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*DETAILED SOIL SURVEY*

*of*

*THE AIRDRIE AREA*

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## SECTION I

## PREFACE

This report is one of a series describing detailed soil surveys of areas found within the jurisdiction of the Calgary Regional Planning Commission. These soil surveys are conducted at sufficiently large scale to be useful for local planning.

The report contains information that can be used to evaluate soil properties for urban and recreational development, to evaluate the engineering properties of soils for construction materials and sites and to assess the agricultural capability of the land. The suitabilities or limitations of the soils for selected uses are described in tabular form in the report. These tables can easily be used to make interpretive maps for specific land uses.

There were seven areas surveyed in this program in 1974. These areas are adjacent to the following towns:

- Strathmore (5,800 acres)
- Okotoks (6,000 acres)
- Airdrie (6,800 acres)
- Black Diamond (7,700 acres)
- Cochrane (10,000 acres)
- High River (11,000 acres)
- Canmore (15,000 acres)

Total acreage surveyed - 62,300.

There is a separate report for each area. A standard explanatory section which is pertinent to all areas is presented at the beginning of each report. Specific results and interpretations for a particular area are presented in the second section of the report.

## INTRODUCTION

Soil is one of our most important natural resources. Man bases his activities on soils and depends on their productivity. Misuse of land can have drastic environmental, economic and social effects. Soil surveys provide baseline data on the soil resources of an area. This information is essential to land characterization and evaluation which is



(2)

the natural basis for effective land use and land management policies.

Soils vary widely in their properties and as such their suitability or limitations for different uses also varies. A soil with low agricultural capability may be suitable for road construction and a soil that is unsuitable for road location due perhaps to periodic flooding hazard or high water table may be excellent pasture land. However soils often are suitable for several uses. For example, well drained, level soils that have a high capability for agriculture also are excellent locations for airports, highways and urban development. Soil surveys provide the planner with information useful for making decisions based on predicted soil performance and soil suitability for multiple uses.

## USE OF THE REPORT

This report consists of a written text and a map. The written part includes introductory and background information on soils, soil mapping, and soil interpretations in the first section and descriptions of the soils, analytical results, and interpretations for various uses in the second section.

The soil map is presented on an aerial photo-mosaic base. The photo base aids in identification and location of areas, however the linear and spatial distortion inherent in a photo mosaic must be appreciated. The soil-landscape units delineated on the map are described briefly in the map legend and in greater detail in the written report. The map and the report should be used together.

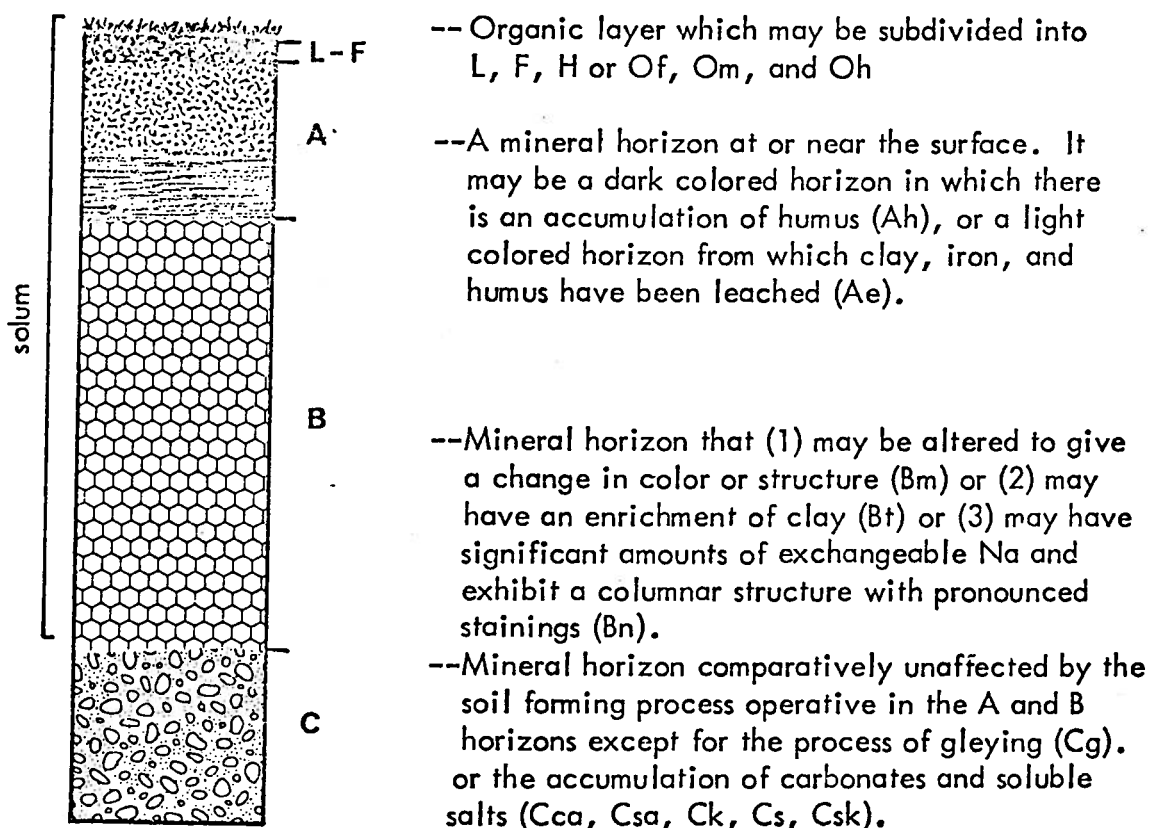
## THE SOILS

### Soil Formation

Soils are natural bodies present on the earth's surface that are an integral part of the environment. Soils display variation both vertically and horizontally and by examining these variations soil individuals may be recognized. Soils have evolved from their geological parent material through the action of a combination of

soil forming processes, which are controlled by environmental parameters or "soil forming factors". These soil forming factors are commonly listed as being the parent material, climate, biotic agents and topography all acting through time. The variations in relative importance or dominance of one or more of the soil forming processes such as addition and removal of organic matter, translocation of clays or iron and aluminum, and chemical and physical transformations result in the formation of horizons or layers of various kinds within the soil body. These horizons differ from one another in such properties as color, texture, structure, consistence, and chemical and biological activity. The major, or master horizons are designated O for organic layers developed mainly from mosses, rushes, and woody materials; L, F and H for organic layers developed mainly from leaves, twigs, woody materials, and a minor component of mosses; and A, B and C for mineral horizons. Subdivisions of the master horizons are denoted by suffix letters appended to the master horizon symbol (see Figure 1, Table 13, and glossary).

FIGURE 1. DIAGRAM OF A SOIL PROFILE



Through observation of soil characteristics it is possible to classify soils into taxonomic units. In this report the System of Soil Classification for Canada (Canada Soil Survey Committee, 1973) is used (see Soil Unit Descriptions).

The criteria used for making the taxonomic separations are significant for understanding soil genesis and for land use applications.

### Soil Mapping

When mapping soils the fieldman examines the soil at points in the landscape to characterize landscape units. Since soil is a continuum, and adjacent soils seldom have sharp boundaries, soil map units are defined as having a certain range of properties. These soil map units are based on geologic materials and landforms, soil development, and soil moisture conditions. The soil and land attributes recognized in mapping are important for various land uses.

The notations on the soil map consist of number and letters: for example

1 - 3  
c

The first digit in the number represents a geologic landform or material (for example an alluvial fan or a glacial till); the second digit denotes soil profile development, moisture conditions, and sometimes textural differences; and the letter denotes the topographical class. The topographical classes are those used by the Canada Soil Survey Committee, which are as follows:

Simple topography Single slopes (regular surface)		Slope %	Complex topography Multiple slopes (irregular surface)	
A	depressional to level	0 to 0.5	a	nearly level
B	very gently sloping	0.5+ to 2	b	gently undulating
C	gently sloping	2+ to 5	c	undulating
D	moderately sloping	5+ to 9	d	gently rolling
E	strongly sloping	9+ to 15	e	moderately rolling
F	steeply sloping	15+ to 30	f	strongly rolling
G	very steeply sloping	30+ to 60	g	hilly
H	extremely sloping	over 60	h	very hilly

The soils were mapped in the field by making observations at selected sites using available exposures or digging with a shovel or coring with a truck-mounted coring machine. These point observations are extrapolated to an area basis through the use of aerial photograph interpretation and field checking. The principal soils were sampled to depths of six feet for physical, chemical and engineering analyses.

### Soil Classification

The soils have been classified according to the System of Soil Classification for Canada (Canada Soil Survey Committee, 1973). This scheme classifies the soils in their natural state and thus indicates relationships between soils and their environment.

These relationships are often important for assessing limitations of soils for various uses. The classification system is described briefly in Table 12.

### Soil Texture

Throughout the report reference is made to soil texture and to soil drainage classes. Soil texture is according to the United States Department of Agriculture (USDA) textural classification which is described below. The soil drainage classes, according to the Canada Soil Survey Committee (1970) are outlined following the textural classification.

