 2.6 |
| Chloride(Cl) | 0.5 | 0.01 | 0.2 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.1 |
| Silica(SiO2) | 10.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 81.0 | | |
| Magnesium(Acidified) | 13.0 | | |
| TDS(mg/l) | 0.0 | | |
| Total Anions(epm) | 5.69 | Total Cations(epm) | 5.62 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 535 | Temperature | 5.00 | |
| pH | 8.4 | pH | 6.6 | |
| Fluoride | 0.2 mg/l | Carbonate(CO3) | 0 | mg/l |
| | | Bicarbonate(HCO3) | 454 | mg/l |
| | | Hydroxide(OH) | | |

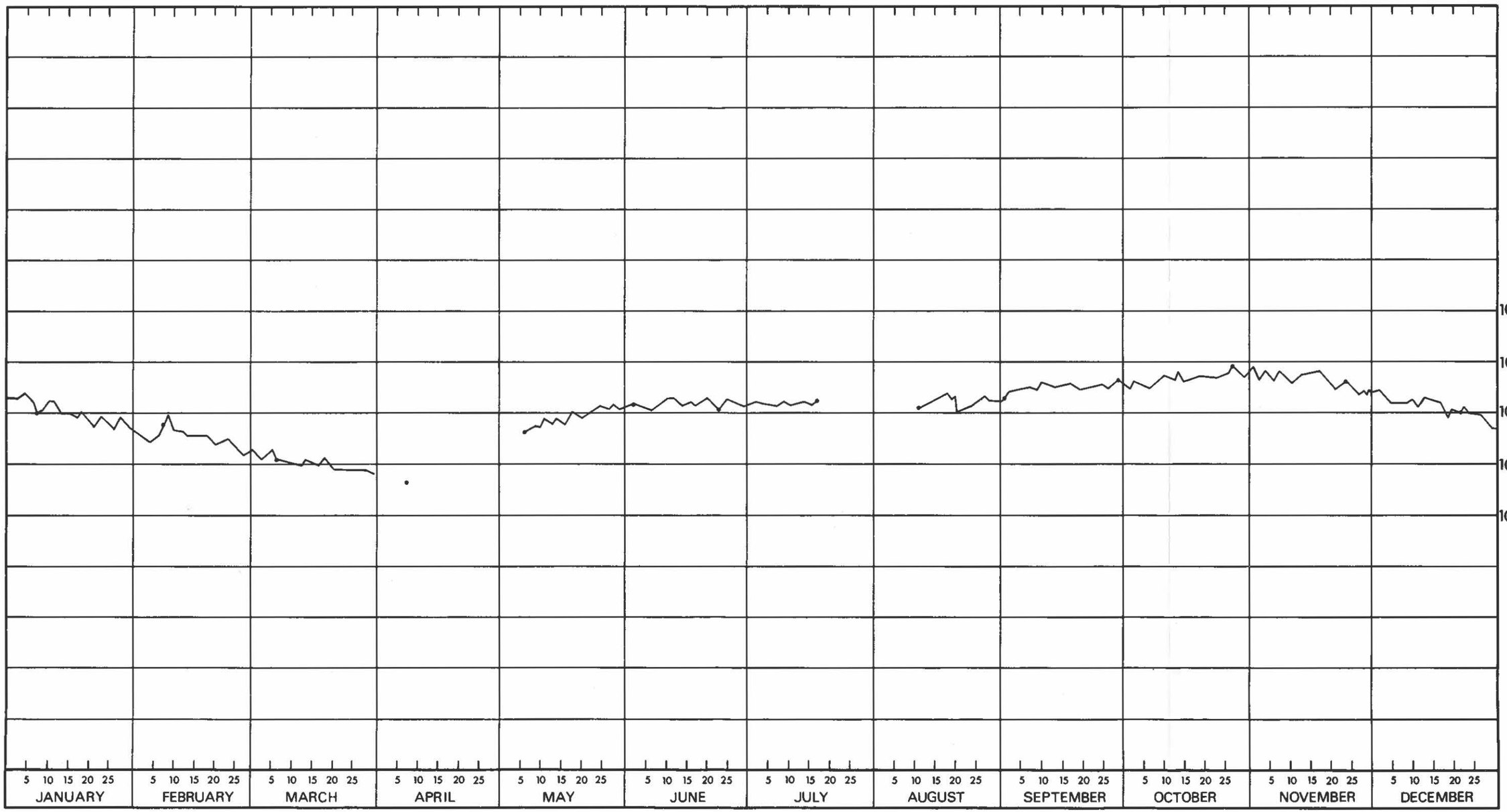
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Twp 95 R 9 W4th

Alberta Research Council

SHELL PW - 2 - H - 77




1976

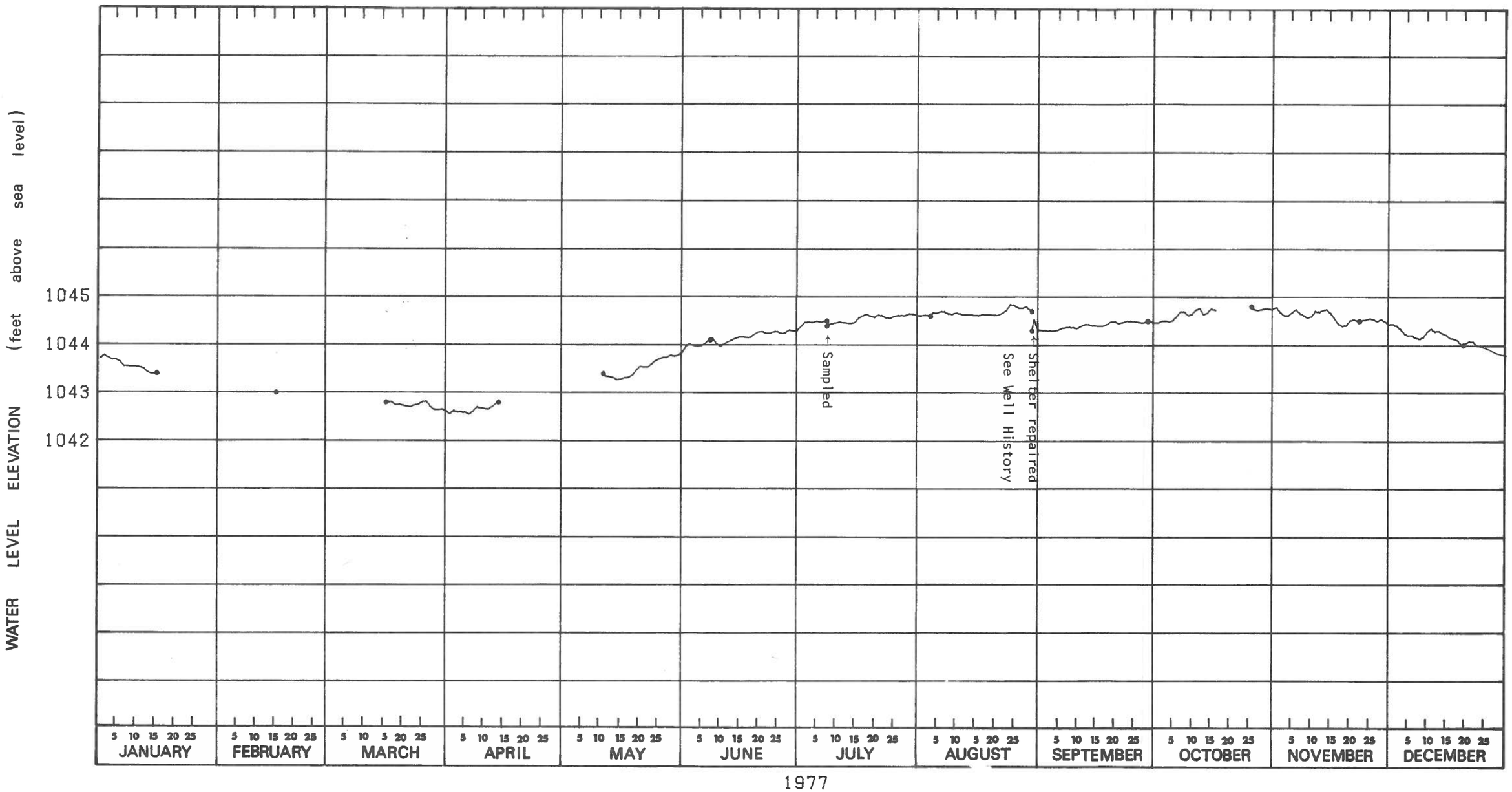
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Twp 95 R 9 W4 th

Alberta Research Council

SHELL PW-2-H-78




1977

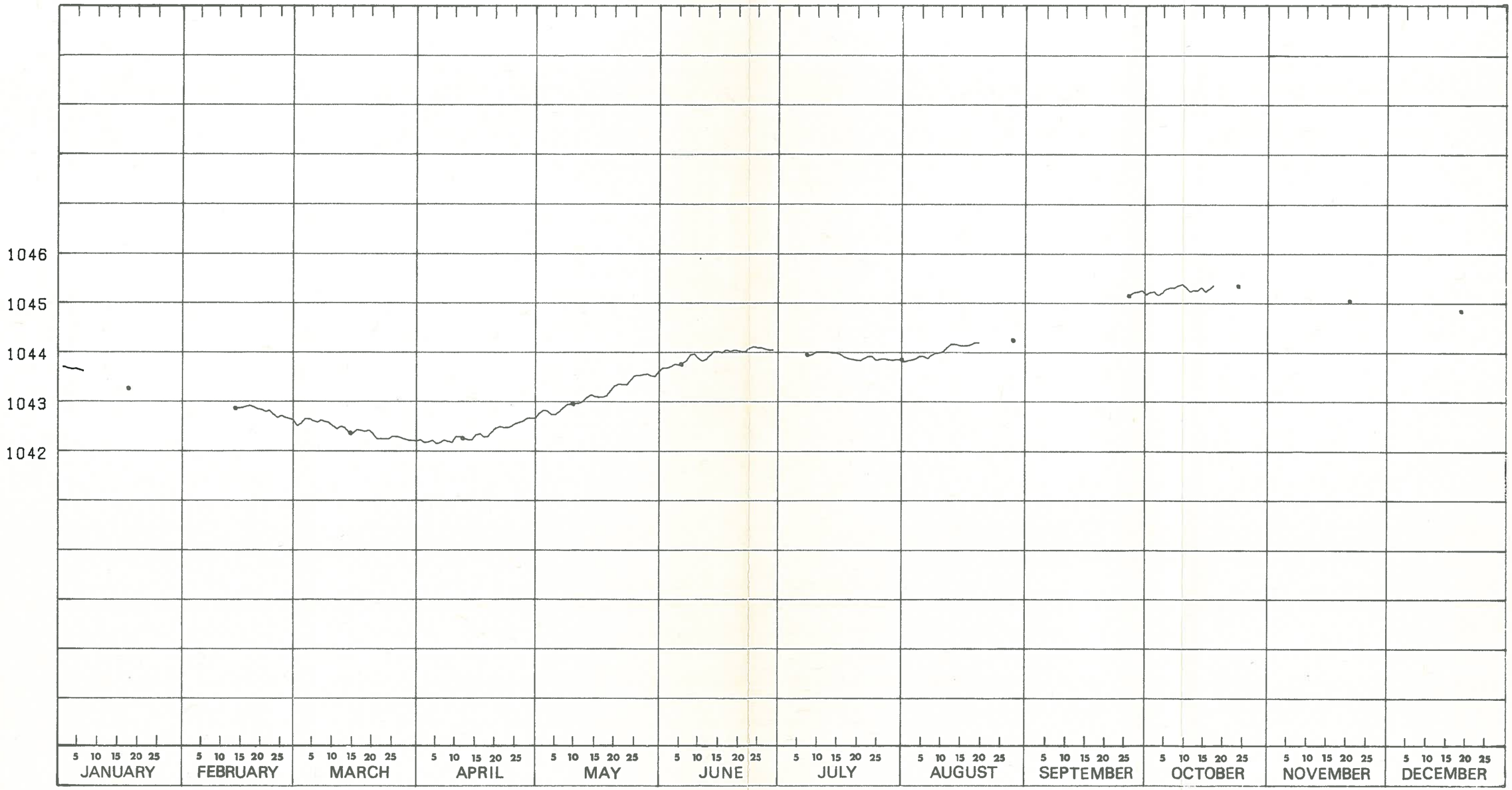
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL PW-2

LSD 10 SEC 24 TWP 95 R 9 W4TH

Alberta Research Council

SHELL PW-2-H-79




1978

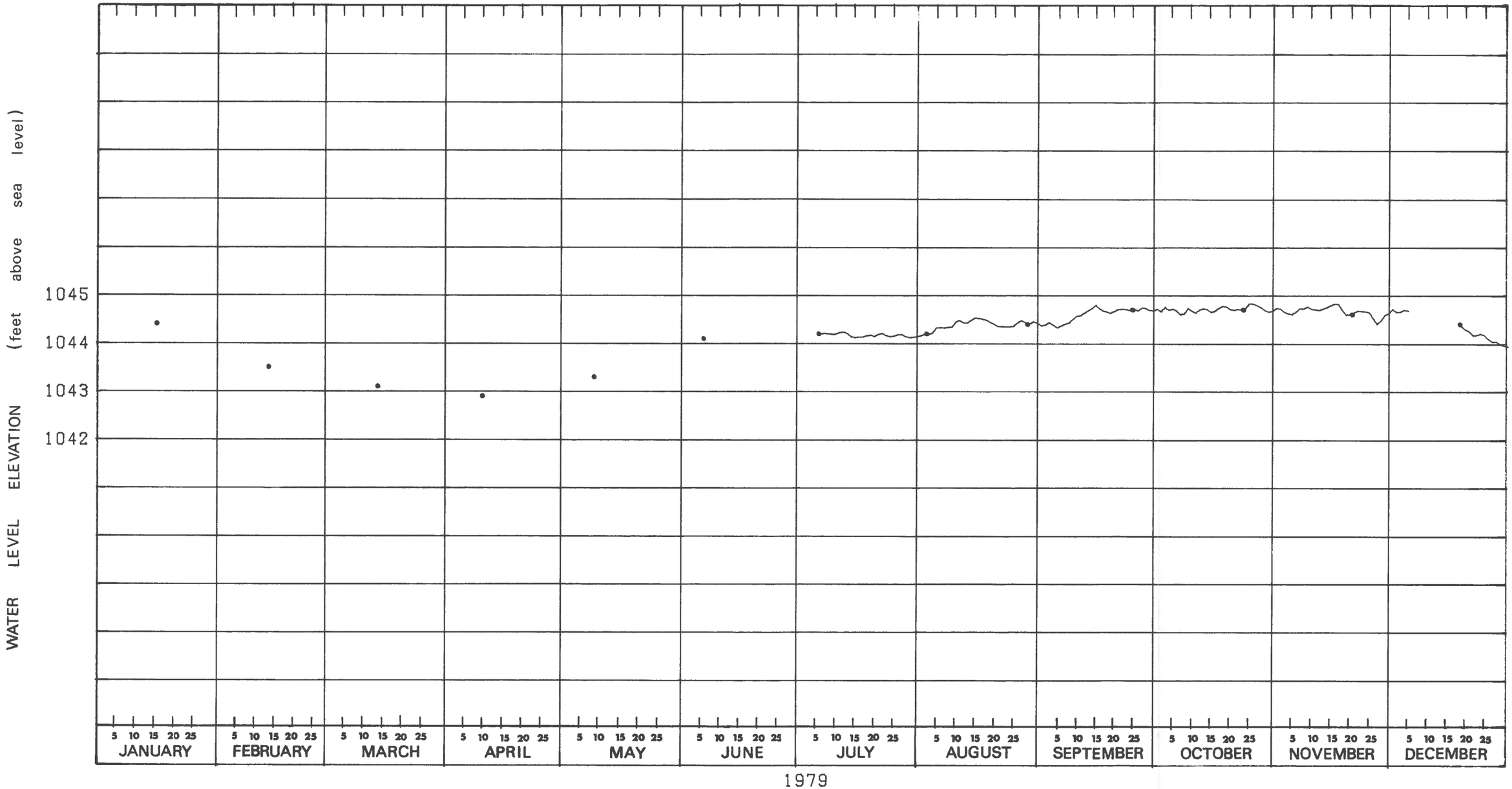
WATER LEVEL HYDROGRAPH

**OBSERVATION WELL NUMBER** SHELL PW-2

SHELL PW-2-H-80

**Lsd** 10 **Sec** 24 **Twp** 95 **R** 9 **W4 th**

**Alberta Research Council**




1979

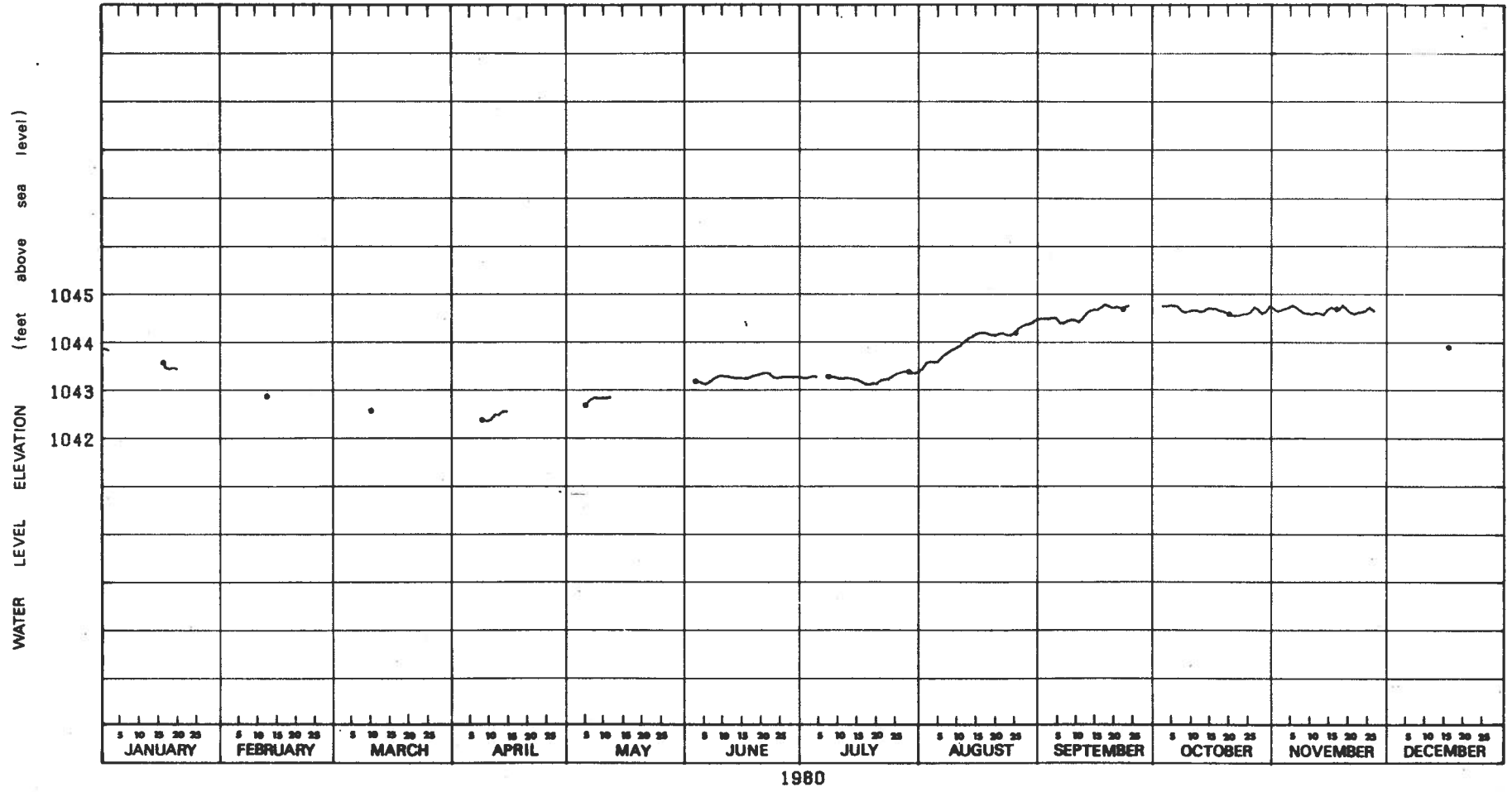
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL PW-2

SHELL PW-2-H-81

Lsd 10 Sec 24 Twp 95 R 9 W4 th

Alberta Research Council



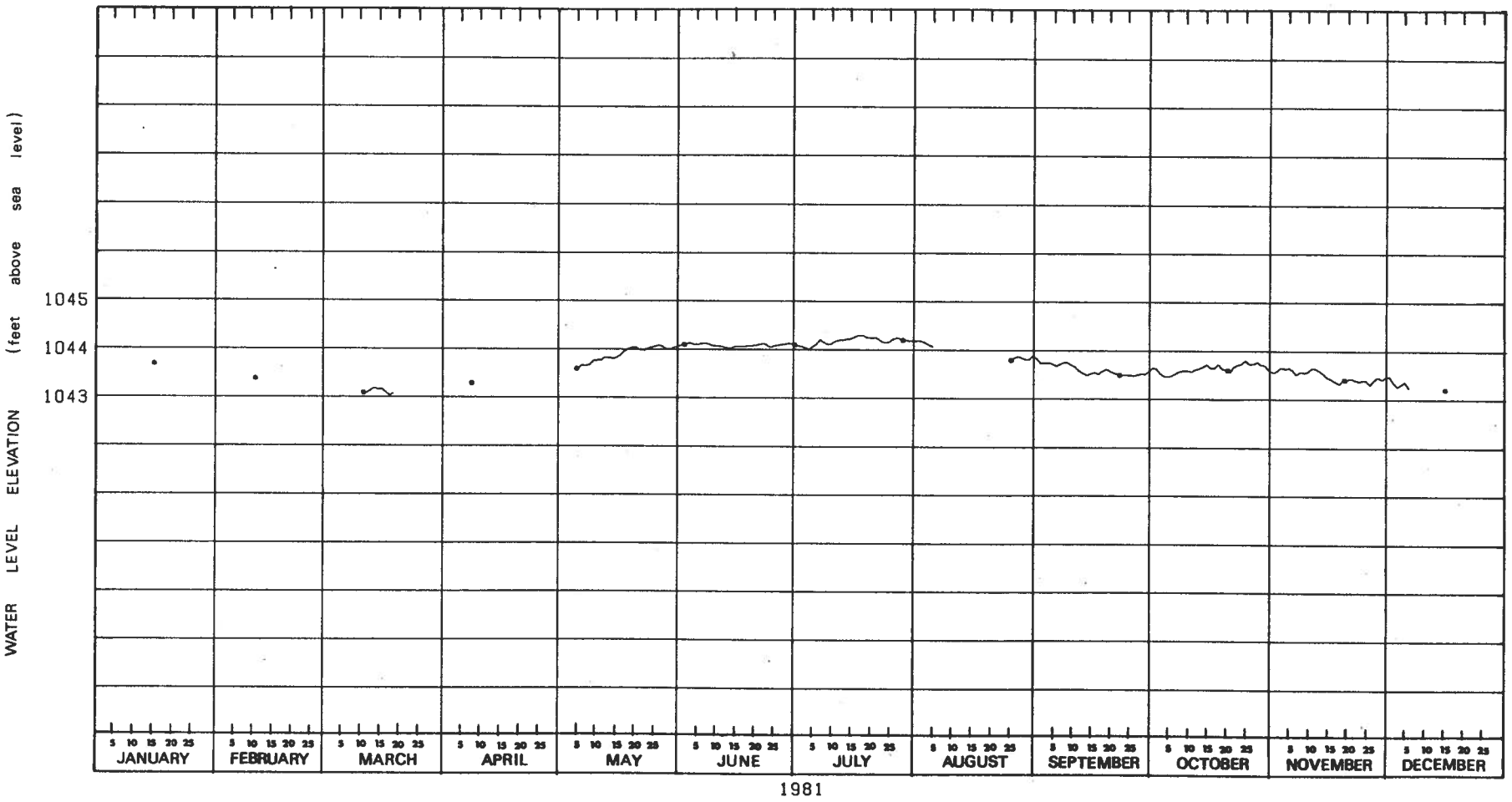
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER SHELL PW-2

SHELL PW-2-H-82

Lsd 10 Sec 24 Twp 95 R 9 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 1053.51

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Aug 7/72 | | | Well completed 103' T.D. |
| Aug 10-16/72 | 3.0 TOC | | 6 day pump test @ 229 IGPM |
| Nov 18/75 | 3.18 MP | 1045.0 | MP = 0.58 m TOC, (1055.4) |
| Dec 7/75 | 3.20 MP | 1044.9 | |
| Jan 7/76 | 3.48 MP | 1044.0 | |
| Feb 7/76 | 3.56 MP | 1043.7 | |
| Mar 6/76 | 3.76 MP | 1043.1 | |
| Apr 7/76 | 3.90 MP | 1042.6 | |
| May 6/76 | 3.60 MP | 1043.6 | |
| June 2/76 | 3.44 MP | 1044.1 | |
| June 23/76 | 3.46 MP | 1044.0 | |
| July 17/76 | 3.42 MP | 1044.2 | |
| | 3.41 MP | 1044.2 | After sample; temp. 5°C |
| Aug 11/76 | 3.45 MP | 1044.1 | |
| Sept 1/76 | 3.39 MP | 1044.3 | |
| Sept 29/76 | 3.29 MP | 1044.6 | |
| Oct 27/76 | 3.20 MP | 1044.9 | |
| Nov 24/76 | 3.28 MP | 1044.6 | |
| Dec 22/76 | 3.48 MP | 1044.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 1053.51

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 3.66 MP | 1043.4 | MP (1055.4) |
| Feb 16/77 | 3.77 MP | 1043.0 | |
| Mar 16/77 | 3.85 MP | 1042.8 | |
| Apr 14/77 | 3.85 MP | 1042.8 | |
| May 11/77 | 3.66 MP | 1043.4 | |
| June 8/77 | 3.45 MP | 1044.1 | |
| July 8/77 | 3.33 MP | 1044.5 | |
| | 3.34 MP | 1044.4 | After sample; temp. 5°C |
| Aug 4/77 | 3.29 MP | 1044.6 | |
| Aug 30/77 | 3.27 MP | 1044.7 | |
| | 3.14 MP | 1044.3 | New MP = 0.32 m TOC, (1054.6) Shelter bolted down on this date; previous reading could be slightly in error |
| Sept 29/77 | 3.09 MP | 1044.5 | |
| Oct 26/77 | 3.00 MP | 1044.8 | |
| Nov 23/77 | 3.08 MP | 1044.5 | |
| Dec 20/77 | 3.24 MP | 1044.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 1053.51

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 3.43 MP | 1043.3 | MP (1054.6) |
| Feb 14/78 | 3.58 MP | 1042.9 | |
| Mar 15/78 | 3.72 MP | 1042.4 | |
| Apr 12/78 | 3.75 MP | 1042.3 | |
| May 10/78 | 3.52 MP | 1043.0 | |
| June 6/78 | 3.30 MP | 1043.8 | |
| July 8/78 | 3.24 MP | 1044.0 | |
| | 3.24 MP | 1044.0 | After sample; temp 4°C |
| Aug 1/78 | 3.25 MP | 1043.9 | |
| Aug 29/78 | 3.13 MP | 1044.3 | |
| Sept 27/78 | 2.85 MP | 1045.2 | |
| Oct 25/78 | 2.80 MP | 1045.4 | |
| Nov 22/78 | 2.88 MP | 1045.1 | |
| Dec 20/78 | 2.95 MP | 1044.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER SHELL PW-2

Lsd 10 Sec 24 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 1053.51

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 3.12 MP | 1044.4 | MP (1054.6) |
| Feb 14/79 | 3.37 MP | 1043.5 | |
| Mar 14/79 | 3.51 MP | 1043.1 | |
| Apr 10/79 | 3.58 MP | 1042.9 | |
| May 9/79 | 3.43 MP | 1043.3 | |
| June 6/79 | 3.19 MP | 1044.1 | |
| July 6/79 | 3.16 MP | 1044.2 | |
| | 3.17 MP | 1044.2 | After sample; temp. 7°C |
| Aug 3/79 | 3.16 MP | 1044.2 | |
| Aug 29/79 | 3.10 MP | 1044.4 | |
| Sept 25/79 | 3.02 MP | 1044.7 | |
| Oct 24/79 | 3.02 MP | 1044.7 | |
| Nov 21/79 | 3.05 MP | 1044.6 | |
| Dec 19/79 | 3.10 MP | 1044.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER SHELL PW-2

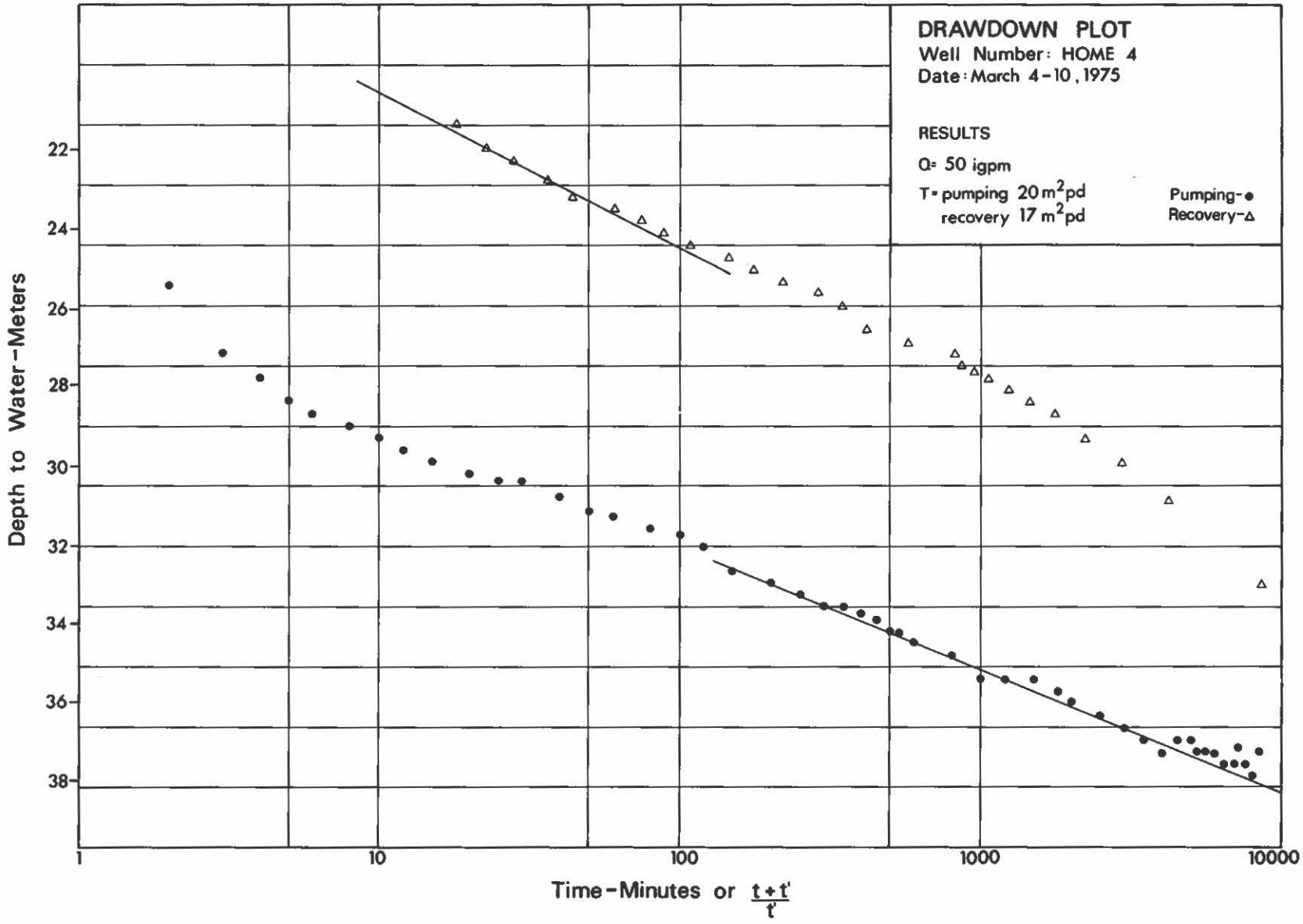
Lsd 10 Sec 24 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 1053.51

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 3.34 MP | 1043.6 | |
| Feb 13/80 | 3.56 MP | 1042.9 | |
| Mar 11/80 | 3.65 MP | 1042.6 | |
| Apr 10/80 | 3.73 MP | 1042.4 | |
| May 6/80 | 3.64 MP | 1042.7 | |
| June 4/80 | 3.46 MP | 1043.2 | |
| July 9/80 | 3.45 MP | 1043.3 | Temp. 5°C |
| | 3.45 MP | 1043.3 | After Sample |
| July 30/80 | 3.41 MP | 1043.4 | |
| Aug 27/80 | 3.18 MP | 1044.2 | |
| Sept 24/80 | 3.03 MP | 1044.7 | |
| Oct 22/80 | 3.04 MP | 1044.6 | |
| Nov 19/80 | 3.03 MP | 1044.7 | |
| Dec 18/80 | 3.25 MP | 1043.9 | |
| Jan 16/81 | 3.33 MP | 1043.7 | |
| Feb 11/81 | 3.42 MP | 1043.4 | |
| Mar 11/81 | 3.50 MP | 1043.1 | |
| Apr 8/81 | 3.45 MP | 1043.3 | |
| May 5/81 | 3.36 MP | 1043.6 | |
| June 2/81 | 3.21 MP | 1044.1 | |
| July 1/81 | 3.21 MP | 1044.1 | |
| July 29/81 | 3.16 MP | 1044.2 | |
| Aug 26/81 | 3.30 MP | 1043.8 | |
| Sept 23/81 | 3.37 MP | 1043.5 | |
| Oct 21/81 | 3.36 MP | 1043.6 | |
| Nov 20/81 | 3.40 MP | 1043.4 | |
| Dec 16/81 | 3.48 MP | 1043.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing


DRAWDOWN PLOT
Well Number: HOME 4
Date: March 4-10, 1975
RESULTS
Q= 50 igpm
T= pumping 20 m²pd
recovery 17 m²pd
Pumping-●
Recovery-△
Depth to Water-Meters
22
24
26
28
30
32
34
36
38
1
10
100
1000
10000
Time-Minutes or (t+t')/t'

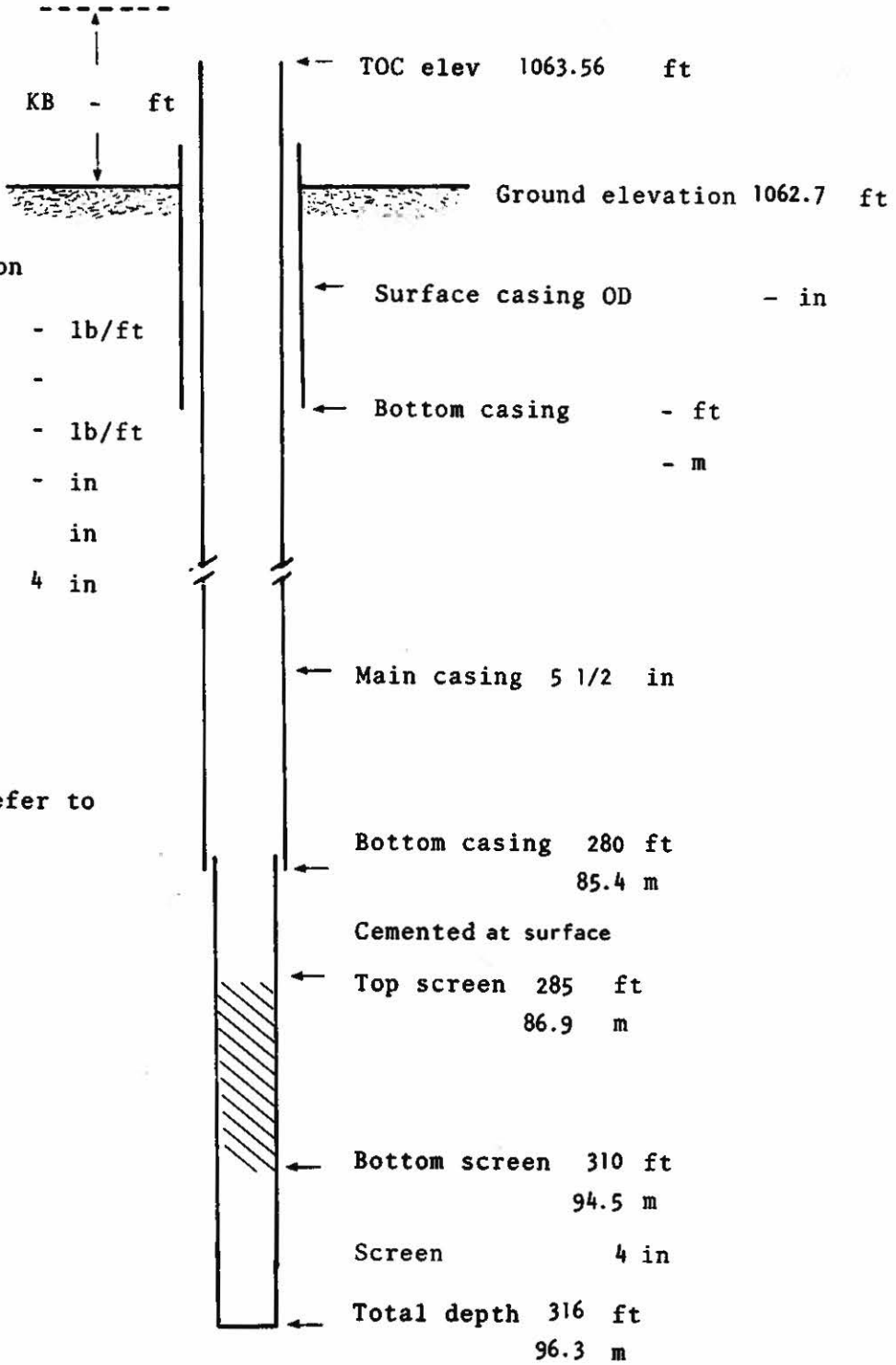
HOME 4-A-77

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Tp 94 R 9 Mer 4th

Alberta Research Council




Construction

Surface casing - lb/ft

wall thickness -

Main casing - lb/ft

wall thickness - in

Screen slot width in

screen OD 4 in

slots per foot

material ss

Sand pack Yes

Note: all depths refer to ground

## SPECTRAL EMISSION ESTIMATES

OBSERVATION WELL NUMBER Home 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Sample source Home 4

Date of sampling March 4, 1975

Total dissolved solids 6940 Mg/L

| ELEMENT | VALUE | ELEMENT | VALUE |
|---|---|---|---|
| Ag | ND | Li | .01 |
| Al | ND | Mg | M |
| As | <.01 | Mn | ND |
| B | .02 | Mo | ND |
| Ba | .005 | Ni | ND |
| Be | ND | Pb | ND |
| Bi | ND | Sb | ND |
| Ca | .08 | Si | .02 |
| Cd | ND | Sn | ND |
| Co | ND | Te | <.005 |
| Cr | ND | Ti | ND |
| Cu | ND | V | ND |
| Fe | ND | Zn | <.005 |
| Ge | ND | Zr | ND |
| Hg | ND | | |

Explanations: All values are in percent of total dissolved solids.
M = Greater than 0.1%
N.D. = Not detected (less than .001%)

## WATER ANALYSIS

OBSERVATION WELL NUMBER Home 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Sample source Pump test on Home 4

Date sampled March 4, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 20.6 | 1.03 | 0.9 |
| Magnesium ($Mg^{++}$) | 58.5 | 4.81 | 4.1 |
| Sodium ($Na^{+}$) | 2550.0 | 110.92 | 94.5 |
| Potassium ($K^{+}$) | 23.8 | 0.61 | 0.5 |
| Carbonate ($CO_3^{=}$) | 19.2 | 0.64 | 0.5 |
| Bicarbonate ($HCO_3^{-}$) | 1581.0 | 25.91 | 20.8 |
| Sulfate ($SO_4^{=}$) | 62.0 | 1.29 | 1.0 |
| Chloride ($Cl^{-}$) | 3440.0 | 97.01 | 77.7 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 5.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 6940.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 124.862 | Total Cations (epm) | 117.365 |

Other Constituents

Lab:

| | |
|---|---|
| Conductivity | 8000+ |
| pH | 8.4 |
| Fluoride ($F^{-}$) | 0.4 ppm |

Field:

| | | |
|---|---|---|
| Temperature (C) | 4.0 | |
| pH | 7.2 | |
| Carbonate ($CO_3^{=}$) | 0 | ppm |
| Bicarbonate ($HCO_3^{-}$) | 1932 | ppm |
| Hydroxide ($OH^{-}$) | | |
| Conductivity | 9756 | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Sample source Home 4 (WILL)

Date sampled March, 1975

### Major Constituents

| | | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|---|
| Calcium ($Ca^{++}$) | | 64 | 3.19 | |
| Magnesium ($Mg^{++}$) | | 58 | 4.77 | |
| Sodium ($Na^{+}$) | Na & K | 2481 | 107.94 | |
| Potassium ($K^{+}$) | | | | |
| Carbonate ($CO_3^{=}$) | | 0 | 0 | |
| Bicarbonate ($HCO_3^{-}$) | | 1625 | 26.65 | |
| Sulfate ($SO_4^{=}$) | | 20 | 0.42 | |
| Chloride ($Cl^{-}$) | | 3150 | 88.83 | |
| Nitrate ($NO_3^{=}$) | | | | |
| Silica ($SiO_2$) | | | | |
| Hydroxide ($OH^{-}$) | | | | |
| Calcium (Acidified) | | | | |
| Magnesium (Acidified) | | | | |
| Total dissolved solids | | 6630 | | |

Total Anions (epm) Total Cations (epm)

### Other Constituents

Lab:

| | | |
|---|---|---|
| Conductivity | | |
| pH | 7.52 | |
| Fluoride ($F^{-}$) | 1.02 | ppm |
| Iron | 1.5 | ppm |

Field:

- Temperature (C)
- pH
- Carbonate ($CO_3^{=}$)
- Bicarbonate ($HCO_3^{-}$)
- Hydroxide ($OH^{-}$)
- Conductivity

## WATER ANALYSIS

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled September 11, 1975

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 72 | 3.59 | 3 |
| Magnesium ($Mg^{++}$) | 66 | 5.43 | 4 |
| Sodium ($Na^{+}$) | 2700 | 117.44 | 92 |
| Potassium ($K^{+}$) | 23.8 | 0.61 | 0 |
| Carbonate ($CO_3^{=}$) | 0 | 0 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1918 | 31.44 | 24 |
| Sulfate ($SO_4^{=}$) | 22 | 0.46 | 0 |
| Chloride ($Cl^{-}$) | 3600 | 101.52 | 76 |
| Nitrate ($NO_3^{=}$) | 0 | 0 | 0 |
| Silica ($SiO_2$) | 6.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 71 | | |
| Magnesium (Acidified) | 64 | | |
| Total dissolved solids | 7352 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 133.42 | Total Cations (epm) | 127.07 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | | Temperature (C) | 4.0 |
| pH | 7.5 | pH | 7.8 |
| Fluoride ($F^{-}$) | 0.9 ppm | Carbonate ($CO_3^{=}$) | 0 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 352 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 65.0 | 3.24 | 3 |
| Magnesium ($Mg^{++}$) | 63.0 | 5.19 | 4 |
| Sodium ($Na^{+}$) | 2550.0 | 110.92 | 93 |
| Potassium ($K^{+}$) | 24.2 | 0.62 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1764.0 | 28.91 | 23 |
| Sulfate ($SO_4^{=}$) | 17.2 | 0.36 | 0 |
| Chloride ($Cl^{-}$) | 3378.0 | 95.26 | 77 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 4.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 68.2 | | |
| Magnesium (Acidified) | 60.5 | | |
| Total dissolved solids | 6914 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 124.54 | Total Cations (epm) | 119.97 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 6.0 | |
| pH | 8.3 | pH | 7.3 | |
| Fluoride ($F^{-}$) | 0.9 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 1864 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 8, 1977

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 67.0 | 3.34 | 2.7 |
| Magnesium ($Mg^{++}$) | 67.0 | 5.51 | 4.5 |
| Sodium ($Na^{+}$) | 2625.0 | 114.18 | 92.4 |
| Potassium ($K^{+}$) | 23.3 | 0.60 | 0.5 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 1869.0 | 30.63 | 23.8 |
| Sulfate ($SO_4^{=}$) | 12.3 | 0.26 | 0.2 |
| Chloride ($Cl^{-}$) | 1460.0 | 97.57 | 76.0 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 5.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 61.0 | | |
| Magnesium (Acidified) | 60.0 | | |
| Total dissolved solids | 7098.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 128.47 | Total Cations (epm) | 123.63 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | 5.0 |
| pH | 7.6 | pH | 7.4 |
| Fluoride ($F^{-}$) | 1.6 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 1859.0 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## MULTIELEMENT ANALYSIS

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Date sampled: July 18, 1976

| Element | Value | Element | Value |
|---|---|---|---|
| Ag | <.002 | Mn | .201 |
| Au | <.003 | Mo | <.006 |
| Al | 0.22 | Na | 2849 |
| As | <.038 | Ni | <.010 |
| B | 2.21 | P | <.110 |
| Ba | <.200 | Pb | <.088 |
| Be | <.001 | Se | <.060 |
| Ca | 67.5 | Si | 2.71 |
| Cd | <.002 | Sn | <.045 |
| Co | <.010 | Sr | 2.41 |
| Cr | <.006 | Te | <.065 |
| Cu | .013 | Ti | <.0009 |
| Eu | <.015 | U | <.020 |
| Fe | 6.26 | V | .011 |
| K | 110 | W | <.078 |
| Mg | 57.2 | Zn | .077 |

NOTES:

1. All values in milligrams per liter
2. Sample bailed from well
3. Analysis done by Multielement Radio Frequency Induction Coupled Plasma Emission Spectrometer at Barringer Research Ltd., Rexdale, Ontario.

