
Soils of the Municipality of Souris-Glenwood Report No. D100

A photograph of a soil profile with a ruler for scale. The ruler is marked in centimeters from 0 to 80. The soil shows distinct layers, with a darker top layer and a lighter, more uniform layer below.

2026



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Additional Poster-Sized Maps with Report:

1:20,000 Soil Series Maps for each township (six maps)

Township 07 Range 20W
 Township 07 Range 21W
 Township 07 Range 22W

Township 08 Range 20W
 Township 08 Range 21W
 Township 08 Range 22W

1:20,000 Agricultural Capability Maps for each township (six maps)

Township 07 Range 20W
 Township 07 Range 21W
 Township 07 Range 22W

Township 08 Range 20W
 Township 08 Range 21W
 Township 08 Range 22W

*Due to rounding, numbers presented throughout this document may not add up precisely to the totals provided.

Part 1 General Description of the Study Area

1.1 Location and Extent

The Municipality (MU) of Souris-Glenwood is located in the southwestern part of Manitoba and consists of approximately 58,153 hectares (ha) or 143,698 acres (ac) of land within townships (TWP) 7 and 8 in Ranges (RNG) of 20, 21 and 22 west of the Principal Meridian (W1). The MU of Souris-Glenwood is bordered to the east by the MU of Oakland-Wawanesa, to the north by the Rural Municipality (RM) of Whitehead, to the west by the RM of Sifton and to the south by the MU of Grassland (Map 1).

This report contains soil resource information and maps at a scale of 1:20,000 for an area formerly covered in the Reconnaissance Soil Survey Reports (1:126,720) of the Rosburn and Virden Map Sheet Areas, Soils Report No. 6 (Ehrlich et al., 1956) and South-Western Manitoba (Ellis and Shafer, 1940). Soil mapping from previously surveyed (1:20,000) Soils of the Souris, Virden and Wawanesa townsites, Report D56 (Podolsky, 1985) is also included in this report.

1.2 Drainage and Relief

Drainage of the study area is facilitated by the network of streams and drainage channels that ultimately discharge into the Souris River along with two major creeks, Plum Creek and Elgin Creek, which provide surface drainage for most of the area. The Souris River enters the MU in TWP 7 RNG 22 W1, flows northeasterly to the town of Souris and then southeasterly out of the study area in TWP 7 RNG 20 W1. Plum Creek runs from TWP 8 RNG 22 W1 and joins the Souris River in the town of Souris. Elgin Creek runs from TWP 7 RNG 21 W1 and meets the Souris River in the town of Souris as well. The study area lies within two watershed districts (Environment and Climate Change 2024), the Souris River Watershed and the Central Assiniboine Watershed (Figure 1).

Most of the surface drainage in the undulating and hummocky areas (particularly in TWP 8 RNG 21 W1) is local in nature. Runoff water from knolls and ridges accumulate in intervening depressions to form sloughs and marshes. The removal of water from these local catch basins is largely through evaporation and seepage (Ehrlich et al., 1956).

The elevation of the study area ranges from approximately 400 metres above sea level (a.s.l.) in the south east corner of the MU in the Souris River Valley to approximately 470 metres a.s.l. in TWP 8 RNG 20 W1 where the Tiger Hill Upland extends into the MU of Souris-Glenwood (Podolsky, 1999) (Map 2). Most of the landscape consists of lacustrine plains with a nearly-level to undulating topography. Greater relief is confined to the till moraines and the deeply incised channels of the Souris River, Plum Creek and Elgin Creek.

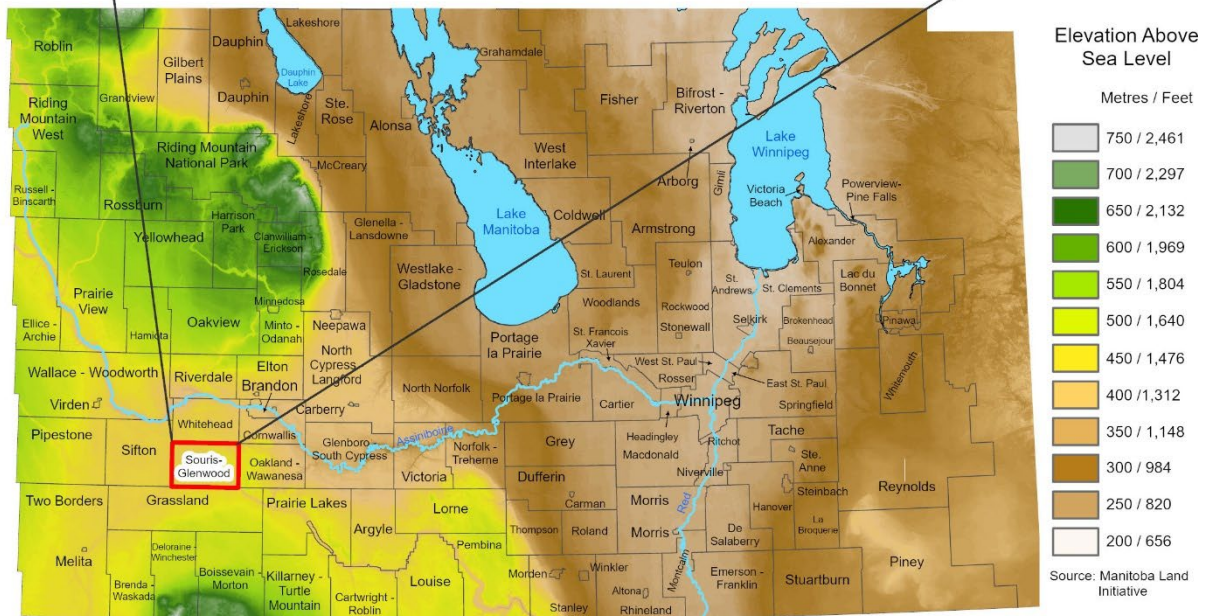
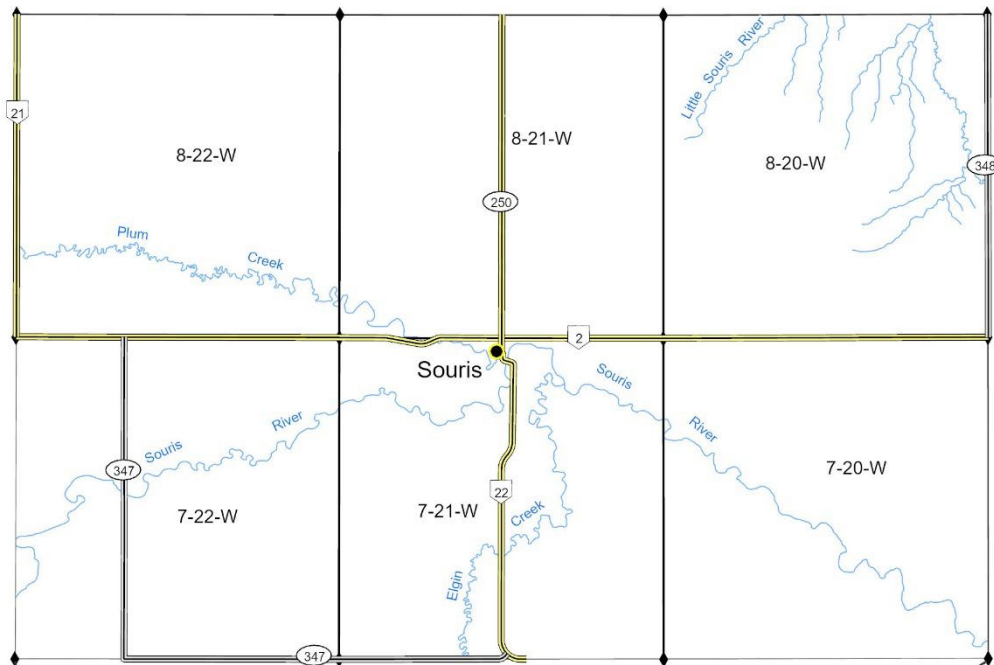
1.3 Geology

The underlying bedrock in the MU of Souris-Glenwood consists entirely of cretaceous shales and siltstone of the Riding Mountain Formation established during the Cretaceous Period.

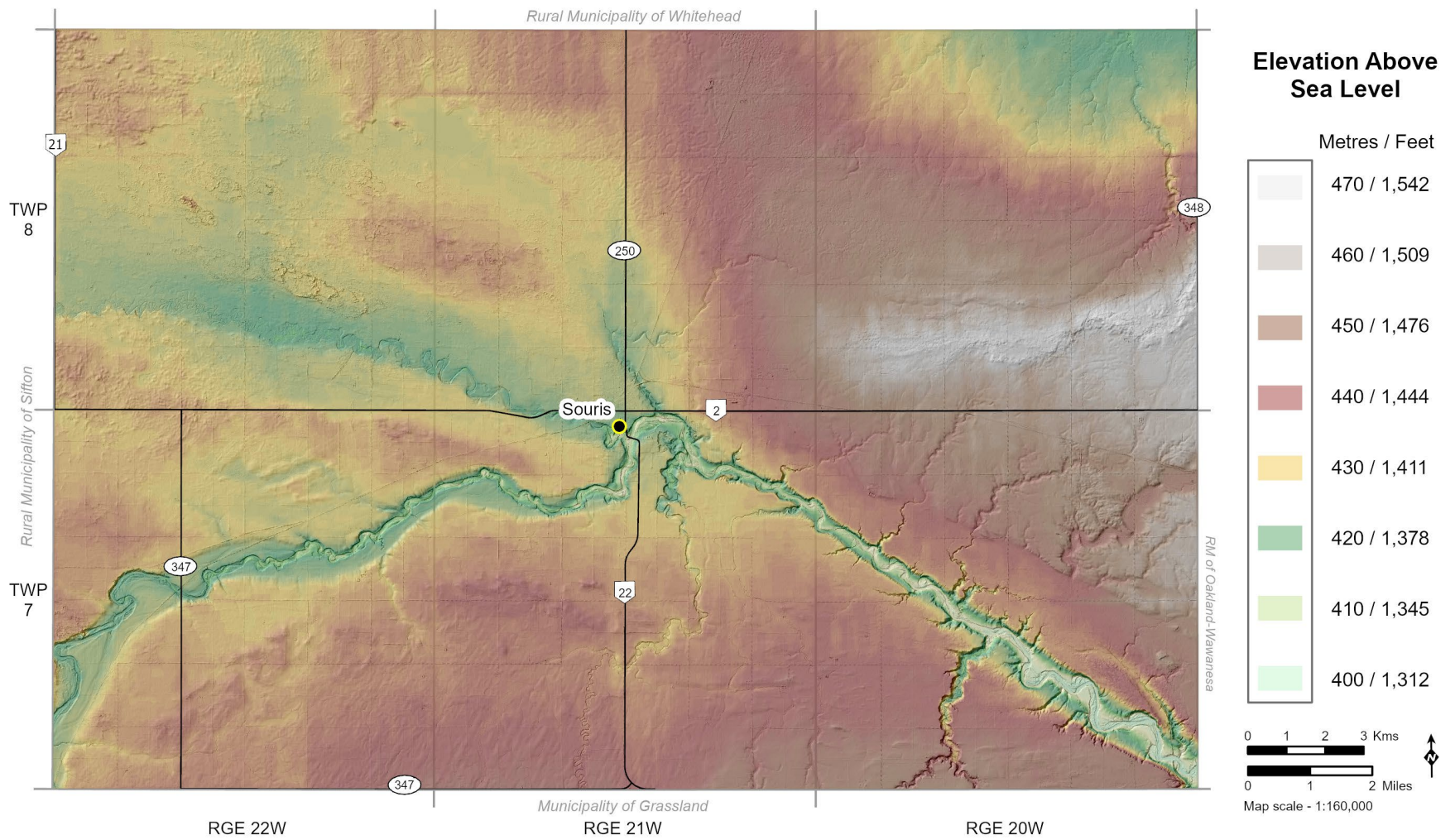
The Riding Mountain Formation includes three members:

- 1) Millwood Member – soft green bentonitic shale;
- 2) Coulter Member – soft grey bentonitic clayed siltstone and shale and
- 3) Odanah Member – hard grey siliceous shale.

The dominant bedrock in the MU of Souris Glenwood is soft grey bentonitic clayed siltstone and shale, the Coulter Member (Figure 2). The Millwood member consisting of soft green bentonitic shale, the dominant bedrock in the neighboring RM of Whitehead, is found in the northeast and northwest corners of the MU of Souris-Glenwood. The hard grey siliceous shale, the Odanah Member of the Riding Mountain Formation, occurs in the northeast of the town of Souris.



Map 1. Location of the Study Area: The Municipality of Souris-Glenwood.



Map 2: Elevation (metres / feet) Map of the Municipality of Souris-Glenwood.

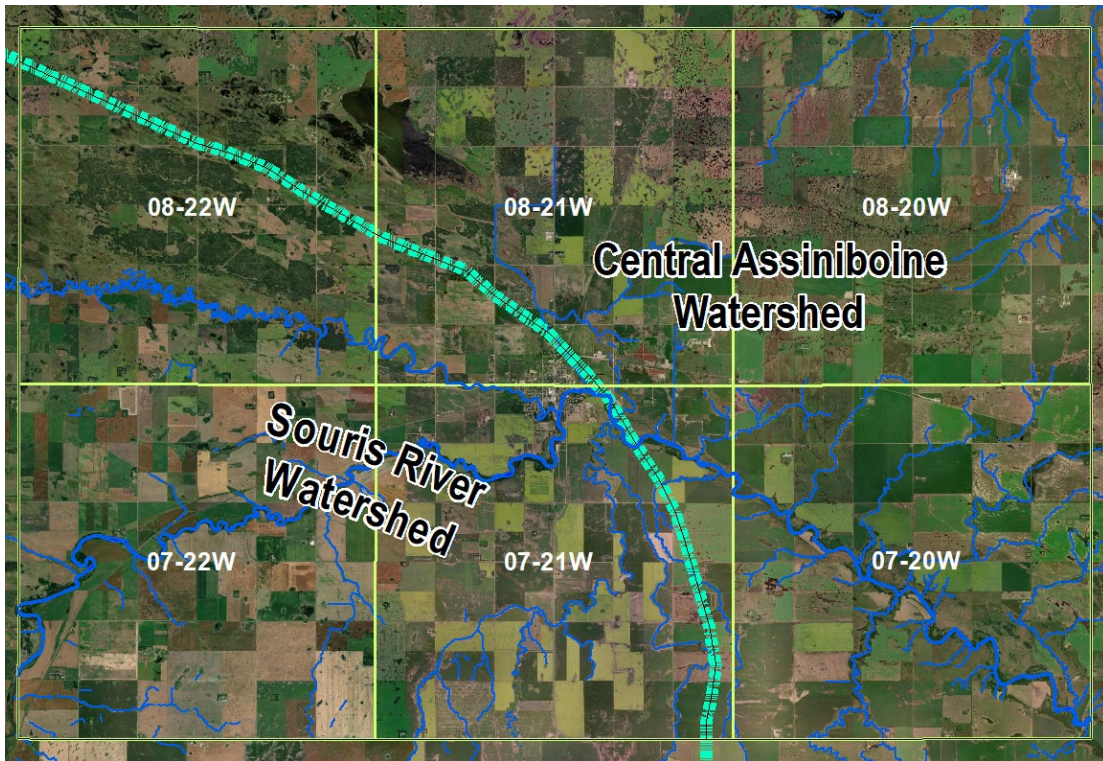


Figure 1. Water Courses and Watershed Districts in the Municipality of Souris-Glenwood.

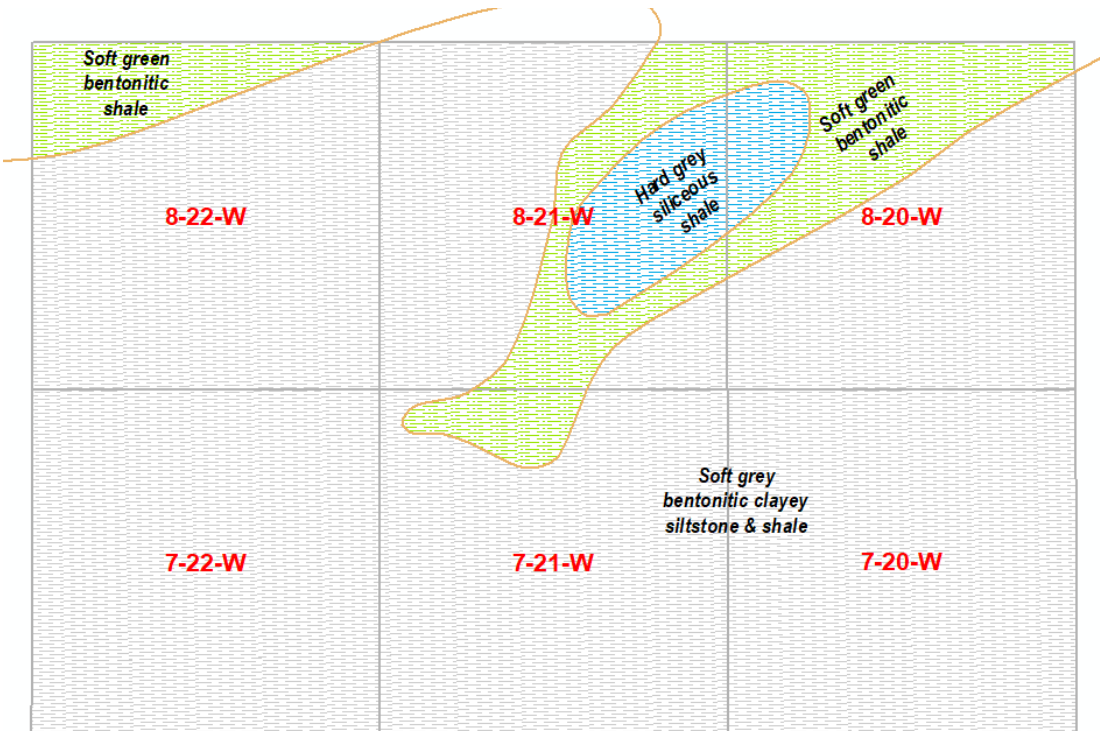


Figure 2. Surface contacts of the rock formations in the Municipality of Souris-Glenwood.

1.4 Physiography and Surface Deposits

The study area lies within multiple ecodistricts which include the Stockton, Oak Lake, Hilton, Killarney, and Manitou (Figure 3). The Killarney Ecodistrict is the largest in the study area, covering approximately 41 per cent, followed by Oak Lake (34 per cent), Stockton (17 per cent), Manitou (7 per cent) and Hilton (1 per cent). All five ecodistricts are in the Aspen Parkland Ecoregion (ESWG, 1995, Smith et al., 1998).

The entire study area is within the Grassland Transition (Gt) Ecoclimatic Region. However, the northeastern part falls in the Grassland Transition Subregion 2 (Gt2), while portions of the southwestern area are in the Grassland Transition Subregion 3 (Gt3) (Figure 4).

Except for the Manitou Ecodistrict, the remaining four ecodistricts were previously known as the Lake Souris Basin (Ehrlich et al., 1956), which occupies almost the entire MU and forms a broad area of lacustrine sediments. These sediments mark the area covered by glacial Lake Souris at the time when the glacier ice had melted back (Ellis and Shafer, 1940).

Most of the lake deposits have level to smooth gently sloping topography although some dissection by runways and streams, and to some extent dunning by wind, have caused an unevenness of the terrain in the northwest of the study area. Lacustrine over glacial till was found in TWP 8 RNG 20 W1 and both sides of the Souris River in TWP 7 RNG 20 W1 and 21 W1, particularly in the south side of the river. This type of the surface sediment was previously described as the Heaslip Soil Association (Ellis and Shafer, 1940).

The dominant landform in the study area is undulating, making up to 68 per cent of the MU. The level landform comprises 19 per cent. The hummocky landforms account for 11 per cent, mainly located in TWP 8 RNG 22 W1 and north part of TWP 8 RNG 21 W1.