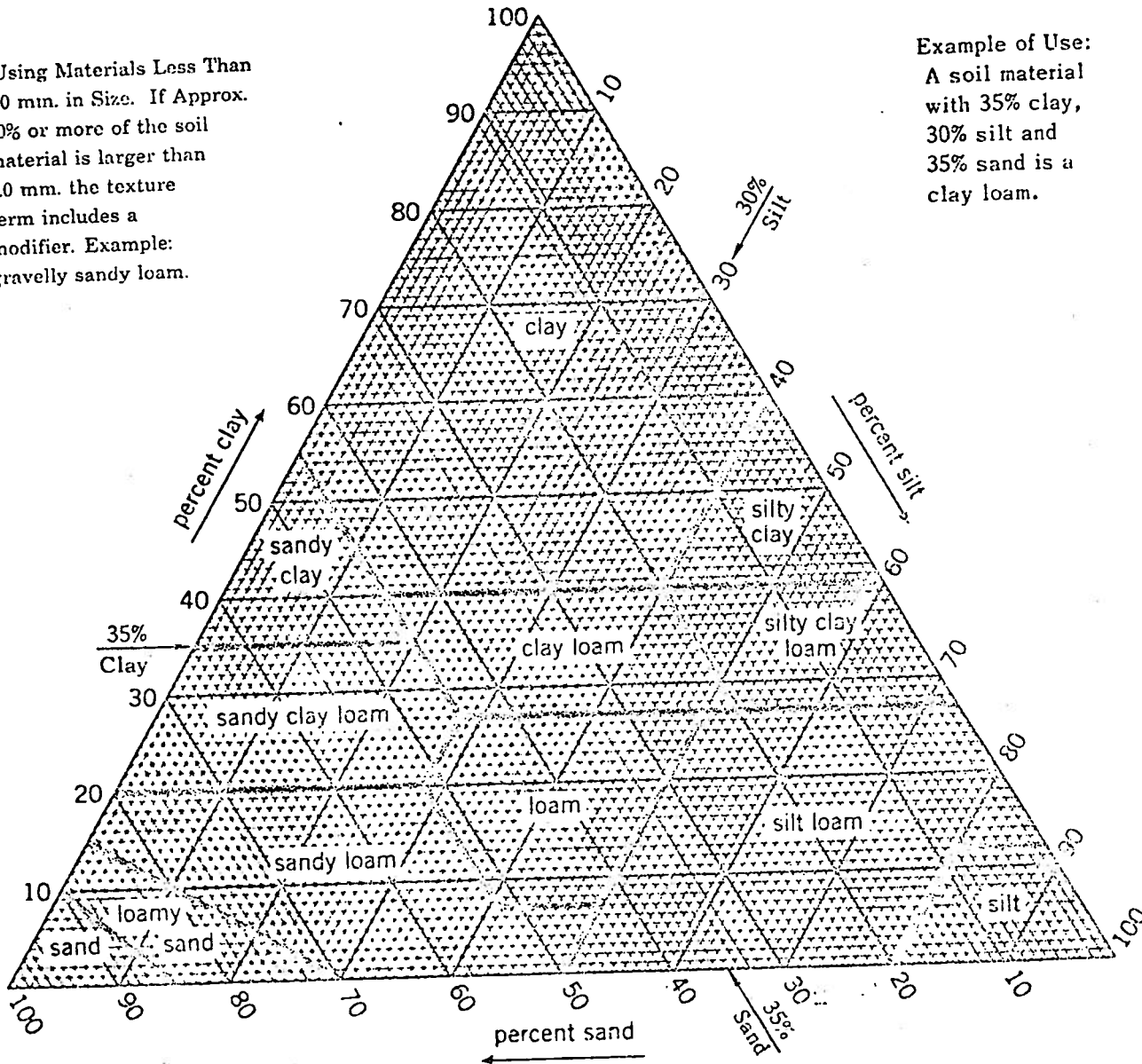
Soil Separates (Particle Size) on which Textural Classes are Based.

<u>Separates</u>		<u>Diameter in Millimeters</u>
Very Coarse Sand (V.C.S.)		2.0 - 1.0
Coarse Sand (C.S.)		1.0 - 0.5
Medium Sand (M.S.)	Sand (S)	0.5 - 0.25
Fine Sand (F.S.)		0.25 - 0.10
Very Fine Sand (V.F.S.)		0.10-0.05
Silt (Si)		0.05 - 0.002
Clay (C)		less than 0.002

FIGURE 2. GUIDE FOR USDA SOIL TEXTURAL CLASSIFICATION.

Using Materials Less Than 2.0 mm. in Size. If Approx. 20% or more of the soil material is larger than 2.0 mm. the texture term includes a modifier. Example: gravelly sandy loam.

Example of Use:  
A soil material with 35% clay, 30% silt and 35% sand is a clay loam.



The soil textural classes are grouped according to the Canada Soil Survey Committee as follows:

Very coarse textured: sands, loamy sands.  
 Moderately coarse textured: sandy loam, fine sandy loam.  
 Medium textured: very fine sandy loam, loam, silt loam, silt.  
 Moderately fine textured: sandy clay loam, clay loam, silty clay loam.  
 Fine textured: sandy clay, silty clay, clay (40 - 60% clay).  
 Very fine textured: heavy clay (more than 60% clay).

The gravelly class names are added to the textural class names according to the following rule:

% gravel by volume

less than 20	- use textural class only.
20 - 50	- gravelly and texture.
50 - 90	- very gravelly and texture.
more than 90 in surface 8 inches	- cobble land type

Soil Drainage Classes

Soil drainage classes are defined in terms of (a) actual moisture content in excess of field moisture capacity, and (b) the extent of the period during which such excess water is present in the plant root zone.

Rapidly drained - soil moisture content seldom exceeds field capacity in any horizon except immediately after water additions.

Well drained - soil moisture content does not normally exceed field capacity in any horizon except possibly the C, for a significant part of the year.

Moderately well drained - soil moisture in excess of field capacity remains for a small but significant period of the year.

Imperfectly drained - soil moisture in excess of field capacity remains in subsurface horizons for moderately long periods during the year.

Poorly drained - soil moisture in excess of field capacity remains in all horizons for a large part of the year.

Very poorly drained - free water remains at or within 12 inches of the surface most of the year.

Specific reference to surface drainage may be designated in terms of run-off and described as high, medium, low or ponded. Similarly, specific reference to the characteristics of horizons within the profile may be designated in terms of permeability or percolation and described as rapid, moderate, slow, very slow, and none.

## SOIL AND LAND USE

### Engineering Use of Pedological Information

Both the report and the map contain information of use to engineers and land use planners. A pedological soil classification, which describes the soil in its natural setting, describes not only the soil material but also the effects of soil climate, drainage, permeability and topography. When planning the construction of roads, airports, residential and other developments which are based on the soil this information can be very useful in predicting performance. Highway engineers make use of soil maps in planning materials investigations and for predicting sub-grade and pavement performance (Allemeier, 1973). A recent soil survey in the Mill Woods area of Edmonton indicated areas where concrete corrosion due to sulfate attack was a potential problem (Lindsay, et al, 1973).

Several terms, such as soil, texture, structure, and consistence differ in usage between pedology and engineering. The pedological meanings are intended in this report and many of the terms are defined in the glossary.

### Engineering Properties of the Soils

Engineering properties including particle size distribution, Atterberg limits, and the Unified and AASHO classification are reported for the major soils. These data are derived from laboratory testing of samples representative of the soil map unit. The philosophy of pedology is involved here in extrapolating from a site to an area. These data are not intended to be site specific and do not substitute for on-site inspection and soil testing but do provide a basis for area planning and further soil investigations.

### Soils and Urban Development

In selecting sites for housing, schools, parks, shopping centres, sewage disposal and other community developments, soil suitability must be considered so as to avoid costly errors and to prevent waste, abuse and loss of valuable agricultural soils.

The soils have been evaluated for limitations to roads, buildings, and sewage lagoons and as suitability as a source of gravel, roadfill and topsoil. The soils have also been assigned ARDA capability ratings for agriculture in order to evaluate the loss of agricultural production potential.

These evaluations consider such soil properties as texture - which affects stability and bearing strength for roads and foundations, shrink-swell, risk of frost heaving, and rate of infiltration and internal drainage; soil moisture conditions - which affect location of buildings, roads, services and sewage disposal; topography - which affects drainage and site location; and flooding hazard - which affects location of buildings, roads and sewage lagoons.

Soil interpretations are included so that soils information may be more easily understood. These interpretations should be treated as evaluations of performance of soils not as recommendations for the use of soils. Many other factors are involved in the recommended use of soils. Also, because soil boundaries are not precise, soil survey interpretations do not eliminate on-site investigations. They are, however, intended as an aid in planning further investigations, to reduce the amount of investigation and minimize the cost.

For each use, the soils are rated in terms of degree of limitation - slight, moderate or severe, or in terms of suitability as a source of material - good, fair or poor.

A slight soil limitation is the rating given soils that have properties favourable for the use. Good performance and low maintenance can be expected.

A moderate soil limitation is the rating given soils that have properties moderately favourable for the use. This limitation can be overcome or modified by planning, design or maintenance.

A severe soil limitation is the rating given soils that have one or more properties that are seriously unfavourable for the use. This limitation generally requires major soil reclamation, special design or intensive maintenance. In most situations, it is difficult and costly to alter the soil or to design a structure so as to compensate for the severe degree of limitation but using these soils without employing corrective measures could result in failure.



