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

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PREFACE

This report is one of a series describing detailed, semi-detailed, and reconnaissance soil surveys which have been conducted in Alberta provincial parks and recreation areas. As well as the Dillberry Lake Provincial Park study area, soil surveys were conducted in the Buck Lake region southwest of Breton, and Midland Provincial Park west of Drumheller during the summer of 1978. The total area mapped was approximately 2370 ha. Also during 1978, soil profiles at 24 sites in the Cypress Hills of Alberta were described and samples collected for laboratory analyses. The purpose at 19 sites was to classify and characterize the soils associated with different plant communities; and at 5 sites to document any observable differences between soils in heavy use and non-use recreation areas.

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 landscape 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.

ACKNOWLEDGMENTS

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recreation maps, while Mr. J. Beres determined the soil physical properties. The soil chemical analyses were determined by Messrs. A. Schwarzer and W. McKean. Able field assistance was given by Mr. D. Skinner.

Special acknowledgment is given to the Park Rangers and other park employees, who co-operated by allowing soil investigations to be conducted throughout the park, and who invariably offered assistance when needed.

SUMMARY

The mapped area covers about 1350 ha, and is located about 16 km southeast of the village of Chauvin or 38 km northeast of the town of Provost. The most prevalent surficial deposits in the study area are outwash sands, and occasional morainal deposits also occur. The sand deposits throughout most of the eastern portion have been re-worked by wind. This region has a cold snowy forest climate with humid winters, characterized by frozen ground and a snow cover of several months duration. The average temperature of the warmest month is between 10°C and 22°C, and of the coldest month is below -3°C. The mapped area is situated in the aspen grove section of the boreal forest region, where prairie and meadow patches were interspersed with aspen bluffs in the original vegetation.

Twelve map units were recognized in the study area. The key profile types are Orthic Dark Brown Chernozems, Orthic Regosols, Gleyed Dark Brown Chernozems, Gleyed Rego Dark Brown Chernozems, Gleyed Regosols, Rego Gleysols, Orthic Gleysols peaty phase, and Terric Humisols. 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 erodibility ratings (K-values) and predicted water erosion hazards have been worked out for selected map units. Soil interpretations of each map unit are made for primitive camping areas, fully serviced campgrounds, picnic areas, lawns and landscaping, paths, trails, buildings, septic tank absorption fields, trench type sanitary landfills, road location, source of roadfill, and source of sand or gravel.

The soils most favourable for recreational development are those of Map Unit 8, but only one small pocket occurs on suitable topography in the north-western portion of the study area. Soils which have only moderate limitations when found on suitable topography are those of Map Units 1, 6, and 9; and Map Unit 1 soils are widespread throughout most of the study area. The dominant soils surrounding Dillberry Lake are those of Map Unit 2, which have very severe limitations due to sandy surface textures and wind erosion hazards. Soils of Map Units 1, 2, and 9; which collectively cover the majority of the mapped area; are all well suited to road construction. Map Units 1, 2, and 6 soils; together which also cover most of the mapped area; constitute good sources of sand. Map Unit 9 soils, which occur in the extreme northwestern portions and near Killarney Lake, comprise a good source of gravel. Careful study of the soil map and Tables 6 to 18 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 mapped area covers about 1350 ha, and is located about 16 km southeast of the village of Chauvin or 38 km northeast of the town of Provost (Figure 1). The study area surrounds the Alberta portion of Dillberry Lake; and is adjacent to the northern shore of Leane Lake, as well as the eastern and southern shores of Killarney Lake. Most of the area is situated in twp 41, rg 1, W4th, and includes secs 25, 34, 35, 36, NE $\frac{1}{4}$ sec 26, and N $\frac{1}{2}$ sec 33. Also included is sec 1, E $\frac{1}{2}$ and SW $\frac{1}{4}$ sec 2, and pt SE $\frac{1}{4}$ sec 4, twp 42, rg 1, W4th.

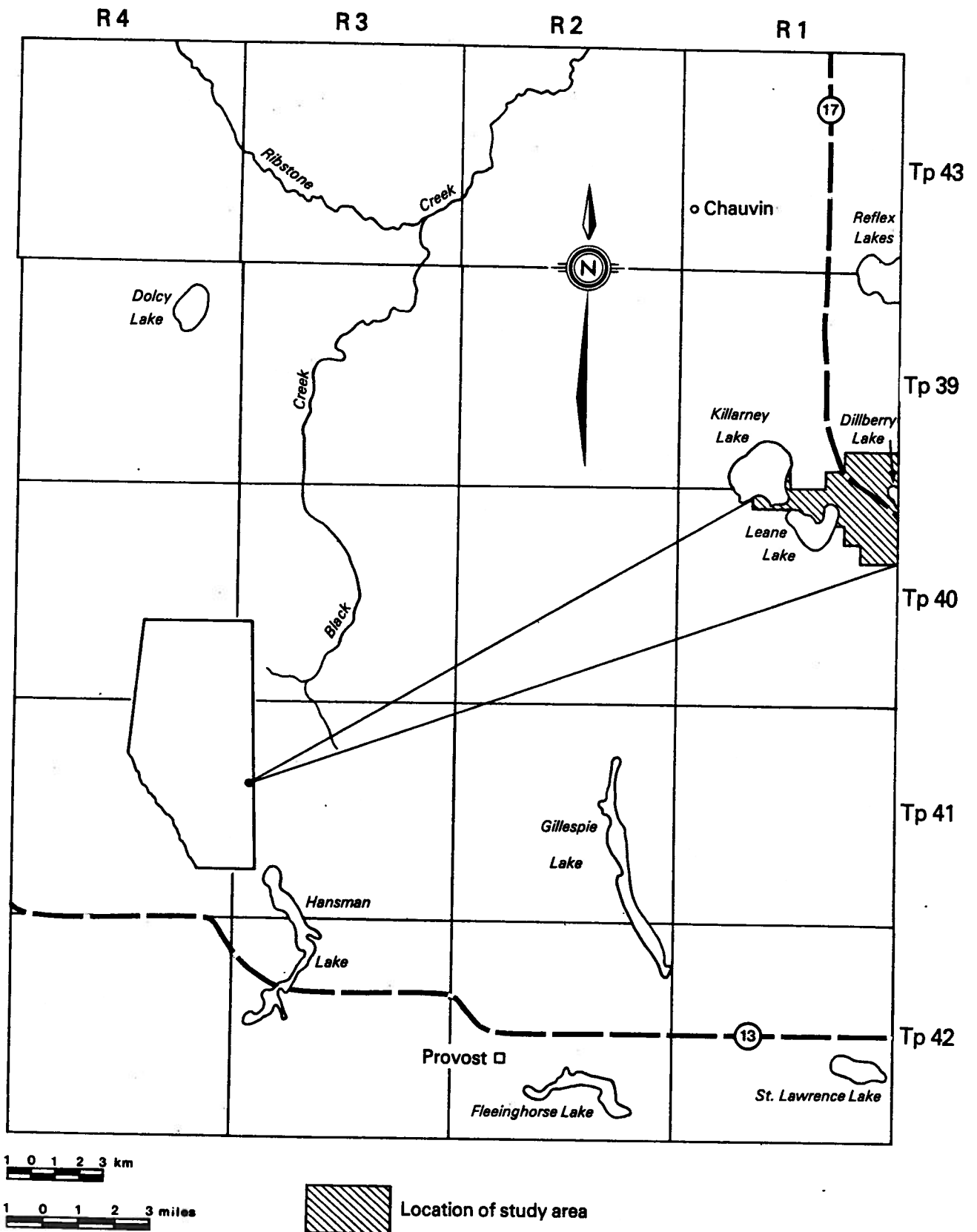


Figure 1. Map showing location of study area.

PHYSIOGRAPHY AND SURFICIAL DEPOSITS

The most prevalent surficial deposits in the study area are outwash sands, and occasional morainal deposits also occur (Hackbarth, 1975). The sand deposits throughout most of the eastern portion have been re-worked by wind. The bed-rock has been classified as the Upper Cretaceous Belly River formation which is non-marine in origin (Green, 1972). Elevations are fairly constant throughout the study area, and average around 640 m. The highest is probably the morainal knoll in the extreme northeastern corner, and the lowest is probably adjacent to the shores of the long east-west oriented lake just west of Dillberry Lake. Drainage of the study area is internal into the very coarse textured sands, as a developed external drainage system does not exist.

Most of the eastern portion of the study area is covered by very coarse textured eolian deposits. Occasional knolls of medium to moderately fine textured till, and pockets of very coarse textured glaciofluvial sediments (gravel) occur across the extreme northeastern portion. Most of the western portion is covered by very coarse textured glaciofluvial sediments (sand, except predominantly gravel bordering Killarney Lake). Narrow bands of very coarse textured lacustrine deposits (beach sand) are common along the shores of Killarney and Leane Lakes.

CLIMATE

The climate of the mapped area is designated as humid microthermal in Koppen's climatic classification (Trewartha and Horn, 1980). This is described as a cold snowy forest climate with humid winters, characterized by frozen ground and a snow cover of several months duration. Summers are cool, having an average temperature of the warmest month between 10°C and 22°C. The average temperature of the coldest month is below -3°C.

Weather records for 1969 through 1978 from Macklin, Saskatchewan about 27 km southeast of the study area and at an elevation of 661 m were used to compile the following information (Environment Canada): the mean annual temperature is 2.2°C. July is the warmest month of the year with a mean temperature of 17.3°C, and January is the coldest month with a mean temperature of -18.7°C. The mean

annual precipitation is 401 mm and 78% falls as rain. The average frost-free period is 106 days.

VEGETATION

The mapped area is situated in the aspen grove section of the boreal forest region as classified by Rowe (1972).

In the aspen grove section, only trembling aspen is abundant in the natural stands. Balsam poplar is frequently present on moist lowlands, and occasionally prominent on uplands after fire. White birch has a sporadic distribution, but is usually found only on rough broken land. Prairie and meadow patches were interspersed with the aspen bluffs in the original vegetation.

Throughout most of the study area, grassland is interspersed with aspen clumps, and the aspen is generally low-growing. The portion north of Leane Lake is dominantly grassland, and balsam poplar is found in numerous lowlands.