WATER ANALYSIS

OBSERVATION WELL NUMBER HOME-4

Lsd 3 Sec 28 Rge 9 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 08, 1978

Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.9 | 0.14 | 0.2 |
| Magnesium(Mg) | 28.0 | 2.30 | 2.7 |
| Sodium(Na) | 1888.0 | 82.12 | 96.5 |
| Potassium(K) | 19.2 | 0.49 | 0.6 |
| Carbonate(CO3) | 60.0 | 2.00 | 2.2 |
| Bicarbonate(HCO3) | 1015.0 | 16.64 | 18.0 |
| Sulphate(SO4) | 15.8 | 0.33 | 0.4 |
| Chloride(Cl) | 2600.0 | 73.32 | 79.4 |
| Nitrate(NO3) | 1.5 | 0.02 | 0.0 |
| Silica(SiO2) | 1.0 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 6.7 | | |
| Magnesium(Acidified) | 25.0 | | |
| TDS(mg/l) | 5070.0 | | |
| Total Anions(epm) | 92.31 | Total Cations(epm) | 85.06 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 8150 | | Temperature(C) | 5.00 | |
| pH | 9.0 | | pH | 9.1 | |
| Fluoride(F) | 0.8 | mg/l | Carbonate(CO3) | 168 | mg/l |
| | | | Bicarbonate(HCO3) | 820 | mg/l |
| | | | Hydroxide(OH) | | |

WATER ANALYSIS

OBSERVATION WELL NUMBER HOME-4

Lsd 3 Sec 28 Rge 9 Twp 94 W4th

Alberta Research Council

Sample Source BAILED

Date sampled July 6, 1979

## Major Constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 45.0 | 2.25 | 1.9 |
| Magnesium(Mg) | 63.0 | 5.19 | 4.3 |
| Sodium(Na) | 2575.0 | 112.01 | 93.3 |
| Potassium(K) | 22.1 | 0.57 | 0.5 |
| Carbonate(CO3) | 0.0 | 0.00 | 0.0 |
| Bicarbonate(HCO3) | 1845.0 | 30.24 | 24.3 |
| Sulphate(SO4) | 35.8 | 0.75 | 0.6 |
| Chloride(Cl) | 3320.0 | 93.63 | 75.1 |
| Nitrate(NO3) | 0.4 | 0.01 | 0.0 |
| Silica(SiO2) | 5.1 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 54.0 | | |
| Magnesium(Acidified) | 60.0 | | |
| TDS(mg/l) | 6970.0 | | |
| Total Anions(epm) | 124.62 | Total Cations(epm) | 120.00 |

## Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 9900 | Temperature(C) | 7.00 | |
| pH | 7.8 | pH | 7.7 | |
| Fluoride(F) | 1.0 mg/l | Carbonate(CO3) | | |
| | | Bicarbonate(HCO3) | 1952 | mg/l |
| | | Hydroxide(OH) | | |

WATER ANALYSIS HOME-4-E-82

OBSERVATION WELL NUMBER HOME-4

Lsd 3 Sec 28 Rge 9 Twp 94 W4th

Alberta Research Council

Sample Source Bailed

Date sampled July 6, 1980

Major constituents

| | mg/l | meq/l | Percent Cations or Anions |
|---|---|---|---|
| Calcium(Ca) | 2.5 | 0.13 | 0.1 |
| Magnesium(Mg) | 31.0 | 2.58 | 2.2 |
| Sodium(Na) | 2663.0 | 115.78 | 97.2 |
| Potassium(K) | 25.0 | 0.64 | 0.5 |
| Carbonate(CO3) | 122.0 | 4.07 | 3.6 |
| Bicarbonate(HCO3) | 1222.0 | 20.03 | 17.5 |
| Sulphate(SO4) | 11.0 | 0.23 | 0.2 |
| Chloride(Cl) | 3200.0 | 90.14 | 78.7 |
| Nitrate(NO3) | 0.0 | 0.0 | 0.0 |
| Silica(SiO2) | 2.3 | | |
| Hydroxide(OH) | | | |
| Calcium(Acidified) | 2.1 | | |
| Magnesium(Acidified) | 39.0 | | |
| TDS(mg/l) | 6842.0 | | |
| Total Anions(epm) | 114.47 | Total Cations(epm) | 119.13 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 11999 | Temperature | 5.00 | |
| pH | 9.0 | pH | 9.0 | |
| Fluoride | 0.8 mg/l | Carbonate(CO3) | 153 | mg/l |
| | | Bicarbonate(HCO3) | 1151 | mg/l |
| | | Hydroxide(OH) | | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

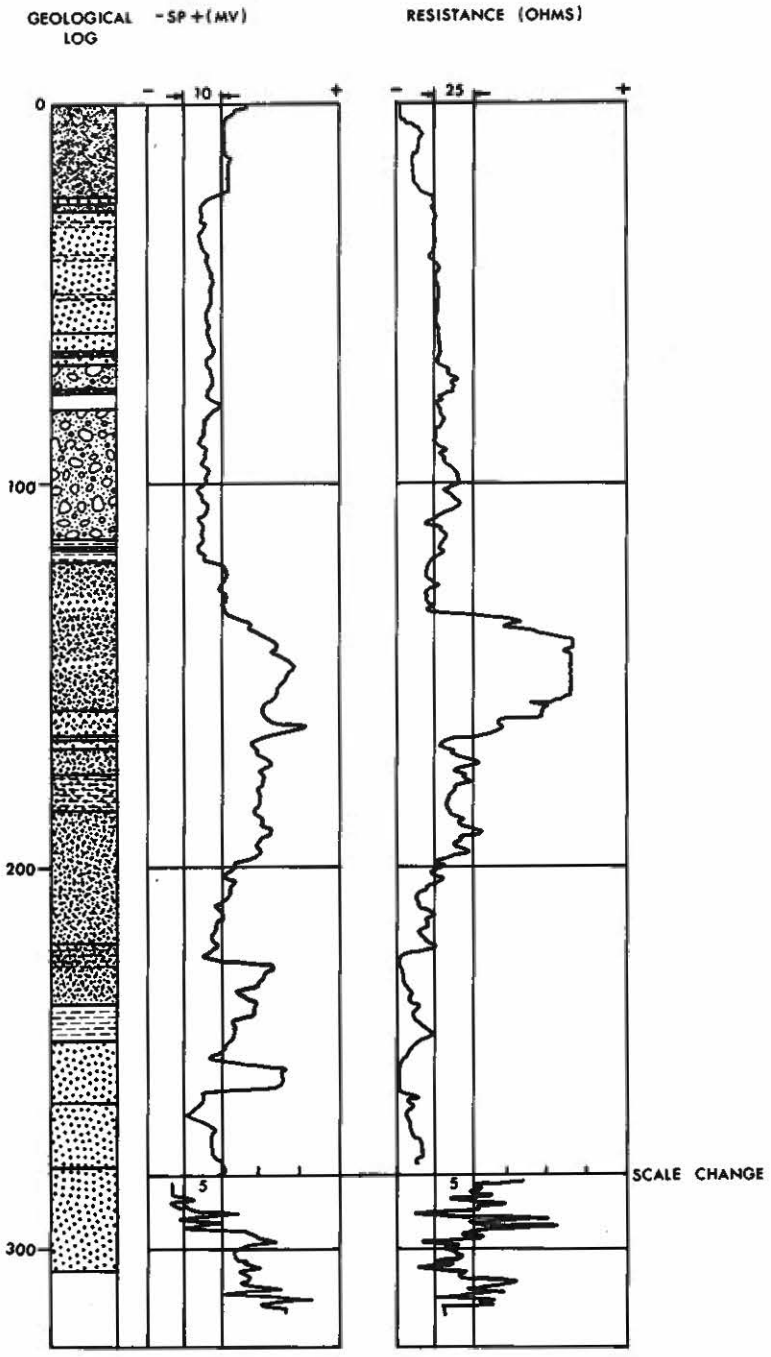
Ground elevation 1062 Total depth 316

KB elevation Unknown
all depths refer to ground

| Interval from | to | Description | Formation |
|---|---|---|---|
| 0 | 24 | Till - sandy | |
| 24 | 26 | Sand | |
| 26 | 28 | Till - sandy | |
| 28 | 60 | Sand - some clayey sand | |
| 60 | 64 | Sand | |
| 64 | 65 | Clay | |
| 65 | 68 | Sand | |
| 68 | 74 | Gravel | |
| 74 | 75 | Clay | |
| 79 | 90 | Gravel | |
| 90 | 114 | Sandy gravel | |
| 114 | 116 | Clay | |
| 116 | 117 | Rich tarsand | |
| 117 | 120 | Clay | |
| 120 | 158 | Rich tarsand - some sand stringers | |
| 158 | 165 | Sand - some tarsand | |
| 165 | 167 | Rich tarsand | |
| 167 | 169 | Sand | |
| 169 | 176 | Rich tarsand - sand stringers | |
| 176 | 184 | Sand - clayey sand | |
| 184 | 195 | Rich tarsand | |
| 195 | 220 | Tarsand - medium 50% clean sand | |
| 220 | 235 | Tarsand - lean - 50% sand 20% clay | |
| 235 | 245 | Clay | |
| 245 | 262 | Sand - some lean tarsand | |
| 262 | 264 | Rich tarsand | |
| 264 | 278 | Tarsand - medium with 25% sand | |
| 278 | 305 | Sand - some lean tarsand | |
| 305 | 316 | No samples | |
| 316 | | Limestone | |

N.B. Descriptions taken from cored hole which collapsed before completion.

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE HOME 4
## 3-28-94-9 W4th
## ALBERTA RESEARCH COUNCIL



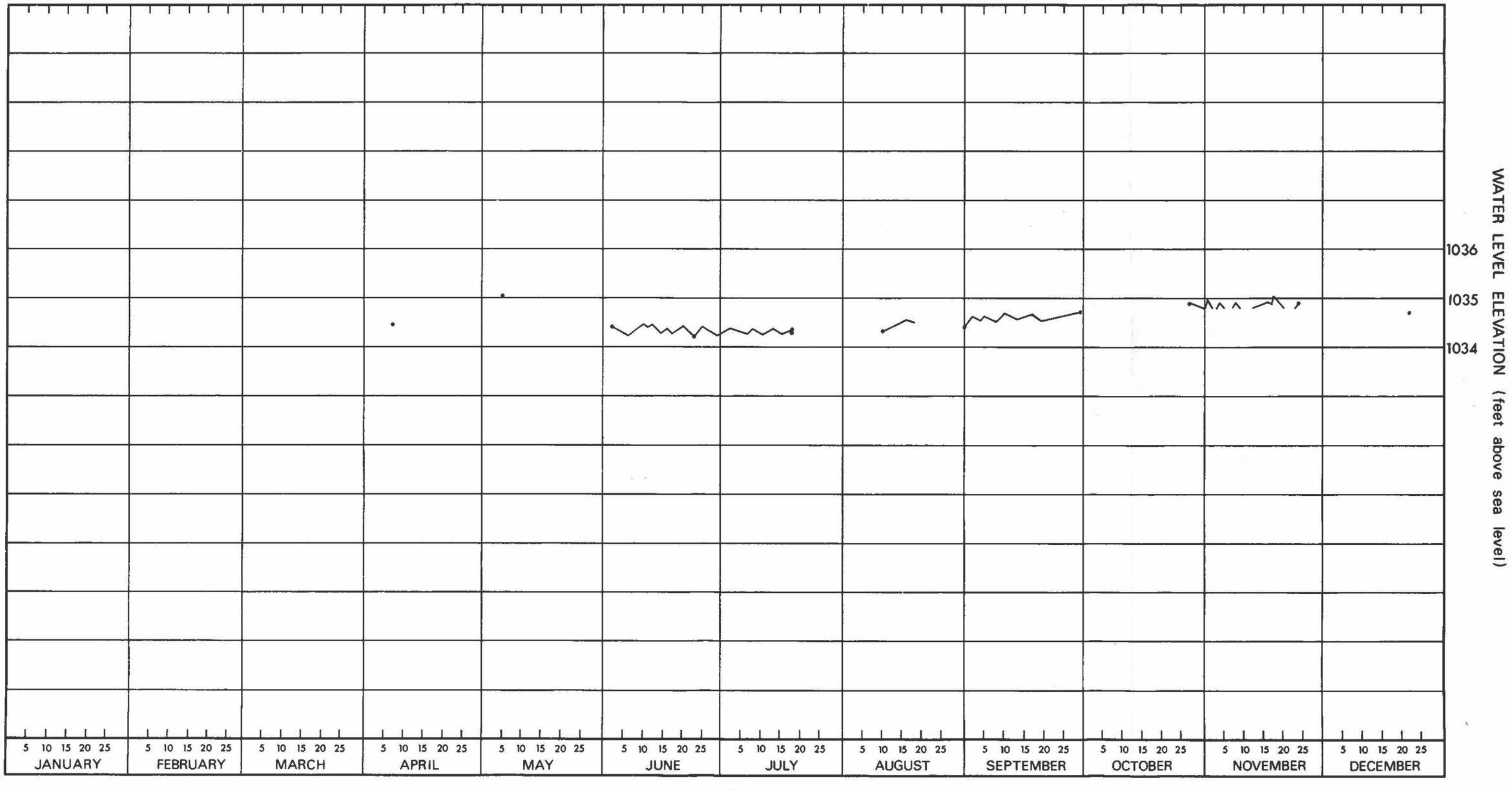
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **HOME 4**

Lsd **3** Sec **28** Twp **94** R **9** W4th

Alberta Research Council

HOME 4 - H - 77




1976

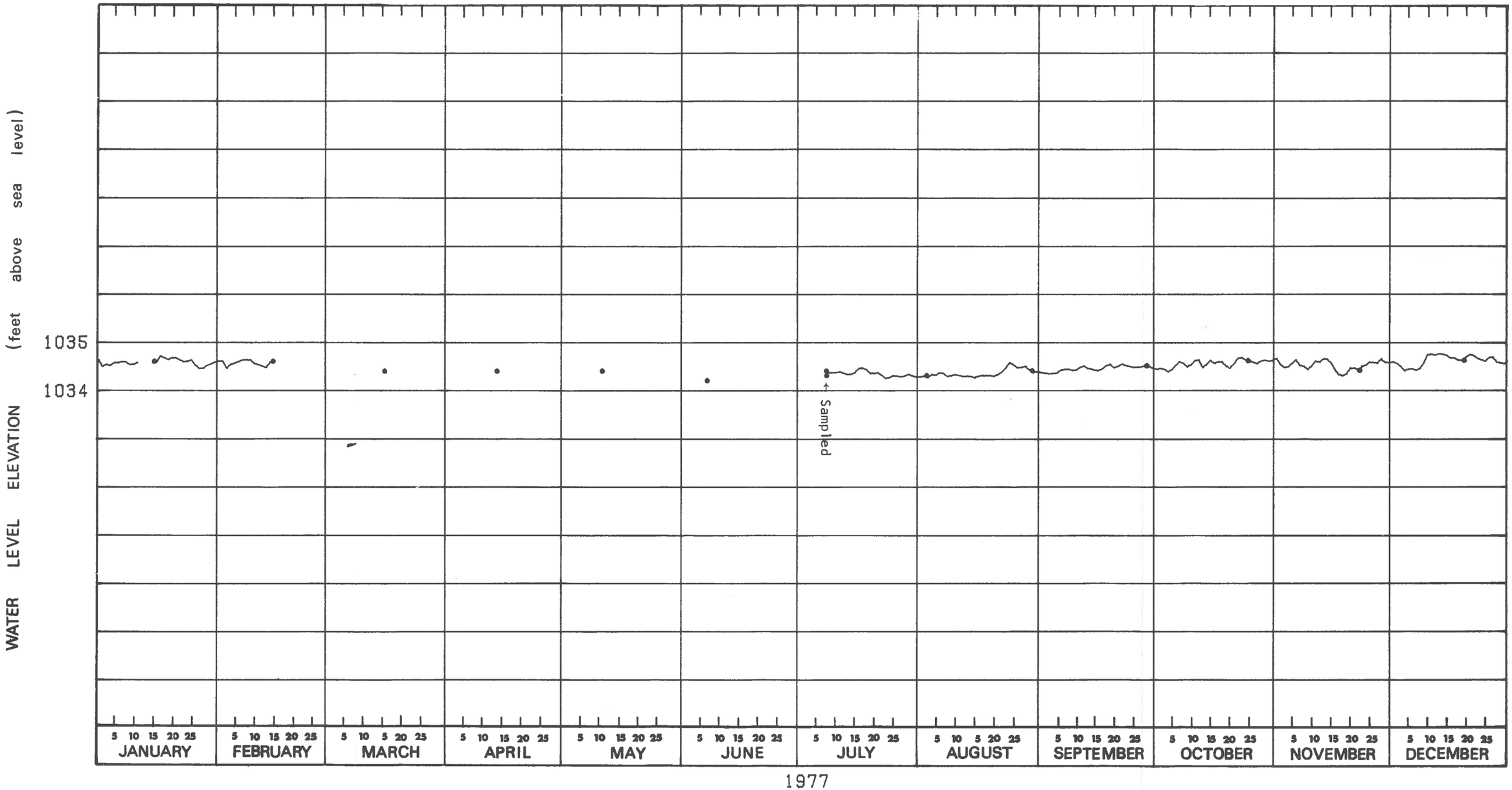
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4 th

Alberta Research Council

HOME 4-H-78




1977

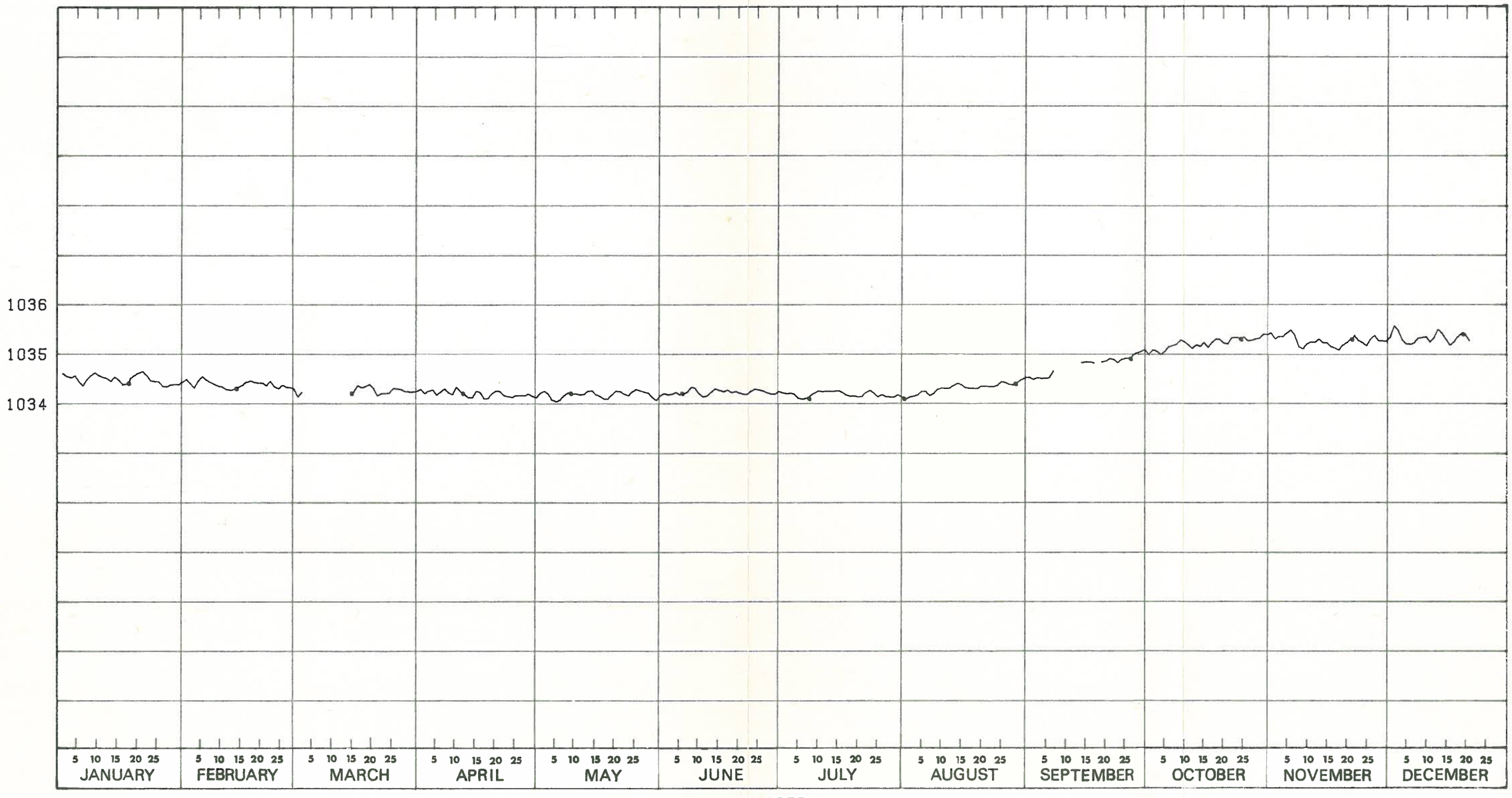
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER HOME 4

LSD 3 SEC 28 TWP 94 R 9 W4TH

HOME 4-H-79

Alberta Research Council




1978

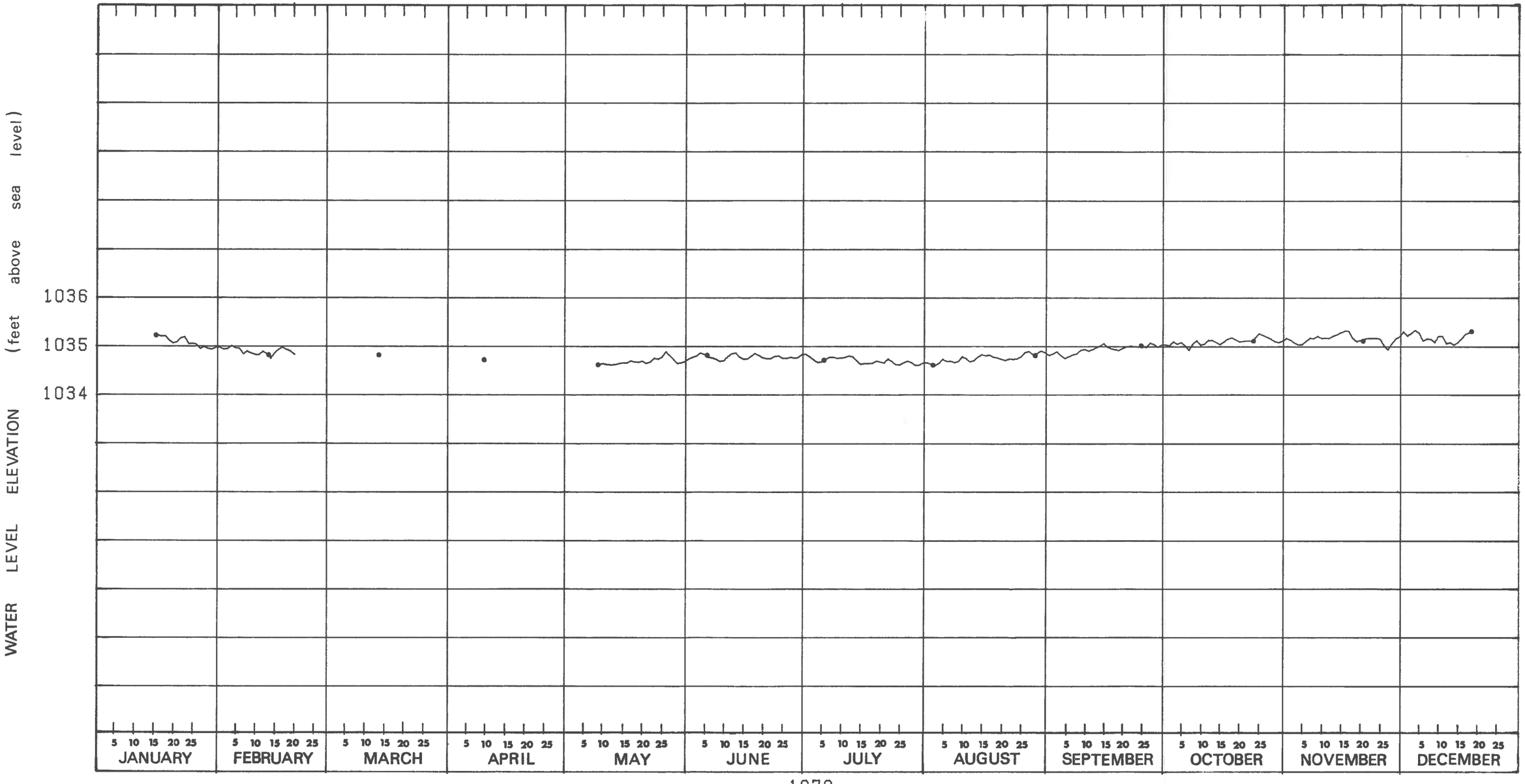
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4 th

Alberta Research Council

HOME 4-H-80



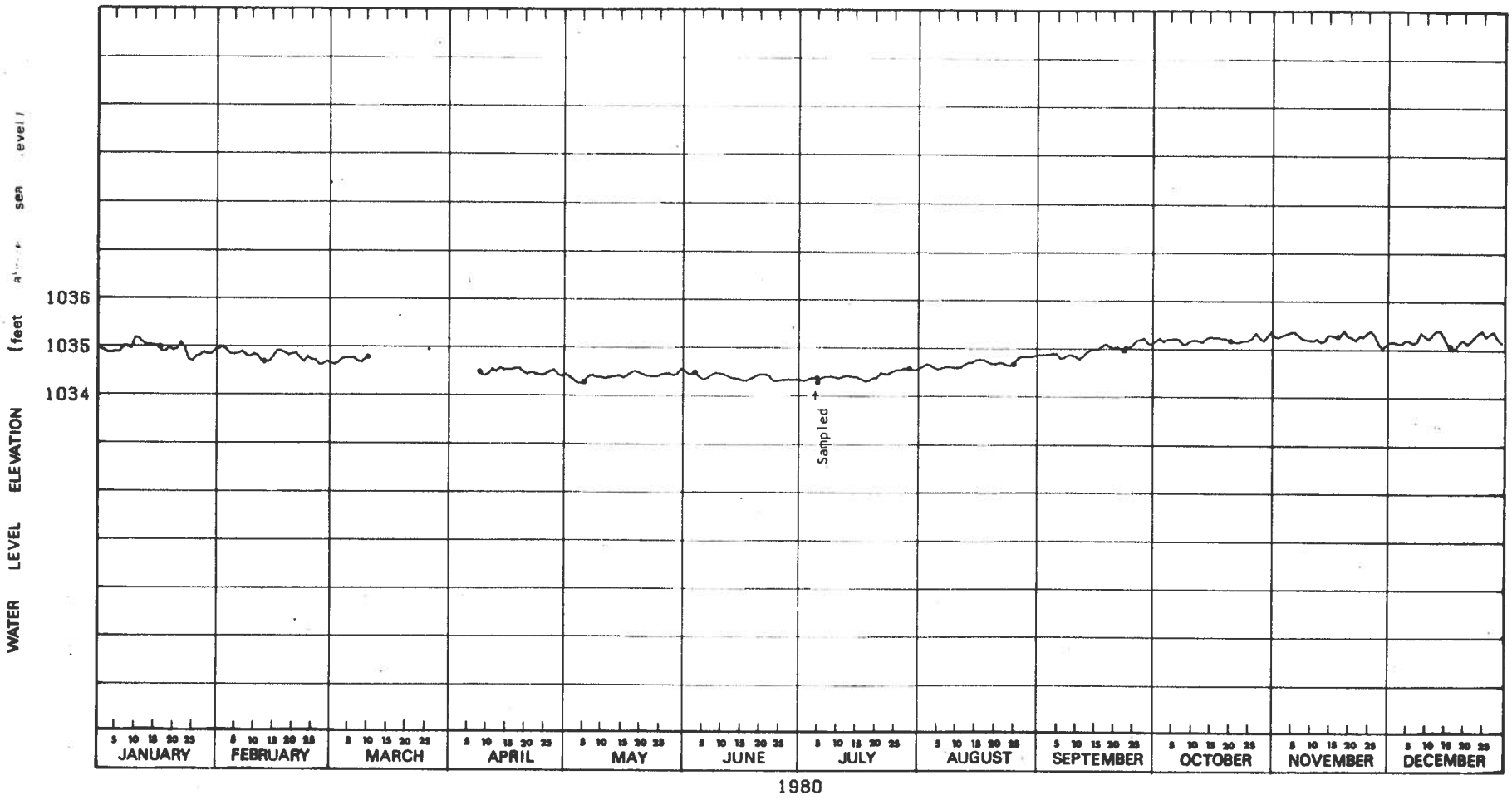
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4 th

Alberta Research Council

HOME 4-H-81



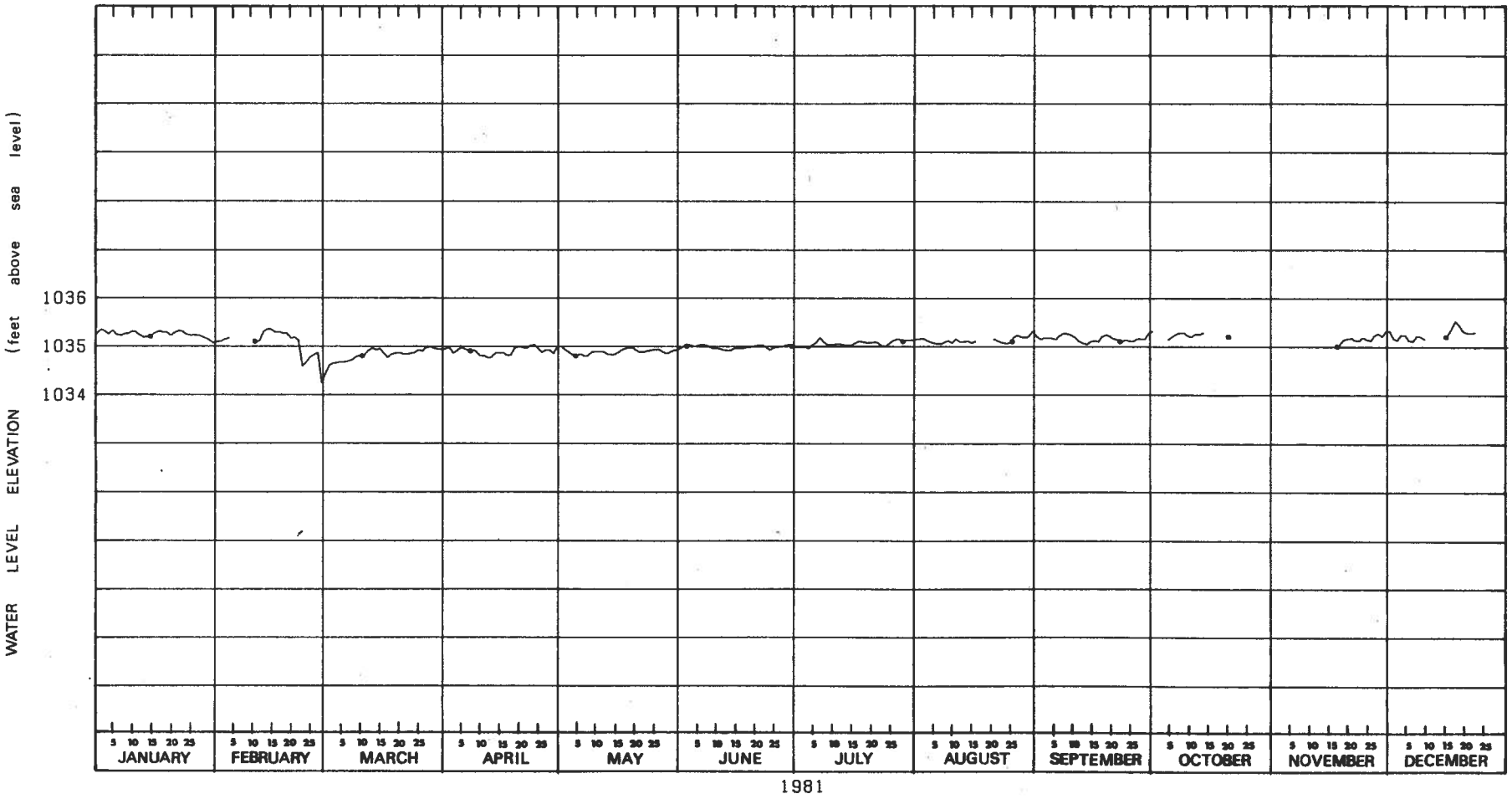
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER HOME 4

HOME 4-H-82

Lsd 3 Sec 28 Twp 94 R 9 W4 th

Alberta Research Council



## WELL HISTORY

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Elevation of top of casing 1063.56

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb /75 | | | Well completed 310' T.D. |
| Mar 4/75 | 9.04 TOC | 1033.91 | |
| Mar 4-10/75 | | | 6 day pump test @ 50 IGPM |
| Apr 16/75 | 9.02 TOC | 1034.0 | |
| June 6/75 | 8.87 TOC | 1034.5 | |
| July 9/75 | 8.83 TOC | 1034.6 | |
| Aug 13/75 | 9.57 MP | 1034.8 | MP = 2.65' TOC, (1066.21) |
| Sept 11/75 | 9.47 MP | 1035.1 | |
| | 9.51 MP | 1035.0 | After sample; temp. 4°C |
| Oct 7/75 | 9.41 MP | 1035.3 | |
| Nov 7/75 | 9.34 MP | 1035.6 | |
| Dec 7/75 | 9.41 MP | 1035.3 | |
| Apr 7/76 | 9.68 MP | 1034.4 | |
| May 5/76 | 9.51 MP | 1035.0 | |
| June 2/76 | 9.70 MP | 1034.4 | |
| June 23/76 | 9.76 MP | 1034.2 | |
| July 18/76 | 9.72 MP | 1034.3 | |
| | 9.74 MP | 1034.2 | After sample; temp. 6°C |
| Aug 10/76 | 9.72 MP | 1034.3 | |
| Aug 31/76 | 9.70 MP | 1034.4 | |
| Sept 29/76 | 9.60 MP | 1034.7 | |
| Oct 27/76 | 9.54 MP | 1034.9 | |
| Nov 24/76 | 9.54 MP | 1034.9 | |
| Dec 22/76 | 9.59 MP | 1034.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Elevation of top of casing 1063.56

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/77 | 9.64 MP | 1034.6 | MP (1066.2) |
| Feb 15/77 | 9.63 MP | 1034.6 | |
| Mar 16/77 | 9.68 MP | 1034.4 | |
| Apr 14/77 | 9.70 MP | 1034.4 | |
| May 11/77 | 9.70 MP | 1034.4 | |
| June 7/77 | 9.75 MP | 1034.2 | |
| July 8/77 | 9.71 MP | 1034.4 | |
| | 9.73 MP | 1034.3 | After sample; temp. 5°C |
| Aug 3/77 | 9.72 MP | 1034.3 | |
| Aug 30/77 | 9.68 MP | 1034.4 | |
| Sept 29/77 | 9.67 MP | 1034.5 | |
| Oct 25/77 | 9.62 MP | 1034.6 | |
| Nov 23/77 | 9.68 MP | 1034.4 | |
| Dec 20/77 | 9.65 MP | 1034.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Elevation of top of casing 1063.56

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 18/78 | 9.70 MP | 1034.4 | MP (1066.2) |
| Feb 14/78 | 9.72 MP | 1034.3 | |
| Mar 15/78 | 9.75 MP | 1034.2 | |
| Apr 4/78 | 9.75 MP | 1034.2 | |
| May 9/78 | 9.74 MP | 1034.2 | |
| June 6/78 | 9.74 MP | 1034.2 | |
| July 8/78 | 9.77 MP | 1034.1 | |
| | 9.79 MP | 1034.1 | After sample; temp 5°C |
| Aug 1/78 | 9.77 MP | 1034.1 | |
| Aug 29/78 | 9.69 MP | 1034.4 | |
| Sept 27/78 | 9.54 MP | 1034.9 | |
| Oct 25/78 | 9.43 MP | 1035.3 | |
| Nov 22/78 | 9.42 MP | 1035.3 | |
| Dec 20/78 | 9.40 MP | 1035.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER HOME 4

Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Elevation of top of casing 1063.56

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 16/79 | 9.45 MP | 1035.2 | MP (1066.2) |
| Feb 14/79 | 9.57 MP | 1034.8 | |
| Mar 14/79 | 9.58 MP | 1034.8 | |
| Apr 10/79 | 9.61 MP | 1034.7 | |
| May 9/79 | 9.64 MP | 1034.6 | |
| June 6/79 | 9.58 MP | 1034.8 | |
| July 6/79 | 9.60 MP | 1034.7 | |
| | 9.61 MP | 1034.7 | After sample; temp. 7°C |
| Aug 3/79 | 9.64 MP | 1034.6 | |
| Aug 29/79 | 9.58 MP | 1034.8 | |
| Sept 25/79 | 9.52 MP | 1035.0 | |
| Oct 24/79 | 9.49 MP | 1035.1 | |
| Nov 21/79 | 9.49 MP | 1035.1 | |
| Dec 19/79 | 9.41 MP | 1035.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

WELL HISTORY

OBSERVATION WELL NUMBER HOME 4

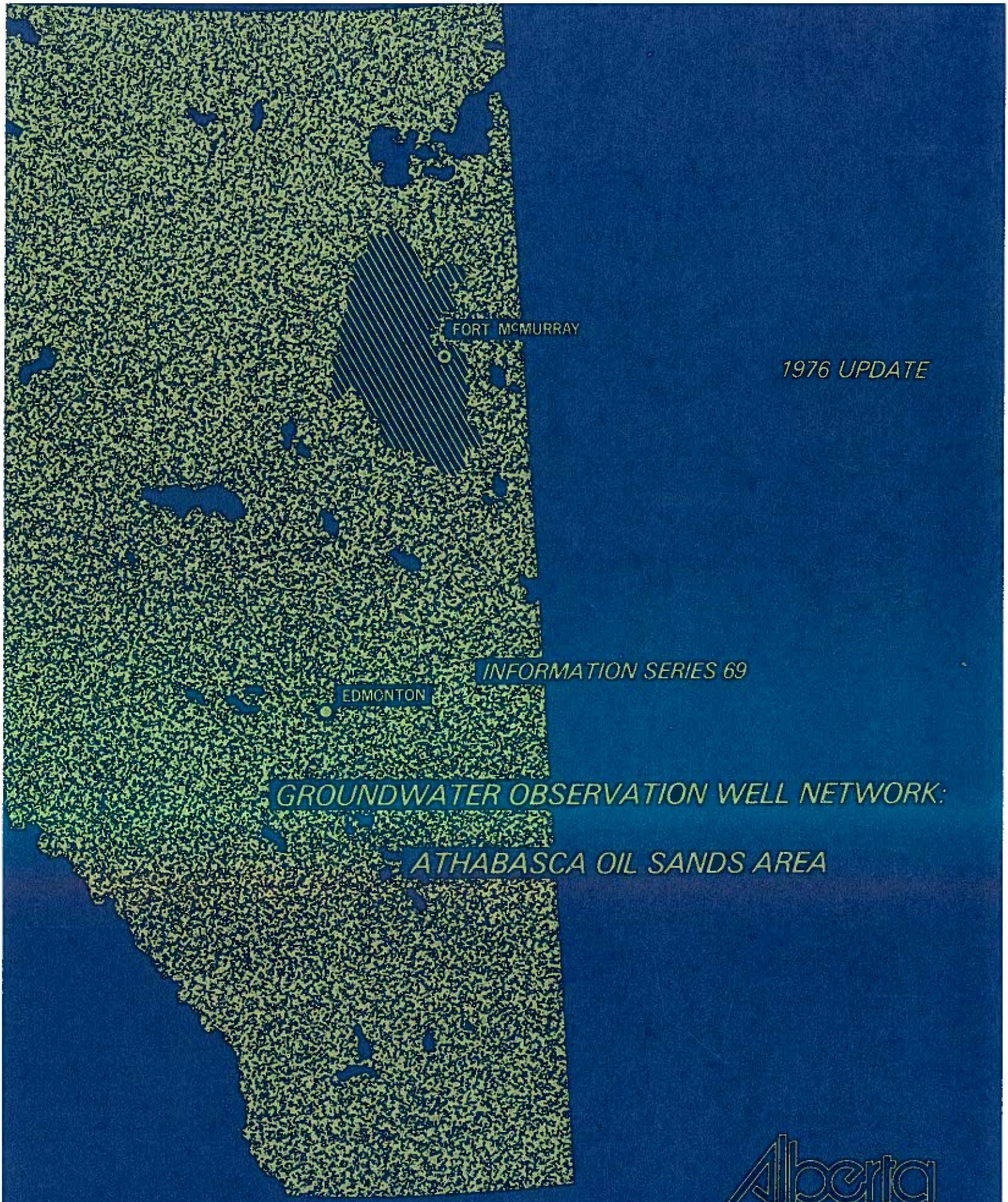
Lsd 3 Sec 28 Twp 94 R 9 W4th

Alberta Research Council

Elevation of top of casing 1063.56

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 17/80 | 9.51 MP | 1035.0 | |
| Feb 13/80 | 9.61 MP | 1034.7 | |
| Mar 11/80 | 9.57 MP | 1034.8 | |
| Apr 9/80 | 9.65 MP | 1034.5 | |
| May 6/80 | 9.71 MP | 1034.3 | |
| June 4/80 | 9.67 MP | 1034.5 | |
| July 6/80 | 9.69 MP | 1034.4 | Temp. 5°C |
| | 9.72 MP | 1034.3 | After Sample |
| July 30/80 | 9.64 MP | 1034.6 | |
| Aug 26/80 | 9.60 MP | 1034.7 | |
| Sept 24/80 | 9.52 MP | 1035.0 | |
| Oct 22/80 | 9.46 MP | 1035.2 | |
| Nov 19/80 | 9.41 MP | 1035.3 | |
| Dec 18/80 | 9.48 MP | 1035.1 | |
| Jan 15/81 | 9.44 MP | 1035.2 | |
| Feb 11/81 | 9.48 MP | 1035.1 | |
| Mar 11/81 | 9.58 MP | 1034.8 | |
| Apr 8/81 | 9.53 MP | 1034.9 | |
| May 5/81 | 9.56 MP | 1034.8 | |
| June 3/81 | 9.50 MP | 1035.0 | |
| June 30/81 | 9.50 MP | 1035.0 | |
| July 29/81 | 9.47 MP | 1035.1 | |
| Aug 26/81 | 9.48 MP | 1035.1 | |
| Sept 23/81 | 9.47 MP | 1035.1 | |
| Oct 21/81 | 9.46 MP | 1035.2 | |
| Nov 18/81 | 9.51 MP | 1035.0 | |
| Dec 16/81 | 9.45 MP | 1035.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing




1976 UPDATE

INFORMATION SERIES 69

# GROUNDWATER OBSERVATION WELL NETWORK:

# ATHABASCA OIL SANDS AREA

Alberta
RESEARCH COUNCIL

## INTRODUCTION

## (1977 UPDATE)

This publication represents the first update for Sites 1, 2, 3, 6, 7, 8, and 9. Included in each site section is material related to well history, water chemistry, annual hydrograph and, in one case, geological and geophysical logs which were collected during 1976.

Included in this volume are "Summary of Contents" pages for each well site for 1975 and 1976. These summarize the number of pages issued in 1976 and 1977 for each well at each site and allow verification of the total number of pages issued.

A considerable amount of additional work was done at Site 1 during February, 1976. A new hole was drilled, drill stem tested and completed to a depht of 1040 feet. New -"Geological Sample Description" pages are included herein for this site. The sample descriptions differ from the previous descriptions because a better sampling technique was utilized and a different geologist examined them.

## ACKNOWLEDGMENTS

The installation and monitoring of wells in this Program was funded by Alberta Energy and Natural Resources; Non-Renewable Resources Division.

Numerous persons and companies contributed to the success of the field program. Their assistance is acknowledged.

Mr. R. Lailey, of Bomay Oilfield Services, provided invaluable assistance in the planning and execution of the field program. His conscientious work is gratefully acknowledged.

Council personnel working on the project were M. Brulotte, K. Holmes, G. Jean, N. Nastasa, G. Sjostrom, and M. Walls. Their dedicated work was a great asset to the project.

Various oil companies have contributed to the Observation Well Netowrk thourgh the loan of wells installed by them. These companies were, as of August 31, 1976: BPOG Operations Ltd., Petrofina Canada Ltd., Tenneco Oil and Minerals Ltd., Shell Canada Ltd. and Home Oil Company Ltd.

D. A. Hackbarth

EDMONTON

1977

## PAGE INDEXING

The numbering of pages in the report is as follows:

Well Number - Subject Code - Year of Publication

where:

Well Number - the name used for designating the well

Subject Code - as follows:

- I - Introduction (no site number indicated)
- L - Legend (no site number indicated)
- G - General site information including geological logs, geophysical logs, site plan (no well number indicated) and summary of contents
- C - Well construction details
- D - Drill stem testing
- A - Aquifer testing
- E - Chemical analyses including multielement analyses and routine water analyses
- H - Annual hydrograph
- W - Well history

Year of Publication - the last two numerals of the year of publication.

So that new pages may be easily added, pages have not been consecutively numbered. The user should insert new pages in the appropriate order within tha tabbed section for that particular well.

## GEOLOGICAL LEGEND

| Symbol | Rock Unit |
|---|---|
| | till |
| | sand & gravel |
| | sand |
| | sandstone |
| | sandstone, arkosic |
| | silt |
| | siltstone |
| | siltstone & sandstone |
| | clay |
| | clay, sandy |
| | claystone, shale |
| | sandstone & shale |
| | oil sand |
| | limestone |
| | limestone, shaley |
| | dolomite |
| | dolomite, argillaceous |
| | rock salt |
| | gypsum & anhydrite |
| | coal |
| | igneous rock |

| Symbol | Stratigraphic Unit |
|---|---|
| | Pleistocene and Recent |
| Qd | Surface deposits |
| | Cretaceous |
| Ks | Smoky Group |
| Klb | La Biche Formation |
| Kd | Dunvegan Formation |
| Ksh | Shaftesbury Formation |
| Kpl | Pelican Formation |
| Kj | Joli Fou Formation |
| Kg | Grand Rapids Formation |
| Kc | Clearwater Formation |
| Kw | Wabiskaw Member |
| Km | McMurray Formation |
| | Devonian |
| Dwd | Woodbend Group |
| Dbl | Beaverhill Lake Formation |
| Dsw | Slave Point Formation & Fort Vermilion Formation & Watt Mountain Formation |
| Dmk | Muskeg Formation |
| Dpe | Prairie Evaporite Formation |
| Dm | Methy Formation (Keg River Formation equivalent) |
| Dmr | McLean River Formation (Chinchaga Formation equivalent) |
| Dl | La Loche Formation |
| | Precambrian |
| Pc | Undivided |

# SYMBOLS

| Symbol | Units or Parameter |
|---|---|
| C&GLL | Analysis done at Chemical and Geological Laboratories Ltd. |
| CPS | counts per second |
| elev | elevation in feet above mean sea level (geodetic datum) |
| epm | equivalents per million |
| ft | foot |
| gl | ground level - feet above geodetic datum |
| ID | inside diameter - inches |
| igpm | Imperial gallons per minute |
| KB | Kelly Bushing |
| Lsd | legal subdivision |
| m | metre |
| $m^2pd$ | square metres per day |
| Mer | meridian |
| Meq/L | milliequivalents per litre |
| MFE | multi formation evaluator |
| Mg/L | milligrams per litre |
| Min | minutes |
| MP | measuring point |
| MV | millivolts |
| OD | outside diameter - inches |
| ppm | parts per million |
| psi | pounds per square inch |
| Q | pumping rate - igpm |
| R | range |
| RBP | recorder bypass |
| Road All'c | road allowance |
| SCL | Analysis done at Shell Canada Ltd., Exploration and Production Laboratory |

| Symbol | Units or Parameter |
|---|---|
| Sec. | section |
| ss | stainless steel |
| T | transmissivity - square metres/day |
| t | time since pumping started (pump testing) or time of flow period (drill stem testing) - minutes |
| t' | time since pumping stopped - minutes |
| Δt | time of shut in period - minutes |
| Tp | township |
| TOC | top of casing |
| TSTM | too small to measure |
| WILL | Analysis done at Western Industrial Laboratories Ltd. |
| Wt | weight |

GEOLOGICAL ABBREVIATIONS

| | |
|---|---|
| biocl | bioclast |
| brac | brachiopod |
| bry | bryozoan |
| calc | calcareous |
| carb | carbonaceous |
| cht | chert |
| fld | feldspar |
| glauc | glauconite, glauconitic |
| gvl | gravel |
| hvy | heavy |
| lt | light |
| mnrls | minerals |
| pbl | pebbles |
| qtz | quartz |
| strgr(s) | stringer(s) |
| stroms | stromotoporoids |
| subang | subangular |
| subrd | subrounded |

## SUMMARY OF CONTENTS

SITE NUMBER ONE

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | site | 1-32 | 1-123 | 1-432 | 1-507 | 1-726 |
| Introduction | 4 | — | — | — | — | — |
| Legend | 8 | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — |
| Geological Sample Description | 5 | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 1 | 0 | 1 | 0 | 0 |
| Drill Stem Test | — | 0 | 2 | 2 | 2 | 2 |
| Shut-In Pressure Data | — | 0 | 1 | 1 | 2 | 2 |
| Water Analysis | — | 3 | 2 | 4 | 4 | 4 |
| Spectral Emission Estimates | — | 0 | 0 | 1 | 1 | 0 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER ONE

sd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

number of pages distributed for this site in 1977

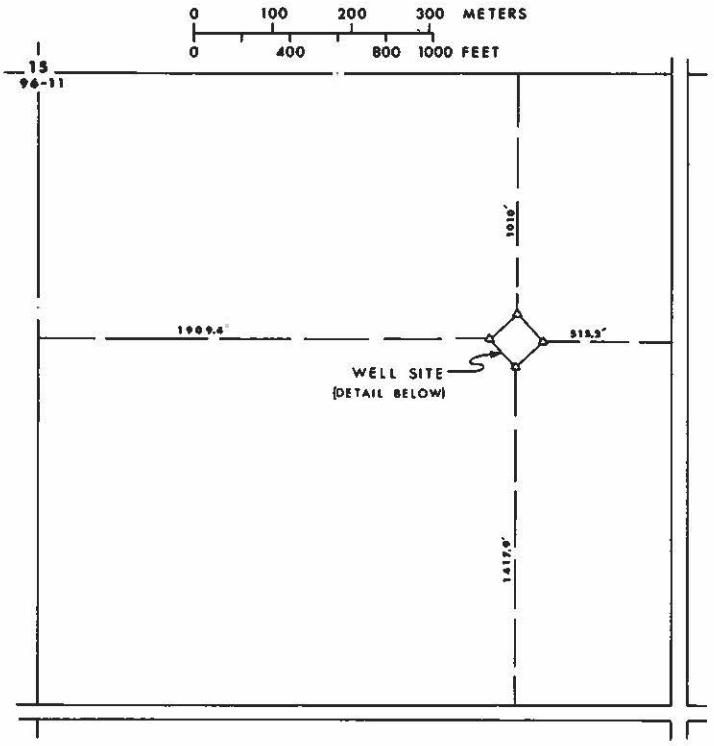
| page title | well name | | | | | | |
|---|---|---|---|---|---|---|---|
| | site | 1-32 | 1-123 | 1-432 | 1-507 | 1-726 | 1-1040 |
| Site Plan | 1* | — | — | — | — | — | — |
| Geological Sample Description | 4* | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1* | — | — | — | — | — | — |
| Well Construction | — | 0 | 1* | 0 | 0 | 1* | 1 |
| Drawdown Plot | — | 0 | 0 | 0 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 0 | 0 | 0 | 10 |
| Shut-In Pressure Data | — | 0 | 0 | 0 | 0 | 0 | 8 |
| Water Analysis | — | 1 | 1 | 2 | 2 | 1 | 3 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 |

*Supersedes pages distributed in 1976

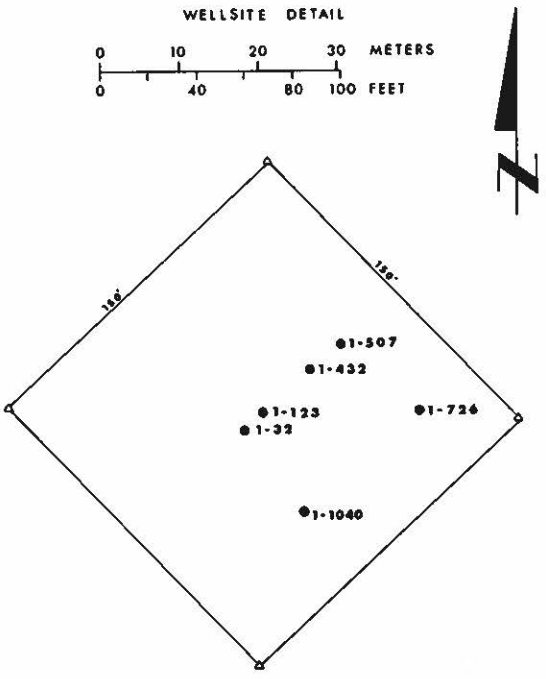
OBSERVATION WELL SITE 1

8-15-96-11 W4th

ALBERTA RESEARCH COUNCIL




WELLSITE DETAIL



## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Ground elevation 850 Total depth 1040

