



SOIL SURVEY OF
GARNER LAKE PROVINCIAL PARK STUDY AREA
AND
INTERPRETATION FOR RECREATIONAL USE

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PREFACE

This report is one of a series describing detailed and semi-detailed soil surveys which have been conducted in Alberta provincial parks and recreation areas. As well the Garner Lake Provincial Park study area, soil surveys were conducted in the following provincial parks during the summer of 1975: Gooseberry Lake, Rochon Sands, Vermilion, Pembina River, and Big Knife. Also included were areas in the vicinities of Upper and Lower Kananaskis Lakes, Cold Lake (Lund's Point), Calling Lake, and Notikewin River. The total area mapped was approximately 11,380 ha.

A general guidebook has been prepared to accompany soil survey reports written for Alberta provincial parks and recreation areas (Greenlee, 1981). It includes general discussions of the following: soil formation; the Canadian soil classification system; soil characteristics and other factors that affect the use of soils for recreational and related purposes; Luvisolic, Organic, and Solonetzic soils; soil erosion; methodology; soil and landform maps that accompany the soil survey reports; an explanation of soil interpretations and guidelines for developing them; chemical and physical properties of soils; and the landform classification system used by Canadian soil pedologists. Also included is a glossary. Specific results and interpretations for the areas covered by this study are presented in the ensuing report.

Also in 1975, soil samples were collected from an archaeological site excavated by the Parks Planning Branch in the Cypress Hills. A detailed field soil profile description was made, laboratory analyses have been completed and a report will be prepared.

ACKNOWLEDGMENTS

The Alberta Research Council provided the staff and the Parks Planning Branch of Alberta Recreation, Parks and Wildlife contributed the operating costs for the 1975-76 Provincial Parks soil survey program. The University of Alberta provided office and laboratory space.

Mrs. Kathy Gates and Miss Ruby Wallis typed and assisted in compiling and proof reading the report. Mrs. J. Dlask drafted the soil, landform and soil limitations for recreation maps, while Mr. J. Beres determined the physical properties of the soils. The soil chemical analyses were determined by the Alberta Soil and Feed Testing Laboratory.

Able field assistance was given by Mr. M. Hennie.

Special acknowledgment is given to the Park Rangers, as well as other park employees, who cooperated by allowing soil investigations to be conducted throughout the parks, and also invariably offered assistance.

SUMMARY

The Garner Lake Provincial Park study area comprises about 100 ha. It is situated about 13 km east and 6 km north of Vilna, which in turn is about 150 km northeast of Edmonton along highway 28. Surficial deposits throughout most of the study area consist of moderately fine to fine textured till. The climate in this region is described as a cold snow-forest climate, characterized by cool summers and humid winters with frozen ground and snow cover of several months duration. The average temperature of the coldest month is less than -3°C , and of the warmest month is between 10 and 22°C . The study area is situated in the mixedwood section of the boreal forest region, where the characteristic forest association of well drained uplands is a mixture in varying proportions of trembling aspen, balsam poplar, white birch, white spruce, and balsam fir.

Four map units were recognized in the study area. The key profile types are Orthic Gray Luvisols, Gleyed Gray Luvisols, Gleyed Regosols, Gleyed Eutric Brunisols, Orthic Gleysols, and Orthic Humic Gleysols. These are distributed over the landscape in relation to landform, parent material, and drainage. Map units consist of single soil series, groupings of series (complexes), or catenas; and their distribution is shown on the soil map.

Soil interpretations of each map unit are made for fully serviced campgrounds, picnic areas, lawns and landscaping, paths, buildings (with and without basements), septic tank absorption fields, road location, source of roadfill, and source of sand or gravel.

The soils best suited for recreational development are those of Map Unit 1 when found on suitable topography, and they cover almost the whole study area. They have moderate limitations due to slow permeability, excessive slopes, and erosion hazard. Map Unit 4 soils, in the southeastern corner of the study area, also have moderate limitations due to seasonally high groundwater tables, flooding hazard (overflow), and sandy surface textures. Map Unit 4 soils are also the best suited for road construction, and they have moderate limitations because of seasonally high groundwater tables and flooding hazard (overflow). Map Unit 4 soils constitute only a fair source of sand because of thin deposits; and Map Unit 2 soils constitute a poor source for the same reason, as well as seasonally high groundwater tables. A source of gravel was not found in the study area. Careful study of the soil map and tables 4 to 13 inclusive (soil limitation and suitability tables) will reveal areas suitable for particular uses.

A soil survey properly interpreted can be one of the most useful tools management has in making a proper design for a recreational area. However, all soil differences which occur in the field cannot be shown on the soil map. Thus for design and construction of specific recreational facilities, an on-site investigation is usually required.

INTRODUCTION

SIZE AND LOCATION

The Garner Lake Provincial park study area comprises about 100 ha, and borders the southwestern shore of Garner Lake (Figure 1). It is situated about 13 km east and 6 km north of Vilna, which in turn is about 150 km northeast of Edmonton along highway 28. The study area includes part of the northeast quarter of section 9, and all of section 16, township 60, range 12, west of the fourth meridian; not covered by Garner Lake.

PHYSIOGRAPHY AND SURFICIAL DEPOSITS

The study area lies within the Eastern Alberta Plains division of the Interior Plains physiographic region (Government and the University of Alberta, 1969). The region is extremely variable in topography; landforms range from a gently undulating featureless till plain to strongly rolling hummocky morainal areas (Kocaoglu, 1975). Surface elevations in the mapped area range from something less than 610 m near the lake shore to something more than 640 m near the southwestern corner, for a difference of more than 30 m. The bedrock has been classified as the Upper Cretaceous Wapiti formation, which is nonmarine (Green, 1972). The study area is drained into Garner Lake, which doesn't appear to have any external outlet.

Surficial deposits throughout most of the study area consist of moderately fine to fine textured till. A narrow band of very coarse to moderately fine textured lacustrine sediments borders the lake shore in the central portion of the study area, and a small patch of very coarse textured lacustrine sediments overlying moderately fine to fine textured till occurs in the southeastern corner; also adjacent to the lake shore.

CLIMATE

The climate is designated in Koppen's classification of climates as humid microthermal (Trewartha and Horn, 1980). It is described as a cold snow-forest climate characterized by cool summers, and humid winters with frozen ground and a snow cover of several months duration. The average temperature of the coldest month is less than -3°C , and the warmest month is between 10 and 22°C .

