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DETAILED SOIL SURVEY

of

THE OKOTOKS AREA

M. Scheelar

ALBERTA RESEARCH COUNCIL

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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

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.

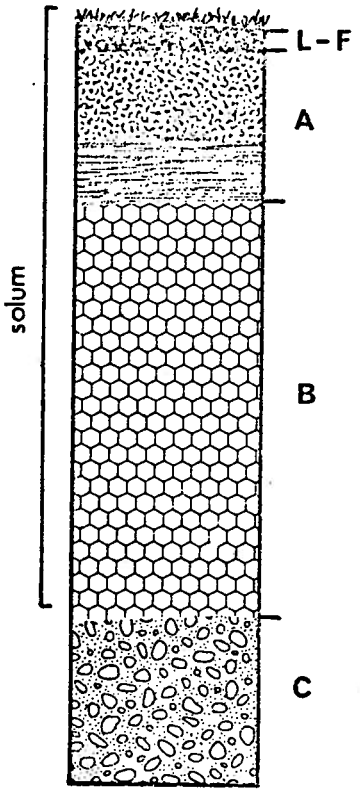
THE SOILS

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, Table13, and glossary).

FIGURE 1. DIAGRAM OF A SOIL PROFILE



-- Organic layer which may be subdivided into L, F, H or Of, Om, and Oh

--A mineral horizon at or near the surface. It may be a dark colored horizon in which there is an accumulation of humus (Ah), or a light colored horizon from which clay, iron, and humus have been leached (Ae).

--Mineral horizon that (1) may be altered to give a change in color or structure (Bm) or (2) may have an enrichment of clay (Bt) or (3) may have significant amounts of exchangeable Na and exhibit a columnar structure with pronounced stainings (Bn).

--Mineral horizon comparatively unaffected by the soil forming process operative in the A and B horizons except for the process of gleying (Cg). or the accumulation of carbonates and soluble salts (Cca, Csa, Ck, Cs, Csk).

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

$$\frac{1-3}{c}$$

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

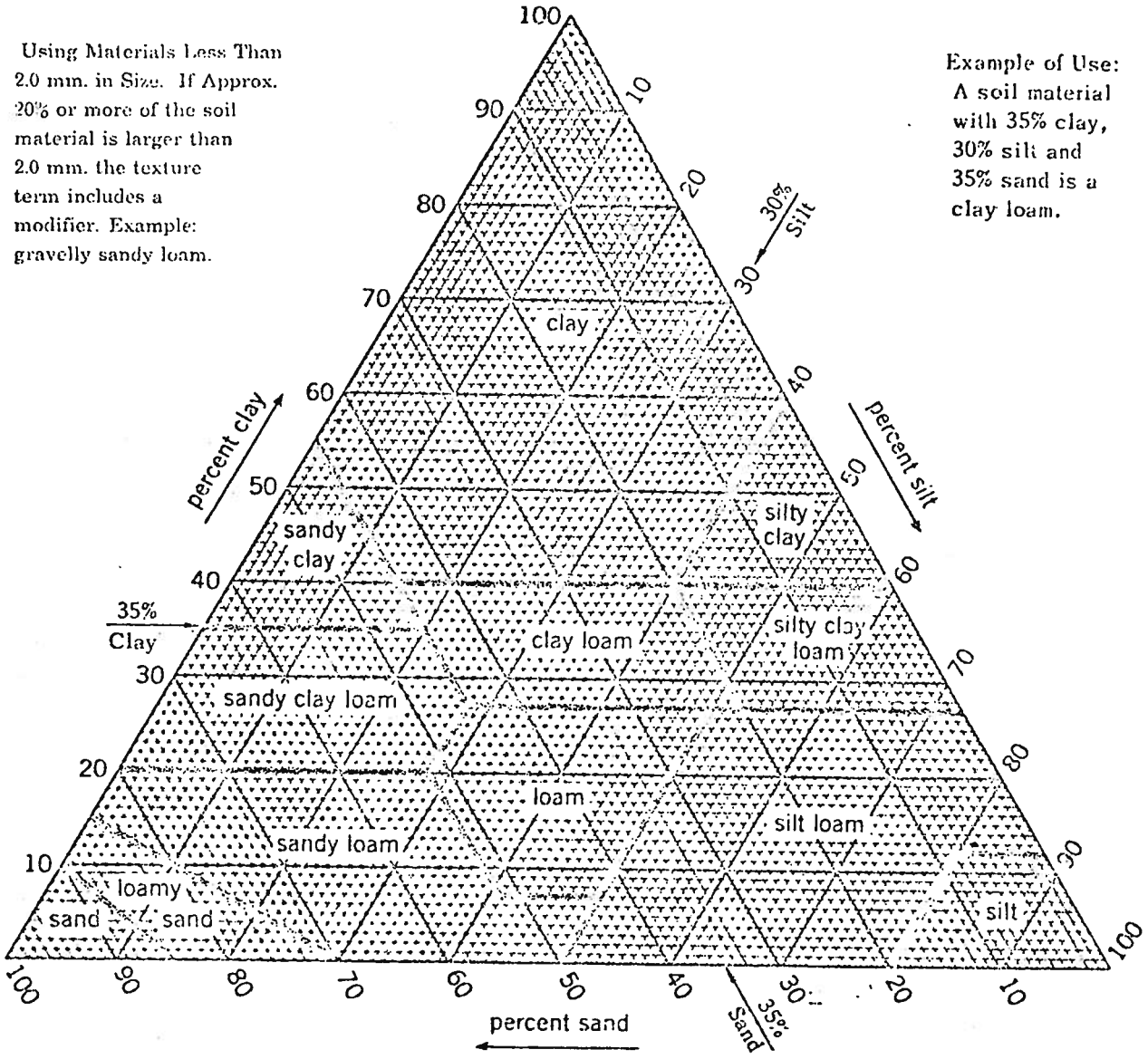
Throughout the report reference is made to soil texture and to soil drainage classes. Soil texture is according to the United States Department of Agriculture (USDA) textural classification which is described below. The soil drainage classes, according to the Canada Soil Survey Committee (1970) are outlined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