KB elevation 858

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 8 | 10 | Clay, medium grey, silty, calc, boulderchips (unsorted drift) | Drift |
| 10 | 30 | Clay, medium grey, silty, calc, ferruginous. Siltstone, medium grey, argillaceous, sandy, calcareous, as strgrs on the bottom | Clearwater |
| 30 | 35 | Siltstone, medium grey, sandy, calc cement, qtz, glauc. Silty clay strgrs | |
| 35 | 60 | Sandstone, medium green, fine grained, silty, subrounded, well sorted, fair porosity, glauc, qtz. Interbedded siltstone, medium grey, sandy and silty, medium grey, calcareous clay (up to 10%) | |
| 60 | 75 | Clay, medium grey, silty; calcareous siltstone medium grey, sandy, glauc on the bottom | |
| 75 | 85 | Sandstone, medium green, fine-medium grained, silty, subangular, medium sorted, good-excellent porosity, glauc, qtz. Thin clayey strgrs | Wabiskaw |
| 85 | 120 | Sandstone, lt brown, fine-coarse grained, subrounded, poorly sorted, fair porosity, moderate oil impregnation, qtz, lt cht, fld, ferruginous. Interbedded clay, medium grey, silty (up to 15%) | McMurray |
| 120 | 130 | Sandstone, lt brown, fine grained, subrounded, well sorted, good porosity, no oil stain. Clay, medium grey, silty strgrs | |
| 130 | 160 | Sandstone, lt brown, fine grained, argillaceous, subangular-subrounded, well sorted, fair porosity, slight-moderate oil impregnation, qtz, lt cht, pyrite, fld; shale, medium-dark grey, interbedded | |
| 160 | 210 | Sandstone, lt brown, fine grained, subrounded, well sorted, fair porosity, moderate oil impregnation in strgrs, qtz, lt cht. Shale, medium-dark grey, interbedded in the upper part | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One (continued)

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 210 | 230 | Sandstone, lt brown, fine grained, subrounded, well sorted, good porosity, slightly oil stained, qtz, lt cht, pyrite | |
| 230 | 270 | Sandstone as above, moderate oil impregnation in strgrs. Thin beds of dark shale, mostly in the lower part | |
| 270 | 340 | Sandstone, lt brown, fine-medium grained, coarse-grained strgrs, subangular-subrounded, well-medium sorted, excellent porosity, no oil stain, qtz, lt cht, traces of pyrite, ferruginous pellets and dark hvy mnrls. Very thin shale strgrs in the lower part | |
| 340 | 450 | Sandstone, lt brown, coarse-very coarse grained, strgr of granular grains (420-440 feet), angular-subangular, medium sorted, excellent porosity, very poorly oil stained in stringers, qtz, lt cht, traces of pyrite | |
| 450 | 460 | Limestone, lt grey-buff, mud supported and micro-granular, argillaceous, fossiliferous (crinoids, stroms, biocl). Poor vuggy porosity | Beaverhill Lake |
| 460 | 490 | Shale, medium grey, limy, grading to argillaceous limestone, fossiliferous (as above), pyrite | |
| 490 | 520 | Limestone, medium grey-buff, argillaceous, fossiliferous, poor vuggy porosity. Shale, medium grey, calcareous, fossiliferous in the lower part (10-20%) | |
| 520 | 550 | Shale, lt-medium grey, calcareous, fossiliferous, grading in stringers to limestone, lt grey, argillaceous, pyrite, poor vuggy porosity | |
| 550 | 560 | Shale, medium grey, calcareous, fossiliferous, interbedded with clayey siltstone, calcareous | |

## GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One (continued)

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 560 | 600 | Limestone, buff, slightly argillaceous in the upper part, fossiliferous (crinoids, stroms, brac, biocl), pyrite traces | |
| 600 | 612 | Limestone, light grey-buff, argillaceous, fossiliferous (crinoids), leaching, calcite recrystallization; anhydrite and pyrite traces | Slave Point and Watt Mountain |
| 612 | 620 | Dolomite, medium-dark grey, calcareous, argillaceous, fossil traces, partially replaced - partially recrystalized, associated with shale, medium grey, dolomitic | |
| 620 | 645 | Shale, medium grey, dolomitic with white to medium grey silty anhydrite interbedded in the lower part | |
| 645 | 665 | Anhydrite, white-grey, powdery in the upper part, crystalline in the lower part, well leached, recrystallization. Interbeds of dolomitic grey shale in the upper part | Prairie Evaporite |
| 665 | 740 | Rock salt, smoky grey, with grey anhydrite, gypsum and dolomitic shale in thin beds | |
| 740 | 750 | Anhydrite, white to grey, leaching, recrystallization, dolomitic traces | |
| 750 | 760 | Rock salt, smoky grey, interbedded with medium grey dolomitic shale | |
| 760 | 770 | Anhydrite, grey to white, dolomitic, crystalline, gypsum bands | |
| 770 | 820 | Anhydrite, grey to white, crystalline, mottled, dolomitic in the upper part; leaching and replacement with crystalline calcite in the lower part; pyrite traces | |

GEOLOGICAL SAMPLE DESCRIPTION

SITE NUMBER One (continued)

Lsd 8 Sec 15 Twp 96 R 11 W4th

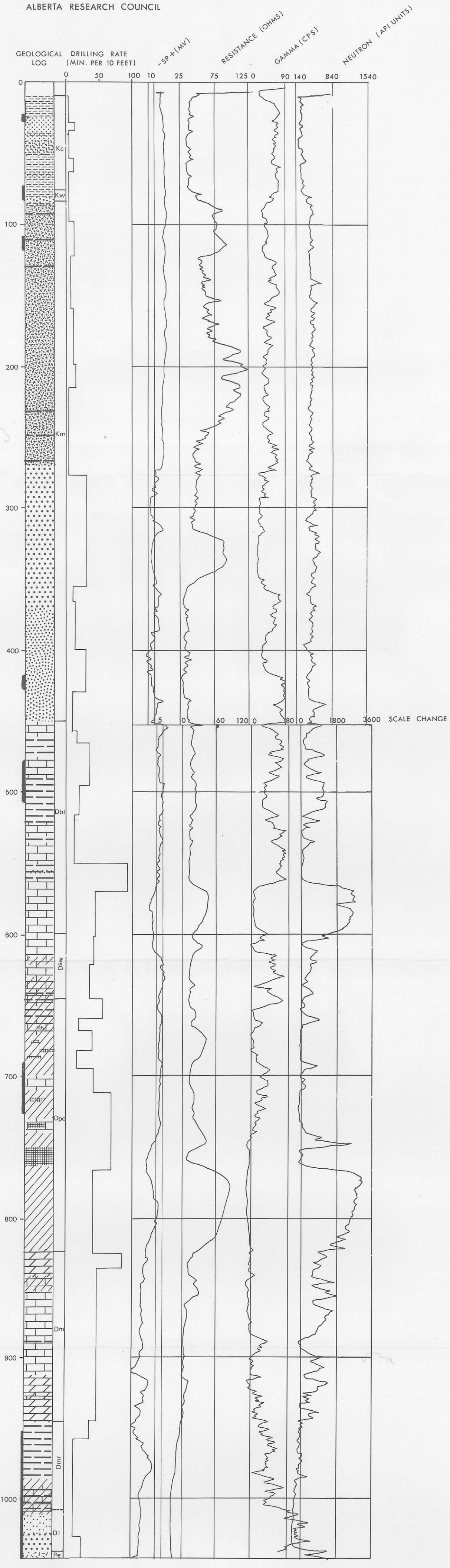
Alberta Research Council

Ground elevation Total depth

KB elevation

| Interval from (feet below KB) | to | Description | Formation |
|---|---|---|---|
| 820 | 840 | Dolomite, brown, fine-grained, fossiliferous, leaching, dolomite replacement, poor intergranular porosity | Methy |
| 840 | 850 | Limestone, brown, dolomitic, sucrosic, fossiliferous (biocl), pyrite traces bedded with gypsum, powdery, leaching, recrystallization | |
| 850 | 885 | Limestone, brown to buff, dolomitic in the bottom, fossiliferous (crinoids, bry, brac, biocl) fair vuggy porosity | |
| 885 | 895 | Shale, black, dolomitic, carbonaceous, fossiliferous | |
| 895 | 910 | Limestone, buff-brown, dolomitic, fossiliferous, poor-fair vuggy porosity, pyrite traces | |
| 910 | 930 | Dolomite, lt brown, grading to dolomitic limestone argillaceous on the lower part, fossiliferous (brac, biocl), calcite and pyrite traces | |
| 930 | 945 | Dolomite, buff-grey, argillaceous, calcite traces grading to dolomitic shale in the lower part | |
| 945 | 980 | Shale, red, dolomitic, qtz sand grains | McLean River |
| 980 | 990 | Anhydrite, white, dolomitic; dolomite, buff, argillaceous, fossiliferous | |
| 990 | 1005 | Shale, red, dolomitic, with gypsum beds | |
| 1005 | 1025 | Siltstone, red, sandy, dolomitic cement, qtz grains | |
| 1025 | 1040 | Sandstone, reddish, dolomitic, angular, poorly sorted, good-excellent porosity, qtz, fld, hvy dark mnrls, mica, ferruginous, argillaceous flakes. Granite, reddish in the bottom | La Loche<br>Precambrian |

# GEOPHYSICAL AND GEOLOGICAL LOGS
## OBSERVATION WELL SITE 1
## 8-15-96-11-W4th
ALBERTA RESEARCH COUNCIL



## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 11.6 | 0.58 | 1 |
| Magnesium ($Mg^{++}$) | 7.2 | 0.59 | 1 |
| Sodium ($Na^{+}$) | 1013.0 | 44.06 | 97 |
| Potassium ($K^{+}$) | 7.5 | 0.19 | 0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1915.0 | 31.39 | 72 |
| Sulfate ($SO_4^{=}$) | 226.0 | 4.71 | 11 |
| Chloride ($Cl^{-}$) | 260.0 | 7.33 | 17 |
| Nitrate ($NO_3^{=}$) | 6.8 | 0.11 | 0 |
| Silica ($SiO_2$) | 5.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 30.8 | | |
| Magnesium (Acidified) | 7.3 | | |
| Total dissolved solids | 2480 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 43.54 | Total Cations (epm) | 45.43 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 4000 | Temperature (C) | 6.0 |
| pH | 8.1 | pH | 7.8 |
| Fluoride ($F^{-}$) | 0.6 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 2044 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

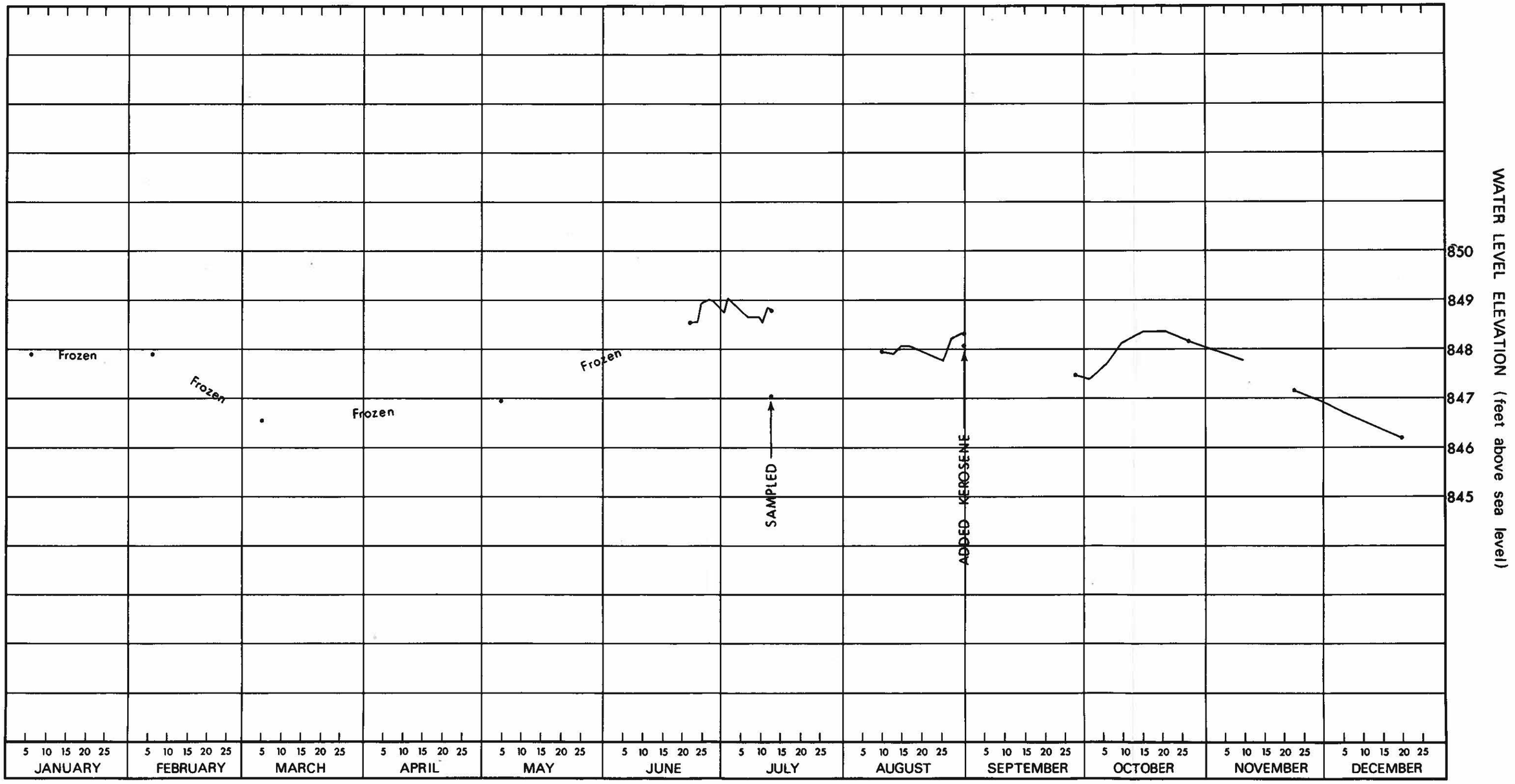
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

1 - 32 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 1-32

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.66

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 2.06 MP | 847.9 | MP (854.7) |
| Feb 6/76 | 2.06 MP | 847.9 | Frozen |
| Feb 22/76 | | | Well blown down with air |
| Mar 5/76 | 2.47 MP | 846.5 | Frozen; MP = 0.91 m TOC, (854.6) |
| Apr 6/76 | | | Frozen |
| May 5/76 | 2.34 MP | 846.9 | Frozen |
| June 1/76 | 5.68 MP | 836.0 | Frozen |
| June 22/76 | 1.85 MP | 848.5 | |
| July 13/76 | 1.78 MP | 848.8 | |
| | 2.32 MP | 847.0 | After sample; temp. 6°C |
| Aug 10/76 | 2.03 MP | 847.9 | |
| Aug 31/76 | 1.92 MP | 848.3 | |
| | 1.40 MP | 848.1 | Added 5 gallons of kerosene; water level elevation adjusted downward by 1.9 ft after this date |
| Sept 28/76 | 1.58 MP | 847.5 | |
| Oct 26/76 | 1.37 MP | 848.2 | |
| Nov 23/76 | 1.67 MP | 847.2 | |
| Dec 20/76 | 1.98 MP | 846.2 | |

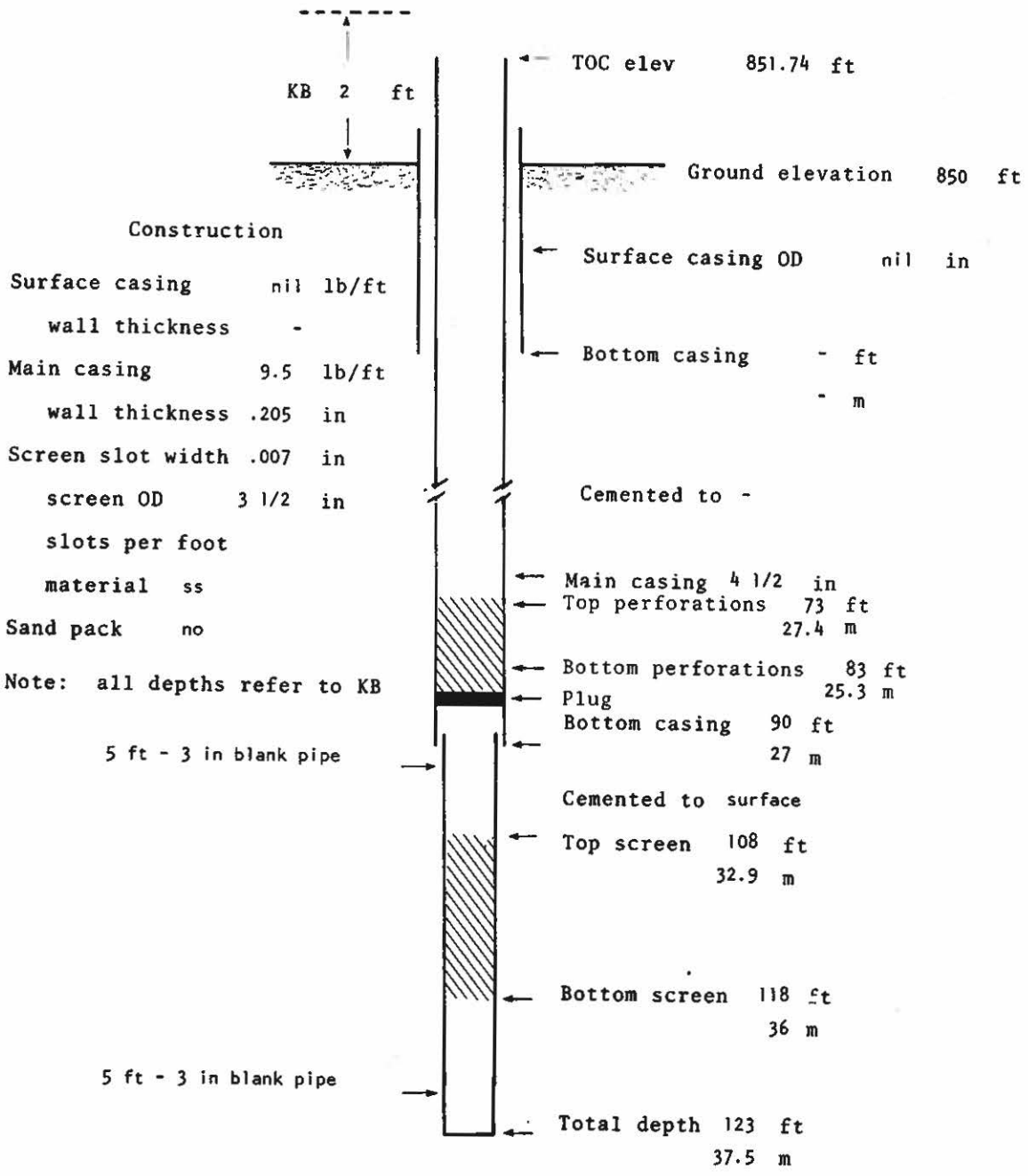
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Tp 96 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | nil | lb/ft |
| wall thickness | - | |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | no | |

Note: all depths refer to KB

N.B. - Perforation done with 20 gram charges at three charges per foot

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 8.9 | 0.44 | 4 |
| Magnesium ($Mg^{++}$) | 21.2 | 1.74 | 15 |
| Sodium ($Na^{+}$) | 168.0 | 7.31 | 62 |
| Potassium ($K^{+}$) | 93.0 | 2.38 | 20 |
| Carbonate ($CO_3^{=}$) | 50.0 | 1.67 | 13 |
| Bicarbonate ($HCO_3^{-}$) | 561.0 | 9.20 | 72 |
| Sulfate ($SO_4^{=}$) | 13.4 | 0.28 | 2 |
| Chloride ($Cl^{-}$) | 56.0 | 1.58 | 12 |
| Nitrate ($NO_3^{=}$) | 2.5 | 0.04 | 0 |
| Silica ($SiO_2$) | 2.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 11.3 | | |
| Magnesium (Acidified) | 21.1 | | |
| Total dissolved solids | 718 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.76 | Total Cations (epm) | 11.88 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1200 | Temperature (C) | 4.0 | |
| pH | 8.9 | pH | 9.1 | |
| Fluoride ($F^{-}$) | 0.4 Mg/L | Carbonate ($CO_3^{=}$) | 101 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 488 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

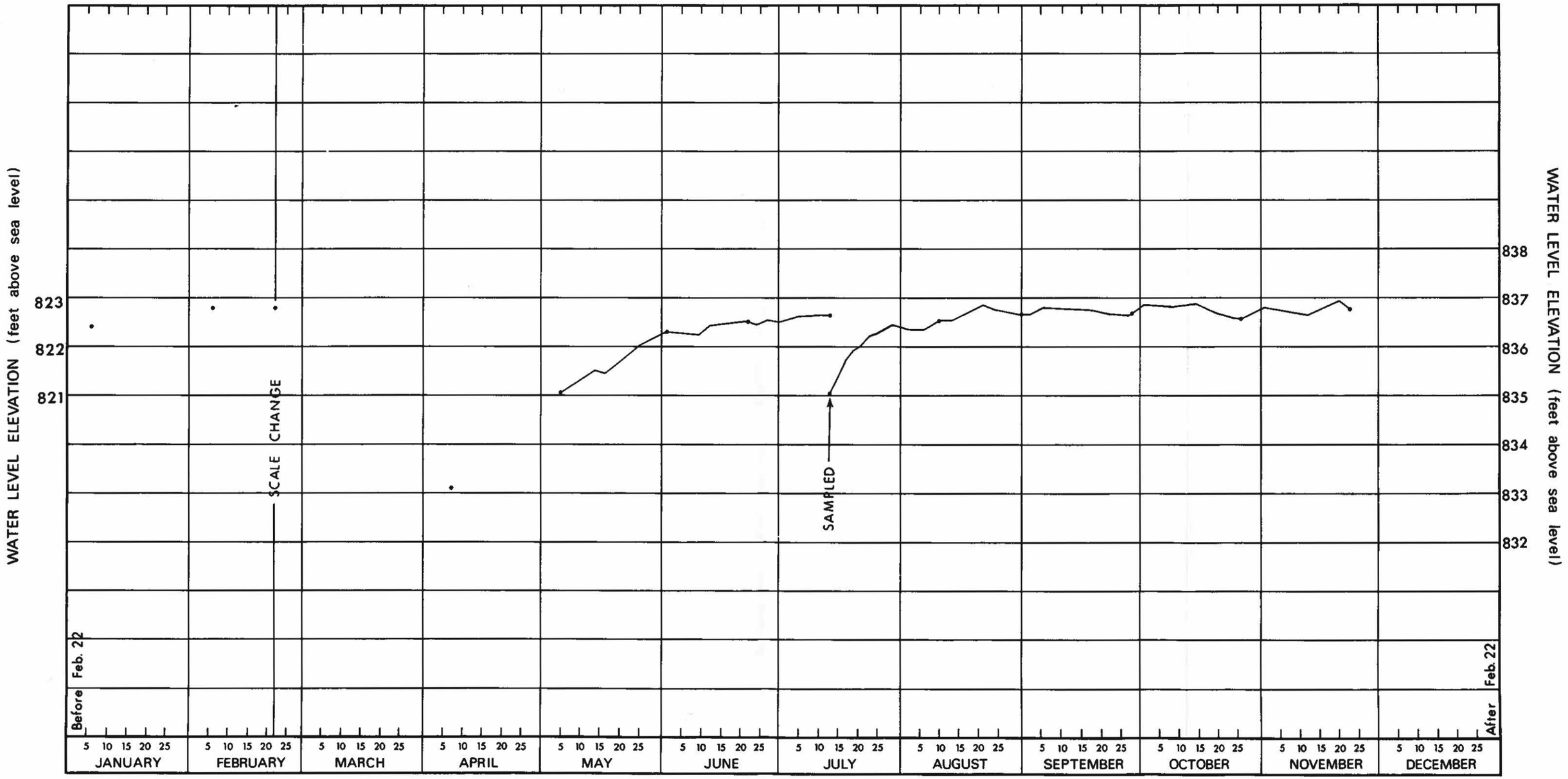
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **1-123**

Lsd **8** Sec **15** Twp **96** R **11** W4th

Alberta Research Council

**1 - 123 - H - 77**



## WELL HISTORY

OBSERVATION WELL NUMBER 1-123

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 851.74

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 9.82 MP | 822.4 | MP (854.6) Recorder did not worked |
| Feb 6/76 | 9.69 MP | 822.8 | Recorder malfunction (float sunk) |
| Feb 22/76 | 9.68 MP | 822.8 | Well blown down with air; heavy oil in well |
| Mar 2/76 | | | Well perforated with 65 gram shots at 3 per foot, interval 71 to 82 |
| Mar 5/76 | | | Place plug at 84 ft |
| Apr 7/76 | 6.66 MP | 833.2 | MP = 0.98 m TOC, (855.0) |
| May 5/76 | 6.06 MP | 835.1 | |
| June 1/76 | 5.68 MP | 836.4 | |
| June 22/76 | 5.62 MP | 836.6 | |
| July 13/76 | 5.58 MP | 836.7 | |
| | 6.07 MP | 835.1 | After sample; temp. 4°C |
| Aug 10/76 | 5.61 MP | 836.6 | |
| Aug 31/76 | 5.57 MP | 836.7 | |
| Sept 28/76 | 5.56 MP | 836.8 | |
| Oct 26/76 | 5.61 MP | 836.6 | |
| Nov 23/76 | 5.54 MP | 836.8 | |
| Dec 20/76 | 5.52 MP | 836.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Blown from 1-432

Date sampled February 24, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1300.0 | 64.87 | 1.4 |
| Magnesium ($Mg^{++}$) | 181.0 | 14.90 | 0.3 |
| Sodium ($Na^{+}$) | 106250.0 | 4621.57 | 98.3 |
| Potassium ($K^{+}$) | 81.0 | 2.07 | 0.0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 254.0 | 4.16 | 0.1 |
| Sulfate ($SO_4^{=}$) | 2900.0 | 60.38 | 1.3 |
| Chloride ($Cl^{-}$) | 164800.0 | 4647.49 | 98.6 |
| Nitrate ($NO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Silica ($SiO_2$) | 7.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 275720.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4712.0 | Total Cations (epm) | 4703.4 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | |
| pH | 6.8 | pH | 7.0 |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 500 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

Major Constituents

| | Mg/l | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1320.0 | 65.87 | 2 |
| Magnesium ($Mg^{++}$) | 293.0 | 24.12 | 1 |
| Sodium ($Na^{+}$) | 89000.0 | 3871.25 | 98 |
| Potassium ($K^{+}$) | 108.0 | 2.76 | 0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 403.0 | 6.61 | 0 |
| Sulfate ($SO_4^{=}$) | 2690.0 | 56.01 | 1 |
| Chloride ($Cl^{-}$) | 144400.0 | 4072.19 | 99 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | | | |
| Hydroxide ($OH^{-}$) | 3.7 | | |
| Calcium (Acidified) | 1254.0 | | |
| Magnesium (Acidified) | 308.0 | | |
| Total dissolved solids | 270340 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4134.82 | Total Cations (epm) | 3964.00 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 6.0 |
| pH | 6.7 | pH | 6.6 |
| Fluoride ($F^{-}$) | 0.1 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 595 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

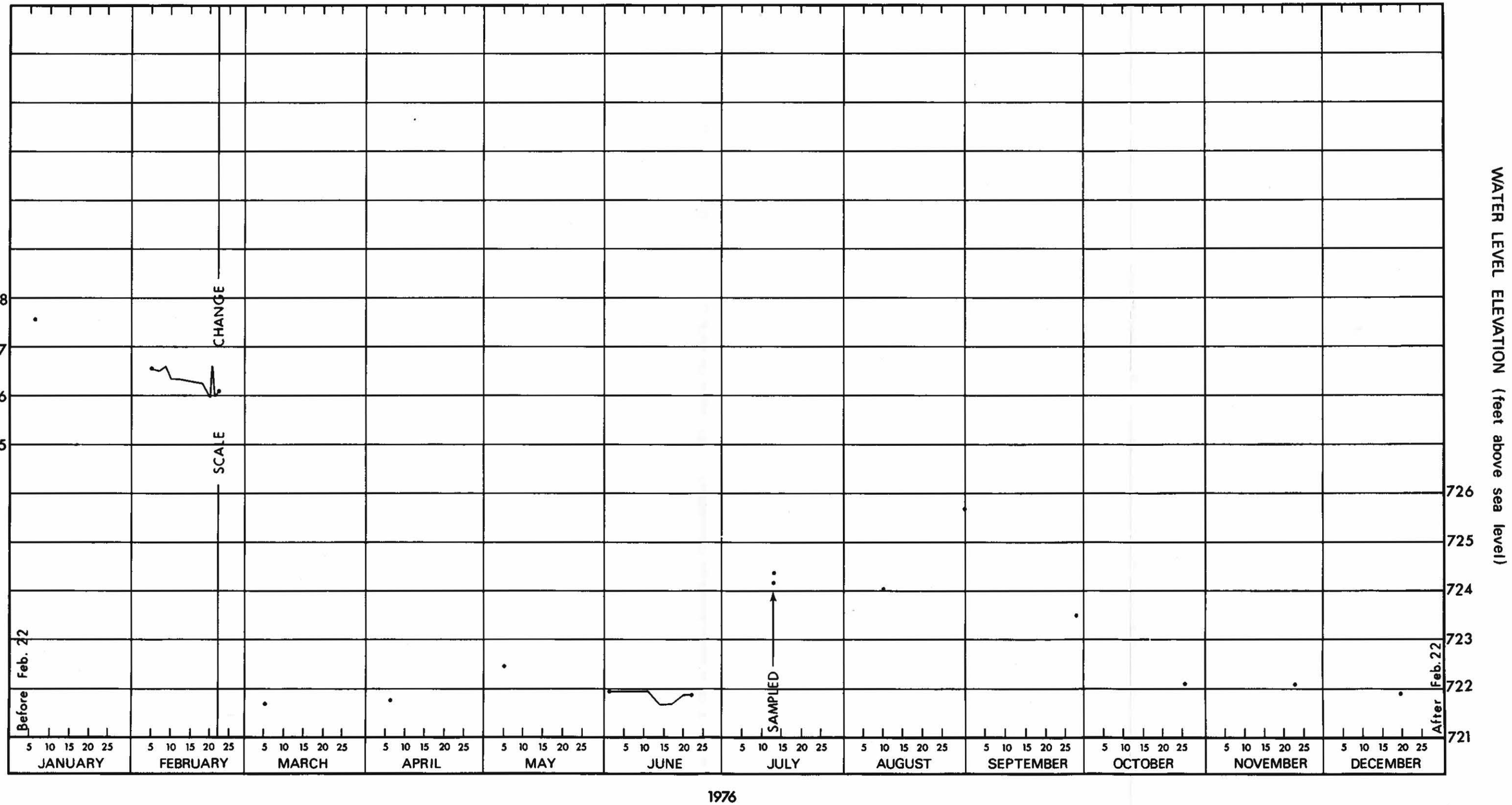
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **1-432**

Lsd **8** Sec **15** Twp **96** R **11** W4th

Alberta Research Council

**1 - 432 - H - 77**



## WELL HISTORY

OBSERVATION WELL NUMBER 1-432

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 32.73 MP | 747.5 | MP (854.9) |
| Feb 6/76 | 33.03 MP | 746.6 | |
| Feb 22/76 | 33.17 MP | 746.1 | Well blown down with air |
| Mar 5/76 | 40.67 MP | 721.7 | MP = 0.79 m TOC, (855.1) |
| Apr 6/76 | 40.66 MP | 721.7 | |
| May 5/76 | 40.44 MP | 722.4 | |
| June 1/76 | 40.60 MP | 721.9 | |
| June 22/76 | 40.61 MP | 721.9 | |
| July 13/76 | 39.85 MP | 724.4 | |
| | 39.91 MP | 724.2 | After sample; temp. 6°C |
| Aug 10/76 | 39.96 MP | 724.0 | |
| Aug 31/76 | 39.45 MP | 725.7 | |
| Sept 28/76 | 40.12 MP | 723.5 | |
| Oct 26/76 | 40.54 MP | 722.1 | |
| Nov 23/76 | 40.55 MP | 722.1 | |
| Dec 20/76 | 40.91 MP | 720.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Blown from 1-507

Date sampled February 24, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1200.0 | 59.88 | 1.4 |
| Magnesium ($Mg^{++}$) | 174.0 | 14.32 | 0.3 |
| Sodium ($Na^{+}$) | 96000.0 | 4175.73 | 98.2 |
| Potassium ($K^{+}$) | 138.0 | 3.53 | 0.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 46.4 | 0.76 | 0.0 |
| Sulfate ($SO_4^{=}$) | 2600.0 | 54.13 | 1.2 |
| Chloride ($Cl^{-}$) | 159200.0 | 4489.57 | 98.8 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 2.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 272200.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4544.4 | Total Cations (epm) | 4253.4 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | | |
| pH | 7.5 | pH | 6.5 | |
| Fluoride ($F^{-}$) | 0.1 ppm | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 54 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1530.0 | 76.35 | 2 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 78000.0 | 3392.78 | 98 |
| Potassium ($K^{+}$) | 95.0 | 2.43 | 0 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 2690.0 | 56.01 | 2 |
| Chloride ($Cl^{-}$) | 129200.0 | 3643.54 | 99 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1419.0 | | |
| Magnesium (Acidified) | 2.0 | | |
| Total dissolved solids | 217700 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3700.36 | Total Cations (epm) | 3471.57 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 7.0 | |
| pH | 10.8 | pH | 10.4 | |
| Fluoride ($F^{-}$) | 0.1 Mg/L | Carbonate ($CO_3^{=}$) | 53 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 20 | Mg/L |
| | | Conductivity | | |

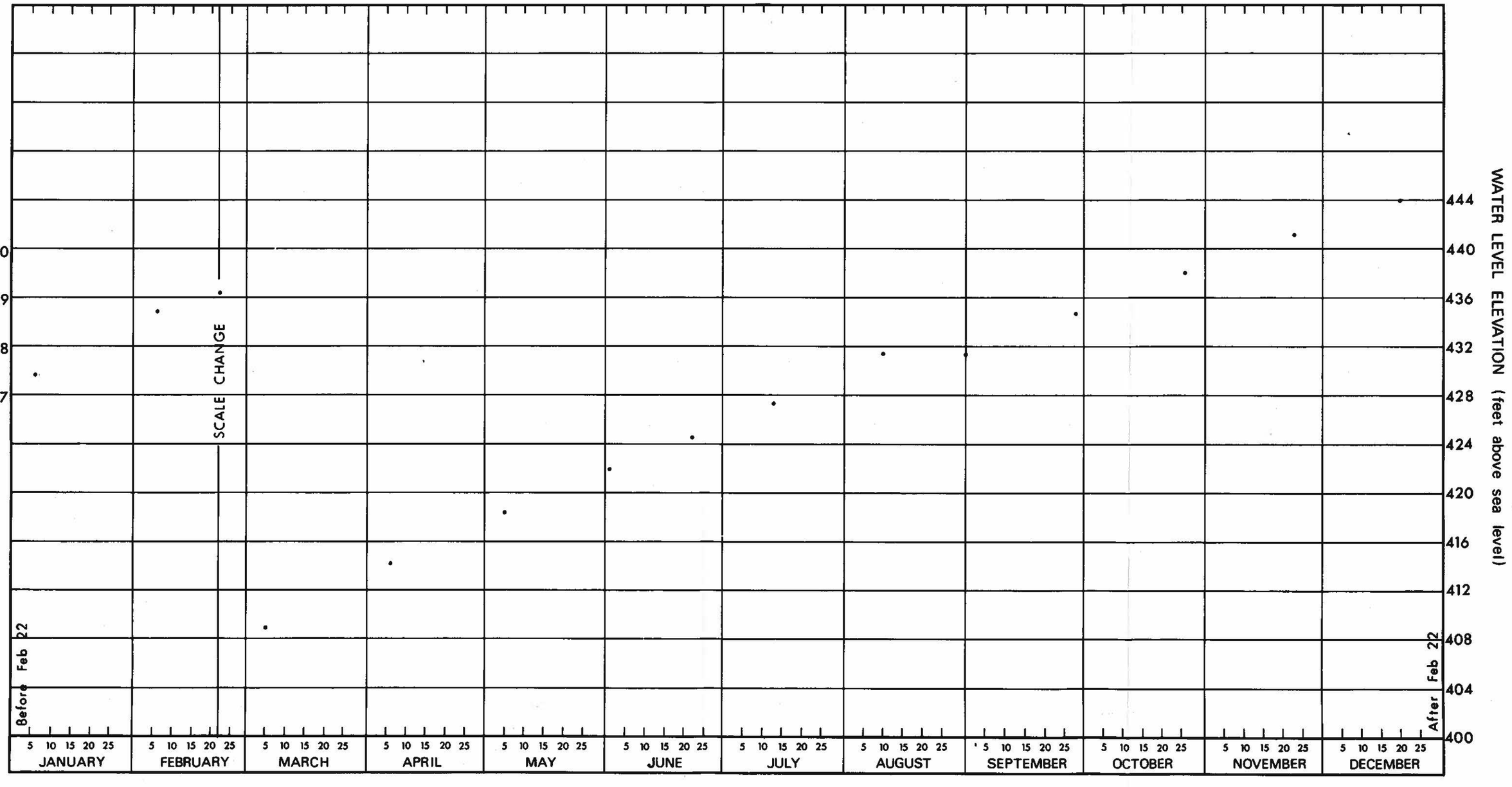
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

1 - 507 - H - 77



## WELL HISTORY

OBSERVATION WELL NUMBER 1-507

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.02

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 51.10 MP | 687.4 | MP (855.0) Recorder stuck float line too short |
| Feb 6/76 | 50.70 MP | 688.7 | " |
| Feb 22/76 | 50.58 MP | 689.1 | Well blown down with air |
| Mar 5/76 | 136.12 MP | 408.9 | MP = 1.02 m TOC, (855.4) |
| Apr 6/76 | 134.51 MP | 414.2 | |
| May 5/76 | 133.28 MP | 418.2 | |
| June 1/76 | 132.15 MP | 421.9 | |
| June 22/76 | 131.32 MP | 424.7 | |
| July 13/76 | 130.50 MP | 427.4 | Sampled; temp. 7°C |
| Aug 10/76 | 129.22 MP | 431.6 | |
| Aug 31/76 | 129.22 MP | 431.6 | |
| Sept 28/76 | 128.22 MP | 434.8 | |
| Oct 26/76 | 127.22 MP | 438.1 | |
| Nov 23/76 | 126.29 MP | 441.2 | |
| Dec 20/76 | 125.40 MP | 444.1 | |

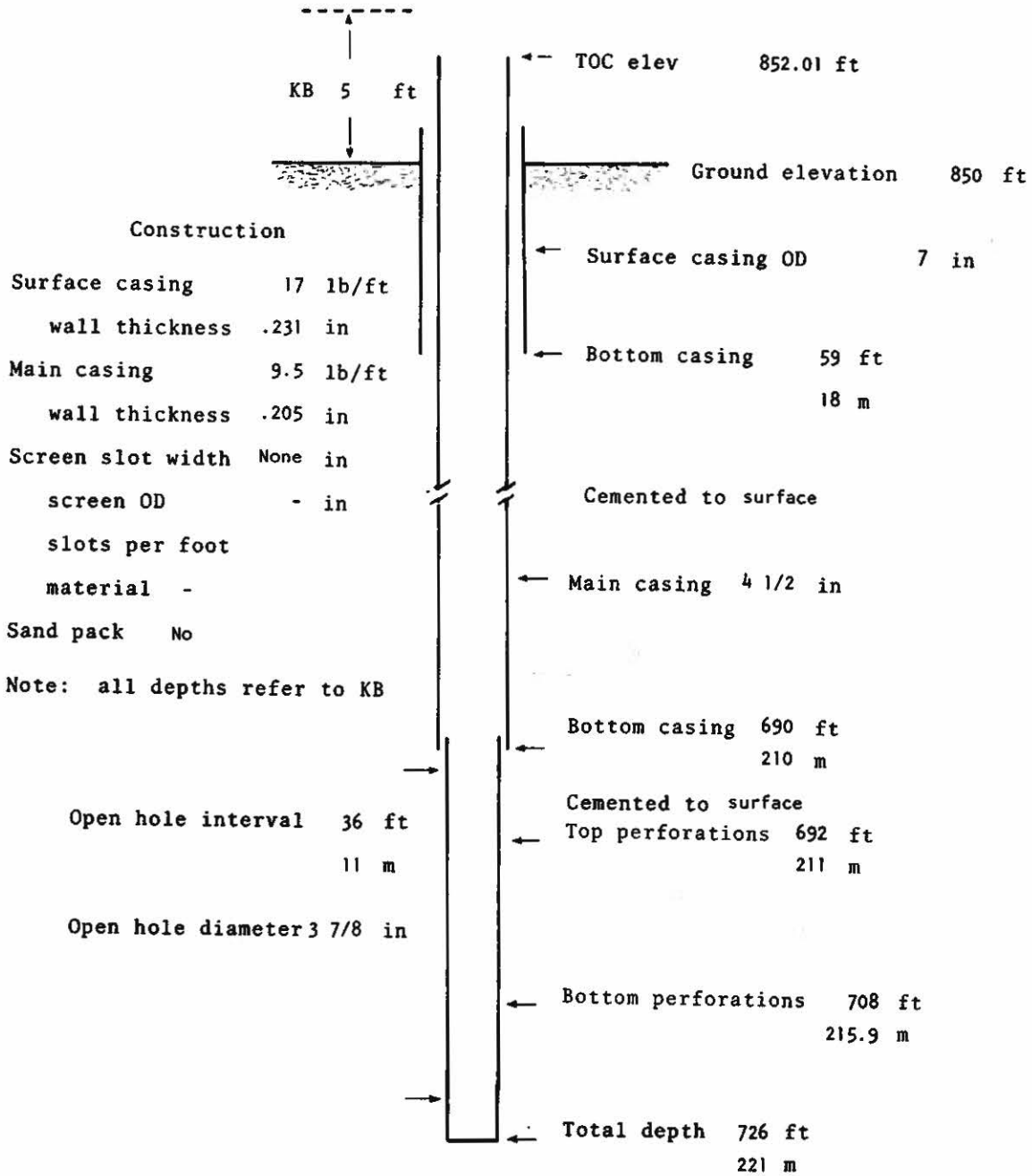
MP - Depth from measuring point
TOC - Depth from top of casing

## WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Tp 96 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | None | in |
| screen OD | - | in |
| slots per foot | | |
| material | - | |
| Sand pack | No | |

Note: all depths refer to KB

Open hole interval 36 ft
11 m

Open hole diameter 3 7/8 in

N.B. - Perforation done with 80 gram charges at two charges per foot

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Blown from 1-726

Date sampled February 25, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 790.0 | 39.42 | 40.1 |
| Magnesium ($Mg^{++}$) | 0.3 | 0.02 | 0.0 |
| Sodium ($Na^{+}$) | 1275.0 | 55.46 | 56.5 |
| Potassium ($K^{+}$) | 129.0 | 3.30 | 3.4 |
| Carbonate ($CO_3^{=}$) | 55.0 | 1.83 | 2.3 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0.0 |
| Sulfate ($SO_4^{=}$) | 1120.0 | 23.32 | 29.4 |
| Chloride ($Cl^{-}$) | 1920.0 | 54.15 | 68.3 |
| Nitrate ($NO_3^{=}$) | 1.3 | 0.02 | 0.0 |
| Silica ($SiO_2$) | 0.7 | | |
| Hydroxide ($OH^{-}$) | 0.0 | 0.00 | 0.0 |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 6000.0 | | |
| Total Anions (epm) | 79.3 | Total Cations (epm) | 98.2 |

### Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | |
| pH | 10.7 | pH | 12.3 |
| Fluoride ($F^{-}$) | 0.5 ppm | Carbonate ($CO_3^{=}$) | 48 ppm |
| | | Bicarbonate ($HCO_3^{-}$) | 0 ppm |
| | | Hydroxide ($OH^{-}$) | 197 ppm |
| | | Conductivity | |

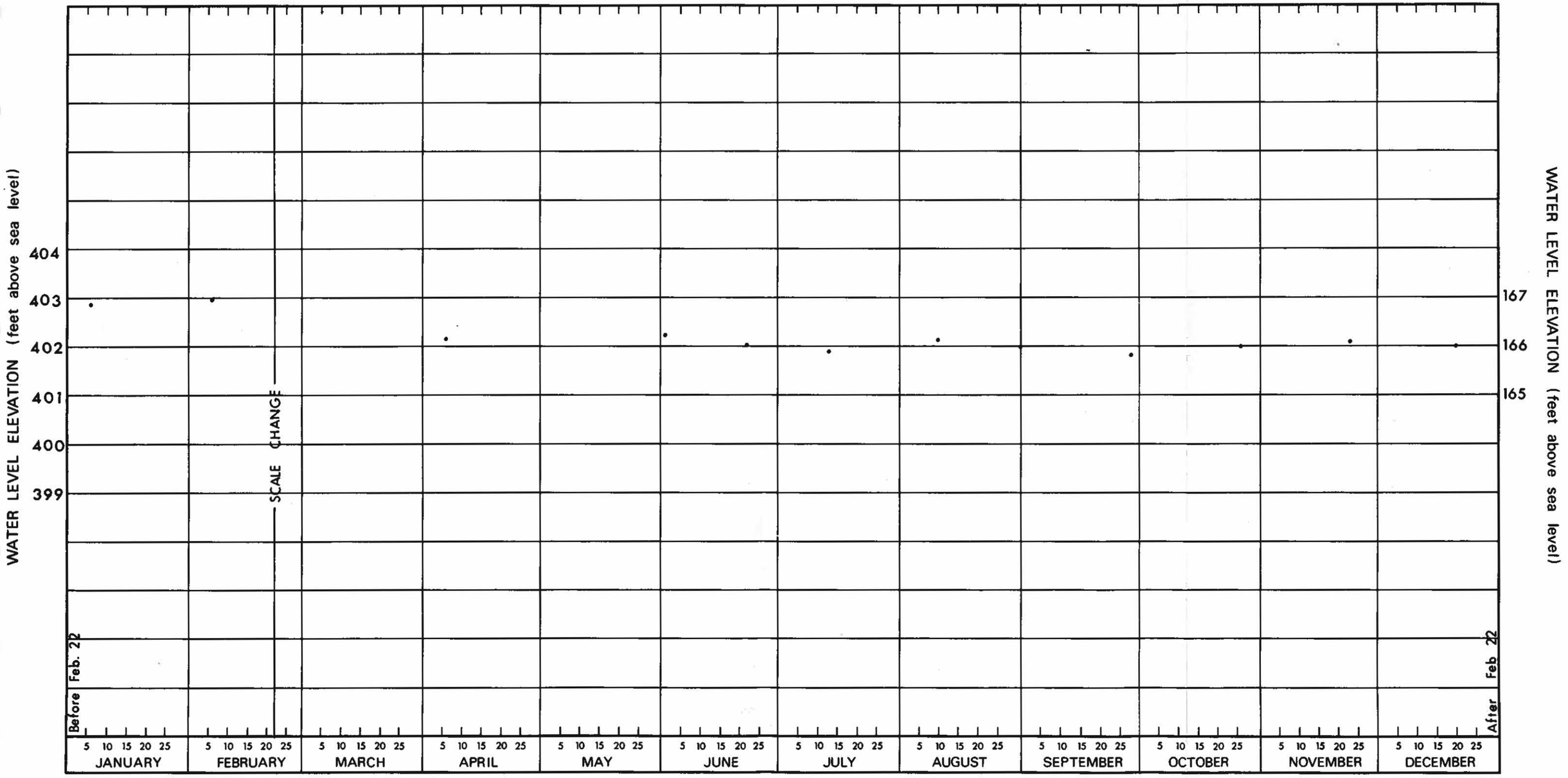
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

1 - 726 - H - 77



## WELL HISTORY

OBSERVATION WELL NUMBER 1-726

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.01

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 137.68 MP | 402.9 | MP (854.5) |
| Feb 6/76 | 137.65 MP | 403.0 | |
| Feb 22/76 | | | Well blown down with air |
| Mar 2/76 | | | Perforated with 80 gram shots; interval 692 - 708 KB |
| Apr 6/76 | 209.89 MP | 166.2 | MP = 0.80 m TOC, (854.6) |
| May 5/76 | | | Could not measure |
| June 1/76 | 209.87 MP | 166.2 | |
| June 22/76 | 209.93 MP | 166.0 | |
| July 13/76 | 209.97 MP | 165.9 | Could not sample; no water (mud) |
| Aug 10/76 | 209.90 MP | 166.1 | |
| Aug 31/76 | 209.95 MP | 166.0 | |
| Sept 28/76 | 210.00 MP | 165.8 | |
| Oct 26/76 | 209.93 MP | 166.0 | |
| Nov 23/76 | 209.92 MP | 166.1 | |
| Dec 20/76 | 209.92 MP | 166.1 | |