1.5 Climate

In relation to world climatic conditions, southwestern Manitoba is within the region designated as subhumid, cool to moderately cool Boreal soil climate (Podolsky, 1985, Smith, et al, 1998) characterized by short, warm summers and long, cold winters. Winds are frequent and often strong in this region. The study area of the MU of Souris-Glenwood is in the Grassland Transition ecoclimatic region (Figure 4) with a mean annual temperature of 2.5°C, a mean annual precipitation of 508.8 mm, an average of 1,693 Degree Days (above 5°C) and on average 109 frost-free days (Souris Weather Station, Environment and Natural Resources Canada, 2022).

1.6 Vegetation

The entire study area is within the Aspen Parkland Ecoregion (ESWG, 1995, Smith et al., 1998). Most of the native vegetation in the study area has now been replaced by agricultural crops, except in the driest parts or areas where very poor drainage occurs where it has been used as rangeland or left as natural areas.

The natural vegetation in the area varies with soil texture, drainage, aspect and slope. The vegetation on rapidly to well drained sites is generally short to mixed-grass prairie grasses with hazel, common and creeping juniper, white spruce, and trembling aspen. Increased forest cover with less grass cover occurs on north facing slopes. Imperfectly drained sites consist of trembling aspen, balsam poplar and dogwood. Poorly drained sites have willow, alder and dogwood with wet meadow grass and sedge groundcover. Saline areas have vegetation dominated by alkali grass, wild foxtail barley, red samphire and sea blite (Smith et al., 1998).

Most land in the southern and eastern part of the MU is being used for arable agriculture. Tree cover is still present on sheltered sites such as slopes of the Souris River where relatively more moisture is available (Smith et al., 1998).

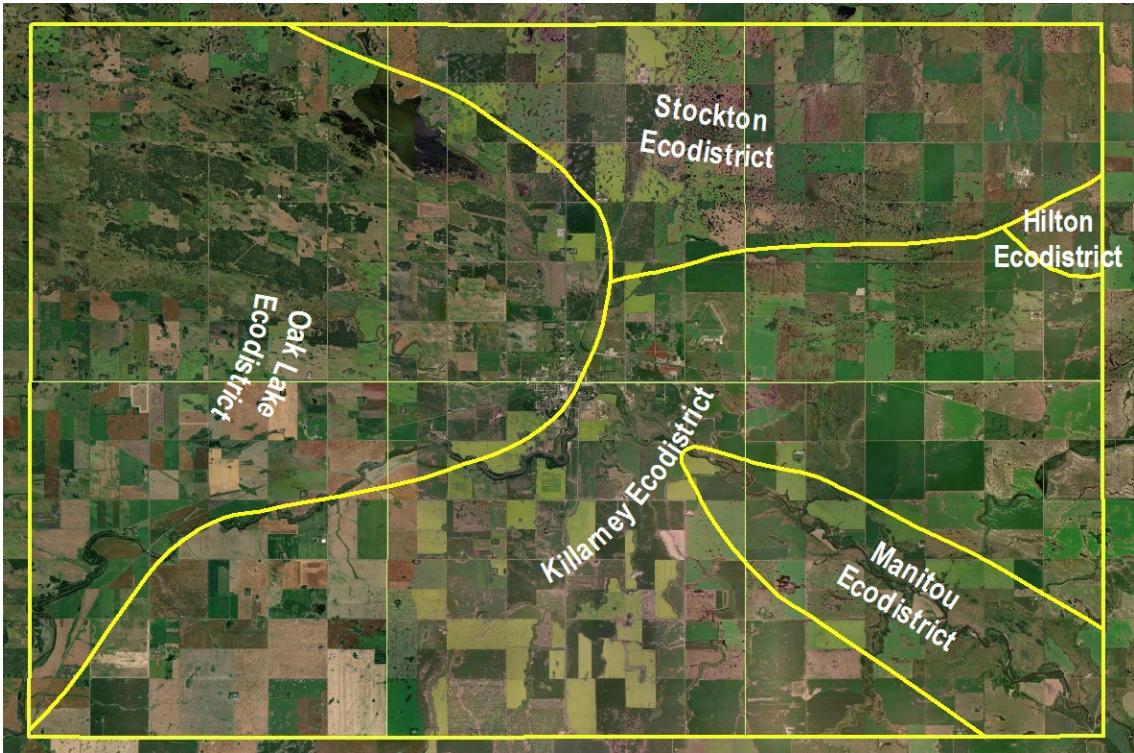


Figure 3. Ecodistricts of the Municipality of Souris-Glenwood.



Figure 4. Ecoclimatic Subregions in the Municipality of Souris-Glenwood.

1.7 Soils

The surface deposits throughout the study area are dominantly deep lacustrine materials, varying considerably in texture from one location to another, but relatively uniform to a profile depth of about 100 centimetres.

As the MU of Souris-Glenwood is located almost entirely in the Lake Souris Basin, most soils are developed from deep lacustrine sediments (Map 3), accounting for approximately 70 per cent of the study area (Table 1). Medium-textured Cameron (Gt3) and Fairland (Gt2) soil associations and moderately fine-textured Carroll (Gt2) and Elva (Gt3) associations are the two major deep lacustrine associations observed in the MU, accounting approximately for 29 and 24 per cent respectively, of the deep lacustrine deposits. The medium-textured soils are primarily distributed in TWP 7 RNG 21 W1 and 7 RNG 22 W1. Moderately fine textured soils are mainly observed in TWP 8 RNG 20 W1 and 7 RNG 20 W1, although some proportions of this association are found in other townships.

Moderately coarse-textured Lyleton (Gt3) and Poollex (Gt2) soil associations and coarse-textured Stanton (Gt3) and Stockton (Gt2) soil associations consist of approximately 22 and 21 per cent of the deep lacustrine deposits in the study area, respectively, and they are commonly seen in western two townships. The fine-textured soil associations account only for four per cent of the study area and are found primarily in north of TWP 8 RNG 21 W1.

Soils derived from lacustrine over glacial till comprise 22 per cent, dominantly located in the TWP 8 RNG 20 W1 and 7 RNG 20 W1 (Table 1 and Map 3). The lacustrine overlying glacial till soils are comprised of four associations in each of the Gt2 and Gt3 regions, among which the Beresford association is predominant (96 per cent) in Gt2, and Waskada (86 per cent) association in Gt3. Small pockets of medium-textured lacustrine over till soils was found in the Gt2 region, but occurring only in a few hundred acres in Gt3, so that creation of a new soil series in Gt3 is not justified (similar to other variants in soil legends of Table 4).

Table 1. Soil Parent Material in the Municipality of Souris-Glenwood

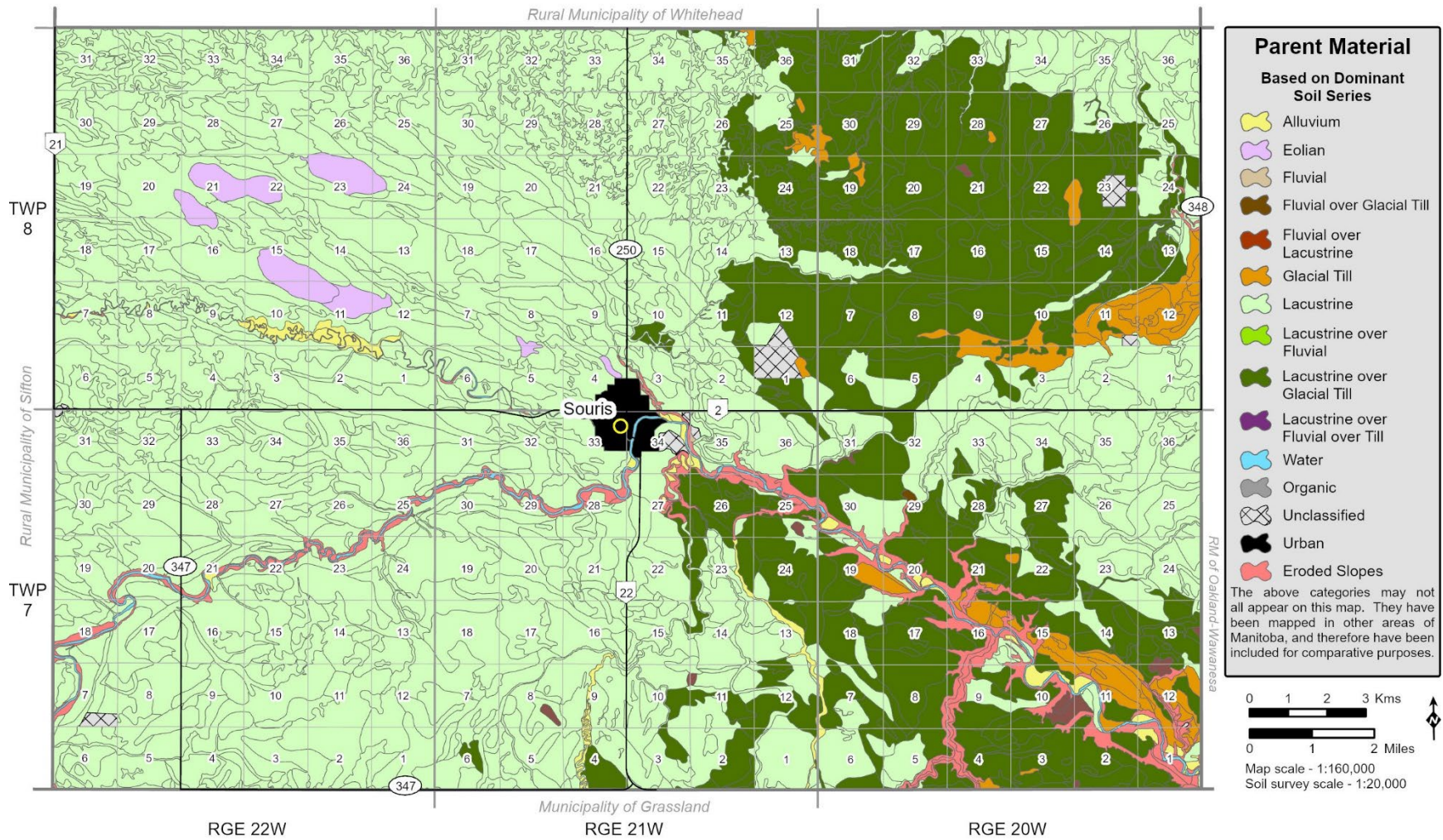
Parent material (0 to 100 cm)	Total area		% of MU
	ha	ac	
Deep Lacustrine	40,566	100,239	69.76
Lacustrine over glacial till	12,862	31,784	22.12
Glacial till	1,154	2,851	1.98
Alluvium	584	1,443	1.00
Eolian	624	1,542	1.07
Lacustrine over fluvial	102	251	0.18
Thin sediments over shale	20	48	0.03
Fluvial over glacial till	8	20	0.01
Fluvial	2	5	0.00
Eroded slope, mash, water & unclassified	2,231	5,514	3.84
Total	58,153	143,698	100

Soils developed from glacial till are mainly distributed in TWP 8 RNG 20 W1 and along the southeastern section of the Souris River in TWP 7 RNG 20 W1 (Map 3). Shaley till was spotted along the north side of the Souris River in TWP 7 RNG 20 W1.

Soils derived from alluvium deposits are distributed along the Souris River and two creeks – Plum and Elgin (Map 3). Soil texture ranges from medium to fine.

Eolian deposits are found in TWP 8 RNG 22 W1 (Map 3), accounting for one per cent of the study area.

Fluvial associated parent materials have a wide variety of surface textures, and their proportions in the study areas are almost negligible.



Map 3: Parent Material map of the Municipality of Souris-Glenwood.

Part 2 Methodology

2.1 Mapping and Map Scale

Detailed soil mapping at a 1:20,000 scale (approx. 5 cm equals one km) was completed for the Municipality of Souris-Glenwood. Soil profiles were examined to a depth of one meter at sites at an approximate 170-metre interval along traverses that were spaced 800 metres apart. The direction of each traverse was determined on the basis of enhancing the information that could be derived from the range of soil-landscape variation in each section. Additional soil inspections occurred in complex soil areas to help locate boundaries between different soil series or variable soil phases. This method of surveying provided approximately 25 to 32 inspections per section of land, or a soil inspection density of one site per 10 hectares (25 acres).

Based on all soil and landscape information collected during field inspections, the boundaries delineating various soil series are digitized using Geographic Information Systems (GIS), digital terrain models and 3-dimensional viewing software – Summit Lite. This allows higher positional accuracy of soil polygons and contrast features. In the areas where previous soil surveys were done, some of the old soil polylines were revised based on new images and updated information. These areas include Soils of the Souris, Virden and Wawanesa Townsites, Report D56 (Podolsky, 1985).

2.2 Map Units

The information from soil inspection sites forms the basis for delineating soil boundaries on a map. Each geographic area enclosed by these soil boundaries is referred to as a soil polygon. Each soil polygon is named according to the soil series present in the polygon.

A soil series is defined as a naturally occurring soil body so that any profile within that body has a similar number and arrangement of horizons whose colour, texture, structure, consistence, reaction and composition are within a narrowly defined

range. If a soil has properties that vary slightly from the prescribed range of the series, a soil series **variant** is established.

A soil polygon can contain up to three named soil series. The collective name or label of a soil polygon is referred to as a map unit.

A map unit represents portions of the soil landscape that have characteristics and properties varying within narrow limits that are determined by the intensity of the survey. The map unit contains one or more than one soil or non-soil plus a certain proportion of unnamed and un-described inclusions. Map units are delineated on the basis of the types and relative proportions of their soils or non-soils, as well as on the basis of external criteria such as slope, stoniness, erosion or salinity. Some examples of a non-soil include water or bedrock.

2.3 Simple and Compound Map Units

There are two major types of map units: simple and compound. The difference between a simple and compound map unit is the proportion and contrast of their components.

A **Simple Map Unit** contains predominantly one soil or non-soil. Its components vary as follows: the predominant component comprises at least 65 per cent with up to 35 per cent of non-limiting, similar components (components that are alike in most properties and behaviour), or up to 25 per cent of non-limiting dissimilar components (components that do not affect management of the map unit but have a significant number of properties that vary from the predominant component), or up to 15 per cent of limiting, dissimilar components (components which have many contrasting properties and usually affect management differently).

A **Compound Map Unit** contains predominantly more than one soil or non-soil (or a combination of both). The proportions of the two major components in a compound map unit, for example, may vary from one considerably exceeding the other to both being approximately equal. Complementary to the definition of a single map unit, the proportions of components vary according to

their areal extent and contrasting characteristics as they may affect soil management or use. Major components vary as follows: if other components are similar and non-limiting, no single component represents more than 65 per cent; or if other components are dissimilar and non-limiting, no single component represents 75 per cent or more; or if other components are dissimilar and limiting, no single component represents 85 per cent or more.

For the purpose of describing compound map units, components are considered dominant if they occupy over 40 per cent of the unit. They are considered significant between 15 and 40 per cent and minor if they occupy less than 15 per cent. Minor components are described only if they are highly contrasting.

2.4 Phases

It is often desirable to indicate a condition or quality of soil property or landscape feature that deviates significantly from the normal definition of map units using a map unit symbol. These variations or phases of soil properties and landscape features, varying from delineation to delineation, significantly affect soil behaviour and land management or use.

Soil properties that are commonly used as phase criteria include texture, depth, surface peat, salinity and physical disruption. Properties of land that are used include slope, wind and water erosion, stoniness, rockiness and altered drainage.

The four properties are identified below the soil series symbol. They are severity of erosion, slope class, degree of stoniness and salinity. The degree or magnitude of each is designated in Figure 5.

The convention employed to indicate these features in the map symbol is as follows:

If none of the above properties is observed to be significant, the map symbol representing the normal or unaffected soil series is used alone without modifiers (example in Figure 5).

If one or more phase features are recognized, the appropriate letter or number is placed below the soil series symbol in one of four

designated locations in the map unit symbol. The designated order is erosion, slope class, stoniness and salinity. If a particular feature is not observed to be significant, an x is used in its appropriate designated location in the map symbol (Figure 5).

An example of a compound unit in Figure 5 is as follows: 50 per cent consists of Fairland (FND⁵) series having no erosion (x), very gently sloping topography (c), no stones at the surface (x), and no salinity (x), 30 per cent Travers (TAV³) series having slight erosion (1), very gently sloping topography (c), no stones (x), and no (x) salinity, and 20 per cent Ramada (RAM²) series having no erosion (x), nearly level sloping topography (b), no stones (x), and no (x) salinity (Figure 5). If all the phases and features have an x designation, the four (x) phases are not shown in the map symbol (for example, Miniota (MXI) in Figure 5).

2.5 Soil Sampling and Analysing

Over 300 soil surface and subsurface samples were collected and analyzed for texture (particle size), pH, organic carbon, electrical conductivity (EC) and calcium carbonate content. Soil cation exchangeable capacity (CEC) was also determined in detailed soil profile samples.

The brief methodologies of lab analyses used to determine soil characteristics are:

Calcium carbonate: Calcimeter using 1M HCl
EC: Saturated paste
pH: 2:1 CaCl₂ to soil ratio
Organic carbon: Walkley-Black method
Particle size: Pipette method

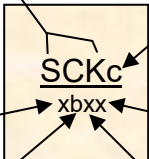
Soil series maps contain labels similar to those shown in the pale brown boxes below. A description of each kind of label is indicated below.

Simple Map Units

(contain predominantly 1 soil or non-soil)

Soil Series Code

Variant Symbol(s)*



- c = classification
- d = drained
- p = peaty
- v = very poorly drained
- 1 = texture variant

*Variants only apply to certain soil series

Degree of Erosion

- x = non-eroded or minimal
- 1 = slightly eroded
- 2 = moderately eroded
- 3 = severely eroded
- o = overblown/overwash

Topography (Slope Class)

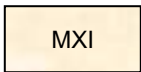
- x = level to nearly level: 0 – .5%
- b = nearly level: > .5 – 2%
- c = very gently sloping: > 2 – 5%
- d = gently sloping: > 5 – 9%
- e = moderately sloping: > 9 – 15%
- f = strongly sloping: > 15 – 30%
- g = very strongly sloping: > 30 – 45%
- h = extremely sloping: > 45 – 70%
- i = steeply sloping: > 70 – 100%
- j = very steeply sloping: > 100%

Degree of Stoniness (Surface Covered)

- x = non-stony: < .01%
- 1 = slightly stony: > .01 – .1%
- 2 = moderately stony: > .1 – 3%
- 3 = very stony: > 3 – 15%
- 4 = exceedingly stony: > 15 – 50%
- 5 = excessively stony: > 50%

Degree of Salinity Condition (mS/cm)

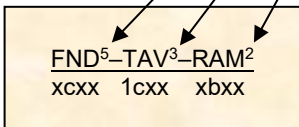
- x = non-saline: 0 – 4
- s = weakly saline: > 4 – 8
- t = moderately saline: > 8 – 16
- u = strongly saline: > 16



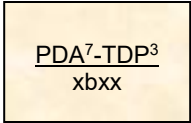
Soil Code with a phase of xxxx (The denominator shown in the above example is referred to as the 'phase')

Compound Map Units

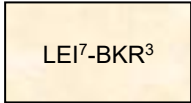
(Contain up to 3 soils or non-soils)



Percent of soil series found in map polygon to be multiplied by 10 (50+30+20=100%)



2 Soil Series with the same phase



2 soil series, both with a phase of xxxx

Figure 5. Map Unit Symbol

Part 3 Soil Development and Classification

3.1 Introduction

This section of the report describes the main characteristics of the soils and their relationship to the factors of soil development. Soil development is related to the regional climate and the degree of leaching, translocation and accumulation of soluble and colloidal fractions of the soil. Soil drainage also plays a significant role in soil development. Soils in the MU of Souris-Glenwood have developed under a cool subhumid boreal climate (Grassland Transition Ecoclimatic Region) which provides sufficient moisture and heat for development of aspen-oak groves, prairie grasses and associated herbs. Consequently, the majority of soils in the area are Chernozemic soils.