TABLE 1. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR ROAD LOCATION

Properties that affect design and construction of roads are (1) those that affect the load supporting capacity and stability of the subgrade; and (2) those that affect the workability and amount of cut and fill. The AASHTO and Unified Classification, and the shrink-swell potential give an indication of the traffic supporting capacity. Wetness and flooding affect stability. Slope, depth of bedrock, stoniness, rockiness, and wetness affect the ease of excavation and the amount of cut and fill to reach an even grade.

Soil limitation ratings do not substitute for basic soil data or for onsite investigations.

Item Affecting Use	Degree of Soil Limitation		
	NONE TO SLIGHT	MODERATE	SEVERE
Soil drainage class <sup>1</sup>	Rapidly <sup>1</sup> , well and moderately well drained.	Imperfectly drained	Poorly and very poorly drained.
Flooding	None	Once in 5 years	More than once in 5 yrs.
Slope	0 to 9% (AD).	9 to 15% (E).	More than 15% (> E).
Depth to Bedrock	More than 40 inches	20 to 40 inches.	Less than 20 inches.
Subgrade <sup>2</sup>			
a. AASHTO Group index <sup>3</sup>	0 to 4.	5 to 8.	more than 8
b. Unified soil classes	GW, GP, SW, GM, SM, and GC <sup>4</sup> and SC <sup>4</sup> .	CL (with PI <sup>5</sup> less than 15), ML, SP.	CL (with PI <sup>5</sup> 15 or more), CH, MH, OH, OL, Pt.
Shrink-swell <sup>6</sup> potential	Low (PI <sup>5</sup> less than 15).	Moderate (PI <sup>5</sup> 10 to 15).	High (PI <sup>5</sup> greater than 20).
Susceptibility to frost heave <sup>7</sup>	Low (F1, F2).	Moderate (F3).	High (F4) (silty & peaty soils).
Stoniness	Stones greater than 5' apart.	Stones 2 to 5' apart.	Stones less than 2' apart.
Consolidated Bedrock exposures	Rock exposures greater than 300' apart and cover less than 2% of the surface	Rock exposures 300 to 100' apart and cover 2 to 10% of the surface.	Rock exposures less than 100' apart and cover greater than 10% surface.

1. For an explanation of soil drainage classes see page 7.
2. This item estimates the strength of a soil as it applies to roadbeds. When available, AASHTO Group Index values from laboratory tests were used; otherwise the estimated Unified classes were used. On unsurfaced roads, rapidly drained, very sandy poorly graded soils may cause washboard or rough roads.
3. Group Index values were estimated from information published by the Portland Cement Assn. 1962. pp 23-25.
4. Downgrade to moderate if content of fines (less than 200 mesh) is greater than about 30%.
5. PI means plasticity index.
6. Inherent swelling capacity is estimated as low when the plasticity index is less than 15, medium when the plasticity index is 10 to 15 and high when the plasticity index is greater than 20 (Terzaghi and Peck, 1967). Gravelly and stony soils may not exhibit shrink-swell as estimated by the plasticity index because of dilution of the fines with coarse fragments. In these situations decrease a severe limitation to moderate and a moderate limitation to slight.
7. Frost heave is important where frost penetrates below the hardened surface layer and moisture transportable by capillary movement is sufficient to form ice lenses at the freezing front. The susceptibility classes are taken from the United States Army Corps of Engineers (1962), pp.5 - 8.

TABLE 2. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR PERMANENT BUILDINGS<sup>1</sup>

This guide provides ratings for undisturbed soils evaluated for single storey buildings and other structures with similar foundation requirements. The emphasis for rating soils for buildings is on foundations; but soil slope, and susceptibility to flooding and other hydrologic conditions, such as seasonal wetness, that have effects beyond those related exclusively to foundations are considered. Also considered are soil properties, particularly depth to bedrock, which influence excavation and construction costs, both for the building itself and for the installation of utility lines. Excluded are limitations for soil corrosivity, landscaping and septic tank absorption fields. On site investigations are needed for specific placement of buildings and utility lines, and for detailed design of foundations. All ratings are for undisturbed soils based on information gained from observations to a depth of 4 to 6 feet.

Item Affecting Use	Degree of Limitation		
	SLIGHT	MODERATE	SEVERE
Wetness <sup>3</sup>	With basements: Rapidly drained and well drained. Without basements: Rapidly, well and moderately well drained.	With basements: Moderately well drained. Without basements: Imperfectly drained.	With basements: Imperfectly, poorly & very poorly drained. Without basements: Poorly & very poorly drained.
Depth to seasonal water table (seasonal means 1 month or more)	With basements: Below 60 inches Without basements: Below 30 inches	With basements: Below 30 inches Without basements: Below 30 inches	With basements: Above 30 inches Without basements: Above 20 inches
Flooding	None	None	Subject to flooding
Slope <sup>4</sup>	0 to 9% (AD).	9 to 15% (E).	More than 15% (>E).
Shrink-swell Potential	Low	Moderate	High
Unified soil group <sup>5</sup>	GW, GP, SW, SP, GM, GC, SM, SC	ML, CL	CH, MH, OL, OH, Pt.
Potential frost action <sup>6</sup>	Low (F1, F2).	Moderate (F3).	High (F4).
Stoniness	Stones greater than 25' apart	Stones 5 to 25' apart	Stones less than 5' apart.
Potential Concrete Corrosion	0.00 to 0.10% sulphate	0.10 - 0.50% sulphate	greater than 0.50% sulphate
Depth to Bedrock	With basements: More than 60 inches. Without basements: More than 40 inches.	With basements: 40 to 60 inches. Without basements: 20 to 40 inches.	With basements: Less than 40 inches. Without basements: Less than 20 inches.

1. By reducing the slope limits by  $\frac{1}{2}$ , this table can be used for evaluating soil limitations for buildings with large floor areas but with foundation requirements not exceeding those of ordinary 3-storey dwellings.
2. Some soils rated as having moderate or severe limitations may be good sites from an aesthetic or use standpoint but require more preparation or maintenance.
3. For an explanation of soil drainage classes see page 7.
4. Reduce slope limits by  $\frac{1}{2}$  for those soils subject to hillside slippage.
5. This item estimates the strength of the soil, that is its ability to withstand applied loads.
6. The potential frost action classes are taken from the United States Army Corps of Engineers (1962), pp. 5-8.

TABLE 3. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR SEWAGE LAGOONS.

A sewage lagoon (aerobic) is a shallow lake used to hold sewage for the time required for bacterial decomposition. Soils have two functions, (1) as an impounding vessel and (2) as material for the impounding embankment. When the lagoon is properly constructed it must be capable of holding water with minimum seepage.

Item Affecting Use	Degree of Soil Limitation		
	SLIGHT	MODERATE	SEVERE
Depth to water table <sup>1</sup> (seasonal or year round)	more than 60 in.	40 - 60 in.	less than 40 in.
Flooding <sup>2</sup>	none	none	soils subject to flooding
Depth to Consolidated Bedrock	more than 60 in.	40 - 60 in.	less than 40 in.
Slope	less than 2%	2 - 9%	more than 9%
Organic Matter	less than 2%	2 - 15%	more than 15%
Unified Soil Group <sup>3</sup>	GC, SC, CL, CH	GM, ML, SM, MH	GP, GW, SW, SP, OL, OH, Pt.

1. If the floor of the lagoon is nearly impermeable material at least 2 feet thick, disregard depth to watertable.
2. Disregard flooding if it is not likely to enter or damage the lagoon (low velocity and depth less than five feet).
3. Rated mainly for the floor of the lagoon.

TABLE 4. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR CAMP AREAS.

This guide applies to soils to be used intensively for trailers and tents and the accompanying activities of outdoor living. It is assumed that little site preparation will be done other than shaping and levelling for campsites and parking areas. The soil should be suitable for heavy foot traffic and for limited vehicular traffic. Soil suitability for growing and maintaining vegetation is not a part of this guide, except as influenced by moisture, but is an important item to consider in the final evaluation of site.

Item Affecting Use	Degree of Soil Limitation		
	NONE TO SLIGHT	MODERATE	SEVERE
Wetness	Rapidly, well and moderately well drained soils. Water table below 30" during season of use.	Moderately well and imperfectly drained soils. Water table below 20" during season of use.	Imperfectly, poorly, and very poorly drained soils. Water table above 20" during season of use.
Flooding	None.	None during season of use.	Floods during season of use.
Permeability	Very rapid to moderate.	Moderately slow and slow.	Very slow.
Slope	0 to 9% (AD).	9 to 15% (E).	Greater than 15% (greater than E).
Surface soil texture <sup>2</sup>	SL, FSL, VFSL, L.	SiL, CL, SCL, SiCL, LS and sand other than loose sand.	SC, SiC, C, loose sand subject to severe blowing, organic soils.
Coarse fragments on surface <sup>3</sup>	0 to 20%.	20 to 50%. <sup>4</sup>	Greater than 50%.
Stoniness <sup>5</sup> (stony)	Stones greater than 25' apart.	Stones 25 to 5' apart.	Stones less than 5' apart.
Rockiness <sup>5</sup> (rock)	no rock exposures.	Rock exposures greater than 30' apart and cover less than 25% of the area.	Rock exposures less than 30' apart & cover greater than 25% of the surface.