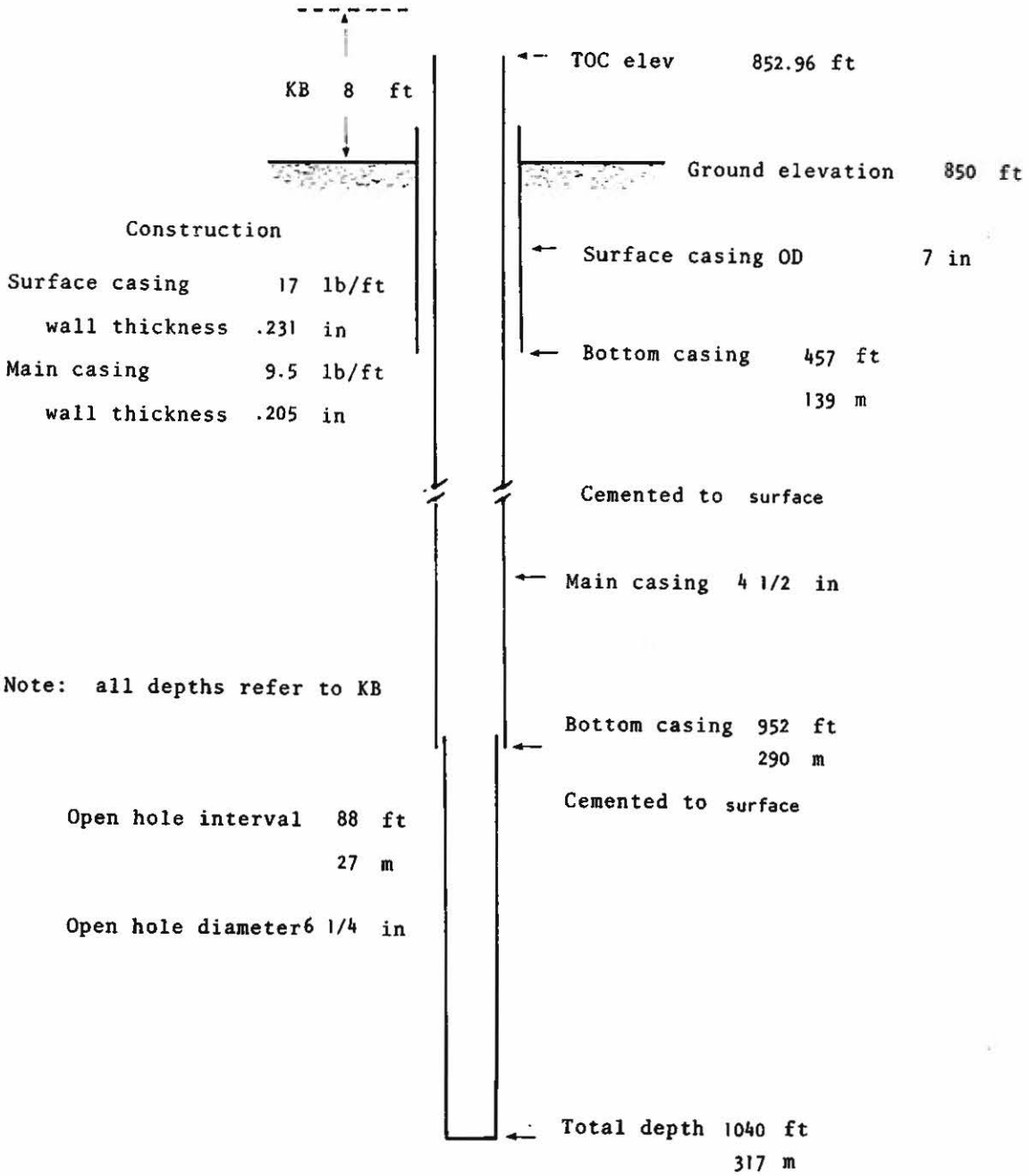
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | 17 | lb/ft |
| wall thickness | .231 | in |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |

Note: all depths refer to KB

Open hole interval 88 ft
27 m

Open hole diameter 6 1/4 in

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 858

Type of test Open hole, Bottom hole

Date of test February 22, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 1430 | hrs |
| Tool opened | 1459 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 1645 | hrs |
| Out of hole at | 1730 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff, faint in one min. Weak air blow on second opening, very faint in one minute

Total water recovered 10 ft

Water sample No. - (drilling mud)

Gas blow Nil

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 488-600'

Formation tested Beaverhill Lake

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 495 | 500 |
| Initial hydrostatic | A | 234 | 218 |
| First flow | B | 14 | 10 |
| | B1 | 12 | 8 |
| Initial shut in | C | 147 | 143 |
| Second flow | D | 15 | 12 |
| | D1 | 15 | 12 |
| Final shut in | G | 192 | 189 |
| Final hydrostatic | H | 218 | 215 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

1-1040-D-77

OBSERVATION WELL NUMBER 1-1040

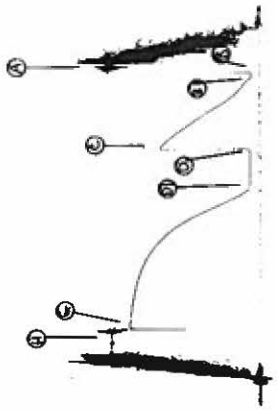
INTERVAL TESTED 488-600

PRESSURE INCREMENTS

Recorder AKI-65
February 22, 1976

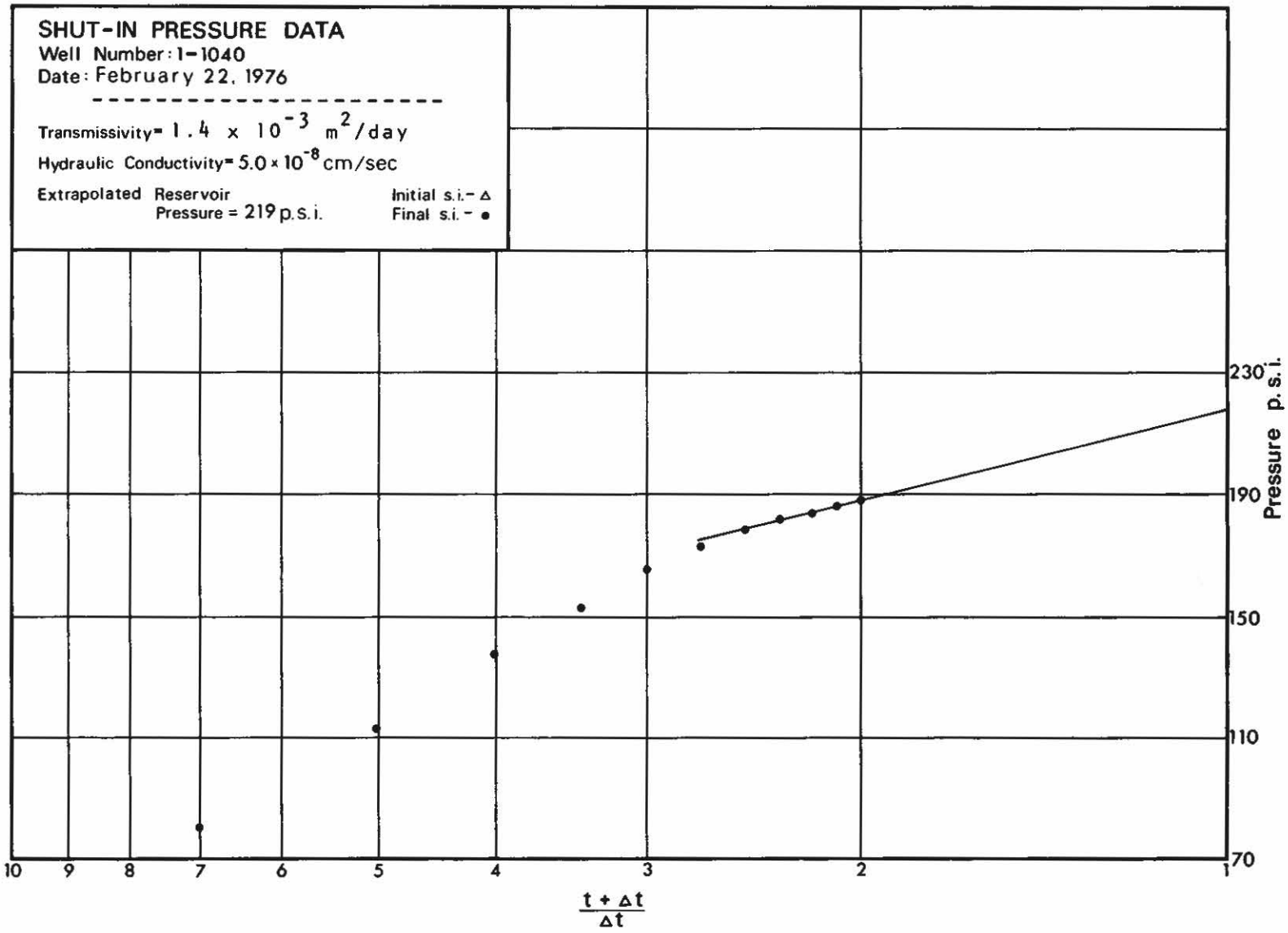
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 27.5 | 7.00 |
| 10 | 46.2 | 4.00 |
| 15 | 74.0 | 3.00 |
| 20 | 100.2 | 2.50 |
| 25 | 124.5 | 2.20 |
| 30 | 144.0 | 2.00 |

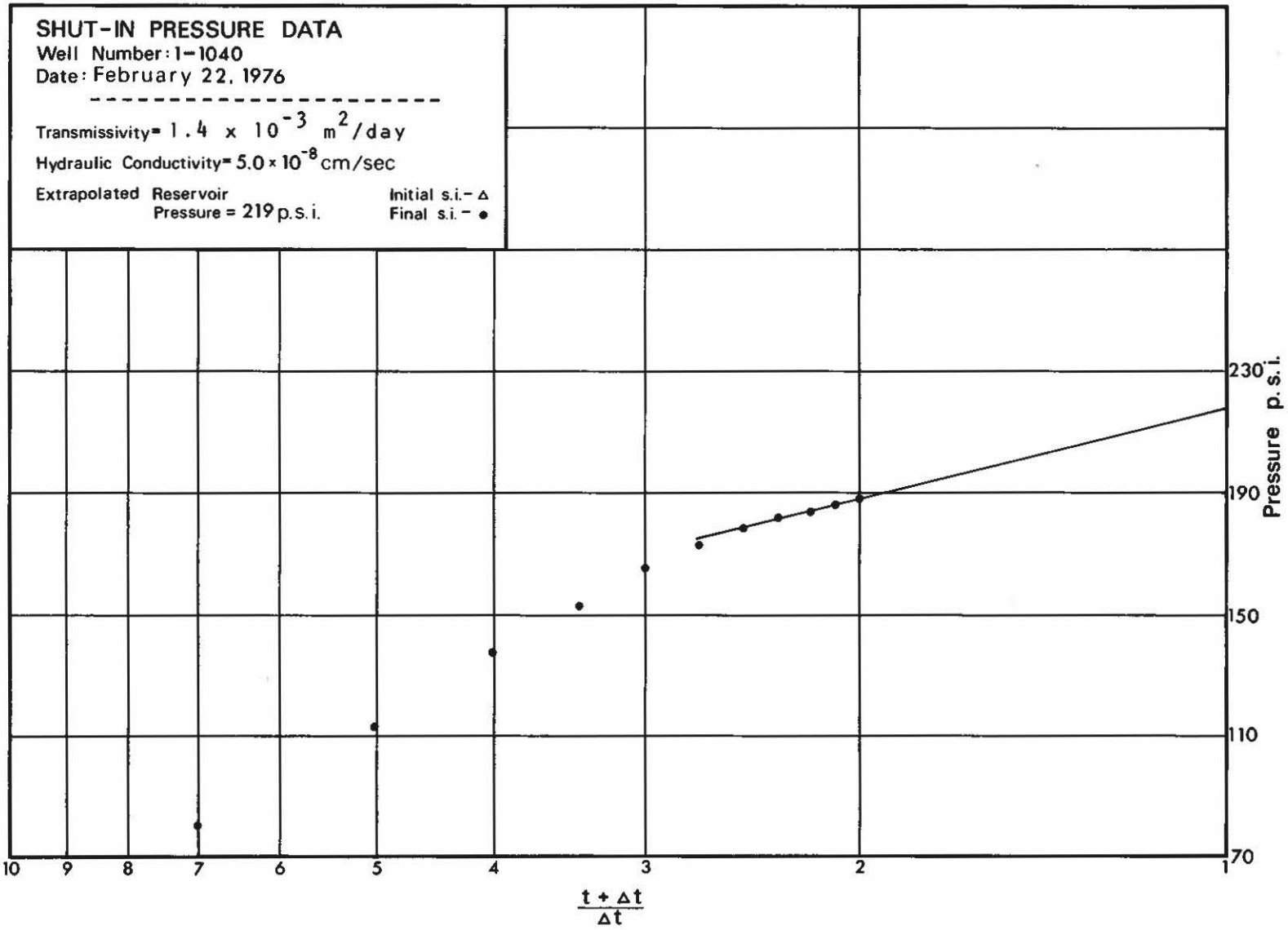


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 40.0 | 13.00 |
| 10 | 79.0 | 7.00 |
| 15 | 112.5 | 5.00 |
| 20 | 136.2 | 4.00 |
| 25 | 152.5 | 3.40 |
| 30 | 164.5 | 3.00 |
| 35 | 172.5 | 2.71 |
| 40 | 178.0 | 2.50 |
| 45 | 182.2 | 2.33 |
| 50 | 185.0 | 2.20 |
| 55 | 187.5 | 2.09 |
| 60 | 188.5 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 22, 1976
Transmissivity = 1.4 x 10^-3 m^2/day
Hydraulic Conductivity = 5.0 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 219 p.s.i.
Initial s.i. - Δ
Final s.i. - •
230
190
150
110
70
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

1-1040-0-77


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 22, 1976
Transmissivity = 1.4 x 10^-3 m^2/day
Hydraulic Conductivity = 5.0 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 219 p.s.i.
Initial s.i. - Δ
Final s.i. - •
230
190
150
110
70
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-1040-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 858

Type of test Open hole, Bottom hole

Date of test February 23, 1976 I

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 0300 | hrs |
| Tool opened | 0429 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0615 | hrs |
| Out of hole at | 0700 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Weak initial puff - faint in one minute. Blow faint on second opening decreasing to nil in 2 min

Total water recovered 10 ft

Water sample No. - (drilling mud)

Gas blow Nil

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 600-712'

Formation tested Prairie Evaporite

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 606 | 610 |
| Initial hydrostatic | A | 275 | 273 |
| First flow | B | 15 | 13 |
| | B1 | 15 | 13 |
| Initial shut in | C | 206 | 204 |
| Second flow | D | 16 | 14 |
| | D1 | 16 | 14 |
| Final shut in | G | 236 | 233 |
| Final hydrostatic | H | 257 | 255 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

1-1040-D-77

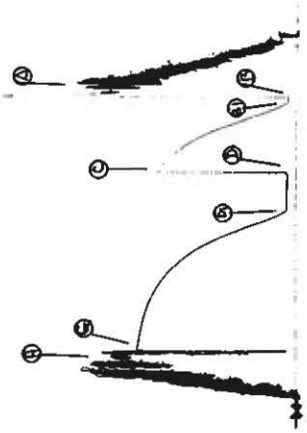
OBSERVATION WELL NUMBER 1-1040

INTERVAL TESTED 600-712

PRESSURE INCREMENTS
Recorder AK1-65
February 23, 1976 I

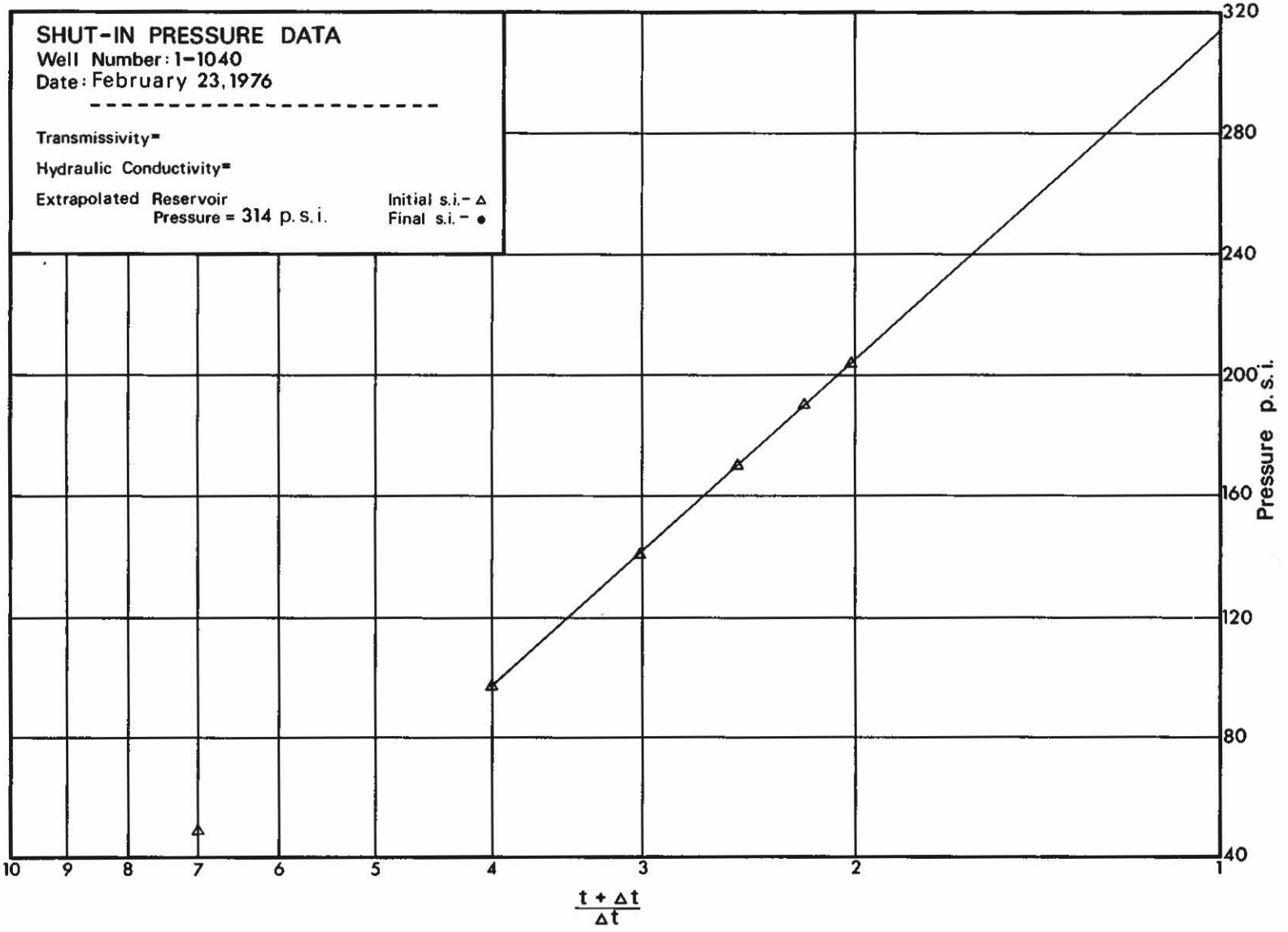
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 48.7 | 7.00 |
| 10 | 97.7 | 4.00 |
| 15 | 140.3 | 3.00 |
| 20 | 169.4 | 2.50 |
| 25 | 189.8 | 2.20 |
| 30 | 204.0 | 2.00 |

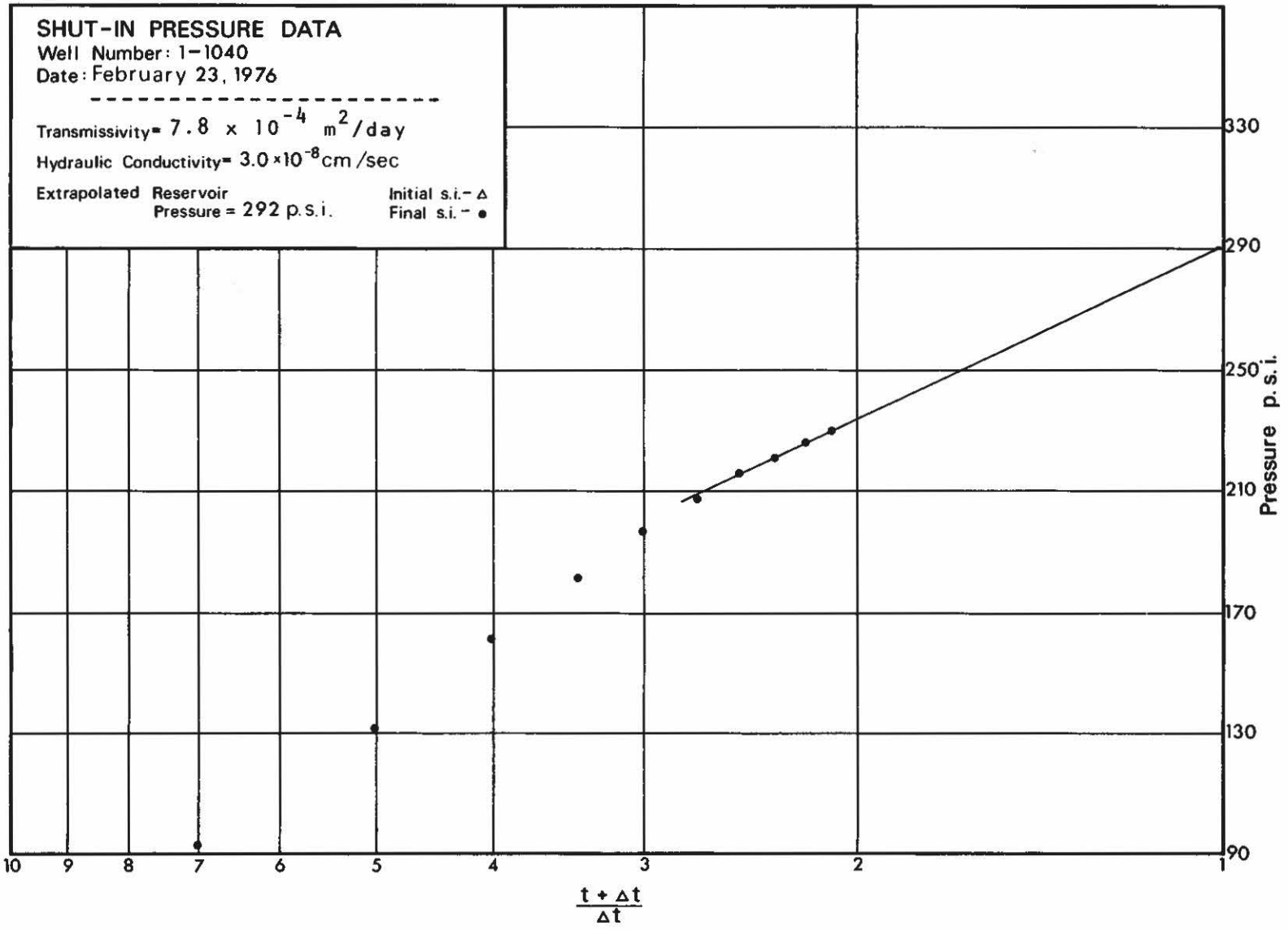


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 44.4 | 13.00 |
| 10 | 92.1 | 7.00 |
| 15 | 131.6 | 5.00 |
| 20 | 160.2 | 4.00 |
| 25 | 181.1 | 3.40 |
| 30 | 196.4 | 3.00 |
| 35 | 207.9 | 2.71 |
| 40 | 216.3 | 2.50 |
| 45 | 222.7 | 2.33 |
| 50 | 227.5 | 2.20 |
| 55 | 230.9 | 2.09 |
| 60 | 233.7 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 23, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 314 p.s.i.
Initial s.i.- Δ
Final s.i. - •
320
280
240
200
160
120
80
40
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-1040-D-77


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 23, 1976
Transmissivity= 7.8 x 10^-4 m^2/day
Hydraulic Conductivity= 3.0 x 10^-8 cm/sec
Extrapolated Reservoir Pressure = 292 p.s.i.
Initial s.i.- Δ
Final s.i. - •
330
290
250
210
170
130
90
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-1040-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 858

Type of test Open hole, Bottom hole

Date of test February 23, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | - | hrs |
| Tool opened | - | hrs |
| First flow | - | min |
| Initial shut in | - | min |
| Second flow | - | min |
| Final shut in | - | min |
| Pulled loose at | - | hrs |
| Out of hole at | 2100 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Nil

Total water recovered Nil ft

Water sample No.

Gas blow Nil

Remarks Misrun.
Unable to obtain packer seat

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 90

Open or screened interval 712-824'

Formation tested Prairie Evaporite

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 717 | 722 |
| Initial hydrostatic | A | - | - |
| First flow | B | - | - |
| | B1 | - | - |
| Initial shut in | C | - | - |
| Second flow | D | - | - |
| | D1 | No pressures available | |
| Final shut in | G | - | - |
| Final hydrostatic | H | - | - |

B1, D1, etc. Initial Hyd. Pressure

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 858

Type of test Open hole, Bottom hole

Date of test February 23, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 2200 | hrs |
| Tool opened | - | hrs |
| First flow | - | min |
| Initial shut in | - | min |
| Second flow | - | min |
| Final shut in | - | min |
| Pulled loose at | - | hrs |
| Out of hole at | 2345 | hrs |
| Wt on packers | 10,000 | lbs |
| Description of blow | Nil | |
| Total water recovered | Nil | ft |
| Water sample No. | - | |
| Gas blow | Nil | |
| Remarks | Misrun; unable to obtain packer seat | |

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 681-824'

Formation tested Prairie Evaporite

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.40 | |
| Sub | 1.70 | |
| Drill Pipe | 124.00 | |
| Sub & Bull Nose | 2.70 | |
| Total Interval | 143.00 | |

### PRESSURE DATA (psi)

| Instrument No. | | 64 | 65 |
|---|---|---|---|
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 688 | 672 |
| Initial hydrostatic | A | - | - |
| First flow | B | - | - |
| | B1 | - | - |
| Initial shut in | C | - | - |
| Second flow | D | - | - |
| | D1 | No pressures available | |
| Final shut in | G | - | - |
| Final hydrostatic | H | - | - |

B1, D1, etc. Initial Hyd. Pressure

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850
KB 858

Type of test Open hole, Bottom hole

Date of test February 24, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 2230 | hrs |
| Tool opened | 2359 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0145 | hrs |
| Out of hole at | - | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Fair initial puff on preflow. Fair air blow remaining steady throughout final flow period

Total water recovered 150 ft

Water sample No. - (drilling mud)

Gas blow No

Remarks Test satisfactory
Lost 3' of mud in annulus during test

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 824-936'

Formation tested Prairie Evaporite

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 830 | 834 |
| Initial hydrostatic | A | 364 | 367 |
| First flow | B | 20 | 23 |
| | B1 | 24 | 27 |
| Initial shut in | C | 365 | 367 |
| Second flow | D | 33 | 34 |
| | D1 | 94 | 97 |
| Final shut in | G | 362 | 365 |
| Final hydrostatic | H | 365 | 366 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

1-1040-D-77

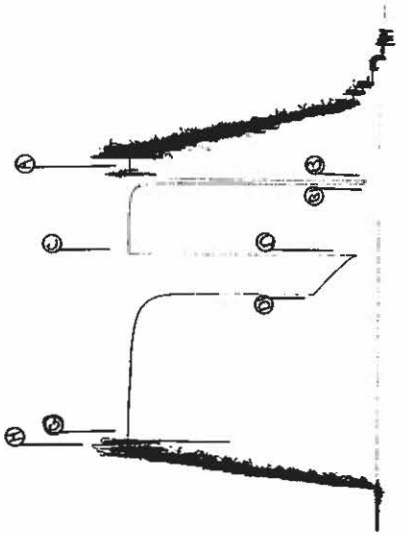
OBSERVATION WELL NUMBER 1-1040

INTERVAL TESTED 824-936

PRESSURE INCREMENTS
Recorder AK1-65
February 24, 1976

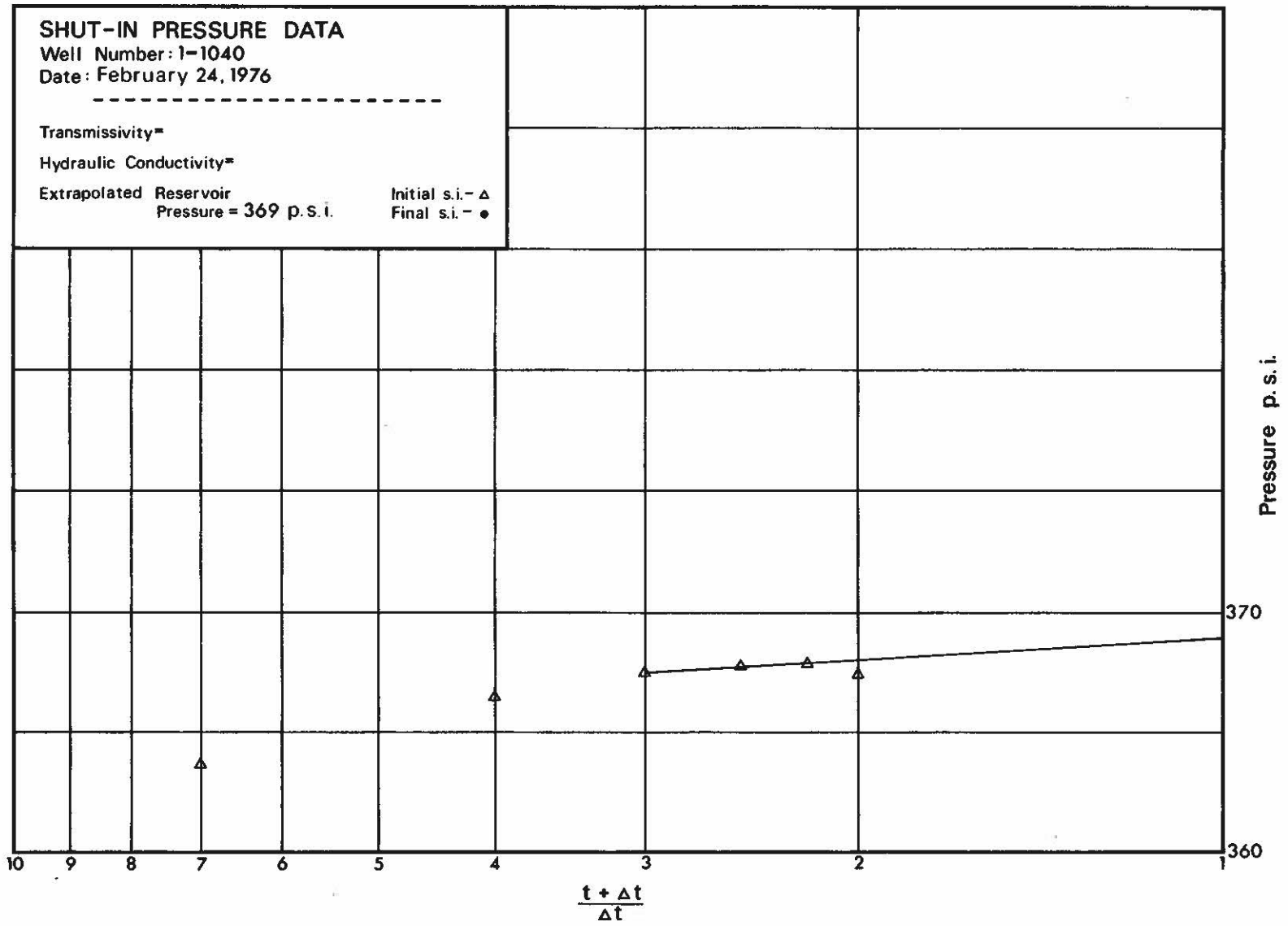
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 363.6 | 7.00 |
| 10 | 366.4 | 4.00 |
| 15 | 367.4 | 3.00 |
| 20 | 367.7 | 2.50 |
| 25 | 367.8 | 2.20 |
| 30 | 367.4 | 2.00 |

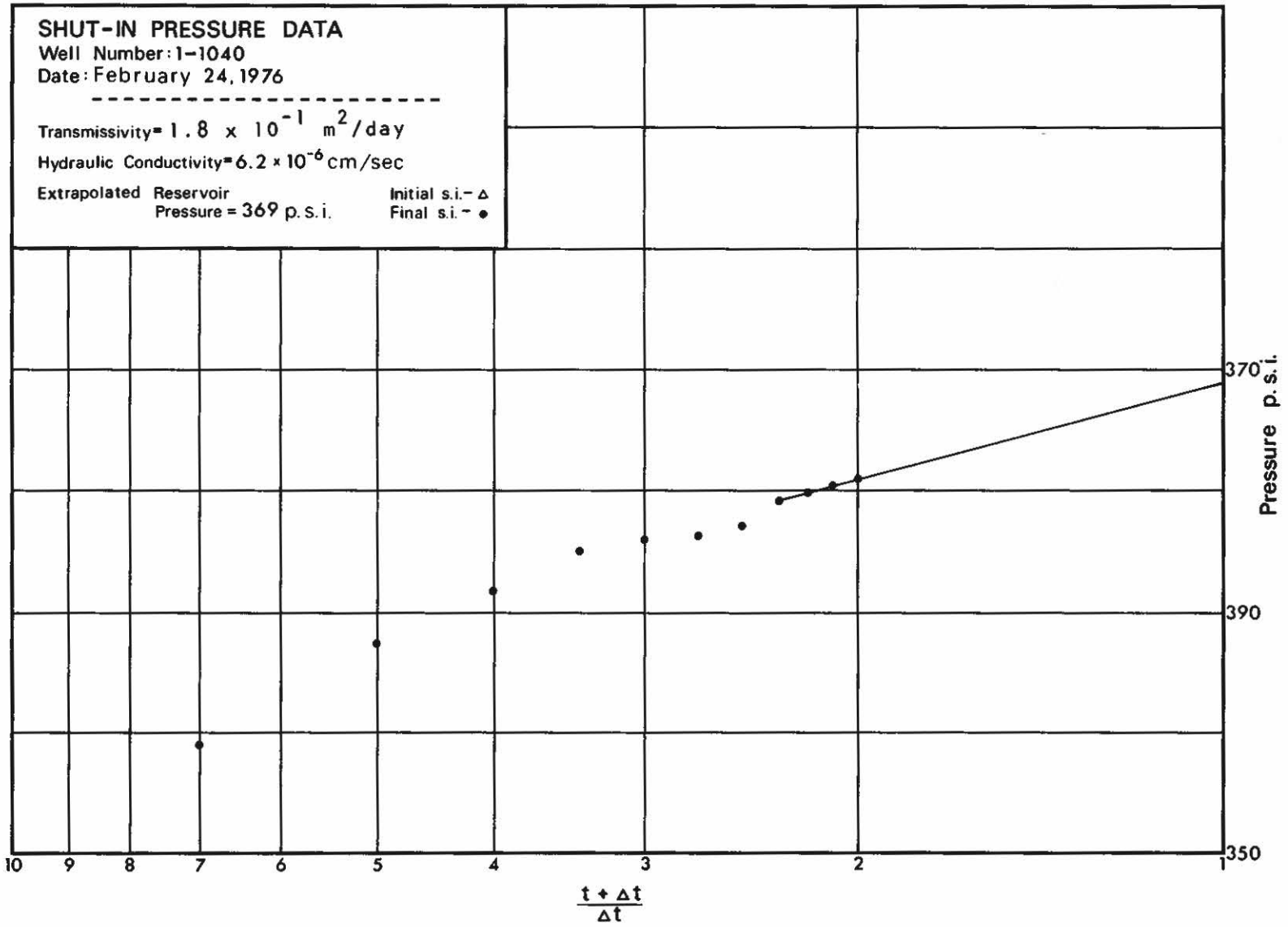


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 344.7 | 13.00 |
| 10 | 354.3 | 7.00 |
| 15 | 358.6 | 5.00 |
| 20 | 360.8 | 4.00 |
| 25 | 362.4 | 3.40 |
| 30 | 362.9 | 3.00 |
| 35 | 363.0 | 2.71 |
| 40 | 363.5 | 2.50 |
| 45 | 364.6 | 2.33 |
| 50 | 365.0 | 2.20 |
| 55 | 365.2 | 2.09 |
| 60 | 365.4 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 24, 1976
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 369 p.s.i.
Initial s.i.- Δ
Final s.i. - •
Pressure p.s.i.
370
360
10 9 8 7 6 5 4 3 2 1
t + Δt / Δt

1-1040-0-77


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 24, 1976
Transmissivity = 1.8 x 10^-1 m^2/day
Hydraulic Conductivity = 6.2 x 10^-6 cm/sec
Extrapolated Reservoir Pressure = 369 p.s.i.
Initial s.i. - Δ
Final s.i. - •
370
390
350
Pressure p.s.i.
10 9 8 7 6 5 4 3 2 1
(t + Δt)/Δt

1-1040-D-77

## DRILL STEM TEST

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Tp 96 R 11 W4th

Alberta Research Council

Elevation: gl 850

KB 858

Type of test Open hole, Bottom hole

Date of test February 25, 1976

Testing company Johnston Testers

### TEST DATA

| | | |
|---|---|---|
| Time started | 2230 | hrs |
| Tool opened | 2344 | hrs |
| First flow | 1 | min |
| Initial shut in | 30 | min |
| Second flow | 15 | min |
| Final shut in | 60 | min |
| Pulled loose at | 0130 | hrs |
| Out of hole at | 0300 | hrs |
| Wt on packers | 10,000 | lbs |

Description of blow Good initial puff on preflow. Good air flow remaining steady throughout final flow period.

Total water recovered 210 ft

Water sample No. - (water)

Gas blow Nil

Remarks Test satisfactory

### HOLE DATA

Contractor Tri City Drilling

Drill pipe size (OD) 2 7/8" IF

Drill collar size (ID) 2"

Drill collar length (ft) 60

Open or screened interval 928-1040'

Formation tested Prarie Evaporite, Ashern and Meadow Lake.

### TOOL SEQUENCE

| Tool | Length (feet) | O D |
|---|---|---|
| D.P. Sub | .90 | |
| Shut-In Tool | 6.02 | |
| Hydraulic Tool | 7.45 | |
| S.S. & Packer | 6.35 | 5 1/2" |
| T.C. & Packer | 5.90 | 5 1/2" |
| Total | 26.62 | |
| Packer Stub | .80 | |
| Perf | 5.00 | |
| Recorder | 4.40 | |
| Recorder | 4.65 | |
| Sub | 1.70 | |
| Drill Pipe | 93.00 | |
| Bull Nose & Perf | 2.70 | |
| Total Interval | 112.25 | |

### PRESSURE DATA (psi)

| | | | |
|---|---|---|---|
| Instrument No. | | 64 | 65 |
| Capacity (psig) | | 1000 | 1000 |
| Instrument set at (ft) | | 935 | 939 |
| Initial hydrostatic | A | 417 | 416 |
| First flow | B | 21 | 18 |
| | B1 | 29 | 23 |
| Initial shut in | C | 440 | 440 |
| Second flow | D | 34 | 32 |
| | D1 | 116 | 115 |
| Final shut in | G | 439 | 439 |
| Final hydrostatic | H | 422 | 412 |

B1, D1, etc. Initial Hyd. Pressure

DRILL STEM TEST

1-1040-D-77

OBSERVATION WELL NUMBER 1-1040

INTERVAL TESTED 928-1040

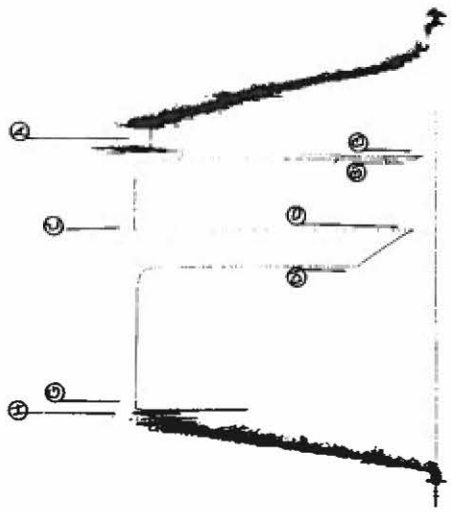
PRESSURE INCREMENTS

Recorder AK1-65

February 25, 1976

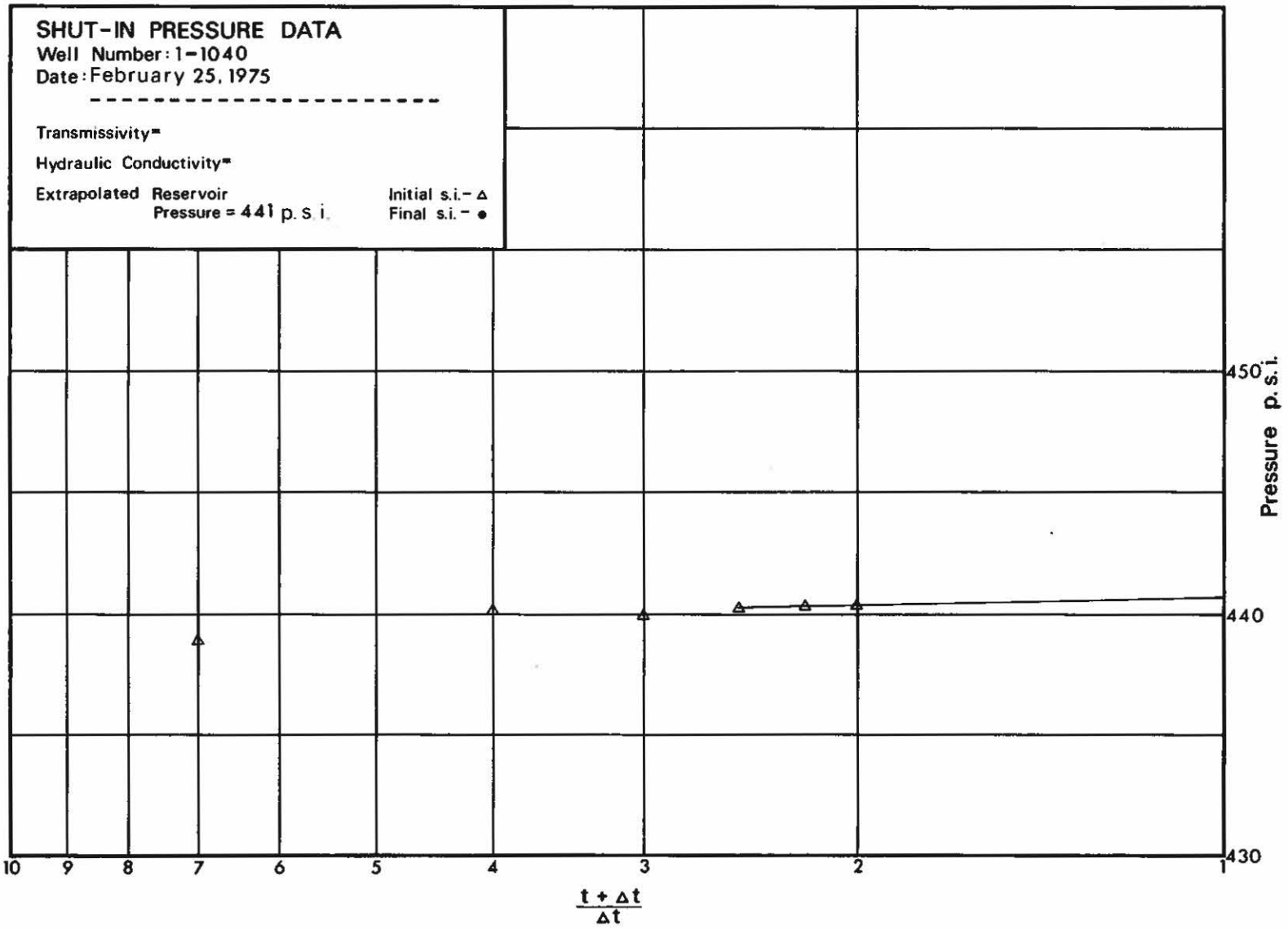
Initial Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 438.9 | 7.00 |
| 10 | 440.2 | 4.00 |
| 15 | 439.9 | 3.00 |
| 20 | 440.3 | 2.50 |
| 25 | 440.4 | 2.20 |
| 30 | 440.4 | 2.00 |

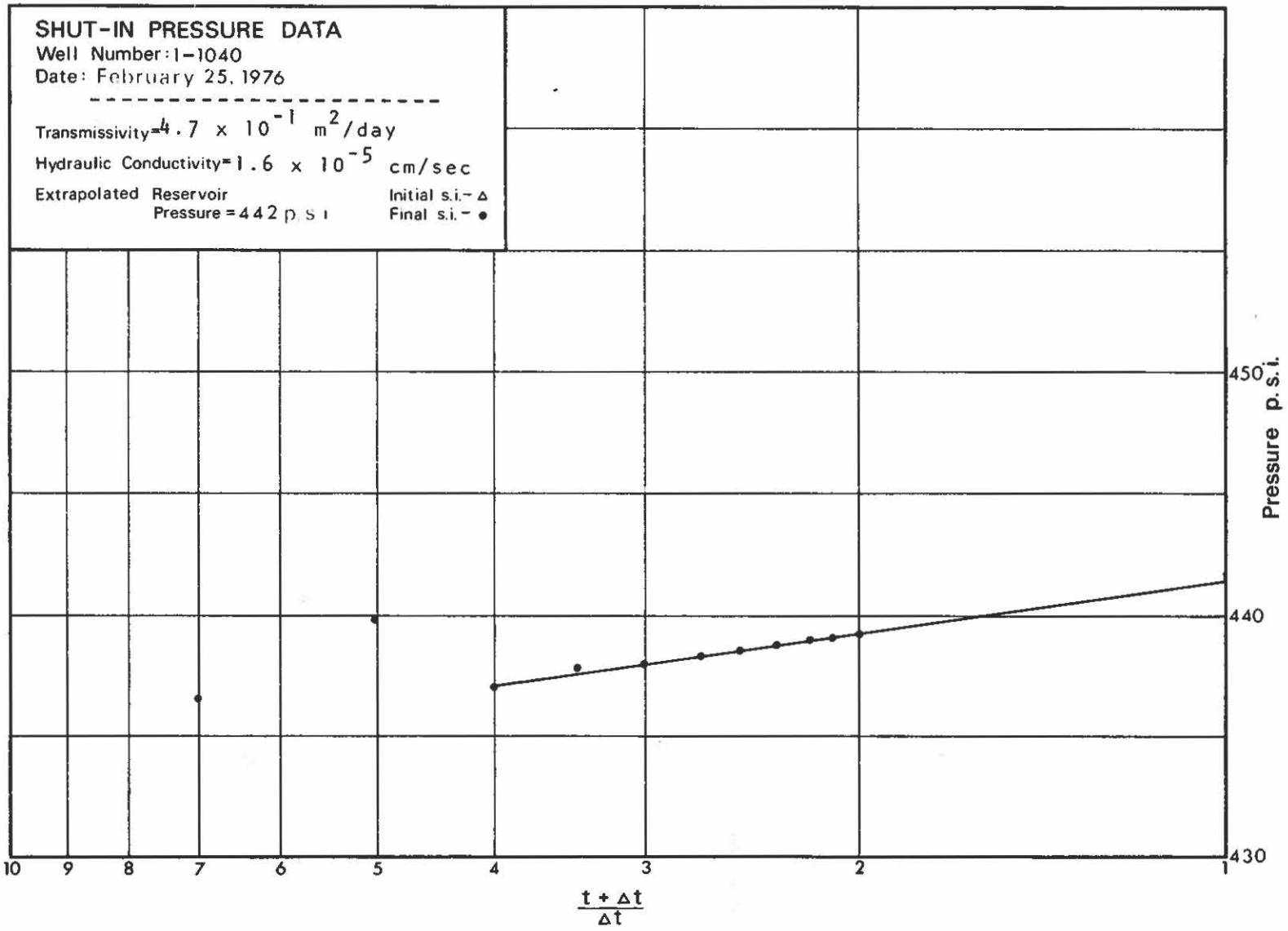


Final Shut In

| point (min) | pressure (psi) | t+Δt/Δt |
|---|---|---|
| 5 | 433.8 | 13.00 |
| 10 | 436.6 | 7.00 |
| 15 | 439.9 | 5.00 |
| 20 | 437.1 | 4.00 |
| 25 | 437.9 | 3.40 |
| 30 | 438.1 | 3.00 |
| 35 | 438.3 | 2.71 |
| 40 | 438.6 | 2.50 |
| 45 | 438.9 | 2.33 |
| 50 | 439.1 | 2.20 |
| 55 | 439.1 | 2.09 |
| 60 | 439.3 | 2.00 |


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 25, 1975
Transmissivity=
Hydraulic Conductivity=
Extrapolated Reservoir Pressure = 441 p. s. i.
Initial s.i.- Δ
Final s.i. - •
450
440
430
Pressure p.s.i.
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-1040-D-77


SHUT-IN PRESSURE DATA
Well Number: 1-1040
Date: February 25, 1976
Transmissivity = 4.7 x 10^-1 m^2/day
Hydraulic Conductivity = 1.6 x 10^-5 cm/sec
Extrapolated Reservoir Pressure = 442 p.s.i.
Initial s.i. - Δ
Final s.i. - •
Pressure p.s.i.
450
440
430
10
9
8
7
6
5
4
3
2
1
t + Δt / Δt

1-1040-D-77

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source DST #5 on 1-1040

Date sampled February 24, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1650.0 | 82.34 | 9.8 |
| Magnesium ($Mg^{++}$) | 72.0 | 5.93 | 0.7 |
| Sodium ($Na^{+}$) | 17250.0 | 750.33 | 89.4 |
| Potassium ($K^{+}$) | 27.5 | 0.70 | 0.1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 190.0 | 3.11 | 0.4 |
| Sulfate ($SO_4^{=}$) | 3640.0 | 75.79 | 8.8 |
| Chloride ($Cl^{-}$) | 27800.0 | 783.98 | 90.9 |
| Nitrate ($NO_3^{=}$) | 1.3 | 0.02 | 0.0 |
| Silica ($SiO_2$) | 3.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 50660.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 862.9 | Total Cations (epm) | 839.2 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | | |
| pH | 7.2 | pH | 6.9 | |
| Fluoride ($F^{-}$) | 0.9 ppm | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 359 | ppm |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source DST #6 on 1-1040