The vegetation is not extensively discussed in this report, because the Outdoor Recreation Planning Branch of Alberta Recreation and Parks conducts biological studies of provincial parks and recreation areas. However, some of the more common plant species observed growing on different soils are indicated as part of the map unit descriptions, and these are listed as follows (Moss, 1959; Cunningham, 1975): aspen (Populus tremuloides), balsam poplar (Populus balsamifera), water birch (Betula occidentalis), white birch (Betula papyrifera), buckbrush (Symphoricarpos occidentalis), wolf willow (Elaeagnus commutata), saskatoon-berry (Amelanchier alnifolia), choke cherry (Prunus virginiana), pin cherry (Prunus pensylvanica), wild rose (Rosa spp), willow (Salix spp), dogwood (Cornus stolonifera), bracted honeysuckle (Lonicera involucrata), twining honeysuckle (Lonicera dioica var. glaucescens), wild red raspberry (Rubus strigosus), wild gooseberry (Ribes spp), wild currant (Ribes spp), Canadian buffalo-berry (Shepherdia canadensis), hawthorn (Crataegus chrysocarpa), native grass (various species), creeping juniper (Juniperus horizontalis), pasture sagewort (Artemisia frigida), prairie sagewort (Artemisia ludoviciana), prairie crocus (Anemone patens var. wolfgangiana), golden bean (Thermopsis rhombifolia), common yarrow (Achillea millefolium), three-flowered avens (Geum triflorum), common bearberry

(Arctostaphylos uva-ursi), early blue violet (Viola adunca), wild strawberry (Fragaria spp), northern bedstraw (Galeum boreale), mouse-ear chickweed (Cerastium arvense), early yellow loco-weed (Oxytropis sericea var spicata), wild onion (Allium spp), vetch (Vicia spp), pale comandra (Comandra pallida), moss phlox (Phlox Hoodii), common dandelion (Taraxacum officinale), prickly pear cactus (Opuntia polyacantha), reindeer-moss (Cladonia spp), slough grass (Beckmannia syzigachne), sedge (Carex spp), horsetail (Equisetum spp), common cattail (Typha latifolia), and rushes (various species).

SOILS

Twelve map units were recognized in the study area. The soils of four were classified in each of the Chernozemic and Gleysolic Orders, three in the Regosolic Order, and one in the Organic Order in 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 Chernozemic Order are well to imperfectly drained mineral soils of good structure, with very high natural fertility and productive capacity. They are characterized by dark coloured surface virgin (Ah or Ahe) or cultivated (Ap) horizons, darkened by the accumulation of organic matter (humus) from the decomposition of grasses and forbs representative of grassland communities or of grassland-forest communities with associated shrubs and forbs. The A horizon is commonly referred to as "topsoil" and ranges from 10 to 25 cm in thickness. In some regions it is much thicker. Chernozemic soils are further divided into four major divisions, the Brown, Dark Brown, Black and Dark Gray Great Groups. These are distinguished by measurable differences in colour of the A horizons, which together with other associated features of depth, organic matter content, and structure reflect significant differences in the climates and vegetation under which they have developed, and which continue to influence and distinguish their characteristics and relative use capabilities.

In general, Brown Chernozemic soils have A horizons that are lower in organic matter content, lighter in colour and thinner than those of the other Chernozemic Great Groups; and are found in southern and south-eastern Alberta. Black Chernozemic soils have A horizons that are higher in organic matter content,

Table 1. Key to the Soils.

Map Unit	Classification	Parent Material	Surface Texture	Slope (class & gradient)	Surface Stoniness	Drainage	Comments and Limitations
1	Orthic Dark Brown Chernozem - 70% Gleyed Dark Brown Chernozem - 20% Orthic Regosol - 10%	very coarse textured eolian and glacio-fluvial sediments (sand)	sand	b,c,d,e,f,g (>0.5 to 60%)	0	Orthic Chernozems and Regosols - rapid. Gleyed Chernozems - imperfect.	1) Orthic Dark Browns occur on knolls, upper and mid slopes; Gleyed Dark Browns on lower slopes and in depressions; Regosols on dry south facing slopes. 2) Some blowouts present usually very steep slopes. Slight to severe limitations, good source of roadfill and sand, unsuitable as a source of gravel-sandy surface textures, excessive slopes, rapid permeability (droughtiness), groundwater contamination hazard.
2	Orthic Regosol - 80% Orthic Dark Brown Chernozem - 20%	very coarse textured eolian and glacio-fluvial sediments (sand).	sand	c,d,e,f (>2 to 30%)	0	rapid	Numerous blowouts occur, usually very steep slopes. Slight to very severe limitations, good source of roadfill and sand, unsuitable as a source of gravel - sandy surface textures, wind erosion hazard, excessive slopes, rapid permeability (droughtiness), groundwater contamination hazard.
3	Gleyed Regosol	very coarse textured lacustrine (beach sand)	sand	b,c,d (>0.5 to 9%)	0 to 3	imperfect	1) Occasional gravelly pockets occur. 2) Water table depths range from 75 to 120 cm. Moderate to very severe limitations, fair source of roadfill and sand, unsuitable as a source of gravel-flooding hazard (overflow), seasonally high groundwater table, sandy surface texture, surface stoniness, high lime content (soil nutrient imbalance), lack of Ah horizon, rapid permeability, groundwater contamination hazard.
4	Rego Gleysol	very coarse textured lacustrine (beach sand)	sand	a (0 to 0.5%)	0	poor	Water table depth varies from 12 to 35 cm. Severe to very severe limitations, poor source of roadfill and sand, unsuitable as a source of gravel-seasonally high groundwater table, flooding hazard (overflow), sandy surface texture, high lime content (soil nutrient imbalance), groundwater contamination hazard.

Table 1. Key to the Soils.

Map Unit	Classification	Parent Material	Surface Texture	Slope (class & gradient)	Surface Stoniness	Drainage	Comments and Limitations
5	Orthic Gleysol, peaty phase	very coarse textured eolian sediments (sand)	sand	a,b (0 to 2%)	0	poor	Water table depth ranges from 30 to 75 cm. Severe to very severe limitations, poor source of roadfill and sand, unsuitable as a source of gravel - seasonally high groundwater table or surface ponding, organic surface layer >15 cm thick, sandy surface texture, rapid permeability, groundwater contamination hazard.
6	Gleyed Dark Brown Chernozem and Gleyed Rego Dark Brown Chernozem	very coarse textured eolian and glacio-fluvial sediments (sand)	sand	c,d, (>2 to 9%)	0	imperfect	Water tables occasionally found at 90 to 100 cm. Moderate to very severe limitations, good source of roadfill and sand, unsuitable as a source of gravel - sandy surface texture, seasonally high groundwater table, rapid permeability, groundwater contamination hazard.
7	Rego Gleysol and Rego Humic Gleysol	very coarse textured eolian and glacio-fluvial sediments (sand)	sandy loam to loam	a (0 to 0.5%)	0	poor	1) The Ah horizon is intermittent. 2) A water table occurs at 60 to 90 cm. Severe to very severe limitations, poor source of roadfill and sand, unsuitable as a source of gravel - seasonally high groundwater table or surface ponding, high lime content (soil nutrient imbalance), thin or no Ah horizon, rapid permeability, groundwater contamination hazard.
8	Orthic Dark Brown Chernozem	very coarse textured glaciofluvial sediments (sand) overlying medium to moderately fine textured till - 70%, medium to moderately fine textured till - 30%	fine sandy loam to loam	c,f,g (>2 to 5% and >15 to 60%)	0 to 2	well drained	1) Thin overlays of sand are general except for the crests of knolls and highs. 2) The till often contains sand pockets. Slight to moderate limitations, fair source of roadfill, very poor source of sand, unsuitable as a source of gravel - excessive slopes, surface stoniness, susceptibility to frost heave, high clay content of subsoil, slow permeability, moderate shrink-swell potential.

Table 1. Key to the Soils.

Map Unit	Classification	Parent Material	Surface Texture	Slope (class & gradient)	Surface Stoniness	Drainage	Comments and Limitations
9	Orthic Dark Brown Chernozem	very coarse textured glaciofluvial sediments (gravel - 70% sand - 30%)	sandy loam to sand	c,d,f,g (>2 to 60%)	0 to 2	rapid	The depth to gravel is highly variable, ranging from 0 to >120 cm. Slight to very severe limitations, good source of roadfill, sand, or gravel - sandy surface texture, excessive slope, surface stoniness, rapid permeability (droughtiness), groundwater contamination hazard.
10	Rego Gleysol	moderately fine to fine textured lacustrine	clay loam to silty clay	a (0 to 0.5%)	0	poor	These small depressions have water during early spring. Severe to very severe limitations, poor source of roadfill, unsuitable as a source of sand or gravel - seasonally high groundwater table or surface ponding, high clay content, slow permeability, slippery or sticky when wet, high lime content (soil nutrient imbalance), lack of Ah horizon, high shrink-swell potential, susceptibility to frost heave, groundwater contamination hazard.
11	Gleyed Regosol	moderately fine textured till	clay loam	C (>2 to 5%)	5	imperfect	Very severe limitations, very poor source of roadfill, unsuitable as a source of sand or gravel - surface stoniness, seasonally high groundwater table, flooding hazard (overflow), slippery or sticky when wet, high lime content (soil nutrient imbalance), groundwater contamination hazard, high shrink-swell potential, susceptibility to frost heave.
TH	Terric Humisol	predominantly humic peat overlying sand	humic peat	a (0 to 0.5%)	0	very poor	A water table is common at the surface or only a few centimeters below. Very severe limitations, very poor source of roadfill and sand, unsuitable as a source of gravel-organic soil, seasonally high groundwater table, flooding hazard (overflow), lack of Ah horizon, high shrink-swell potential, rapid permeability, groundwater contamination hazard.

darker in colour and thicker than those of the other great groups; and are found in central and east-central Alberta. Dark Brown Chernozemic soils have A horizons with characteristics intermediate between those of the Browns and the Blacks; and are found in south-central and east-central Alberta. Dark Gray Chernozemic soils have A horizons with variable colours, thicknesses and modifications of structural pattern indicative of degradation of the typical Chernozemic A horizon. Under virgin conditions, the Dark Grays usually have leaf mats (L-H horizons) overlying the mineral soil, and degradation of the A horizons frequently causes a banded or "salt and pepper" effect. The organic matter content varies with the degree of degradation, from high accumulations in slightly degraded soils comparable to that of Blacks; to significantly lower amounts in the more strongly degraded types. These latter types are intergrades to Dark Gray Luvisolic soils of the Luvisolic Order. Dark Gray Chernozemics are found primarily in transitional areas of grassland and forest in north-central Alberta and in the Peach River region.

Very rapidly drained Dark Brown Chernozemic soils developed on very coarse textured sand occur throughout most of the study area, and the parent material is predominantly gravel in the extreme northwestern portion as well as south of Killarney Lake. A few small sporadic patches of imperfectly drained Dark Browns developed on very coarse textured sand also occur, usually adjacent to lakes or large sloughs. A few small sporadic patches of well drained Dark Browns developed on moderately coarse to very coarse textured sand overlying medium to moderately fine textured till are found across the northern portion of the 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.