3.2 Classification

Soils in the study area are classified according to the Canadian System of Soil Classification (SCWG, 1998). This system is hierarchical, employing five levels of generalization or categories of classification. Beginning with the most generalized, these categories are the Order, Great Group, Subgroup, Family (Association) and Series. The classification is based on measurable soil properties that can be observed in the field or can be inferred from other properties observable in the field. The properties selected as criteria for the higher categories are the result of soil genesis or of factors that affect soil genesis. Properties utilized to differentiate soils at the lower levels of family and series affect management. The five levels of generalization are defined as follows:

Order - Soil orders are defined on the basis of soil properties of the pedon that reflect the nature of the soil environment and the effects of the dominant soil forming process. An

example is a Chernozem in which soils with dark coloured surface horizons developed under sub-humid climate and dominantly grassland environments.

Great Group - Each order is subdivided into great groups based on differences in the strength of dominant processes or a major contribution of a process in addition to a dominant one. Such processes result in particular kinds, arrangements and degrees of expressions of pedogenic horizons. An example is a Luvic Gleysol in which the dominant process is considered to be gleying, but clay translocation is also a major process.

Subgroup - Subgroups are subdivisions of great groups and are defined according to the kind and arrangement of horizons that indicate the conformity to the central concept of the great group e.g. Orthic, intergrades toward soils in other orders, e.g. Gleyed or special features such as carbonate accumulation in B-horizons.

Family - Families are established within a subgroup based on the similarity of physical and chemical properties that affect management. The properties that are considered important for recognizing families are particle size distribution, mineralogy, soil climate, soil reaction and thickness of solum.

Series - The series consists of soils that formed in a particular kind of material and have horizons with colour, texture, structure, consistence, thickness, reaction and chemical composition that are similar in differentiating characteristics and in arrangement in the soil profile.

The classification of soils in the study area in relation to parent material, texture and drainage is listed in Tables 2 and 3. The proportion of soils in terms of land area and surface texture in the MU of Souris-Glenwood is shown in Table 4. Each individual soil series is described in detail in Appendix 2.

Table 2. Relationship between Soil Series, Soil Drainage, Parent Material and Soil Classification (Gt2 North Subregion)

Drainage	Soil Classification	Glacial Till (Gt2 North)			Lacustrine over Till (Gt2 North)			
		Loamy Very Strongly to Extremely calcareous Till (L, CL, SiCL)	Loamy Mixed, Calc. (L, CL, SCL)	Loamy or CL, SiCL (shaly)	(FS, LFS) over Mixed Till or Extr. Calc.Till	(LVFS, FSL) over Mixed Till or Extr. Calc.Till	Fine Loamy (CL, SiCL) over Mixed Till	Clayey (SiC, C) over Mixed Till
Well to Mod. Well	Orthic Regosol	Madill (MXH)					Roddan (ROD)	
	Orthic Black Chernozem	Hilton (HIT)	Newdale (NDL)	Lenore (LNO)	Kirkness (KKS)	Lockhart (LKH)=2M	Clementi (CLN)	Everton (EVO)
	Calc. Black Chernozem	Woodfield* (WDF)	Cordova (CVA)				Kleysen (KYS)	
	Rego Black Chernozem	Bermont (BMN)	Rufford (RUF)				Chambers (CBS)	
	Orthic Dark Gray Chernozem	Tiger Hills (TGL) Statley* (SXB)						
Imperfectly	Gleyed Black Chernozem		Moore Park (MPK)				Cobfield (CBF)	Justice (JUC)
	Gl. Eluv. Black Chernozem		Angusville (ANL)					
	Gl. Calc. Black Chernozem		Lavinia (LAV)					
	Gl. Rego Black Chernozem	Barwood (BWO) Wesley* (WEL)	Varcoe (VRC)		Killeen (KLL)	Lindstrom (LDM)	Beresford (BSF)	Forrest (FRT)
Poorly	Orthic Humic Gleysol		Hamiota (HMI)					
	Rego Humic Gleysol	Hickson (HKS)	Drokan (DRO)			Lonery (LOE)	Vodroff (VFF)	Fenton (FET)
	Humic Luvic Gleysol		Penrith (PEN)					

Soil texture abbreviations: C = clay, Co = coarse, F = fine, H = heavy, L = loam(y), S = sand(y), Si = silt(y), and V = very.

* Observed in the Brandon Hills area;

Table 2. Relationship between Soil Series, Soil Drainage, Parent Material and Soil Classification (Gt2 North Subregion) (cont'd)

Drainage	Soil Classification	Lacustrine over Outwash			Outwash	Lacustrine over Outwash over Till	Fluvial over Till	Alluvium	
		MS, FS, LS over (CoS, MS)	(VFS, LVFS, SL, FSL) over (S & Gravel)	(L, SiL, CL, SiCL) over (S + Gravel)	Sand and Gravel	(L, SiL, SiCL, CL) over (S & Gravel) Over (L, CL, SiCL)	(S & Gravel) over (L, CL, SiCL)	(VFSL, L, SiL, CL, SiCL)	(SiC, C)
Well to Mod. Well	Cumulic Regosol							Mowbray (MOW)	Manson (MXD)
	Orthic BL Chernozem	Wheatland (WHL)	Miniota (MXI)	Croyon (CYN)	Dorset (DOT)	Jaymar (JAY)			
	Calc. BL Chernozem				Marringhurst (MRH)	Dogand (DGA)	Chater (CXW)		
	Rego BL Chernozem		Ashmore (AHO)	Zarnet (ZRT)	Floors (FLS)				
Imperfectly	Gleyed Cumulic Regosol							Levine (LEI)	Assiniboine (ASB)
	Gleyed BL Chernozem	Hughes (HGH)	Wytonville (WVI)	Druxman (DXM)	Dexter (DXT)				
	Gleyed El. Bl. Chernozem					Longdens (LGD)			
	Gleyed Rego Bl. Chernozem	Gendzel (GDZ)	Kilmury (KUY)	Capell (CXT)	Mansfield (MFI)	Melland (MXT)	Barager (BAA)		
Poorly	Rego Humic Gleysol	Lowroy (LOW)	Bornett (BOR)	Carvey (CAV) Carvey, peaty (CAVp)	Fortina (FTN) Fortina, peaty (FTNp)	Marsden (MDN)		Basker (BKR) Basker, peaty (BKRp)	Kerran (KRN)

Table 2. Relationship between Soil Series, Soil Drainage, Parent Material and Soil Classification (Gt2 North Subregion) (cont'd)

Drainage	Soil Classification	Eolian	Lacustrine							
		Coarse (FS, LFS)	Coarse (FS, LFS)	Mod. coarse (VFS, LVFS, FSL)	Medium (VFSL, L, SiL)	Mod. Fine (CL, SiCL)	Fine (SiC, C)	(VFSL, L, SiL) over (FS, LFS, VFS, LVFS)	(CL, SiCL) over (FS, LFS, VFS, LVFS)	(SiC, C) over (FS, LFS, VFS, LVFS)
Well to Mod. Well	Orthic Regosol	Shilox (SHX)	Arizona (AIZ)	Brownridge (BWD)	Knolls (KLS)	Barren (BAE)				
	Orthic BL Chernozem		Stockton (SCK)	Prosser (PSE)	Fairland (FND)	Ramada (RAM)	Janick (JIK)	Glenboro (GBO)	Wellwood (WWD)	
	Calc. BL Chernozem				Traverse (TAV)	Rempel (RMP)				
	Rego BL Chernozem		Cactus (CCS)	Purple (POR)	Durnan (DRN)	Carroll (CXF)	Bankton (BAO)			
	Orthic Dark Gray Chern.		Dobbin (DOB)	Halstead (HAT)	Pollen (POL)	Firdale (FIR)				
Imperfectly	Gleyed Regosol	Onahan (ONH)								
	Gleyed BL Solonetz									Oliver (OIV)
	Gleyed BL Chernozem		Lavenham (LVH)	Gateside (GTD)	Torcan (TOC)	Charman (CXV)	Harding (HRG)	Petrel (PTR)	Oberon (OBR)	
	Gleyed El. Bl. Chernozem					Gregg (GRG)				
	Gleyed Rego Bl. Chernozem		Hummerston (HMO)	Pleasant (PLE)	Taggart (TGR)	Prodan (PDA)	Sigmund (SGO)	Grover (GRO)	Crookdale (CKD)	
	Gl. D.Gray Chernozem			Bone (BNE)		Danlin (DLN)				
Poorly	Rego Humic Gleysol	Mockry (MKY)	Sewell (SEE)	Poolex (POX)	Vordas (VDS)	Tadpole (TDP)	Lowton (LWN)	Grayson (GYS)	Sutton (SXP)	Landseer (LSR)

Table 3. Relationship between Soil Series, Soil Drainage, Parent Material and Soil Classification (Gt3 North Subregion)

Drainage	Soil Classification	Glacial till mixed shale, limestone & granite	Thin (>25 cm) lacustrine over (< 5 cm gravelly lens) over glacial till				Thin (>25cm) lacustrine and (5-75cm) fluvial materials over glacial till			
		Deep (> 1 m) (L, CL, SCL, SiCL)	(FS, LS, LFS) over glacial till	(VFS, LVFS, FSL) over glacial till	(L, VFSL, SiL, Si) over glacial till	(SCL, CL, SiCL) over glacial till	(FS, LS, LFS) over (5 to 75 cm) gravelly lens) over till	(VFS, LVFS, FSL) (5 to 75 cm gravelly lens) over till	(VFSL, L, SiL, Si) over (5 to 75) cm sand and gravel) over till	(SCL, CL, SiCL) over (5 to 75 cm) coarse textured gravel) over till
Well to Mod. Well	Orthic Black Chernozem	Ryerson (RYS)	Margaret (MRE)	Langvale (LGV)	Waskada (WKD)	Bearford (BEF)	Pendennis (PDN)	Griswold (GWD)	Newstead (NWS)	Hartley (HLY)
	Calc. Black Chernozem	Medora (MDO)	Dunrea (DUR)	Nesbitt (NBT)	Dalny (DNY)					
	Rego Black Chernozem	Hathaway (HHY)	Rhodes (RHD)	Fairbiurn (FBU)	Maskawata (MAW)					
	Rego Dark Gray Chernozem	Oskar (OSK)								
	Orthic Dark Gray Chernozem	Horton (HOT)								
Imperfectly	Gleyed Black Chernozem	Regent (RGT)	Ashdown (AHW)	Ashbury (AHY)	Two Creeks (TWC)	Desford (DFD)	Eramosh (EMH)		Bower (BOW)	
	Gleyed El. Black Chernozem	Hazeldean (HZD)			Glenlorne (GNO)				Bannerman (BNM)	
	Gleyed Rego Black Chernozem	Coatstone (CSE)	Terence (TRC)	Mentieth (MNH)	Montgomery (MOT)	Croll (CLL)	Carnige (CRG)	Cauldwell (CDW)	Alexander (AXD)	
Poorly	Orthic Humic Gleysol	Stoney Creek (SYE)			Villette (VLT)					
	Humic Luvisol	Tilston (TLT)								
	Rego Humic Gleysol	Ewart (EWT)		Gainsborough (GGH)	Deloraine (DRI)	Wassewa (WSW)			Bella Lake (BEL)	

Table 3. Relationship between Soil Series, Soil Drainage, Parent Material and Soil Classification (Gt3 North Subregion)(cont'd)

Drainage	Soil Classification	Fluvial Outwash	Thin (>25 cm) Lacustrine over Fluvial Outwash				Thin (>25cm) Fluvial Outwash over Glacial Till	Thin (< 100 cm) Sediments over Hard Gray siliceous (Riding Mtn.) Shale		Glacial Till over Boissevain (Sandstone) Formation
		(FS, LS, LFS, gravelly deltaic & beach materials)	(FS, LS, LFS) over fluvial outwash	(VFS, LVFS, SL, FSL) over fluvial outwash	(VFSL, L, SiL) over fluvial outwash	(SCL, CL, SiCL) over fluvial outwash	(FS, LS, LFS) gravelly deltaic and outwash over medium to mod. fine till	(VFS, LVFS, FSL, VFSL, L) over shale	(FS, LFS, LVFS, VFSL, L) over shaly, fluvial sediments	(VFS, LVFS, FSL, VFSL, L), mod. to strongly calc. glacial till
Well to Mod. well	Orthic Regosol									Charlton (CHT)
	Orthic Black Chernozem	Bede (BED)	Chaucer (CUC)	George Lake (GGK)	Dromore (DOM)		Bernice (BIC)	Maples (MPS)		Reaper (RPR)
	Calc. Black Chernozem	Broomhill (BOH)			Breadon (BRO)		Adelpha (APH)			
	Rego Black Chernozem	Jackson Creek (JKE)								Algar (ALG)
	Orthic D. Gray Chernozem	Butler (BUR)								
Imperfectly	Gleyed Black Chernozem	Cartwright (CWG)	Methvin (MHV)	Ninette (NTT)	Glenview (GLN)		Turtlehead (TUA)	Merle (MRL)		
	Gleyed El. Bl. Chernozem									
	Gleyed Rego Bl. Chernozem	Napinka (NPK)	Reston (RST)	Linklater (LIK)	Gopher Creek (GPE)	Leon (LEO)	Glenora (GLO)	Mountainside (MUE)	Ebor (EBO)	
Poorly	Orthic Humic Gleysol									
	Humic Luvic Gleysol									
	Rego Humic Gleysol	Partridge (PDG)		Pierson (PIS)	William (WIL)		Bosshill (BSH)			

Table 3. Relationship between Soil Series, Soil Drainage, Parent Material and Soil Classification (Gt3 North Subregion) (cont'd)

Drainage	Soil Classification	Eolian	Lacustrine							Deep (> 100 cm) Alluvium	
		Coarse (FS, LFS)	Coarse (FS, LFS)	Mod. Coarse (VFSL, LVFS, FSL)	Medium (VFSL, L, SiL, Si)	Mod. Fine (SCL, CL, SiCL)	Fine (SC, SiC, C)	Medium (VFSL, L, SiL, Si) over Coarse (FS, LFS)	Mod. Fine to Fine & mod. Saline (SCL, CL, SiCL to SC, SiC, C)	Medium (VFSL, L, SiL, Si)	Mod. Fine to Fine (SCL, CL, SiCL to SC, SiC, C)
Well to Mod. Well	Orthic Regosol	Grande Clairiere (GDC)		Findlay (FDY)							
	Cumulic Regosol									Melita (MLT)	
	Orthic Black Chernozem		Stanton (STU)	Lyleton (LYT)	Cameron (CMR)	Elva (ELV)		Mather (MTR)			
	Calc. Black Chernozem		Deleau (DLU)	Kemnay (KMY)	Schaffner (SFR)						
	Rego Black Chernozem		Scarath (SCH)	Maon (MON)	Argue (ARG)						
	Gleyed Regosol	Ralston* (RTO) Rutledge** (RUG)		Plum Creek (PUE)	Fairhall (FHL)						
Imperfectly	Gl. Cumulic Regosol									Liege (LIG)	Neelin (NEI)
	Gleyed Black Solonetz		Dand (DND)			Ninga (NNG)					
	Gleyed Black Chernozem		Lauder (LUD)	Denbow (DBW)	Underhill (UHL)	Goodlands (GOL)	Agnew (AGW)	Badger Creek (BDC)	Marshy Lake (MYK)		
	Gleyed El. Bl. Chernozem				Hayfield (HYF)	Minto (MTO)					
	Gleyed Rego Bl. Chernozem		Souris (SOU)	Switzer (SWZ)	Hartney (HRY)	Cranmer (CME)	Pipestone (PPT)	Wawanesa (WWS)	Whitewater (WIW)		Coulter (COU)
Poorly	Orthic Humic Gleysol		Bell creek (BEC)		Sanger (SGR)	Naples (NPS)					
	Humic Luvic Gleysol				Orthez (OHZ)	Bunclody (BCY)					
	Rego Humic Gleysol		Oak Lake (OKL)	Plum Lake (PAK)	Emblem (EBL)	Fairfax (FFX)	Cromer (CRM)	Martinville (MNV)	Rebecca (RCC)	Graham (GHM)	Leighton (LGT)

*: Stabilized sand dunes; **: Active sand dunes

Table 4. Soil Series, Drainage and Surface Texture in the Municipality of Souris-Glenwood

Soil name	Soil code	Drainage	Surface texture	Textural group of soil profile within 1 metre	Total area		% of MU
					ha	ac	
Agnew	AGW	Imperfect	Clay	Fine	16	40	0.03
Argue	ARG	Well / Mod Well	Loam	Medium	446	1,101	0.77
Argue ¹	ARG _t	Well / Mod Well	Clay loam	Moderately fine	14	36	0.02
Assiniboine	ASB	Imperfect	Clay or silty clay	Fine	16	40	0.03
Bankton	BAO	Well	Clay or silty clay	Fine	285	705	0.49
Barwood	BWO	Imperfect	Loam to clay loam	Medium to mod. fine	26	65	0.04
Basker	BKR	Poor	Loam to clay loam	Medium to mod. fine	32	79	0.06
Bearford	BEF	Well / Mod Well	Clay loam	Moderately fine	96	237	0.16
Bede	BED	Rapid	Loamy medium sand	Coarse to very coarse	2	5	0.00
Bell Creek	BEC	Poor	Fine sand to loamy fine sand	Coarse	28	70	0.05
Beresford	BSF	Imperfect	Clay loam	Moderately fine	1,324	3,272	2.28
Beresford ¹	BSF _t	Imperfect	Loam	Medium over mod. fine	63	156	0.11
Bermont	BMN	Well / Mod Well	Well / Mod Well	Loam to clay loam	12	29	0.02
Bornett	BOR	Poor	Fine sandy loam	Mod. coarse over very coarse	6	14	0.01
Cactus	CCS	Well / Mod Well	Fine sand to loamy fine sand	Coarse	111	275	0.19
Cameron	CMR	Well / Mod Well	Loam	Medium	1,791	4,427	3.08
Capell	CXT	Imperfect	Loam to clay loam	Medium or mod. fine over very coarse	4	9	0.01
Carroll	CXF	Well / Mod Well	Clay loam	Moderately fine	499	1,234	0.86
Chaucer	CUC	Well / Mod Well	Fine sandy loam	Mod. coarse over medium or mod coarse	32	78	0.05
Chambers	CBS	Well / Mod Well	Clay loam	Moderately fine	470	1,162	0.81
Charman	CXV	Imperfect	Clay loam	Moderately fine	2,167	5,354	3.73
Chater	CXW	Well / Mod Well	Loamy medium sand	Coarse over medium to mod. fine	8	20	0.01
Clementi	CLN	Well / Mod Well	Clay loam	Moderately fine	3,094	7,644	5.32
Clementi ¹	CLN _t	Well / Mod Well	Loam	Medium over mod. fine	49	122	0.08
Coatstone	CSE	Imperfect	Loam to clay loam	Medium to mod. fine	4	10	0.01
Cobfield	CBF	Imperfect	Clay loam	Moderately fine	3,439	8,497	5.91
Cobfield ¹	CBF _t	Imperfect	Loam	Medium over mod. fine	82	203	0.14
Cordova	CVA	Well / Mod Well	Loam to clay loam	Medium to mod. fine	164	404	0.28
Coulter	COU	Imperfect	Clay loam to clay	Mod. fine to fine	14	36	0.02
Cranmer	CME	Imperfect	Clay loam	Moderately fine	268	662	0.46

¹ texture variant.