Records for 1951 through 1980 from a weather station at Elk Point, about 50 km to the east and 30 km to the south and at an elevation of 594 m, show the following values (Environment Canada, 1982): a mean annual temperature of 0.7°C ; July is the warmest month of the year with a mean temperature of 16.4°C , and January is the coldest with a mean temperature of -19.5°C ; the mean annual precipitation is 454 mm with 74% falling as rain. The average frost free period is 88 days.

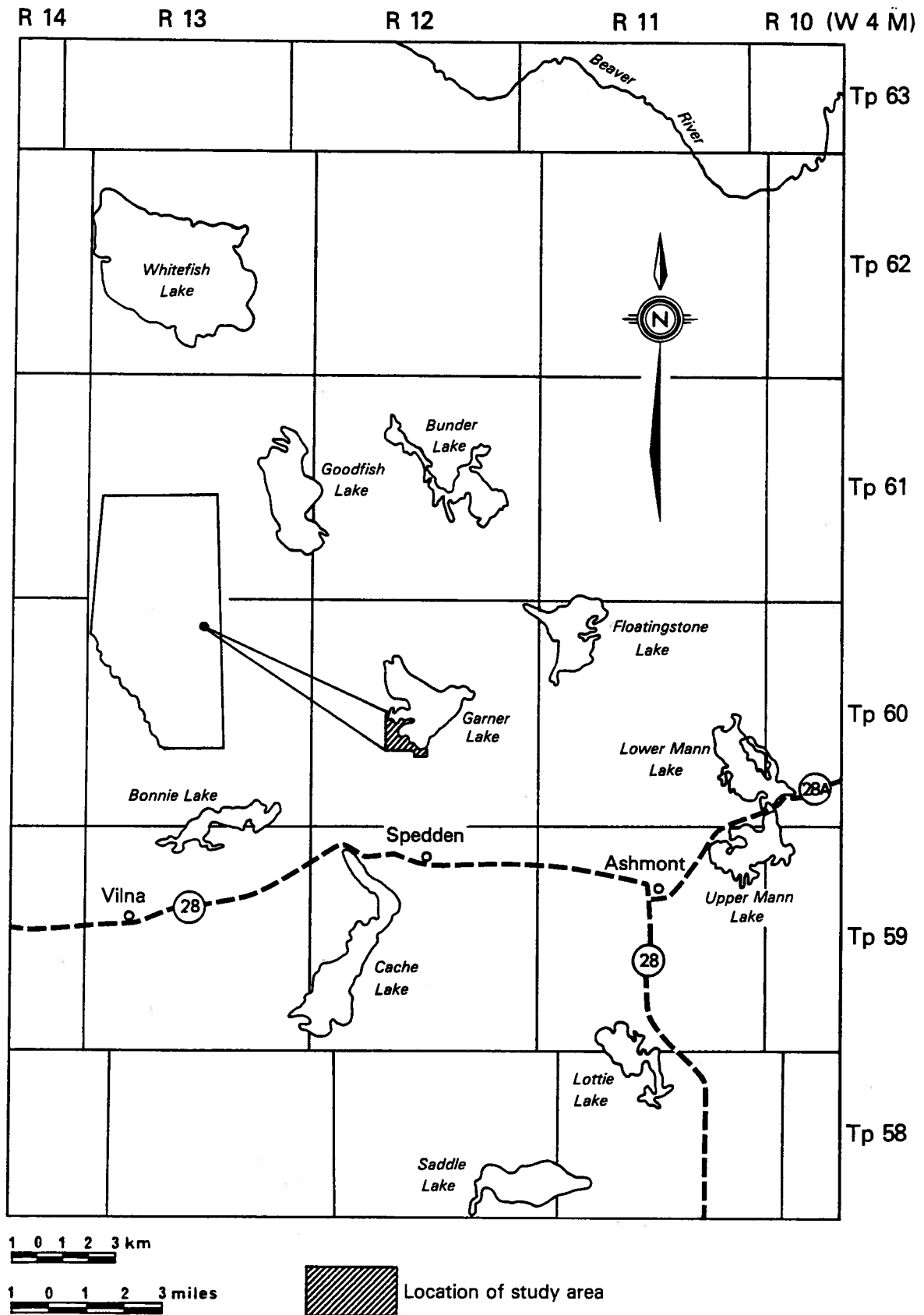


Figure 1. Map showing location of study area.

VEGETATION

The study area is situated in the mixedwood section of the boreal forest region (Rowe, 1972), where the characteristic forest association of well drained uplands is a mixture in varying proportions of trembling aspen, balsam poplar, white birch, white spruce, and balsam fir. The last two species are especially prominent in old stands; however the cover type of greatest areal extent is the trembling aspen. Jackpine is usually dominant in sandy areas, occurs on the drier till soils, and is mixed with black spruce on the plateau-like tops of the higher hills. Black spruce and tamarack muskeg develops in lower positions and the upper water catchment areas.

The dominant vegetation throughout most of the study area is aspen, and considerable balsam poplar also occurs. Balsam poplar is dominant near most of the lake shore, where patches of white spruce also occur. Small amounts of white birch also occur throughout, especially in draws.

Since the Outdoor Recreation Planning Branch of Alberta Recreation and Parks conducts biological studies in provincial parks and recreation areas, the vegetation is not discussed extensively in this report. However, some of the more common plant species indicated as part of the map unit descriptions are listed as follows (Moss, 1959; Cormack, 1967): aspen (Populus tremuloides), balsam poplar (Populus balsamifera), white birch (Betula papyrifera), white spruce (Picea glauca), beaked hazelnut (Corylus cornuta), dogwood (Cornus stolonifera), low-bush cranberry (Viburnum edule), saskatoon-berry (Amelanchier alnifolia), willow (Salix spp), alder (Alnus spp), wild rose (Rosa spp), wild red raspberry (Rubus strigosus), wild gooseberry (Ribes spp), wild currant (Ribes spp), horsetail (Equisetum spp), slough grass (Beckmannia syzigachne), common cattail (Typha latifolia), and marsh marigold (Caltha palustris).

SOILS

Only four map units were recognized in the study area. The soils of one were classified in the Luvisolic Order, one in the Regosolic Order, one in the Brunisolic Order, and one in the Gleysolic Order of the Canadian soil classification system (Canada Soil Survey Committee, 1978). The system is outlined in Greenlee (1981). Pertinent features of the map units are outlined in Table 1.