Date sampled February 26, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1370.0 | 68.36 | 16.9 |
| Magnesium ($Mg^{++}$) | 105.0 | 8.64 | 2.1 |
| Sodium ($Na^{+}$) | 7500.0 | 326.23 | 80.7 |
| Potassium ($K^{+}$) | 41.7 | 1.07 | 0.3 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0.0 |
| Bicarbonate ($HCO_3^{-}$) | 68.0 | 1.11 | 0.3 |
| Sulfate ($SO_4^{=}$) | 2760.0 | 57.46 | 14.1 |
| Chloride ($Cl^{-}$) | 12400.0 | 349.69 | 85.6 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0.0 |
| Silica ($SiO_2$) | 2.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | | | |
| Magnesium (Acidified) | | | |
| Total dissolved solids | 24700.0 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 408.2 | Total Cations (epm) | 404.3 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | >8000 | Temperature (C) | |
| pH | 7.0 | pH | 7.7 |
| Fluoride ($F^{-}$) | 1.0 ppm | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 95 ppm |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

## WATER ANALYSIS

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 13, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3500.0 | 174.65 | 5 |
| Magnesium ($Mg^{++}$) | 320.0 | 26.34 | 1 |
| Sodium ($Na^{+}$) | 81500.0 | 3545.02 | 95 |
| Potassium ($K^{+}$) | 175.0 | 4.48 | 0 |
| Carbonate ($CO_3^{=}$) | 21.6 | 0.72 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 12.2 | 0.20 | 0 |
| Sulfate ($SO_4^{=}$) | 2510.0 | 52.26 | 1 |
| Chloride ($Cl^{-}$) | 133600.0 | 3767.63 | 99 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 0.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1661.0 | | |
| Magnesium (Acidified) | 319.0 | | |
| Total dissolved solids | 241840 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3820.82 | Total Cations (epm) | 3750.49 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 7.0 | |
| pH | 8.9 | pH | 7.9 | |
| Fluoride ($F^{-}$) | 0.1 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 59 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

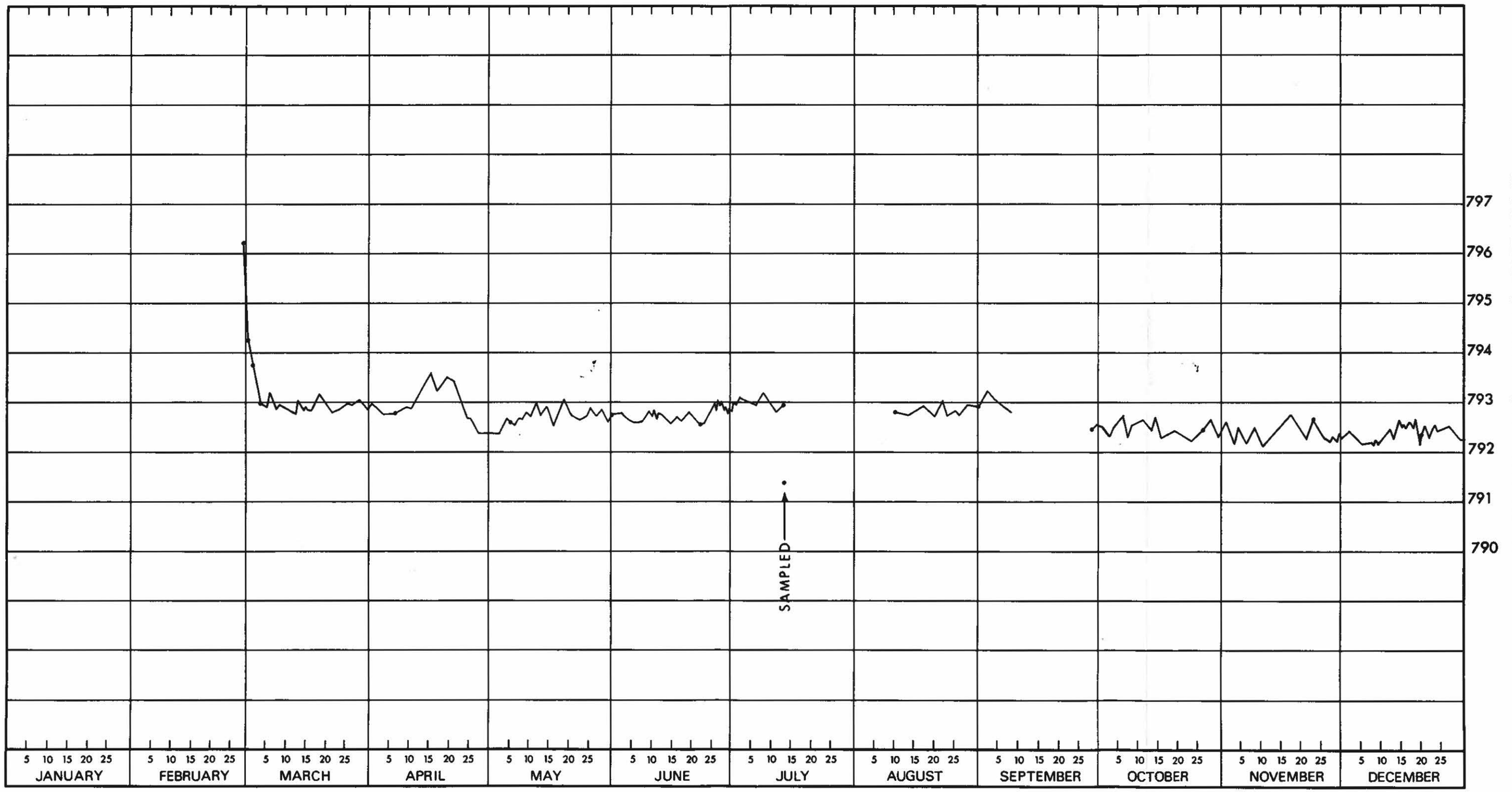
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

1 - 1040 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 1-1040

Lsd 8 Sec 15 Twp 96 R 11 W4th

Alberta Research Council

Elevation of top of casing 852.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Feb 26/76 | | | Well completed |
| Feb 28/76 | 17.3 TOC | 796.3 | |
| Feb 29/76 | 17.9 TOC | 794.3 | |
| Mar 1/76 | 18.05 TOC | 793.8 | |
| Mar 3/76 | 19.10 MP | 792.9 | MP = 0.81 m TOC, (855.6) |
| Apr 6/76 | 19.16 MP | 792.7 | |
| May 5/76 | 19.22 MP | 792.6 | |
| June 1/76 | 19.18 MP | 792.7 | |
| June 22/76 | 19.24 MP | 792.5 | |
| July 13/76 | 19.12 MP | 792.9 | |
| | 19.60 MP | 791.3 | After sample; temp. 7°C |
| Aug 10/76 | 19.16 MP | 792.7 | |
| Aug 31/76 | 19.13 MP | 792.8 | |
| Sept 28/76 | 19.27 MP | 792.4 | |
| Oct 26/76 | 19.26 MP | 792.4 | |
| Nov 23/76 | 19.22 MP | 792.6 | |
| Dec 20/76 | 19.31 MP | 792.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## SUMMARY OF CONTENTS

SITE NUMBER TWO

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | |
|---|---|---|---|---|---|
| | site | 2-46 | 2-222 | 2-402 | 2-525 |
| Introduction | 4 | — | — | — | — |
| Legend | 8 | — | — | — | — |
| Site Plan | 1 | — | — | — | — |
| Geological Sample Description | 2 | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 1 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 2 | 2 | 1 |
| Shut-In Pressure Data | — | 0 | 1 | 2 | 0 |
| Water Analysis | — | 2 | 2 | 4 | 3 |
| Spectral Emissions Estimates | — | 0 | 1 | 1 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER TWO

Lsd 1 Sec 11 Twp 96 R 12 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | |
|---|---|---|---|---|
| | 2-46 | 2-222 | 2-402 | 2-525 |
| Shut-In Pressure Data | 0 | 1* | 0 | 0 |
| Water Analysis | 1 | 1 | 1 | 1 |
| Well Construction | 0 | 1* | 0 | 0 |
| Water Level Hydrograph | 1 | 1 | 1 | 1 |
| Well History | 1 | 1 | 1 | 1 |

*Supersedes page issued in 1976

### ERRATUM STATEMENT

Material Distributed in 1976

1. McMurray Formation should be listed on the GEOLOGICAL SAMPLE DESCRIPTION at the interval 120 to 130 and from depths of 130 to 464 feet on the GEOPHYSICAL AND GEOLOGICAL LOGS.
2. The "formation tested" on the DRILL STEM TEST for well 2-222 (page 2-222-D-76) should be changed to "McMurray".
3. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
4. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.
5. A new SHUT-IN PRESSURE DATA page has been issued for well 2-222. The page indexed 2-222-D-77 has replaced 2-222-D-76.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 21.0 | 1.05 | 3 |
| Magnesium ($Mg^{++}$) | 63.0 | 5.19 | 15 |
| Sodium ($Na^{+}$) | 625.0 | 27.19 | 81 |
| Potassium ($K^{+}$) | 6.7 | 0.17 | 1 |
| Carbonate ($CO_3^{=}$) | 7.2 | 0.24 | 1 |
| Bicarbonate ($HCO_3^{-}$) | 503.0 | 8.24 | 27 |
| Sulfate ($SO_4^{=}$) | 800.0 | 16.66 | 54 |
| Chloride ($Cl^{-}$) | 198.0 | 5.58 | 18 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 30.8 | | |
| Magnesium (Acidified) | 55.0 | | |
| Total dissolved solids | 2070 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 30.74 | Total Cations (epm) | 33.59 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 3100 | Temperature (C) | 4.0 | |
| pH | 8.4 | pH | 8.8 | |
| Fluoride ($F^{-}$) | 0.5 Mg/L | Carbonate ($CO_3^{=}$) | 38 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 459 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

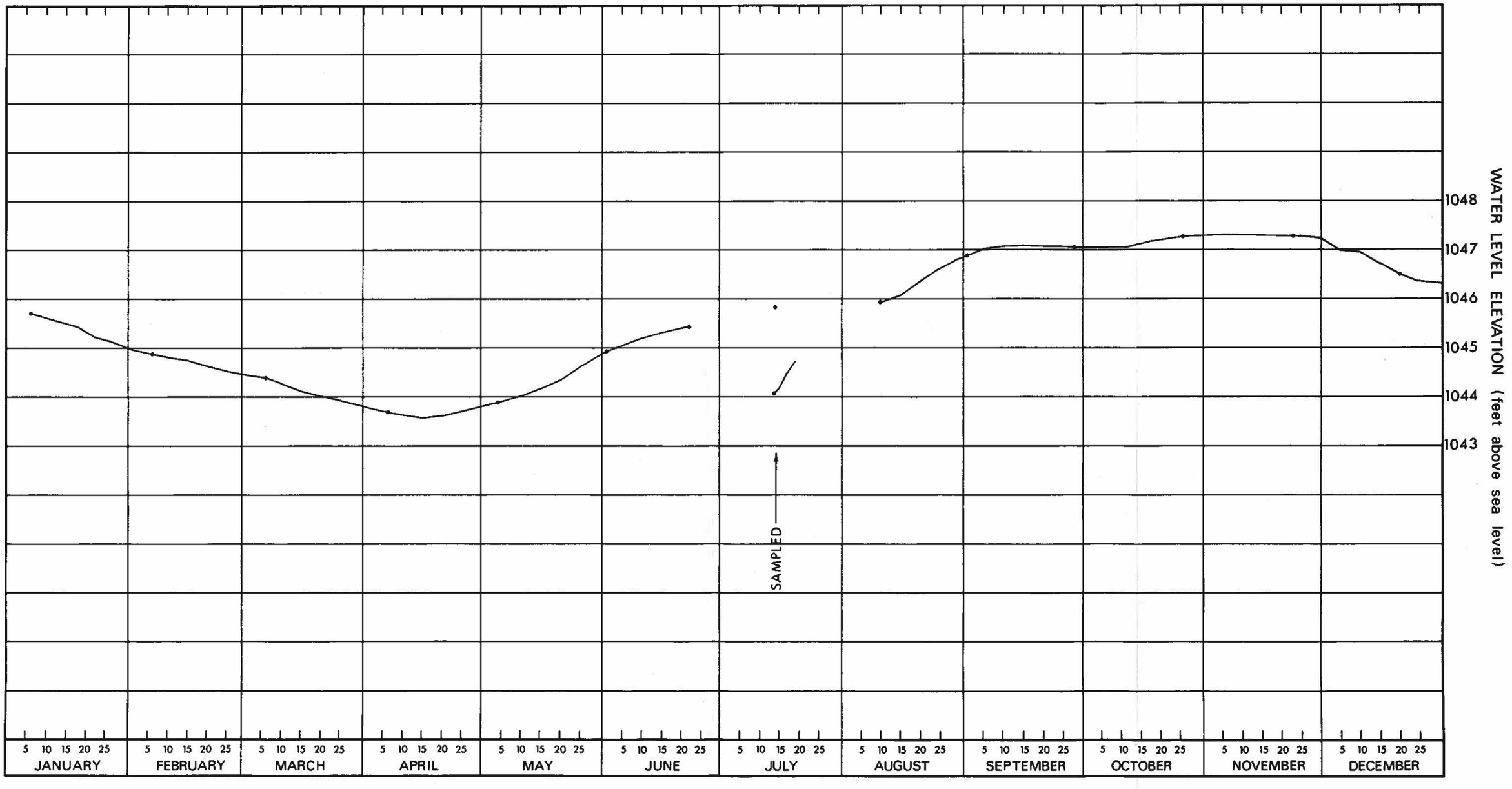
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

2 - 46 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 2-46

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 5.42 MP | 1045.7 | MP (1063.5) |
| Feb 6/76 | 5.67 MP | 1044.9 | |
| Mar 6/76 | 5.82 MP | 1044.4 | |
| Apr 6/76 | 6.04 MP | 1043.7 | |
| May 4/76 | 5.98 MP | 1043.9 | |
| June 1/76 | 5.66 MP | 1044.9 | |
| June 22/76 | 5.51 MP | 1045.4 | |
| July 14/76 | 5.38 MP | 1045.8 | |
| | 5.92 MP | 1044.1 | After sample; temp. 4°C |
| Aug 10/76 | 5.35 MP | 1045.9 | |
| Sept 1/76 | 5.06 MP | 1046.9 | |
| Sept 28/76 | 5.01 MP | 1047.1 | |
| Oct 26/76 | 4.94 MP | 1047.3 | |
| Nov 23/76 | 4.95 MP | 1047.3 | |
| Dec 20/76 | 5.18 MP | 1046.5 | |

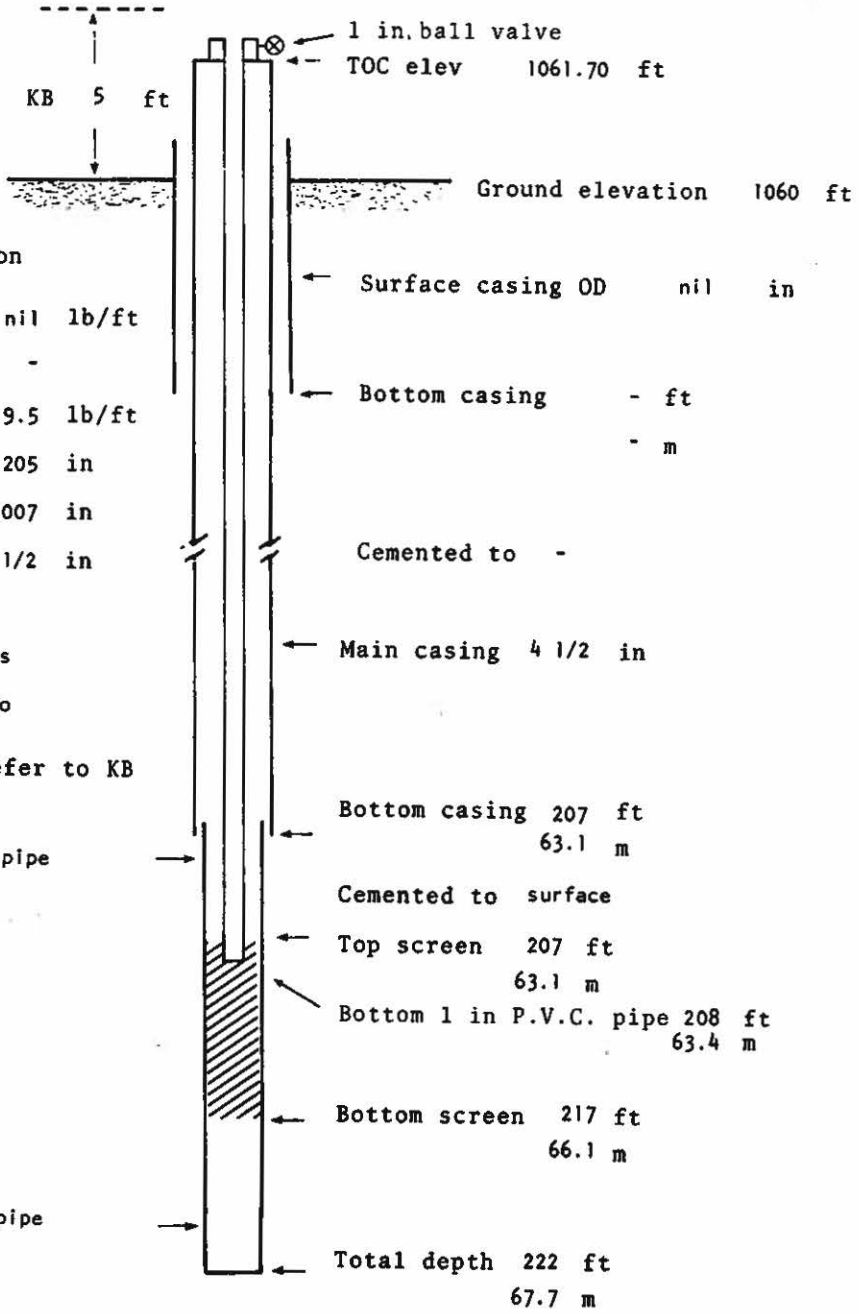
MP - Depth from measuring point
TOC - Depth from top of casing

WELL CONSTRUCTION.

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Tp 97 R 12 W 4th

Alberta Research Council




Construction

| | | |
|---|---|---|
| Surface casing | nil | lb/ft |
| wall thickness | - | |
| Main casing | 9.5 | lb/ft |
| wall thickness | .205 | in |
| Screen slot width | .007 | in |
| screen OD | 3 1/2 | in |
| slots per foot | | |
| material | ss | |
| Sand pack | No | |

Note: all depths refer to KB

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Flowing under gas pressure

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 94.0 | 4.69 | 2 |
| Magnesium ($Mg^{++}$) | 193.0 | 15.88 | 6 |
| Sodium ($Na^{+}$) | 5575.0 | 242.50 | 92 |
| Potassium ($K^{+}$) | 38.3 | 0.98 | 0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 4135.0 | 67.78 | 25 |
| Sulfate ($SO_4^{=}$) | 6.2 | 0.13 | 0 |
| Chloride ($Cl^{-}$) | 7300.0 | 205.87 | 75 |
| Nitrate ($NO_3^{=}$) | 1.3 | 0.02 | 0 |
| Silica ($SiO_2$) | 8.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 133.1 | | |
| Magnesium (Acidified) | 167.2 | | |
| Total dissolved solids | 15060 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 273.79 | Total Cations (epm) | 264.05 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 9.0 |
| pH | 7.9 | pH | 7.4 |
| Fluoride ($F^{-}$) | 0.5 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 4367 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

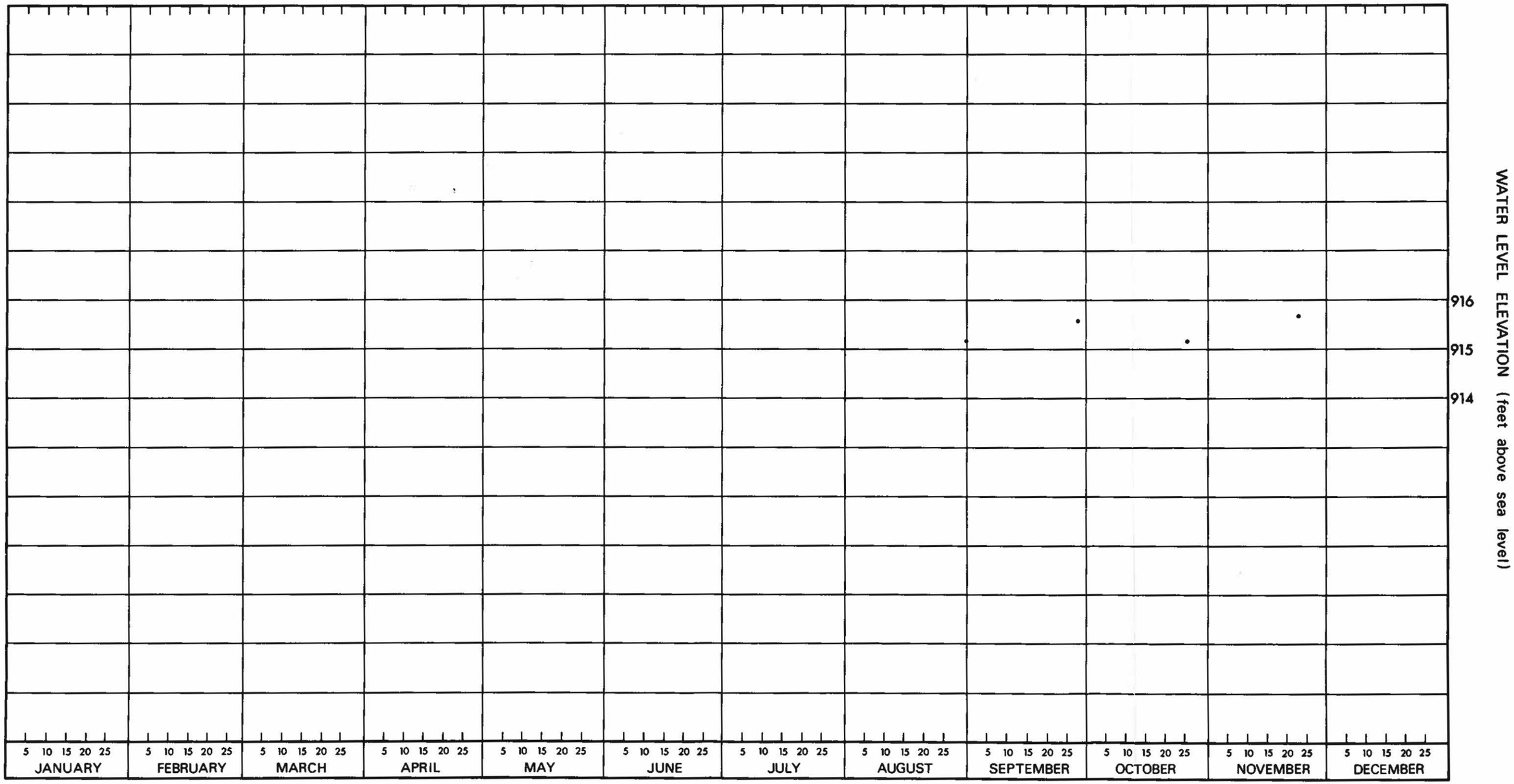
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **2-222**

**2 - 222 - H - 77**

Lsd 1 Sec **11** Twp **97** R **12** W4th

Alberta Research Council




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 2-222

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.70

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| June 1/76 | 51 TOC approx | | In casing; install plastic pipe |
| | 38 TOC approx | | In plastic pipe |
| July 14/76 | | | Sampled; temp. 9°C |
| Aug 10/76 | >62.1 TOC approx | | End of plastic pipe |
| Sept 1/76 | 39.60 TOC approx | | Inside casing; gas lifting water |
| | 44.65 TOC | 915.2 | Inside plastic pipe |
| Sept 28/76 | 44.55 TOC | 915.6 | |
| Oct 26/76 | 44.65 TOC | 915.2 | |
| Nov 23/76 | 44.52 TOC | 915.7 | Frost in pipe |
| Dec 20/76 | | | Could not measure |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 83.0 | 4.14 | 1 |
| Magnesium ($Mg^{++}$) | 313.0 | 25.76 | 7 |
| Sodium ($Na^{+}$) | 8313.0 | 361.59 | 92 |
| Potassium ($K^{+}$) | 94.0 | 2.40 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 2479.0 | 40.63 | 10 |
| Sulfate ($SO_4^{=}$) | 3.3 | 0.07 | 0 |
| Chloride ($Cl^{-}$) | 12700.0 | 358.15 | 90 |
| Nitrate ($NO_3^{=}$) | 0.2 | 0.00 | 0 |
| Silica ($SiO_2$) | 9.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 79.2 | | |
| Magnesium (Acidified) | 302.5 | | |
| Total dissolved solids | 22760 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 398.86 | Total Cations (epm) | 393.90 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 6.5 |
| pH | 7.8 | pH | 7.3 |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 2518 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

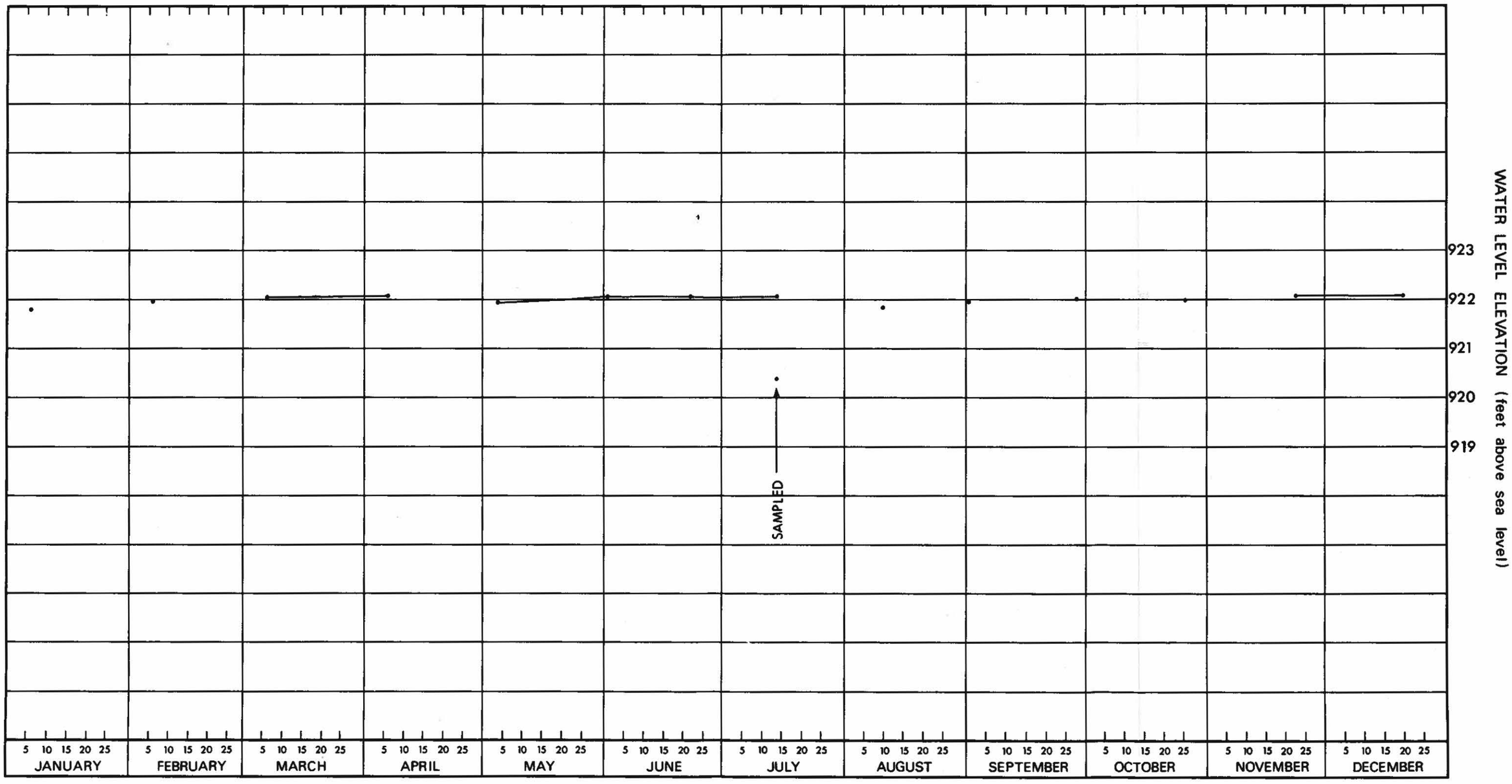
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **2-402**

2 - 402 - H - 77

Lsd **1** Sec **11** Twp **97** R **12** W4th

Alberta Research Council




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 2-402

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1061.34

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 43.20 MP | 921.8 | MP (1063.5) |
| Feb 6/76 | 43.15 MP | 922.0 | |
| Mar 6/76 | 43.12 MP | 922.1 | |
| Apr 6/76 | 43.11 MP | 922.1 | |
| May 4/76 | 43.16 MP | 921.9 | |
| June 1/76 | 43.12 MP | 922.1 | |
| June 22/76 | 43.12 MP | 922.1 | |
| July 14/76 | 43.11 MP | 922.1 | |
| | 43.63 MP | 920.4 | After sample; temp. 6.5°C |
| Aug 10/76 | 43.18 MP | 921.9 | |
| Sept 1/76 | 43.15 MP | 922.0 | |
| Sept 28/76 | 43.13 MP | 922.0 | |
| Oct 26/76 | 43.15 MP | 922.0 | |
| Nov 23/76 | 43.11 MP | 922.1 | |
| Dec 20/76 | 43.12 MP | 922.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 12.3 | 0.61 | 0 |
| Magnesium ($Mg^{++}$) | 70.0 | 5.76 | 3 |
| Sodium ($Na^{+}$) | 4775.0 | 207.70 | 97 |
| Potassium ($K^{+}$) | 48.8 | 1.25 | 1 |
| Carbonate ($CO_3^{=}$) | 122.0 | 4.07 | 2 |
| Bicarbonate ($HCO_3^{-}$) | 439.0 | 7.20 | 3 |
| Sulfate ($SO_4^{=}$) | 259.0 | 5.39 | 2 |
| Chloride ($Cl^{-}$) | 7240.0 | 204.17 | 92 |
| Nitrate ($NO_3^{=}$) | 1.3 | 0.02 | 0 |
| Silica ($SiO_2$) | 0.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 12.8 | | |
| Magnesium (Acidified) | 69.3 | | |
| Total dissolved solids | 12360 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 220.85 | Total Cations (epm) | 215.32 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 9.0 | |
| pH | 9.4 | pH | 9.2 | |
| Fluoride ($F^{-}$) | 0.6 Mg/L | Carbonate ($CO_3^{=}$) | 168 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 361 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

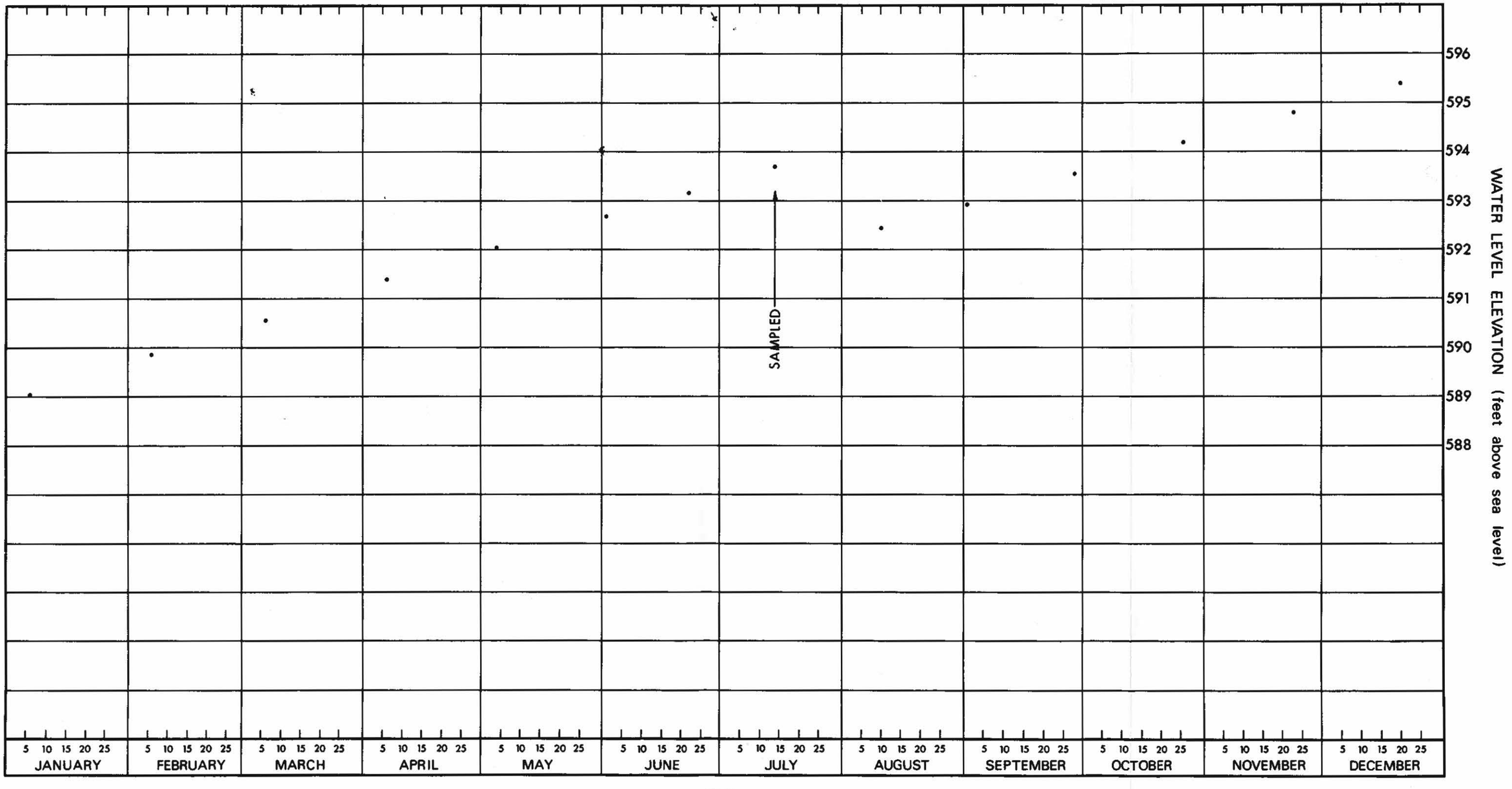
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

2 - 525 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 2-525

Lsd 1 Sec 11 Twp 97 R 12 W4th

Alberta Research Council

Elevation of top of casing 1060.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 144.47 MP | 589.0 | MP (1062.9) |
| Feb 6/76 | 144.22 MP | 589.9 | |
| Mar 6/76 | 144.01 MP | 590.5 | |
| Apr 6/76 | 143.76 MP | 591.4 | |
| May 4/76 | 143.56 MP | 592.0 | |
| June 1/76 | 143.36 MP | 592.7 | |
| June 22/76 | 143.21 MP | 593.2 | |
| July 14/76 | 143.05 MP | 593.7 | Sampled; temp. 9°C |
| Aug 10/76 | 143.42 MP | 592.5 | |
| Sept 1/76 | 143.28 MP | 593.0 | |
| Sept 28/76 | 143.09 MP | 593.6 | |
| Oct 26/76 | 142.89 MP | 594.2 | |
| Nov 23/76 | 142.70 MP | 594.8 | |
| Dec 20/76 | 142.52 MP | 595.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## SUMMARY OF CONTENTS

SITE NUMBER THREE

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | site | 3-44 | 3-57 | 3-209 | 3-425 | 3-731 | 3-1144 | 3-1310 |
| Introduction | 4 | — | — | — | — | — | — | — |
| Legend | 8 | — | — | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — | — | — |
| Geological Sample Description | 5 | — | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Drill Stem Test | — | 0 | 0 | 2 | 1 | 1 | 2 | 2 |
| Shut-In Pressure Data | — | 0 | 0 | 2 | 0 | 0 | 2 | 2 |
| Water Analysis | — | 2 | 1 | 3 | 1 | 2 | 3 | 3 |
| Spectral Emission Estimates | — | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER THREE

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | site | 3-44 | 3-57 | 3-209 | 3-425 | 3-731 | 3-1144 | 3-1310 |
| Geological Sample Description | 3* | — | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1* | — | — | — | — | — | — | — |
| Water Analysis | — | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

*Erratum sheets replacing material distributed in 1976

### ERRATUM STATEMENT

Material Distributed in 1976

1. Corrected GEOLOGICAL SAMPLE DESCRIPTION pages have been issued. Pages indexed 3-G-77 have replaced those indexed 3-G-76.
2. A corrected GEOPHYSICAL AND GEOLOGICAL LOGS page has been issued. The page indexed 3-G-77 has replaced 3-G-76.
3. The "formation tested" on the DRILL STEM TEST for well 3-209 (page 3-209-D-76) should be changed to "Shaftesbury".
4. The "formation tested" on the DRILL STEM TEST for well 3-425 (page 3-425-D-76) should be changed to "Grand Rapids".
5. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
6. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 64.0 | 3.19 | 8 |
| Magnesium ($Mg^{++}$) | 27.0 | 2.22 | 5 |
| Sodium ($Na^{+}$) | 850.0 | 36.97 | 87 |
| Potassium ($K^{+}$) | 7.5 | 0.19 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 517.0 | 8.47 | 20 |
| Sulfate ($SO_4^{=}$) | 1620.0 | 33.73 | 78 |
| Chloride ($Cl^{-}$) | 30.0 | 0.85 | 2 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 67.1 | | |
| Magnesium (Acidified) | 29.7 | | |
| Total dissolved solids | 2828 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 43.06 | Total Cations (epm) | 42.58 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 4000 | Temperature (C) | 4.0 |
| pH | 8.0 | pH | 8.3 |
| Fluoride ($F^{-}$) | 0.8 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 542 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

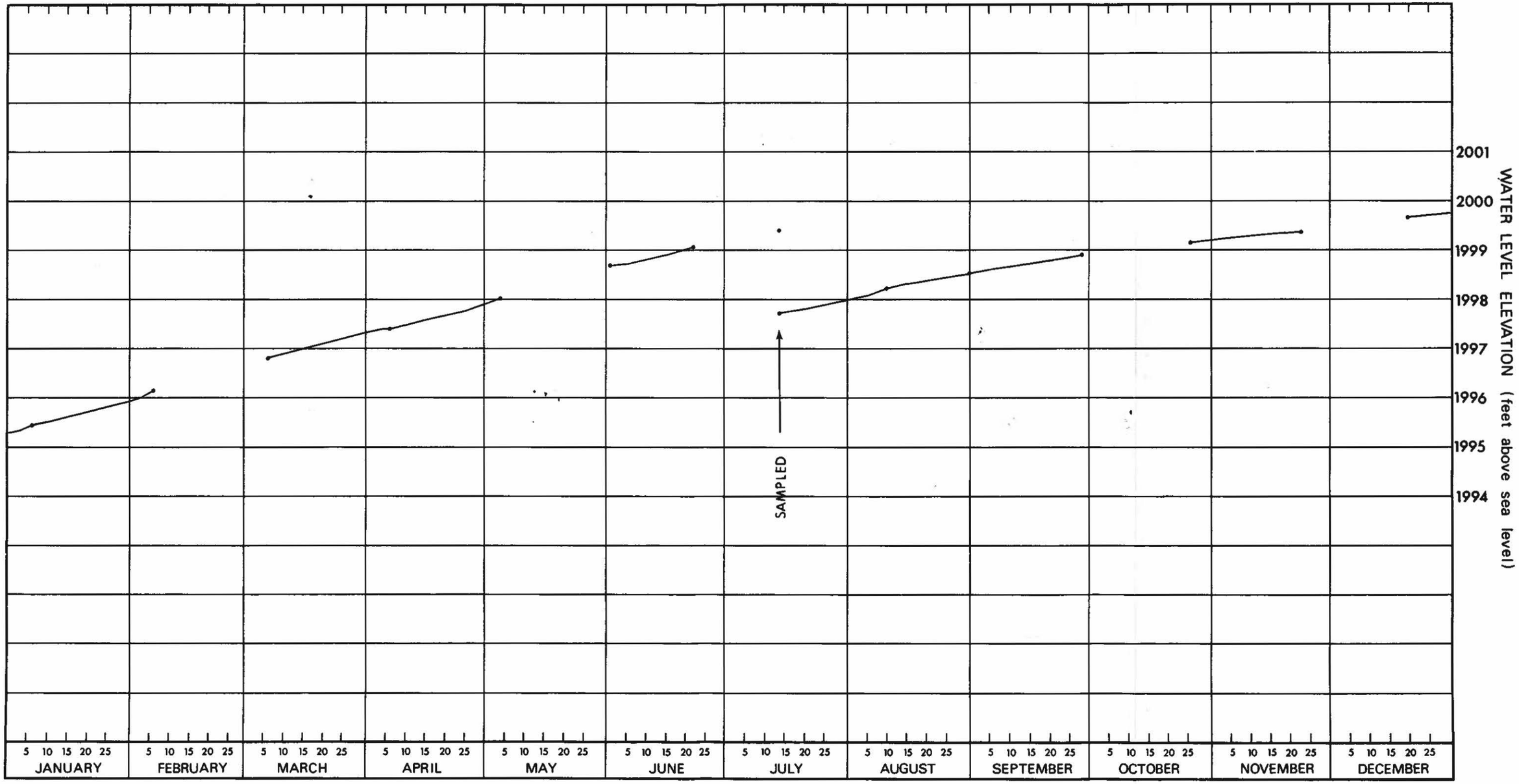
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

3 - 44 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 3-44

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.64

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 7.06 MP | 1995.4 | MP (2018.6) |
| Feb 6/76 | 6.84 MP | 1996.2 | |
| Mar 6/76 | 6.64 MP | 1996.8 | |
| Apr 6/76 | 6.46 MP | 1997.4 | |
| May 4/76 | 6.27 MP | 1998.0 | New MP = 0.70 m TOC, (2017.9) |
| June 1/76 | 5.86 MP | 1998.7 | |
| June 22/76 | 5.74 MP | 1999.1 | |
| July 14/76 | 5.63 MP | 1999.4 | |
| | 6.15 MP | 1997.7 | After sample; temp. 4°C |
| Aug 10/76 | 5.99 MP | 1998.2 | |
| Aug 31/76 | 5.90 MP | 1998.5 | |
| Sept 28/76 | 5.79 MP | 1998.9 | |
| Oct 26/76 | 5.70 MP | 1999.2 | |
| Nov 23/76 | 5.63 MP | 1999.4 | |
| Dec 20/76 | 5.55 MP | 1999.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 151.0 | 7.53 | 18 |
| Magnesium ($Mg^{++}$) | 45.0 | 3.70 | 9 |
| Sodium ($Na^{+}$) | 700.0 | 30.45 | 72 |
| Potassium ($K^{+}$) | 14.2 | 0.36 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 124.0 | 2.03 | 5 |
| Sulfate ($SO_4^{=}$) | 1920.0 | 39.98 | 94 |
| Chloride ($Cl^{-}$) | 24.0 | 0.68 | 2 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 1.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 170.5 | | |
| Magnesium (Acidified) | 51.7 | | |
| Total dissolved solids | 2922 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 42.70 | Total Cations (epm) | 42.05 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4000 | Temperature (C) | 3.5 | |
| pH | 6.9 | pH | 6.6 | |
| Fluoride ($F^{-}$) | 0.8 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 142 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

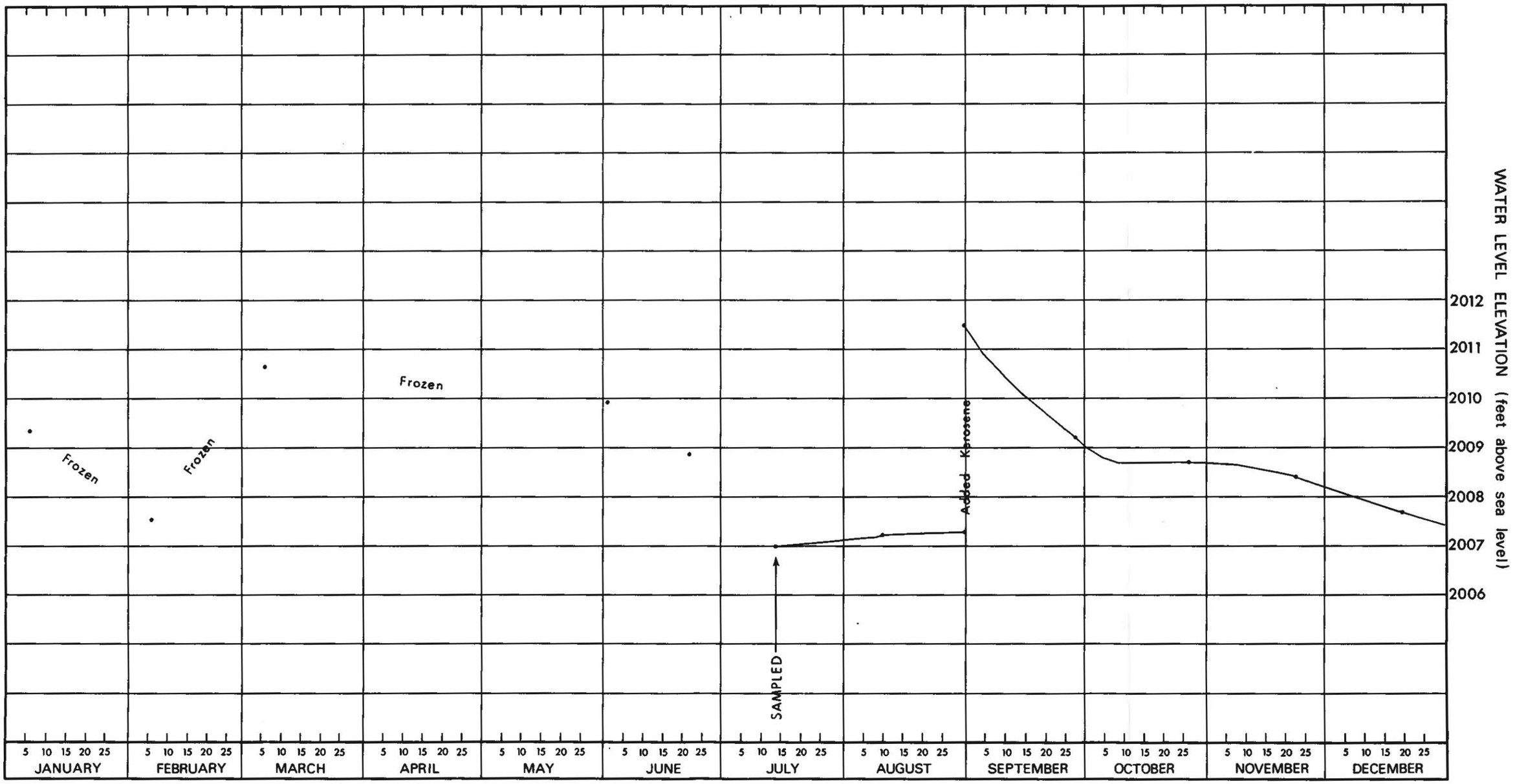
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

3 - 57 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 3-57

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.95

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 2.36 MP | 2009.4 | Frozen MP (2017.1) |
| Feb 6/76 | 2.91 MP | 2007.5 | Frozen |
| Mar 6/76 | 1.96 MP | 2010.7 | Frozen |
| Apr 6/76 | | | Frozen |
| May 4/76 | | | Frozen |
| June 1/76 | 2.18 MP | 2009.9 | Frozen |
| June 22/76 | 2.41 MP | 2008.9 | New MP = 0.87 m TOC, (2016.8) |
| July 14/76 | 2.99 MP | 2007.0 | After sample; temp. 3.5°C |
| Aug 10/76 | 2.92 MP | 2007.2 | |
| Aug 31/76 | 2.90 MP | 2007.3 | |
| | 1.22 MP | 2011.5 | Added 5 gallons of kerosene; water level elevation adjusted downward by 1.25 ft after this date |
| Sept 28/76 | 1.94 MP | 2009.2 | |
| Oct 26/76 | 2.10 MP | 2008.7 | |
| Nov 23/76 | 2.20 MP | 2008.4 | |
| Dec 20/76 | 2.38 MP | 2007.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.9 | 0.19 | 4 |
| Magnesium ($Mg^{++}$) | 0.4 | 0.03 | 1 |
| Sodium ($Na^{+}$) | 83.8 | 3.65 | 74 |
| Potassium ($K^{+}$) | 41.0 | 1.05 | 21 |
| Carbonate ($CO_3^{=}$) | 50.0 | 1.67 | 36 |
| Bicarbonate ($HCO_3^{-}$) | 46.4 | 0.76 | 16 |
| Sulfate ($SO_4^{=}$) | 69.0 | 1.44 | 31 |
| Chloride ($Cl^{-}$) | 24.0 | 0.68 | 15 |
| Nitrate ($NO_3^{=}$) | 5.7 | 0.09 | 2 |
| Silica ($SiO_2$) | 2.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 5.1 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 360 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4.63 | Total Cations (epm) | 4.92 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 540 | Temperature (C) | 5.0 | |
| pH | 9.5 | pH | 11.2 | |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 62 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 15 | Mg/L |
| | | Conductivity | | |