Table 4. Soil Series, Drainage and Surface Texture in the Municipality of Souris-Glenwood (cont'd)

Soil name	Soil code	Drainage	Surface texture	Textural group of soil profile within 1 metre	Total area		% of MU
					ha	ac	
Croll	CLL	Imperfect	Clay loam	Moderately fine	237	587	0.41
Cromer	CRM	Poor	Clay	Fine	1	3	0.00
Croyon	CYN	Well / Mod Well	Loam to clay loam	Medium or mod. fine over very coarse	7	18	0.01
Dalny	DNY	Well / Mod Well	Loam	Medium	29	72	0.05
Deleau	DLU	Well / Mod Well	Fine sand to loamy fine sand	Coarse	103	254	0.18
Deloraine	DRI	Poor	Loam	Medium	72	178	0.12
Denbow	DBW	Imperfect	Fine sandy loam	Moderately coarse	2,163	5,343	3.72
Denbow [§]	DBW _i	Imperfect	Fine sandy loam	Moderately coarse over medium	123	305	0.21
Desford	DFD	Imperfect	Clay loam	Moderately fine	333	824	0.57
Drokan	DRO	Poor	Loam to clay loam	Medium to mod. fine	34	84	0.06
Dromore	DOM	Well / Mod Well	Loam	Medium over very coarse	18	43	0.03
Druxman	DXM	Imperfect	Loam to clay loam	Medium or mod. fine over very coarse	7	18	0.01
Durnan	DRN	Well / Mod Well	Silt loam or loam	Medium	519	1,283	0.89
Elva	ELV	Well / Mod Well	Clay loam	Moderately fine	416	1,026	0.71
Elva [#]	ELV _c	Well / Mod Well	Clay loam	Moderately fine	13	33	0.02
Emblem	EBL	Poor	Loam to clay loam	Medium to mod. fine	920	2,274	1.58
Everton	EVO	Well / Mod Well	Clay	Fine over medium to mod. fine	15	37	0.03
Fairfax	FFX	Poor	Clay loam	Moderately fine	433	1,069	0.74
Fairland	FND	Well / Mod Well	Loam	Medium	467	1,155	0.80
Forrest	FRT	Imperfect	Clay	Fine over medium to mod. fine	46	114	0.08
Gateside	GTD	Imperfect	Fine sandy loam	Moderately coarse	278	687	0.48
George Lake	GGK	Well / Mod Well	Fine sandy loam	Mod. coarse over very coarse	1	2	0.00
Glenview	GLN	Imperfect	Loam	Medium over coarse	12	30	0.02
Goodlands	GOL	Imperfect	Clay loam	Moderately fine	1,764	4,360	3.03
Graham	GHM	Poor	Loam	Medium	49	120	0.08
Grande-Clairiere	GDC	Rapid	Fine sand to loamy fine sand	Coarse	346	854	0.59
Grayson	GYS	Poor	Loam	Medium over coarse or mod. coarse	8	19	0.01
Grover	GRO	Imperfect	Loam	Medium over coarse or mod. coarse	5	12	0.01

[§] fine loamy substrate variant; [#] classification variant.

Table 4. Soil Series, Drainage and Surface Texture in the Municipality of Souris-Glenwood (cont'd)

Soil name	Soil code	Drainage	Surface texture	Textural group of soil profile within 1 metre	Total area		% of MU
					ha	ac	
Harding	HRG	Imperfect	Clay	Fine	597	1,475	1.03
Hartney	HRY	Imperfect	Loam	Medium	2,225	5,498	3.83
Hayfield	HYF	Imperfect	Loam	Medium	6	14	0.01
Hickson	HKS	Poor	Loam to clay loam	Medium or mod. fine	50	124	0.09
Hilton	HIT	Well / Mod Well	Loam to clay loam	Medium or mod. fine	156	386	0.27
Hummerston	HMO	Imperfect	Fine sand to loamy fine sand	Coarse	308	762	0.53
Janick	JK	Well / Mod Well	Clay	Fine	195	482	0.34
Kemnay	KMY	Well / Mod Well	Fine sandy loam	Moderately coarse	71	176	0.12
Kleysen	KYS	Well / Mod Well	Clay loam	Mod. fine over Medium to mod. fine	342	845	0.59
Langvale	LGV	Well / Mod Well	Fine sandy loam	Mod. coarse over medium to mod. fine	84	208	0.14
Lauder	LUD	Imperfect	Fine sand to loamy fine sand	Coarse	2,057	5,083	3.54
Lavenham	LVH	Imperfect	Fine sand to loamy fine sand	Coarse	524	1,296	0.90
Lavinia	LAV	Imperfect	Loam to clay loam	Medium or mod. fine	31	76	0.05
Leighton	LGT	Poor	Clay loam to clay	Mod. fine to fine	114	281	0.20
Lenore	LNO	Well / Mod Well	Loam to clay loam	Medium to mod. fine	88	218	0.15
Levine	LEI	Imperfect	Loam to clay loam	Medium to mod. fine	81	201	0.14
Liege	LIG	Imperfect	Loam	Medium	204	505	0.35
Lockhart	LKH	Well / Mod Well	Fine sandy loam	Mod. coarse over medium or mod. fine	42	104	0.07
Lowton	LWN	Poor	Clay	Fine	469	1158	0.81
Lyleton	LYT	Well / Mod Well	Fine sandy loam	Moderately coarse	2,050	5,065	3.52
Maon	MON	Well / Mod Well	Fine sandy loam	Moderately coarse	250	617	0.43
Maples	MPS	Well / Mod Well	Fine sandy loam to loam	Mod. coarse to medium over shale	13	31	0.02
Martinville	MNV	Poor	Loam	Medium over coarse	154	379	0.26
Maskawata	MAW	Well / Mod Well	Loam	Medium over medium or mod. fine	147	364	0.25
Melita	MLT	Well / Mod Well	Loam	Medium	23	57	0.04
Mentieth	MNH	Imperfect	Fine sandy loam	Mod. coarse over medium or mod. coarse	9	23	0.02
Miniota	MXI	Well / Mod Well	Sandy loam	Mod. coarse over very coarse	16	38	0.03

Table 4. Soil Series, Drainage and Surface Texture in the Municipality of Souris-Glenwood (cont'd)

Soil name	Soil code	Drainage	Surface texture	Textural group of soil profile within 1 metre	Total area		% of MU
					ha	ac	
Minto	MTO	Imperfect	Clay loam	Moderately fine	1	2	0.00
Montgomery	MOT	Imperfect	Loam	Medium over medium or mod. fine	540	1,334	0.93
Moore Park	MPK	Imperfect	Loam to clay loam	Medium or mod. fine	59	145	0.10
Mountainside	MUE	Imperfect	Fine sandy loam to loam	Mod. coarse to medium over shale	7	17	0.01
Mowbray	MOW	Well / Mod Well	Loam to clay loam	Medium or mod. fine	1	4	0.00
Naples	NPS	Poor	Clay loam	Moderately fine	21	51	0.04
Neelin	NEI	Imperfect	Clay loam to clay	Moderately fine or fine	49	121	0.08
Newdale	NDL	Well / Mod Well	Loam to clay loam	Medium or mod. fine	135	334	0.23
Oak Lake	OKL	Poor	Fine sand to loamy fine sand	Coarse	229	565	0.39
Onahan	ONH	Imperfect	Fine sand to loamy fine sand	Coarse	56	138	0.10
Pipestone	PPT	Imperfect	Clay	Fine	19	47	0.03
Pleasant	PLE	Imperfect	Fine sandy loam	Moderately coarse	672	1,660	1.16
Plum Lake	PAK	Poor	Fine sandy loam	Moderately coarse	799	1,975	1.37
Poolex	POX	Poor	Fine sandy loam	Moderately coarse	912	2,254	1.57
Purple	POR	Well / Mod Well	Fine sandy loam	Moderately coarse	127	315	0.22
Prodan	PDA	Imperfect	Clay loam	Moderately fine	1,494	3,692	2.57
Prosser	PSE	Well / Mod Well	Fine sandy loam	Moderately coarse	130	321	0.22
Ralston	RTO	Imperfect	Fine sand to loamy fine sand	Coarse	139	342	0.24
Ramada	RAM	Well / Mod Well	Clay loam	Moderately fine	1,153	2,848	1.98
Regent	RGT	Imperfect	Loam to clay loam	Medium or mod. fine	11	28	0.02
Rempel	RMP	Well / Mod Well	Clay loam	Moderately fine	152	375	0.26
Rufford	RUF	Well / Mod Well	Loam to clay loam	Medium or mod. fine	247	610	0.42
Ryerson	RYS	Well / Mod Well	Loam to clay loam	Medium or mod. fine	50	123	0.09
Sanger	SGR	Poor	Loam	Medium	7	16	0.01
Scarth	SCH	Well / Mod Well	Fine sand to loamy fine sand	Coarse	314	775	0.54
Schaffner	SFR	Well / Mod Well	Loam	Medium	422	1,043	0.73
Sewell	SEE	Poor	Fine sand to loamy fine sand	Coarse	389	962	0.67
Shilox	SHX	Rapid	Fine sand to loamy fine sand	Coarse	84	207	0.14

Table 4. Soil Series, Drainage and Surface Texture in the Municipality of Souris-Glenwood (cont'd)

Soil name	Soil code	Drainage	Surface texture	Textural group of soil profile within 1 metre	Total area		% of MU
					ha	ac	
Sigmund	SGO	Imperfect	Clay	Fine	240	593	0.41
Souris	SOU	Imperfect	Fine sand to loamy fine sand	Coarse	897	2217	1.54
Stanton	STU	Well / Mod Well	Fine sand to loamy fine sand	Coarse	2,543	6,283	4.37
Stanton ¹	STU _t	Well / Mod Well	Fine sand to loamy fine sand	Coarse over medium to mod fine	40	100	0.07
Stewart	SWR	Well / Mod Well	Loam to clay loam	Medium or mod. fine	25	61	0.04
Stockton	SCK	Well / Mod Well	Fine sand to loamy fine sand	Coarse	597	1,475	1.03
Stockton [#]	SCK _c	Well / Mod Well	Fine sand to loamy fine sand	Coarse	18	44	0.03
Switzer	SWZ	Imperfect	Fine sandy loam	Moderately coarse	1,078	2,664	1.85
Switzer ¹	SWZ _t	Imperfect	Fine sandy loam	Moderately coarse over medium to mod fine	62	154	0.11
Tadpole	TDP	Poor	Clay loam	Moderately fine	766	1,893	1.32
Taggart	TGR	Imperfect	Loam	Medium	882	2,179	1.52
Torcan	TOC	Imperfect	Loam	Medium	738	1,823	1.27
Traverse	TAV	Well / Mod Well	Loam	Medium	103	254	0.18
Two Creeks	TWC	Imperfect	Loam to clay loam	Medium or mod. fine	980	2,420	1.68
Underhill	UHL	Imperfect	Loam	Medium	3,496	8,638	6.01
Varcoe	VRC	Imperfect	Loam to clay loam	Medium or mod. fine	62	153	0.11
Vodroff	VFF	Poor	Clay loam	Mod. fine over Medium or mod. fine	480	1,186	0.83
Vordas	VDS	Poor	Loam or VFSL	Medium	309	764	0.53
Waskada	WKD	Well / Mod Well	Loam	Medium over medium or mod. fine	877	2,168	1.51
Wassewa	WSW	Poor	Clay loam	Mod. fine over medium or mod. fine	12	29	0.02
Wawanesa	WWS	Imperfect	Loam or VFSL	Medium over coarse	152	375	0.26
Wesley	WEL	Imperfect	Loam to clay loam	Medium or mod. fine	44	109	0.08
Woodfield	WDF	Well / Mod Well	Loam to clay loam	Medium or mod. fine	18	45	0.03
Eroded Slope Complex	\$ER	Rapid			1,268	3,134	2.18
Marsh	\$MH	Very poor			156	386	0.27
Water	\$ZZ	-			285	705	0.49
Urban land	\$UR	-			271	669	0.47
Unclassified land	\$UL	-			251	620	0.43
Total					58,153	143,698	100

¹ Coarse over moderately fine texture variant # classification variant.

Part 4 Agricultural Use and Management

Interpretations of Soils

4.1 Introduction

These sections provide predictions for the performance or soil suitability ratings for various land uses, based on soil and landscape characteristics, laboratory data, and on soil behaviour under specified conditions of land use and management. Suitability ratings or interpretations for various land use applications are intended to serve as guides for planners and managers.

The management of soil and landscape data using GIS technology enables rapid and more quantitative analysis of natural soil variability than is possible using manual techniques. The areal distribution of various soil components and properties that occur in complex landscapes can be highlighted in a mapped form and can thereby assist in planning and managing the soil resource. Such single factor maps and interpretative maps illustrate the distribution of individual soil properties and indicate the degree of soil limitation or potential for agricultural use and environmental applications.

A series of derived and interpretive maps are included in this section to assist in the interpretation of the soil resource information for the study area. The GIS uses the 1:20, 000 scale soil map and related soil analysis and landscape information to generate these colour thematic maps.

The maps portray a selection of individual soil properties or landscape conditions for map unit delineations. Combinations of soil properties or landscape features affecting land use and management are derived as specific interpretations. Derived maps portray specific interpretations based on the dominant condition in each map polygon.

Soil properties determine to a great extent the

potential and limitations for both dryland and irrigated agriculture. In this section, interpretive soil information is provided for agricultural land use evaluations such as soil capability for agriculture and irrigation suitability.

4.2 Soil Capability for Agriculture

The soil capability rating for agriculture is based on an evaluation of both the soil characteristics and landscape conditions that influence the soil suitability and limitations for agricultural use (Anon, 1965) (Appendix 1, Section A).

The class indicates the general suitability of the soils for agriculture. The first three classes are considered capable of sustained production of common field crops, the fourth is marginal for sustained arable agriculture, the fifth is suitable only for improved permanent pasture, the sixth is capable of use only for native pasture while the seventh class is for soils and land types considered incapable of use for arable agriculture or permanent pasture.

Soil capability subclasses identify the soil properties or landscape conditions that may limit use or be a hazard. The various kinds of limitations recognized at the subclass level are defined in Section B of Appendix 1.

Class 1 soils in the map area have level to very gently sloping topography; they are deep, well to moderately well drained, have moderate water holding capacity and have no major limitations for crop use.

Class 2 soils have moderate limitations that reduce the choice of crops or require moderate conservation practice. They include the imperfectly drained soils with a wetness limitation (2W) and the well-drained and imperfectly drained soils having a topographic limitation (2T). The two to five per cent slopes associated with the 2T soils may increase cultivation costs over that of a

smooth landscape and increase the risk of water erosion.

Class 3 soils have moderately severe limitations that restrict the range of crops or require moderate conservation practices. These soils usually associate with gently sloping topography (five to nine per cent) resulting in a moderate risk of water erosion.

Class 4 soils have significant limitations that restrict the choice of crops or require special conservation practices. Poorly drained soils with no improvement are grouped in this class. The timing of cultivation or choice of crops is severely limited because of the wetness limitation.

Class 5 soils have very severe limitations that restrict their capability to producing perennial forage crops. This class of soils usually has excess water (5W) or moisture limitation (5M) including the lower depressional areas of the poorly drained soils.

Class 6 soils have an extremely severe limitation due to excess wetness (6W), moisture limitations (6M) or soil erosion (6E), which restricts their capability to producing perennial forage crops.

Class 7 soils have no capability for arable culture. However, these soils may have high capability for native vegetation species and habitat for waterfowl and wildlife.

A guideline table of agriculture capability as affected by soil characteristics and landscape is listed in Table A1 of Appendix 1.

A summary of classification for dryland agriculture capability in the MU of Souris-Glenwood is presented in Table 5. Over 55 per cent of land in the MU is grouped into classes 1 and 2. Class 3 and 5 lands follow, comprising 22 and 9 per cent of the study area, respectively. Class 4 land covers approximately seven per cent of the study area. Classes 6 and 7 account for only three per cent.

The most limiting factor in Class 2 land is excess water (2W, 2IW, 2WT) and topography (2T, 2IT, 2WT, 2MT, 2TD, 2TP), accounting for 30 and 19 percent of the Class 2, respectively. This indicates that imperfectly drained soil with two to five per cent of topography is very common in this MU.

A combined limitation from either limited moisture and excess water (3MW), soil salinity (3N), as well as limited moisture itself (3M) are dominant in Class 3 category.

Class 4 lands in the study area predominantly consists of sandier soil texture, which limits crop production considerably. This sandier (4M and 4MT) soil is approximately seven per cent of the study area.

Class 5 lands are predominantly grouped as 5W, attributed by poorly drained soils in the study area. Topography and erosion are the main limiting factors in the Class 6 land.

It is evident that approximately two-thirds of land are impacted by either excess water (W) or moisture limitation (M) in this MU.

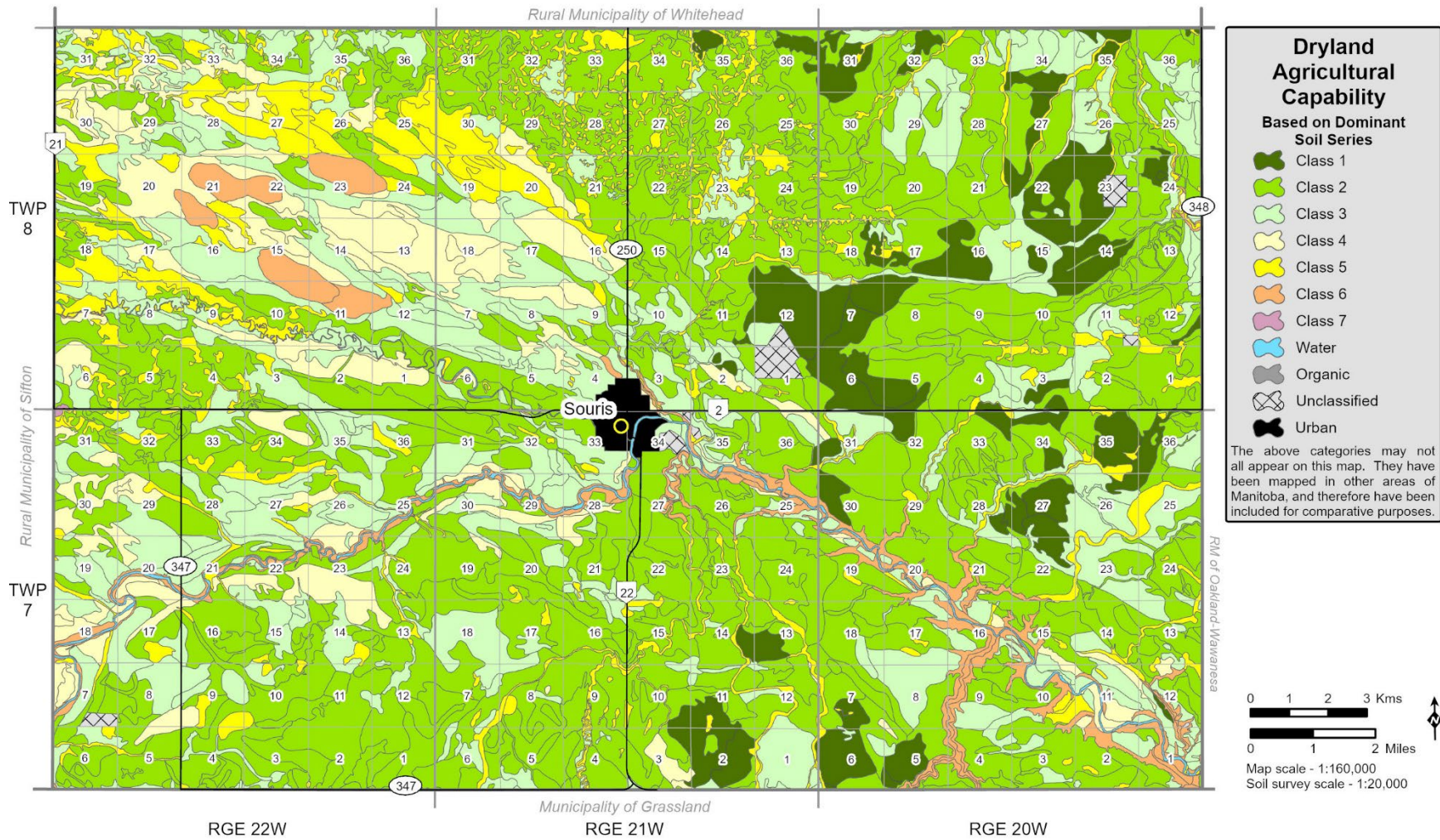
An interpretative map (Map 4) depicts the rating of the dominant soil series and landscape features for each polygon. The nature of the subclass limitations and the ratings of subdominant soil and landscape components are not shown at the scale of this map, but they are detailed in Table A2 of Appendix 1. A poster-sized agricultural capability map (1:20,000) is also included with this report.