1. For information specific to roads and parking lots see Table 1.
2. Surface soil texture influences soil ratings as it affects foot trafficability, dust, soil permeability and erosion hazard.
3. Coarse fragments include both gravels and cobbles.
4. Some gravelly soils may be rated as slight if the content of gravel exceeds 20% by only a small margin providing (a) the gravel is embedded in the soil matrix, or (b) the fragments are less than 3/4 inch in size. See the definition for gravels in the System of Soil Classification for Canada (C.S.S.C., 1970), pp 213-214.
5. Very shallow soils are rated as having a severe soil limitation for rockiness and/or stoniness. See also definitions of rockiness and stoniness in the System of Soil Classification for Canada (C.S.S.C., 1970), pp 213-214.

TABLE 5. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR PICNIC AREAS.

This guide applies to soils considered for intensive use as park-type picnic areas. It is assumed that most vehicular traffic will be confined to access roads.<sup>1</sup> Soil suitability for growing and maintaining vegetation is not a part of this guide, except as influenced by moisture, but is an important item to consider in the final evaluation of site.

Items Affecting Use	Degree of Soil Limitation		
	None to Slight	Moderate	Severe
Wetness	Rapidly, well and moderately well drained soils. Water table below 20" during season of use.	Moderately well and imperfectly drained soils. Water table during season of use may be less than 20" for short periods.	Poorly and very poorly drained soils. Water table above 20" and often near the surface for a month or more during season of use.
Flooding	None during season of use.	May flood once a year for short period during season of use.	Floods more than once a year during season of use.
Slope	0 to 9% (AD).	9 to 15% (E).	Greater than 15% (greater than E).
Surface soil texture <sup>2</sup>	SL, FSL, VFSL, L.	SiL, CL, SCL, SiCL, LS, and sand other than loose sand.	SC, SiC, C, loose sand subject to severe blowing, organic soils.
Coarse fragments on surface <sup>3</sup>	0 to 20%.	20 to 50% <sup>4</sup> .	More than 50%
Stoniness <sup>3</sup>	Stones greater than 5' apart.	Stones 2 to 5' apart.	Stones less than 2' apart.
Rockiness <sup>3</sup>	Rock exposures roughly 100 to 300 or more feet apart and cover less than 10% of the surface.	Rock exposures 30 to 100' apart and cover about 10 to 25% of the surface.	Rock exposures less than 30' apart and cover greater than 25% of the surface.

1. For information specific to roads or parking lots see Table 1.
2. Surface soil texture influences soil ratings as it affects foot trafficability, dust, soil permeability and erosion hazard.
3. See also definitions for gravel, rockiness and stoniness in the System of Soil Classification for Canada (C.S.S.C., 1970), pp. 213-214. Coarse fragments include both gravels and cobbles.
4. Some gravelly soils may be rated as slight if the content of gravel exceeds 20% by only a small margin providing (a) the gravel is embedded in the soil matrix or (b) the fragments

TABLE 6. GUIDES FOR ASSESSING SOIL LIMITATIONS FOR PLAYING FIELDS.

This guide applies to soils considered for intensive use as playing fields for organized games such as baseball or football. Soil suitability for growing and maintaining vegetation is not a direct consideration in this guide, but is an important item to consider.

Item Affecting Use	Degree of Soil Limitation		
	SLIGHT	MODERATE	SEVERE
Flooding	none during season of use	subject to occasional flooding. Not more than once in 3 years.	subject to more than occasional flooding.
Wetness	rapidly to moderately well drained.	imperfectly drained soils subject to occasional ponding.	poorly and very poorly drained.
Depth to Water table	more than 30 inches during season of use.	20 to 30 inches during season of use.	less than 20 inches during season of use.
Permeability	very rapid to moderate (20 in./hr to 0.6 in./hr.)	moderately slow (0.6 - 0.2 in./hr)	slow and very slow. (less than 0.2 in/hr)
Slope	0 - 2%	2 - 5%	more than 5%
Surface Texture	SL, FSL, VFSL, L	CL, SCL, SiCL, SiL, LS and S other than loose sand.	SC, SiC, C, loose sand, organic
Depth to Bedrock	more than 40 inches	20 to 40 inches	less than 20 inches
Surface Stoniness	slightly stony	moderately stony	very to excessively stony.

TABLE 7. SUITABILITY RATINGS OF SOILS AS SOURCES OF GRAVEL

The main purpose of these ratings is to indicate local sources of gravel. The ratings are based on the probability that soils contain sizable quantities of gravel.

Item Affecting Use	Degree of Soil Suitability		
	GOOD	FAIR	POOR
Unified Soil Group	GW, GP	GP-GM GW-GM	GM, GP-GC, GW-GC (all other groups unsuited)
Flooding	none or occasional		frequent or constant
Wetness	better than poorly drained <sup>1</sup>		poorly and very poorly drained
Depth of overburden	less than 2 feet	2 to 5 feet	more than 5 feet

1. See page 7 for an explanation of drainage classes.

TABLE 8. SUITABILITY RATINGS OF SOILS AS SOURCES OF ROADFILL

The ratings in this table indicate the performance of a soil after it is placed in a road embankment and also the degree of difficulty in excavating the fill material. Ratings of the material are the same as for road location (Table 3) however ratings of factors governing excavation differ.

Item Affecting Use	Degree of Soil Suitability <sup>1</sup>		
	GOOD	FAIR	POOR
Wetness	Rapidly to moderately well drained <sup>2</sup>	Imperfectly drained	Poorly and very poorly drained
Engineering Groups Unified Group	GW, GP, GC, SW, SP, SM, SC	ML, CL with P.I. <sup>3</sup> less than 15	CH, MH, OL, OH, Pt, and CL with P.I. more than 15
AASHTO Group Index	0 - 4	5 - 8	greater than 8
Stoniness	none to moderately stony	very stony	exceedingly stony
Depth to consolidated bedrock	more than 6 feet	3 to 6 feet	less than 3 feet
Slope	0 - 15%	15 - 30%	more than 30%

1. A rating of unsuited (u) is applied to land units, such as bedrock (R), where no conventional fill material is present.

2. See page 7 for an explanation of drainage classes.

3. P.I. means plasticity index.

TABLE 9. SUITABILITY RATINGS OF SOILS AS SOURCES OF TOPSOIL

Topsoil, for these ratings, refers essentially to Ah horizon material. In some cases the B, and even C horizon materials could be used for dressing disturbed land. These ratings are intended for use by engineers, landscapers, planners and others who make decisions about selecting, stockpiling and using topsoil. These ratings are based on quality of topsoil and ease of excavation. In addition to the Good, Fair, and Poor ratings described below, an Unsited (U) rating is used.

Item Affecting Use	Degree of Suitability <sup>1</sup>		
	GOOD	FAIR	POOR
Texture	SL, FSL, VFSL, L, SiL	CL, SCL, SiCL	LS, S, SC, SiC, C, Organic
Depth of topsoil	more than 6 in.	3 - 6 in.	less than 3 in.
Flooding	none	may flood occasionally	frequently or constantly flooded
Wetness	Drainage class not determining if better than poorly drained		Poorly and very poorly drained
Coarse fragments % by volume	less than 3%	3 - 15%	more than 15%
Slope	less than 9%	9 - 15%	more than 15%
Stoniness	none to slightly stony	moderately stony	very to excessively stony
Salinity of topsoil	E.C. <sup>2</sup> 0 - 1 <sup>3</sup>	E.C. 1 - 3	E.C. more than 3
Permeability of upper subsoil	moderate	slow	very slow

1. A rating of unsited (U) is used for soil and land units that do not have topsoil present.
2. E.C. = electrical conductivity of a saturation extract in mmhos/cm.
3. These are the limits suggested by the Alberta Soil and Feed Testing Laboratory when considering lawn growth.



The decision as to whether or not a soil will be utilized for a specific use, regardless of the soil limitation, is beyond the scope of this report.

### Agricultural Capability

The soils have been rated as to their suitability as agricultural cropland. This information is required to make sound decisions on land use where soils are being lost to agricultural production.

The ratings are made using the ARDA Canada Land Inventory, Soil Capability Classification for Agriculture. These classes and subclasses are defined in the Soil Capability Classification for Agriculture. (Canada Land Inventory, 1965).

Briefly the 7 classes are:

Class 1 - Soils in this class have no significant limitations in use for crops.

Class 2 - Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices.

Class 3 - Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices.

Class 4 - Soils in this class have severe limitations that restrict the range of crops.

Class 5 - Soils in this class have very severe limitations that restrict their capability to producing perennial forage crops, and improvement practices are feasible.

Class 6 - Soils in this class are capable of only producing perennial forage crops and improvement practices are not feasible.

Class 7 - Soils in this class have no capability for arable culture or permanent pasture.

The subclasses are as follows:

- D - the depth of the rooting zone is restricted by soil conditions other than wetness or consolidated bedrock.
- F - low fertility.
- I - inundation by streams or lakes.
- M - low moisture-holding capacity.
- N - presence of enough soluble salts to adversely affect crop growth or restrict the range of crops that can be grown.
- P - stoniness.
- S - used in a collective sense for one or more subclasses.
- T - adverse topography.
- W - excess water other than from flooding.