Soils of the Luvisolic Order are well to imperfectly drained mineral soils characterized by an Ae horizon near the surface, and it generally varies from 7.5 to 30 cm in thickness. It is a leached gray coloured horizon, very low in organic matter (humus) content and in plant nutrients. Luvisolic soils in their natural state commonly have surface L-H and Ah horizons as well. The L-H horizon ranges from 2.5 to 12.5 cm or more in thickness; however, the Ah horizon below is usually less than 5 cm

Table 1. Key to the Soils.

Map Unit	Classification	Parent Material	Surface Texture	Slope (class & gradient)	Surface Stoniness	Drainage	Comments and Limitations
1	Orthic Gray Luvisol-70% Gleyed Gray Luvisol-30%	moderately fine to fine textured till	loam to fine sandy loam	d,e,f,g (> 5 to 60%)	1 to 4	Orthic Gray Luvisols well drained, Gleyed Gray Luvisols - imperfect	Gleyed Gray Luvisol soils occur in lower slope positions and depressions. Slight to very severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - slow permeability, surface stoniness, excessive slopes, erosion hazard, lack of Ah horizon, moderate to high shrink-swell potential, susceptibility to frost heave; seasonally high groundwater table, and groundwater contamination hazard for the Gleyed Gray Luvisols.
2	Orthic Gleysol and Orthic Humic Gleysol	very coarse to moderately fine textured lacustrine sediments	sandy loam, loam to silt loam, silty clay loam, sand	b (> 0.5 to 2%)	0	poor	(1) These two great groups are intimately and unpredictably associated. (2) Water table occurs about 75 cm below surface. Severe limitations, poor source of roadfill and sand, unsuitable as a source of gravel - seasonally high groundwater table, flooding hazard (overflow), groundwater contamination hazard.
3	Gleyed Eutric Brunisol	moderately fine to fine textured till	loam	b,c (> 0.5 to 5%)	1	imperfect	Moderate to severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - seasonally high groundwater table, flooding hazard (overflow), lack of Ah horizon, moderate to high shrink-swell potential, susceptibility to frost heave, slow permeability.
4	Gleyed Regosol	very coarse textured lacustrine sediments, overlying moderately fine to fine textured till	sand	c (> 2 to 5%)	0	imperfect	(1) The till is usually > 120 cm below the surface, but is occasionally within 60 cm. (2) A water table occurs about 120 cm below the surface. Moderate to severe limitations, good source of roadfill, fair source of sand, unsuitable as a source of gravel - seasonally high groundwater table, flooding hazard (overflow), sandy surface texture, rapid permeability (droughtiness), lack of Ah horizon, groundwater contamination hazard.

thick, and often absent altogether. When Luvisolic soils are cultivated, the L-H and Ah horizons quickly become mixed with the Ae, resulting in gray coloured fields. Also, the L-H and Ah horizons rapidly become broken down under conditions of heavy foot traffic in recreation areas, and often disappear completely from a combination of physical destruction and soil erosion. When thoroughly dried out, the Ae horizon is often baked and hard, so that plant seedlings may be unable to push up through the crust. Also, entry of moisture from rainfall may be hampered and runoff increased, thereby enhancing soil erosion. This problem is especially serious on steep slopes.

Well to imperfectly drained Luvisolic soils developed on moderately fine to fine textured till cover almost the whole study area.

Soils of the Regosolic Order are rapidly to imperfectly drained mineral soils with profile development too weakly expressed to meet the requirements for classification in any other order. They lack any expression of a B horizon, and therefore, reflect essentially the characteristics of the C horizons and the parent materials from which they are formed.

One small patch of imperfectly drained Regosolic soils developed on very coarse textured lacustrine sediments overlying moderately fine to fine textured till occurs in the southeastern corner of the study area adjacent to the lake shore. The sands are almost completely devoid of fines, and lime occurs to the surface. Soil profile development is not evident, except for gleying. These features suggest fluctuating water tables and a lack of any net downward leaching.

Soils of the Brunisolic order are rapidly to imperfectly drained mineral soils with sufficient profile development to exclude them from the Regosolic order, but that lack the degrees or kinds of horizon development specified for soils of other orders. Their common characteristic of identification is the development in situ of the prominent brownish Bm horizon with sufficient alteration by hydrolysis, oxidation or solution to produce significant changes in color, structure and composition different from those of an A or C horizon. Because the processes of leaching and weathering are relatively weakly developed in Brunisolic soils, they tend to reflect the chemical characteristics, particularly the base status and acidity, of parent materials from which they have been derived.

A very narrow band of imperfectly drained Brunisolic soils developed on moderately fine to fine textured till borders the lake shore all around the edge of the peninsula in the northwestern portion of the study area. The weak soil profile development is a reflection of a fluctuating water table, which results in a low incidence of net downward leaching.

Soils of the Gleysolic order are poorly drained mineral soils whose profiles reflect the influence of waterlogging for significant periods. Water saturation causes reducing conditions due to a lack of aeration. These conditions result in gleyed horizons having dull gray to olive, greenish or bluish-gray moist colours, frequently accompanied by

prominent usually rust-coloured mottles resulting from localized oxidation and reduction of hydrated iron oxides.

A narrow band of Gleysolic soils developed on very coarse to moderately fine textured lacustrine sediments borders the lake shore in the central portion of the study area.

Very minor differences exist among some map units. However, the differences are usually significant with regard to a particular recreational or engineering use, and thus justify separation of different map units. They are described in chronological order, and horizon thicknesses represent averages. Thicknesses of comparative horizons in identical soil profiles often vary as much as 10 to 40 percent from the norm at different points in the landscape.

The dominant plant species are listed using common names. These are very general lists, and not purported to be complete.

Map Unit 1

Classification: Orthic Gray Luvisol - 70%
Gleyed Gray Luvisol - 30%

Parent material: moderately fine to fine textured till.

Landform: hummocky morainal (Mh), inclined morainal (Mi).

Slope: gently rolling to hilly (>5 to 60%).

Surface stoniness: slightly to exceedingly stony (1 to 4).

Drainage: Orthic Gray Luvisols - well drained.
Gleyed Gray Luvisols - imperfect.

Vegetation: mostly aspen; considerable balsam poplar; occasional white birch, especially in draws; understory consists of variable proportions of beaked hazelnut, dogwood, low-bush cranberry, wild rose, wild red raspberry, wild gooseberry, wild currant, saskatoon-berry; some willow and alder in low areas.