Map 4 indicates that most Class 1 and Class 2 lands are distributed in the southern and northeastern areas of the MU, particularly in TWP 8 RNG 20 W1 and TWP 7 RNG 21 W1.

Table 5. Agriculture Capability of Land in the Municipality of Souris-Glenwood

Agricultural Capability Class	Total area		% of MU	
	ha	ac		
1	3,127	7,726	5.38	
2	2D	17	41	0.03
	2I	4	10	0.01
	2IT	14	34	0.02
	2IW	14	36	0.02
	2M	2,635	6,512	4.53
	2MT	1,422	3,515	2.44
	2T	5,167	12,767	8.88
	2TD	269	664	0.46
	2TP	16	40	0.03
	2W	13,033	32,206	22.41
	2WT	4,351	10,752	7.48
	2X	2,610	6,449	4.49
Subtotal	29,553	73,026	50.82	
3	3I	283	700	0.49
	3IN	53	130	0.09
	3IT	17	42	0.03
	3M	2,302	5,689	3.96
	3MN	54	134	0.09
	3MT	384	948	0.66
	3MW	3,715	9,181	6.39
	3N	4,098	10,125	7.05
	3NW	66	164	0.11
	3T	1,278	3,158	2.20
	3W	725	1,791	1.25
Subtotal	12,976	31,849	22.32	
4	4M	3,686	9,109	6.34
	4MT	210	519	0.36
	4N	147	363	0.25
	4R	12	30	0.02

	4RT	8	19	0.01
	4T	215	530	0.37
	4W	80	198	0.14
Subtotal		4,358	10,768	7.49
5	5IW	194	480	0.33
	5M	42	103	0.07
	5N	4	9	0.01
	5T	14	36	0.02
	5W	5,224	12,908	8.98
Subtotal		5,478	13,536	9.42
6	6E	960	2,373	1.65
	6ET	196	485	0.34
	6M	430	1,062	0.74
	6NW	1	2	0.00
	6T	110	271	0.19
Subtotal		1,697	4,193	2.92
7	7T	2	5	0.00
	7W	156	386	0.27
Subtotal		158	391	0.27
Unclassified, urban and water		807	1,994	1.39
Grand Total		58,153	143,698	100



Map 4. Dryland Agricultural Capability Map of the Municipality of Souris-Glenwood.

4.3 Irrigation Suitability

The rating guidelines in this section are derived from "An Irrigation Suitability Classification System for the Canadian Prairies" (ISC, 1987). The irrigation suitability rating of the soils is based on soil and landscape characteristics. It does not consider factors such as method of water application, water availability, water quality or economics of this type of land use.

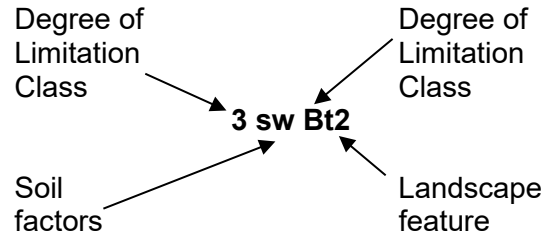
Soil properties considered important for evaluating irrigation suitability are texture, soil drainage, depth to water table, salinity and geological uniformity.

Landscape features considered important for rating irrigation suitability are topography and stoniness.

The irrigation suitability of the soil and landscape characteristics in the study area assist in making initial irrigation plans. The next step involves on-site field investigation to examine the depth to water table, salinity and geological uniformity to a depth of 3 m. Drainability, drainage outlet requirement, organic matter status and potential for surface crusting are other factors to consider. This assessment also considers potential impact of irrigation on non-irrigated areas as well as on the irrigated area.

The most limiting soil property and landscape feature are combined to determine the placement of a land area in one of 16 classes of irrigation suitability, which are grouped and described by four ratings: **Excellent, Good, Fair** and **Poor**. (Table A3 of Appendix 1). The guidelines of assessing irrigation suitability are listed in Table A4 and A5 of Appendix 1, respectively.

An example of an irrigation suitability class rating with subclass limitations is shown:



A maximum of three codes is used to identify the subclass rating. Salinity (s) and drainage class (w) are soil factors that contribute to the soil rating of 3 or Moderate. The landscape limitation due to complex topography (t2) is Slight or (B). As the soil factor (3 or Moderate) is more limiting than the landscape feature (B or Slight), the general rating for this land area (3B) is fair (Appendix 1, Table A3 to A5).

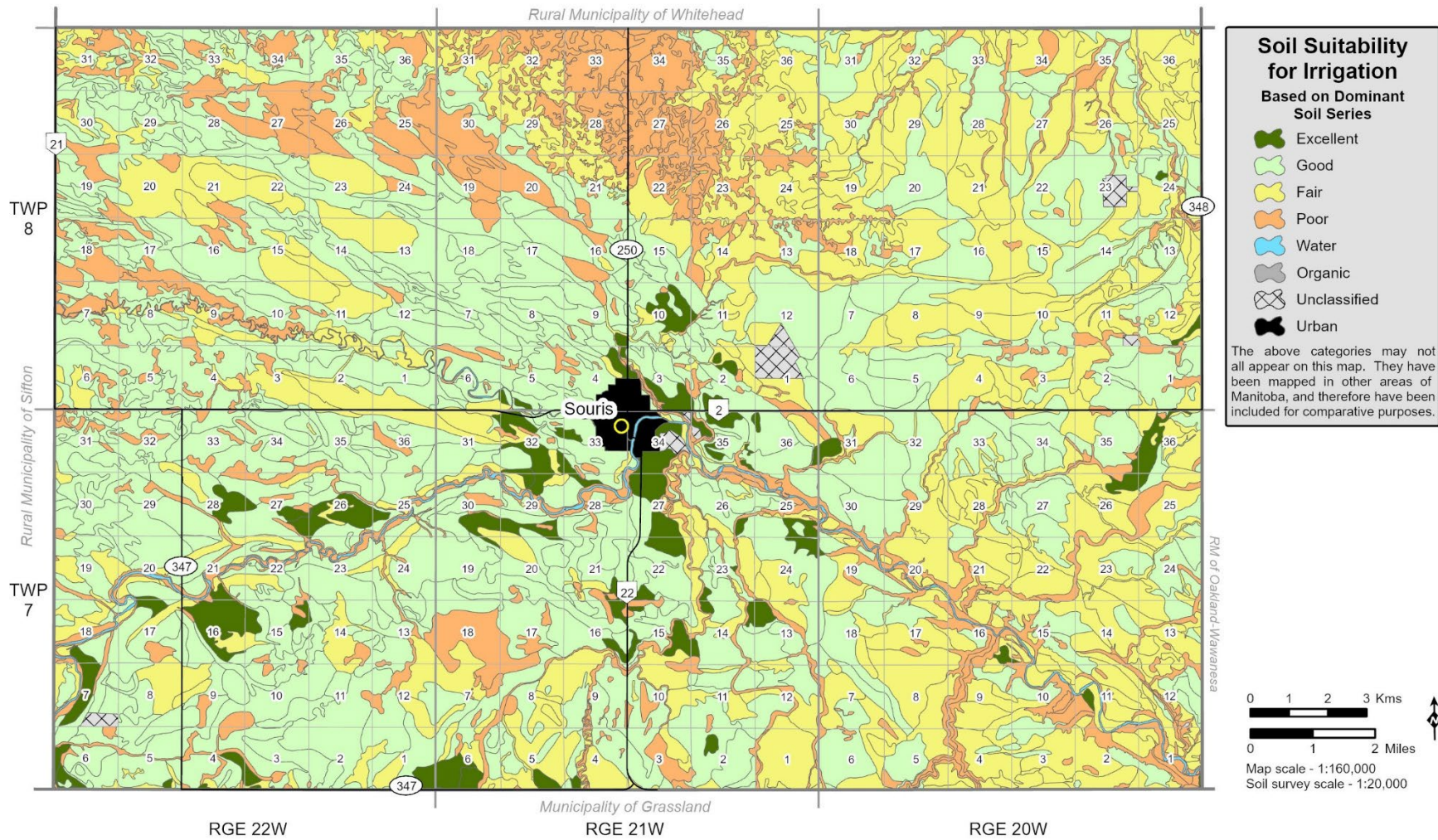
A summary of soils and their interpretive classification for irrigation suitability is presented in Table 6. The subdominant soil series and phases are considered when analyzing the data. Approximately three per cent of lands in the MU of Souris-Glenwood are excellent for irrigation project development; 48 per cent of the lands are classified as good. In this class, well or moderately well drained soil (2w A) and relatively flat topography (1 Bt2) are attributed most to this class. The fair class lands account for 30 per cent. Imperfectly drained soils (3w A) are the major factor attributing to this class. Approximately 16 percent of the study area is poorly suited for irrigation. Poorly drained conditions (4w A), low water holding capacity with severe topography limitation (4m Dt2) and heavier texture (4kx Bt2) in the poor class are the main limiting factors for irrigation suitability.

An interpretative map (Map 5) illustrates the rating of the dominant soil series and landscape features for each polygon. It shows that most lands in the southwestern portion of the MU are suitable for irrigation. Lands in fair class are primarily in the eastern areas of the Municipality (MU) of Souris-Glenwood.

Table 6. Soil Irrigation Suitability in the Municipality of Souris-Glenwood

Class (%)	Soil & landscape features	Total area		% of MU
		ha	ac	
Excellent	1 A	2,062	5,095	3.55
Good	1 Bt2	3,529	8,721	6.07
	2gm A	11	27	0.02
	2k A	1,123	2,774	1.93
	2kx A	3,426	8,465	5.89
	2m A	562	1,388	0.97
	2mw A	2,461	6,082	4.23
	2w A	7,359	18,184	12.65
	2x A	42	104	0.07
	2gm Bt2	7	17	0.01
	2k Bt2	814	2,011	1.40
	2kx Bt2	1,987	4,910	3.42
	2m Bt2	2,215	5,473	3.81
	2mw Bt2	1,449	3,580	2.49
	2w Bt2	3,157	7,800	5.43
	2x Bt2	18	44	0.03
	Subtotal		28,158	69,580
Fair	1 Ct2	793	1,959	1.36
	2gm Ct2	7	18	0.01
	2k Ct2	307	760	0.53
	2kx Ct2	578	1,428	0.99
	2m Ct2	966	2,387	1.66
	2mw Ct2	17	42	0.03
	2w Ct2	37	91	0.06
	2x Ct2	66	164	0.11
	3kw A	1	2	0.00
	3s A	1,213	2,996	2.09
	3sw A	2,563	6,333	4.41
	3w A	7,848	19,393	13.50
	3kw Bi	16	40	0.03
	3m Bt2	12	29	0.02
	3s Bt2	118	291	0.20
	3sw Bt2	215	532	0.37
	3sw Bt2i	37	91	0.06
	3w Bi	34	85	0.06
	3w Bt2	2,175	5,375	3.74

	3w Bt2i	249	615	0.43
	3m Ct2	418	1,033	0.72
	3sw Ct2	28	70	0.05
	3w Ct2	60	147	0.10
Subtotal		17,757	43,878	30.54
Poor	1 Dt2	6	16	0.01
	2kx Dt2	8	20	0.01
	4gm Bt2	8	20	0.01
	4k A	40	98	0.07
	4k Bt2	21	52	0.04
	4kw A	459	1,134	0.79
	4kw Bt2	11	27	0.02
	4kx A	489	1,209	0.84
	4kx Bt2	877	2,168	1.51
	4m Ct2	112	277	0.19
	4m Dt2	1,190	2,940	2.05
	4r Bt2	12	30	0.02
	4r Ct2	8	19	0.01
	4s A	107	265	0.18
	4s Bt2	44	108	0.08
	4sw A	62	152	0.11
	4w A	4,925	12,169	8.47
	4w Bt2	640	1,581	1.10
	4w Ci	194	480	0.33
	4wx Di	156	386	0.27
Subtotal		9,369	23,150	16.11
Unclassified land, urban and water		807	1,994	1.39
Grand Total		58,153	143,698	100



Map 5. Irrigation Suitability Map of the Municipality of Souris-Glenwood.

4.4 Soil Suitability for Irrigated Potato Production

An evaluation of soil properties and landscape features was used to generate a five-class rating of land for irrigated potato production. Soil properties considered are texture, soil drainage, salinity and sodicity. Landscape features considered are topography and stoniness. The most suitable soil and landscape conditions occur in **Class 1** and the least desirable conditions occur in **Class 5**. Details regarding the criteria applied in the suitability rating are described in Tables A6 and A7 of Appendix 1.

Assumptions:

This evaluation examines soil and landscape factors that are important for irrigated production of potatoes for processing. Production of seed and table potatoes with irrigation may not be impacted to the same degree by soil conditions such as stoniness and texture.

Stoniness hinders soil preparation, interferes with harvesting and increases the chances of potato bruising during harvest.

Deep, well-drained sandy loam to loam soils exhibit favourable properties for the production of high-quality potatoes. Clay soils with impeded internal soil drainage have a severe limitation to potato production because of reduced oxygen supply and increased incidence of fungal diseases. An increased risk of delayed spring tillage and planting and crop harvesting due to wet conditions can occur on fine textured soils.

Slope or topography reduces uniform water infiltration and increases the potential for soil erosion and nutrient loss.

This evaluation of soil and landscape properties does not incorporate additional factors that must be assessed for sustainable irrigated production of potatoes.

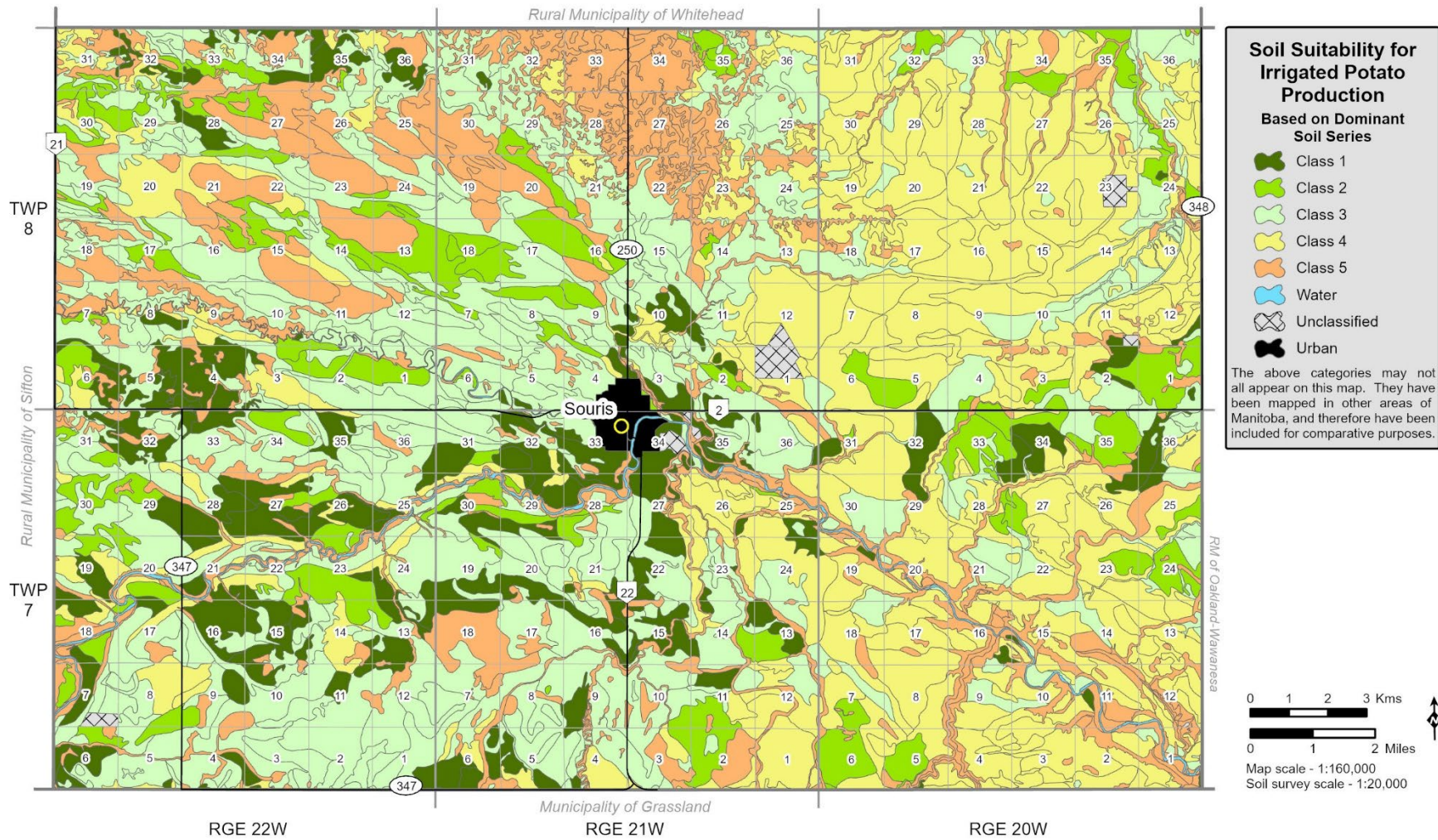
The environmental impact of intensive management practices on soil and water quality, the supply of good quality water and the suitability of climatic conditions for optimum potato production must all be evaluated.

Integration of related databases in a GIS environment can be used to create a map that depicts the rating of the dominant soil and landscape feature for each soil polygon. The nature of the subclass limitations and the rating of subdominant soil and landscape components are not shown at this scale but are indicated in Table A2 of Appendix 1. An interpretative map (Map 6) illustrates the rating of the dominant soil series and landscape features for each polygon.

Approximately 18 per cent of soils in the MU of Souris-Glenwood are well suited for potato production (Class 1 & 2) (Table 7). Class 3 land makes up 35 per cent of the land in Souris-Glenwood. Approximately 28 and 18 per cent of the land are Class 4 and 5 soils respectively and these are not suitable for potato production, primarily due to soil moisture, topography and texture limitations.

Table 7. Soil Irrigation Suitability for Potato Production in the Municipality of Souris-Glenwood

Potato Suitability Class	Total area		% of MU
	ha	ac	
Class 1	5,602	13,842	9.63
Class 2	4,729	11,687	8.13
Class 3	20,482	50,611	35.22
Class 4	16,119	39,830	27.72
Class 5	10,414	25,734	17.91
Water, urban & unclassified	807	1,994	1.39
Total	58,153	143,698	100



Map 6. Soil Suitability for Irrigated Potato in the Municipality of Souris-Glenwood.

4.5 Soil Texture

Mineral particles in soil are grouped according to size into sand (2 - 0.05 mm in diameter), silt (0.05 - 0.002 mm) and clay (less than 0.002 mm). The proportion of individual mineral particles present in a soil is referred to as texture. Soil texture is described by means of 13 textural classes defined according to the relative proportions of sand, silt and clay (Figure 6). The presence of larger particles (diameter is greater than 2 mm) in soil is recognized as:

gravelly - particles ranging from 0.2 to 7.5 cm in diameter

cobbly - rock fragments ranging from 7.5 to 25 cm in diameter

stony - rock fragments ranging from 25 to 60 cm in diameter, or if flat, 38 to 60 cm long.