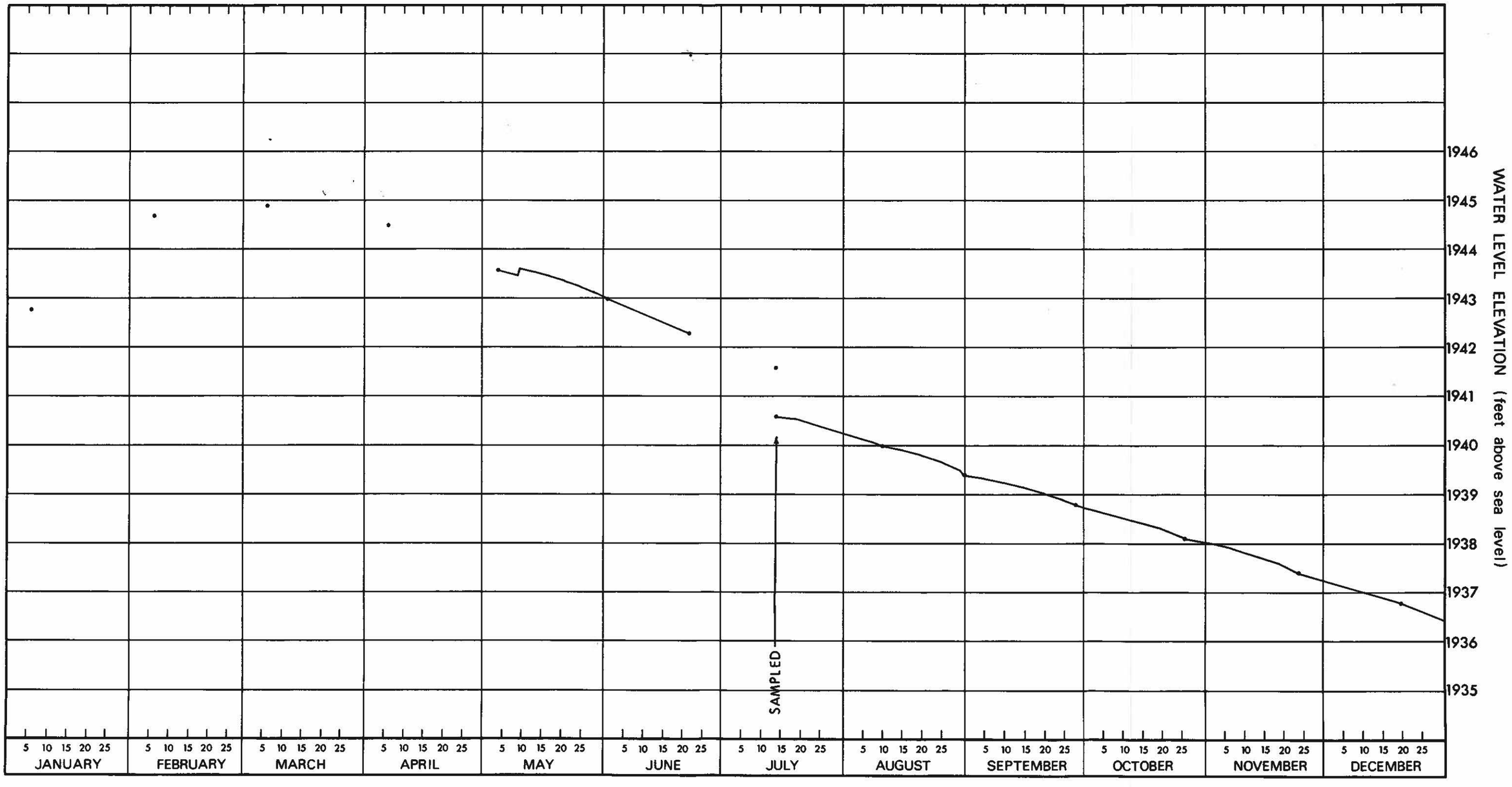
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-209

3 - 209 - H - 77

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 3-209

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2015.92

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 23.12 MP | 1942.8 | MP (2018.6) |
| Feb 6/76 | 22.53 MP | 1944.7 | |
| Mar 6/76 | 22.47 MP | 1944.9 | |
| Apr 6/76 | 22.60 MP | 1944.5 | |
| May 4/76 | 22.86 MP | 1943.6 | |
| June 1/76 | 23.06 MP | 1943.0 | |
| June 22/76 | 23.26 MP | 1942.3 | |
| July 14/76 | 23.46 MP | 1941.6 | |
| | 23.78 MP | 1940.6 | After sample; temp. 5°C |
| Aug 10/76 | 23.97 MP | 1940.0 | |
| Aug 31/76 | 24.13 MP | 1939.4 | |
| Sept 28/76 | 24.33 MP | 1938.8 | |
| Oct 26/76 | 24.53 MP | 1938.1 | |
| Nov 23/76 | 24.73 MP | 1937.4 | |
| Dec 20/76 | 24.95 MP | 1936.8 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WELL HISTORY

OBSERVATION WELL NUMBER 3-425

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.84

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | Dry | | MP (2017.9) |
| Feb 6/76 | Dry | | |
| Mar 6/76 | Dry | | |
| Apr 6/76 | Dry | | |
| May 4/76 | Dry | | |
| June 1/76 | Dry | | |
| June 22/76 | Dry | | |
| July 14/76 | Dry | | |
| Aug 10/76 | Dry | | |
| Aug 31/76 | Dry | | |
| Sept 28/76 | Dry | | |
| Oct 26/76 | Dry | | |
| Nov 23/76 | 130.88 MP | 1588.6 | |
| Dec 20/76 | 130.90 MP | 1588.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.2 | 0.16 | 1 |
| Magnesium ($Mg^{++}$) | 0.7 | 0.06 | 0 |
| Sodium ($Na^{+}$) | 491.0 | 21.36 | 98 |
| Potassium ($K^{+}$) | 6.3 | 0.16 | 1 |
| Carbonate ($CO_3^{=}$) | 60.0 | 2.00 | 10 |
| Bicarbonate ($HCO_3^{-}$) | 698.0 | 11.44 | 55 |
| Sulfate ($SO_4^{=}$) | 13.8 | 0.29 | 1 |
| Chloride ($Cl^{-}$) | 252.0 | 7.11 | 34 |
| Nitrate ($NO_3^{=}$) | 9.8 | 0.16 | 1 |
| Silica ($SiO_2$) | 3.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 3.1 | | |
| Magnesium (Acidified) | 1.2 | | |
| Total dissolved solids | 1252 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 20.99 | Total Cations (epm) | 21.74 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2150 | Temperature (C) | 9.0 | |
| pH | 8.8 | pH | 9.3 | |
| Fluoride ($F^{-}$) | 1.8 Mg/L | Carbonate ($CO_3^{=}$) | 120 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 605 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

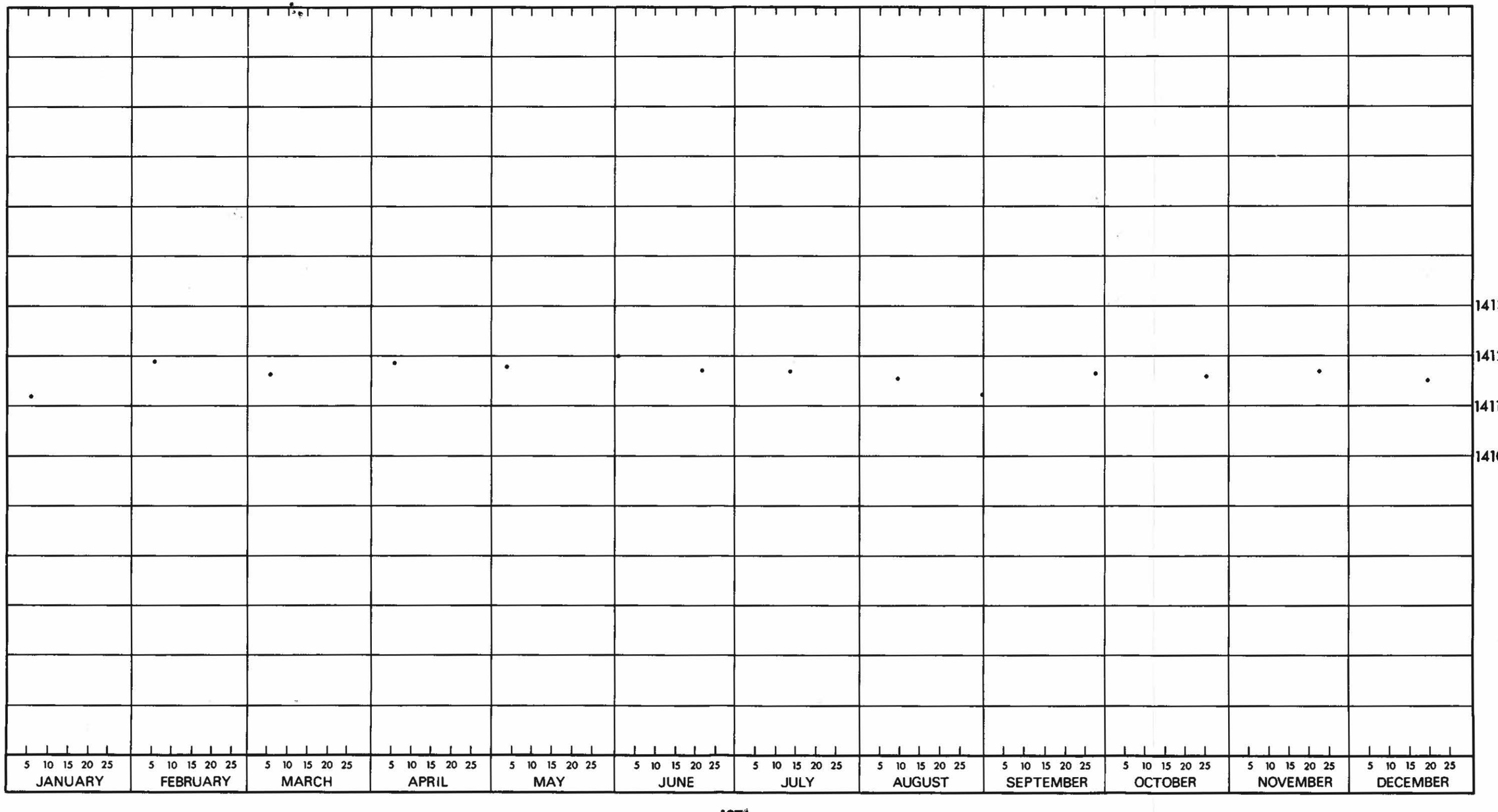
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

3 - 731 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 3-731

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2012.54

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 184.20 MP | 1411.2 | MP (2015.4) |
| Feb 6/76 | 183.99 MP | 1411.9 | |
| Mar 6/76 | 184.07 MP | 1411.6 | |
| Apr 6/76 | 184.00 MP | 1411.9 | |
| May 4/76 | 184.03 MP | 1411.8 | |
| June 1/76 | 183.96 MP | 1412.0 | |
| June 22/76 | 184.05 MP | 1411.7 | |
| July 14/76 | 184.05 MP | 1411.7 | Sampled; temp. 9°C |
| Aug 10/76 | 184.10 MP | 1411.5 | |
| Aug 31/76 | 184.20 MP | 1411.2 | |
| Sept 28/76 | 184.07 MP | 1411.6 | |
| Oct 26/76 | 184.07 MP | 1411.6 | |
| Nov 23/76 | 184.05 MP | 1411.7 | |
| Dec 20/76 | 184.10 MP | 1411.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 8.2 | 0.41 | 4 |
| Magnesium ($Mg^{++}$) | 3.8 | 0.31 | 3 |
| Sodium ($Na^{+}$) | 163.0 | 7.09 | 74 |
| Potassium ($K^{+}$) | 67.0 | 1.71 | 18 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 429.0 | 7.03 | 76 |
| Sulfate ($SO_4^{=}$) | 26.8 | 0.56 | 6 |
| Chloride ($Cl^{-}$) | 60.0 | 1.69 | 18 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 7.4 | | |
| Magnesium (Acidified) | 4.1 | | |
| Total dissolved solids | 540 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 9.30 | Total Cations (epm) | 9.53 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 950 | Temperature (C) | 12.0 | |
| pH | 7.2 | pH | 7.3 | |
| Fluoride ($F^{-}$) | 0.4 Mg/L | Carbonate ($CO_3^{=}$) | 0 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 444 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

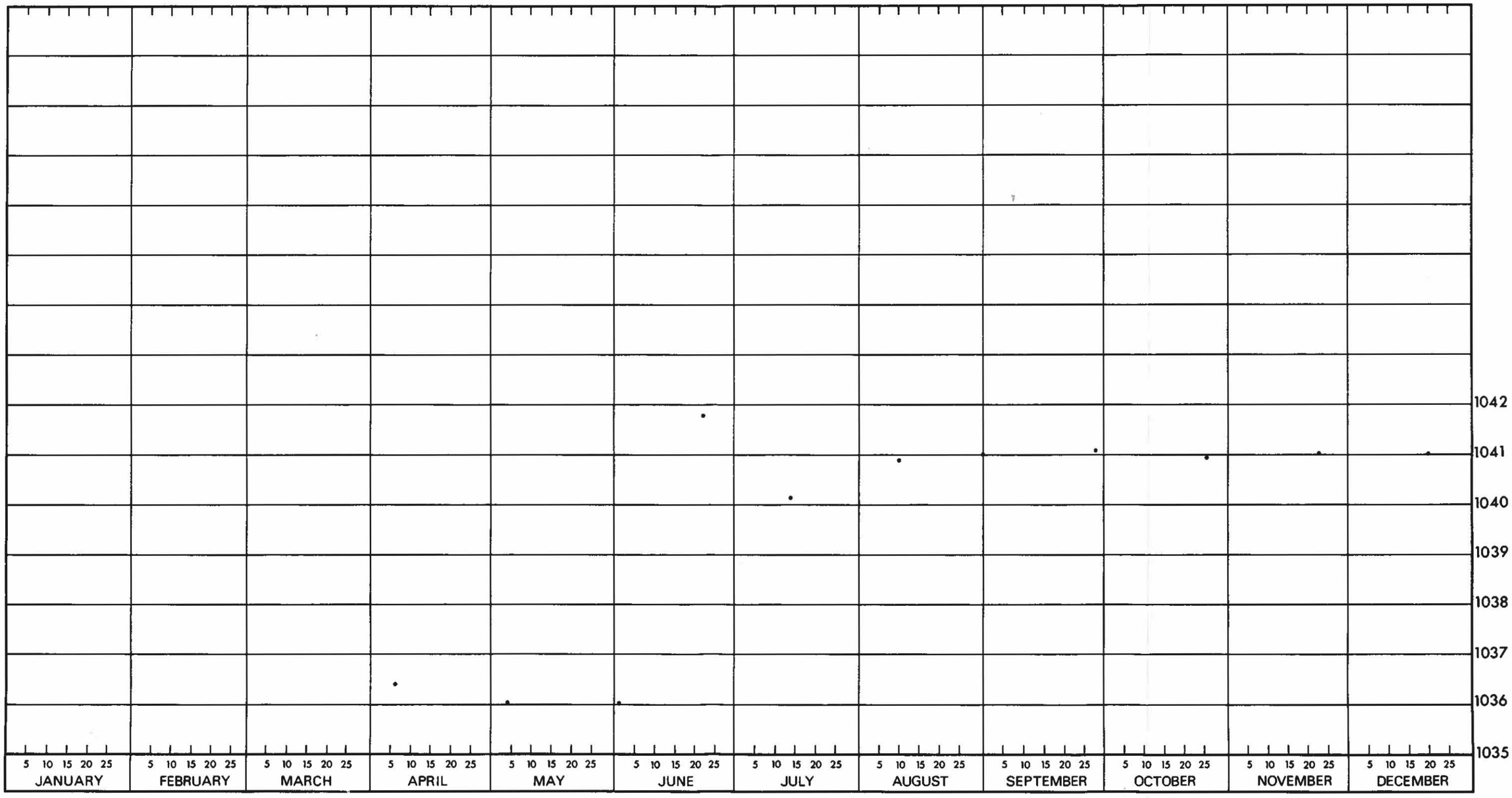
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

3 - 1144 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 3-1144

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2014.48

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | | | MP (2017.2) Could not measure |
| Feb 6/76 | 294.96 MP | 1049.7 | |
| Mar 6/76 | 307.97 MP | 1007.1 | Questionable measurement |
| Apr 6/76 | 299.03 MP | 1036.4 | |
| May 4/76 | 299.15 MP | 1036.0 | |
| June 1/76 | 299.15 MP | 1036.0 | |
| June 22/76 | 297.39 MP | 1041.8 | |
| July 14/76 | 297.90 MP | 1040.1 | Sampled; temp. 12°C |
| Aug 10/76 | 297.67 MP | 1040.8 | |
| Aug 31/76 | 297.63 MP | 1041.0 | |
| Sept 28/76 | 297.62 MP | 1041.0 | |
| Oct 26/76 | 297.64 MP | 1040.9 | |
| Nov 23/76 | 297.63 MP | 1041.0 | |
| Dec 20/76 | 297.63 MP | 1041.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 14, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 54.0 | 2.69 | 29 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 149.0 | 6.48 | 69 |
| Potassium ($K^{+}$) | 9.6 | 0.25 | 3 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 12 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 74.0 | 1.54 | 23 |
| Chloride ($Cl^{-}$) | 156.0 | 4.40 | 65 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 5.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 70.4 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 568 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 6.75 | Total Cations (epm) | 9.42 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1330 | Temperature (C) | 10.0 | |
| pH | 11.0 | pH | | |
| Fluoride ($F^{-}$) | 0.4 Mg/L | Carbonate ($CO_3^{=}$) | 19 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 58 | Mg/L |
| | | Conductivity | | |

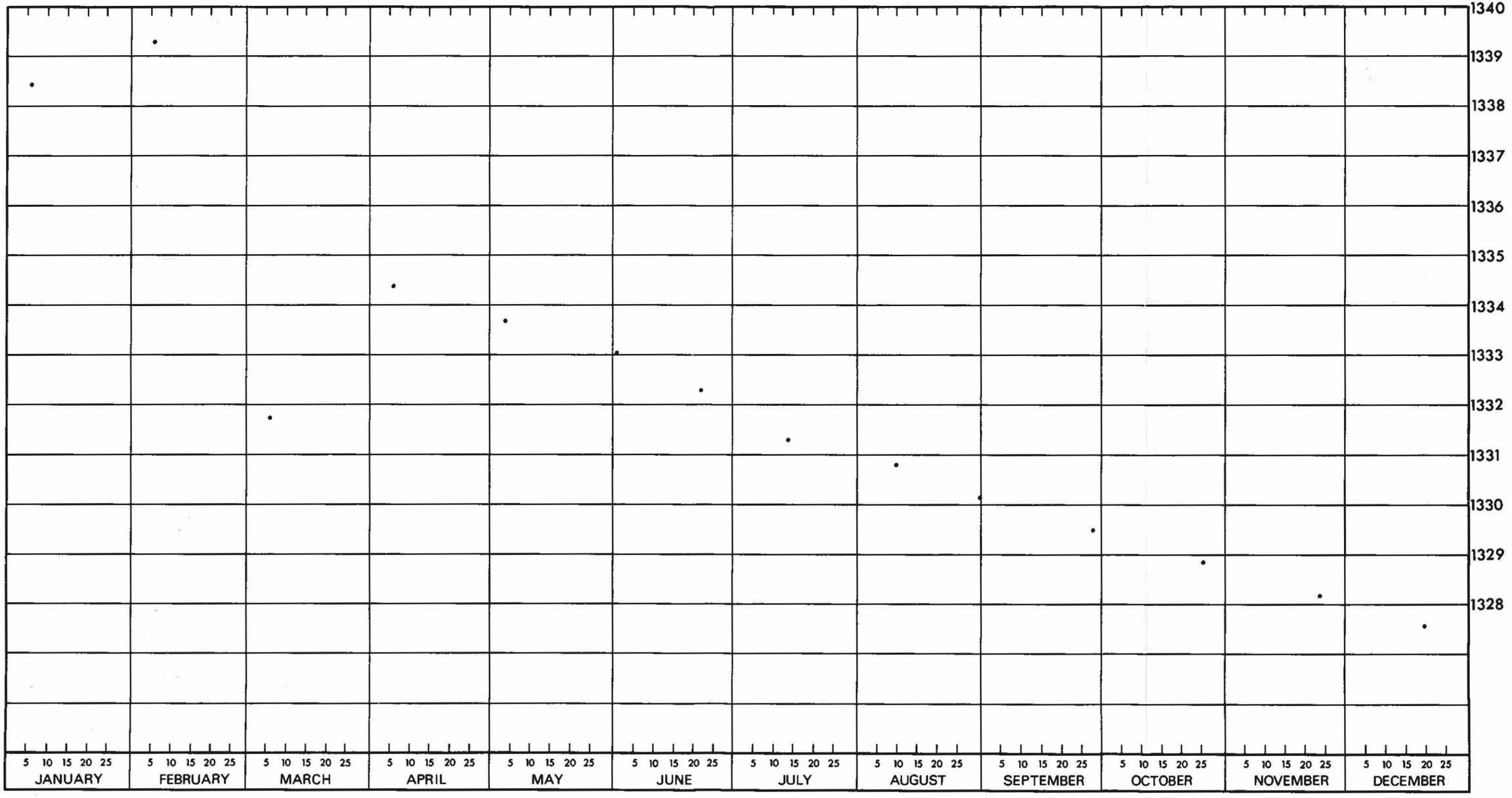
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **3-1310**

Lsd **9** Sec **26** Twp **97** R **13** W4th

Alberta Research Council

3 - 1310 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 3-1310

Lsd 9 Sec 26 Twp 97 R 13 W4th

Alberta Research Council

Elevation of top of casing 2013.59

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 6/76 | 203.41 MP | 1348.9 | MP (2016.1) |
| Feb 6/76 | 202.90 MP | 1350.6 | |
| Mar 6/76 | 207.50 MP | 1335.5 | |
| Apr 6/76 | 205.88 MP | 1340.8 | |
| May 4/76 | 206.31 MP | 1339.4 | |
| June 1/76 | 206.70 MP | 1338.1 | |
| June 22/76 | 207.16 MP | 1336.6 | |
| July 14/76 | 207.77 MP | 1334.6 | Sampled; temp. 11°C |
| Aug 10/76 | 208.17 MP | 1333.6 | |
| Aug 31/76 | 208.48 MP | 1332.3 | |
| Sept 28/76 | 208.88 MP | 1331.0 | |
| Oct 26/76 | 209.28 MP | 1329.7 | |
| Nov 23/76 | 209.67 MP | 1328.4 | |
| Dec 20/76 | 210.04 MP | 1327.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## SUMMARY OF CONTENTS

SITE NUMBER SIX

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | |
|---|---|---|---|---|
| | site | 6-21 | 6-220 | 6-310 |
| Introduction | 4 | — | — | — |
| Legend | 8 | — | — | — |
| Site Plan | 1 | — | — | — |
| Geological Sample Description | 2 | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — |
| Well Construction | — | 1 | 1 | 1 |
| Drawdown Plot | — | 0 | 1 | 2 |
| Drill Stem Test | — | 0 | 0 | 0 |
| Shut-In Pressure Data | — | 0 | 0 | 0 |
| Water Analysis | — | 2 | 2 | 3 |
| Spectral Emissions Estimates | — | 1 | 1 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER SIX

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | |
|---|---|---|---|
| | 6-21 | 6-220 | 6-310 |
| Water Analysis | 1 | 1 | 1 |
| Water Level Hydrograph | 1 | 1 | 1 |
| Well History | 1 | 1 | 1 |

### ERRATUM STATEMENT

Material Distributed in 1976

1. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
2. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 220.0 | 10.98 | 59 |
| Magnesium ($Mg^{++}$) | 59.0 | 4.86 | 26 |
| Sodium ($Na^{+}$) | 65.0 | 2.83 | 15 |
| Potassium ($K^{+}$) | 2.1 | 0.05 | 0 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 842.0 | 13.80 | 75 |
| Sulfate ($SO_4^{=}$) | 0.0 | 0.00 | 0 |
| Chloride ($Cl^{-}$) | 158.0 | 4.46 | 24 |
| Nitrate ($NO_3^{=}$) | 5.3 | 0.09 | 0 |
| Silica ($SiO_2$) | 7.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 242.0 | | |
| Magnesium (Acidified) | 60.5 | | |
| Total dissolved solids | 1138 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 18.34 | Total Cations (epm) | 18.72 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 1700 | Temperature (C) | 11.0 |
| pH | 7.1 | pH | 6.4 |
| Fluoride ($F^{-}$) | 0.5 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 829 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

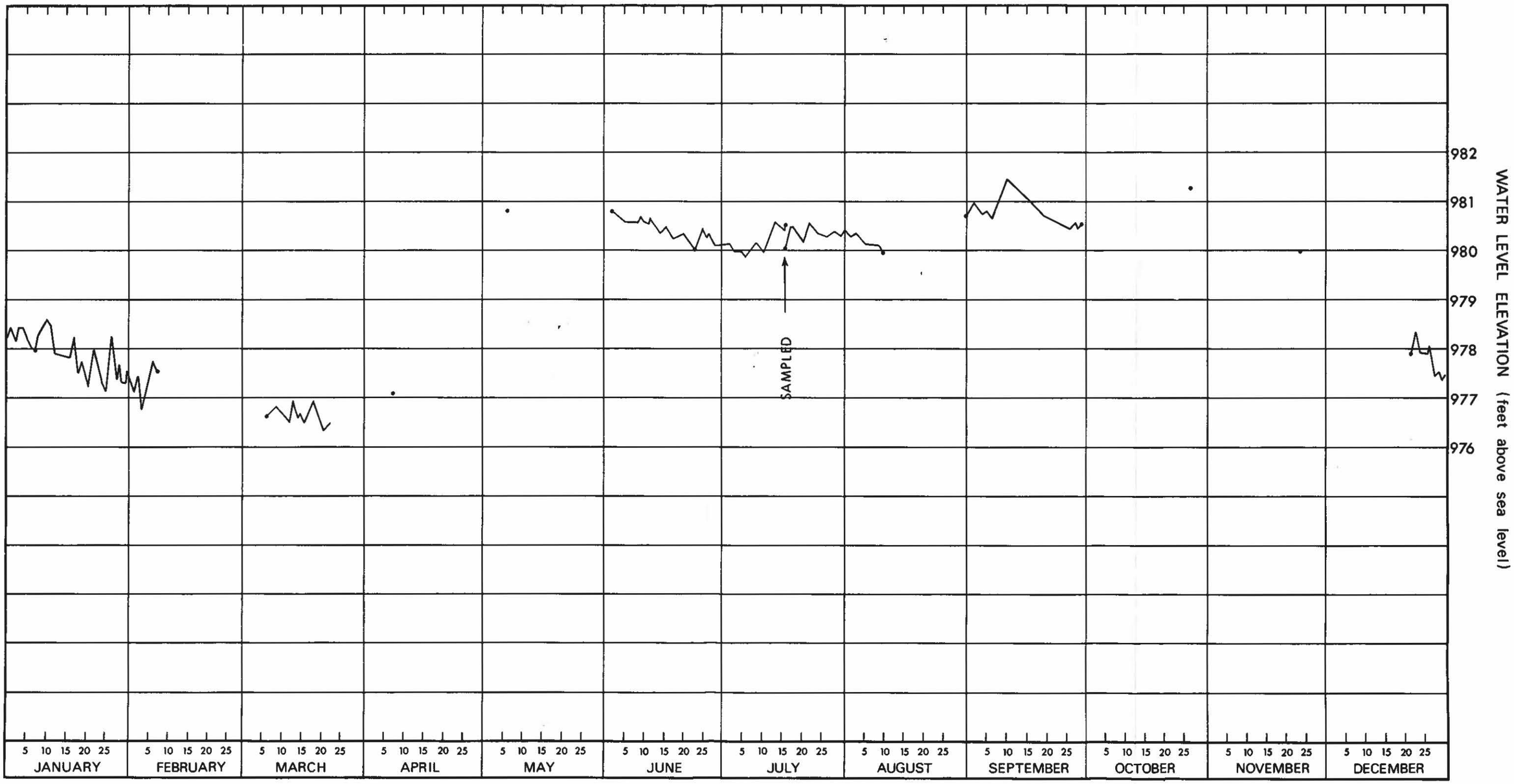
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER **6-21**

Lsd **2** Sec **18** Twp **95** R **9** W4th

Alberta Research Council

6 - 21 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 6-21

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 986.31

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 3.32 MP | 978.0 | MP (988.9) |
| Feb 7/76 | 3.45 MP | 977.6 | |
| Mar 6/76 | 3.73 MP | 976.7 | |
| Apr 7/76 | 3.59 MP | 977.1 | |
| May 6/76 | 2.45 MP | 980.9 | |
| June 2/76 | 2.46 MP | 980.8 | |
| June 23/76 | 2.70 MP | 980.0 | |
| July 16/76 | 2.54 MP | 980.6 | |
| | 2.69 MP | 980.1 | After sample; temp. 11°C |
| Aug 10/76 | 2.72 MP | 980.0 | |
| Aug 31/76 | 2.49 MP | 980.7 | |
| Sept 29/76 | 2.54 MP | 980.6 | |
| Oct 27/76 | 2.31 MP | 981.3 | |
| Nov 24/76 | 2.72 MP | 980.0 | |
| Dec 22/76 | 3.36 MP | 977.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 40.0 | 2.00 | 3 |
| Magnesium ($Mg^{++}$) | 24.0 | 1.98 | 3 |
| Sodium ($Na^{+}$) | 1450.0 | 63.07 | 90 |
| Potassium ($K^{+}$) | 133.0 | 3.40 | 5 |
| Carbonate ($CO_3^{=}$) | 86.0 | 2.87 | 4 |
| Bicarbonate ($HCO_3^{-}$) | 1969.0 | 32.27 | 47 |
| Sulfate ($SO_4^{=}$) | 11.2 | 0.23 | 0 |
| Chloride ($Cl^{-}$) | 1200.0 | 33.84 | 49 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 3.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 9.9 | | |
| Magnesium (Acidified) | 25.3 | | |
| Total dissolved solids | 3908 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 69.23 | Total Cations (epm) | 70.45 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 7000 | Temperature (C) | 5.0 | |
| pH | 8.7 | pH | 8.1 | |
| Fluoride ($F^{-}$) | 0.9 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 2220 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

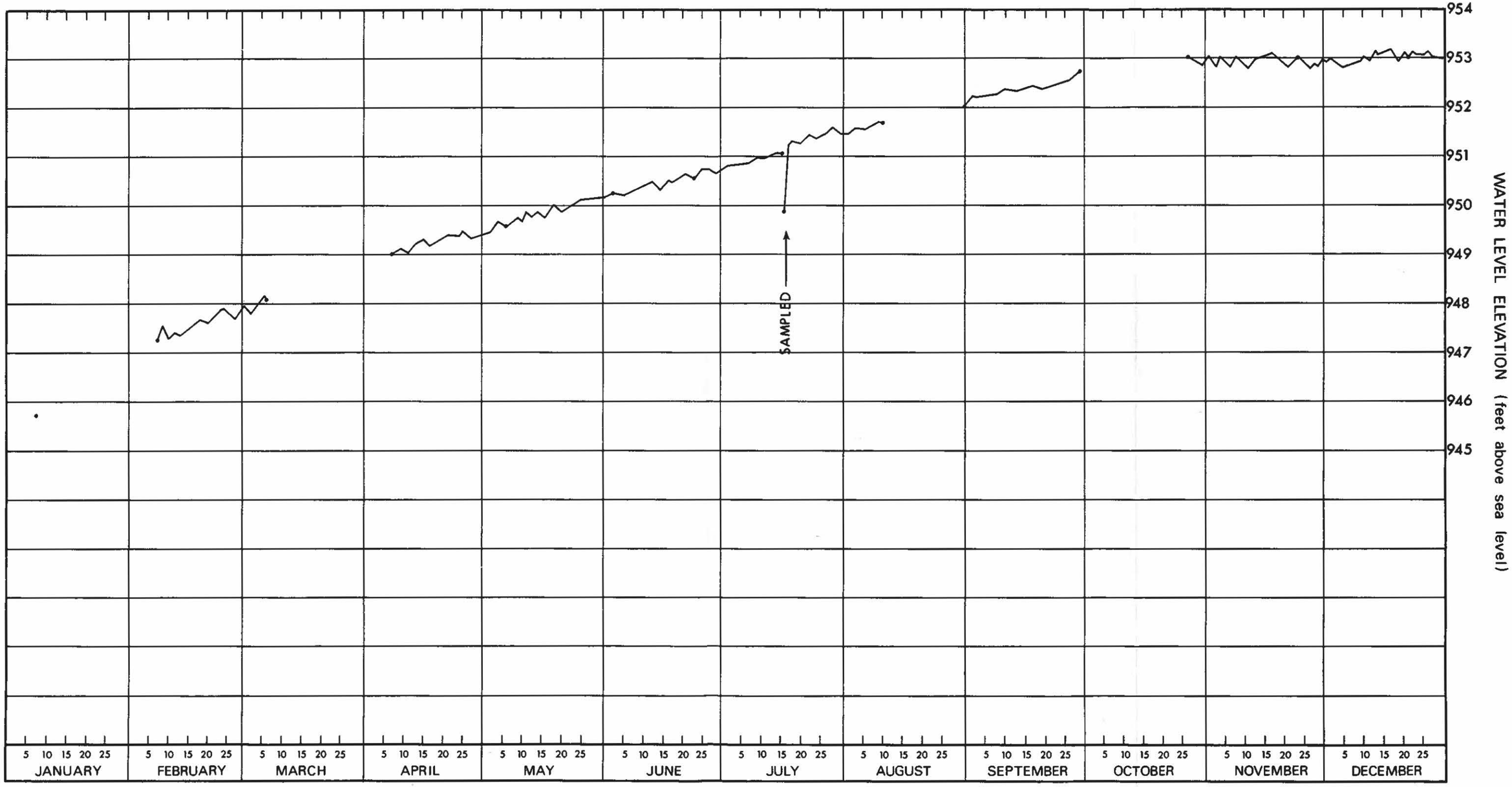
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

6 - 220 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 6-220

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 985.45

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 13.06 MP | 945.8 | MP (988.6) |
| Feb 7/76 | 12.60 MP | 947.3 | |
| Mar 6/76 | 12.35 MP | 948.1 | |
| Apr 7/76 | 12.06 MP | 949.0 | |
| May 6/76 | 11.90 MP | 949.6 | |
| June 2/76 | 11.69 MP | 950.3 | |
| June 23/76 | 11.60 MP | 950.5 | |
| July 16/76 | 11.43 MP | 951.1 | |
| | 11.80 MP | 949.9 | After sample; temp. 5°C |
| Aug 10/76 | 11.25 MP | 951.7 | |
| Aug 31/76 | 11.15 MP | 952.0 | |
| Sept 29/76 | 10.94 MP | 952.7 | |
| Oct 27/76 | 10.85 MP | 953.0 | |
| Nov 24/76 | 10.84 MP | 953.0 | |
| Dec 22/76 | 10.84 MP | 953.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 16, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 111.0 | 5.54 | 3 |
| Magnesium ($Mg^{++}$) | 233.0 | 19.18 | 11 |
| Sodium ($Na^{+}$) | 3475.0 | 151.15 | 85 |
| Potassium ($K^{+}$) | 78.0 | 2.00 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 869.0 | 14.24 | 8 |
| Sulfate ($SO_4^{=}$) | 17.7 | 0.37 | 0 |
| Chloride ($Cl^{-}$) | 5460.0 | 153.98 | 91 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0 |
| Silica ($SiO_2$) | 6.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 122.1 | | |
| Magnesium (Acidified) | 234.3 | | |
| Total dissolved solids | 10340 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 168.59 | Total Cations (epm) | 177.86 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 6.0 | |
| pH | 7.9 | pH | 6.9 | |
| Fluoride ($F^{-}$) | 0.4 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 2182 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

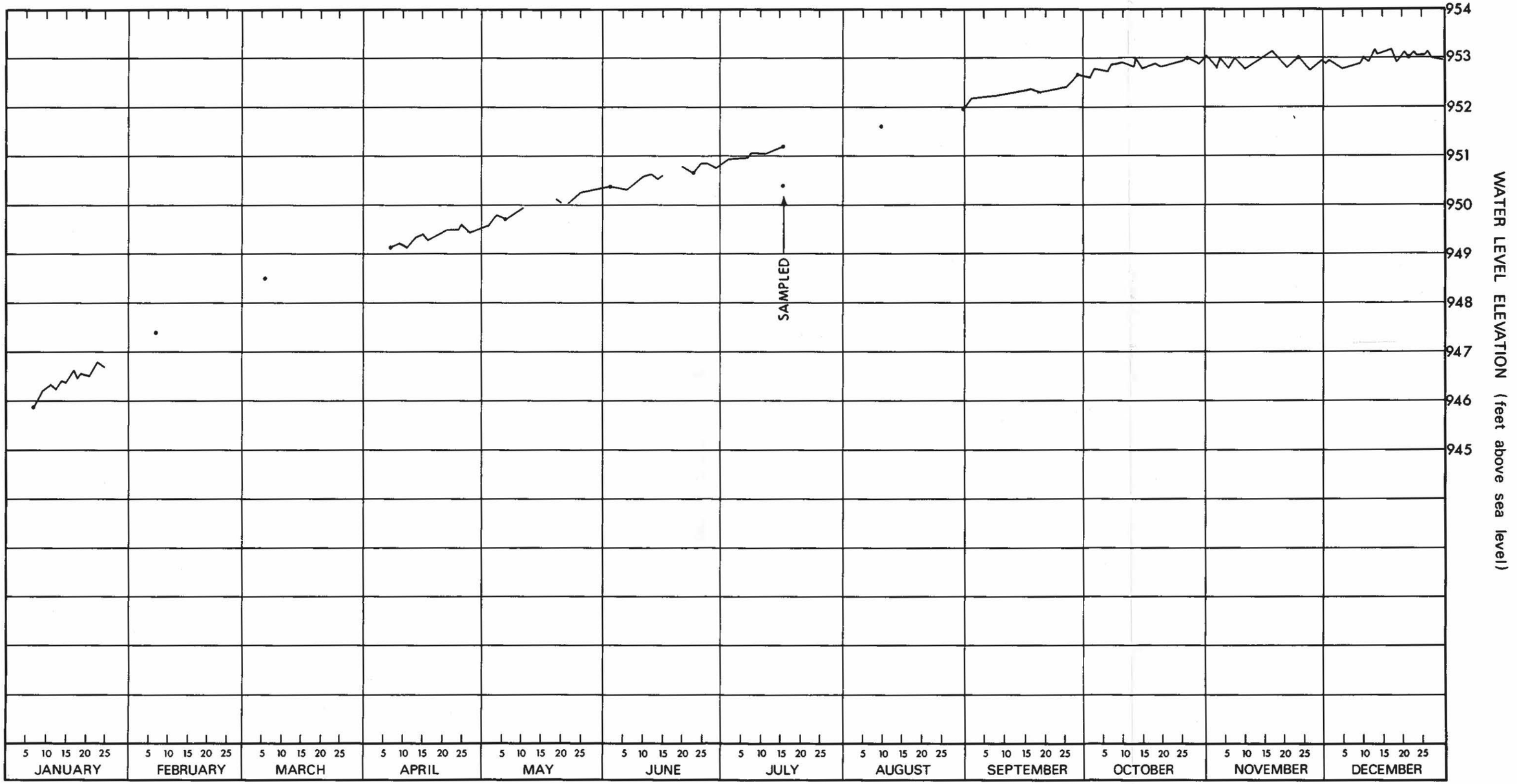
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

6 - 310 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 6-310

Lsd 2 Sec 18 Twp 95 R 9 W4th

Alberta Research Council

Elevation of top of casing 987.94

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 13.36 MP | 945.9 | MP (989.7) |
| Feb 7/76 | 12.90 MP | 947.4 | |
| Mar 6/76 | 12.66 MP | 948.2 | |
| Apr 7/76 | 12.36 MP | 949.2 | |
| May 6/76 | 12.19 MP | 949.7 | |
| June 2/76 | 11.99 MP | 950.4 | |
| June 23/76 | 11.90 MP | 950.7 | |
| July 16/76 | 11.73 MP | 951.2 | |
| | 11.98 MP | 950.4 | After sample; temp. 6°C |
| Aug 10/76 | 11.61 MP | 951.6 | |
| Aug 31/76 | 11.50 MP | 952.0 | |
| Sept 29/76 | 11.29 MP | 952.7 | |
| Oct 27/76 | 11.19 MP | 953.0 | |
| Nov 24/76 | 11.19 MP | 953.0 | |
| Dec 22/76 | 11.18 MP | 953.0 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## SUMMARY OF CONTENTS

SITE NUMBER SEVEN

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | site | 7-32 | 7-135 | 7-337 | 7-594 | 7-933 |
| Introduction | 4 | — | — | — | — | — |
| Legend | 8 | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — |
| Geological Sample Description | 6 | — | — | — | — | — |
| Geophysical and Geological Logs | 2 | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 1 | 4 | 3 | 1 | 0 |
| Drill Stem Test | — | 0 | 0 | 0 | 2 | 2 |
| Shut-In Pressure Data | — | 0 | 0 | 0 | 2 | 1 |
| Water Analysis | — | 3 | 3 | 5 | 4 | 4 |
| Spectral Emissions Estimates | — | 1 | 1 | 1 | 0 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER SEVEN

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | site | 7-32 | 7-135 | 7-337 | 7-594 | 7-933 |
| Geological Sample Description | 3* | — | — | — | — | — |
| Geophysical and Geological Logs | 1* | — | — | — | — | — |
| Shut-In Pressure Data | — | 0 | 0 | 0 | 0 | 1* |
| Water Analysis | — | 1 | 1 | 1 | 1 | 1 |
| Water Level Hydrograph | — | 2** | 1 | 1 | 1 | 1 |
| Well History | — | 1* | 1 | 1 | 1 | 1 |

*Erratum sheets replacing material distributed in 1976.
**Includes 1976 hydrograph and corrected 1975 hydrograph.

# SITE 7

## ERRATUM STATEMENT

### Material Distributed in 1976

1. Corrected GEOLOGICAL SAMPLE DESCRIPTION pages have been issued. Pages indexed 7-G-77 have replaced those indexed 7-G-76.
2. A corrected GEOPHYSICAL AND GEOLOGICAL LOGS page has been issued. The page indexed 7-G-77 has replaced 7-G-76.
3. The "formation tested" on the DRILL STEM TEST page for well 7-594 should be changed to Prairie Evaporite.
4. The "formation tested" on the DRILL STEM TEST page for well 7-933 should be changed to McLean River/La Loche.
5. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
6. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.
7. A new WATER LEVEL HYDROGRAPH has been issued for well 7-32 covering 1975. The page index is 7-32-H-77 and replaces 7-32-H-76.
8. A new WELL HISTORY has been issued for well 7-32 covering 1975 and 1976. The page index is 7-32-W-77 and replaces 7-32-W-76.
9. The top of casing elevation (TOC elev) shown on the WELL CONSTRUCTION page for well 7-32 should be 1073.42 not 1972.42.
10. A new SHUT-IN PRESSURE DATA page has been issued for well 7-933. The page indexed 7-973-D-77 has replaced 7-973-D-76.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 90.0 | 4.49 | 51 |
| Magnesium ($Mg^{++}$) | 32.0 | 2.63 | 30 |
| Sodium ($Na^{+}$) | 35.0 | 1.52 | 17 |
| Potassium ($K^{+}$) | 5.0 | 0.13 | 2 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 478.0 | 7.83 | 97 |
| Sulfate ($SO_4^{=}$) | 6.6 | 0.14 | 2 |
| Chloride ($Cl^{-}$) | 4.0 | 0.11 | 1 |
| Nitrate ($NO_3^{=}$) | 0.7 | 0.01 | 0 |
| Silica ($SiO_2$) | 9.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 84.7 | | |
| Magnesium (Acidified) | 28.6 | | |
| Total dissolved solids | 426 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 8.10 | Total Cations (epm) | 8.78 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 720 | Temperature (C) | 7.0 | |
| pH | 7.6 | pH | 6.9 | |
| Fluoride ($F^{-}$) | 0.6 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 522 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

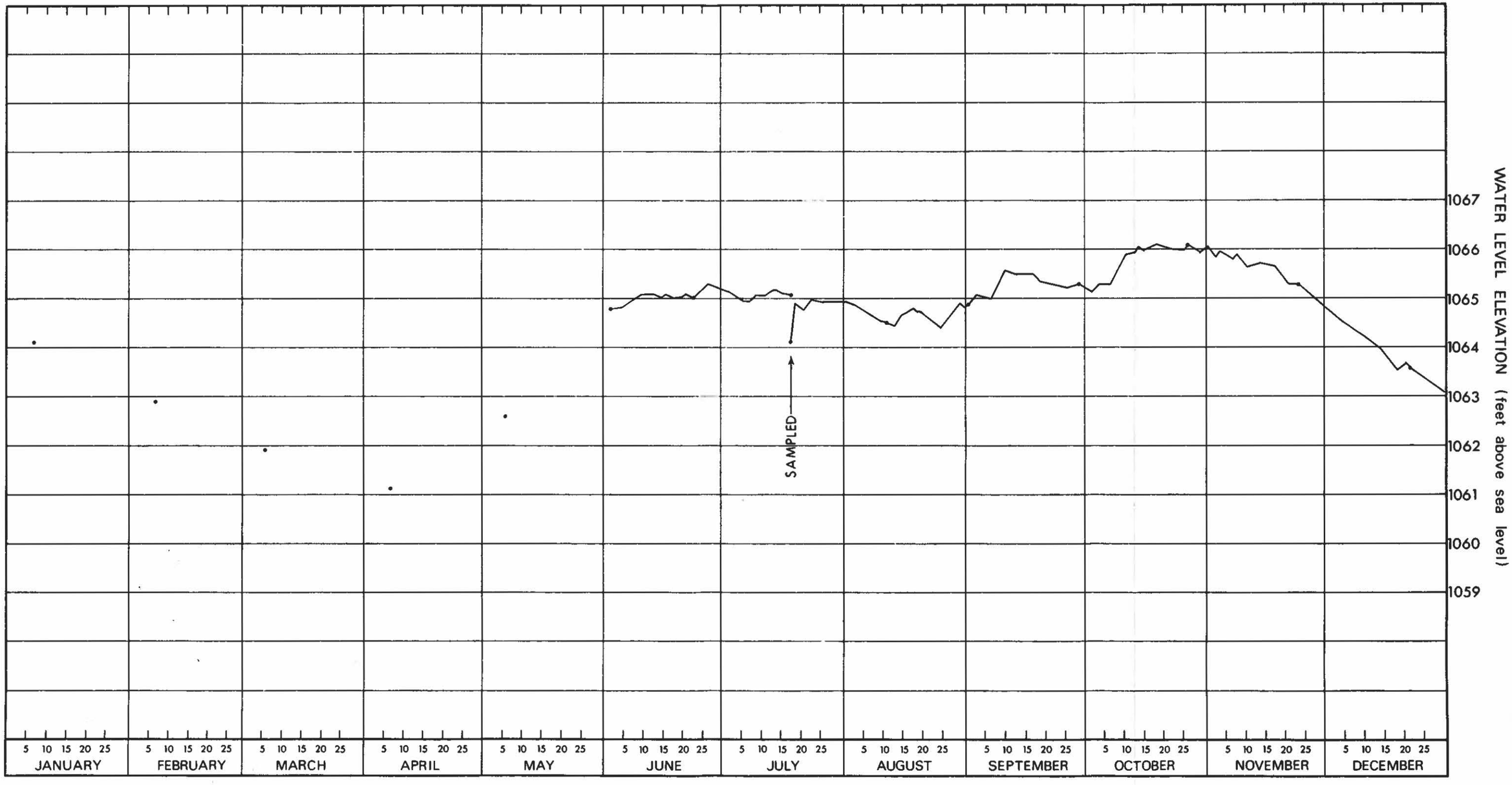
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

7 - 32 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 7-32

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1073.42

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 29/75 | | | Well completed; water sample, bail 15 gallons recovery T = 4 IGPD/FT |
| Feb 8/75 | 3.67 MP | 1064.1 | MP = 2.65 TOC, (1076.1) |
| Feb 25/75 | 3.93 MP | 1063.2 | |
| Mar 14/75 | 4.04 MP | 1062.8 | |
| Apr 16/75 | 4.30 MP | 1062.0 | |
| May 13/75 | 4.28 MP | 1062.1 | |
| June 10/75 | 2.99 MP | 1066.3 | |
| July 9/75 | 2.98 MP | 1066.3 | |
| Aug 14/75 | 2.95 MP | 1066.4 | |
| Sept 10/75 | 2.67 MP | 1067.3 | Sampled well; temp. 7.5°C |
| | 2.94 MP | 1066.5 | After sample |
| Oct 7/75 | 2.60 MP | 1067.6 | |
| Nov 7/75 | 2.64 MP | 1067.4 | |
| Dec 7/75 | 3.10 MP | 1065.9 | |
| Jan 7/76 | 3.65 MP | 1064.1 | |
| Feb 7/76 | 4.02 MP | 1062.9 | |
| Mar 6/76 | 4.32 MP | 1061.9 | |
| Apr 7/76 | 4.56 MP | 1061.1 | |
| May 6/76 | 4.11 MP | 1062.6 | |
| June 2/76 | 3.23 MP | 1064.8 | |
| June 23/76 | 3.17 MP | 1065.0 | |
| July 18/76 | 3.15 MP | 1065.1 | |
| | 3.44 MP | 1064.1 | After sample; temp. 7°C |
| Aug 10/76 | 3.32 MP | 1064.5 | |
| Sept 1/76 | 3.20 MP | 1064.9 | |
| Sept 29/76 | 3.08 MP | 1065.4 | |
| Oct 27/76 | 2.85 MP | 1066.1 | |
| Nov 24/76 | 3.07 MP | 1065.1 | |
| Dec 22/76 | 3.61 MP | 1063.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.6 | 0.18 | 1 |
| Magnesium ($Mg^{++}$) | 12.5 | 1.03 | 6 |
| Sodium ($Na^{+}$) | 341.0 | 14.83 | 85 |
| Potassium ($K^{+}$) | 53.0 | 1.36 | 8 |
| Carbonate ($CO_3^{=}$) | 82.0 | 2.73 | 16 |
| Bicarbonate ($HCO_3^{-}$) | 800.0 | 13.11 | 78 |
| Sulfate ($SO_4^{=}$) | 4.0 | 0.08 | 1 |
| Chloride ($Cl^{-}$) | 28.0 | 0.79 | 5 |
| Nitrate ($NO_3^{=}$) | 1.5 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.6 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 7.4 | | |
| Magnesium (Acidified) | 12.7 | | |
| Total dissolved solids | 984 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 16.74 | Total Cations (epm) | 17.40 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 1520 | Temperature (C) | 4.0 | |
| pH | 8.9 | pH | 9.4 | |
| Fluoride ($F^{-}$) | 1.4 Mg/L | Carbonate ($CO_3^{=}$) | 154 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 683 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