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

Separates		Diameter in Millimeters
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 signifjcant 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 subgrade 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 AASHO 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[1]	Rapidly[1], 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[2]			
a. AASHO Group index[3]	0 to 4.	5 to 8.	more than 8
b. Unified soil classes	GW, GP, SW, GM, SM, and GC[4] and SC[4].	CL (with PI[5] less than 15), ML, SP.	CL (with PI[5] 15 or more), CH, MH, OH, OL, Pt.
Shrink-swell 6 potential	Low (PI[5] less than 15).	Moderate (PI[5] 10 to 15).	High (PI[5] greater than 20).
Susceptibility to frost heave[7]	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, AASHO 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[1]

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[2] SLIGHT	MODERATE	SEVERE
Wetness[3]	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[4]	0 to 9% (AD).	9 to 15% (E).	More than 15% (> E).
Shrink-swell Potential	Low	Moderate	High
Unified soil group[5]	GW, GP, SW, SP, GM, GC, SM, SC	ML, CL	CH, MH, OL, OH, Pt.
Potential frost action[6]	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[1] (seasonal or year round)	more than 60 in.	40 - 60 in.	less than 40 in.
Flooding[2]	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[3]	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[1]. 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[2]	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[3]	0 to 20%.	20 to 50%.[4]	Greater than 50%.
Stoniness[5] (stony)	Stones greater than 25' apart.	Stones 25 to 5' apart.	Stones less than 5' apart.
Rockiness[5] (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.[1] 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[2]	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[3]	0 to 20%.	20 to 50%[4].	More than 50%
Stoniness[3]	Stones greater than 5' apart.	Stones 2 to 5' apart.	Stones less than 2' apart.
Rockiness[3]	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 are less than 3/4 inch in size.

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 [1]		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 [1]		
	GOOD	FAIR	POOR
Wetness	Rapidly to moderately well drained [2]	Imperfectly drained	Poorly and very poorly drained
Engineering Groups Unified Group	GW, GP, GC, SW, SP, SM, SC	ML, CL with P.I. [3] less than 15	CH, MH, OL, OH, Pt, and CL with P.I. more than 15
AASHO 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 Unsuited (U) rating is used.

Item Affecting Use	Degree of Suitability[1]		
	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.[2] 0 - 1[3]	E.C. 1 - 3	E.C. more than 3
Permeability of upper subsoil	moderate	slow	very slow

1. A rating of unsuited (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 OKOTOKS AREA

Location and Extent of Study Area

The area described in this report covers approximately $9\frac{1}{2}$ square miles or about 6,000 acres in the vicinity of Okotoks, Alberta. Okotoks is located in sections 28 and 29, Township 20, Range 29, west of the fourth meridian. The fifth meridian is approximately 1 mile west of the town limits and is the west boundary of the study area. Okotoks is 15 miles south of Calgary on highways 2 and 2A.

Physiography of the Area

The terrain in this area is composed of gently undulating and undulating uplands interspersed with depressions, nearly level to gently undulating lowlands, very steeply sloping areas and level flats and benches adjacent to the Sheep River.

The uppermost bedrock formations are the Paskapoo and Porcupine Hills Formations (Green,1970). The Paskapoo Formation is early Tertiary to late Cretaceous in age, non-marine and consists of soft, gray clayey sandstones and clay shale. The Porcupine Hills Formation is Tertiary in age, non-marine and consists of pale gray, calcareous sandstone and mudstone.

Glaciers from the vicinity of the Rocky Mountains and the Hudson's Bay mixed material from the underlying bedrock and debris from many miles away and deposited till on the uplands in the form of ground moraine. The debris from the west consists of limestone, dolomite and quartzitic sandstone while that from the northeast consists of igneous and metamorphic rocks of Canadian Shield origin. Quartzitic sandstone bulders have been observed as far east as the fifth meridian. As the ice melted, lacustrine and glacio-fluvial material was deposited in glacial lakes and streams in the lowland area. Recent deposits of alluvial material have been deposited on the flats and benches of the Sheep River.

All materials are strongly to very strongly calcareous. The area is drained by the Bow River drainage system.

The Soils

The soils of Alberta are divided into broad soil zones (see Soil Group Map of Alberta, Alberta Insitiute of Pedology). The zonal divisions are based on color differences of the soil surface that have developed as a result of different soil moisture and vegetation conditions over time. The soils in the Okotoks area are in the thin Black soil zone, which is a shallow phase of the Black soil zone. They have developed under a fairly high annual rainfall, although it is less than in the adjoining Black soil zone. In the souther half of Alberta's thin Black soil zone, evaporation is fairly high and the vegetative cover is dominantly grasses. The thin Black soils generally have from three to six inches of black surface (Ah) horizon.