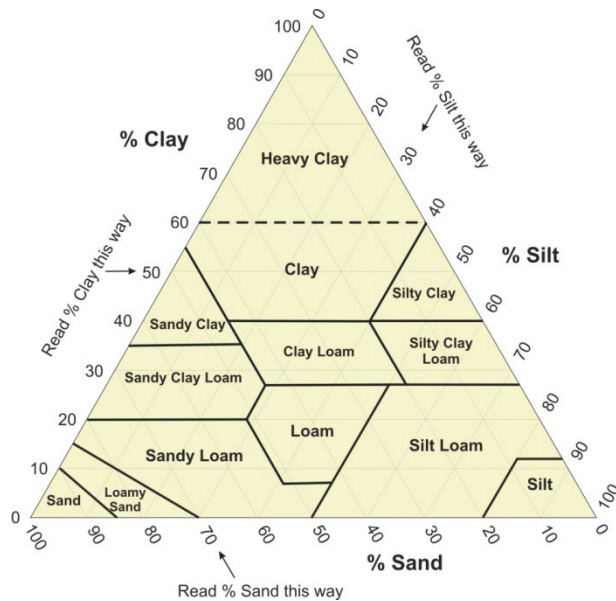


Figure 6. Soil Texture Triangle

Soil texture strongly influences the soil's ability to retain moisture, soil fertility and ease or difficulty of cultivation. Water moves easily

through coarse-textured (sandy) soils, so little moisture is retained and they dry out more quickly than fine textured (clay) soils. Sandy soils do not retain plant nutrients as well as clay soils and are lower in natural fertility. Sandy soils are often characterized by loose or single grained structure, which is very susceptible to wind erosion. Clay soils have a high proportion of very small pore spaces, which hold moisture tightly and are usually fertile because they are able to retain plant nutrients. Clay soils transmit water very slowly; therefore, these soils are susceptible to excess soil moisture conditions. Textural class names are grouped as coarse, medium and fine (Table 8).

Table 8. Soil Texture Group

Texture group	Texture		
	Class	Symbol	
Coarse	Very coarse	Very coarse sand	VCoS
		Coarse sand	CoS
		Medium sand	S
	Coarse	Fine sand	FS
		Loamy coarse sand	LCoS
		Loamy sand	LS
		Loamy fine sand	LFS
	Mod. coarse	Very fine sand	VFS
		Loamy very fine sand	LVFS
		Coarse sandy loam	CoSL
Medium	Medium	Sandy loam	SL
		Fine sandy loam	FSL
		Very fine sandy loam	VFSL
		Loam	L
	Medium	Silt loam	SiL
		Silt	Si
		Silty loam	SiLo
Fine	Mod. fine	Sandy clay loam	SCL
		Clay loam	CL
		Silty clay loam	SiCL
	Fine	Sandy clay	SC
		Silty clay	SiC
		Clay	C
	Very fine	Heavy clay	HC

Particle analysis showed that among 320 soil samples collected from A horizon in the study area, medium and moderately fine soil texture accounts for 39 and 32 per cent respectively. Loam and clay loam each account for approximately 25 and 21 per cent respectively (Table 9). Detailed mechanical analysis is shown in Table 18. Lab data present in Table 9 and 18 does not include soil samples from the Souris townsite report (Podolsky, G., 1985).

Table 9. Lab Results of Soil Surface Texture in the Municipality of Souris-Glenwood

Texture		# of samples	% of total
Very coarse (0.0%)	S	--	--
Coarse (10.31%)	FS	12	3.75
	LFS	21	6.56
	LS	--	--
Mod. coarse (14.69%)	FSL	45	14.06
	SL	2	0.63
Medium (39.06%)	L	81	25.31
	Si	--	--
	SiL	25	7.81
	VFSL	19	5.94
Mod. fine (31.56%)	CL	66	20.63
	SCL	9	2.81
	SiCL	26	8.13
Fine (4.38%)	C	10	3.13
	SiC	4	1.25
Total		320	100

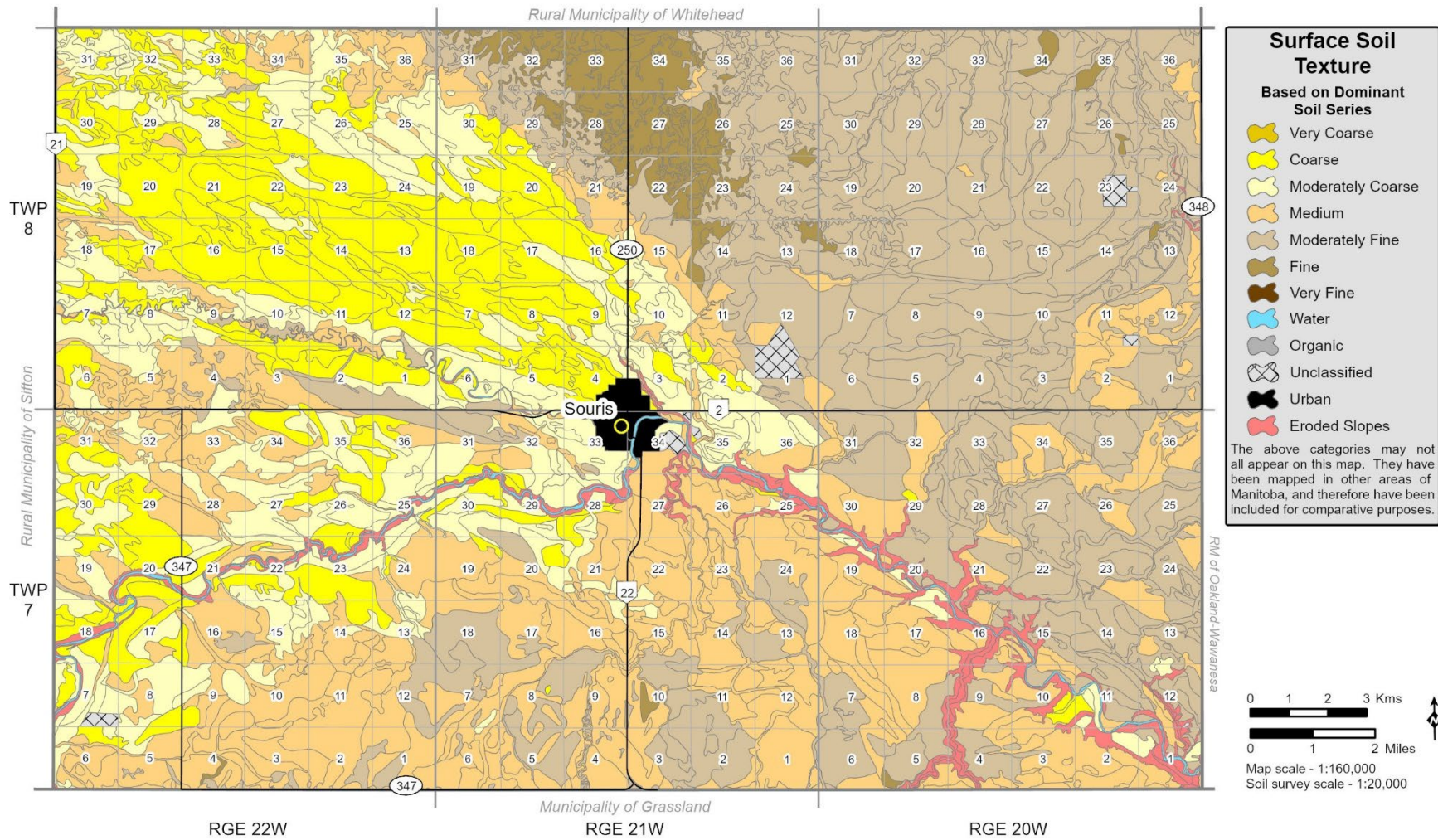
Based on soil polygons, the different texture groups and their proportions in terms of land area in the MU of Souris-Glenwood are listed in Table 10. Soil textures determined in the laboratory and those delineated from soil polygons show a similar trend with

approximately 35 per cent of soils having a moderately fine texture (CL, SiCL, SCL) and 28 per cent having a medium texture (L, SiL, VFSL).

Table 10. Soil Surface Texture and Their Proportions in the Study Area

Texture group	Texture	Total area		% of MU
		ha	ac	
Very coarse (0.0%)	S	--	--	--
Coarse (15.17%)	FS	84	207	0.14
	LFS	7,986	19,734	13.73
	LS	755	1,865	1.30
Mod. coarse (15.14%)	FSL	3,432	8,480	5.90
	LVFS	5,354	13,231	9.21
	SL	16	38	0.03
Medium (28.28%)	L	14,548	35,950	25.02
	SiL	931	2,301	1.60
	VFSL	965	2,386	1.66
Mod. fine (34.55%)	CL	20,050	49,545	34.48
	SCL	11	28	0.02
	SiCL	32	79	0.06
Fine (3.29%)	C	1,596	3,944	2.74
	SiC	317	783	0.55
Unclassified, eroded slope, urban & water		2,075	5,128	3.57
Total		58,153	143,698	100

Surface soil texture shown in Map 7 illustrates the textural group of the dominant soil for each polygon.



Map 7. Soil Surface Texture in the Municipality of Souris-Glenwood.

4.6 Soil Drainage

Soil drainage refers to the frequency and duration of periods when the soil is free of saturation. Excessive water content in soil limits the free movement of oxygen and decreases the efficiency of nutrient uptake. Delays in spring tillage and planting are more frequent in depressional or imperfectly to poorly drained areas of a field. Improved surface drainage and subsurface tile drainage are management considerations that can reduce excessive moisture conditions in soils. The majority of poorly drained soils remain in the native state supporting vegetation associated with wetlands and marsh. Five soil drainage classes are described below.

Rapidly drained - water is quickly removed from the soil in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow can occur on steep slopes during heavy rainfall. Soils have low water storage capacity and are usually coarse in texture.

Well-drained - excess water is removed from the soil, flowing downward readily into underlying pervious material or laterally as subsurface flow.

Imperfectly drained - water is removed from the soil, sufficiently slowly, in relation to supply to keep the soil wet for a significant part of the growing season. The source of moisture includes precipitation or groundwater.

Poorly drained - water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time when the soil is not frozen. The main water source is subsurface flow or groundwater in addition to precipitation.

Very poorly drained - water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time that the soil is not frozen. Excess water

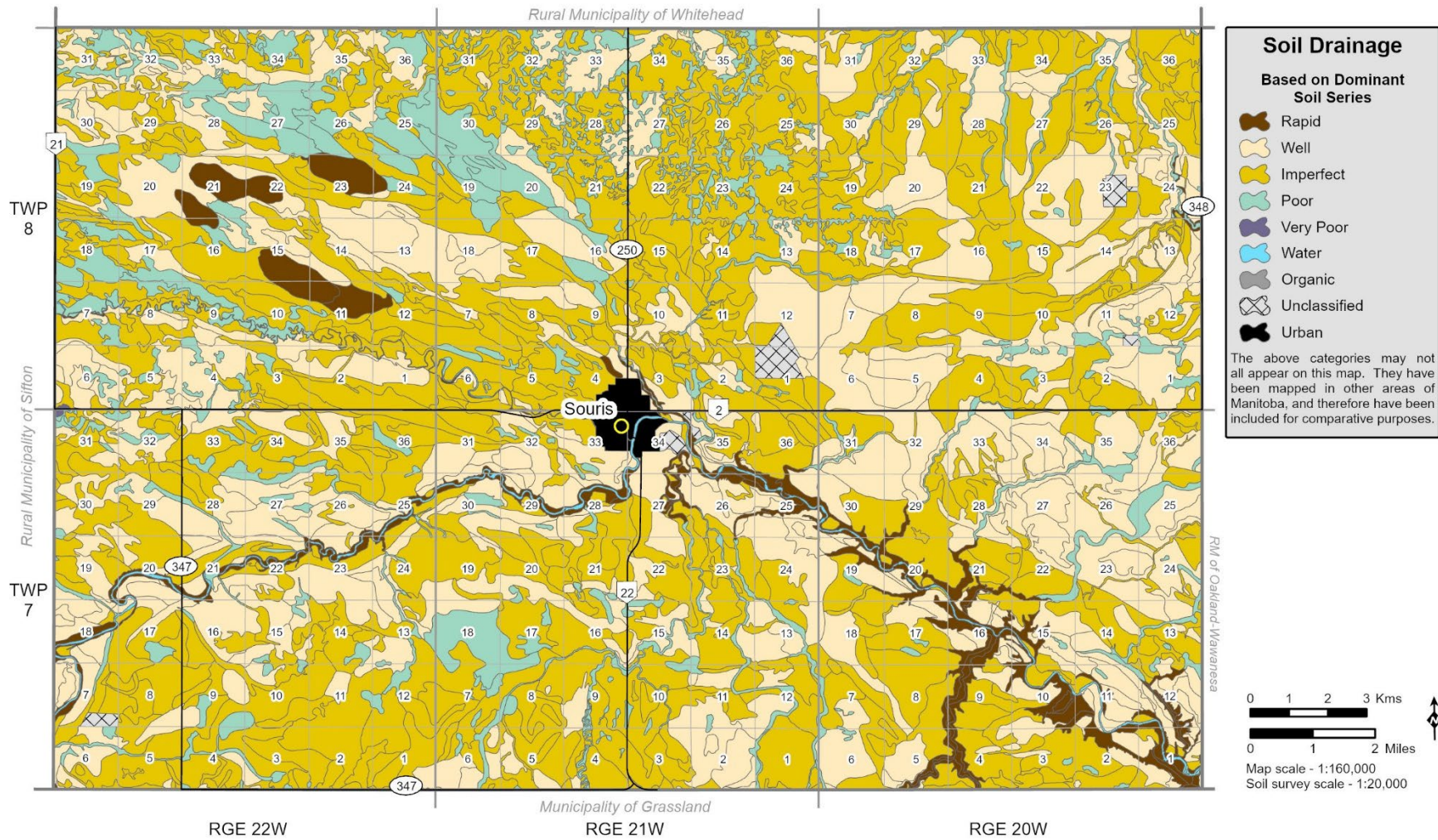
is present in the soil throughout most of the year.

Soil drainage in Table 11 indicates that approximately 36 per cent of the soils in the MU of Souris-Glenwood are moderately well, well and rapidly drained. The imperfectly drained soils comprise 52 per cent of the lands. The poorly and very poorly drained soils in the MU account for approximately 11 per cent.

Table 11. Soil Drainage Classes in the Municipality of Souris-Glenwood

Drainage Class	Total area		% of MU
	ha	ac	
Rapid	1,732	4,279	2.98
Mod. Well / Well	19,056	47,089	32.77
Imperfect	30,111	74,406	51.78
Poor	6,290	15,544	10.82
Very poor	156	386	0.27
Water, urban & unclassified	807	1,994	1.39
Total	58,153	143,698	100

Soil drainage for the study area is presented in Map 8 and shows that imperfectly and moderately well to well-drained soils are spread evenly across the MU. Rapidly drained soils are mainly found in TWP 8 RNg 22 W1 and along the Souris River. The poorly drained soils are found mainly in depressional areas in the landscape with a large portion of the poorly drained soils located in TWP 8 RNg 22 and 21 W1.



Map 8. Soil Drainage in the Municipality of Souris-Glenwood.

4.7 Soil Erosion

Erosion is defined as the detachment and movement of soil particles by water, wind, ice or gravity. Soil erosion by water is the main concern on undulating and hummocky soil landscapes in the agricultural region of Manitoba. Soil loss resulting from rainfall-runoff is usually due to combinations of raindrop splash, sheet, and rill, gully and channel bank erosion. Sheet and rill erosion are usually least apparent in the landscape, but often the most damaging since they cause gradual thinning of the soil profile over the entire slope. Sheet erosion tends to occur on upper slopes and ridges, whereas the more visible rills form in the area of concentrated runoff on mid and lower slopes. The deposition of eroded soil at the base of slopes or in ditches constitutes additional losses and costs attributed to erosion.

Wind erosion has its largest influence on sandy (coarse) textured, cultivated soils on relatively level landscapes. However, all soils are subject to wind erosion if vegetation or crop residues do not cover the soil surface. Continuous cropping and minimum or zero tillage to maximize residue cover will reduce the risk of erosion. Row crops such as potatoes produce low amounts of residue, therefore seeding annual crops, such as fall rye and winter wheat, will help to protect the soil surface during the critical post harvest period until the establishment of groundcover the following spring.

The impact of soil erosion on soil loss and productivity is not easily measured. In addition to nutrient loss from soil erosion, there is physical deterioration of the soil resulting in lower water holding and infiltration capacity, and poorer surface structure. Crops are thus susceptible to more frequent and severe water stress and lower crop yields occur.

The ratings of soil erosion are generally classified into three classes.

Slightly eroded - soil with a sufficient amount of the A horizon removed that ordinary tillage will bring up and mix the B-horizon or lower horizons.

Moderately eroded - soil with the entire A horizon and a part of the B or lower horizons removed.

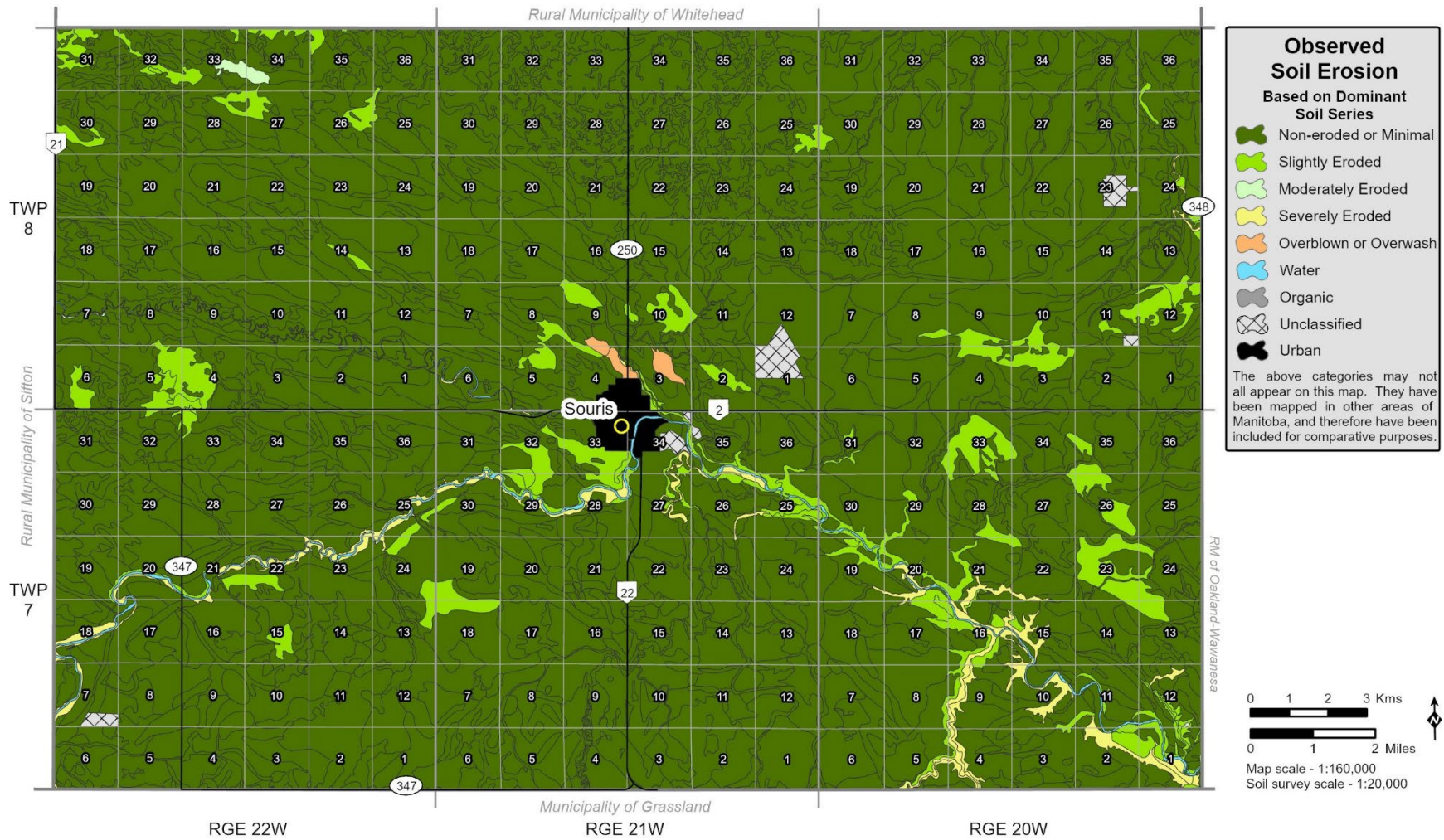
Severely eroded - soils which have practically all of the original surface soil removed and the tilled layer consists mainly of C-horizon material. This condition occurs on knolls and steep upper slope positions.

In general, soil erosion in the MU of Souris-Glenwood is not severe. Approximately, 93 per cent of the study area has minimal or non-eroded lands (Table 12). The slightly eroded areas comprise four per cent and moderate to severely eroded lands comprise a small proportion of the lands.