Profile description: Orthic Gray Luvisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	5-10	leaf and root litter		
Ae	7-13	loam to fine sandy loam	platy	friable to very friable, moist
Bt1	25	clay loam	blocky	firm to very firm, moist.
Bt2	40-65	clay loam to clay	blocky	firm to very firm, moist.
Cca	at 75-100	clay loam to clay	amorphous	firm to very firm, moist.

Gleyed Gray Luvisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	7-12	leaf and root litter		
Aegj	7-13	loam to fine sandy loam	platy	friable to very friable, moist
Btgj	25	clay loam	blocky	firm to very firm, moist
Btg	40-65	clay loam to clay	blocky	firm to very firm, moist
Ccag	at 75-100	clay loam to clay	amorphous	firm to very firm, moist

- Comments:
- 1) The Gleyed Gray Luvisol soils occur in lower slope positions and depressions.
 - 2) The Bt1 horizons of the Orthic Gray Luvisols, and Btgj horizons of the Gleyed Gray Luvisols often contain a few sand pockets, 2 to 7 cm thick.
 - 3) The C horizons sometimes contain sand pockets.

Limitations: Slight to very severe-slight on suitable topography for picnic areas, paths, and buildings without basements; moderate on suitable topography for campgrounds, lawns and landscaping, and buildings with basements; severe for septic tank absorption fields, and road location; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include slow permeability, surface stoniness, excessive slopes, erosion hazard, lack of Ah horizon, moderate to high shrink-swell potential, susceptibility to frost heave; seasonally high groundwater table, and groundwater contamination hazard for the Gleyed Gray Luvisols.

Map Unit 2

Classification: Orthic Gleysol and Orthic Humic Gleysol (these two great groups are intimately and unpredictably associated).

Parent material: very coarse to moderately fine textured lacustrine sediments.

Landform: level lacustrine (L1)

Slope: gently undulating (>0.5 to 2%).

Surface stoniness: nonstony (0)

Drainage: poor

Vegetation: mostly balsam poplar; some aspen, and white birch; patches of white spruce; understory is various combinations of beaked hazelnut, dogwood, wild rose, wild red raspberry, and wild currant; some patches of willow, and alder near the lake shore; some patches of horsetail, and marsh marigold in extremely wet portions.

Profile description: Orthic Gleysol, and Orthic Humic Gleysol.

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	5-15 leaf and root litter			
Ahg	0-20	sandy loam	granular	very friable, moist
Bg	pockets and layers: 10-20 extends to 100	loam to silt loam	subangular blocky	very friable, moist
		silty clay loam	subangular blocky	firm, moist
		sand	amorphous	loose, moist

Comments: 1) A water table occurs about 75 cm below the surface.
 2) Two to three H horizons, 2 to 15 cm thick, often occur in the upper 60 cm of the soil profile.

Limitations: Severe for all uses; poor source of roadfill; poor source of sand because of thin deposits and seasonally high groundwater table; unsuitable as a source of gravel due to unsuitable textures. Other limitations include flooding hazard (overflow), and groundwater contamination hazard.

Map Unit 3

Classification: Gleyed Eutric Brunisol
 Parent Material: moderately fine to fine textured till.
 Landform: level morainal (M1), undulating morainal (Mu).
 Slope: gently undulating to undulating (>0.5 to 5%).
 Surface stoniness: slightly stony (1).
 Drainage: imperfect.
 Vegetation: mostly aspen; some balsam poplar, and white birch; patches of white spruce.

Profile description: Gleyed Eutric Brunisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	5 leaf and root litter.			
Bmg	15-20	loam	subangular blocky	very friable; moist
Ccag	80-85	clay loam to clay	amorphous	firm to very firm, moist.

Comment: The soil profiles contain a few sand pockets, 2 to 15 cm thick.

Limitations: Moderate to severe-moderate for campgrounds, picnic areas, lawns and landscaping, and paths; severe for buildings, septic tank absorption fields, and road location; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include seasonally high groundwater table, flooding hazard (overflow), lack of an Ah horizon, moderate to high shrink-swell potential, susceptibility to frost heave, and slow permeability.

Map Unit 4

Classification: Gleyed Regosol.

Parent material: very coarse textured lacustrine sediments, overlying moderately fine to fine textured till.

Landform: lacustrine blanket and veneer, overlying undulating morainal ($\frac{Lbv}{Mu}$).

Slope: undulating (>2 to 5%).

Surface stoniness: nonstony (0).

Drainage: imperfect.

Vegetation: balsam poplar, aspen, wild rose, dogwood; some white spruce.

Profile description: Gleyed Regosol.

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
H	2-8 leaf and root litter			
Ckg	60 to >120	sand	amorphous	loose, moist
ll Ccag (till)	at 60 to >120	clay loam to clay	amorphous	very firm, moist

- Comments:
- 1) An occasional H layer, 1 to 3 cm thick, occurs in the Ckg horizon.
 - 2) The till is usually more than 120 cm below the surface, but is occasionally within 60 cm.
 - 3) A water table occurs at about 120 cm below the surface.

Limitations: Moderate to severe- moderate for campgrounds, picnic areas, and road location; severe for all other uses; good source of roadfill; fair source of sand (thin deposit); unsuitable as a source of gravel because of unsuitable textures. Other limitations include seasonally high groundwater table, flooding hazard (overflow), sandy surface texture, rapid permeability (droughtiness), lack of an Ah horizon, and groundwater contamination hazard.

Special Features

The soils in Alberta have been classified into broad general zones (Figure 2) as established by Alberta Soil Survey during the normal course of soil surveys, and correlated with temperature and precipitation records. Annual precipitation amounts change gradually from one soil zone to another, and are not abrupt changes at the point where a zone boundary has been located. Thus a zone boundary is a broad transitional belt, which can be many kilometres across. Topsoil colors reflect this gradual change. For example, in the centre of the Brown Soil zone (annual precipitation about 30 to 33 cm), topsoil colors are brown. Similarly in the centre of the Dark Brown Soil Zone (annual precipitation about 38 cm), topsoil colors are dark brown. Between these two zones, topsoil colors are brown to dark brown, and annual precipitation is about 35 cm. The boundary between the two soil zones has been placed approximately at the mid-point.