## SECTION II

## THE AIRDRIE AREA

## LOCATION AND EXTENT OF STUDY AREA

The area described in this report covers approximately  $10\frac{1}{2}$  square miles or about 6,700 acres in the vicinity of Airdrie, Alberta. Airdrie is located in section 12, Township 27, Range 1, west of the 5th meridian. It is approximately 12 miles north of Calgary on Highway 2.

## PHYSIOGRAPHY OF THE AREA

The terrain in this area is composed of gently undulating to undulating uplands and nearly level to gently undulating lowlands interspersed with depressional areas. There is also a small area of steeply sloping topography in the southeast.

The soils of the uplands are developed from till that is high in sandstone content and those of the lowlands are developed from lacustrine and glacio-fluvial material.

The physiography of the area was described by J. A. Allan (1943) in the Soil Survey of the Rosebud and Banff sheets. The uppermost bedrock formation is the Paskapoo Formation which is early Tertiary in age and consists chiefly of soft, gray clayey sandstones in the Airdrie area.

The ice sheets in passing over this area mixed material from the underlying surface bedrock with minor amounts of material from considerable distances and deposited it in the form of gently undulating to undulating ground moraine. The Cordilleran ice sheet originated within the Rocky Mountains bringing with it rock debris that consists largely of limestone, dolomite and quartzitic sandstones. Large glacial erratics of quartzitic sandstone are located in the vicinity of Airdrie. The Keewatin ice sheet originated in the vicinity of Hudson Bay and Allan believes it advanced at a later date bringing with it rock debris from the Canadian Shield (granites, etc.). There is no sharp line of demarcation between areas covered with debris from each of these ice sheets.

The till in the Airdrie area contains considerable amounts of calcareous Paskapoo clayey sandstone. The pebbles are mainly quartzites and dolomites in a sandy matrix. There are some groundwater discharge areas that are high in soluble salts within the till area resulting in the development of solonetzic soils.

The valley of Nose Creek between Crossfield and Calgary extends through the area and is composed mainly of moderately fine textured, saline lacustrine deposits. The salts originated from saline rock formations probably to the north and have been brought near the surface in groundwater discharge areas.

Small areas of moderately fine to medium textured glacio-fluvial deposits also occur in this valley and along its edges.

The area is drained by the Bow River Drainage system.

## THE SOILS

The soils of Alberta are classified into broad soil zones principally on the color of the soil surface. The soil profile reflects the climate and vegetation of each zone. The Airdrie area is included in the thin black soil zone which is a shallow phase of the black soil zone. The A horizon is black and is from 3 to 6 inches thick as compared to 6 to 18 inches in the black soil zone. This is a reflection of a slightly lower rainfall, higher evapotranspiration and grassland rather than parkland vegetation.

The legend shown on the accompanying map indicates the classification of the soils in the area. Thirteen soil associations were mapped - six on till, six on lacustrine and one on glacio-fluvial deposits. In the following section, generalized descriptions of the soil associations in the Airdrie area are presented:

SOIL ASSOCIATION DESCRIPTIONS

Soil Association: 1-1  
 Soil Classification: thin Orthic Black and thin Gleyed Orthic Black  
 Parent Material: medium textured till.  
 Topography: gently undulating and gently rolling  
 Drainage: well and imperfectly drained  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA* texture	Lime content	Salinity
Ah	Black	3 to 6	6.5 - 7.0	soft	L	low	nil
Bm	Dark Brown	8 to 12	6.5 - 7.5	slightly hard	L	low	nil
Ck	Gray	-	7.5 - 8.5	-	L	high	nil

Comments:

Limitations for selected uses: slight for most uses, moderate for sewage lagoons.

\* see pages 5, 6 and 7 for explanation of texture symbols.

Soil Association: 1-2  
 Soil Classification: thin Gleyed Orthic Black.  
 Parent Material: medium textured till  
 Topography: nearly level  
 Drainage: imperfectly drained  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA texture	Lime content	Salinity
Ah	Black	3 to 6	6.5 - 7.0	soft	L	low	nil
Bg	Dark brown	8 to 12	7.0 - 7.5	slightly hard	L	low	nil
Ckg	Gray	-	7.5 - 8.5	-	L	high	nil

Comments: B and C horizons are moderately gleyed and mottled.

Limitations for selected uses: moderate for most recreational uses; severe for sewage lagoons;  
 moderate for permanent buildings with basements.

Soil Association: 1-3  
 Soil Classification: Orthic Humic Gleysol and peaty Orthic Humic Gleysol  
 Parent Material: medium textured till  
 Topography: depressional  
 Drainage: poorly and very poorly drained  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA texture	Lime content	Salinity
Om	Brown	0 to 6	5.5 - 6.5	-	-	-	-
Ahg	Black	3 to 6	6.5 - 7.0	-	L	low	nil
Bg	Dark Gray	4 to 8	7.0 - 8.0	-	L	low	nil
Ckg	Gray	-	7.5 - 8.5	-	L	high	nil

Comments: May have up to 6 inches of organic matter on the surface. A, B, and C horizons are strongly gleyed and mottled.

Limitations for selected uses: Severe for most uses.

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Soil Association: 1-4  
 Soil Classification: peaty Orthic Humic Gleysol  
 Parent Material: medium textured till  
 Topography: depressional  
 Drainage: very poorly drained  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA texture	Lime content	Salinity
Om	Brown	6 to 10	5.5 - 6.5	-	-	low	nil
Ahg	Black	3 to 6	6.5 - 7.0	-	L	low	nil
Bg	Dark Gray	4 to 8	7.0 - 8.0	-	L	low	nil
Ckg	Gray	-	7.5 - 8.5	-	L	high	nil

Comments: May have from 6 to 10 inches of organic matter on the surface. A, B, and C horizons are strongly gleyed and mottled.

Limitations for selected uses: Severe for most uses.

Soil Association: 1-5  
 Soil Classification: Gleyed Black Solonetz and Gleyed Black Solod.  
 Parent Material: medium textured till.  
 Topography: nearly level  
 Drainage: imperfectly drained  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA texture	Lime content	Salinity
Ah	Black	2 to 4	7.0 - 7.5	slightly hard	L	low	low
Bng	Dark grayish brown	4 to 6	7.0 - 7.5	very hard	L	medium	med.
Cskg	Gray	-	7.5 - 8.5	-	L	high	high

Comments: B horizon is columnar with dark stains on ped surfaces. B and C horizons are moderately gleyed and mottled.

Limitations for selected uses: Severe for most uses. Moderate to severe for buildings with basements.

Soil Association: 1-6  
 Soil Classification: Orthic Regosol and thin Rego Black  
 Parent Material: medium textured till.  
 Topography: very steeply sloping  
 Drainage: rapidly drained  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA texture	Lime content	Salinity
Ahe	light brown	1 to 3	7.0 - 7.5	soft	L	med.	nil
Ck	gray	-	7.5 - 8.5	-	L	high	nil

Comments: A horizon is very light in color compared to thin Orthic Black soils.

Limitations for selected uses: Severe for most uses.

Soil Association: 2-1  
 Soil Classification: thin Orthic Black and thin Gleyed Orthic Black  
 Parent Material: moderately fine textured lacustrine  
 Topography: nearly level  
 Drainage: well and imperfectly drained  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA texture	Lime content	Salinity
Ah	Black	3-6	6.5 - 7.0	soft	SiL	low	nil
Bm	Dark Brown	6-8	7.0 - 7.5	slightly hard	Cl-SiC	low	nil
Ck	Gray	-	7.5 - 8.5	-	SiCl-Cl	high	nil

Comments:

Limitations for selected uses: Moderate for recreational uses; slight for sewage lagoons; poor source of roadfill.

Soil Association: 2-2  
 Soil Classification: thin Gleyed Orthic Black  
 Parent Material: moderately fine textured lacustrine  
 Topography: nearly level.  
 Drainage: imperfectly drained.  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA texture	Lime content	Salinity
Ah	Black	3 to 6	6.5 - 7.0	soft	SiL	low	nil
Bg	Dark grayish brown	6 to 8	7.0 - 7.5	slightly hard	CL-SiC	low	nil
Ckg	Gray	-	7.5 - 8.5	-	SiCL-CL	high	nil

Comments: B and C horizons are moderately gleyed and mottled.

Limitations for selected uses: Moderate for recreational uses, sewage lagoons and buildings; fair source of topsoil; poor source of roadfill.

Soil Association: 2-3  
 Soil Classification: Saline Humic Gleysol and peaty Saline Humic Gleysol  
 Parent Material: moderately fine textured lacustrine  
 Topography: depressional  
 Drainage: poorly and very poorly drained  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA texture	Lime content	Salinity
Om	Brown	0 to 6	5.5 - 6.5	-	-	-	-
Ahg	Black	3 to 6	7.0 - 7.5	slightly hard	SiL	low to medium	low to medium
Bng	Dark Gray	0 to 6	7.0 - 8.0	hard	CL-SiC	medium	medium
Cskg	Gray	-	8.0 - 8.5	-	SiCL-CL	high	high

Comments: May have up to 6 inches of organic matter at the surface. A, B and C horizons are strongly gleyed and mottled.

Limitations for selected uses: Severe for all uses.