Table 12. Soil Erosion Classes in the Municipality of Souris-Glenwood

Observed Erosion Class	Total area		% of MU
	ha	ac	
Non-eroded or minimal	54,012	133,465	92.88
Slightly	2,559	6,324	4.40
Moderately	39	97	0.07
Severely	657	1,624	1.13
Overblown / Over wash	79	194	0.14
Water, urban & unclassified	807	1,994	1.39
Total	58,153	143,698	100

The degree of observed soil erosion shown on Map 9 is based on the dominant soil for each polygon. Slightly eroded soils are scattered in the MU and moderately to severely eroded soils located along the Souris River eroded slope complexes.



Map 9. Soil Erosion Observed in the Municipality of Souris-Glenwood.

4.8 Topography

Slope describes the steepness of the landscape surface. The degree and length of slope are important topographic factors affecting the potential for surface runoff and infiltration of precipitation.

Ten slope classes are used to denote the dominant but not necessarily most severe slopes within a mapping unit (Table 13).

Table 13. Slope Classes Used in Soil Map

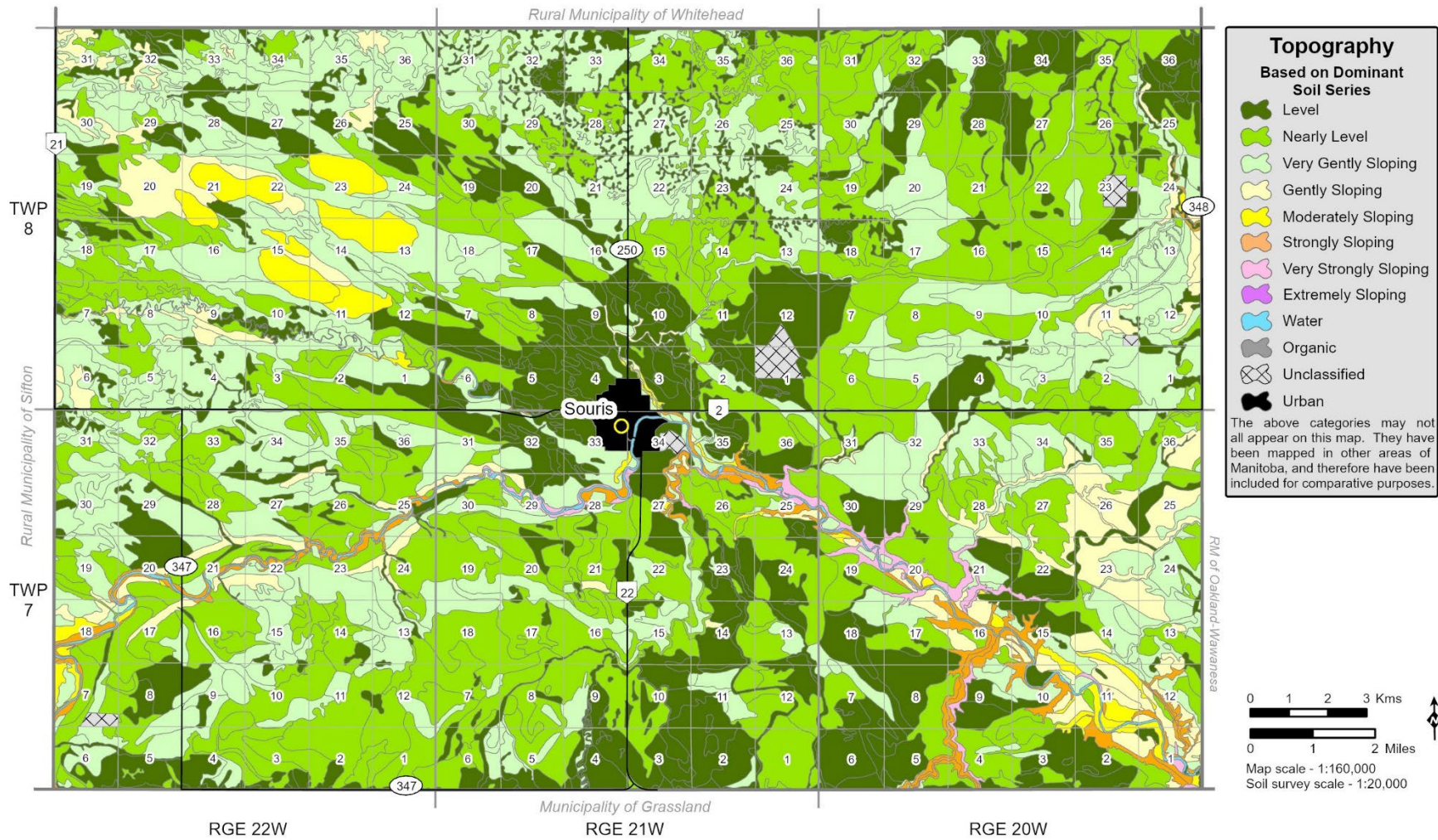
Slope Class	Slope Description	% Slope
x	Level	0 - 0.5
b	Nearly level	> 0.5 - 2
c	Very gently sloping	> 2 - 5
d	Gently sloping	> 5 - 9
e	Moderately sloping	> 9 - 15
f	Strongly sloping	> 15 - 30
g	Very strongly sloping	> 30 - 45
h	Extremely sloping	> 45 - 70
i	Steeply sloping	> 70 - 100
j	Very steeply sloping	> 100

Because surface deposits of the MU of Souris-Glenwood are predominantly from the Lake Souris Basin, land in the study area is relatively level to nearly level and represents approximately 60 per cent of the study area (Table 14). Very gentle slopes account for another 30 per cent. Steep slopes are not common in this MU and generally only occur near the Souris River.

Table 14. Topography observed in the Municipality of Souris-Glenwood

Topography (slope classes)	Total area		% of MU
	ha	ac	
x	13,726	33,918	23.60
b	21,350	52,756	36.71
c	17,704	43,746	30.44
d	2,445	6,042	4.20
e	917	2,267	1.58
f	896	2,215	1.54
g	306	756	0.53
h	2	5	0.00
Water, urban & unclassified	807	1,994	1.39
Total	58,153	143,698	100

Topography classes shown on Map 10 are based on the dominant soil for each polygon. The majority (90 per cent) of the MU of Souris-Glenwood is level to very gently sloping i.e. slopes are less than five per cent. Relatively steeper slopes such as moderately sloping to extremely sloping are mainly observed in the northwest township and along the Souris River.



Map 10. Topography of the Municipality of Souris-Glenwood.

4.9 Stoniness

Soils with stones can hinder tillage, planting and harvesting operations. The degree of stoniness is described by five classes. Class 1 stoniness is not considered a limitation for soil capability since there is little or no hindrance to cultivation and clearing is generally not required. Although stone clearing can be a mechanized procedure, it presents a management cost that does not occur in non-stony soils.

As aforementioned, stones are 25 to 60 cm in diameter, or if flat, 38 to 60 cm long. The classes of stoniness are defined as follows:

Stones 0 (x). (Non-stony) - Land having less than 0.01 per cent of surface occupied by stones.

Stones 1. (Slightly stony) - Land having 0.01 to 0.1 per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter and 10 to 30 m apart. The stones offer only slight to no hindrance to cultivation.

Stones 2. (Moderately stony) - Land having 0.1 to 3 per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter and 2 to 10 m apart. Stones cause some interference with cultivation.

Stones 3. (Very stony) - Land having three to 15 per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter and 1 to 2 m apart. There are sufficient stones to constitute a serious handicap to cultivation.

Stones 4. (Exceedingly stony) - Land having 15 to 50 per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter and 0.7 to 1.5 m apart. There are sufficient stones to prevent cultivation until considerable clearing has been done.

Stones 5. (Excessively stony) - Land having more than 50 per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter

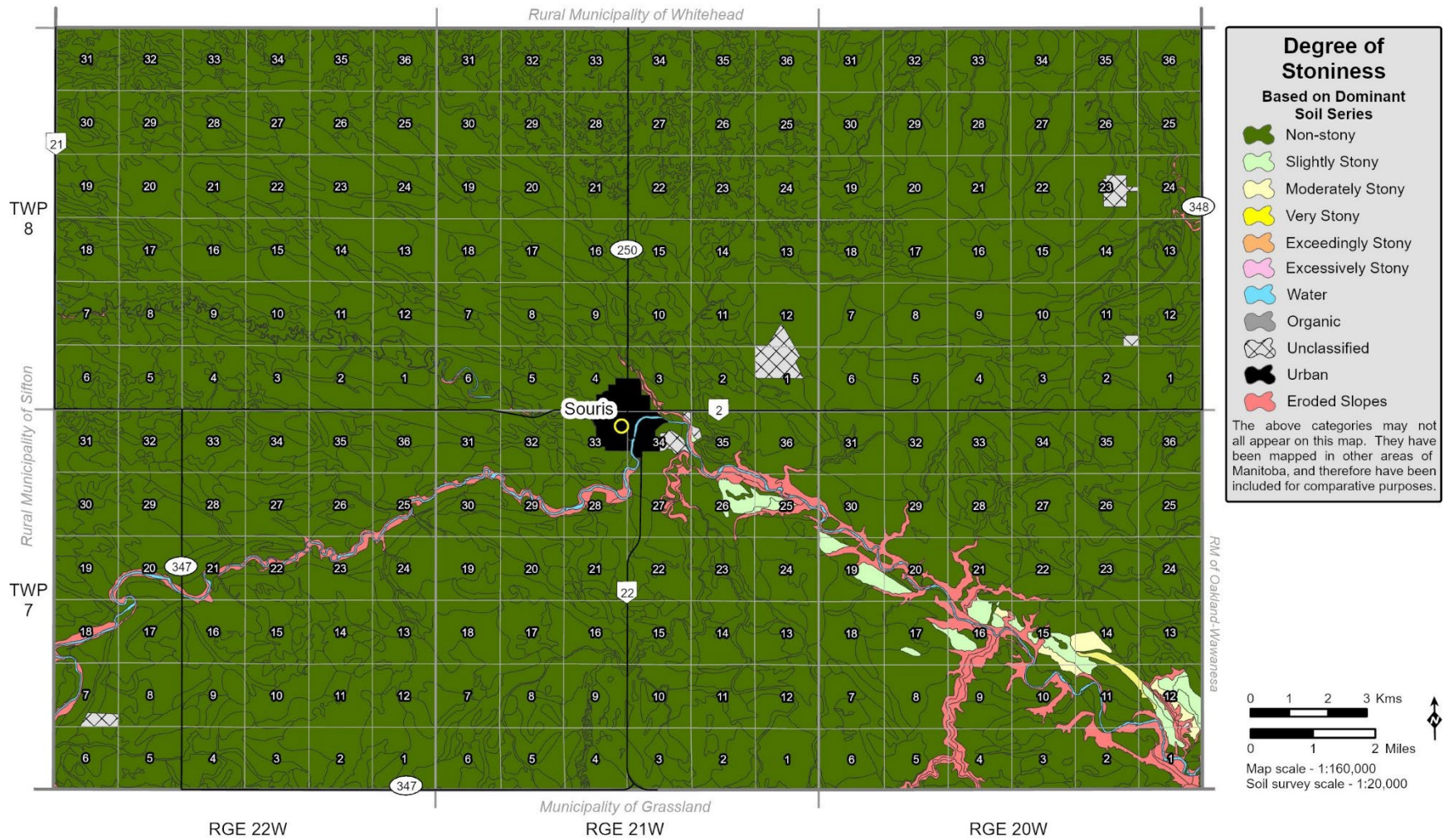
and less than 0.7 m apart. The land is too stony to permit cultivation until considerable clearing has occurred.

Lands in the MU of Souris-Glenwood are not considered stony, as approximately 96 per cent of the lands fall into the non-stony category (Table 15). Slightly to very stony soils account only for roughly one per cent of the study area.

Table 15. Stoniness Classes in the Municipality of Souris-Glenwood

Degree of Stoniness	Total area		% of MU
	ha	ac	
Non-stony	55,614	137,425	95.63
Slightly stony	354	875	0.61
Moderately stony	82	204	0.14
Very stony	27	66	0.05
Eroded slope, water, urban, & unclassified	2,075	5,128	3.57
Total	58,153	143,698	100

The degree of stoniness shown on Map 11 is based on the dominant soil for each polygon. In general, lands in the MU of Souris-Glenwood are non-stony. Some previous stony fields have been improved as producers have been removing stones from their fields since the early 1970s. Some slightly stony to moderately stony lands are observed in TWP 7 RNG 20 W1 near the Souris River.



Map 11. Degree of Stoniness of the Municipality of Souris-Glenwood.

4.10 Soil physical and chemical properties

4.10.1 Salinity

Saline soils have a high concentration of soluble salts. The salts include sodium sulphate, magnesium sulphate, calcium sulphate, sodium chloride, magnesium chloride, calcium chloride and others.

The primary effect of salts in soils is the deprivation of water to plants. If the soil solution becomes too high in salts, the plants slowly starve, though the supply of water and dissolved nutrients in the soil may be sufficient.

In saline soils, crops usually grow poorly or not at all. At certain times of the year, the salts may precipitate out on the surface of the soil, leaving a white crust. Generally, plants which are affected by soil salinity have a bluish-green appearance. Common field weeds such as Russian Thistle, Kochia, Wild Barley and Foxtail often occur in areas of high salt concentration. In uncultivated areas, plants such as Samphire, Desert Salt Grass and Greasewood are frequently dominant species (Henry et al, 1987).

Soil salinity is difficult to manage because it is influenced by soil moisture conditions. In wet years, there is sufficient leaching and dissolving of salts so that salts are not visible on the surface and some crop growth may be possible. In dry years, increased evaporation dries out the soil and draws salts up to the soil surface, producing a white crust.

Field instrumentation, using a non-contacting terrain conductivity metre (EM-38 or a Dual EM), can determine if soluble salts are present.

Identification of salt affected areas and the selection of a salt-tolerant crop are the most important management practices available to farmers.

A saline soil is defined as a soil with an electrical conductivity (EC) of the saturation extract greater than 4 milli-Siemens/cm (mS/cm). The exchangeable sodium percentage is less than 15 and the pH is usually less than 8.5.

Approximate limits of salinity classes are:

Class	EC mS/cm
Non-saline (x)	0 to 4
Weakly saline (s)	> 4 to 8
Moderately saline (t)	> 8 to 16
Strongly saline (u)	> 16

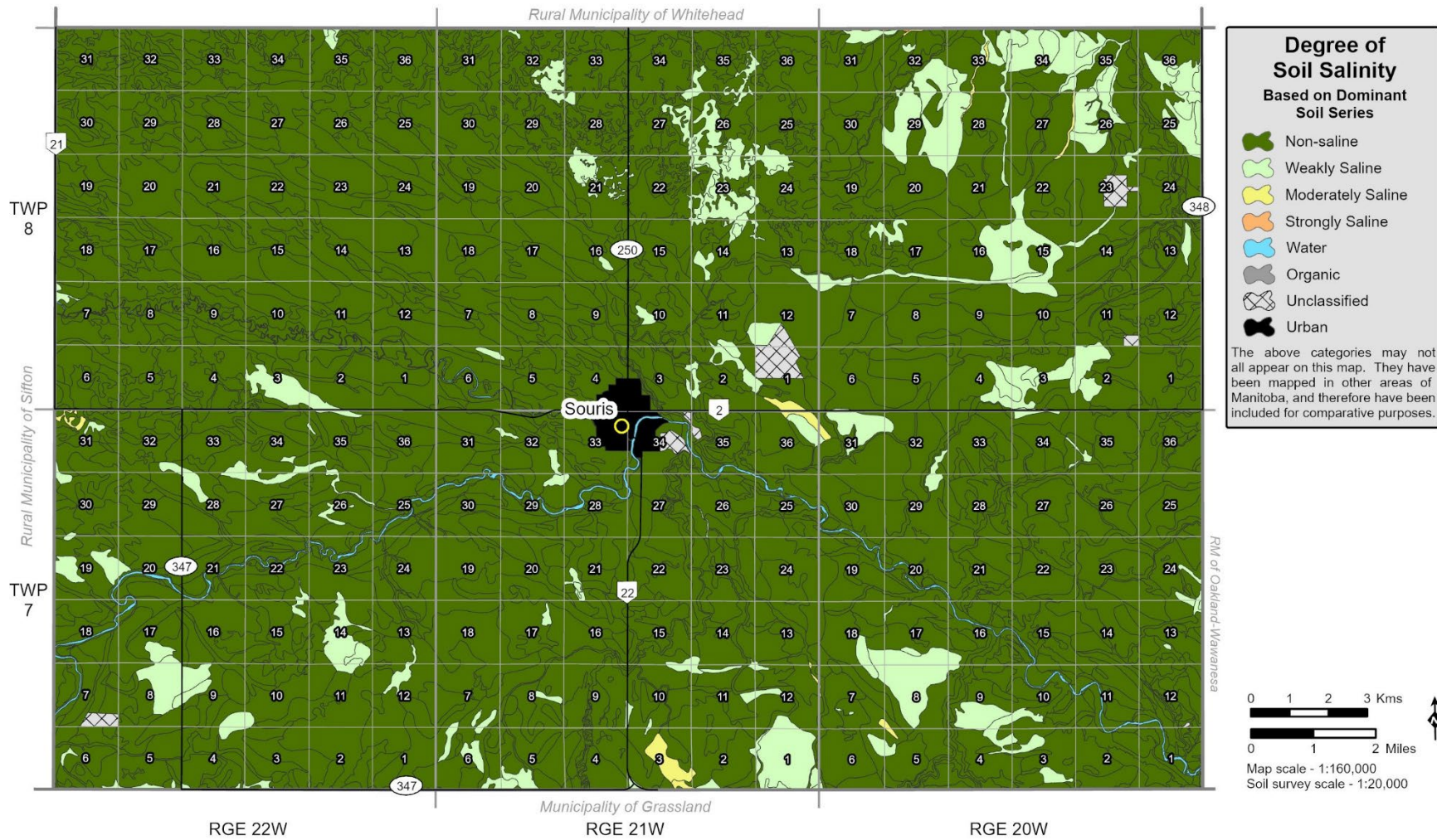
Note: mS/cm is equivalent to dS/m

Most soils in the MU of Souris-Glenwood are classified as non-saline (89 per cent). Weakly saline soils account for approximately nine per cent and moderately plus strongly saline soils account for less than one per cent (Table 16 and Map 12).

Table 16. Soil Salinity Classes in the Municipality of Souris-Glenwood

Class of Salinity	Total area		% of MU
	ha	ac	
Non-saline	52,086	128,706	89.57
Weakly saline	5,048	12,473	8.68
Moderately saline	208	513	0.36
Strongly saline	5	12	0.01
Water, urban & unclassified	807	1,994	1.39
Total	58,153	143,698	100

The soil salinity for the study area is shown in Map 12 and is based on the dominant soil for each polygon.



Map 12. Soil Salinity in the Municipality of Souris-Glenwood.

4.10.2 Soil mechanical analysis, soil organic carbon, pH and CaCO₃

A summary of selected soil chemical properties is summarized based on 315 soil organic carbon (SOC), 312 soil pH and 272 soil carbonate calcium determinations. Soil organic carbon in A horizon is affected by several factors. One of these factors is soil texture. Data analysis from A horizon shows that SOC increases when soil particles become finer under well-drained conditions (Table 17). For example, coarse-textured Stanton soil averages 17.3 g per kg (or 1.73 per cent) of SOC, while SOC from moderately coarse Lyleton, medium-textured Cameron, moderately fine Elva and fine texture Janick soils increases to 22.1, 25.1, 31.1 and 38.3 g/kg, respectively.