Zonal soils are soils with well developed soil characteristics that reflect the zonal or normal influences of climate and living organisms,

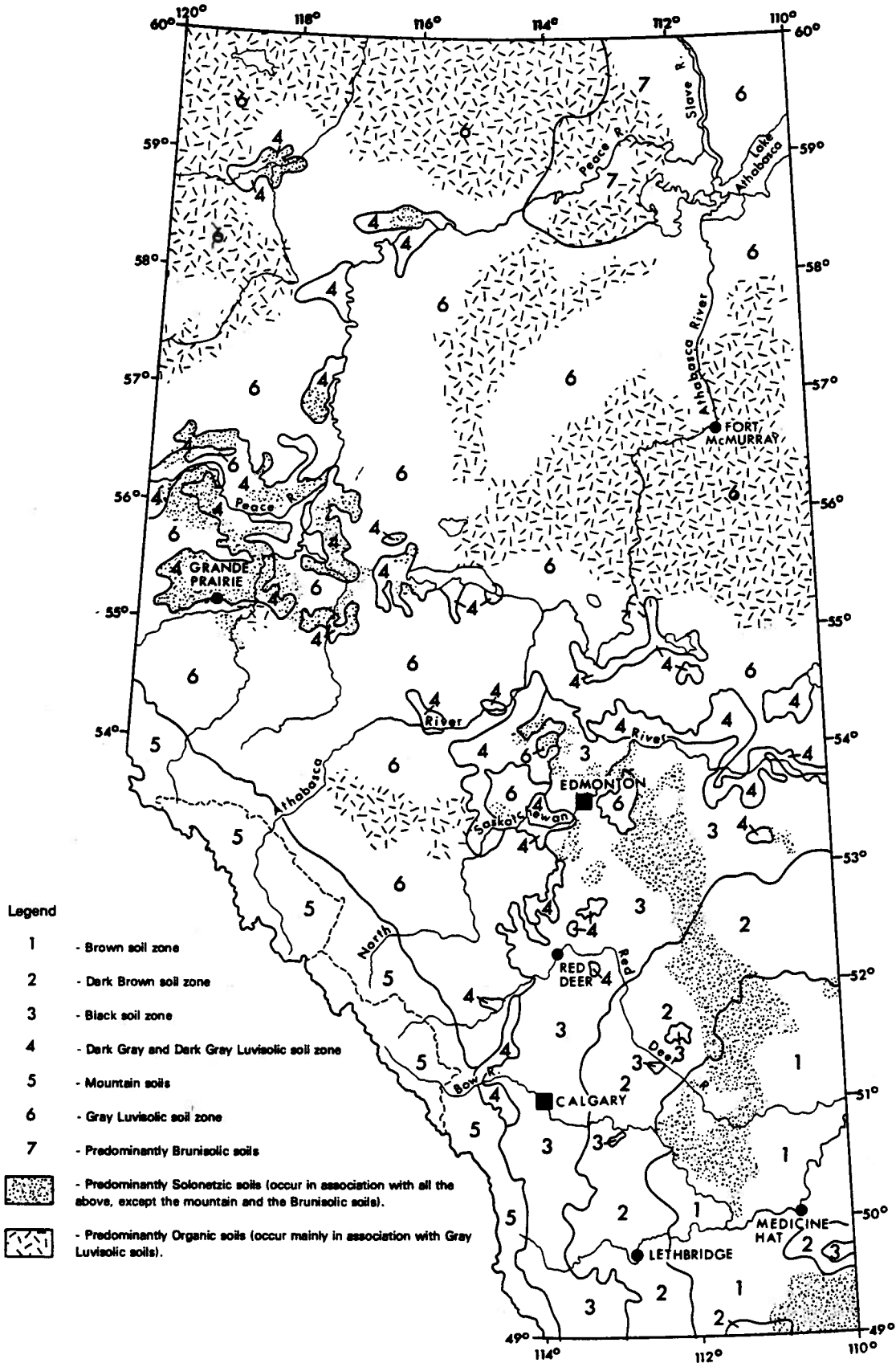



Figure 2. Map showing soil zones of Alberta (from Soil Group Map of Alberta, Alberta Institute of Pedology, undated).

mainly vegetation, as active factors of soil genesis. Examples are Brown, Dark Brown, or Black soils of the Brown, Dark Brown, or Black Soil Zones respectively. Intrazonal soils are soils with morphology that reflects the influence of some local factor of relief, parent material, or age; rather than of climate and vegetation. An examples is Solonetzic soils, which develop as a result of salinization. This may originate internally from a saline parent material, or from saturation by external saline waters. Solonetzic soils are found across many soil zones (Figure 2). Azonal soils are soils without distinct genetic horizons, and are represented by Regosolic soils in Canada. These occur across all the soil zones in the province.


The study area is situated in the Gray Luvisolic soil zone (Figure 2) and the soils throughout the majority of the area are classified as Orthic Gray Luvisols, which are zonally normal. Exceptions are the Regosolic soils, which are azonal; and the Gleysolic and Brunisolic soils, which are intrazonal. Gleysolic soils occur across all the soil zones, and Brunisolic soils occur in most. Soils of the mapped area can be considered typical, both locally and regionally (Kocaoglu, 1975).


Special features of soils in the study area are first the inherent properties of Luvisolic soils, and second the very coarse textures of the Regosolic soils. The Luvisolic soils in their natural state display surface leaf litter (L-H) and leached light gray coloured Ae horizons, typical of soils developed under forest vegetation. The Ae horizons are underlain by much finer textured Bt horizons of clay accumulation. The Regosolic soils have very low moisture holding capacities, so are droughty in nature. Also they have loose consistence, so are prone to rapid deterioration under human foot traffic. These soils are especially fragile because they lack Ah horizons; thus surface soils are very low in soil organic matter, an important soil-binding agent.

MISCELLANEOUS SYMBOLS

 This symbol indicates a small drainage channel, or the location of an intermittent stream. These are very narrow, and have low steep banks.

 This symbol indicates escarpments.

 This symbol indicates the location of periodic wet or water-filled depressions. They usually occur along the lakeshore, and are inundated. They are characterized by the growth of hydrophytic vegetation, including slough grass, willow, and some common cattails around the fringes. These depressions have severe to very severe limitations for all uses because of seasonally high groundwater tables or surface ponding, and flooding hazard (overflow).

 This symbol indicates open water.

SOIL INTERPRETATIONS

An explanation of soil interpretations and definitions of the soil limitation and suitability ratings are given in Greenlee (1981). The results of soil chemical and physical analyses are given in Tables 2 and 3.

The soils best suited for recreational development are those of Map Unit 1 when found on suitable topography, and they cover almost the whole study area. They have moderate limitations due to slow permeability, excessive slopes, and erosion hazard. The soils of Map Units 3 and 4 also have moderate limitations due to seasonally high groundwater tables and flooding hazard (overflow); and sandy surface textures for Map Unit 4 soils. Map Unit 2 soils have severe limitations due to seasonally high groundwater tables or surface ponding, and flooding hazard (overflow).