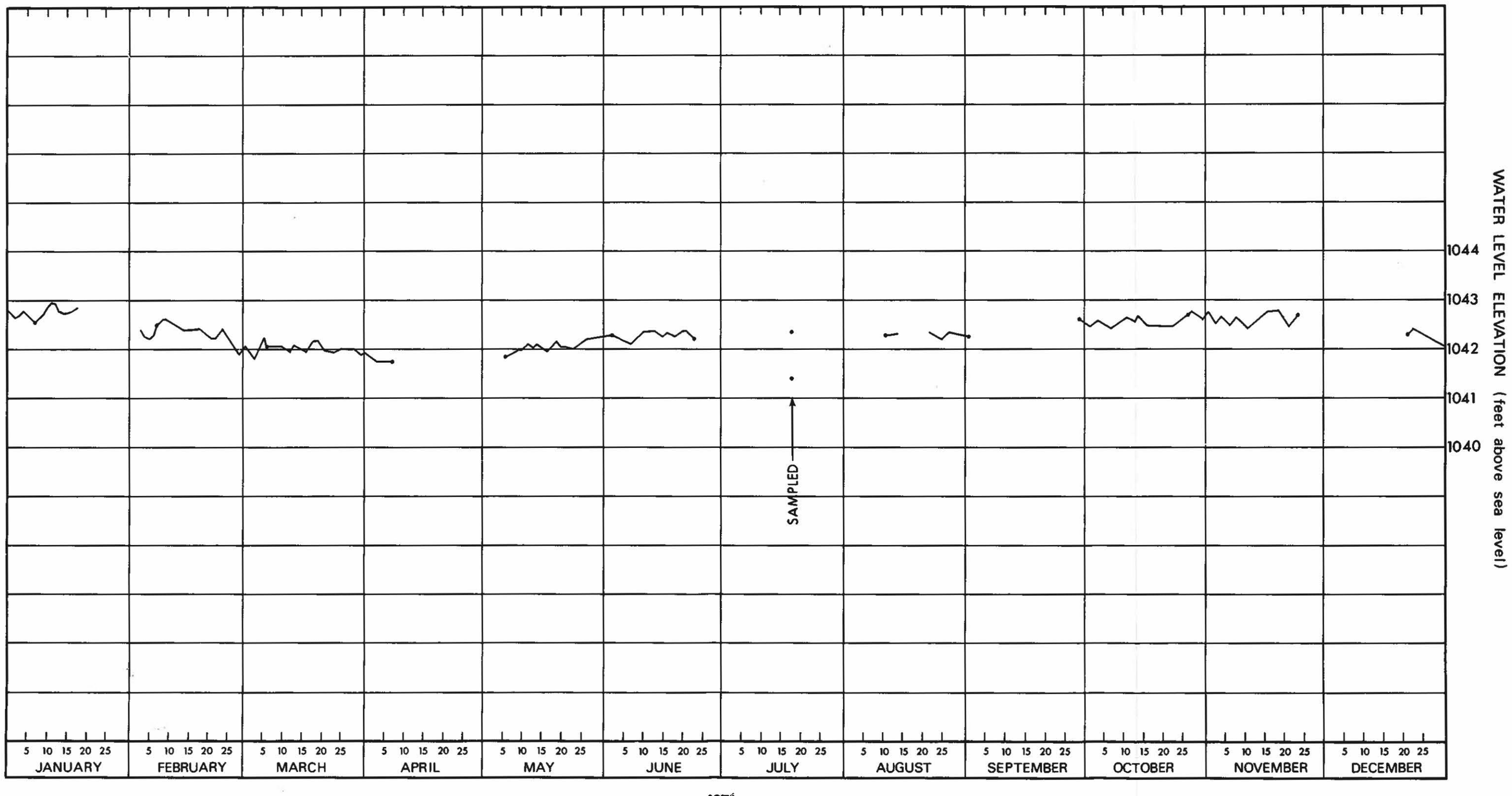
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

7 - 135 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 7-135

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.93

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 9.85 MP | 1042.6 | MP (1074.9) |
| Feb 7/76 | 9.87 MP | 1042.5 | |
| Mar 6/76 | 10.01 MP | 1042.1 | |
| Apr 7/76 | 10.11 MP | 1041.7 | |
| May 6/76 | 10.07 MP | 1041.9 | |
| June 2/76 | 9.84 MP | 1042.2 | New MP = 0.80 m TOC, (1074.5) |
| June 23/76 | 9.86 MP | 1042.2 | |
| July 18/76 | 9.82 MP | 1042.3 | |
| | 10.11 MP | 1041.3 | After sample; temp. 4°C |
| Aug 11/76 | 9.84 MP | 1042.2 | |
| Sept 1/76 | 9.85 MP | 1042.2 | |
| Sept 29/76 | 9.74 MP | 1042.6 | |
| Oct 27/76 | 9.69 MP | 1042.7 | |
| Nov 24/76 | 9.69 MP | 1042.7 | |
| Dec 22/76 | 9.81 MP | 1042.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 6.6 | 0.33 | 1 |
| Magnesium ($Mg^{++}$) | 25.0 | 2.06 | 7 |
| Sodium ($Na^{+}$) | 599.0 | 26.05 | 90 |
| Potassium ($K^{+}$) | 23.3 | 0.60 | 2 |
| Carbonate ($CO_3^{=}$) | 31.2 | 1.04 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 1154.0 | 18.91 | 61 |
| Sulfate ($SO_4^{=}$) | 3.7 | 0.08 | 0 |
| Chloride ($Cl^{-}$) | 398.0 | 11.22 | 36 |
| Nitrate ($NO_3^{=}$) | 0.4 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 6.2 | | |
| Magnesium (Acidified) | 25.3 | | |
| Total dissolved solids | 1618 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 31.26 | Total Cations (epm) | 29.04 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2700 | Temperature (C) | 5.0 | |
| pH | 8.5 | pH | 8.6 | |
| Fluoride ($F^{-}$) | 1.2 Mg/L | Carbonate ($CO_3^{=}$) | 62 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 1069 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

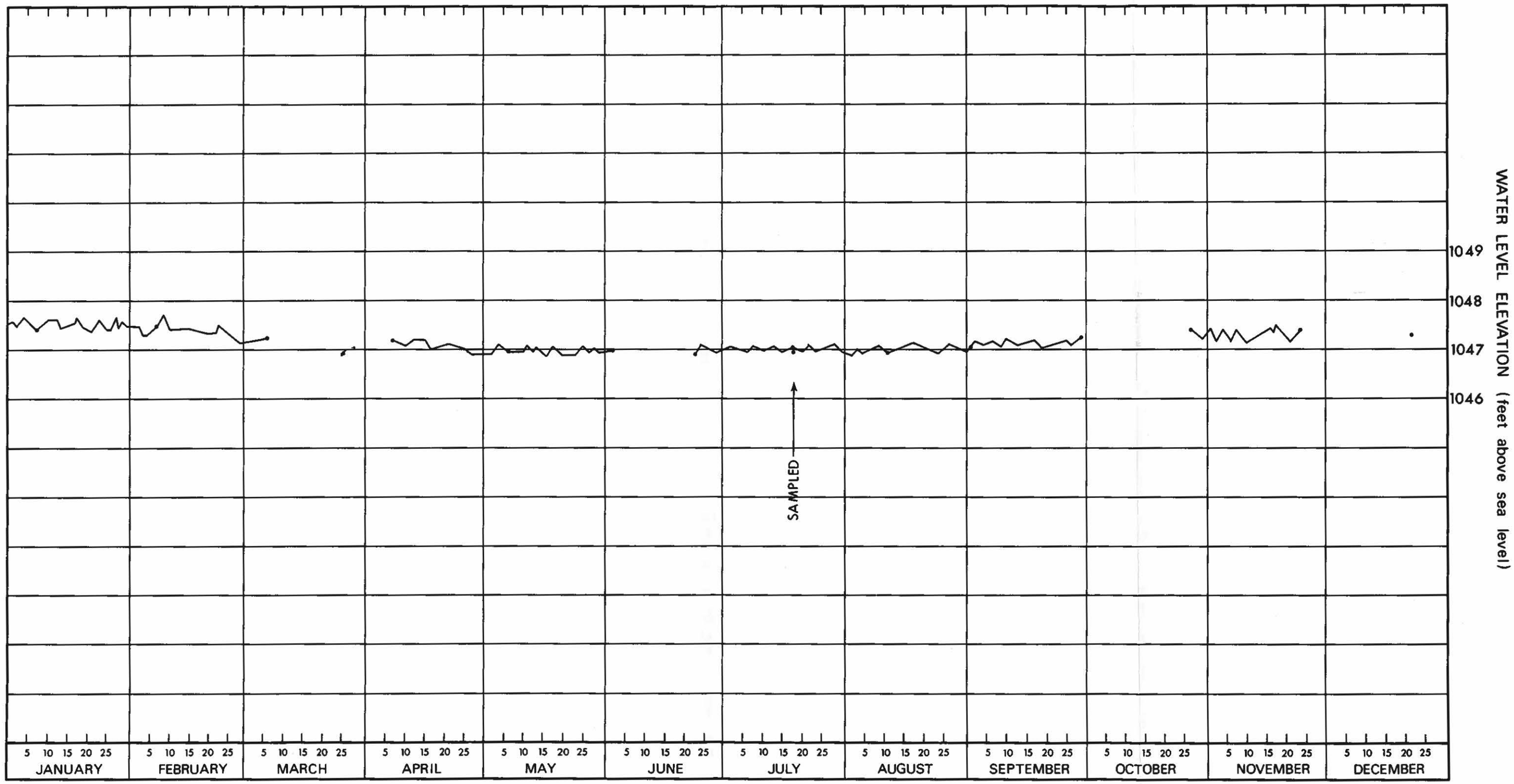
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

7 - 337 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 7-337

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1071.68

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 8.31 MP | 1047.4 | MP (1074.7) |
| Feb 7/76 | 8.29 MP | 1047.5 | |
| Mar 6/76 | 8.37 MP | 1047.2 | |
| Apr 7/76 | 8.38 MP | 1047.2 | |
| May 6/76 | 8.45 MP | 1047.0 | |
| June 2/76 | 8.42 MP | 1047.0 | New MP = 0.89 m TOC, (1074.6) |
| June 23/76 | 8.44 MP | 1046.9 | |
| July 18/76 | 8.41 MP | 1047.0 | |
| | 8.43 MP | 1046.9 | After sample; temp. 5°C |
| Aug 11/76 | 8.43 MP | 1046.9 | |
| Sept 1/76 | 8.40 MP | 1047.0 | |
| Sept 29/76 | 8.34 MP | 1047.2 | |
| Oct 27/76 | 8.30 MP | 1047.4 | |
| Nov 24/76 | 8.30 MP | 1047.4 | |
| Dec 22/76 | 8.35 MP | 1047.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 107.0 | 5.34 | 9 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 750.0 | 32.62 | 56 |
| Potassium ($K^{+}$) | 779.0 | 19.93 | 34 |
| Carbonate ($CO_3^{=}$) | 67.0 | 2.23 | 9 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 201.0 | 4.18 | 17 |
| Chloride ($Cl^{-}$) | 640.0 | 18.05 | 74 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.1 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 121.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 3574 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 24.49 | Total Cations (epm) | 57.89 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 7.0 | |
| pH | 12.5 | pH | 12.4 | |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 74 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 646 | Mg/L |
| | | Conductivity | | |

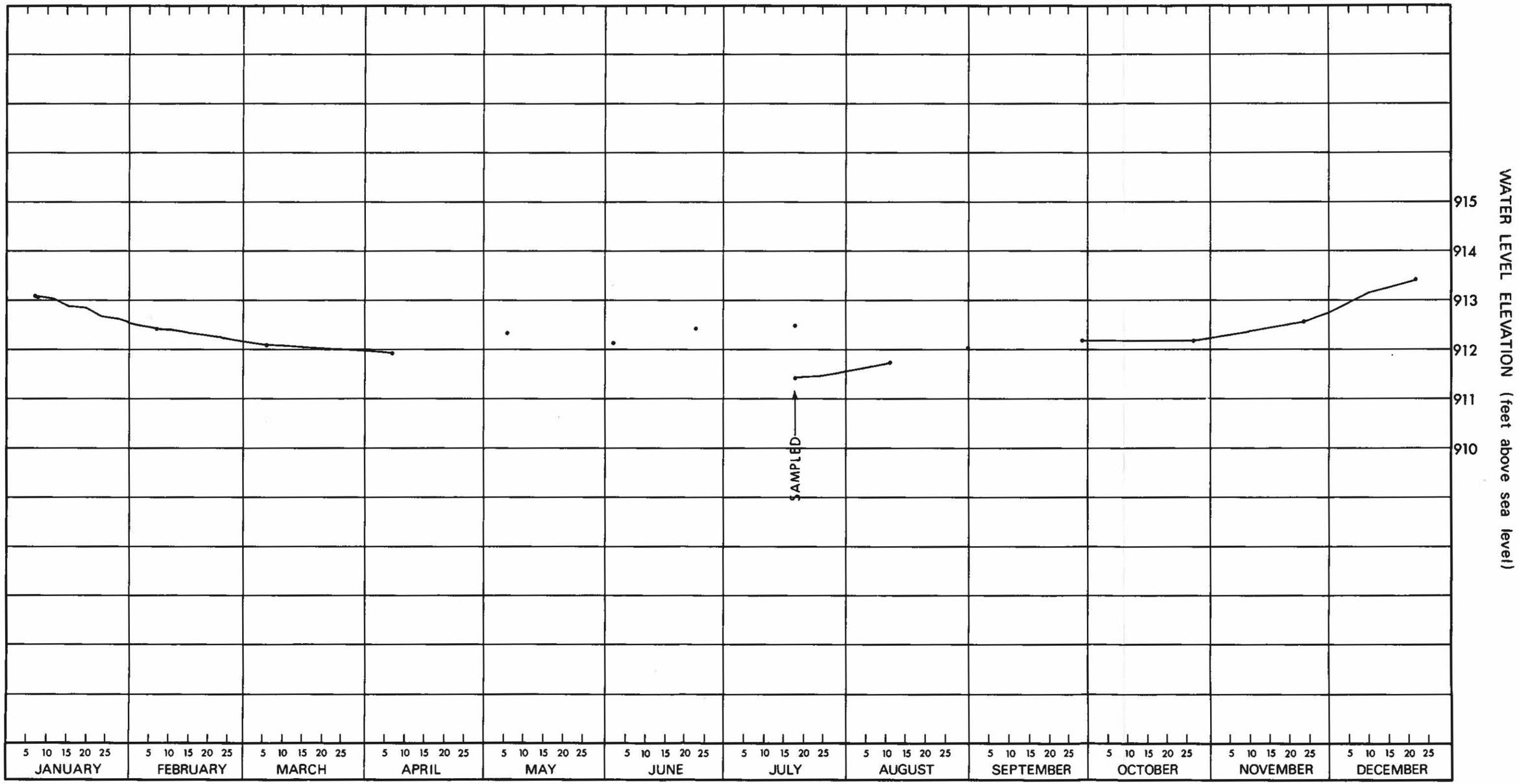
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

7 - 594 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 7-594

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 49.15 MP | 913.1 | MP (1074.3) |
| Feb 7/76 | 49.36 MP | 912.4 | |
| Mar 6/76 | 49.46 MP | 912.1 | |
| Apr 7/76 | 49.51 MP | 911.9 | |
| May 6/76 | 49.50 MP | 912.3 | New MP = 0.78 m TOC, (1074.7) |
| June 2/76 | 49.56 MP | 912.1 | |
| June 23/76 | 49.47 MP | 912.4 | |
| July 18/76 | 49.46 MP | 912.5 | |
| | 49.78 MP | 911.4 | After sample; temp. 7°C |
| Aug 11/76 | 49.68 MP | 911.7 | |
| Sept 1/76 | 49.59 MP | 912.0 | |
| Sept 29/76 | 49.55 MP | 912.2 | |
| Oct 27/76 | 49.55 MP | 912.2 | |
| Nov 24/76 | 49.41 MP | 912.6 | |
| Dec 22/76 | 49.19 MP | 913.4 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 18, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 390.0 | 19.46 | 36 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 750.0 | 32.62 | 60 |
| Potassium ($K^{+}$) | 108.0 | 2.76 | 5 |
| Carbonate ($CO_3^{=}$) | 33.6 | 1.12 | 2 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 747.0 | 15.55 | 32 |
| Chloride ($Cl^{-}$) | 1138.0 | 32.09 | 66 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 5.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 387.2 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 3388 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 48.78 | Total Cations (epm) | 54.85 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 7000 | Temperature (C) | 6.0 | |
| pH | 12.0 | pH | 12.2 | |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 48 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 170 | Mg/L |
| | | Conductivity | | |

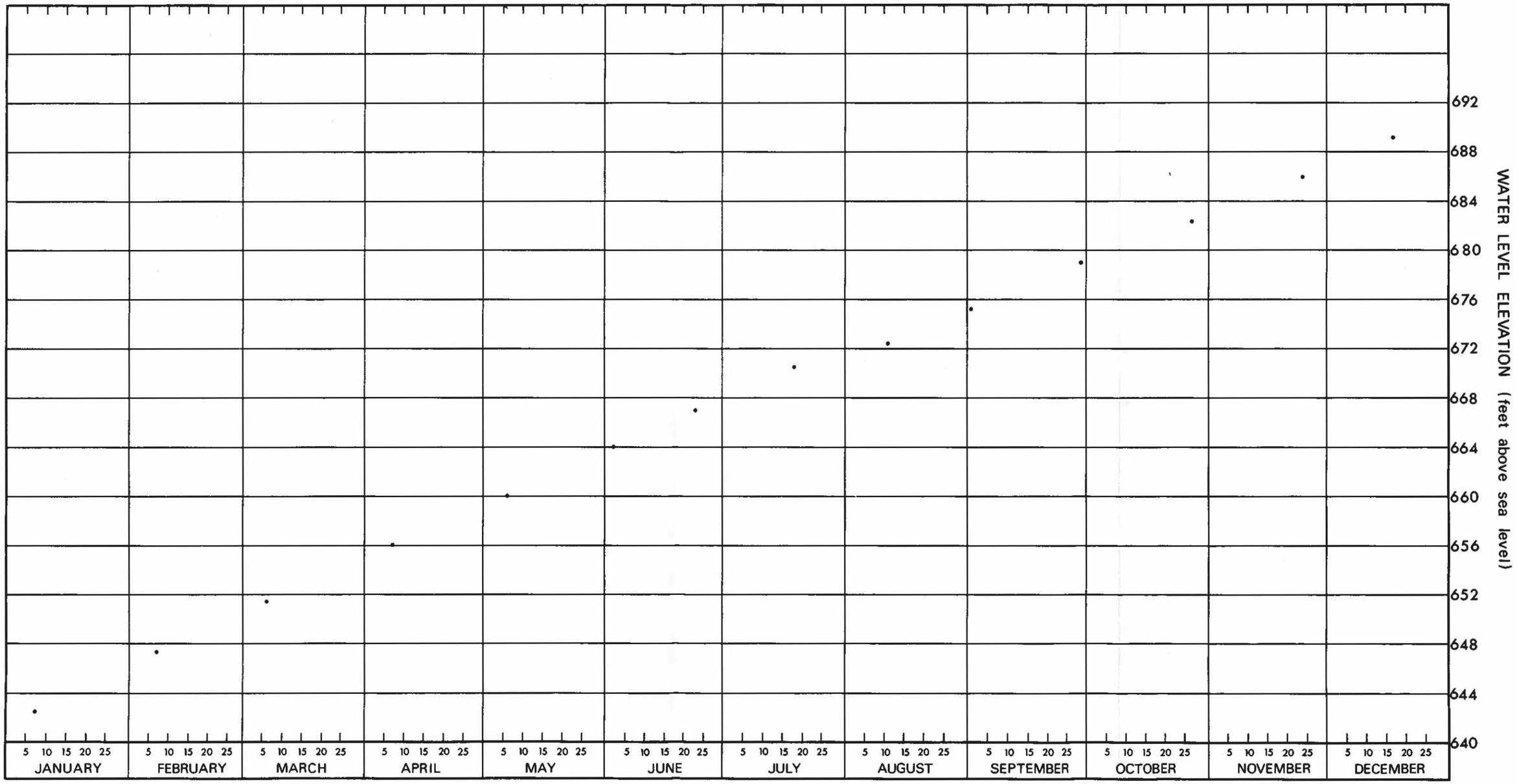
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

7 - 933 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 7-933

Lsd 13 Sec 20 Twp 95 R 8 W4th

Alberta Research Council

Elevation of top of casing 1072.40

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 7/76 | 131.53 MP | 642.6 | MP (1074.0) |
| Feb 7/76 | 130.08 MP | 647.3 | |
| Mar 6/76 | 128.82 MP | 651.5 | |
| Apr 7/76 | 127.45 MP | 656.0 | |
| May 6/76 | 126.19 MP | 660.1 | |
| June 2/76 | 125.00 MP | 664.0 | |
| June 23/76 | 124.08 MP | 667.0 | |
| July 18/76 | 123.02 MP | 670.5 | Sampled; temp. 6°C |
| Aug 11/76 | 122.40 MP | 672.5 | |
| Sept 1/76 | 121.56 MP | 675.3 | |
| Sept 29/76 | 120.44 MP | 679.0 | |
| Oct 27/76 | 119.35 MP | 682.5 | |
| Nov 24/76 | 118.32 MP | 685.9 | |
| Dec 22/76 | 117.36 MP | 689.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## SUMMARY OF CONTENTS

SITE NUMBER EIGHT

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | | | |
|---|---|---|---|---|---|---|---|
| | site | 8-34 | 8-114 | 8-220 | 8-370 | 8-532 | 8-716 |
| Introduction | 4 | — | — | — | — | — | — |
| Legend | 8 | — | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — | — |
| Geological Sample Description | 3 | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 0 | 3 | 0 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 2 | 1 | 2 | 2 |
| Shut-In Pressure Data | — | 0 | 0 | 1 | 0 | 1 | 1 |
| Water Analysis | — | 2 | 3 | 2 | 1 | 3 | 3 |
| Spectral Emissions Estimates | — | 1 | 1 | 1 | 1 | 1 | 0 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 0 | 1 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER EIGHT

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | 8-34 | 8-114 | 8-220 | 8-370 | 8-532 | 8-716 |
| Shut-In Pressure Data | 0 | 0 | 0 | 0 | 0 | 1* |
| Water Analysis | 1 | 1 | 1 | 1 | 1 | 1 |
| Water Level Hydrograph | 1 | 1 | 1 | 1 | 1 | 1 |
| Well History | 1 | 1 | 1* | 1 | 1* | 1 |

*Supersedes page issued in 1976

### ERRATUM STATEMENT

Material Distributed in 1976

1. Well 8-532 - A different WELL HISTORY page has been issued covering 1975. The page index is 8-532-W-77 and replaces 8-532-W-76.
2. Well 8-220 - A different WELL HISTORY page has been issued covering 1975. The page index is 8-220-W-77 and replaces 8-220-W-76.
3. The Grand Rapids Formation should be listed on the GEOLOGICAL SAMPLE DESCRIPTION at the interval 60 to 70 and from depths of 62 to 112 feet on the GEOPHYSICAL AND GEOLOGICAL LOGS.
4. The McMurray Formation should be listed on the GEOLOGICAL SAMPLE DESCRIPTION at the interval 330 to 350 and from depths of 336 to 510 on the GEOPHYSICAL AND GEOLOGICAL LOGS.
5. The "formation tested" on the DRILL STEM TEST page for well 8-370 (page 8-370-D-76) should be changed to "McMurray".
6. The stratigraphic symbol Dw on the GEOPHYSICAL AND GEOLOGICAL LOGS page should be changed to Dbl.
7. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
8. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.
9. A new SHUT-IN PRESSURE DATA page has been issued for Well 8-716. The page indexed 8-716-D-77 has replaced 8-716-D-76.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 30.0 | 1.50 | 16 |
| Magnesium ($Mg^{++}$) | 16.8 | 1.38 | 14 |
| Sodium ($Na^{+}$) | 152.0 | 6.61 | 69 |
| Potassium ($K^{+}$) | 5.4 | 0.14 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 466.0 | 7.64 | 84 |
| Sulfate ($SO_4^{=}$) | 18.2 | 0.38 | 4 |
| Chloride ($Cl^{-}$) | 36.0 | 1.02 | 11 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 25.3 | | |
| Magnesium (Acidified) | 17.9 | | |
| Total dissolved solids | 500 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 9.05 | Total Cations (epm) | 9.63 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 850 | Temperature (C) | 6.0 | |
| pH | 7.9 | pH | 7.9 | |
| Fluoride ($F^{-}$) | 0.4 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 478 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

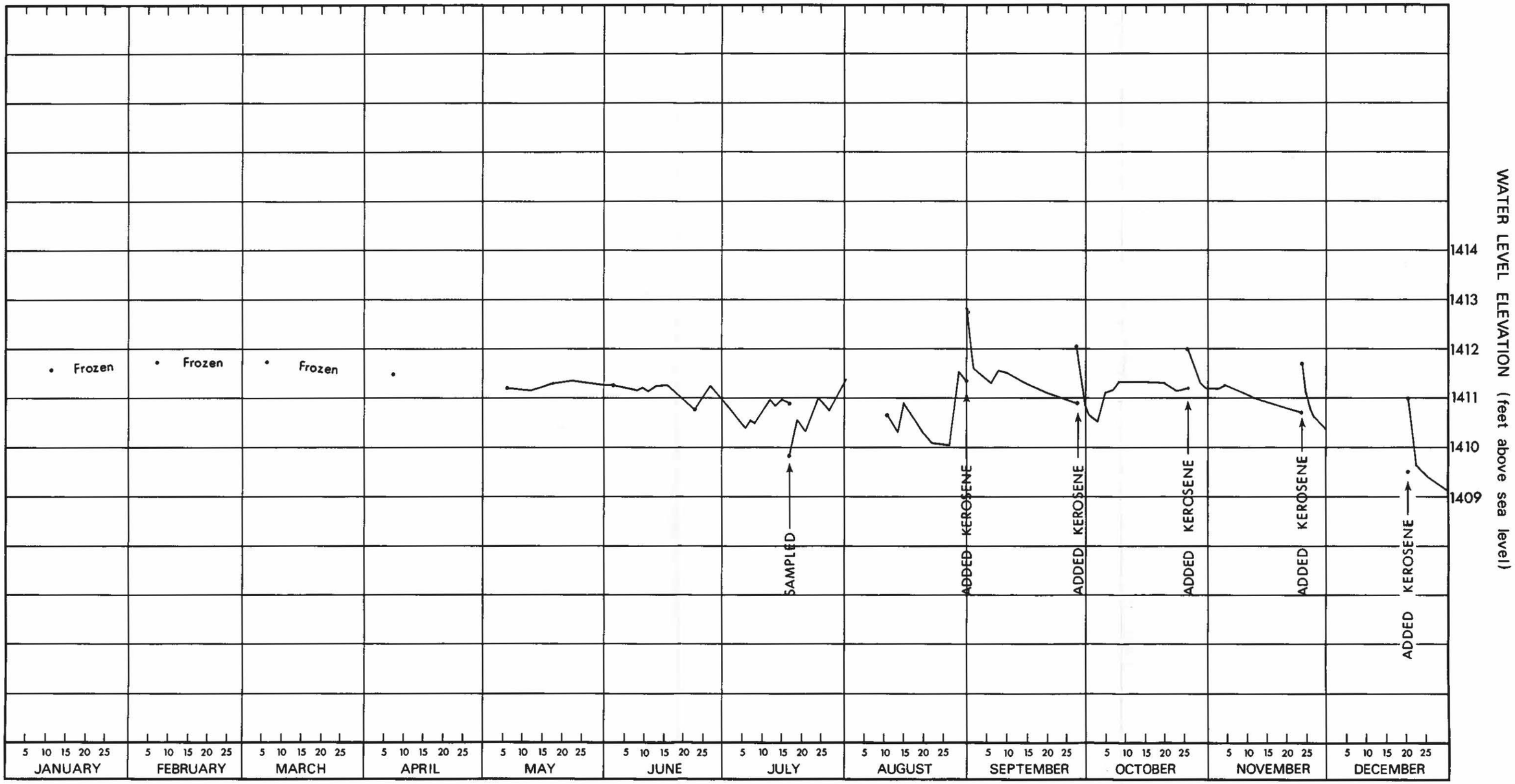
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

8 - 34 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 8-34

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1413.18

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 1.20 MP | 1411.6 | MP (1415.5); frozen |
| Feb 7/76 | 1.15 MP | 1411.7 | Frozen |
| Mar 6/76 | 1.15 MP | 1411.7 | Frozen |
| Apr 7/76 | 1.23 MP | 1411.5 | Frozen |
| May 5/76 | 1.32 MP | 1411.2 | |
| June 2/76 | 1.30 MP | 1411.2 | |
| June 23/76 | 1.45 MP | 1410.7 | |
| July 17/76 | 1.42 MP | 1410.8 | |
| | 1.74 MP | 1409.8 | After sample; temp. 6°C |
| Aug 11/76 | 1.49 MP | 1410.6 | |
| Aug 31/76 | 1.27 MP | 1411.3 | Added 1.5 gallons of kerosene; water level elevation adjusted |
| | TOC | 1412.80 | downward by .4 ft after this date |
| Sept 28/76 | 1.30 MP | 1410.8 | |
| | .80 MP | 1412.0 | Added 2 gallons of kerosene; water level elevation adjusted downward by .9 ft after this date |
| Oct 26/76 | 1.04 MP | 1411.2 | |
| | .72 MP | 1412.0 | Added 1 gallon of kerosene; water level elevation adjusted downward by 1.1 ft after this date |
| Nov 24/76 | 1.13 MP | 1410.7 | |
| | .74 MP | 1411.7 | Added 1 gallon of kerosene; water level elevation adjusted downward by 1.4 ft after this date |
| Dec 21/76 | 1.41 MP | 1409.5 | Added 1.5 gallon of kerosene; water |
| | .81 MP | 1411.0 | level elevation adjusted downward by 1.8 ft after this date |

MP - Depth from measuring point
TOC - Depth from top of casing

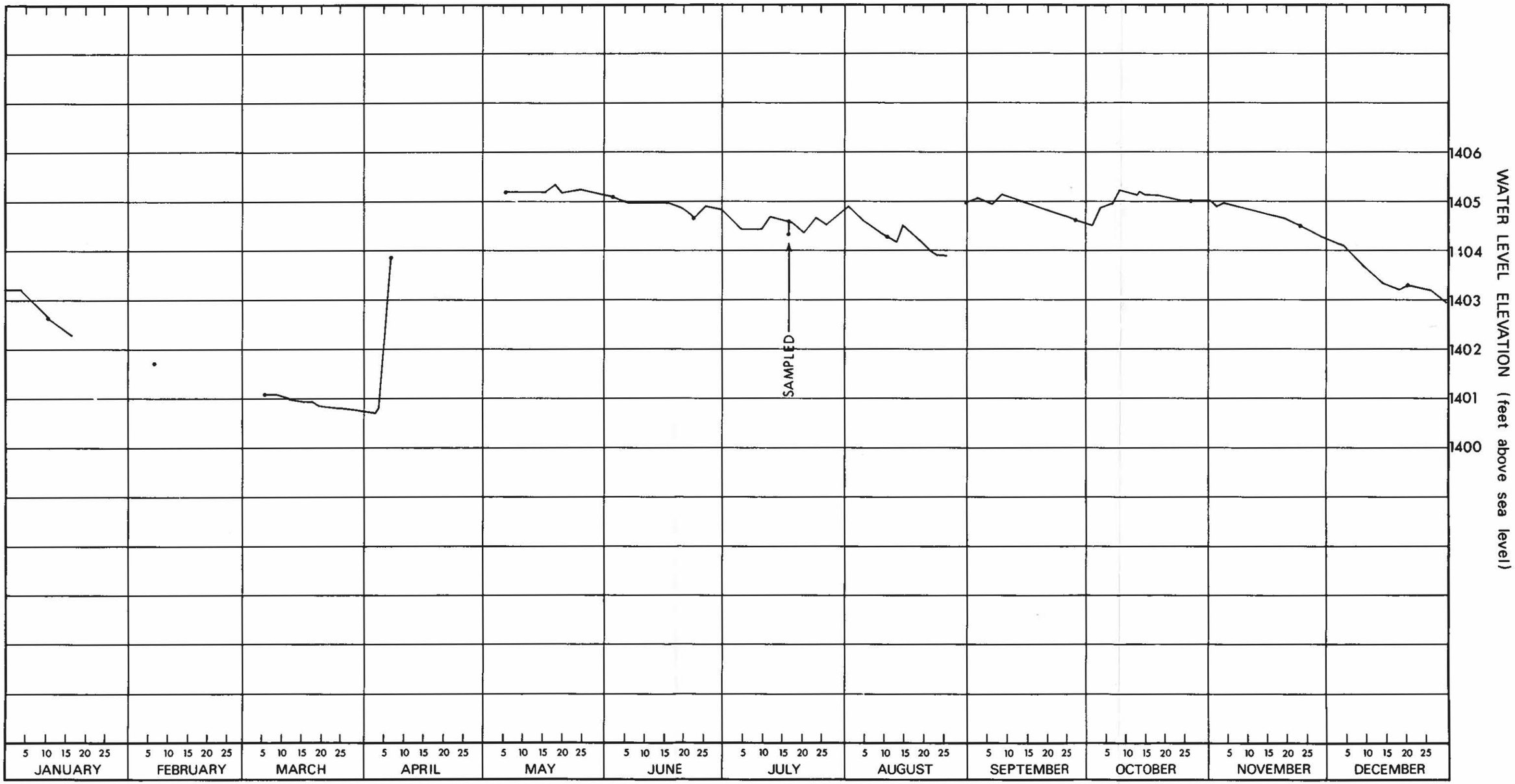
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

8 - 114 - H - 77




1976

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 38 Twp 97 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 8.1 | 0.40 | 3 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 238.0 | 10.35 | 75 |
| Potassium ($K^{+}$) | 117.0 | 2.99 | 22 |
| Carbonate ($CO_3^{=}$) | 192.0 | 6.40 | 73 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 3.3 | 0.07 | 1 |
| Chloride ($Cl^{-}$) | 80.0 | 2.26 | 26 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 11.3 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 9.0 | | |
| Magnesium (Acidified) | 0.1 | | |
| Total dissolved solids | 792 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 8.73 | Total Cations (epm) | 13.76 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2600 | Temperature (C) | 5.0 | |
| pH | 11.7 | pH | 11.9 | |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 120 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 163 | Mg/L |
| | | Conductivity | | |

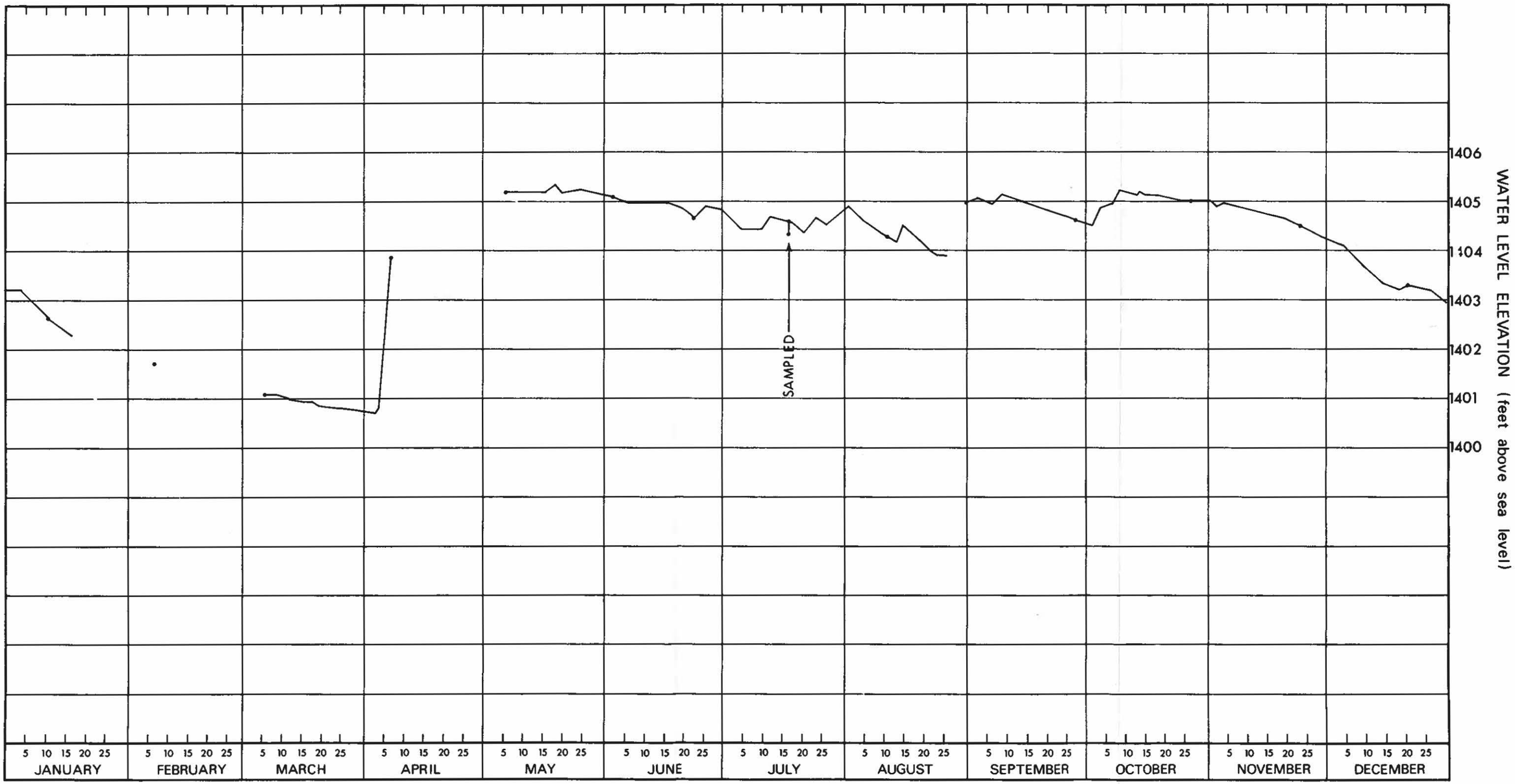
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

8 - 114 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 8-114

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.96

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 4.62 MP | 1402.6 | MP (1417.8) |
| Feb 7/76 | 4.90 MP | 1401.7 | |
| Mar 6/76 | 5.09 MP | 1401.1 | |
| Apr 7/76 | 4.25 MP | 1403.9 | |
| May 5/76 | 3.84 MP | 1405.2 | |
| June 2/76 | 3.87 MP | 1405.1 | |
| June 23/76 | 4.00 MP | 1404.7 | |
| July 17/76 | 4.02 MP | 1404.6 | |
| | 4.10 MP | 1404.3 | After sample; temp. 5°C |
| Aug 11/76 | 4.12 MP | 1404.3 | |
| Aug 31/76 | 3.90 MP | 1405.0 | |
| Sept 28/76 | 4.01 MP | 1404.6 | |
| Oct 27/76 | 3.90 MP | 1405.0 | |
| Nov 24/76 | 4.04 MP | 1404.5 | |
| Dec 21/76 | 4.43 MP | 1403.3 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 3.6 | 0.18 | 1 |
| Magnesium ($Mg^{++}$) | 2.3 | 0.19 | 1 |
| Sodium ($Na^{+}$) | 601.0 | 26.14 | 98 |
| Potassium ($K^{+}$) | 7.9 | 0.20 | 1 |
| Carbonate ($CO_3^{=}$) | 21.6 | 0.72 | 3 |
| Bicarbonate ($HCO_3^{-}$) | 1274.0 | 20.88 | 79 |
| Sulfate ($SO_4^{=}$) | 9.6 | 0.20 | 1 |
| Chloride ($Cl^{-}$) | 158.0 | 4.46 | 17 |
| Nitrate ($NO_3^{=}$) | 7.8 | 0.13 | 1 |
| Silica ($SiO_2$) | 5.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 4.0 | | |
| Magnesium (Acidified) | 2.1 | | |
| Total dissolved solids | 1000 | | |
| Total Anions (epm) | 26.38 | Total Cations (epm) | 26.71 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 5.0 | |
| pH | 8.4 | pH | 8.7 | |
| Fluoride ($F^{-}$) | 1.1 Mg/L | Carbonate ($CO_3^{=}$) | 57 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 1235 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

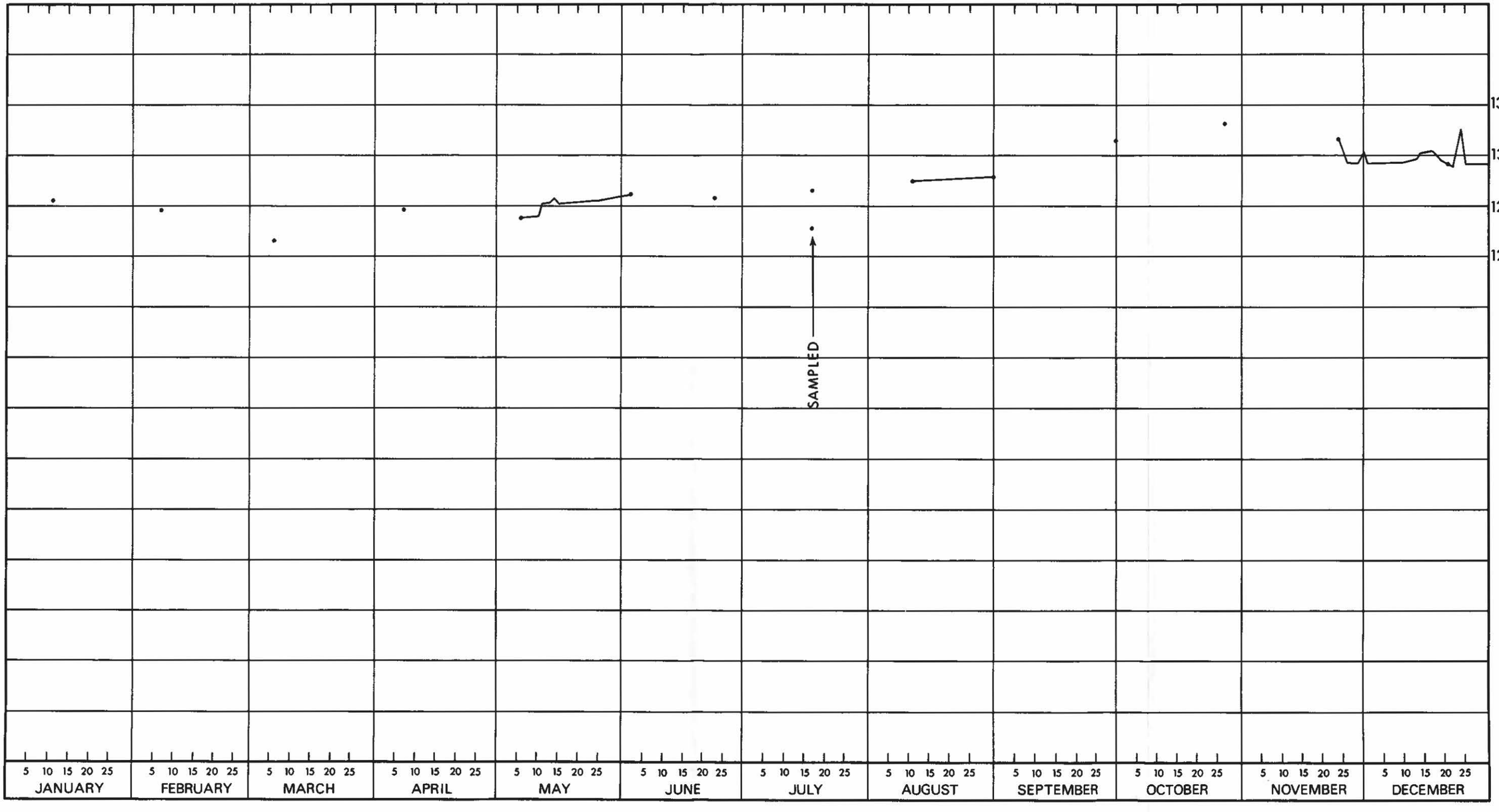
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-220

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

8 - 220 - H - 77




1976

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 2.0 | 0.10 | 0 |
| Magnesium ($Mg^{++}$) | 1.0 | 0.08 | 0 |
| Sodium ($Na^{+}$) | 415.0 | 18.05 | 73 |
| Potassium ($K^{+}$) | 254.0 | 6.50 | 26 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1449.0 | 23.75 | 95 |
| Sulfate ($SO_4^{=}$) | 6.3 | 0.13 | 1 |
| Chloride ($Cl^{-}$) | 40.0 | 1.13 | 5 |
| Nitrate ($NO_3^{=}$) | 0.8 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1.4 | | |
| Magnesium (Acidified) | 1.3 | | |
| Total dissolved solids | 1560 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 25.02 | Total Cations (epm) | 24.73 |

Other Constituents

| Lab: | | Field: | |
|---|---|---|---|
| Conductivity | 2400 | Temperature (C) | 6.0 |
| pH | 7.8 | pH | 8.0 |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | |
| | | Bicarbonate ($HCO_3^{-}$) | 1474 Mg/L |
| | | Hydroxide ($OH^{-}$) | |
| | | Conductivity | |

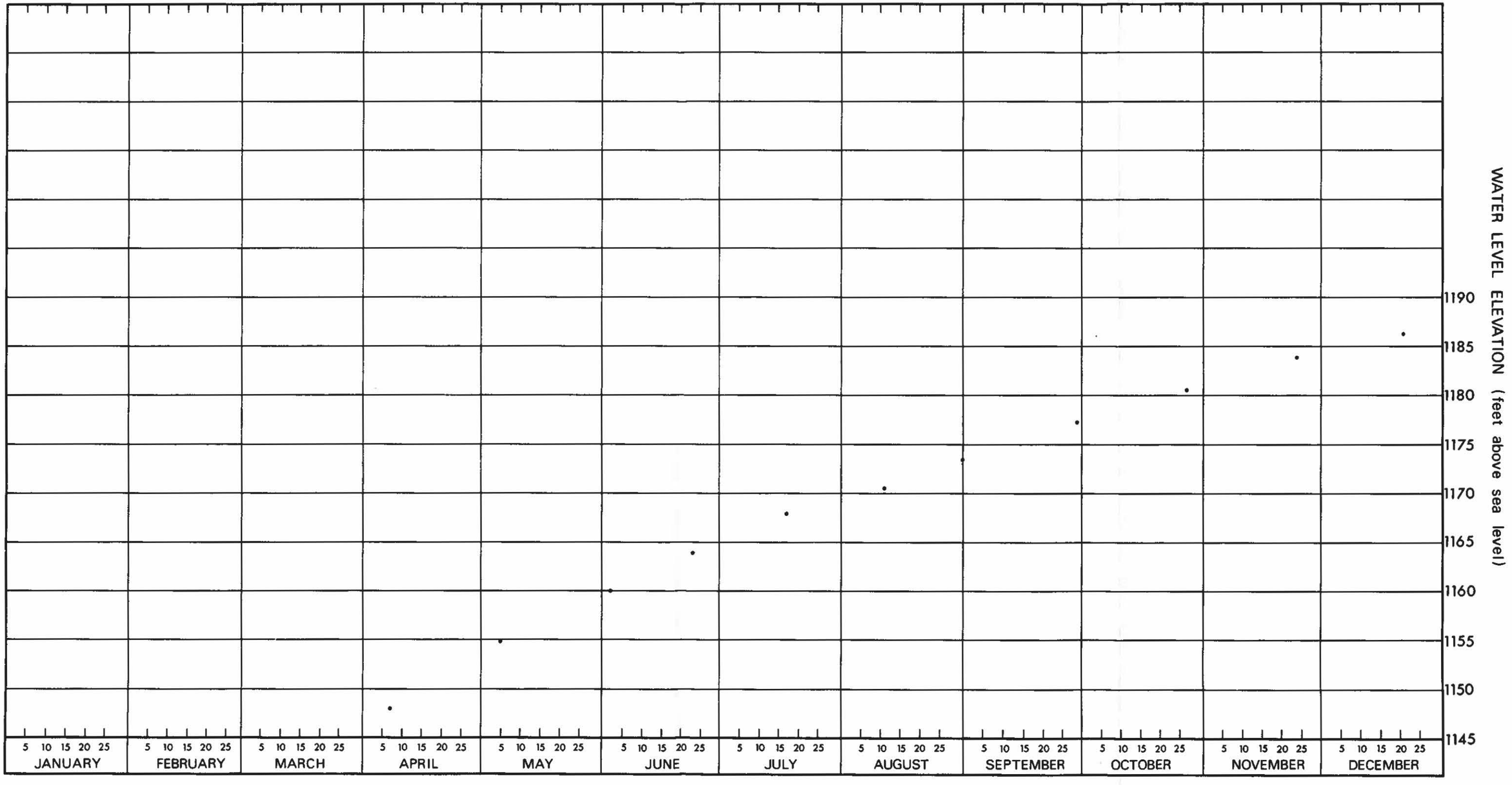
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8 - 370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