Soils developed on till in this area are mainly thin Orthic Black Chernozems and Humic Gleysols. Lime occurs within 8 to 12 inches of the surface but thin Bm horizons are usually present. The well drained soils developed on lacustrine and glacio-fluvial materials usually lack B horizons and lime occurs within 4 to 6 inches of the surface. These soils are classified as thin Rego Black Chernozems.

Salts occur near the soil surface in groundwater discharge areas within the area of lacustrine deposits. Solonetzic soils have developed in areas of high sodium salt concentrations.

The soils developed on alluvial materials and on the very steeply sloping areas are Regosolic (no B horizon) and often have lime in the Ah horizons. The Ah horizons are lower in organic matter content and of lighter color than those of Chernozemic soils.

The soils were classified according to the System of Soil Classification for Canada (Canada Soil Survey Committee, 1973). Tables 12 and 13 briefly explain the classification system and soil horizon terminology. The legend on the soil map and the following soil unit descriptions indicate soil and landscape properties. Twenty-four soil units were mapped - six on till, six on lacustrine material, one on glacio-fluvial material, three on residual material, and eight on alluvial material. Due to mapping scale, units may occur together as complexes on the map. Soils that have been eroded by wind due to poor management practices are indicated as eroded phases.

Lime content and salinity classes mentioned in the following profile descriptions are described according to the following parameters:

Lime content ($CaCO_3$ equivalent	Salinity (electrical conductivity)
L - low (0-1% $CaCO_3$ equivalent)	L - low (0 - 1 mmho/cm)
M - medium (1-15% $CaCO_3$ equiv.)	M - medium (1 - 4 mmhos/cm)
H - high (15% $CaCO_3$ equiv.)	H - high (4 mmhos/cm)

SOIL UNIT DESCRIPTIONS

Soil Unit: 1 - 1

Soil Classification: thin Orthic Black, thin Gleyed Orthic Black and greater than 15% Orthic Humic Gleysol

Parent Material: medium textured till

Topography: gently undulating, undulating, nearly level and depressional

Drainage: well to poorly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA * texture	Lime content	Salin
Ah	Black	3 - 6	6.5 - 7.0	soft	L	L	L
Bm	Dark Brown	4 - 8	7.0 - 7.5	slightly hard	L	L	L
Ck	Gray	-	7.5 - 8.5	-	L	H	L

Comments: (unless otherwise indicated comments refer to dominant soil subgroup)

Limitations for selected uses: slight for most uses, poor source of roadfill.

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

* *

Soil Unit: 1 - 2

Soil Classification: thin Orthic Black, thin Gleyed Orthic Black and 15 - 50% Orthic Humic Gleyso

Parent Material: medium textured till

Topography: gently undulating, undulating, nearly level and depressional

Drainage: well to poorly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salin'
Ah	Black	3 - 6	6.5 - 7.0	soft	L	L	L
Bm	Dark Brown	4 - 8	7.0 - 7.5	slightly hard	L	L	L
Ck	Gray	-	7.5 - 8.5	-	L	H	L

Comments:

Limitations for selected uses: higher percentage of depressional areas lowers suitability of land for cropland and road location.

Soil Unit: 1 - 3

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	Salin
Ah	Black	3 to 6	6.5 - 7.0	soft	L	L	L
Bg	Dark Gray Brown	4 to 8	7.0 - 7.5	slightly hard	L	L	L
Ckg	Gray	-	7.5 - 8.5	-	L	H	L

Comments: B and C horizons are moderately gleyed and mottled

Limitations for selected uses: moderate limitations for agriculture, buildings, recreational uses and sewage lagoons; fair source of topsoil

* *

Soil Unit: 1 - 4

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	Salin
Om	Brown	0 - 6	5.5 - 6.5	-	-	-	-
Ahg	Black	3 to 6	7.0 - 7.5	soft	L	L	L
Bg	Dark Gray	4 to 8	7.0 - 7.5	slightly hard	L	L	L
Ckg	Gray	-	7.5 - 8.5	-	L	H	L

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

Limitations for selected uses: severe for all uses due to seasonal or permanent high water table.

Soil Unit: 1 - 5

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	Salin
Om	Brown	6 to 10	5.5 - 6.5	-	-	-	-
Ahg	Black	3 to 6	7.0 - 7.5	soft	L	L	L
Bg	Dark Gray	2 to 6	7.0 - 7.5	slightly hard	L	L	L
Ckg	Gray	-	7.5 - 8.5	-	L	H	L

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

Limitations for selected uses: severe for all uses due to permanent high water table.

* *

Soil Unit: 1 - 6

Soil Classification: Orthic Regosol

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	Salini
Ah	Light Brown	2 to 4	7.0 - 7.5	soft	L	M	L
Ck	Gray	-	8.0 - 8.5	-	L	H	L

Comments: Ah lighter in color due to less organic matter than in thin Orthic Black soils

Limitations for selected uses: severe for all uses due to steep slopes.

Soil Unit: 2 - 1

Soil Classification: thin Rego Black and thin Gleyed Rego Black

Parent Material: moderately fine textured lacustrine

Topography: nearly level and gently undulating

Drainage: well to imperfectly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salin'
Ahk	Black	3 to 5	7.0 - 7.5	soft	L	L-M	L
Ck	Gray	-	8.0 - 8.5	-	CL	H	L

Comments: Profile has no B horizon. Lime may or may not be present in the A horizon

Limitations for selected uses: poor source of roadfill; slight limitation for buildings and sewage lagoons; moderate limitations for recreational uses; fair source of topsoil; good cropland.