The soils best suited for road construction are those of Map Unit 4, and they have moderate limitations because of seasonally high groundwater tables and flooding hazard (overflow). Soils of all other map units have severe limitations, including high shrink-swell potential, susceptibility to frost heave, excessive slopes, seasonally high groundwater tables, and flooding hazard (overflow).

Map Unit 4 soils constitute only a fair source of sand because of thin deposits; and Map Unit 2 soils constitute a poor source for the same reason, as well as seasonally high groundwater tables. Soils of other map units are unsuitable because of unsuitable textures. A source of gravel was not found in the study area.

Specific limitations and suitabilities of the various soils for selected uses are shown in Tables 4 and 13 inclusive. The ratings were determined on the basis of morphological, physical, and chemical properties of the soils, as well as steepness of slope. The principal limiting properties are indicated, and are generally listed in decreasing order of importance. In Tables 4 to 11 inclusive, the soil limitations for various uses have been designated as none to slight, moderate, severe, and very severe. In Tables 12 and 13, the suitability of soils as sources of roadfill and as sources of sand and gravel respectively, have been designated as good, fair, poor, and very poor.

TABLE 2. Chemical Analyses of Selected Map Units¹

MAP UNIT	DEPTH cm	pH H ₂ O	² EC	³ Na	³ SO ₄	³ OM	³ CaCO ₃
1	0-15	6.1	0.2	L	⁴ nd	L+	-
	15-30	5.7	0.3	H+	nd	L	-
3	0-15	6.4	0.7	L+	nd	M-	-
	15-30	8.2	0.4	L	nd	L+	L-
4	0-15	6.8	0.3	L-	nd	L	-
	15-30	7.5	0.1	L-	nd	L-	-

¹Chemical Analyses done by Alberta Soil and Feed Testing Laboratory.

²EC - electrical conductivity, millimhos/cm. ³These tests are rated into 4 categories: High (H), Medium (M), Low (L), and none (-). The degree within each category is indicated by a + or - sign. The tests for OM (organic matter) and CaCO₃ (free lime) are visual estimates only. ⁴nd - not determined.

Table 3. Physical Analyses of Selected Map Units (1)

Map Unit	Depth cm	Field Moisture %	Mechanical Analysis											Liquid Limit	Plasticity Index	Optimum Moisture % (2)	Maximum Dry Density lb/ft. ³ (2)	Classification			
			Percentage Passing Sieve							Percentage Smaller Than								AASHO	Unified	USDA	
			1 inch	3/4 inch	5/8 inch	#4 (4.7 mm.)	#10 (2.0 mm.)	#40 (0.42 mm.)	#200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.	0.001 mm.								
1	90-120	15	100	100	100	100	99	94	72	65	49	40	36	41	17	25	95.0	A-7-6 (11)	CL	C	

(1) Map Units developed on similar parent material: 1.3. and 4.
 (2) These values are obtained from charts worked out by the Highways Testing Laboratory, Alberta Transportation.

TABLE 4. Soil Limitations for Fully Serviced Campgrounds

MAP ¹ SYMBOL	DEGREE OF LIMITATION ²	MAP SYMBOL	DEGREE OF LIMITATION
3 $\frac{1}{d1}$ $\frac{1}{d2}$ $\frac{1}{e1}$ $\frac{1}{e2}$ $\frac{1}{f2}$ $\frac{1}{f4}$ $\frac{1}{g2}$	M - S1 Perm	$\frac{2}{b0}$	S - Wet, Flood
	M - S1 Perm, Stony	$\frac{3}{b1}$ $\frac{3}{c1}$	M - Wet, Flood
	M - Slope, Er, S1 Perm	$\frac{4}{c0}$	M - Wet, Flood, Sandy
	S - Slope, Er, S1 Perm		
	S - Slope, Er, Stony		
	VS - Slope, Er S1 Perm		

1. For explanation, see Soil Map.
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe.
3. These ratings are for the Orthic Gray Luvisols. The Gleyed Gray Luvisols have an additional moderate limitation due to a seasonally high groundwater table.

ABBREVIATIONS

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky
 when wet
 Slope - Excessive slope
 S1 Perm - Slow permeability
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater
 table or surface ponding

TABLE 5. Soil Limitations for Picnic Areas

MAP ¹ SYMBOL	DEGREE OF LIMITATION ²	MAP SYMBOL	DEGREE OF LIMITATION
$\frac{1}{d1}$ $\frac{1}{d2}$	SL	$\frac{4}{c0}$	M - Sandy
$\frac{1}{e1}$ $\frac{1}{e2}$	M - Slope, Er		
$\frac{1}{f2}$	S - Slope, Er		
$\frac{1}{f4}$	S - Slope, Er, Stony		
$\frac{1}{g2}$	VS - Slope, Er		
$\frac{2}{b0}$	S - Wet		
$\frac{3}{b1}$ $\frac{3}{c1}$	M - Wet		

1. For explanation, see Soil Map.
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe.

ABBREVIATIONS

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky
 when wet
 Slope - Excessive slope
 Sl Perm - Slow permeability
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater
 table or surface ponding

TABLE 6. Soil Limitations for Lawns and Landscaping

MAP ¹ SYMBOL	DEGREE OF LIMITATION ²	MAP SYMBOL	DEGREE OF LIMITATION
$\frac{1}{d1}$	M - Thin Ah	$\frac{3}{b1}$ $\frac{3}{c1}$	M - Wet, Thin Ah
$\frac{1}{d2}$	M - Thin Ah, Stony	$\frac{4}{c0}$	S - Sandy, R Perm, Thin Ah
$\frac{1}{e1}$ $\frac{1}{e2}$	M - Slope, Er, Thin Ah		
$\frac{1}{f2}$	S - Slope, Er, Thin Ah		
$\frac{1}{f4}$	S - Slope, Er, Stony		
$\frac{1}{g2}$	VS - Slope, Er, Thin Ah		
$\frac{2}{b0}$	S - Wet		