Patches of very rapidly drained Regosolic soils developed on very coarse textured sand are found in the southeastern portion of the study area, where frequent sand dunes occur. These sands are almost completely devoid of fines,

and soil profile development is not evident with the exception of very thin Ah horizons and the leaching of lime. Narrow bands of imperfectly drained Regosolic soils developed on very coarse textured sand and moderately fine textured till parallel portions of Killarney and Leane Lakes. Lime occurs to the surface in these soils, and the only visible profile development is gleying. These features suggest fluctuating water tables and a lack of any net downward leaching of water.

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.

Small patches of Gleysolic soils developed on very coarse textured sand occur sporadically throughout much of the study area. Most are of very limited extent, and parallel lake shores or large sloughs. Also, some are found in small isolated depressions.

Soils of the Organic order include all soils that have developed largely from organic deposits, contain more than 30% organic matter by weight, and meet specifications of depth and thickness within a defined control section. The majority of Organic soils are either water saturated or nearly so for much of the year unless artificially drained. The organic deposits are derived primarily from the decomposition of hydrophytic or mesohydrophytic vegetation. The further classification and naming of the great groups into Fibrisols, Mesisols and Humisols depends on the occurrence and identification of three major diagnostic layers: Fibric, Mesic and Humic. Fibric layers are the least decomposed of all the organic soil materials and have large amounts of well preserved fibres, which are readily identifiable as to botanical origin. The organic matter of humic layers is in a highly decomposed state, and often has a smooth greasy feel when moist. It has the least amount of recognizable plant fibre, and is usually darker in colour than fibric or mesic materials. It is relatively stable and changes little in physical or chemical composition with time. The organic

matter of mesic layers is in an intermediate stage of decomposition between that of fibric and humic layers, and is partially altered both chemically and physically. Management problems in areas of cultivated Organic soils involve the maintenance of controlled drainage, adequate fertilization, and tillage practices necessary to maintain a firm bed for seed germination and root development. Overdrainage and dessication of peat are detrimental to crop production and to the maintenance of the organic layers in a desirable physical condition. Under cultivation, many Organic soils show deficiencies in macro and micro mineral nutrients, and most require the application of phosphorus and potassium to obtain maximum productivity. Special problems also exist in using Organic soils for construction purposes. These are their low bearing strength, high shrink-swell potential and susceptibility to frost heaving.

Only a few small patches of thin Organic soils are found in depressional locations in the northeastern portion of the study area, and all are adjacent to lakes or sloughs. Near the edges of Organic soil patches, where the thickness of organic material is less than 40 cm, the soils are classified as peaty phases of Gleysols.

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 intended to be complete.

Map Unit 1

Classification:	Orthic Dark Brown Chernozem - 70%
	Gleyed Dark Brown Chernozem - 20%
	Orthic Regosol - 10%
Parent Material:	very coarse textured eolian and glaciofluvial sediments (sand)
Landform:	level eolian (El), undulating eolian (Eu), ridged eolian (Er), hummocky eolian (Eh); undulating glaciofluvial (^G Fu), hummocky

G
glaciofluvial (Fh).

Slope: gently undulating to hilly (>0.5 to 60%).

Surface stoniness: nonstony (0).

Drainage: Orthic Chernozems and Regosols - rapid.

Gleyed Chernozems - imperfect

Vegetation: dominantly short sparse grass and scattered forbs including prairie crocus, golden bean, pasture sagewort, prairie sage-wort, three-flowered avens, wild onion, early yellow loco-weed, mouse-ear chickweed; reindeer-moss common; patches of creeping juniper, common bearberry, buckbrush, wild rose, wolf willow; numerous patches of sparse stunted aspen; also some patches of denser larger aspen with an understory of saskatoon-berry, choke cherry, pin cherry, hawthorn, bracted honeysuckle, twining honeysuckle, wild strawberry, northern bedstraw, early blue violet, common dandelion; some prickly pear cactus on very dry south-facing slopes.

Profile description:

Orthic Dark Brown

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl2	OM ¹ %
L-H	5	leaf litter	(absent under grass)		6.3	31.3
Ah	30	sand	amorphous	loose, dry or moist	5.6	0.93
Bm	60	sand	amorphous	loose, dry or moist	5.9	0.29
BC	10	sand	amorphous	loose, dry or moist	6.0	nd ²

¹OM - organic matter, ²nd - not determined

Orthic Dark Brown

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl2	OM ¹ %
Ah	40	loamy sand	amorphous	loose, dry or moist	6.2	2.02
Bm	40	sand	amorphous	loose, dry or moist	6.2	0.44
BC	20	sand	amorphous	loose, dry or moist	6.8	nd ²

¹OM - organic matter ²nd - not determined

Gleyed Dark Brown

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl ₂	OM ¹ %
Ah	20	sand	amorphous	loose, dry or moist	5.7	1.75
Bmg	15	sand	amorphous	loose, dry or moist	5.5	0.32
BCg	65	sand	amorphous	loose, dry or moist	5.4	nd ²

¹OM - organic matter, ²nd - not determined

Orthic Regosol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ah	0-2	sand	amorphous	loose, moist
C	98-100	sand	amorphous	loose, moist

Comments:

- (1) This is the dominant map unit throughout most of the study area. Exceptions are the vicinities surrounding Dillberry and Killarney Lakes.
- (2) The Orthic Dark Browns occur on knolls, upper slopes, and mid slopes; the Gleyed Dark Browns occur on lower slopes and in depressions; the Regosols occur on dry south-facing slopes with very sparse vegetation including grass, reindeer-moss, creeping juniper, and prickly pear cactus.
- (3) Some blowouts are present, usually on very steep slopes. These are patches where the soil solum has been removed by wind action, exposing bare sand (C horizon) at the surface. These patches are devoid of vegetation.
- (4) Ah horizons of the Orthic and Gleyed Dark Browns are commonly 12 to 15 cm in thickness, but often 25 to 30 cm or more under the denser aspen stands and in low sectors of humpy landscapes (9 to 30% slopes).

(5) In some areas of dense creeping juniper growth under aspen, a substantial L-H horizon occurs, about 5 to 8 cm thick and matted.

Limitations: Slight to severe-slight on suitable topography for buildings and road location; moderate on suitable topography for primitive camping areas, fully serviced campgrounds, picnic areas; severe for lawns and landscaping, paths, trails, septic tank absorption fields; very severe for trench type sanitary landfills; good source of roadfill on suitable topography; good source of sand; unsuitable as a source of gravel due to unsuitable textures. Other limitations include sandy surface textures, excessive slopes, rapid permeability (droughtiness), groundwater contamination hazard.

Map Unit 2

Classification: Orthic Regosol - 80%
Orthic Dark Brown Chernozem - 20%

Parent material: very coarse textured eolian and glaciofluvial sediments (sand).

Landform: undulating eolian (Eu), ridged eolian (Er), hummocky eolian (Eh); undulating glaciofluvial (F_G), hummocky glaciofluvial (Fh).

Slope: undulating to strongly rolling (>2 to 30%).

Surface Stoniness: nonstony (0)

Drainage: rapid

Vegetation: dominantly short grass and forbs including pasture sagewort, golden bean, mouse-ear chickweed, wild onion; numerous patches of creeping juniper, wolf willow, buckbrush, saskatoon-berry, choke cherry, wild rose; reindeer-moss; patches of sparse stunted aspen with an understory of saskatoon-berry, choke-

cherry, wild rose, pin cherry, common bearberry, grass;
some prickly pear cactus on dry south-facing slopes.

Profile description: Orthic Regosol

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl ₂	OM ¹ %
C1	50	sand	amorphous	loose, dry or moist	6.5	0.93
C2	45	sand	amorphous	loose, dry or moist	6.9	0.68
C3	5	loamy sand	amorphous	loose, dry or moist	7.0	nd ²

¹OM - organic matter, ²nd - not determined

Orthic Regosol

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl ₂	OM ¹ %
drift	4	sand (field texture)	amorphous	loose, dry or moist	nd ²	nd
Ah	5	sand	amorphous	loose, dry or moist	6.7	2.91
C1	80	sand	amorphous	loose, dry or moist	6.1	0.27
C2	15	sand	amorphous	loose, dry or moist	6.0	nd

¹OM - organic matter, ²nd - not determined

Comments: (1) Map Unit 2 soils are dominant in the vicinity surrounding Dillberry Lake. A large patch occurs east of Leane Lake; and smaller patches occur between Leane and Killarney Lakes, adjacent to the southern shore of Killarney Lake, and in the north central portion of the study area.

(2) Occasional random pockets of Map Unit 2 soils have Ah horizons at least 10 cm thick, and these soils are classified as Orthic Dark Brown Chernozems. They are described under Map Unit 1.

(3) Numerous blowouts occur, usually on very steep slopes. These are patches where the soil solum has been removed by wind action, exposing bare sand (C horizon) at the surface. These patches are devoid of vegetation.

(4) In some areas of dense creeping juniper growth under aspen, a substantial L-H horizon occurs, about 5 to 8 cm thick and matted.

Limitations: Slight to very severe-slight on suitable topography for buildings and road location; very severe for all other uses; good source of roadfill on suitable topography; good source of sand; unsuitable as a source of gravel due to unsuitable textures. Other limitations include sandy surface textures, wind erosion hazard, excessive slopes, rapid permeability (droughtiness), groundwater contamination hazard.

Map Unit 3

Classification: Gleyed Regosol

Parent material: very coarse textured lacustrine (beach sand).

Landform: level lacustrine (L1), undulating lacustrine (Lu), ridged lacustrine (Lr).

Slope: gently undulating to gently rolling (>0.5 to 9%).

Surface stoniness: nonstony to very stony (0 to 3)

Drainage: imperfect

Vegetation: mainly water birch, creeping juniper, and common bearberry; scattered willow, Canadian buffalo-berry, wild rose, wolf willow, wild gooseberry, aspen; some vetch, wild strawberry, horsetail; patches of sparse stunted balsam poplar and some saskatoon-berry; very sparse grass.

Profile description: Gleyed Regosol

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl2	OM ¹ %
Ccag1	24	sand	amorphous	loose, dry or moist	7.4	0.58
Ccag2	56	sand	amorphous	loose, dry or moist	7.6	0.43
Ccag3	20	sand	amorphous	loose, dry or moist	7.7	nd ²

¹OM - organic matter, ²nd - not determined

Comments: (1) These soils are found adjacent to Leane and Killarney Lakes.
 (2) Occasional gravelly pockets occur in Map Unit 3 soils.
 (3) Water table depths range from 75 to 120 cm below the surface.