* *

Soil Unit: 2 - 2

Soil Classification: thin Gleyed Rego 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	Salini
Ahk	Black	3 to 5	7.0 - 7.5	soft	L	L-M	L
Ckg	Gray	-	8.0 - 8.5	-	CL	H	L

Comments: Profile has no B horizon. Lime may or may not be present in the A horizon. C horizon is moderately gleyed and mottled.

Limitations for selected uses: moderate limitations for buildings, sewage lagoons and agriculture, moderate to severe limitations for recreational uses.

Soil Unit: 2 - 3

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	Salin
Ah	Black	2 to 4	7.0 - 7.5	slightly hard	L	L	L
Bng	Very Dark Brown	3 to 5	7.5 - 8.0	very hard	CL-C	L-M	L-M
Cskg	Gray	-	8.0 - 8.5	-	CL	H	H

Comments: Bng has columnar structure and has dark stains on ped surfaces. B and C horizons are moderately gleyed and mottled.

Limitations for selected uses: severe for recreational uses; moderate to severe for buildings with basements and moderate for sewage lagoons; fair to poor cropland.

* *

Soil Unit: 2 - 4

Soil Classification: Black Solonetz and Black Solod

Parent Material: moderately fine textured lacustrine

Topography: nearly level and gently undulating

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	2 to 4	7.0 - 7.5	slightly hard	L	L	L
Bn	Very Dark Brown	3 to 5	7.5 - 8.0	very hard	CL-C	L-M	L-M
Csk	Gray	-	8.0 - 8.5	-	CL	H	H

Comments: Bn has columnar structure and has dark stains on ped surfaces.

Limitations for selected uses: severe for recreational uses; moderate to severe for buildings with basements; slight for sewage lagoons, fair cropland.

Soil Unit: 2 - 5

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	Salini
Om	Brown	6 to 10	5.5 - 6.5	-	-	-	-
Ahg	Black	3 to 6	7.0 - 7.5	slightly hard	L	L	L
Bg	Dark Gray	0 to 4	7.5 - 8.0	very hard	CL-C	L	M
Cskg	Gray	-	8.0 - 8.5	-	CL	H	H

Comments: A, B and C horizons are strongly gleyed and mottled. Profile may have from 6 to 10 inches of peat on the surface.

Limitations for selected uses: severe limitations for all uses due to permanent high water table.

* *

Soil Unit: 2 - 6

Soil Classification: Orthic Regosol

Parent Material: moderately fine textured lacustrine

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	Salini
Ah	Light Brown	2 to 4	7.0 - 7.5	slightly hard	L	L	L
Ck	Gray	-	8.0 - 8.5	-	CL	H	L

Comments: Ah is lighter in color due to less organic matter than in thin Orthic Black soils.

Limitations for selected uses: severe limitations for all uses due to steep slopes

Soil Unit: 3 - 1

Soil Classification: thin Rego Black and thin Gleyed Rego Black

Parent Material: medium textured glacio-fluvial

Topography: gently undulating and nearly level

Drainage: well to imperfectly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salin
Ah	Black	3 to 6	6.5 - 7.0	soft	L	L	L
Bm	Dark Brown	0 to 4	7.0 - 7.5	slightly hard	L	L	L
Ck	Gray	-	7.5 - 8.0	-	L-SiL	H	L

Comments: B horizon may or may not exist but area considered to be dominantly thin Orthic Black.

Limitations for selected uses: slight for recreational uses and houses; moderate for sewage lagoons; fair to good source of topsoil.

* *

Soil Unit: 4 - 1

Soil Classification: thin Lithic Rego Black and thin Gleyed Lithic Rego Black

Parent Material: medium textured residual

Topography: gently undulating to gently rolling

Drainage: well to imperfectly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salin
Ah	Black	3 to 6	6.5 - 7.0	soft	L	L	L
Bm	Dark Brown	0 to 4	7.0 - 7.5	soft	L	L	L
Ck	Gray	6 to 12	7.5 - 8.0	-	SiL	H	L
R	Brown	-	-	-		H	L

Comments: B horizon may or may not exist but area considered to be dominantly thin Orthic Black.

Consolidated bedrock occurs at from 9 to 22 inches from the surface

Limitations for selected uses: severe for all uses due to proximity to consolidated bedrock.

Soil Unit: 4 - 2

Soil Classification: Orthic Regosol and consolidated bedrock outcrops

Parent Material: medium textured residual

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	Salin
Ah	Light Brown	2 to 4	7.0 - 7.5	soft	L	L	L
Ck	Gray	6 to 12	8.0 - 8.5	-	SiL	H	L
R	Brown	-	-	-	-	-	-

Comments: A horizon lighter in color than in thin Orthic Black soils. Consolidated bedrock occurs at from 0 to 16 inches from the surface.

Limitations for selected uses: severe for all uses due to steep slopes.

* *

Soil Unit: 4 - 3

Soil Classification: peaty Orthic Humic Gleysol

Parent Material: medium textured residual

Topography: depressional

Drainage: very poorly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salini
Om	Brown	6 to 10	5.5 - 6.5	-		-	-
Ahg	Black	3 to 6	7.0 - 7.5	soft	L	L	L
Bg	Dark Gray	0 to 4	7.0 - 7.5	slightly hard	L	L	L
Ckg	Gray	6 to 12	8.0 - 8.5	-	SiL	H	L
R	Brown	-	-	-		-	-

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

Limitations for selected uses: severe for all uses due to permanent high water table.