1. For explanation, see Soil Map.
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe.

ABBREVIATIONS

- | | |
|---|---|
| <p>BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Lime - High lime content (soil
 nutrient imbalance)
 Org - Organic soil
 Org Surf - Organic surface layer
 > 15 cm thick
 R Perm - Rapid permeability
 (droughtiness)</p> | <p>Saline - Surface soil salinity
 Sandy - Sandy surface texture
 Slope - Excessive slope
 Sl Perm - Slow permeability
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Thin Ah - Thin or no Ah horizon
 Wet - Seasonally high groundwater
 table or surface ponding</p> |
|---|---|

TABLE 7. Soil Limitations for Paths

MAP ¹ SYMBOL	DEGREE OF LIMITATION ²	MAP SYMBOL	DEGREE OF LIMITATION
$\frac{1}{d1}$	SL	$\frac{3}{b1}$ $\frac{3}{c1}$	M - Wet
$\frac{1}{d2}$	M - Stony, other- wise SL	$\frac{4}{c0}$	S - Sandy, Wet
$\frac{1}{e1}$	M - Slope, Er		
$\frac{1}{e2}$	M - Slope, Er, Stony		
$\frac{1}{f2}$ $\frac{1}{f4}$	S - Slope, Er, Stony		
$\frac{1}{g2}$	VS - Slope, Er, Stony		
$\frac{2}{b0}$	S - Wet		

1. For explanation, see Soil Map.
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe.

ABBREVIATIONS

Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Org Surf - Organic surface layer
 > 15 cm thick
 Sandy - Sandy surface texture

Slip - Slippery or sticky
 when wet
 Slope - Excessive slope
 Solz - Solonetzic soil
 Stony - Surface stoniness
 Wet - Seasonally high groundwater
 table or surface ponding

TABLE 8. Soil Limitations for Buildings with Basements

MAP 1 SYMBOL	DEGREE OF LIMITATION 2	MAP SYMBOL	DEGREE OF LIMITATION
3 $\frac{1}{d1}$ $\frac{1}{d2}$ $\frac{1}{e1}$ $\frac{1}{e2}$ $\frac{1}{f2}$ $\frac{1}{f4}$ $\frac{1}{g2}$	M - M Sh-Sw, Frost	$\frac{2}{b0}$	S - Wet, Flood
	M - M Sh-Sw, Frost Stony	$\frac{3}{b1}$ $\frac{3}{c1}$	S - Wet, Flood, M Sh-Sw
	M - Slope, M Sh-Sw, Frost	$\frac{4}{c0}$	S - Wet, Flood
	S - Slope, M Sh-Sw, Frost		
	S - Slope, Stony, M Sh-Sw		
	VS - Slope, M Sh-Sw, Frost		

1. For explanation, see Soil Map.
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe.
3. These ratings are for the Orthic Gray Luvisols. The Gleyed Gray Luvisols have an additional severe limitation due to a seasonally high groundwater table.

ABBREVIATIONS

BR - Shallow depth to bedrock
 Clay - High clay content
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost heave
 M Sh-Sw - Moderate shrink-swell potential
 Org - Organic soil

Sh-Sw - High shrink-swell potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Sulfate - Possible concrete corrosion hazard (soluble sulfate)
 Wet - Seasonally high groundwater table or surface ponding

TABLE 9. Soil Limitations for Buildings Without Basements

MAP ¹ SYMBOL	DEGREE OF LIMITATION ²	MAP SYMBOL	DEGREE OF LIMITATION
3 $\frac{1}{d1}$ $\frac{1}{d2}$ $\frac{1}{e1}$ $\frac{1}{e2}$ $\frac{1}{f2}$ $\frac{1}{f4}$ $\frac{1}{g2}$	SL	$\frac{3}{b1}$ $\frac{3}{c1}$	S - Flood, Wet
	M - Stony, otherwise SL	$\frac{4}{c0}$	S - Flood, Wet
	M - Slope		
	M - Slope, Stony		
	S - Slope, Stony		
	VS - Slope, Stony		
$\frac{2}{b0}$	S - Wet, Flood		

1. For explanation, see Soil Map.
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe.
3. These ratings are for the Orthic Gray Luvisols. The Gleyed Gray Luvisols have an additional moderate limitation due to seasonally high groundwater tables.

ABBREVIATIONS

BR - Shallow depth to bedrock
 Flood - Flooding hazard (overflow)
 Org - Organic soil
 Slope - Excessive slope

Stony - Surface stoniness
 Wet - Seasonally high groundwater table or surface ponding

TABLE 10. Soil Limitations for Septic Tank Absorption Fields

MAP ¹ SYMBOL	DEGREE OF LIMITATION ²	MAP SYMBOL	DEGREE OF LIMITATION	
3 $\frac{1}{d1}$ $\frac{1}{d2}$	S - S1 Perm	$\frac{4}{c0}$	S - Wet, R Perm, GW	
	$\frac{1}{e1}$ $\frac{1}{e2}$			S - S1 Perm, Slope
	$\frac{1}{f2}$ $\frac{1}{f4}$			S - Slope, S1 Perm
	$\frac{1}{g2}$			VS - Slope, S1 Perm
$\frac{2}{b0}$	VS - Wet, Flood, GW			
$\frac{3}{b1}$ $\frac{3}{c1}$	S - Wet, Flood, S1 Perm			

1. For explanation, see Soil Map.
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe.
3. These ratings are for the Orthic Gray Luvisols. The Gleyed Gray Luvisols have an additional severe limitation due to seasonally high groundwater tables, and groundwater contamination hazard.

ABBREVIATIONS

BR - Shallow depth to bedrock
 Clay - High clay content
 Flood - Flooding hazard (overflow)
 GW - Groundwater contamination
 hazard
 Org - Organic soil

R Perm - Rapid permeability
 Slope - Excessive slope
 S1 Perm - Slow permeability
 Wet - Seasonally high groundwater
 table or surface ponding

TABLE 11. Soil Limitations for Road Location

MAP ¹ SYMBOL	DEGREE OF LIMITATION ²	MAP SYMBOL	DEGREE OF LIMITATION
³ $\frac{1}{d1}$ $\frac{1}{d2}$ $\frac{1}{e1}$ $\frac{1}{e2}$ $\frac{1}{f2}$ $\frac{1}{f4}$ $\frac{1}{g2}$	S - Sh-Sw, Frost	$\frac{3}{b1}$ $\frac{3}{c1}$	S - Sh-Sw, Frost, Wet
	S - Sh-Sw, Slope, Frost		
	S - Slope, Sh-Sw, Frost	$\frac{4}{c0}$	M - Wet, Flood
	S - Slope, Sh-Sw, Stony		
	VS - Slope, Sh-Sw, Frost		
$\frac{2}{b0}$	S - Wet, Flood		

1. For explanation, see Soil Map.
2. SL - None to slight, M - Moderate, S - Severe, VS - Very severe.
3. These ratings are for the Orthic Gray Luvisols. The Gleyed Gray Luvisols have an additional moderate limitation due to seasonally high groundwater tables.