Soil Association: 2-4  
 Soil Classification: peaty Saline Humic Gleysol  
 Parent Material: moderately fine textured lacustrine  
 Topography: depressional  
 Drainage: very poorly drained  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA texture	Lime content	Salinity
Om	Brown	6 to 10	5.5 - 6.5	-	-	-	-
Ahg	Black	3 to 6	7.0 - 7.5	slightly hard	SiL	low to medium	low to medium
Bng	Dark Gray	0-6	7.0 - 8.0	hard	CL-SiC	medium	medium
Cskg	Gray	-	8.0 - 8.5	-	SiCL-CL	high	high

Comments: May have from 6 to 10 inches of organic matter at the surface. A, B, and C horizons are strongly gleyed and mottled.

Limitations for selected uses: Severe for all uses.



Soil Association: 2-5  
 Soil Classification: Black Solod and Black Solonetz  
 Parent Material: moderately fine textured lacustrine  
 Topography: nearly level  
 Drainage: moderately well drained  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA texture	Lime content	Salini
Ah	Black	3 to 6	6.5 - 7.0	slightly hard	SiL	low	low
Bn	Dark Brown	6 to 10	7.0 - 7.5	very hard	CL-SiC	low	low
Csk	Gray	-	8.0 - 8.5	-	SiCL	high	high

Comments: B horizon is columnar with dark stains on ped surfaces.

Limitations for selected uses: Moderate to severe for most recreational uses; moderate to severe for buildings with basements; poor source of topsoil and roadfill.

Soil Association: 2-6  
 Soil Classification: Gleyed Black Solonetz and Gleyed Black Solod  
 Parent Material: moderately fine textured lacustrine  
 Topography: nearly level  
 Drainage: imperfectly drained  
 Profile description of dominant soil subgroup:

Horizon	Color	Thickness inches	pH	Consistence when dry	USDA texture	Lime content	Sal
Ah	Black	2 to 4	6.5 - 7.0	slightly hard	SiL	low	low
Bng	Dark grayish brown	3 to 6	7.0 - 8.0	very hard	CL-SiC	medium	medi
Cskg	Gray	-	8.0 - 8.5	-	SiCL	high	high

Comments: B and C horizons moderately gleyed and mottled. B horizon is columnar with dark stains on ped surfaces.

Limitations for selected uses: Severe for recreational uses; moderate to severe for buildings with basements; poor source of topsoil and roadfill.

Soil Association: 3-1  
 Soil Classification: Orthic Black  
 Parent Material: moderately fine to medium textured glacio-fluvial  
 Topography: gently undulating  
 Drainage: well drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salinit
Ah	Black	6 to 10	6.5 - 7.0	soft	VFSL-SL	low	nil
Bm	Brown	6 to 12	7.0 - 7.5	soft	FSCL-VFSCCL	low	nil
Ck	Gray	-	7.5 - 8.0	-	FSCL-VFSCCL	high	nil

Comments: Profile may have varying amounts of gravel strata.

Limitations for selected uses: Slight for all recreational uses; moderate for sewage lagoons; good source of topsoil and roadfill.

## SOIL SURVEY INTERPRETATIONS

Soil survey interpretations are included with this report so that soils information may be more easily understood.

The eight uses for which the soils have been rated in this study are:

(1) suitability as a source of topsoil, (2) suitability as a source of roadfill, (3) sewage lagoons, (4) permanent buildings with basements, (5) playing fields, (6) camp areas, (7) picnic areas and (8) capability for agriculture.

Soil properties and landscape features that appear important in affecting the designated uses are: (1) seasonal or permanent high water table (2) high sulphate content (3) low permeability (4) poor trafficability (5) steep slopes (6) thin topsoil (7) potential frost action (8) high percentage of organic matter (9) soil texture (10) nutrient imbalance and (11) groundwater contamination hazard.

Tables 1 to 9 are used to determine the suitability rating or the degree of limitation for each association. The suitability or limitations for the selected uses are shown in Table 11 and the limiting properties are indicated by number.

### Suitability as a Source of Topsoil

In general, the better soils in the area can be rated as fair to good as sources of topsoil if there is over 3 inches of A horizon. The soils of the area are given a suitability rating according to Table 9.

### Suitability as a Source of Roadfill

Soils of the 1-1 and 3-1 associations that are well drained and on slopes of less than 15% are good sources of roadfill. Table 8 is used for determining the suitability rating for each association.

### Sewage Lagoons

Table 3 is used for determining the degree of limitation for each association. Gleysols have severe limitations due to a high content of organic matter and a shallow depth to a seasonal high water table. Soils of the 2-1 association have

slight limitations while soils of the 3-1 association have moderate limitations due to texture resulting in groundwater contamination hazard.

#### Permanent Buildings with Basements

Table 2 is used for determining the degree of limitation for each association. According to Table 10 the soils range from 0.00 to 0.55 percent soluble sulphate. The Concrete Manual of the United States Bureau of Reclamation (1966) recognizes the following concrete corrosion categories: negligible attack - less than 0.10 percent; mild but positive attack - 0.10 to 0.20 percent; considerable attack - 0.20 to 0.50 percent; severe attack - greater than 0.50 percent. Soils of the 2-3, 2-4, 1-5 and 2-6 associations have moderate to severe limitations due to their sulphate content.

#### Playing Fields, Camp Areas and Picnic Areas

Tables 4, 5 and 6 are used for determining the degree of limitation for each association. These suitability ratings were proposed by Montgomery and Edminster (1966). The soils should possess good trafficability properties to withstand heavy foot traffic and possible vehicular traffic and vegetative cover should be easily maintained.

#### Capability for Agriculture

The well drained soils on level to undulating topography are Class 1 soils because climate, soil and topography characteristics are suitable for all major crops grown in the area. Other soils have limitations because of poor drainage, topography, salinity or soil permeability. The capability ratings for agriculture for the soil associations are shown in Table 11.

TABLE 10. ENGINEERING AND CHEMICAL SOIL DATA OF REPRESENTATIVE SOIL SAMPLES FROM THE AIRDRIE AREA

Soil Assoc.	Depth from surface (inches)	pH	Elec. Cond. mmhos/cm	SO <sub>4</sub> (%)	CaCO <sub>3</sub> equiv. (%)	Grain Size Analysis										Atterberg limits			Textural Class			
						% passing sieve							% smaller than				Liquid Limit	Plastic Limit	Plast. Index	AA SHO	Uni- fied	USDA
						1"	3/4"	5/8"	No.4	No.10	No.40	No.200	.05 mm	.005 mm	.002 mm	.001 mm						
1-1	12-22	8.5	1.2	0.01	31.9	100	98	98	97	95	90	52	50	25	20	15	28.9	20.2	8.7	A4(7)	CL	L
	22-52	8.2	1.2	0.01	24.3	100	97	95	92	92	90	67	64	16	18	15	21.9	16.1	4.8	A4(8)	CL-ML	L
	52+	8.1	0.8	0.00	20.8	100	100	100	98	98	96	72	70	15	8	6	-	-	-	-	-	-
	6-18	7.1	-	-	-	100	97	97	97	97	96	64	60	29	21	19	27.9	20.9	7.0	A4(10)	CL-ML	L
	30-48	8.0	0.5	0.00	26.0	95	95	95	95	94	90	59	55	17	15	12	18.6	15.8	2.8	A4(7)	CL-ML	L
	48+	7.9	1.0	0.00	18.3	100	100	100	99	98	97	72	70	17	10	8	26.5	15.2	11.3	A6(8)	CL	SiL
	6-18	7.0	-	-	-	100	96	95	94	94	91	56	54	28	21	17	27.4	19.0	8.4	A4(8)	CL-ML	L
	18-26	8.5	1.0	0.00	33.3	100	100	96	94	94	92	66	65	35	27	21	28.8	21.9	6.9	A4(11)	CL-ML	L-CL
	26+	7.9	1.5	0.03	18.2	100	95	94	93	92	90	57	52	18	12	10	23.0	18.2	4.8	A4(7)	CL-ML	L
2-1	12-24	7.1	-	-	-	100	100	100	100	100	96	70	70	48	49	30	40.1	25.1	15.0	A6(12)	CL-CH	C
	24-48	7.9	0.6	0.00	29.6	100	100	100	100	100	98	81	75	54	40	30	33.3	15.1	18.2	A6(10)	CL	SiCL
	till at 48+	8.5	0.9	0.00	27.2	100	100	100	98	97	95	68	68	21	15	12	25.4	20.1	5.3	A4(11)	CL-ML	SiL
2-2	12-60	8.0	1.0	0.07	30.3	100	100	100	100	100	98	80	79	50	40	30	33.4	16.9	16.5	A6(11)	CL	SiCL
	72-96	7.7	5.1	0.22	19.2	100	100	100	100	100	100	87	84	72	62	59	61.2	29.1	32.1	A7-5(16)	CH	CL HvC
2-3	8-30	8.6	11.2	0.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	14-30	8.6	7.7	0.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6-34	8.3	6.0	0.23	22.5	100	100	100	100	100	98	78	76	52	38	30	35.2	17.5	17.7	A6(11)	CL	CL
2-6	12-42	7.8	9.8	0.55	22.2	100	100	98	98	98	92	80	77	55	47	32	35.7	16.9	18.8	A6(11)	CL	C
3-1	14-60	8.1	0.6	0.00	19.5	100	100	100	100	100	100	44	44	31	24	20	25.3	18.1	7.2	A4(2)	SC	SCL
	22-72	7.9	1.0	0.02	18.7	100	100	100	99	98	86	48	48	29	21	18	28.1	18.7	9.3	A4(2)	SC	SCL

TABLE 11. LIMITATIONS AND SUITABILITY OF THE SOILS FOR SELECTED USES.