Soil Unit: 5 - 1

Soil Classification: Orthic Regosol and Gleyed Orthic Regosol

Parent Material: medium textured alluvial

Topography: nearly level and level

Drainage: well to imperfectly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salin
Ahk	Dark Gray Brown	3 to 6	7.0 - 7.5	soft	SiL	L-M	L
Ck	Gray	-	7.5 - 8.0	-	SiL	H	L

Comments: Ahk lighter in color than in thin Orthic Black soils.

Limitations for selected uses: moderate for sewage lagoons, recreational uses and permanent buildings with basements; fair to good cropland.

* *

Soil Unit: 5 - 2

Soil Classification: Gleyed Orthic Regosol

Parent Material: medium textured alluvial

Topography: level

Drainage: imperfectly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salini
Ahk	Dark Gray Brown	3 to 6	7.0 - 7.5	soft	SiL	L-M	L
Ckg	Gray	-	7.5 - 8.0	-	SiL	H	L

Comments: C horizon is moderately gleyed and mottled.

Limitations for selected uses: moderate to severe for sewage lagoons, recreational uses and permanent buildings with basements; fair cropland.

Soil Unit: 5 - 3

Soil Classification: Rego Humic Gleysol

Parent Material: medium textured alluvial

Topography: depressional

Drainage: poorly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salini
Om	Brown	0 to 6	5.5 - 6.5	-		-	-
Ahgk	Black	3 to 6	7.0 - 7.5	soft	SiL	L-M	L
Ckg	Gray	-	8.0 - 8.5	-	SiL	H	L

Comments: profile may have up to 6 inches of peat on the surface. A and C horizons are strongly gleyed and mottled.

Limitations for selected uses: severe for all uses due to seasonal high water table.

* *

Soil Unit: 5 - 4

Soil Classification: peaty Rego Humic Gleysol

Parent Material: medium textured alluvial

Topography: depressional

Drainage: very poorly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salini
Om	Brown	6 to 10	5.5 - 6.5	-			
Ahgk	Black	3 to 6	7.0 - 7.5	soft	SiL	L-M	L
Ckg	Gray	-	8.0 - 8.5	-	SiL	H	L

Comments: Profile has from 6 to 10 inches of peat on the surface. A and C horizons are strongly gleyed and mottled.

Limitations for selected uses: severe for all uses due to permanent high water table.

Soil Unit: 5/6 - 1

Soil Classification: Orthic Regosol and Gleyed Orthic Regosol

Parent Material: medium textured over gravelly alluvial

Topography: nearly level and level

Drainage: well to imperfectly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salini[ty]
Ahk	Dark Brown	3 to 6	7.0 - 7.5	soft	SiL	L-M	L
Ck	Gray	6 to 10	8.0 - 8.5	-	SiL	H	L
IICk *	Gray	-	-	-	G	H	-

Comments: A horizon lighter in color than in thin Orthic Black soils.

*IICk indicates an underlying contrasting material.

Limitations for selected uses: slight to moderote for permanent homes; moderate for recreational uses; severe for sewage lagoons; good source of roadfill; fair to good cropland.

* *

Soil Unit: 5/6 - 2

Soil Classification: Gleyed Orthic Regosol

Parent Material: medium textured over gravelly alluvial

Topography: level

Drainage: imperfectly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salini[ty]
Ahk	Dark Gray Brown	3 to 6	7.0 - 7.5	soft	SiL	L-M	L
Ckg	Gray	5 to 8	8.0 - 8.5	-	SiL	H	L
IICkg	Gray	-	-	-	G	H	L

Comments: A horizon lighter in color than in thin Orthic Black soils. C horizon moderately gleyed and mottled.

Limitations for selected uses: severe for sewage lagoons; moderate to severe for permanent buildings with basements and recreational uses; fair cropland.

Soil Unit: 6 - 1

Soil Classification: Orthic Regosol

Parent Material: very gravelly alluvial on terraces

Topography: nearly level and level

Drainage: rapidly drained

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salin
Ahk	Brown	3 to 6	7.0 - 7.5	soft	GLS	L-M	L
Ck	Gray	-	8.0 - 8.5	-	Gravel	H	L

Comments: A horizon lighter in color than in thin Orthic Black soils.

Limitations for selected uses: good source of roadfill; severe limitations for sewage lagoons, permanent building with basements, and recreational uses; poor source of topsoil.

* *

Soil Unit: 6 - 2

Soil Classification: Orthic Regosol and gravel outcrops

Parent Material: very gravelly alluvial on flats

Topography: nearly level and level

Drainage: rapidly to poorly drained (depending on proximity to river)

Profile description of dominant soil subgroup:

Horizon	Color	Thickness (inches)	pH	Consistence when dry	USDA texture	Lime content	Salini
Ahk	Brown	2 to 4	7.0 - 7.5	soft	GLS	L-M	L
Ck	Gray	-	8.0 - 8.5	-	Gravel	H	L

Comments: Drainage in these areas is quite variable depending on depth to water table as influenced by depth of water in the river.

Limitations for selected uses: severe limitations for all uses.