ABBREVIATIONS

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost heave
 M Sh-Sw - Moderate shrink-swell potential

Org - Organic soil
 Sh-Sw - High shrink-swell potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Wet - Seasonally high groundwater table or surface ponding

TABLE 12. Soil Suitability for Source of Roadfill

MAP 1 SYMBOL	DEGREE OF Suitability ²	MAP SYMBOL	DEGREE OF Suitability
$\frac{1}{d1}$ $\frac{1}{d2}$ $\frac{1}{e1}$ $\frac{1}{e2}$	P - Sh-Sw, Frost	$\frac{4}{c0}$	G
$\frac{1}{f2}$	P - Sh-Sw, Slope, Frost		
$\frac{1}{f4}$	S - Sh-Sw, Stony, Slope		
$\frac{1}{g2}$	P - Slope, Sh-Sw, Frost		
$\frac{2}{b0}$	P - Wet		
$\frac{3}{b1}$ $\frac{3}{c1}$	P - Sh-Sw, Frost		

1. For explanation, see Soil Map.
2. G - Good, F - Fair, P - Poor, VP - Very poor.

ABBREVIATIONS

BR - Shallow depth to bedrock
 Clay - High clay content
 Er - Erosion hazard
 Flood - Flooding hazard (overflow)
 Frost - Susceptibility to frost
 heave
 M Sh-Sw - Moderate shrink-swell
 potential

Org - Organic soil
 Sh-Sw - High shrink-swell
 potential
 Slope - Excessive slope
 Stony - Surface stoniness
 Wet - Seasonally high groundwater
 table or surface ponding

TABLE 13. Soil Suitability for Source of Sand or Gravel

MAP ¹ SYMBOL	DEGREE OF Suitability ²	MAP SYMBOL	DEGREE OF Suitability
$\frac{1}{d1}$ $\frac{1}{d2}$ $\frac{1}{e1}$ $\frac{1}{e2}$ $\frac{1}{f2}$ $\frac{1}{f4}$ $\frac{1}{g2}$	VP - Text		
$\frac{2}{b0}$	P - Thin, Wet		
$\frac{3}{b1}$ $\frac{3}{c1}$	VP - Text		
$\frac{4}{c0}$	F - Thin		

1. For explanation, see Soil Map.
2. G - Good, F - Fair, P - Poor, VP - Very poor.

ABBREVIATIONS

Flood - Flooding hazard (overflow)
 OB - Excessive overburden
 Org - Organic soil
 Text - Unsuitable texture

Thin - Thin deposit of sand
 or gravel
 Wet - Seasonally high groundwater
 table or surface ponding

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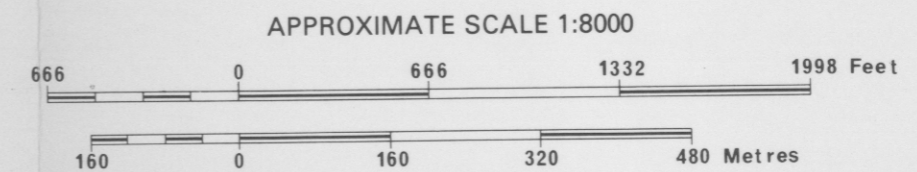
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LEGEND:

- L - Lacustrine
- Li - level lacustrine
- Lbv - lacustrine blanket and veneer,
Mu overlying undulating morainal
- M - Morainal
- Mh - hummocky morainal
- Mi - inclined morainal
- MI - level morainal
- Mu - undulating morainal

- landform line
- boundary of mapped area
- escarpment
- small drainage channel
- direction of slope
- periodic wet or water-filled depression
- open water



Landform Map, Garner Lake Provincial Park Study Area

Tp 60 R 12 W4M

G.M. Greenlee
Published 1984
Fieldwork conducted in 1975

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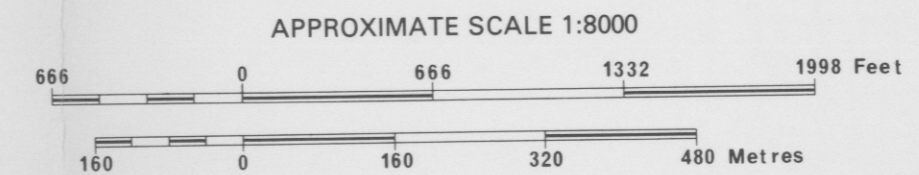
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LEGEND:

- SL - none to slight soil limitations
- M - moderate soil limitations
- S - severe soil limitations
- VS - very severe soil limitations

- soil limitation line
- boundary of mapped area
- escarpment
- small drainage channel
- direction of slope
- periodic wet or water-filled depression
- open water



Soil Limitations for Recreation, Garner Lake Provincial Park Study Area

Tp 60 R 12 W4M

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SOIL CLASSIFICATION			
MAP UNIT	SOIL ORDER	SOIL SUBGROUP	SOIL PARENT MATERIAL
1	Luvisolic	Orthic Gray Luvisol-70% Gleyed Gray Luvisol - 30%	moderately fine to fine textured till
2	Gleysolic	Orthic Gleysol and Orthic Humic Gleysol	very coarse to moderately fine textured lacustrine sediments
3	Brunisolic	Gleyed Eutric Brunisol	moderately fine to fine textured till
4	Regosolic	Gleyed Regosol	very coarse textured lacustrine sediments, overlying moderately fine to fine textured till

LEGEND:

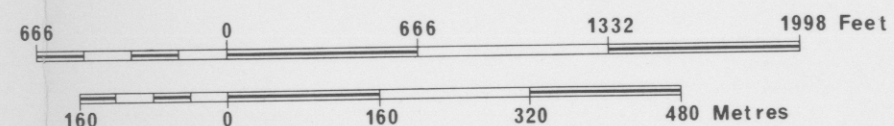


- soil line
- boundary of mapped area
- escarpment
- small drainage channel
- direction of slope
- periodic wet or water-filled depression
- open water

Map Symbol:

- 1 ← map unit
- e2 ← surface stoniness rating
- topographic class

APPROXIMATE SCALE 1:8000



Soil Map, Garner Lake Provincial Park Study Area

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