Soil Association	Soil Suitability for:		Degree of Limitation for:					Capability for Agriculture
	Topsoil	Roadfill	Sewage Lagoons	Buildings with Basements	Playing Fields	Camp Areas	Picnic Areas	
1-1	F-G 6	F9	S	S	M5	S	S	1
1-2	F6,1	F1,9	V1,9,11	M1	M1	M1	M1	2 <sup>w</sup>
1-3	P1	P1,9	V1,8,9,11	V1,7	V1	V1	V1	4 <sup>w</sup>
1-4	P1	P1,9	V1,8,9,11	V1,7	V1	V1	V1	5 <sup>w</sup>
1-5	P1,6	F1,9	V1,9,11	V1,2	V3,1,4	V3,1,4	M1	4 <sup>d</sup> <sub>w</sub>
1-6	P5,6,10	P5,9	V5,9,11	V5	V5	V5	V5	5 <sup>t</sup>
2-1	F6	P9	S	M9	M9	M9	M9	1
2-2	F6,1	P1,9	M1	M1,9	M1,9	M1,9	M1,9	2 <sup>w</sup>
2-3	P1	P1,9	V1,8	V1,2,9,7	V1,9	V1,9	V1,9	4 <sup>w</sup> <sub>n</sub>
2-4	P1	P1,9	V1,8	V1,2,9,7	V1,9	V1,9	V1,9	5 <sup>w</sup> <sub>n</sub>
2-5	F6	P9	S	M2,9	V3,4,9	V3,4,9	V ,3,4,9	3 <sup>s</sup>
2-6	P1,6	P1,9	M1	V1,2,7,9	V1,3,4,9	V1,3,4,9	V1,3,4,9	4 <sup>d</sup> <sub>w</sub>
3-1	G	G	M 9,11	S	S	S	S	1

1. Seasonal or permanent high water table
2. High sulphate content
3. Low permeability
4. Poor trafficability
5. Steep slopes
6. Thin topsoil

7. Potential frost action
8. High percentage of organic matter
9. Soil texture
10. Nutrient imbalance
11. Groundwater contamination hazard.

- G - Good  
F - Fair  
P - Poor  
S - Slight  
M - Moderate  
V - Severe

## GLOSSARY

This is included to define terms commonly used in the report; it is not a comprehensive soil glossary.

aeolian (eolian) deposit - material deposited by wind, includes both loess and dune sand.

aggregate - a group of soil particles cohering so as to behave mechanically as a unit.

alluvial deposit - material deposited by moving water.

aspect - orientation of the land surface with respect to compass direction.

Atterberg limits - see plastic limit, liquid limit.

available plant nutrients - that portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants.

cation - an ion carrying a positive charge of electricity. The common soil cations are calcium, magnesium, sodium, potassium and hydrogen.

cation-exchange capacity (C.E.C.) - a measure of the total amount of exchangeable cations that can be held by the soil. It is expressed in terms of milliequivalents/100 grams of soil.

coarse fragments - rock or mineral particles greater than 2 mm in diameter.

colluvium - a heterogeneous mixture of material that has been deposited mainly by gravitational action.

creep - slow mass movement of soil material down rather steep slopes primarily under the influence of gravity, but aided by saturation with water and alternate freezing and thawing.

edaphic - (i) of or pertaining to the soil, (ii) resulting from, or influenced by, factors inherent in the soil or other substrate rather than by climatic factors.

eluviation - the removal of soil material in suspension or in solution from a layer or layers of the soil.

erosion - the wearing away of the land surface by running water, wind, or other erosive agents. It includes both normal and accelerated soil erosion. The latter is brought about by changes in the natural cover or ground conditions and includes those due to human activity.

**field capacity** - the percentage of water remaining in a soil after having been saturated and after free drainage has practically ceased.

**glacio-fluvial deposits** - material moved by glaciers and subsequently deposited by streams flowing from the melting ice.

**gley** - gleying is a reduction process that takes place in soils that are saturated with water for long periods of time. The horizon of most intense reduction is characterized by a gray, commonly mottled appearance, which on drying shows numerous rusty brown iron stains or streaks. Those horizons in which gleying is intense are designated with the subscript g.

**groundwater** - that portion of the total precipitation which at any particular time is either passing through or standing in the soil and the underlying strata and is free to move under the influence of gravity.

**horizon** - a layer in the soil profile approximately parallel to the land surface with more or less well-defined characteristics that have been produced through the operation of soil forming processes. Soil horizons may be organic or mineral.

**illuviation** - the process of deposition of soil material removed from one horizon to another in the soil, usually from an upper to a lower horizon in the soil profile. Illuviated compounds include silicate clay, iron and aluminum hydrous oxides and organic matter.

**infiltration** - the downward entry of water into the soil.

**lacustrine deposit** - material deposited in lake water and later exposed either by a lowering of the water or by uplift of the land.

**liquid limit (upper plastic limit)** - the water content at which a pat of soil, cut by a groove of standard dimensions, will flow together for a distance of 12 mm under the impact of 25 blows in a standard liquid limit apparatus.

**lithic** - a soil subgroup modifier that indicates a bedrock contact within 50 cm (20 in.) of the soil surface.

**morphology, soil** - the makeup of the soil, including the texture, structure, consistence, colour, and other physical, mineralogical and biological properties of the various horizons of the soil profile.

**mottles** - spots or blotches of different color or shades of color interspersed with the dominant color. Mottling in soils usually indicates poor aeration and drainage.



organic matter - the decomposition residues of plant material derived from:  
(i) plant materials deposited on the surface of the soil, and (ii) roots  
that decay beneath the surface of the soil.

parent material - unconsolidated mineral material or peat from which the soil  
profile develops.

peat - unconsolidated soil material consisting largely of undecomposed to partially  
decomposed organic matter accumulated under conditions of excessive moisture.

ped - a unit of soil structure such as a prism, block or granule formed by natural  
processes (in contrast to a clod which is formed artificially).

pedology - those aspects of soil science involving the constitution, distribution,  
genesis and classification of soils.

percolation, soil water - the downward movement of water through soil. Especially  
the downward flow of water in saturated or nearly saturated soil at hydraulic  
gradients of the order of 1.0 or less.

permeability - the ease with which gases, liquids, or plant roots penetrate or pass  
through a bulk mass of soil or a layer of soil. Since different horizons of soil  
vary in permeability, the particular horizon under question should be designated.

pH - a notation used to designate the relative acidity or alkalinity of soils and other  
materials. A pH of 7.0 indicates neutrality, higher values indicate alkalinity,  
and lower values acidity.

phase, soil - a subdivision of a taxonomic class based on soil characteristics or  
combinations thereof which are considered to be potentially significant of  
man's use or management of the land.

plastic limit - water content at which a soil will just begin to crumble when rolled  
into a thread approximately 3 mm in diameter.

plasticity index - the numerical difference between the liquid and the plastic limit.

profile - a vertical section of the soil throughout all its horizons and extending into  
the parent material.

relief - the elevations or inequalities of the land surface when considered collectively.  
Minor configurations are referred to as "microrelief".

residual material - unconsolidated and partly weathered mineral material accumulated  
by disintegration of consolidated rock in place.

**saline soil** - a soil containing enough soluble salts in such quantities that they interfere with the growth of most crop plants.

**seepage (groundwater)** - the emergence of water from the soil over an extensive area in contrast to a spring where it emerges from a local spot.

**soil consistency** - (i) the resistance of a soil material to deformation or rupture.  
(ii) the degree of cohesion or adhesion of the soil mass. Terms used for describing consistency at various soil moisture conditions are:

wet soil - non-plastic, slightly plastic, plastic, very plastic.

moist soil - loose, friable, firm, very firm, extremely firm.

dry soil - loose, soft, hard, very hard, extremely hard.

**soil structure** - the combination or arrangement of primary soil particles into secondary particles, units or peds, e.g. prismatic, columnar, blocky, platy.

**soil unit** - a defined aggregate of soil bodies occurring together in an individual and characteristic pattern over the land surface.

**solum** (plural-sola) - the part of the soil profile that is above the parent material and in which the processes of soil formation are active. It comprises the A and B horizons.

**texture (soil)** - the relative proportions of the various sized soil separates in a soil as described by the textural class names.

**till** - unstratified glacial drift deposited directly by ice and consisting of non-sorted clay, silt, sand, and boulders.

**watertable** - the upper limit of the part of the soil or underlying rock material that is wholly saturated with water.