SOIL SURVEY INTERPRETATIONS

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

Soil and landscape properties that will affect the probable uses of the soil are: (1) shallow depth to a seasonal or permanent water table,(2) potential concrete corrosion,(3) low permeability,(4)flooding hazard, (5) thin topsoil, (6) high percentage of organic matter, (7) soil texture , (8) shallow depth to consolidated bedrock, (9) high percentage of poorly drained depressions,(10) coarse fragments on surface, (11) steep slopes, (12) low capability to sustain foot or vehicular traffic, (13) groundwater contamination hazard, (14) potential frost action, (15) erosion potential, (16) poor vegetative rooting for lawn and campground grasses, (17) bearing capacity , (18) low topsoil quality, and (19) shrink-swell potential.

The ten uses for which the soils have been rated in this area are: (1) road location, (2) permanent buildings with basements, (3) sewage lagoons, (4) camp areas and lawns, (5) picnic areas, (6) playing fields (7) a source of gravel (8) a source of roadfill, (9) a source of topsoil and (10) capability for agriculture.

The limitations and suitabilities of the various mapping units for the selected uses are determined by referring to Tables 1 to 9 and are shown in Table 11 with the limiting properties being indicated by number.

Limitations for Road Location

1) Shallow depth to a seasonal or permanent water table affects potential frost action, shrink-swell potential and cost of construction and maintenance.

2) Soil texture affects bearing capacity and shrink-swell potential.

3) Shallow depth to consolidated bedrock affects cost of construction and erosion potential.

4) High percentage of poorly drained depressions in area affects cost of construction and maintenance.

5) Flooding hazard affects cost of construction and maintenance.

6) Steep slopes affects cost of construction and maintenance and erosion potential.

Limitations for Permanent Buildings with Basements

1) Shallow depth to a seasonal or permanent water table affects potential frost action, shrink-swell potential and construction and maintenance costs.

2) Potential concrete corrosion is caused by a high soluble sulfate content in the soil solution. According to Table 10 the soils range from 0.00 to 0.23% soluble sulfate. The Concrete Manual of the United States Bureau of Reclamation (1966) recognizes the following concrete corrosion categories:

negligible attack - less than 0.10%

mild but positive attack - 0.10 to 0.20%

considerable attack - 0.20 to 0.50%

severe attack - greater than 0.50%

Mapping units 2-3/a and 2-4/b have moderate limitations due to a high soluble sulfate content.

3) Flooding hazard affects the cost of construction and maintenance and may occur adjacent to rivers or lakes.

4) Soil texture affects potential frost action, shrink-swell potential and cost of construction and maintenance.

5) Shallow depth to consolidated bedrock affects the cost of construction.

6) Steep slopes affects cost of construction and maintenance.

Sewage Lagoons

1) Shallow depth to a seasonal or permanent water table affects the cost of construction and maintenance and groundwater contamination hazard. If the floor of the lagoon is made of relatively impermeable material from another site the depth to the water-table may be ignored. However this increases the cost of construction.

2) Flooding hazard affects the cost of construction and maintenance. Embankments must be high enough to prevent entrance of floodwater.

3) A high percentage of organic matter occurs in Humic Gleysols and peaty Humic Gleysols and may lead to the accumulation of aquatic plants that are detrimental to the proper functioning of the lagoon.

4) Soil texture affects the groundwater contamination hazard and if remedied by bringing in soil from another site, cost of construction is increased.

5) Shallow depth to consolidated bedrock and steep slopes affect the cost of construction.

Limitation for Camp Areas, Lawns, Picnic Areas and Playing Fields

1) Shallow depth to a seasonal or permanent water table affects the soils' capability to sustain foot or vehicular traffic and causes poor vegetative rooting for grasses.

2) Low permeability has the same effect, but also affects erosion potential.

3) Flooding hazard affects the cost of construction.

4) Thin topsoil affects the ability to sustain foot or vehicular traffic and erosion potential.

5) Soil texture affects the capability to sustain foot or vehicular traffic and erosion potential.

6) Coarse fragments on the surface affects the capability to sustain foot or vehicular traffic.

7) Steep slopes affects the ability to sustain foot or vehicular traffic and erosion potential.

Suitability as a Source of Gravel

1) Shallow depth to a seasonal or permanent water table and flooding hazard affects the cost of excavation.

Suitability as a Source of Roadfill

1) Shallow depth to a seasonal or permanent water table, or consolidated bedrock and steep slopes affects the cost of excavation.

2) Soil texture affects the bearing capacity.

TABLE 10. Engineering and Chemical Soil Data of Representative Soil Samples from the Okotoks Area.