Limitations: Moderate to very severe-moderate for picnic areas; very severe for trench type sanitary landfills; severe for all other uses; fair source of roadfill and sand; unsuitable as a source of gravel due to unsuitable textures. Other limitations include flooding hazard (overflow), seasonally high groundwater table, sandy surface texture, surface stoniness, high lime content (soil nutrient imbalance), lack of an Ah horizon, rapid permeability, groundwater contamination hazard.

Map Unit 4

Classification: Rego Gleysol
 Parent Material: very coarse textured lacustrine (beach sand).
 Landform: level lacustrine (L1)
 Slope: nearly level (0 to 0.5%)
 Surface stoniness: nonstony (0)

Drainage: Poor

Vegetation: sparse stunted willow and water birch; sedge, slough grass; some aspen, balsam poplar, Canadian buffalo-berry, buckbrush, wild rose.

Profile Description: Rego Gleysol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ccag	90	sand	amorphous	nonsticky, nonplastic, wet

Comments: (1) Soils of this map unit border the northeastern shore of Leane Lake, and small patches are found adjacent to two large ponds in the north central portion of the study area.
(2) The water table depth varies from 12 to 35 cm below the surface.

Limitations: Severe to very severe - very severe for buildings, septic tank absorption fields, trench type sanitary landfills, road location; severe for primitive camping areas, fully serviced campgrounds, picnic areas, lawns and landscaping, paths, trails; poor source of roadfill and sand; unsuitable as a source of gravel due to unsuitable textures. Other limitations include seasonally high groundwater table, flooding hazard (overflow), sandy surface texture, high lime content (soil nutrient imbalance), groundwater contamination hazard.

Map Unit 5

Classification: Orthic Gleysol, peaty phase.

Parent material: very coarse textured eolian sediments (sand).

Landform: level eolian (E1).

Slope: nearly level to gently undulating (0 to 2%)

Surface stoniness: nonstony (0)

Drainage: Poor

Vegetation: balsam poplar, aspen, willow, dogwood, wild rose; some water birch, grass, forbs, slough grass; occasional white birch, creeping juniper, common bearberry.

Profile description: Orthic Gleysol, peaty phase.

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Oh	25-40	predominantly humic peat		
Cg	90	sand	amorphous	loose, moist

Comments: (1) Small patches of these soils are found near Dillberry Lake on the western and northwestern sides, and near the eastern end of the long lake between Dillberry and Leane Lakes.

(2) The water table ranges from 30 to 75 cm below the surface.

Limitations: Severe to very severe-very severe for septic tank absorption fields and trench type sanitary landfills; severe for all other uses; poor source of roadfill and sand; unsuitable as a source of gravel due to unsuitable textures. Other limitations include seasonally high groundwater table or surface ponding, organic surface layer more than 15 cm thick, sandy surface texture, rapid permeability, groundwater contamination hazard.

Map Unit 6

Classification: Gleyed Dark Brown Chernozem and Gleyed Rego Dark Brown Chernozem (these two subgroups are intimately and unpredictably associated).

Parent material: very coarse textured eolian and glaciofluvial sediments (sand).

Landform: undulating glaciofluvial (^GFu), hummocky eolian (Eh).

Slope: undulating to gently rolling (>2 to 9%).

Surface stoniness: nonstony (0)

Drainage: imperfect

Vegetation: predominantly wooded areas - balsam poplar, aspen, willow, dogwood, wild rose, wild gooseberry, water birch, creeping juniper, grass; some grassland areas - grass, pasture sagewort, prairie sagewort, golden bean, common yarrow, mouse-ear chickweed, early blue violet, patches of buckbrush and wolf willow, occasional small patch of creeping juniper.

Profile description: Gleyed Dark Brown

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl ₂	OM ¹ %
Ah	30	sand	amorphous	loose, dry or moist	5.9	3.32
Bmg	25	sand	amorphous	loose, dry or moist	6.5	0.94
BCg	45	sand	amorphous	loose, dry or moist	7.3	0.25

¹OM - organic matter

Gleyed Rego Dark Brown

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
L-H	7-8	leaf litter (found under aspen)		
Ahg	20-25	sand	amorphous	loose, moist
Cg	75-80	sand	amorphous	loose, moist

Comments: (1) Patches of Map Unit 6 soils commonly occur adjacent to lakeshores, ponds, or sloughs throughout much of the study area.

(2) Water tables are occasionally found within 90 to 100 cm of the surface.

Limitations: moderate to very severe-moderate for primitive camping areas, fully serviced campgrounds, picnic areas, buildings without basements, road location; severe for lawns and landscaping, paths, trails, buildings with basements, septic tank absorption fields; very severe for trench type sanitary landfills; good source of roadfill and sand; unsuitable as a source of gravel due to unsuitable textures. Other limitations include sandy surface texture, seasonally high groundwater table, rapid permeability, groundwater contamination hazard.

Map Unit 7

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

Parent Material: very coarse textured eolian and glaciofluvial sediments (sand).

Landform: level eolian (E1), level glaciofluvial (F1).^G

Slope: nearly level (0 to 0.5%)

Surface stoniness: nonstony (0)

Drainage: poor

Vegetation: open areas - slough grass; wooded areas - aspen, dogwood, wild rose, willow, water birch.

Profile description: Rego Gleysol and Rego Humic Gleysol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Oh	0-10	humic peat (occurs under trees)		
Ahkg	0-30	sandy loam	amorphous to weak granular	very friable, moist
Ccag1	30-40	loam to sandy loam	amorphous	very friable, moist
Ccag2	30-70	sand	amorphous	loose, moist

- Comments: (1) Only three small patches of these soils were found near the northwestern shore of Dillberry Lake.
(2) The Ah horizon is intermittent.
(3) A water table occurs 60-90 cm below the surface.
- Limitations: severe to very severe-very severe for septic tank absorption fields and trench type sanitary landfills; severe for all other uses; poor source of roadfill and sand; unsuitable as a source of gravel due to unsuitable textures. Other limitations include seasonally high groundwater table or surface ponding, high lime content (soil nutrient imbalance), thin or no Ah horizon, rapid permeability, groundwater contamination hazard.

Map Unit 8

- Classification: Orthic Dark Brown Chernozem
- Parent Material: very coarse textured glaciofluvial sediments (sand) overlying medium to moderately fine textured till - 70%.
Medium to moderately fine textured till - 30%.
- Landform: combination of glaciofluvial veneer overlying undulating morainal, and undulating morainal ($\frac{Fv}{G} - Mu$); combination of glaciofluvial veneer overlying hummocky morainal, and hummocky morainal ($\frac{Fv}{G} - Mh$); combination of glaciofluvial veneer overlying inclined morainal, and inclined morainal ($\frac{Fv}{Mi} - Mi$).
- Slope: undulating, and strongly rolling to hilly (>2 to 5%, and >15 to 60%).
- Surface stoniness: nonstony to moderately stony (0 to 2).
- Drainage: well drained.
- Vegetation: grass, pasture sagewort, prairie crocus, golden bean, common yarrow, early yellow loco-weed, three-flowered avens, mouse-ear chickweed, pale comandra; numerous patches of wolf willow and buckbrush; some wild rose, saskatoon-berry, choke cherry; some patches of creeping juniper; some aspen clumps.

Profile description: Orthic Dark Brown on sand overlying till.

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl2	OM ¹ %
Ah	13	fine sandy loam	granular	very friable, moist	5.4	6.10
Bm1	19	sand	amorphous	loose, dry or moist	5.6	0.87
11Bm2	10	loam	prismatic, breaking to subangular blocky	friable, moist	7.2	1.33
11Cca	58	loam to clay loam	amorphous, breaking to subangular blocky	friable, moist	7.8	nd ²

¹OM - organic matter, ²nd - not determined

Orthic Dark Brown on till

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ah	10-16	loam	granular	very friable, moist
Bm1	20	loam	prismatic, breaking to subangular blocky	very friable, moist
Bm2	0-50	sandy loam	prismatic, breaking to subangular blocky	very friable, moist
Cca	14-70	clay loam	amorphous	friable to firm, moist

Comments:

- (1) Only a few small patches of Map Unit 8 soils are found, in the northern and northwestern portions of the study area.
- (2) Thin overlays of sand occur generally over these soil areas, except for the crests of knolls and highs.
- (3) The till often contains sand pockets.

Limitations: slight to moderate-moderate on suitable topography for buildings with basements, septic tank absorption fields, trench type sanitary landfills, road location; slight on suitable topography for all other uses; fair source of roadfill on suitable topography; very poor source of sand because of thin deposits; unsuitable as a source of gravel due to unsuitable textures. Other limitations include excessive slopes, surface stoniness, susceptibility to frost heave, high clay content of subsoil, slow permeability, moderate shrink-swell potential.

Map Unit 9

Classification: Orthic Dark Brown Chernozem.

Parent material: very coarse textured glaciofluvial sediments (gravel - 70%, sand - 30%).

Landform: undulating glaciofluvial (Fu)^G, hummocky glaciofluvial (Fh)^G, inclined glaciofluvial (Fi)^G.

Slope: undulating to hilly (>2 to 60%).

Surface stoniness: nonstony to moderately stony (0 to 2).

Drainage: rapid

Vegetation: grass, pasture sagewort, golden bean, prairie crocus, three-flowered avens, mouse-ear chickweed, moss phlox, early yellow loco-weed; patches of wolf willow and buck-brush; some wild rose; occasional patch of aspen.

Profile description: Orthic Dark Brown on gravel

Horizon	Thickness (cm)	Lab Texture	Structure	Consistence	pH CaCl2	OM ¹ %
Ah	16	sandy loam to loamy sand	granular	slightly hard, dry	5.3	4.83
Bm1	10	loamy sand	prismatic, breaking to subangular blocky	soft, dry	5.2	2.21

Bm2	24	gravel	amorphous	loose, dry or moist	nd ²	nd
BC	20	gravel	amorphous	loose, dry or moist	nd	nd
Cca	30	gravel	amorphous	loose, dry or moist	nd	nd

¹OM - organic matter, ²nd - not determined

Orthic Dark Brown on sand

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ah	12-15	sand	amorphous	loose, dry or moist
AB	0-20	sand	amorphous	loose, dry or moist
Bm	50-75	sand	amorphous	loose, dry or moist
BC	10-40	sand	amorphous	loose, dry or moist

Comments:

- (1) These soils occur in the extreme northwestern portions of the study area, as well as east and south of Killarney Lake.
- (2) The depth to gravel below the soil surface is highly variable, ranging from a few centimeters to more than 120 cm. Surface outcrops occur on the crests of some knolls and these are very stony to exceedingly stony (stony 3 to 4).