TABLE 12. CANADIAN SOIL CLASSIFICATION SYSTEM

ORDER	GREAT GROUP	DISTINGUISHING CHARACTERISTICS
1. Chernozemic (Developed under grassland and transitional grassland-forest communities)	Brown Dark Brown Black Dark Gray	Light Brown Ah horizon Dark Brown Ah horizon Black Ah horizon Have L-H surface horizons typical of forest vegetation
2. Solonetzic (Columnar or prismatic B horizon and a saline C horizon; Ca/Na ratio of B horizon is less than 10)	Solonetz Solodized Solonetz Solod	Ah horizon — Bnt horizon Ah — Ae — Bnt Ah — Ae — AB — Bnt
3. Luvisolic (Developed in forest areas; accumulation of clay in the B horizon)	Gray Brown Luvisol Gray Luvisol	(L-H) — Ah — Ae — Bt; Mull-like Ah horizon L-H — (Ah) — Ae — Bt
4. Podzolic (Accumulation of Fe+Al and/or organic matter in the B horizon)	Humic Podzol Ferro-Humic Podzol Humo-Ferric Podzol	Bh > 4" which contains > 1% O.C. < 0.3% Fe Bhf > 4" which contains > 5% O.C. > 0.6% Fe+Al Bf > 2" which contains < 5% O.C. > 0.6% Fe+Al
5. Brunisolic (Generally weakly developed B horizons)	Melanic Brunisol Eutric Brunisol Sombric Brunisol Dystric Brunisol	Ah > 2", Bm > 2"; pH > 5.5 Ah < 2", Bm > 2"; pH > 5.5 Ah > 2", Bm > 2"; pH < 5.5 Ah < 2", Bm > 2"; pH < 5.5
6. Regosolic (Weakly developed or young soils; no B horizon)	Regosol	(L-H) — Ah — C; no B horizon
7. Gleysolic (Poorly drained and show mottling and gleying)	Humic Gleysol Gleysol Luvic Gleysol	Ah > 3" Ah < 3" Have Aeg and Btg horizons
8. Organic (Contains > 17% organic carbon are > 24" in depth if dominantly fibric or > 16" if dominantly mesic or humic)	Fibrisol Mesisol Humisol Folisol	Large amount of well preserved fiber Partially decomposed fiber Well decomposed fiber (Black)

TABLE 13. DEFINITION OF SOIL HORIZON SYMBOLS (after C.S.S.C., 1973)

Organic Layers

Organic layers are found at the surface of some mineral soils, and may occur at any depth beneath the surface in buried soils, or overlying geologic deposits. They contain more than 17% organic carbon by weight. Two groups of these layers are recognized.

- O - This is an organic layer developed mainly from mosses, rushes, and woody materials.
- Of - The fibric layer is the least decomposed of all the organic soil materials. It has large amounts of well-preserved fibre that are readily identifiable as to botanical origin.
- Om - The mesic layer is the intermediate stage of decomposition with intermediate amounts of fibre, bulk density and water-holding capacity. The material is partly altered both physically and biochemically. A mesic layer is one that fails to meet the requirements of fibric or of humic.
- Oh - The humic layer is the most highly decomposed of the organic soil materials. It has the least amount of fibre, the highest bulk density, and the lowest saturated water-holding capacity. It is very stable and changes very little physically or chemically with time unless it is drained.
- L-F-H- These organic layers develop primarily from leaves, twigs, woody materials, and a minor component of mosses.
- L - This is an organic layer characterized by an accumulation of organic matter in which the original structures are easily discernible.
- F - This is an organic layer characterized by an accumulation of partly decomposed organic matter. The original structures in part are difficult to recognize. The layer may be partly comminuted by soil fauna, as in moder<sup>1</sup>, or it may be partly decomposed mat permeated by fungal hyphae, as in mor<sup>1</sup>.
- H - This is an organic layer characterized by an accumulation of decomposed organic matter in which the original structures are indiscernible. This material differs from the F layer by its greater humification chiefly through the action of organisms. This layer is a zoogenous humus form consisting mainly of spherical or cylindrical droppings of microarthropods. It is frequently intermixed with mineral grains, especially near the junction with a mineral layer.

Master Mineral Horizons and Layers

Mineral horizons are those that contain less organic matter than that specified for organic layers.

- A - This is a mineral horizon or horizons formed at or near the surface in the zone of removal of materials in solution and suspension, or of maximum in situ accumulation of organic matter, or both. Included are:

<sup>1</sup> Bernier, B. 1968. Soils under forest. Proceedings of the Seventh Meeting of the National Soil Survey Committee of Canada - 145 and 147.

(TABLE 13 - cont.)

- (1) horizons in which organic matter has accumulated as a result of biological activity (Ah);
  - (2) horizons that have been eluviated of clay, iron, aluminum, or organic matter, or all of these (Ae).
- 
- B - This is a mineral horizon or horizons characterized by one or more of the following:
    - (1) an enrichment in silicate clay (Bt).
    - (2) an alteration by hydrolysis, reduction, or oxidation to give a change in color or structure from horizons above or below (Bm and Bg).
    - (3) a prismatic or columnar structure that exhibits pronounced coatings or stainings and significant amounts of Na (Bn).
  - C - This is a mineral horizon or horizons comparatively unaffected by the pedogenic processes operative in A and B, excepting the process of gleying or the accumulation of carbonates and soluble salts.
  - R - This is consolidated bedrock that is too hard to break with the hands or dig with a spade when moist, and that does not meet the requirements of a C horizon. The boundary between the R layer and any overlying unconsolidated material is called a lithic contact.

#### Lowercase Suffixes

- b - A buried soil horizon.
- e - A horizon characterized by the removal of clay, iron, aluminum, or organic matter alone, or in combination. When dry, it is higher in color value by 1 or more units than an underlying B horizon. It is used with A (Ae, Ahe).
- g - A horizon characterized by gray colors, or prominent mottling, or both, indicative of permanent or periodic intense reduction. Chromas of the matrix are generally 1 or less.
- h - A horizon enriched with organic matter. When used with A it must show one Munsell unit of value darker than the horizon below, or have 0.5% more organic matter than the IC. It contains less than 17% organic carbon by weight.
- k - Denotes the presence of carbonate as indicated by visible effervescence when dilute HCl is added.
- m - A horizon slightly altered by hydrolysis, oxidation, or solution, or all three, to give a change in color or structure, or both.
- n - A horizon in which the ratio of exchangeable Ca to exchangeable Na is 10 or less. When used with B it must also have the following properties: prismatic or columnar structure, dark coatings on ped surfaces, and hard to very hard consistence when dry.

(TABLE 13 - cont.)

- s - A horizon with salts which may be detected as crystals or veins, as surface crusts, by distressed crop growth or by presence of salt-tolerant plants. It is most commonly used with C and k.
- t - A horizon enriched with silicate clay. It is used with B (Bt, Btg).

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SOIL SURVEY OF SELECTED AREAS ADJACENT TO THE TOWN OF AIRDRIE



Soils Legend:

PARENT MATERIAL	SOIL ASSOCIATION	SURFACE TEXTURE	DRAINAGE CLASSES	DOMINANT SUBGROUP	SIGNIFICANT SUBGROUPS
medium textured till	1-1	L	well to imperfectly	thin Orthic Black	thin Gleyed Orthic Black
	1-2	L	imperfectly	thin Gleyed Orthic Black	
	1-3	L	poorly and very poorly	Orthic Humic Gleysol	peaty Orthic Humic Gleysol
	1-4	L	very poorly	peaty Orthic Humic Gleysol	
	1-5	L	imperfectly	Gleyed Black Solonetz	Gleyed Black Solod
	1-6	L	rapidly	Orthic Regosol	thin Rego Black
moderately fine textured lacustrine	2-1	SiL	well to imperfectly	thin Orthic Black	thin Gleyed Orthic Black
	2-2	SiL	imperfectly	thin Gleyed Orthic Black	
	2-3	SiL	poorly and very poorly	Saline Humic Gleysol	peaty Saline Humic Gleysol
	2-4	SiL	very poorly	peaty Saline Humic Gleysol	
	2-5	SiL	imperfectly to moderately well	Black Solod	Black Solonetz
	2-6	SiL	imperfectly	Gleyed Black Solonetz	Gleyed Black Solod
moderately fine to medium textured glacio-fluvial	3-1	FSL	well to moderately well	Orthic Black	

Simple topography  
Single slopes  
(regular surface)

- A - depressional to level
- B - very gently sloping
- C - gently sloping
- D - moderately sloping
- E - strongly sloping
- F - steeply sloping
- G - very steeply sloping
- H - extremely sloping

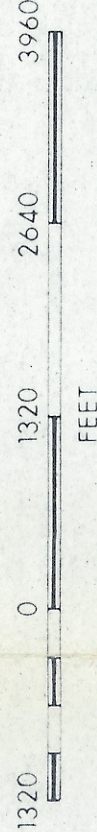
Slope

- 0 to 0.5
- 0.51 to 2
- 2.1 to 5
- 5.1 to 9
- 9.1 to 15
- 15.1 to 30
- 30.1 to 60
- over 60

Complex topography  
Multiple slopes  
(irregular surface)

- a - nearly level
- b - gently undulating
- c - undulating
- d - gently rolling
- e - moderately rolling
- f - strongly rolling
- g - hilly
- h - very hilly

APPROXIMATE SCALE



D.L. - Disturbed Land  
W. - Water  
- soil line

Surface Texture

- L - Loam
- SiL - Silt Loam
- FSL - Fine Sandy Loam

Base map from unrectified photograph.

Mapped and Compiled by: M. D. Scheeler  
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Alberta  
RESEARCH COUNCIL  
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