Soil Unit	Horizon	Depth from surface (inches)	pH	Elec. Cond. (mmhos/cm)	% sulphate	% $CaCO_3$	Grain Size Analysis % passing sieve No.10	No.40	No.200	% smaller than .05 mm	.002 mm	Atterberg limits Liquid Limit	Plastic Limit	Textural Classification AASHO	Unified	USDA
1-1	Bm	6-12					97	96	70	62	19	36	15	A6(9)	CL	L
	Cca	12-18	7.8	0.2	0.00	21.6										
	Ck	18-60	8.4	0.3	0.00	20.3	86	84	63	59	21	27	9	A4(6)	CL	L
	Bm	6-16					93	91	70	62	20	32	8	A4(7)	ML	L
	Cca	15-24	8.1	0.5	0.00	25.8										
	Ck	24-72	8.0	0.4	0.00	15.7	96	94	78	69	26	28	11	A6(8)	CL	L
2-1	Ck	10-40	8.4	0.6	0.00	20.7	100	98	80	73	31	30	14	A6(10)	CL	CL
	II Ck(till)	40-72	8.3	0.7	0.00	14.4	94	92	71	61	22	26	10	A4(7)	CL	L
2-3	Csk	10-40	8.2	5.1	0.23	21.5	99	97	77	68	32	29	12	A6(8)	CL	CL
	II Csk(till)	40-72	8.1	5.2	0.25	19.3										
3-1	Ck1	6-36	7.9	0.2	0.00	20.7	91	89	58	55	16	27	6	A4(5)	CL-ML	L
	Ck2	36-60	8.0	0.3	0.00	15.7	96	94	70	66	13	23	6	A4(7)	CL-ML	SiL
	Ck3	60-84	8.5	0.2	0.00	15.9	93	92	75	65	12	22	4	A4(8)	CL-ML	SiL
4-1	Ck1	6-22					100	100	77	65	13	29	6	A4(8)	ML	SiL
	Ck2	22-72					100	100	68	65	11	25	4	A4(7)	ML	SiL
5/6 - 1	Ck	6-24	8.2	0.4	0.00	12.1	90	89	69	62	12	27	5	A4(7)	ML	SiL

Suitability as a Source of Topsoil

1) Shallow depth to a seasonal or permanent water table and flooding hazard affects the cost of removal.

2) Low permeability and thin topsoil and texture affect the erosion potential at the borrow site. Texture also affects the quality of the topsoil.

Capability for Agriculture

The Okotoks area is in Agroclimatic Zone 2A (Bowser, 1967) and thus is an area where the amount of precipitation in approximately 50% of the years, has been a limiting factor to crop growth. Therefore the best soils in such an area are classified as 2C where climate is considered to be the only limiting factor. Other limiting factors such as low fertility, excess water, adverse topography, restriction of the depth of the rooting zone, low moisture holding capacity and inundation by streams and lakes affects the soil capability further as indicated in Table 11.

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

Mapping Units	Degree of Limitation for:						Suitability as a Source of:			Capability for Agriculture
	Road Location	Buildings with Basements	Sewage Lagoons(a)	Camp Areas and Lawns	Picnic Areas	Playing fields	Gravel	Sandfill	Topsoil	
1-1/b	M7,17	M7	S	M10, 12	M10,12	M10,12	U	F7	F5,10,18	2C
1-1/b - er	M7,17	M7	S	V5,10,12	V5,10,12	V5,10,12	U	F7	P5,10,18	3F
1-1/c	M7,17	M7	M11	M10,12	M10, 12	M10,11,12	U	F7	F5,10,18	2C
1-1/c - er	M7,17	M7	M11	V5,10,12	V5,10,12	V5,10,11,12	U	F7	P5,10,18	3F
1-1/e	M-V7,11,17	M-V7,11	M-V11	M-V10,11,12	M-V10,11, 12	V10,11,12	U	F7	P-F9,10,11, 18	3T
1-1/f	V7,11,17	V7,11	V11	V10,11,12,15	V10,11,12, 15	V10,11,12, 15	U	F7	P5,10,11,15, 18	4T
1-2/b	V7,9,17	M7	S	M10,12	M10,12	M10,12	U	F7	F5,10,18	2C[7] 4W[3] (b)
1-2/c	V7,9,17	M7	M11	M10,12	M10,12	M10,11,12	U	F7	F5,10,18	2C[7] 4W[3]
1-3/a	M1,7,17	M1,7	M1	V1,10,12	V1,10,12	M1,10,12	U	P1,7	F1,5,10,18	3W
1-4/A	V1,7,14,17	V1,7,14	V1,6	V1,10,12,16	V1,10,12, 16	V1,10,12,16	U	P1,7	P1,5,10,18	4W[8] 5W[2]
1-5/A	V1,7,14,17	V1,7,14	V1,6	V1,10,12,16	V1,10,12, 16	V1,10,12,16	U	P1,7	P1,5,10,18	5W
1-6/G	V7,11,17,15	V7,11	V11	V10,11,12,15	V10,11,12, 15	V10,11,12,15	U	P7,11	P5,10,11,15 18	6T
2-1/b	M7,17,19	M7,19	S	M7,12	M7,12	M7,12	U	P7	F5	2C
2-1/c	M7,17,19	M7,19	M11	M7,12	M7,12	M7,11,12	U	P7	F5	2C
2-2/a	V1,7,17,19	V1,7,19	M1	V1,7,12	V1,7,12	M1,7,12	U	P1,7	F5	3W
2-3/a	V1,7,17,19	V1,2,7,19	M1	V1,3,5,7, 12,15,16	V1,7,12,15	V1,3,5,7, 12,15,16	U	P1,7	P3,3,5	D 4W
2-4/b	V7,17,19	M2,7,19	S	V3,5,7,12, 15,16	M7,12,15	V3,5,7,12, 15,16	U	P7	P3,5	3D
2-5/A	V1,7,14,17 19	V1,7,14,19	V1,6	V1,7,12,16	V1,7,12,16	V1,7,12,16	U	P1,7	P1,3	5W
2-6/G	V7,11,17, 15,19	V7,11,19	V11	V7,11,12,15	V7,11,12,15	V7,11,12,15	U	P7,11	P5,11	6T
3-1/b	S	S	M7,13	S	S	S	U	F7	F5	2C
3-1/c	S	S	M-V7,11,13	S-M11	S	M11,15	U	F7	F5	2C
3-1/d	M11	M11	V7,11,13	M11,15	M11,5	M-V11,15	U	F7	P-F5,11	3T
3-1/f	V11,15	V11	V7,11,13	V11,15,12	V11,12,15	V11,15	U	P7,11	P5,11	4T
4-1/c	M-V8,15	M-V8	M-V8,11,13	S-M11	S	M11,15	U	P8	F5	2C
4-2/f	V8,11,15	V8,11	V8,11,13	V11,12,15	V11,12,15	V11,15	U	P8,11	P5,11	4T
4-2/G	V8,11,15	V8,11	V8,11,13	V11,12,15	V11,12,15	V11,15	U	P8,11	P5,11	6T
4-3/A	V1,8	V1,8	V1,6,8	V1,12,16	V1,12,16	V1,12,16	U	P1,8	P1,5	5W
5-1/a	M4,7	M4,7	M4,7,13	M4,7,12	M4,7,12	M4,7,12	U	F1,7	F4,5	2C
5-2/a	M1,4,7	M1,4,7	V1,4,7,13	V1,4,7,12	V1,4,7,12	V1,4,7,12	U	P1,7	P4,5,7	3W
5-3/A	V1,4,7	V1,4,7	V1,4,7,13	V1,4,7,12, 16	V1,4,7,12, 16	V1,4,7,12, 16	U	P1,7	P1,4,5	4W
5-4/A	V1,4,7	V1,4,7	V1,4,7,13	V1,4,7,12, 16	V1,4,7,12, 16	V1,4,7,12, 16	U	P1,7	P1,4,5	5W
5/6-1/a	S-M4	S-M4	V4,7,13	M4,7,12	M4,7,12	M4,7,12	P4	G	P4,5	3M
5/6-2/a	M1,4	M1,4	V1,4,7,13	V1,4,7,12	V1,4,7,12	V1,4,7,12	P1,4	P1	P1,4,5	3W
6-1/a-cb	V4	V4	V4,7,13	V4,10,12	V4,10,12	V4,10,12	P4	G	P4,5,10,18	5M
6-1/f-cb	V11	V11	V7,11,13	V10,11,12	V10,11,12	V10,11,12	G	P11	P5,10,11,18	6 M T
6-2/a-cb	V4	V4	V4,7,13	V4,10,12	V4,10,12	V4,10,12	P4	G	P5,4,10,18	6T