Limitations:

slight to very severe-slight on suitable topography for buildings and road location ; moderate on suitable topography for primitive camping areas, fully serviced campgrounds, picnic areas, paths, and trails; severe for lawns and landscaping, septic tank absorption fields; very severe for trench type sanitary landfills; good source of roadfill on suitable topography; good source of sand or gravel. Specific limitations include sandy surface texture, excessive slopes, surface stoniness,

rapid permeability (droughtiness), groundwater contamination hazard, unsuitable texture (for trench type sanitary landfills).

Map Unit 10

Classification: Rego Gleysol.

Parent material: moderately fine to fine textured lacustrine.

Landform: level lacustrine (L1)

Slope: nearly level (0 to 0.5%)

Surface stoniness: nonstony (0)

Drainage: poor

Vegetation: slough grass

Profile description: Rego Gleysol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ccag	100	clay loam to silty clay	amorphous	firm to very firm, moist; hard, dry

Comments: (1) Only two very small patches of Map Unit 10 soils were found; one between Leane and Killarney Lakes, and one south of Killarney Lake.
(2) These depressions contain water during early spring, but they are so small that the water is quickly lost by evaporation.

Limitations: severe to very severe-very severe for septic tank absorption fields and trench type sanitary landfills; severe for all other uses; poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include seasonally high groundwater table or surface ponding, high clay content,

slow permeability, slippery or sticky when wet, high lime content (soil nutrient imbalance), lack of Ah horizon, high shrink-swell potential, susceptibility to frost heave, groundwater contamination hazard.

Map Unit 11

Classification: Gleyed Regosol
Parent Material: moderately fine textured till.
Landform: inclined morainal (Mi).
Slope: gently sloping (>2 to 5%).
Surface stoniness: excessively stony (5).
Drainage: imperfect
Vegetation: aspen, saskatoon-berry, choke cherry, willow, Canadian buffalo-berry, dogwood, buckbrush, forbs.
Profile description: Gleyed Regosol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Ccag	100	clay loam	amorphous	very firm, moist

Comments: These soils are adjacent to the eastern shoreline of Killarney Lake.

Limitations: very severe for all uses; very poor source of roadfill; unsuitable as a source of sand or gravel due to unsuitable textures. Other limitations include surface stoniness, seasonally high groundwater table, flooding hazard (overflow), slippery or sticky when wet, high lime content (soil nutrient imbalance), groundwater contamination hazard, high shrink-swell potential, susceptibility to frost heave.

TH (Organic soil)

Classification: Terric Humisol

Parent material: predominantly humic peat overlying sand.

Landform: horizontal fen (Nh)

Slope: nearly level (0 to 0.5%)

Surface stoniness: nonstony (0).

Drainage: very poor.

Vegetation: balsam poplar, aspen, willow, dogwood; some wild red raspberry, wild currant, wild gooseberry, wild rose, grass, slough grass, water birch; occasional white birch; also some depressional patches with slough grass in the centre and willow around the fringe.

Profile description: Terric Humisol

Horizon	Thickness (cm)	Field Texture	Structure	Consistence
Oh	60-75	predominantly humic peat.		
Cg	60	sand	amorphous	loose, moist

Comments:

- (1) Small patches of these soils occur adjacent to lakes and sloughs in the northeastern portion of the study area.
- (2) A water table commonly occurs at the soil surface, or only a few centimeters below the surface.

Limitations: very severe for all uses; very poor source of roadfill and sand; unsuitable as a source of gravel due to unsuitable textures. Other limitations include organic soil, seasonally high groundwater table, flooding hazard (overflow), lack of Ah horizon, high shrink-swell potential, rapid permeability, 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 that midpoint.

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

The study area is situated in the Dark Brown soil zone and most of the soils are classified as Dark Brown Chernozemic, which are zonally normal. Exceptions are the Regosolic soils, which are azonal; and the Gleysolic and Organic soils, which are intrazonal. Regosolic and Gleysolic soils occur across all the soil zones, and Organic soils occur in most. Soils of the study area can be considered typical, both locally and regionally (Wyatt et al, 1944).

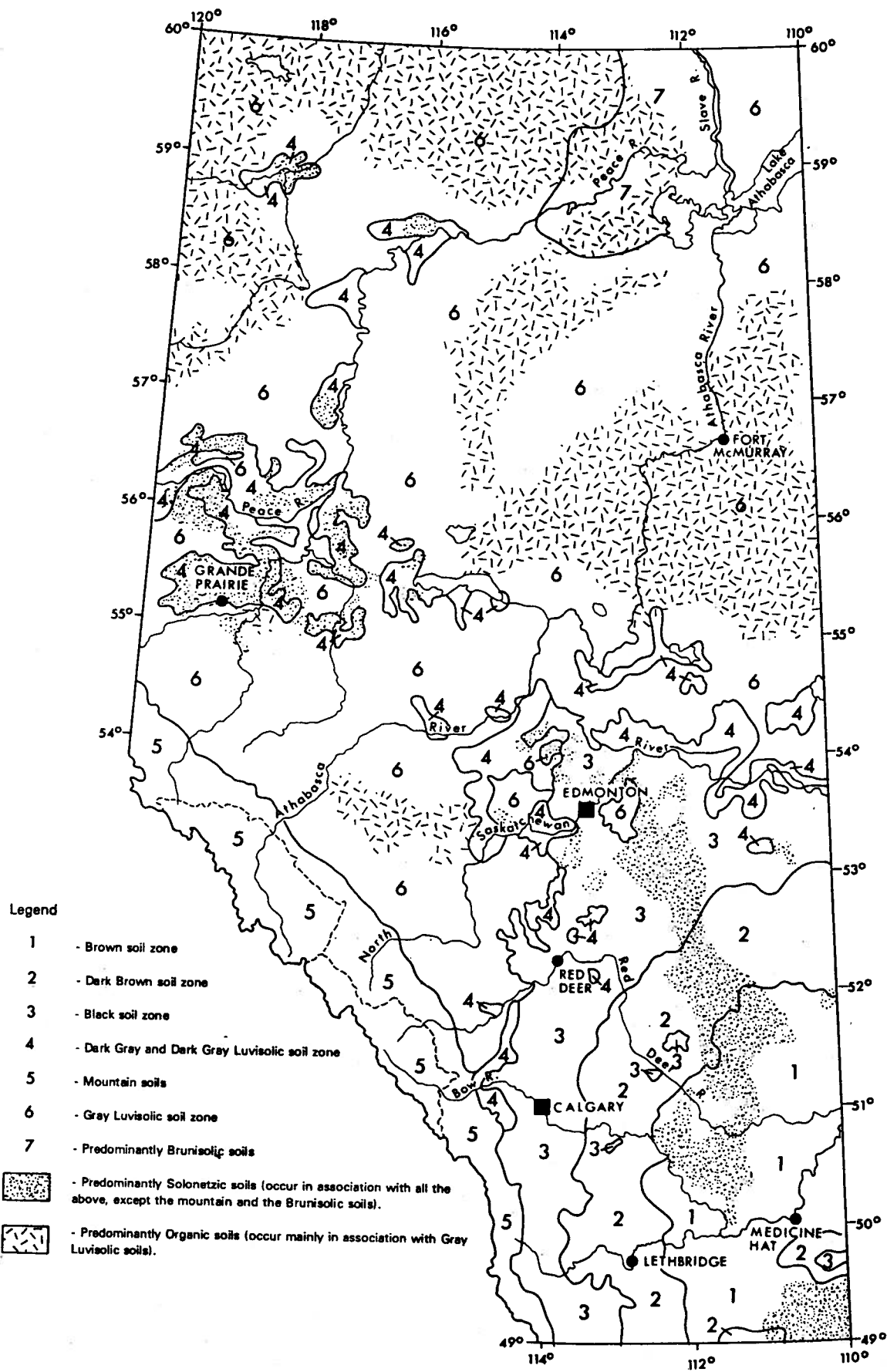


Figure 2. Map showing soil zones of Alberta (from Soil Group Map of Alberta, Alberta Institute of Pedology).


Special features of soils in the study area relate to their very coarse textures, and consequential very low moisture holding capacities. Firstly, they are rapidly drained, and droughty in nature. Secondly they have loose consistence, rendering them prone to rapid deterioration under human foot traffic. The Regosols, prominent around Dillberry Lake, are especially fragile because they have thin or no Ah horizons. Thus surface horizons are very low in soil organic matter, an important soil-binding agent.

MISCELLANEOUS SYMBOLS

BP This symbol indicates a borrow pit.

Bo This symbol indicates sand blowouts where the soil solum has been removed by wind action, exposing bare sand (C horizon) at the surface. These patches usually occur on very steep slopes, are devoid of vegetation, and are highly susceptible to further wind erosion.

GP This symbol indicates a gravel pit.

 This symbol indicates water filled depressions. They are often characterized by extensive stands of emergent hydrophytic vegetation such as cattails, rushes, and sedge.

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.

Soil erodibility ratings (K values) and predicted water erosion hazards of selected map units are presented in Tables 4 and 5. As well as surface horizons, values have been worked out for soil parent materials, because they may be exposed during construction activities.

The soils most favourable for recreational development in the study area are those of Map Unit 8 when found on suitable topography. Only one small pocket occurs on suitable topography in the northwestern portion along Highway 17. Soils which have only moderate limitations when found on suitable topography are those of Map Units 1, 6, and 9. Map Unit 1 soils are widespread throughout most of the study area. The dominant soils surrounding Dillberry Lake are those of Map Unit 2, which have very severe limitations due to sandy surface

Table 2. Chemical and Physical Analyses of Selected Map Units.