8 - 370 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 8-370

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1414.50

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Apr 7/76 | 81.26 TOC | 1148.0 | |
| May 5/76 | 79.97 MP | 1154.8 | MP = 0.80 m TOC, (1417.1) |
| June 2/76 | 78.33 MP | 1160.2 | |
| June 23/76 | 77.17 MP | 1164.0 | |
| July 17/76 | 75.95 MP | 1168.0 | Sampled; temp. 6°C |
| Aug 11/76 | 75.15 MP | 1170.6 | |
| Aug 31/76 | 74.28 MP | 1173.5 | |
| Sept 29/76 | 73.11 MP | 1177.3 | |
| Oct 27/76 | 72.06 MP | 1180.7 | |
| Nov 24/76 | 71.11 MP | 1183.9 | |
| Dec 21/76 | 70.28 MP | 1186.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 1.0 | 0.05 | 0 |
| Magnesium ($Mg^{++}$) | 0.7 | 0.06 | 0 |
| Sodium ($Na^{+}$) | 389.0 | 16.92 | 72 |
| Potassium ($K^{+}$) | 258.0 | 6.60 | 28 |
| Carbonate ($CO_3^{=}$) | 554.0 | 18.47 | 77 |
| Bicarbonate ($HCO_3^{-}$) | 151.0 | 2.48 | 10 |
| Sulfate ($SO_4^{=}$) | 16.8 | 0.35 | 2 |
| Chloride ($Cl^{-}$) | 98.0 | 2.76 | 12 |
| Nitrate ($NO_3^{=}$) | 1.1 | 0.02 | 0 |
| Silica ($SiO_2$) | 0.5 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 1.4 | | |
| Magnesium (Acidified) | 0.9 | | |
| Total dissolved solids | 1436 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 24.07 | Total Cations (epm) | 23.63 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 2500 | Temperature (C) | 6.0 | |
| pH | 10.3 | pH | 10.7 | |
| Fluoride ($F^{-}$) | 0.3 Mg/L | Carbonate ($CO_3^{=}$) | 624 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | 20 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

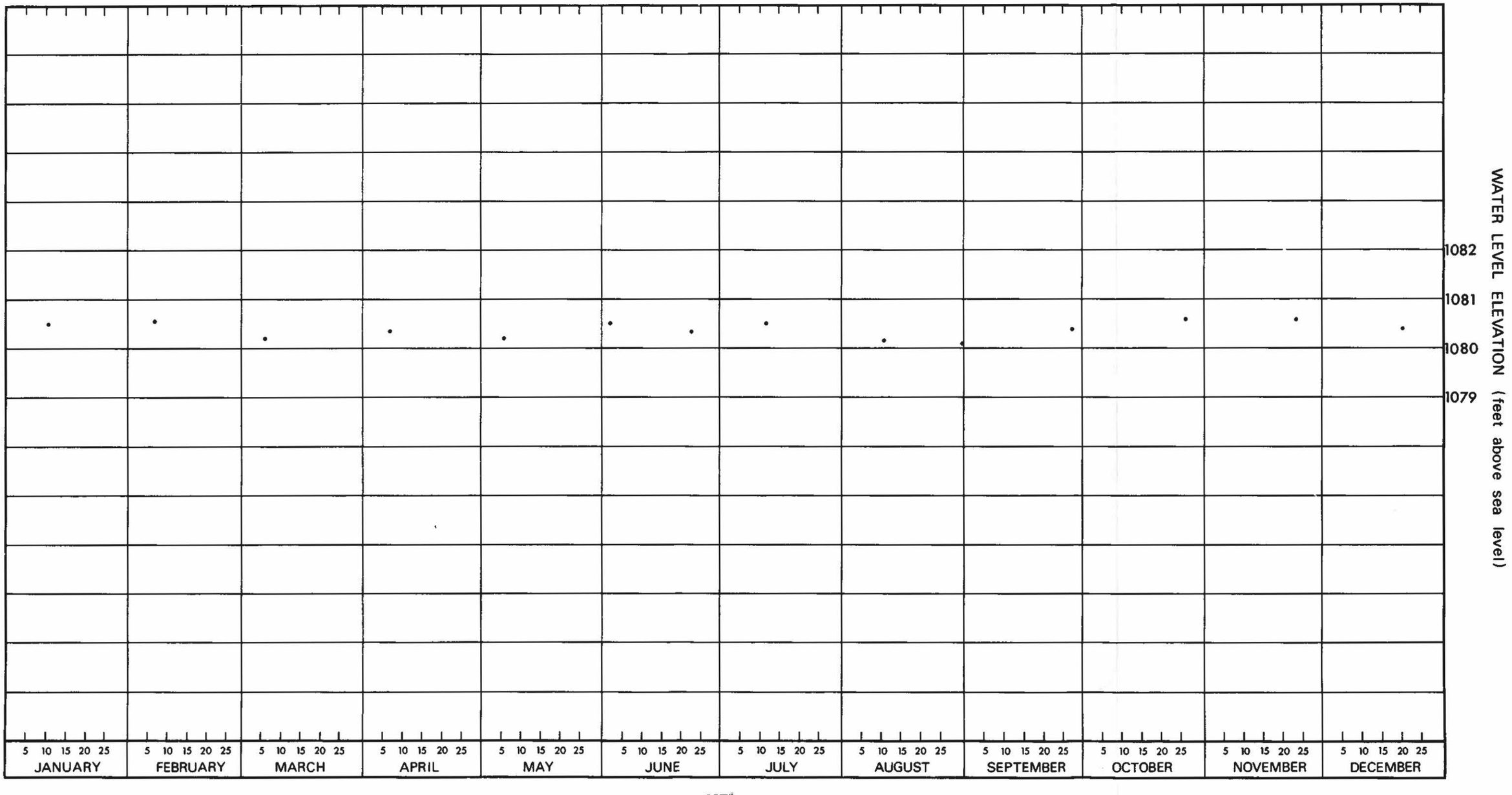
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-532

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

8 - 532 - H - 77




1976

## WATER ANALYSIS

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 37.0 | 1.85 | 2 |
| Magnesium ($Mg^{++}$) | 141.0 | 11.60 | 11 |
| Sodium ($Na^{+}$) | 2050.0 | 89.17 | 86 |
| Potassium ($K^{+}$) | 54.0 | 1.38 | 1 |
| Carbonate ($CO_3^{=}$) | 0.0 | 0.00 | 0 |
| Bicarbonate ($HCO_3^{-}$) | 1537.0 | 25.19 | 24 |
| Sulfate ($SO_4^{=}$) | 227.0 | 4.73 | 5 |
| Chloride ($Cl^{-}$) | 2600.0 | 73.32 | 71 |
| Nitrate ($NO_3^{=}$) | 7.5 | 0.12 | 0 |
| Silica ($SiO_2$) | 16.4 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 39.6 | | |
| Magnesium (Acidified) | 146.3 | | |
| Total dissolved solids | 6020 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 103.36 | Total Cations (epm) | 104.00 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 9.0 | |
| pH | 8.3 | pH | 7.9 | |
| Fluoride ($F^{-}$) | 1.6 Mg/L | Carbonate ($CO_3^{=}$) | | |
| | | Bicarbonate ($HCO_3^{-}$) | 1591 | Mg/L |
| | | Hydroxide ($OH^{-}$) | | |
| | | Conductivity | | |

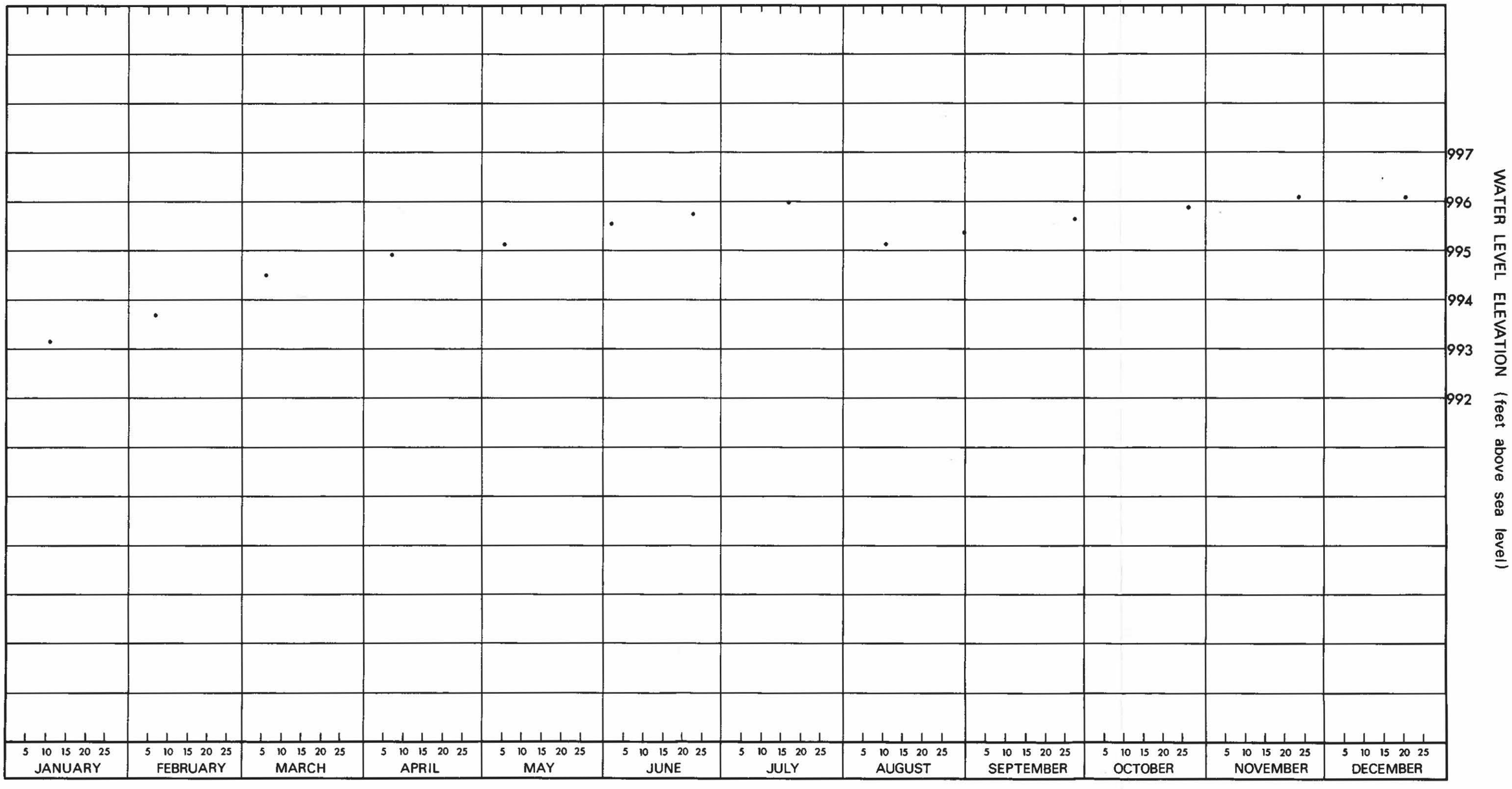
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

8 - 716 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 8-716

Lsd 5 Sec 30 Twp 94 R 7 W4th

Alberta Research Council

Elevation of top of casing 1415.53

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 129.44 MP | 993.2 | MP (1417.8) |
| Feb 7/76 | 129.21 MP | 994.0 | |
| Mar 6/76 | 129.05 MP | 994.5 | |
| Apr 7/76 | 128.92 MP | 994.9 | |
| May 6/76 | 128.85 MP | 995.2 | |
| June 2/76 | 128.73 MP | 995.6 | |
| June 23/76 | 128.66 MP | 995.8 | |
| July 17/76 | 128.60 MP | 996.0 | Sampled; temp. 9°C |
| Aug 11/76 | 128.85 MP | 995.2 | |
| Aug 31/76 | 128.78 MP | 995.4 | |
| Sept 29/76 | 128.69 MP | 995.7 | |
| Oct 27/76 | 128.63 MP | 995.9 | |
| Nov 24/76 | 128.58 MP | 996.1 | |
| Dec 21/76 | 128.58 MP | 996.1 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## SUMMARY OF CONTENTS

SITE NUMBER NINE

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

number of pages distributed for this site in 1976

| page title | well name | | | | | | |
|---|---|---|---|---|---|---|---|
| | site | 9-43 | 9-161 | 9-449 | 9-951 | 9-1056 | 9-1150 |
| Introduction | 4 | — | — | — | — | — | — |
| Legend | 8 | — | — | — | — | — | — |
| Site Plan | 1 | — | — | — | — | — | — |
| Geological Sample Description | 3 | — | — | — | — | — | — |
| Geophysical and Geological Logs | 1 | — | — | — | — | — | — |
| Well Construction | — | 1 | 1 | 1 | 1 | 1 | 1 |
| Drawdown Plot | — | 1 | 1 | 0 | 0 | 0 | 0 |
| Drill Stem Test | — | 0 | 0 | 2 | 4 | 2 | 2 |
| Shut-In Pressure Data | — | 0 | 0 | 1 | 3 | 2 | 2 |
| Water Analysis | — | 2 | 2 | 2 | 1 | 1 | 2 |
| Spectral Emission Estimates | — | 0 | 1 | 1 | 0 | 0 | 1 |
| Water Level Hydrograph | — | 1 | 1 | 1 | 1 | 0 | 1 |
| Well History | — | 1 | 1 | 1 | 1 | 1 | 1 |

## SUMMARY OF CONTENTS

SITE NUMBER NINE

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

number of pages distributed for this site in 1977

| page title | well name | | | | | |
|---|---|---|---|---|---|---|
| | 9-43 | 9-161 | 9-449 | 9-951 | 9-1050 | 9-1156 |
| Shut-In Pressure Data | 0 | 0 | 0 | 0 | 0 | 1* |
| Water Analysis | 1 | 1 | 1 | 1 | 1 | 1 |
| Water Level Hydrograph | 1* | 1 | 1 | 1 | 1 | 1 |
| Well History | 1* | 1 | 1 | 1 | 1 | 1 |

*Supersedes page issued in 1976

### ERRATUM STATEMENT

Material Distributed in 1976

1. The location on the second and third pages of the GEOLOGICAL SAMPLE DESCRIPTION was omitted. The location for both these pages is Lsd 16 Sec 4 Twp 94 R 6 W4th.
2. Well 9-43 - A different WELL HISTORY page has been issued covering 1975. The page index is 9-43-W-77 and replaces 9-43-W-76.
3. Grand Rapids Formation should be listed on the GEOLOGICAL SAMPLE DESCRIPTION at the interval 580 to 600 and from depths of 587 to 705 feet on the GEOPHYSICAL AND GEOLOGICAL LOGS.
4. Clearwater Formation should be listed on the GEOLOGICAL SAMPLE DESCRIPTION at the interval 670 to 710 and from depths of 705 to 917 feet on the GEOLOGICAL AND GEOPHYSICAL LOGS.
5. The symbol for milliequivalents per litre in the LEGEND should be Meq/L rather than Meg/L.
6. A new GEOLOGICAL LEGEND has been issued which has page index L-77. This replaces the legend indexed L-76.
7. A new WATER LEVEL HYDROGRAPH has been issued for well 9-43 covering 1975. The page index is 9-43-H-77 and replaces 9-43-H-76.
8. A new SHUT-IN PRESSURE DATA page has been issued for well 9-1150. The page indexed 9-1150-D-77 replaces 9-1150-D-76.

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 103.0 | 5.14 | 76 |
| Magnesium ($Mg^{++}$) | 0.2 | 0.02 | 0 |
| Sodium ($Na^{+}$) | 28.8 | 1.25 | 19 |
| Potassium ($K^{+}$) | 12.9 | 0.33 | 5 |
| Carbonate ($CO_3^{=}$) | 19.2 | 0.64 | 16 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 55.0 | 1.15 | 28 |
| Chloride ($Cl^{-}$) | 80.0 | 2.26 | 56 |
| Nitrate ($NO_3^{=}$) | 0.6 | 0.01 | 0 |
| Silica ($SiO_2$) | 7.2 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 130.9 | | |
| Magnesium (Acidified) | 0.6 | | |
| Total dissolved solids | 404 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 4.05 | Total Cations (epm) | 6.74 |

Other Constituents

| Lab: | | | Field: | | |
|---|---|---|---|---|---|
| Conductivity | 1050 | | Temperature (C) | 5.5 | |
| pH | 11.2 | | pH | 11.4 | |
| Fluoride ($F^{-}$) | 0.2 | Mg/L | Carbonate ($CO_3^{=}$) | 276 | Mg/L |
| | | | Bicarbonate ($HCO_3^{-}$) | 127 | Mg/L |
| | | | Hydroxide ($OH^{-}$) | | |
| | | | Conductivity | | |

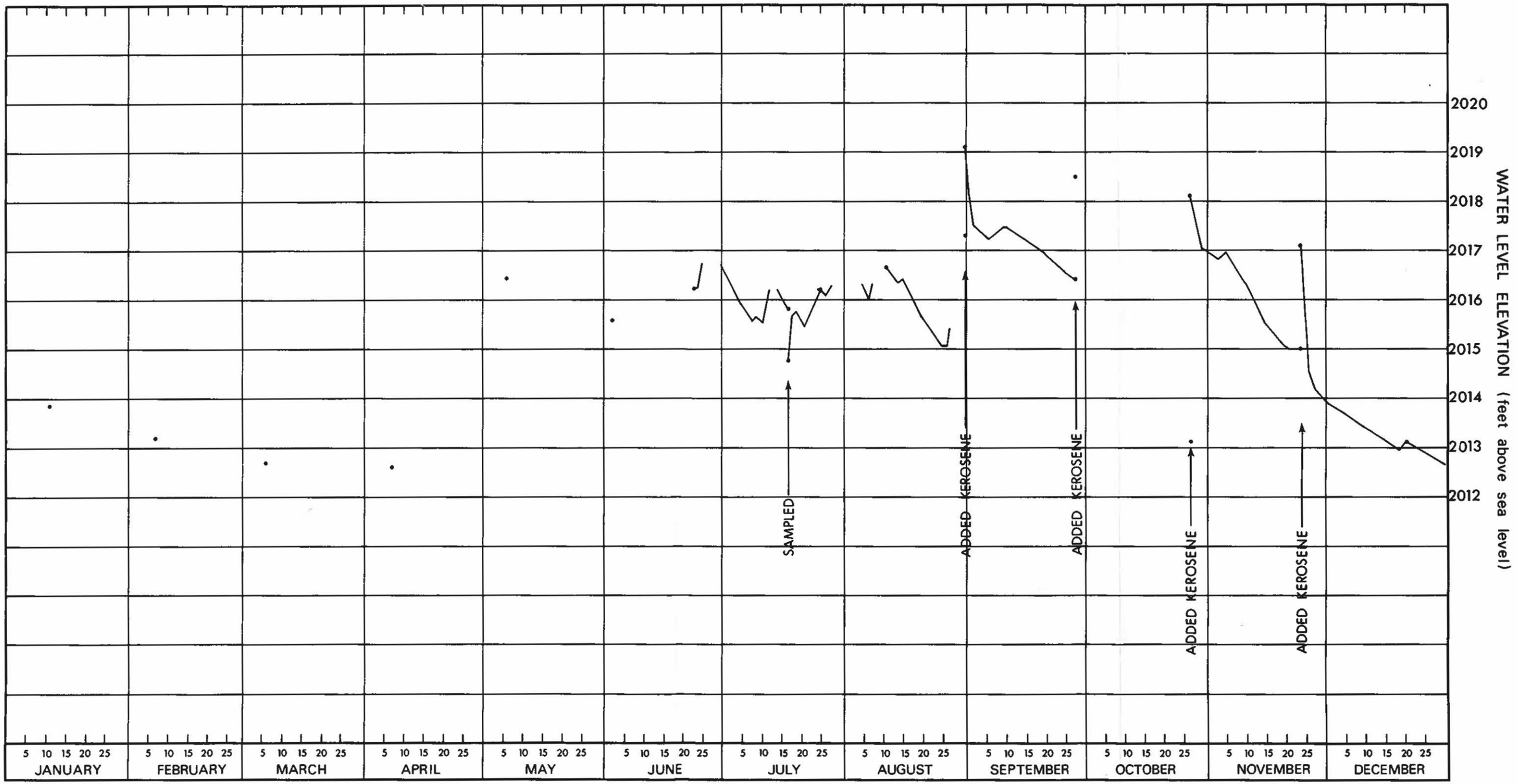
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-43

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

9 - 43 - H - 77




1976

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-161

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 540.0 | 26.95 | 75 |
| Magnesium ($Mg^{++}$) | 0.2 | 0.02 | 0 |
| Sodium ($Na^{+}$) | 81.0 | 3.52 | 10 |
| Potassium ($K^{+}$) | 212.0 | 5.42 | 15 |
| Carbonate ($CO_3^{=}$) | 31.2 | 1.04 | 27 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 2.4 | 0.05 | 1 |
| Chloride ($Cl^{-}$) | 100.0 | 2.82 | 72 |
| Nitrate ($NO_3^{=}$) | 1.0 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.8 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 550.0 | | |
| Magnesium (Acidified) | 0.3 | | |
| Total dissolved solids | 1898 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 3.93 | Total Cations (epm) | 35.91 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 8000 | Temperature (C) | 5.0 | |
| pH | 12.4 | pH | 12.3 | |
| Fluoride ($F^{-}$) | 0.1 Mg/L | Carbonate ($CO_3^{=}$) | 73 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 591 | Mg/L |
| | | Conductivity | | |

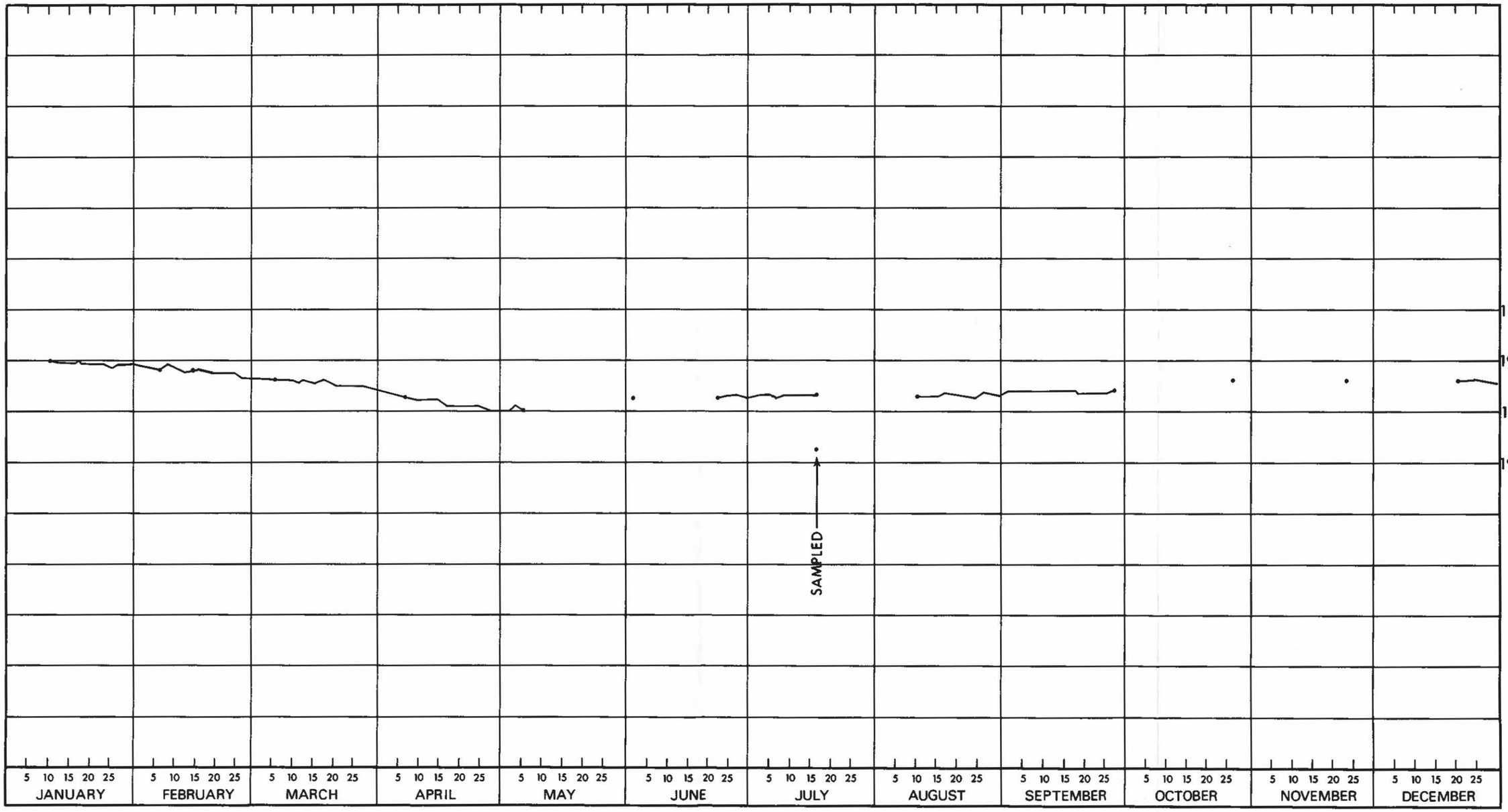
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4th

Alberta Research Council

9 - 161 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 9-161

Lsd 1 Sec 9 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 13.56 MP | 1977.0 | MP (2021.5) |
| Feb 7/76 | 13.61 MP | 1976.9 | |
| Mar 6/76 | 13.68 MP | 1976.6 | |
| Apr 7/76 | 13.78 MP | 1976.3 | |
| May 6/76 | 13.86 MP | 1976.0 | |
| June 2/76 | 13.79 MP | 1976.3 | |
| June 23/76 | 13.79 MP | 1976.3 | |
| July 17/76 | 13.77 MP | 1976.3 | |
| | 14.09 MP | 1975.3 | After sample; temp. 5°C |
| Aug 11/76 | 13.78 MP | 1976.3 | |
| Aug 31/76 | 13.77 MP | 1976.3 | |
| Sept 28/76 | 13.74 MP | 1976.4 | |
| Oct 27/76 | 13.70 MP | 1976.6 | |
| Nov 24/76 | 13.69 MP | 1976.6 | |
| Dec 21/76 | 13.69 MP | 1976.6 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 120.0 | 5.99 | 27 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 189.0 | 8.22 | 37 |
| Potassium ($K^{+}$) | 313.0 | 8.01 | 36 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 8 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 3.0 | 0.06 | 1 |
| Chloride ($Cl^{-}$) | 334.0 | 9.42 | 92 |
| Nitrate ($NO_3^{=}$) | 0.5 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.7 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 143.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 1416 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 10.29 | Total Cations (epm) | 22.22 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4700 | Temperature (C) | 5.0 | |
| pH | 11.9 | pH | 12.1 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | 25 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 272 | Mg/L |
| | | Conductivity | | |

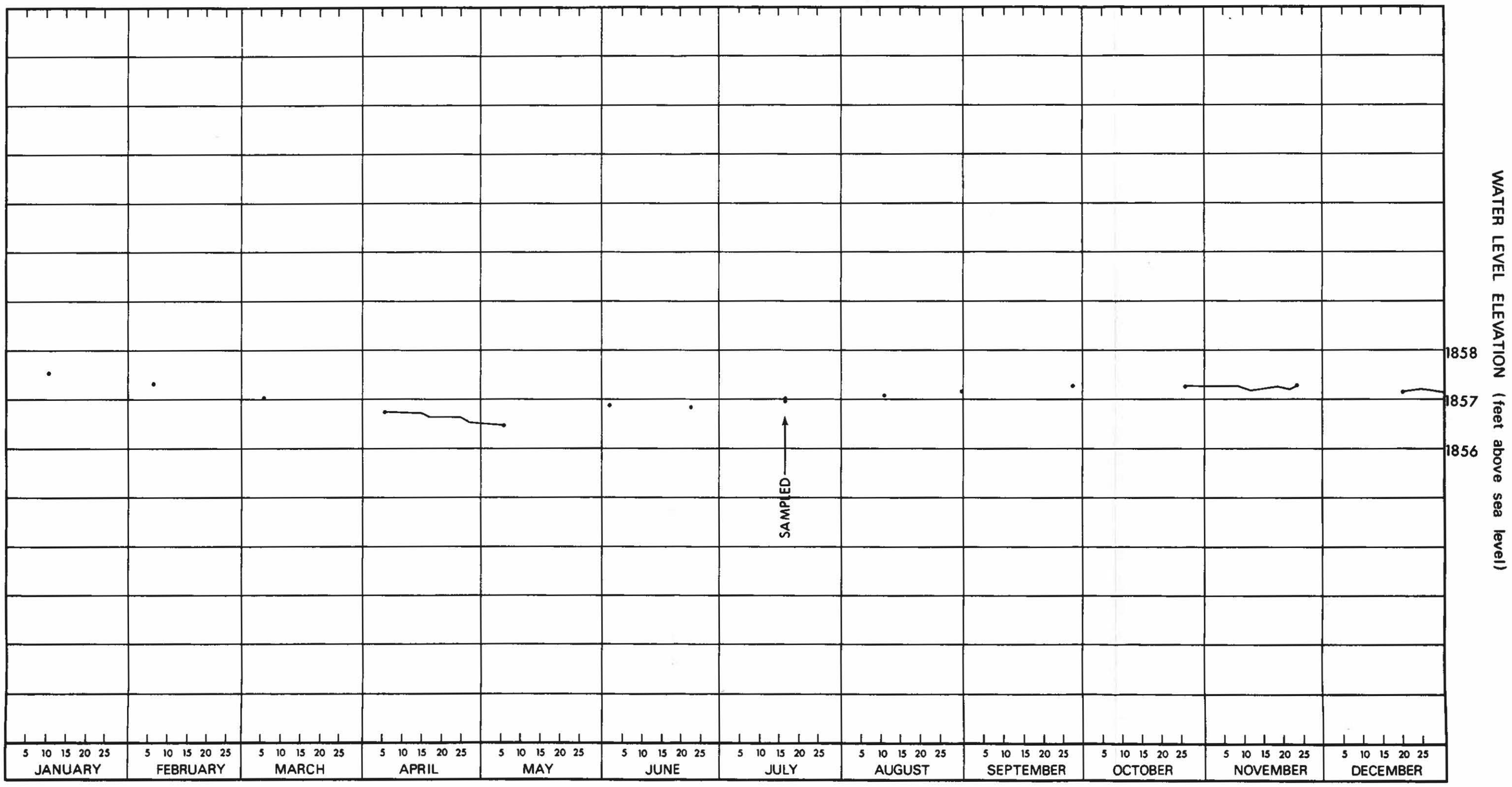
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

9 - 449 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 9-449

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2020.22

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 50.45 MP | 1857.5 | MP (2023.0) |
| Feb 7/76 | 50.51 MP | 1857.3 | |
| Mar 6/76 | 50.60 MP | 1857.0 | |
| Apr 6/76 | 50.69 MP | 1856.7 | |
| May 6/76 | 50.77 MP | 1856.4 | |
| June 2/76 | 50.62 MP | 1856.9 | New MP = 0.83 m TOC, (2022.9) |
| June 23/76 | 50.64 MP | 1856.8 | |
| July 17/76 | 50.59 MP | 1857.0 | |
| | 50.60 MP | 1856.9 | After sample; temp. 5°C |
| Aug 11/76 | 50.56 MP | 1857.1 | |
| Aug 31/76 | 50.55 MP | 1857.1 | |
| Sept 28/76 | 50.50 MP | 1857.3 | |
| Oct 27/76 | 50.49 MP | 1857.3 | |
| Nov 24/76 | 50.50 MP | 1857.3 | |
| Dec 21/76 | 50.52 MP | 1857.2 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 310.0 | 15.47 | 24 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 725.0 | 31.54 | 49 |
| Potassium ($K^{+}$) | 700.0 | 17.91 | 28 |
| Carbonate ($CO_3^{=}$) | 55.0 | 1.83 | 14 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 2.3 | 0.05 | 0 |
| Chloride ($Cl^{-}$) | 400.0 | 11.28 | 86 |
| Nitrate ($NO_3^{=}$) | 1.2 | 0.02 | 0 |
| Silica ($SiO_2$) | 1.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 308.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 3706 | | |
| Total Anions (epm) | 13.18 | Total Cations (epm) | 64.92 |

Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 78000 | Temperature (C) | 7.0 | |
| pH | 12.8 | pH | 12.6 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | 74 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 945 | Mg/L |
| | | Conductivity | | |

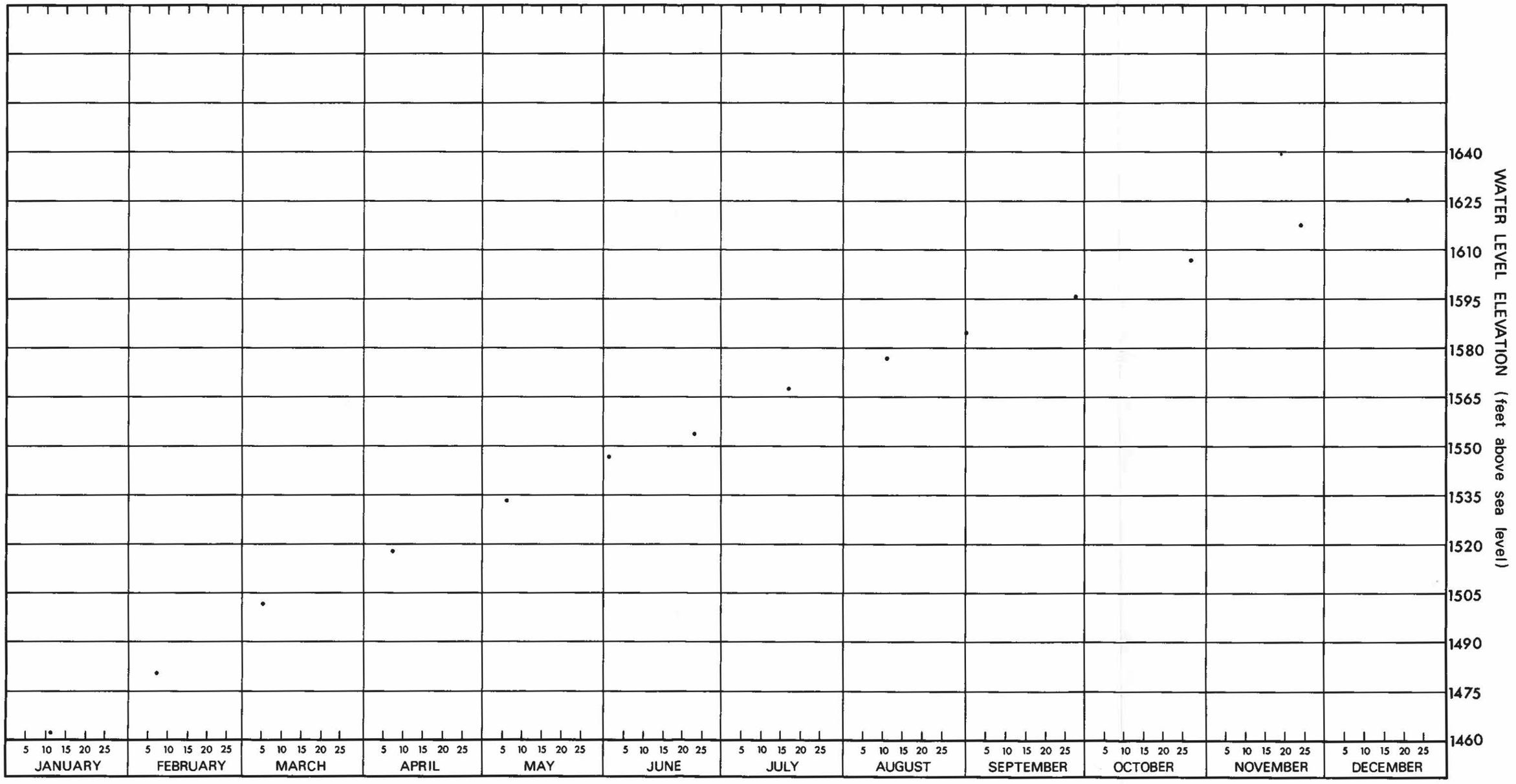
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-951

9 - 951 - H - 77

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 9-951

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2019.11

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 170.49 MP | 1462.8 | MP (2022.0) |
| Feb 7/76 | 164.89 MP | 1481.2 | |
| Mar 6/76 | 159.45 MP | 1499.0 | |
| Apr 7/76 | 153.65 MP | 1518.0 | |
| May 6/76 | 148.90 MP | 1533.6 | |
| June 2/76 | 144.83 MP | 1547.0 | |
| June 23/76 | 141.80 MP | 1556.9 | |
| July 17/76 | 138.50 MP | 1567.7 | Sample; temp. 7°C |
| Aug 11/76 | 135.51 MP | 1577.5 | |
| Aug 31/76 | 133.21 MP | 1585.1 | |
| Sept 28/76 | 129.90 MP | 1595.9 | |
| Oct 27/76 | 126.45 MP | 1607.2 | |
| Nov 24/76 | 123.15 MP | 1618.1 | |
| Dec 21/76 | 120.77 MP | 1625.9 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 515.0 | 25.70 | 81 |
| Magnesium ($Mg^{++}$) | 0.0 | 0.00 | 0 |
| Sodium ($Na^{+}$) | 105.0 | 4.57 | 14 |
| Potassium ($K^{+}$) | 59.0 | 1.51 | 5 |
| Carbonate ($CO_3^{=}$) | 24.0 | 0.80 | 16 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 3.7 | 0.08 | 2 |
| Chloride ($Cl^{-}$) | 148.0 | 4.17 | 83 |
| Nitrate ($NO_3^{=}$) | 0.3 | 0.00 | 0 |
| Silica ($SiO_2$) | 0.0 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 528.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 1548 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 5.06 | Total Cations (epm) | 31.78 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 7000 | Temperature (C) | | |
| pH | 12.2 | pH | 12.2 | |
| Fluoride ($F^{-}$) | 0.2 Mg/L | Carbonate ($CO_3^{=}$) | 1080 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 197 | Mg/L |
| | | Conductivity | | |

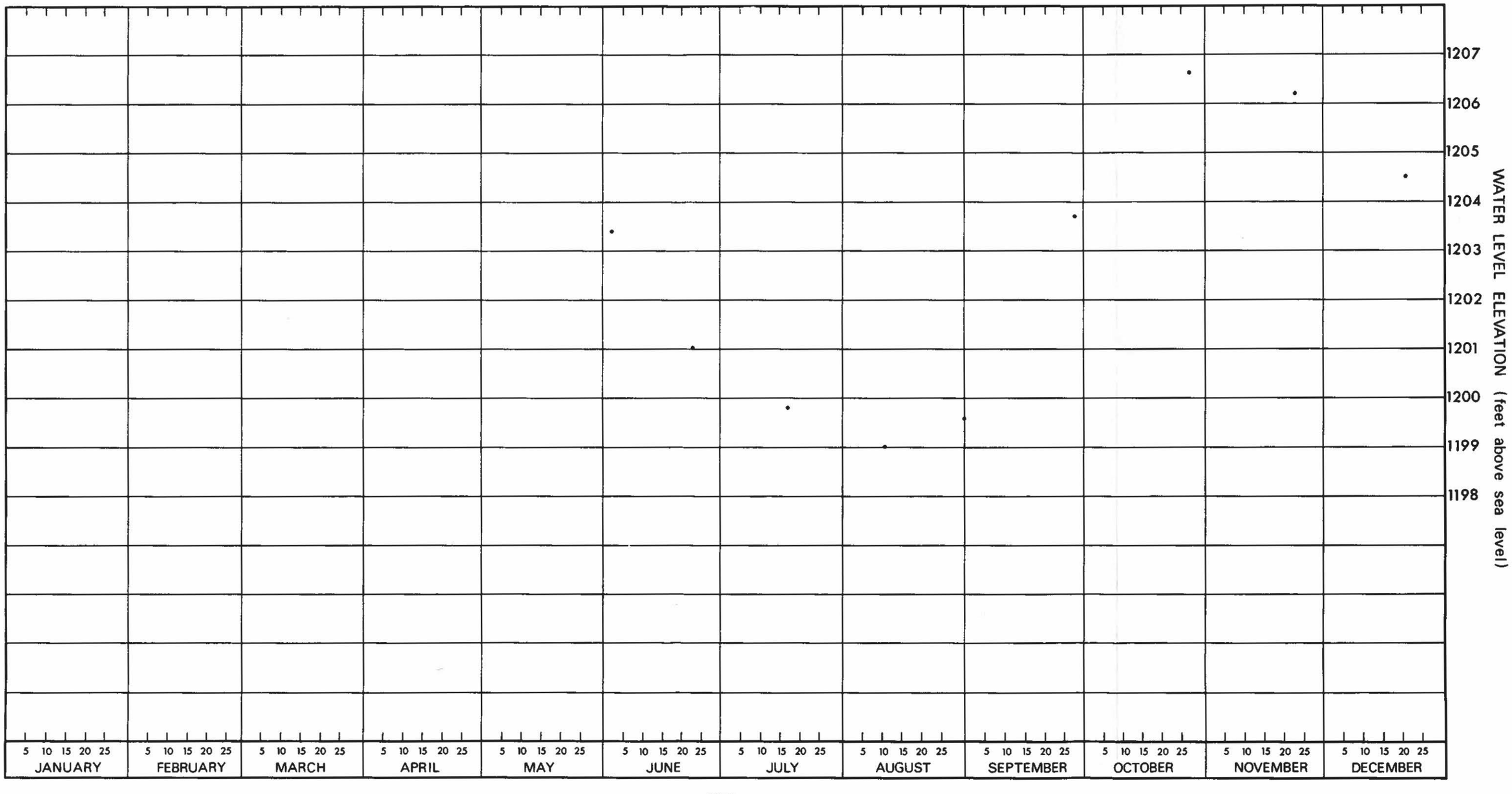
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

9 - 1056 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 9-1056

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2018.16

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | | | MP (2020.8); could not measure |
| Apr 7/76 | | | Install Bassani Packer |
| June 2/76 | 249.20 MP | 1203.4 | |
| June 23/76 | 249.93 MP | 1201.0 | |
| July 17/76 | 250.29 MP | 1199.8 | Sampled |
| Aug 11/76 | 250.54 MP | 1199.0 | |
| Aug 31/76 | 250.37 MP | 1199.6 | |
| Sept 28/76 | 249.10 MP | 1203.7 | |
| Oct 27/76 | 248.24 MP | 1206.6 | |
| Nov 24/76 | 248.36 MP | 1206.2 | |
| Dec 21/76 | 248.86 MP | 1204.5 | |

MP - Depth from measuring point
TOC - Depth from top of casing

## WATER ANALYSIS

OBSERVATION WELL NUMBER **9-1150**

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Sample source Bailed

Date sampled July 17, 1976

### Major Constituents

| | Mg/L | Meq/L | Percent Cations or Anions |
|---|---|---|---|
| Calcium ($Ca^{++}$) | 150.0 | 7.49 | 32 |
| Magnesium ($Mg^{++}$) | 0.1 | 0.01 | 0 |
| Sodium ($Na^{+}$) | 260.0 | 11.31 | 48 |
| Potassium ($K^{+}$) | 188.0 | 4.81 | 20 |
| Carbonate ($CO_3^{=}$) | 43.2 | 1.44 | 12 |
| Bicarbonate ($HCO_3^{-}$) | 0.0 | 0.00 | 0 |
| Sulfate ($SO_4^{=}$) | 3.2 | 0.07 | 1 |
| Chloride ($Cl^{-}$) | 378.0 | 10.66 | 88 |
| Nitrate ($NO_3^{=}$) | 0.9 | 0.01 | 0 |
| Silica ($SiO_2$) | 2.9 | | |
| Hydroxide ($OH^{-}$) | | | |
| Calcium (Acidified) | 154.0 | | |
| Magnesium (Acidified) | 0.0 | | |
| Total dissolved solids | 1328 | | |

| | | | |
|---|---|---|---|
| Total Anions (epm) | 12.18 | Total Cations (epm) | 23.61 |

### Other Constituents

| Lab: | | Field: | | |
|---|---|---|---|---|
| Conductivity | 4500 | Temperature (C) | 6.0 | |
| pH | 12.1 | pH | 12.1 | |
| Fluoride ($F^{-}$) | 0.5 Mg/L | Carbonate ($CO_3^{=}$) | 67 | Mg/L |
| | | Bicarbonate ($HCO_3^{-}$) | | |
| | | Hydroxide ($OH^{-}$) | 231 | Mg/L |
| | | Conductivity | | |

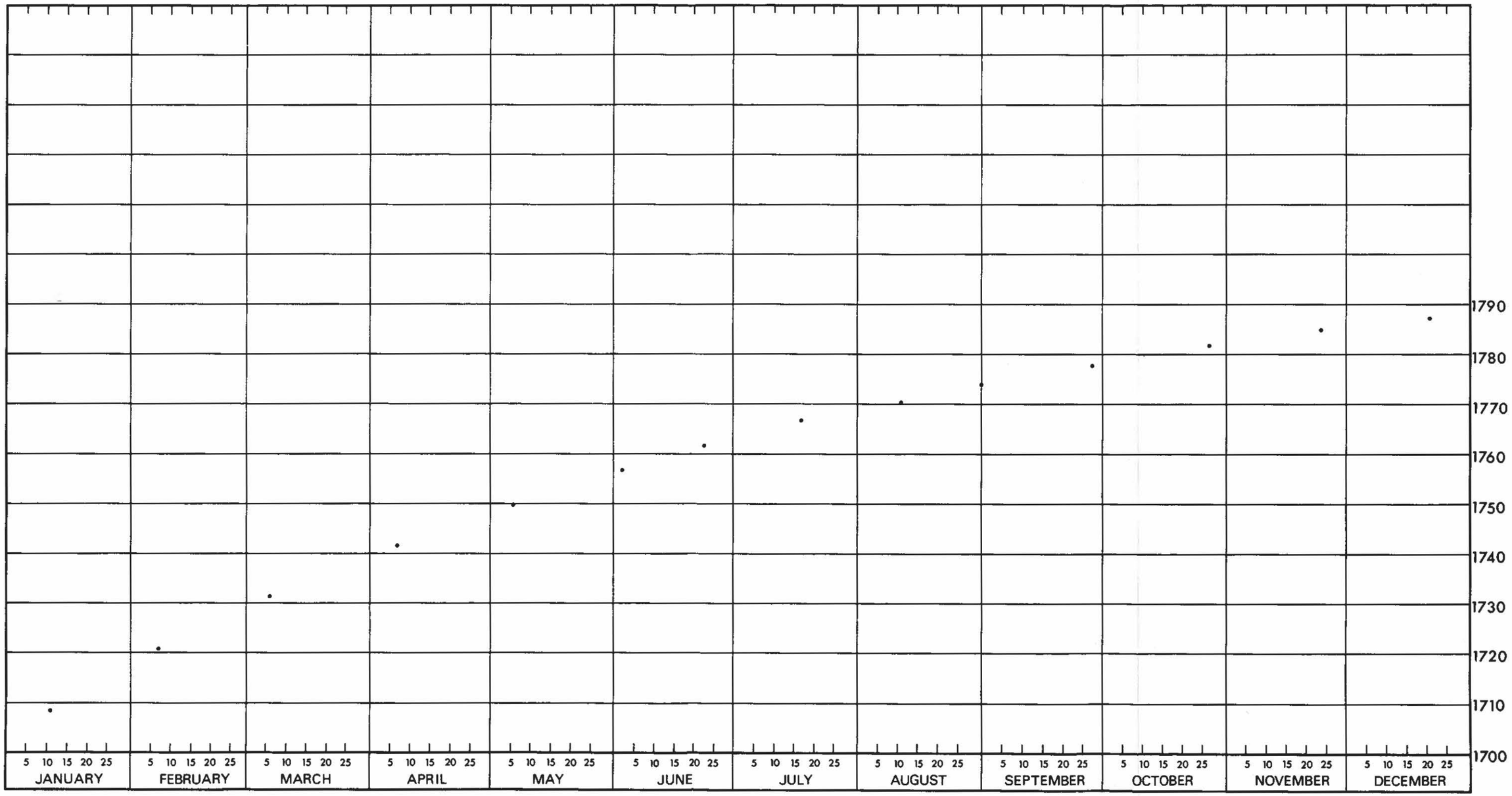
WATER LEVEL HYDROGRAPH

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

9 - 1150 - H - 77




1976

## WELL HISTORY

OBSERVATION WELL NUMBER 9-1150

Lsd 16 Sec 4 Twp 94 R 6 W4th

Alberta Research Council

Elevation of top of casing 2017.89

| Date | Depth to water (meters) | Water level elevation (feet) | Comments |
|---|---|---|---|
| Jan 11/76 | 95.18 MP | 1708.4 | MP (2020.6) |
| Feb 7/76 | 91.35 MP | 1721.0 | |
| Mar 6/76 | 88.11 MP | 1731.6 | |
| Apr 7/76 | 85.04 MP | 1741.7 | |
| May 6/76 | 82.54 MP | 1750.0 | New MP = 0.85 m TOC, (2020.7) |
| June 2/76 | 80.42 MP | 1756.9 | |
| June 23/76 | 78.88 MP | 1762.0 | |
| July 17/76 | 77.33 MP | 1767.1 | Sampled; temp. 6°C |
| Aug 11/76 | 76.28 MP | 1770.5 | |
| Aug 31/76 | 75.20 MP | 1774.0 | |
| Sept 28/76 | 73.89 MP | 1778.3 | |
| Oct 27/76 | 72.75 MP | 1782.1 | |
| Nov 24/76 | 71.81 MP | 1785.2 | |
| Dec 21/76 | 71.05 MP | 1787.7 | |

MP - Depth from measuring point
TOC - Depth from top of casing