S - slight; M - moderate; V - severe; G - good; F - fair; P - poor; U - unsuited.

(a) Limitations may be lessened considerably if lagoon is made of impermeable materials that are from another site and if embankments are sufficiently high to prevent entrance of floodwater. If floor of lagoon is nearly impermeable material at least 2 feet thick disregard depth to water table.

(b) Small arabic numerals placed after a class numeral give the approximate proportion of the class out of a total of 10.

Limiting Soil and Landscape Properties and Hazards

1. Shallow depth to a seasonal or permanent water table
2. Potential concrete corrosion
3. Low permeability
4. Flooding hazard
5. Thin topsoil
6. High percentage of organic matter
7. Soil texture
8. Shallow depth to consolidated bedrock
9. High percentage of poorly drained depressions in area
10. Coarse fragments on surface
11. Steep slopes
12. Low ability to sustain foot or vehicular traffic
13. Groundwater contamination hazard
14. Potential frost action.
15. Erosion potential
16. Poor vegetative rooting for lawn or camp ground grasses
17. Bearing capacity
18. Low topsoil quality
19. Shrink-swell potential

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	Light Brown Ah horizon
	Dark Brown	Dark Brown Ah horizon
	Black	Black Ah horizon
	Dark Gray	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	Ah horizon — Bnt horizon
	Solodized Solonetz	Ah —— Ae --- Bnt
	Solod	Ah —— Ae —— AB —— Bnt
3. Luvisolic (Developed in forest areas; accumulation of clay in the B horizon)	Gray Brown Luvisol	(L-H) —— Ah —— Ae —— Bt; Mull-like Ah horizon
	Gray Luvisol	L-H —— (Ah) —— Ae —— Bt
4. Podzolic (Accumulation of Fe+Al and/or organic matter in the B horizon)	Humic Podzol	Bh > 4" which contains > 1% O.C. < 0.3% Fe
	Ferro-Humic Podzol	Bhf > 4" which contains > 5% O.C. > 0.6% Fe+Al
	Humo-Ferric Podzol	Bf > 2" which contains < 5% O.C. > 0.6% Fe+Al
5. Brunisolic (Generally weakly developed B horizons)	Melanic Brunisol	Ah > 2", Bm > 2"; pH > 5.5
	Eutric Brunisol	Ah < 2", Bm > 2"; pH > 5.5
	Sombric Brunisol	Ah > 2", Bm > 2"; pH < 5.5
	Dystric Brunisol	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	Ah > 3"
	Gleysol	Ah < 3"
	Luvic Gleysol	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	Large amount of well preserved fiber
	Mesisol	Partially decomposed fiber
	Humisol	Well decomposed fiber (Black)
	Folisol	

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[1], or it may be partly decomposed mat permeated by fungal hyphae, as in mor[1].

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:

[1] Bernier, B. 1968. Soils under forest. Proceedings of the Seventh Meeting of the National Soil Survey Committee of Canada. p. 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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