Map Unit	Horizon	Depth cm	pH CaCl ₂	Exchangeable cations ¹ meq/100 gm soil				² CEC meq/100 gm	³ OC %	CaCO ₃ equiv %	Mech Analysis % from frac<2mm diam			⁴ % VFS	⁵ % CF	Texture	
				Na+	K+	Ca++	Mg++				sand	silt	clay			Lab det	Field est
1	L-H	5-0	6.3	⁶ nd	nd	nd	nd	nd	18.4	nd	nd	nd	nd	nd	0	nd	nd
	Ah	0-30	5.6	0.03	0.26	3.97	0.77	5.4	0.55	nd	91	9	0	10	0	S	S
	Bm	30-90	5.9	0.02	0.25	2.81	0.72	3.6	0.17	nd	94	6	0	10	0	S	S
	BC	90-100	6.0	0	0.21	2.88	0.77	3.7	nd	nd	94	6	0	6	0	S	S
1	Ah	0-40	6.2	0.01	0.21	4.88	1.13	6.7	1.18	nd	86	7	7	10	0	LS	S
	Bm	40-80	6.2	0.04	0.17	3.41	1.08	2.4	0.26	nd	88	7	5	10	0	S	S
	BC	80-100	6.8	nd	nd	nd	nd	nd	nd	0.1	92	5	3	6	0	S	S
1	Ah	0-20	5.7	0.06	0.28	2.88	0.82	4.2	1.03	nd	94	6	0	3	0	S	S
	Bmg	20-35	5.5	0.02	0.18	1.63	0.46	2.5	0.19	nd	94	4	2	4	0	S	S
	BCg	35-100	5.4	nd	nd	nd	nd	nd	nd	0.1	97	1	2	3	0	S	S
2	C1	0-50	6.5	0.04	0.24	4.28	0.87	5.0	0.55	nd	89	11	0	11	0	S	S
	C2	50-95	6.9	0.03	0.14	3.66	0.77	4.2	0.40	nd	89	9	2	12	0	S	S
	C3	95-100	7.0	nd	nd	nd	nd	nd	nd	0.2	88	6	6	10	0	LS	S
2	drift	4-0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0	nd	S
	Ah	0-5	6.7	0.03	0.20	7.03	1.23	7.0	1.71	nd	94	6	0	2	0	S	S
	C1	5-85	6.1	0.01	0.10	1.38	0.31	1.9	0.16	nd	98	2	0	1	0	S	S
	C2	85-100	6.0	nd	nd	nd	nd	nd	nd	0.1	98	2	0	1	0	S	S

¹meq - milliequivalents, ²CEC - cation exchange capacity, ³OC - organic carbon, ⁴VFS - very fine sand,
⁵CF - coarse fragments (< 2 mm diam) (field estimate), ⁶nd - not determined

Table 2. Chemical and Physical Analyses of Selected Map Units.

Map Unit	Horizon	Depth cm	pH CaCl ₂	Exchangeable cations ¹ meq/100 gm soil				² CEC meq/100 gm	³ OC %	CaCO ₃ equiv %	Mech Analysis % from frac<2mm diam			⁴ % VFS	⁵ % CF	Texture	
				Na+	K+	Ca++	Mg++				sand	silt	clay			Lab det	Field est
3	Ccag1	0-24	7.4	⁶ nd	nd	nd	nd	nd	0.34	3.9	98	2	0	3	0	S	S
	Ccag2	24-80	7.6	nd	nd	nd	nd	nd	0.25	1.2	99	1	0	0	0	S	S
	Ccag3	80-100	7.7	nd	nd	nd	nd	nd	nd	0.8	98	2	0	0	0	S	S
6	Ah	0-30	5.9	0.02	0.59	7.72	1.38	9.8	1.95	nd	94	5	1	3	0	S	LS
	Bmg	30-55	6.5	0.07	0.16	4.38	0.67	4.6	0.55	nd	88	12	0	2	0	S	S
	BCg	55-100	7.3	nd	nd	nd	nd	nd	0.15	0.1	96	4	0	3	0	S	S
8	Ah	0-13	5.4	0.03	0.57	9.56	3.28	16.1	3.59	nd	70	17	13	9	0	FSL	FSL
	Bm1	13-32	5.6	0.03	0.13	3.75	1.69	6.4	0.51	nd	88	7	5	12	0	S	LS
	11Bm2	32-42	7.2	0.10	0.30	22.8	10.0	19.9	0.78	4.2	38	36	26	nd	20	L	^{7gv} CL
	11Cca	42-100	7.8	nd	nd	nd	nd	nd	nd	12.7	37	36	27	nd	30	L-CL	^{9v} CL
9	Ah	0-16	5.3	0.04	0.91	8.84	1.74	13.8	2.84	nd	74	22	4	6	5	SL-LS	L
	Bm1	16-26	5.2	0.03	0.15	4.72	1.13	7.7	1.30	0.2	77	17	6	10	10	LS	LS

¹meq - milliequivalents, ²CEC = cation exchange capacity, ³OC - organic carbon, ⁴VFS - very fine sand
⁵CF - coarse fragments (<2 mm diam) (field estimate), ⁶nd - not determined ^{7gv} - gravelly

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								AASHTO	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.							
8	90-120	6	100	100	100	99	99	95	69	62	38	34	31	33	14	18	105.0	A-6(9)	CL	CL
						</														

(1) Map Units developed on similar parent material: 8 and 11

(2) These values are obtained from charts worked out by the Highways Testing Laboratory, Alberta Transportation.

Table 4. Soil Erodibility Ratings (K-values) of Selected Map Units

Map Unit	Horizon	K-value(1)	Map Unit	Horizon	K-value(1)
(2) 1	(3) Ah Bm	0.17 0.16	3	Ccag1 Ccag2	0.05 0.03
1	Ah Bm	0.12 0.16	6	Ah BCg	0.05 0.06
1	Ah BCg	0.07 0.05	8	Ah (4) 11Cca	0.15 0.28
(5) 2	C1 C2	0.19 0.20	9	Ah Bm1	0.11 0.19
2	Ah C1	0.05 0.04			

- (1) The K-values were determined from data provided in this report using the soil erodibility nomograph presented in Figure 5 of Greenlee (1981).
- (2) Map Unit 1 soils were sampled at three different sites. The soils were classified as Orthic Dark Brown Chernozems at the first two, and as a Gleyed Dark Brown at the third. These three profiles correspond to the same three respectively that are documented in Table 2 (Chemical and Physical Analyses of Selected Map Units).
- (3) Where the percent organic matter was more than four, it was taken as four for the purposes of the nomograph; and where it was not determined, it was assumed to be zero.
- (4) Where the percent VFS was not determined, it was assumed to be zero.
- (5) Map Unit 2 soils were sampled at two different sites, and the soils were classified as Orthic Regosols at both. These two profiles correspond to the same two respectively that are documented in Table 2.

Table 5. Predicted Water Erosion Hazards of Selected Map Units

Map Unit	Horizon	Erosion risk (1)	Map Unit	Horizon	Erosion risk (1)
(2) $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	Ah Bm Ah Bm Ah Bm	L L L-M L-M M M	$\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$	Ah Cl	L L
			$\frac{3}{bo}$ $\frac{3}{b3}$ $\frac{3}{co}$ $\frac{3}{do}$	Ccag1 Ccag2	L L
			$\frac{6}{co}$ $\frac{6}{do}$	Ah BCg	L L
$\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	Ah Bm Ah Bm Ah Bm	L L L L-M L-M M	$\frac{8}{co}$ $\frac{8}{fo}$ $\frac{8}{f1}$ $\frac{8}{go}$ $\frac{8}{g2}$	Ah IICca Ah IICca Ah IICca	L L L M L-M M-H
$\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	Ah BCg Ah BCg	L L L-M L	$\frac{9}{co}$ $\frac{9}{do}$ $\frac{9}{fo}$ $\frac{9}{f1}$ $\frac{9}{f2}$ $\frac{9}{go}$	Ah Bm1 Ah Bm1 Ah Bm1	L L L L-M L-M M
(3) $\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$	C1 C2 C1 C2	L L L-M L-M			

- (1) L = Low erosion risk, M = Moderate erosion risk, H = High erosion risk. These ratings were derived by applying the K-values from Table 4 to the graph presented in Figure 6 of Greenlee (1981).
- (2) Map Unit 1 soils were sampled at three different sites. The soils were classified as Orthic Dark Brown Chernozems at the first two, and as a Gleyed Dark Brown at the third. These three profiles correspond to the same three respectively that are documented in Table 2 (Chemical and Physical Analyses of Selected Map Units).
- (3) Map Unit 2 soils were sampled at two different sites, and the soils were classified as Orthic Regosols at both. These two profiles correspond to the same two respectively that are documented in Table 2.

textures and wind erosion hazards. Soils of other map units have severe limitations due to various factors including flooding hazard (overflow), seasonally high groundwater tables or surface ponding, sandy surface textures, surface stoniness, organic surface layer more than 15 cm thick, slow permeability, slippery or sticky when wet, and organic soils.

Soils of Map Units 1, 2 and 9; which collectively cover the majority of the mapped area; are all well suited to road construction. Map Unit 6 soils have moderate limitations due to seasonally high groundwater tables, and Map Unit 8 soils have moderate limitations due to moderate shrink-swell potentials and susceptibility to frost heave. Other soils have severe to very severe limitations because of seasonally high groundwater tables or surface ponding, flooding hazard (overflow), surface stoniness, high shrink-swell potential, susceptibility to frost heave, and organic soils.

Map Units 1, 2 and 6 soils; together which also cover most of the mapped area; constitute good sources of sand. Map Unit 9 soils, which occur in the extreme northwestern portions and near Killarney Lake, comprise a good source of gravel. Other soils are poor to very poor sources because of seasonally high groundwater tables or surface ponding, flooding hazard (overflow), and thin deposits of sand. Some soils are unsuitable due to unsuitable textures.

Specific limitations and suitabilities of the various soils for selected uses are shown in tables 6 to 18 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.

Limitations due to slope are not further subdivided once the slope becomes steep enough to cause a very severe limitation for a specified use. It follows, however, that the steeper the slope, the more severe the limitation, and this fact should be kept in mind while using the soil interpretation tables. In tables 6 to 16 inclusive, the soil limitations for various uses have been designated as none to slight, moderate, severe, and very severe. In tables 17 and 18, 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 6. Soil Limitations for Primitive Camping Areas

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	M - Sandy	$\frac{8}{co}$	SL		
		$\frac{8}{fo}$ $\frac{8}{fl}$	M - Slope		
	M - Slope, Sandy	$\frac{8}{go}$	S - Slope		
	S - Slope, Sandy	$\frac{8}{g2}$	S - Slope, Stony		
⁴ $\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$ $\frac{3}{bo}$ $\frac{3}{co}$ $\frac{3}{do}$ $\frac{3}{b3}$ $\frac{4}{ao}$ $\frac{5}{ao}$ $\frac{5}{bo}$ $\frac{6}{co}$ $\frac{6}{do}$ $\frac{7}{ao}$	VS - Sandy, Er	$\frac{9}{co}$ $\frac{9}{do}$	M - Sandy		
	VS - Sandy, Er M - Slope	$\frac{9}{fo}$ $\frac{9}{fl}$	M - Slope, Sandy		
	S - Flood, Wet, Sandy	$\frac{9}{f2}$	M - Slope, Sandy, Stony		
	S - Flood, Stony, Wet	$\frac{9}{go}$	S - Slope, Sandy		
	S - Wet, Flood, Sandy	$\frac{10}{ao}$	S - Wet, Sl Perm, Slip		
	S - Wet, Org Surf, Sandy	$\frac{11}{c5}$	VS - Stony, Wet, Slip		
	M - Sandy, Wet	$\frac{TH}{ao}$	VS - Org, Wet, Flood		
	S - Wet				

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 Dark Browns. The Gleyed Dark Browns and Orthic Regosols are rated under Map Units 6 and 2 respectively.

4 - These ratings are for the Orthic Regosols. The Orthic Dark Browns are rated under Map Unit 1.

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 ground-water table or surface ponding

Table 7. Soil Limitations for Fully Serviced Campgrounds

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	M - Sandy	$\frac{6}{co}$ $\frac{6}{do}$	M - Sandy, Wet	$\frac{11}{cs}$	VS - Stony, Wet, Slip
	M - Slope, Sandy	$\frac{7}{ao}$	S - Wet	$\frac{TH}{ao}$	VS - Org, Wet, Flood
	S - Slope, Sandy	$\frac{8}{co}$	SL		
	VS - Slope, Sandy	$\frac{8}{fo}$ $\frac{8}{fl}$	S - Slope		
⁴ $\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$	VS - Sandy, Er	$\frac{8}{go}$	VS - Slope		
	VS - Sandy, Er M - Slope	$\frac{8}{g2}$	VS - Slope, Stony		
	VS - Sandy, Er S - Slope	$\frac{9}{co}$ $\frac{9}{do}$	M - Sandy		
	S - Flood, Wet, Sandy	$\frac{9}{fo}$ $\frac{9}{fl}$	S - Slope, Sandy		
$\frac{3}{bo}$ $\frac{3}{co}$ $\frac{3}{do}$ $\frac{3}{b3}$	S - Flood, Stony, Wet	$\frac{9}{f2}$	S - Slope, Sandy, Stony		
$\frac{4}{ao}$	S - Wet, Flood, Sandy	$\frac{9}{go}$	VS - Slope, Sandy		
$\frac{5}{ao}$ $\frac{5}{bo}$	S - Wet, Org Surf, Sandy	$\frac{10}{ao}$	S - Wet, Sl Perm, Slip		

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 Dark Browns. The Gleyed Dark Browns and Orthic Regosols are rated under Map Units 6 and 2 respectively.

4 - These ratings are for the Orthic Regosols. The Orthic Dark Browns are rated under Map Unit 1.

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 8. Soil Limitations for Picnic Areas

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	M - Sandy	$\frac{6}{co}$ $\frac{6}{do}$	M - Sandy, Wet		
	M - Slope, Sandy	$\frac{7}{ao}$	S - Wet		
	S - Slope, Sandy	$\frac{8}{co}$	SL		
	VS - Slope, Sandy	$\frac{8}{fo}$ $\frac{8}{f1}$	S - Slope		
⁴ $\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$ $\frac{3}{bo}$ $\frac{3}{co}$ $\frac{3}{do}$ $\frac{3}{b3}$ $\frac{4}{ao}$ $\frac{5}{ao}$ $\frac{5}{bo}$	VS - Sandy, Er	$\frac{8}{go}$ $\frac{8}{g2}$	VS - Slope		
	VS - Sandy, Er M - Slope	$\frac{9}{co}$ $\frac{9}{do}$	M - Sandy		
	VS - Sandy, Er S - Slope	$\frac{9}{fo}$ $\frac{9}{f1}$ $\frac{9}{f2}$	S - Slope, Sandy		
	M - Sandy, Flood, Wet	$\frac{9}{go}$	VS - Slope, Sandy		
	M - Sandy, Stony, Flood	$\frac{10}{ao}$	S - Wet, Sl Perm, Slip		
	S - Wet, Sandy, Flood	$\frac{11}{c5}$	VS - Stony, Wet, Slip		
	S - Wet, Org Surf, Sandy	$\frac{TH}{ao}$	VS - Org, 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 Dark Browns. The Gleyed Dark Browns and Orthic Regosols are rated under Map Units 6 and 2 respectively.

4 - These ratings are for the Orthic Regosols. The Orthic Dark Browns are rated under Map Unit 1.

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

Sl Perm - Slow permeability

Solz - Solonetzic soil

Stony - Surface stoniness

Wet - Seasonally high groundwater table or surface ponding

Table 9. Soil Limitations for Lawns and Landscaping

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	S - Sandy, R Perm	$\frac{6}{co}$ $\frac{6}{do}$	S - Sandy, Wet	$\frac{TH}{ao}$	VS - Wet, Org, Thin Ah
	S - Sandy, R Perm M - Slope	$\frac{7}{ao}$	S - Wet, Lime, Thin Ah		
	S - Slope, Sandy R Perm	$\frac{8}{co}$	SL		
	VS - Slope, Sandy, R Perm	$\frac{8}{fo}$ $\frac{8}{fl}$	S - Slope		
⁴ $\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$	VS - Sandy, Er, R Perm	$\frac{8}{go}$	VS - Slope		
	VS - Sandy, Er, R Perm M - Slope	$\frac{8}{g2}$	VS - Slope, Stony		
	VS - Sandy, Er, R Perm S - Slope	$\frac{9}{co}$ $\frac{9}{do}$	S - R Perm, Sandy		
$\frac{3}{bo}$ $\frac{3}{b3}$ $\frac{3}{co}$ $\frac{3}{do}$	S - Sandy, Lime, Thin Ah	$\frac{9}{fo}$ $\frac{9}{fl}$ $\frac{9}{f2}$	S - Slope, R Perm, Sandy		
		$\frac{9}{go}$	VS - Slope, R Perm, Sandy		
$\frac{4}{ao}$	S - Wet, Sandy, Lime	$\frac{10}{ao}$	S - Wet, Lime, Thin Ah		
$\frac{5}{ao}$ $\frac{5}{bo}$	S - Wet, Org Surf, Sandy	$\frac{11}{c5}$	VS - Stony, Wet, Lime		

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 Dark Browns. The Gleyed Dark Browns and Orthic Regosols are rated under Map Units 6 and 2 respectively.

4 - These ratings are for the Orthic Regosols. The Orthic Dark Browns are rated under Map Unit 1.

Abbreviations

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)
 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

Table 10. Soil Limitations for Paths

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$	S - Sandy	$\frac{6}{co}$ $\frac{6}{do}$	S - Sandy, Wet	$\frac{11}{c5}$	VS - Stony, Wet, Slip
$\frac{1}{eo}$	S - Sandy M - Slope	$\frac{7}{ao}$	S - Wet	$\frac{TH}{ao}$	VS - Org, Wet, Flood
$\frac{1}{fo}$	S - Slope, Sandy	$\frac{8}{co}$	SL		
$\frac{1}{go}$	VS - Slope, Sandy	$\frac{8}{fo}$ $\frac{8}{f1}$	S - Slope		
⁴ $\frac{2}{co}$ $\frac{2}{do}$	VS - Sandy, Er	$\frac{8}{go}$	VS - Slope		
$\frac{2}{eo}$	VS - Sandy, Er M - Slope	$\frac{8}{g2}$	VS - Slope, Stony		
$\frac{2}{fo}$	VS - Sandy, Er S - Slope	$\frac{9}{co}$ $\frac{9}{do}$	M - Sandy		
$\frac{3}{bo}$ $\frac{3}{co}$ $\frac{3}{do}$	S - Sandy, Flood, Wet	$\frac{9}{fo}$ $\frac{9}{f1}$	S - Slope, Sandy		
$\frac{3}{b3}$	S - Sandy, Stony, Flood	$\frac{9}{f2}$	S - Slope, Sandy, Stony		
$\frac{4}{ao}$	S - Wet, Sandy, Flood	$\frac{9}{go}$	VS - Slope, Sandy		
$\frac{5}{ao}$ $\frac{5}{bo}$	S - Wet, Org Surf, Sandy	$\frac{10}{ao}$	S - Wet, Slip, Clay		

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 Dark Browns. The Gleyed Dark Browns and Orthic Regosols are rated under Map Units 6 and 2 respectively.

4 - These ratings are for the Orthic Regosols. The Orthic Dark Browns are rated under Map Unit 1.

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 ground-water table or surface ponding

Table 11. Soil Limitations for Trails

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	S - Sandy	$\frac{7}{ao}$	S - Wet		
		$\frac{8}{co}$	SL		
	S - Sandy M - Slope	$\frac{8}{fo}$ $\frac{8}{f1}$	M - Slope		
	S - Slope, Sandy	$\frac{8}{go}$ $\frac{8}{g2}$	S - Slope		
⁴ $\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$	VS - Sandy, Er	$\frac{9}{co}$ $\frac{9}{do}$	M - Sandy		
	VS - Sandy, Er M - Slope	$\frac{9}{fo}$ $\frac{9}{f1}$ $\frac{9}{f2}$	M - Slope, Sandy		
$\frac{3}{bo}$ $\frac{3}{co}$ $\frac{3}{do}$ $\frac{3}{b3}$	S - Sandy, Flood, Wet	$\frac{9}{go}$	S - Slope, Sandy		
	S - Sandy, Flood, Stony	$\frac{10}{ao}$	S - Wet, Slip, Clay		
$\frac{4}{ao}$	S - Wet, Sandy, Flood	$\frac{11}{c5}$	VS - Stony, Wet, Slip		
$\frac{5}{ao}$ $\frac{5}{bo}$	S - Wet, Org Surf, Sandy	$\frac{TH}{ao}$	VS - Org, Wet, Flood		
$\frac{6}{co}$ $\frac{6}{do}$	S - Sandy, Wet				

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 Dark Browns. The Gleyed Dark Browns and Orthic Regosols are rated under Map Units 6 and 2 respectively.

4 - These ratings are for the Orthic Regosols. The Orthic Dark Browns are rated under Map Unit 1.

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 12. Soil Limitations for Buildings with Basements

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	SL	$\frac{6}{co}$ $\frac{6}{do}$	S - Wet	$\frac{11}{C5}$	VS - Stony, Wet, Flood
	M - Slope	$\frac{7}{ao}$	S - Wet	$\frac{TH}{ao}$	VS - Wet, Org, Sh-Sw
	S - Slope	$\frac{8}{co}$	M - Frost		
	VS - Slope	$\frac{8}{fo}$ $\frac{8}{f1}$	S - Slope, Frost		
$\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$	SL	$\frac{8}{go}$	VS - Slope, Frost		
	M - Slope	$\frac{8}{g2}$	VS - Slope, Frost, Stony		
	S - Slope	$\frac{9}{co}$ $\frac{9}{do}$	SL		
$\frac{3}{bo}$ $\frac{3}{co}$ $\frac{3}{do}$ $\frac{3}{b3}$	S - Wet, Flood	$\frac{9}{fo}$ $\frac{9}{f1}$	S - Slope		
	S - Wet, Flood, Stony	$\frac{9}{f2}$	S - Slope, Stony		
$\frac{4}{ao}$	VS - Flood, Wet	$\frac{9}{go}$	VS - Slope		
$\frac{5}{ao}$ $\frac{5}{bo}$	S - Wet	$\frac{10}{ao}$	S - Wet, 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 Dark Browns and Orthic Regosols. The Gleyed Dark Browns are rated under Map Unit 6.

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 ground-water table or surface ponding

Table 13. Soil Limitations for Buildings Without Basements

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$	SL	$\frac{6}{co}$ $\frac{6}{do}$	M - Wet	$\frac{11}{c5}$	VS - Stony, Flood, Wet
$\frac{1}{eo}$	M - Slope	$\frac{7}{ao}$	S - Wet	$\frac{TH}{ao}$	VS - Wet, Org, Flood
$\frac{1}{fo}$	S - Slope	$\frac{8}{co}$	SL		
$\frac{1}{go}$	VS - Slope	$\frac{8}{fo}$ $\frac{8}{f1}$	S - Slope		
$\frac{2}{co}$ $\frac{2}{do}$	SL	$\frac{8}{go}$	VS - Slope		
$\frac{2}{eo}$	M - Slope	$\frac{8}{g2}$	VS - Slope, Stony		
$\frac{2}{fo}$	S - Slope	$\frac{9}{co}$ $\frac{9}{do}$	SL		
$\frac{3}{bo}$ $\frac{3}{co}$ $\frac{3}{do}$	S - Flood, Wet	$\frac{9}{fo}$ $\frac{9}{f1}$	S - Slope		
$\frac{3}{b3}$	S - Flood, Wet, Stony	$\frac{9}{f2}$	S - Slope, Stony		
$\frac{4}{ao}$	VS - Flood, Wet	$\frac{9}{go}$	VS - Slope		
$\frac{5}{ao}$ $\frac{5}{bo}$	S - Wet	$\frac{10}{ao}$	S - Wet		

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 Dark Browns and Orthic Regosols. The Gleyed Dark Browns are rated under Map Unit 6.

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 14. Soil Limitations for Septic Tank Absorption Fields

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$	S - R Perm, GW	$\frac{6}{co}$ $\frac{6}{do}$	S - Wet, R Perm, GW		
$\frac{1}{eo}$	S - R Perm, GW M - Slope	$\frac{7}{ao}$	VS - Wet, R Perm, GW		
$\frac{1}{fo}$	S - Slope, R Perm, GW	$\frac{8}{co}$	M - SI Perm		
$\frac{1}{go}$	VS - Slope, R Perm, GW	$\frac{8}{fo}$ $\frac{8}{f1}$	S - Slope, SI Perm		
$\frac{2}{co}$ $\frac{2}{do}$	VS - R Perm, GW	$\frac{8}{go}$ $\frac{8}{g2}$	VS - Slope, SI Perm		
$\frac{2}{eo}$	VS - R Perm, GW M - Slope	$\frac{9}{co}$ $\frac{9}{do}$	S - R Perm, GW		
$\frac{2}{fo}$	VS - R Perm, GW S - Slope	$\frac{9}{fo}$ $\frac{9}{f1}$ $\frac{9}{f2}$	S - Slope, R Perm, GW		
$\frac{3}{bo}$ $\frac{3}{b3}$	S - Wet, Flood, GW	$\frac{9}{go}$	VS - Slope, R Perm, GW		
$\frac{3}{co}$ $\frac{3}{do}$		$\frac{10}{ao}$	VS - Wet, SI Perm, GW		
$\frac{4}{ao}$	VS - Wet, Flood, GW	$\frac{11}{c5}$	VS - Wet, Flood, GW		
$\frac{5}{ao}$ $\frac{5}{bo}$	VS - Wet, R Perm, GW	$\frac{TH}{ao}$	VS - Wet, Org, GW		

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 Dark Browns and Orthic Regosols. The Gleyed Dark Browns are rated under Map Unit 6.

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
SI Perm - Slow permeability

Wet - Seasonally high groundwater
table or surface ponding

Table 15. Soil Limitations for Trench Type Sanitary Landfills

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	VS - Text, R Perm, GW	$\frac{8}{co}$	SL - M - Clay		
		$\frac{8}{fo}$ $\frac{8}{fl}$	M - Slope, Clay		
	VS - Text, R Perm, GW M - Slope	$\frac{8}{go}$	S - Slope, Clay		
	VS - Text, R Perm, GW S - Slope	$\frac{8}{g2}$	S - Slope, Clay, Stony		
$\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$	VS - Text, R Perm, GW	$\frac{9}{co}$ $\frac{9}{do}$	VS - Text, R Perm, GW		
	VS - Text, R Perm, GW M - Slope	$\frac{9}{fo}$ $\frac{9}{fl}$	VS - Text, R Perm, GW M - Slope		
$\frac{3}{bo}$ $\frac{3}{b3}$ $\frac{3}{co}$ $\frac{3}{do}$	VS - Text, R Perm, GW	$\frac{9}{f2}$	VS - Text, R Perm, GW M - Slope, Stony		
		$\frac{9}{go}$	VS - Text, R Perm, GW S - Slope		
$\frac{4}{ao}$	VS - Wet, Flood, GW	$\frac{10}{ao}$	VS - Wet, GW, Clay		
$\frac{5}{ao}$ $\frac{5}{bo}$	VS - Wet, R Perm, GW	$\frac{11}{c5}$	VS - Wet, GW, Stony		
$\frac{6}{co}$ $\frac{6}{do}$	VS - R Perm, Wet, GW	$\frac{TH}{ao}$	VS - Wet, R Perm, GW		
$\frac{7}{ao}$	VS - Wet, R Perm, GW				

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 Dark Browns and Orthic Regosols. The Gleyed Dark Browns are rated under Map Unit 6.

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
 Slip - Slippery or sticky when wet
 Slope - Excessive slope
 Stony - Surface stoniness
 Text - Unsuitable texture

Wet - Seasonally high groundwater
 table or surface ponding

Table 16. Soil Limitations for Road Location

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	SL	$\frac{6}{co}$ $\frac{6}{do}$	M - Wet		
	M - Slope	$\frac{7}{ao}$	S - Wet		
	S - Slope	$\frac{8}{co}$	M - M Sh-Sw, Frost		
	VS - Slope	$\frac{8}{fo}$ $\frac{8}{f1}$	S - Slope, M Sh-Sw, Frost		
$\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$	SL	$\frac{8}{go}$ $\frac{8}{g2}$	VS - Slope, M Sh-Sw, Frost		
	M - Slope	$\frac{9}{co}$ $\frac{9}{do}$	SL		
	S - Slope	$\frac{9}{fo}$ $\frac{9}{f1}$ $\frac{9}{f2}$	S - Slope		
$\frac{3}{bo}$ $\frac{3}{co}$ $\frac{3}{do}$ $\frac{3}{b3}$	S - Wet, Flood	$\frac{9}{go}$	VS - Slope		
	S - Wet, Flood, Stony	$\frac{10}{ao}$	S - Wet, Sh-Sw, Frost		
$\frac{4}{ao}$	VS - Flood, Wet	$\frac{11}{c5}$	VS - Stony, Wet, Sh-Sw		
$\frac{5}{ao}$ $\frac{5}{bo}$	S - Wet	$\frac{TH}{ao}$	VS - Wet, Flood, Org		

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 Dark Browns and Orthic Regosols. The Gleyed Dark Browns are rated under Map Unit 6.

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 17. Soil Suitability for Source of Roadfill

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	G	$\frac{7}{ao}$	P - Wet		
	F - Slope	$\frac{8}{co}$	F - M Sh-Sw, Frost		
	P - Slope	$\frac{8}{fo}$ $\frac{8}{f1}$	F - M Sh-Sw, Frost, Slope		
		$\frac{8}{go}$ $\frac{8}{g2}$	P - Slope, M Sh-Sw, Frost		
$\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$	G	$\frac{9}{co}$ $\frac{9}{do}$	G		
	F - Slope	$\frac{9}{fo}$ $\frac{9}{f1}$ $\frac{9}{f2}$	F - Slope		
$\frac{3}{bo}$ $\frac{3}{co}$ $\frac{3}{do}$ $\frac{3}{b3}$	F - Wet, Flood	$\frac{9}{go}$	P - Slope		
	F - Wet, Flood, Stony	$\frac{10}{ao}$	P - Wet, Sh-Sw, Frost		
$\frac{4}{ao}$	P - Wet, Flood.	$\frac{11}{c5}$	VP - Stony, Sh-Sw, Frost		
$\frac{5}{ao}$ $\frac{5}{bo}$	P - Wet	$\frac{TH}{ao}$	VP - Wet, Flood, Org		
$\frac{6}{co}$ $\frac{6}{do}$	G				

1 - For explanation, see Soil Map.

2 - G - Good, F - Fair, P - Poor, VP - Very poor

3 - These ratings are for the Orthic Dark Browns and Orthic Regosols. The Gleyed Dark Browns are rated under Map Unit 6.

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 18. Soil Suitability for Source of Sand or Gravel

Map Symbol ¹	Degree of Limitation ²	Map Symbol	Degree of Limitation	Map Symbol	Degree of Limitation
³ $\frac{1}{bo}$ $\frac{1}{co}$ $\frac{1}{do}$ $\frac{1}{eo}$ $\frac{1}{fo}$ $\frac{1}{go}$	G	$\frac{9}{co}$ $\frac{9}{do}$ $\frac{9}{fo}$ $\frac{9}{fl}$ $\frac{9}{f2}$ $\frac{9}{go}$	G		
$\frac{2}{co}$ $\frac{2}{do}$ $\frac{2}{eo}$ $\frac{2}{fo}$	G	$\frac{10}{ao}$	VP - Text, Wet		
$\frac{3}{bo}$ $\frac{3}{b3}$ $\frac{3}{co}$ $\frac{3}{do}$	F - Wet, Flood	$\frac{11}{C5}$	VP - Text, Wet, Flood		
$\frac{4}{ao}$	P - Wet, Flood	$\frac{TH}{ao}$	VP - Wet, Flood, Org		
$\frac{5}{ao}$ $\frac{5}{bo}$	P - Wet				
$\frac{6}{co}$ $\frac{6}{do}$	G				
$\frac{7}{ao}$	P - Wet				
$\frac{8}{co}$ $\frac{8}{fo}$ $\frac{8}{fl}$ $\frac{8}{go}$ $\frac{8}{g2}$	VP - Thin, Text				

1 - For explanation, see Soil Map.

2 - G - Good, F - Fair, P - Poor, VP - Very poor

3 - These ratings are for the Othic Dark Browns and Orthic Regosols. The Gleyed Dark Browns are rated under Map Unit 6.

Abbreviations

Flood - Flooding hazard (overflow)
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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