Table 17. SOC in A horizon Affected by Soil Texture and Drainage in the Municipality of Souris-Glenwood

Drainage	Deep lacustrine soils		# of samples	SOC g/kg
	Soil texture	Soil & Code		
Well or mod. well	Coarse	Stanton (STU)	9	17.3
	Mod. coarse	Lyleton (LYT)	13	22.1
	Medium	Cameron (CMR)	8	25.1
	Mod. fine	Elva (ELV)	3	31.1
	Fine	Janick (JIK)	3	38.3
Imperfect	Coarse	Lauder (LUD)	14	11.3
	Mod. coarse	Denbow (DBW)	15	26.7
	Medium	Underhill (UHL)	21	35.7
	Mod. fine	Goodland (GOL)	11	36.3
	Fine	Harding (HRG)	5	37.0

Soil organic carbon changes under imperfect drainage conditions generally follow a similar trend as those in well- or moderately well-drained conditions (Table 17).

Soil pH in the A horizon ranges from as low as 5.15 in Stanton of an Orthic Black Chernozem to as high as 8.6 in Cranmer, a Gleyed Rego Black Chernozem. The large variations are due to different physical and chemical processes occurring in the A horizon. All carbonates are basically leached out from A horizon in well-drained coarser textured Orthic Black Chernozems, resulting in a relatively low pH value. This can occur in soils of the same texture as well, soil pH in A horizon of medium-textured Fairland developed from deep lacustrine is 5.66 (Table 18), while same textured Traverse, a well-drained Calcareous Black Chernozem and Durnan, a well-drained Rego Black Chernozem, have pH values of 7.15 and 7.47, respectively. Some variations exist because soil erosion and cultivation can also have considerable impact on soil pH in A horizon.

Table 18. Soil Physical and Chemical Properties from Selected Soils in the Municipality of Souris-Glenwood

Soil name (code)	Horizon	Depth cm	Mechanical analysis (%)								pH (2:1)	CCE (%)	OC (%)	EC (mS/cm)
			VCoS	CoS	MS	FS	VFS	Silt	Clay	Texture				
Argue® (ARG)	Ap	0 - 24	0.1	0.5	1.3	2.2	20.5	45.6	29.8	CL	7.70	0.9	2.7	-
	Ck	24 - 73	0.8	1.6	3.1	2.3	5.7	51.7	34.8	SiCL	8.40	17.3	0.4	-
Argue (ARG)	Ap	0 - 18	0.2	0.6	1.7	11.4	45.9	26.8	13.4	VFSL	6.84	0.1	1.7	-
	ACk	18 - 25	-	-	-	-	-	-	-	VFSL*	-	1-5*	-	-
	Ck	25 - 76	0.1	0.2	0.7	6.5	47.7	29.7	15.1	VFSL	8.00	9.8	0.5	-
Assiniboine (ASB)	Ahks	0 - 28	0.1	0.4	1.1	4.4	11.8	40.3	41.9	SiC	7.62	1.7	4.0	4.2
	Ahks2	28 - 65	0.4	0.8	2.3	10.2	14.3	38.7	33.3	CL	8.25	7.6	1.1	12.3
	Ckgj	65 - 100	0.4	0.9	3.5	11.8	16.8	25.4	41.2	C	8.41	9.2	0.7	-
Bankton (BAO)	Ahk	0 - 13	0.5	1.0	1.7	4.1	8.8	37.0	46.9	C	7.55	11.0	2.6	-
	Ck	13 - 70	0.1	0.1	0.2	0.5	1.2	36.9	61.0	C	7.84	32.8	0.8	-
	Ck2	70-100	-	-	-	-	-	-	-	CL*	-	16-25*	-	-
Bearford (BEF)	Apk	0 - 17	0.1	0.0	0.9	2.2	15.5	50.3	31.0	SiCL	7.66	2.0	2.7	1.2
	Bmk	17 - 25	0.0	0.3	1.1	2.1	25.4	43.2	27.9	CL	7.98	3.0	1.2	0.8
	Ck	25 - 40	0.2	0.4	1.6	3.0	25.2	44.3	25.3	L	8.25	9.5	0.5	-
	II Ck	40 - 100	0.0	0.2	0.7	1.2	3.1	44.4	50.4	SiC	8.19	10.6	0.3	-
Beresford# (BSF)	Ap	0 - 28	0.2	1.4	4.5	8.9	22.2	38.9	23.9	L	6.49	0.0	5.6	0.9
	Bmk	28 - 37	0.3	1.1	3.3	10.8	24.7	36.3	23.5	L	7.51	4.6	2.9	1.2
	II Ckgj	37 - 55	0.1	0.3	1.4	7.6	21.4	35.8	33.4	CL	7.67	22.8	1.8	-
	II Ckgj2	55 - 100	-	-	-	-	-	-	-	CL *	-	6-15*	-	-
Cameron (CMR)	Ap	0 - 22	0.0	0.0	0.1	27.7	34.3	26.4	11.5	VFSL	7.18	0.2	1.7	-
	Bm	22 - 38	0.0	0.0	0.0	26.1	37.9	23.2	12.8	VFSL	7.46	0.5	1.0	-
	Ck	38 - 100	0.0	0.0	0.1	4.5	20.3	49.9	25.2	L	8.01	14.5	0.6	-
Cameron (CMR)	Ap	0 - 15	0.0	0.0	0.8	10.2	26.5	42.5	20.0	L	7.87	0.2	2.2	0.4
	Ah	15 - 56	0.1	0.2	0.9	9.7	28.5	41.0	19.6	L	6.70	0.1	2.2	0.3
	Bm	56 - 68	0.1	0.1	0.9	9.7	33.2	38.0	18.0	L	7.55	0.3	1.0	0.3
	Ck	68 - 78	0.1	0.1	0.7	12.8	42.0	30.8	13.5	VFSL	7.98	2.5	0.4	-
	Ck2	78 - 100	0.1	0.2	0.6	6.3	16.5	45.0	31.3	CL	8.25	13.5	0.4	-
Carroll (CXF)	Apk	0 - 15	0.2	0.5	1.0	3.0	15.0	50.0	30.3	SiCL	7.65	1.9	3.7	6.4
	Cca	15 - 65	0.1	0.1	0.3	0.7	4.0	72.0	32.8	SiCL	8.47	17.8	0.9	-
	Ck	65 - 90	0.0	0.0	0.1	0.2	0.8	77.6	21.3	SiL	8.50	11.7	0.4	-
Chambers (CBS)	Ah	0 - 29	0.3	0.8	1.3	4.5	13.8	42.2	37.1	CL	7.54	0.9	3.7	8.8
	II Ck	29 - 70+	1.0	1.4	1.7	2.5	4.5	40.6	48.3	SiC	8.61	27.6	0.6	-

@texture variant; * Field test; #loam surface texture variant.

Table 18. Soil Physical and Chemical Properties from Selected Soils in the MU of Souris-Glenwood (cont'd)

Soil name (code)	Horizon	Depth (cm)	Mechanical analysis (%)								pH (2:1)	CCE (%)	OC (%)	EC (mS/cm)
			VCoS	CoS	MS	FS	VFS	Silt	Clay	Texture				
Charman (CXV)	Apk	0 - 30	0.0	0.2	0.7	2.8	14.1	73.1	9.1	SiL	7.44	2.6	3.4	1.7
	Btgj	30 - 52	0.1	0.2	0.7	2.1	7.7	38.0	51.2	C	7.37	0.7	1.6	0.7
	BCKgj	52 - 78	0.1	0.2	0.7	1.5	5.1	55.0	37.4	SiCL	7.60	6.2	1.1	0.5
	Ckgj	78 - 100	0.1	0.6	1.7	3.1	4.3	69.5	20.7	SiL	7.61	12.5	0.5	-
Charman (CXV)	Apk	0 - 26	0.0	0.1	0.7	4.6	11.0	48.0	35.6	SiCL	7.80	1.3	4.0	7.6
	Bmkgj	26 - 45	0.0	0.1	0.4	2.4	19.2	66.7	11.2	SiL	8.30	8.7	1.3	-
	Ckgj	45 - 100	0.0	0.0	0.2	0.8	9.2	55.8	34.0	SiCL	8.30	15.8	0.5	-
Chater (CXW)	Apk	0 - 11	3.3	12.1	15.8	4.4	16.5	29.0	18.9	(M)SL	7.04	1.4	2.7	-
	Bmk	11 - 29	13.4	25.9	22.1	5.7	6.4	19.4	7.1	CoSL	7.66	26.0	1.2	-
	IIck	45 - 100	0.9	3.1	7.2	1.6	1.0	47.7	38.5	SiCL	8.14	15.1	0.3	-
Clementi# (CLN)	Ap	0 - 28	0.1	0.7	1.7	3.0	17.1	50.9	26.5	SiL	7.71	0.6	3.6	0.5
	Bm	28 - 41	0.0	0.1	0.7	2.0	20.1	53.8	23.3	SiL	7.29	0.7	1.7	0.3
	IIck	41 - 73	0.1	0.2	0.4	0.7	8.8	61.1	28.7	SiCL	7.65	20.5	0.9	-
	IIck2	73 - 100	0.0	7.9	13.8	3.0	8.1	45.8	21.4	L	7.70	16.4	0.8	-
Clementi (CLN)	Ap	0 - 26	0.0	1.1	3.3	7.7	11.2	42.7	34.0	CL	7.50	0.8	4.3	-
	Bm	26 - 50	0.0	0.5	2.7	5.9	19.5	40.1	31.3	CL	7.80	0.7	1.9	-
	IIck	50 - 80+	0.2	1.3	4.3	6.8	11.0	45.4	31.0	CL	8.20	18.5	0.8	-
Cobfield# (CBF)	Ah	0 - 17	0.3	2.1	4.8	8.9	21.5	38.0	24.4	L	6.00	0.3	8.2	0.6
	Bm	17 - 30	0.3	1.9	4.7	7.8	28.5	32.9	23.9	L	7.11	0.6	2.9	0.6
	II Ckgj	30 - 45+	0.5	10.7	8.5	7.8	15.9	32.2	24.4	L	7.47	10.9	2.1	-
Cobfield (CBF)	Ap	0 - 20	0.2	2.5	5.5	8.4	10.6	43.7	29.1	CL	6.92	0.0	7.1	1.5
	Bmgj	20 - 47	0.3	2.2	5.5	8.1	12.5	40.2	31.2	CL	7.24	0.2	2.3	0.9
	II Ckgj	47 - 100	0.2	3.8	6.8	9.1	9.7	47.9	22.5	L	7.70	17.6	0.8	-
Cordova (CVA)	Ap	0 - 7	0.3	5.0	9.8	11.6	11.9	40.2	21.2	L	6.93	0.3	3.4	-
	Bmk	7 - 15	0.2	9.5	15.1	13.3	10.6	34.6	16.7	L	7.54	7.9	1.2	-
	Ck	15 - 80+	0.3	1.1	4.0	7.7	11.7	55.8	19.4	SiL	8.03	13.5	0.4	-
Cranmer (CME)	Apk	0 - 23	0.0	0.5	5.4	25.7	19.6	29.9	18.9	L	7.82	4.6	3.3	3.4
	ACk	23 - 35	0.1	0.9	6.6	27.8	20.2	23.4	21.0	SCL	8.06	7.8	2.8	1.1
	Ckgj	35 - 100	0.0	0.9	7.6	17.6	20.9	26.8	26.2	SCL	7.75	16.9	0.7	-
Croll (CLL)	Ahk	0 - 41	0.0	0.0	0.5	1.8	20.3	45.1	32.3	CL	7.63	4.1	3.2	1.1
	II Ckgj	41 - 60	0.0	0.9	2.8	3.2	25.4	44.8	22.9	L	7.68	7.9	0.6	-
	IIckgj2	60 -100	-	-	-	-	-	-	-	CL *	-	6 -15*	-	-

#loam surface texture variant; * Field test;

Table 18. Soil Physical and Chemical Properties from Selected Soils in the MU of Souris-Glenwood (cont'd)

Soil name (code)	Horizon	Depth (cm)	Mechanical analysis (%)								pH (2:1)	CCE (%)	OC (%)	EC (mS/cm)
			VCoS	CoS	MS	FS	VFS	Silt	Clay	Texture				
Dalny (DNY)	Ap	0 - 23	0.0	0.6	1.8	3.5	14.9	56.7	22.5	SIL	5.94	0.3	2.9	-
	Bmk	23 - 48	0.0	0.7	2.1	3.7	25.4	51.9	16.2	SIL	7.53	2.7	1.0	-
	Ck	48 - 60	-	-	-	-	-	-	-	SiL*	-	6-15*	-	-
	II Ck	60 - 100	0.3	2.4	5.8	7.1	8.5	41.6	34.3	CL	7.92	18.2	0.5	-
Deleau (DLU)	Ah	0 - 22	0.2	0.3	21.4	63.1	8.6	2.9	3.5	FS	6.85	0.7	2.0	0.5
	Bmk	22 - 63	0.3	0.3	32.1	51.5	8.8	3.1	3.9	FS	7.72	2.8	0.8	0.4
	Ckgj	63 - 100	0.4	0.3	9.0	59.8	16.7	3.1	10.7	LFS	7.92	10.0	0.3	-
Denbow (DBW)	Ap	0 - 27	0.1	0.9	10.0	35.4	25.5	15.1	13.0	FSL	6.16	0.0	1.9	1.0
	Bmgj	27 - 52	0.4	1.2	10.1	34.9	26.0	14.6	12.8	FSL	7.13	0.3	0.6	0.4
	Ckgj	52 - 100	0.1	0.3	6.1	49.3	31.8	4.9	7.5	LFS	7.16	0.3	0.2	0.3
	Ap	0 - 26	0.0	0.1	1.0	41.9	30.4	15.4	11.2	FSL	5.10	0.5	1.3	-
	Bmgj	26 - 50	0.0	0.0	0.8	35.5	27.2	22.4	13.8	FSL	6.50	0.6	1.3	-
	Cgj	50 - 75	0.0	0.0	0.6	29.8	37.1	18.4	14.1	VFSL	6.70	0.3	0.5	-
	Cgj2	75 - 100	0.0	0.0	1.1	49.5	31.0	10.3	8.1	LFS	7.60	3.1	0.1	-
Desford (DFD)	Ap	0 - 25	0.3	2.3	4.8	5.5	19.9	38.9	28.3	CL	7.84	0.0	2.8	1.0
	Bmgj	25 - 41	0.3	1.4	3.0	4.6	24.8	37.7	28.2	CL	7.99	0.2	1.0	0.6
	II Ckgj	41 - 70	0.2	0.5	1.5	4.1	32.3	38.8	22.6	L	7.78	8.6	0.5	-
Dromore (DOM)	Ap	0 - 15	0.1	3.7	6.9	4.8	28.1	36.5	19.9	L	7.06	0.1	2.4	-
	Bm	15 - 29	0.0	2.1	3.9	3.3	32.8	39.1	18.8	L	7.12	0.2	1.3	-
	II Ck	29 - 70+	0.3	28.2	27.7	6.9	8.0	17.4	11.5	CoSL	7.59	8.9	0.5	-
Durnan (DRN)	Apk	0 - 14	0.0	0.9	2.3	7.1	10.7	56.0	23.0	SIL	7.47	2.6	2.9	-
	Cca	14 - 33	-	-	-	-	-	-	-	SiCL*	-	15-25*	-	-
	Ck	33 - 100	0.0	0.0	0.0	0.4	1.5	85.5	12.6	SIL	8.12	8.4	0.4	-
Elva (ELV)	Ap	0 - 15	0.0	0.0	0.8	5.7	19.5	46.8	27.2	CL	6.78	0.1	2.8	3.3
	Ah	15 - 36	0.0	0.1	0.9	5.3	22.4	46.4	24.9	L	7.18	0.2	1.9	3.3
	Bmk	36 - 55	0.1	0.1	1.0	6.2	25.5	42.2	24.9	L	7.56	2.9	0.8	2.3
	II Ck	55 - 100	0.0	0.0	0.4	2.4	9.6	56.9	30.7	SiCL	7.75	16.4	0.5	-
Emblem (EBL)	Ahk	0 - 23	0.1	0.4	1.6	10.4	23.7	35.6	28.2	CL	7.70	4.1	3.0	-
	Ccag	23 - 50	0.0	0.1	1.1	6.6	31.7	31.3	29.2	CL	7.90	23.5	0.7	-
	Ckg	50-100	-	-	-	-	-	-	-	VFSL*	-	6-15*	-	-
Fairland (FND)	Ap	0 - 29	0.4	1.4	2.9	10.5	34.0	31.2	19.6	L	5.66	0.2	3.9	1.3
	Bm	29 - 45	0.2	1.3	2.2	6.8	31.1	40.1	18.3	L	6.79	0.0	2.2	0.5
	C	45 - 100	0.2	0.5	1.1	7.3	46.7	31.4	12.8	VFSL	7.49	0.6	0.9	0.8

* Field test.

Table 18. Soil Physical and Chemical Properties from Selected Soils in the MU of Souris-Glenwood (cont'd)

Soil name (code)	Horizon	Depth (cm)	Mechanical analysis (%)								pH (2:1)	CCE (%)	OC (%)	EC (mS/cm)
			VCo S	CoS	MS	FS	VFS	Silt	Clay	Texture				
Forrest (FRT)	Ap	0 - 15	0.0	0.9	2.5	5.2	15.9	34.9	40.6	C	7.70	0.4	3.0	-
	II Ckgj	45 - 80+	0.0	0.8	2.2	3.6	3.9	27.7	61.8	C	8.70	28.8	0.5	-
Gateside® (GTD)	Ap	0 - 28	0.0	0.2	1.9	51.9	29.8	7.8	8.4	LFS	8.10	0.0	1.6	-
	Bmkgj	28 - 56	0.0	0.0	1.3	41.9	30.1	9.7	17.0	FSL	8.20	7.2	0.9	-
	Ckgj	56 - 100	0.0	0.0	0.6	37.4	23.4	17.6	21.0	SCL	8.10	12.9	0.3	-
Goodlands (GOL)	Ap	0 - 29	0.0	0.2	0.9	1.6	16.5	49.4	31.4	SiCL	6.72	-	3.4	0.9
	Bmgj	29 - 50	0.0	0.2	0.6	1.3	19.2	51.6	27.1	CL	7.48	0.2	1.1	1.0
	Ccagj	50 - 88	0.0	0.3	0.8	1.3	7.4	41.9	48.3	SiC	7.92	21.6	0.6	-
	Ckgj	88 - 100	0.0	0.1	0.4	0.6	3.1	66.8	29.0	SiCL	7.99	11.0	0.3	-
Goodlands (GOL)	Ap	0 - 15	0.1	0.8	2.2	2.8	18.1	50.4	25.6	SIL	5.18	-	3.1	0.8
	Ah	15 - 34	0.1	0.3	1.1	1.5	17.5	48.9	30.6	CL	6.47	-	2.1	0.3
	Bmgj	34 - 51	0.1	0.3	0.9	1.5	22.0	47.1	28.1	CL	6.91	0.1	1.2	0.2
	Ckgj	51 - 100	0.0	0.2	0.5	0.7	3.8	59.8	35.0	SiCL	7.75	12.7	0.5	0.0
Harding [§] (HRG)	Ap	0 - 18	0.0	0.7	1.8	3.0	7.0	37.4	50.1	C	7.50	1.3	3.5	-
	Bmkgj	18 - 33	0.0	0.2	0.6	1.1	6.7	34.9	56.5	C	7.90	13.8	1.5	-
	Ckgj	33 - 100	0.0	0.1	0.3	0.5	3.4	31.8	63.9	C	8.20	26.8	0.8	-
Hartney (HRY)	Apk	0 - 27	0.1	0.2	1.1	5.5	14.7	55.4	23.0	SIL	7.79	6.2	2.8	3.0
	ACkgj	27 - 41	0.0	0.0	0.8	5.7	28.2	38.0	27.3	CL	7.91	12.2	1.3	3.0
	Ccagj	41 - 62	0.0	0.0	1.0	4.4	25.0	46.5	23.1	L	7.92	13.7	0.6	-
	Ckgj	62 - 100	0.0	0.2	1.9	8.2	33.0	42.9	13.8	L	7.86	6.7	0.3	-
Hilton (HIT)	Ap	0 - 15	0.0	2.6	7.0	10.2	9.0	43.6	27.6	CL	7.10	0.8	4.5	-
	Bm	15 - 40	0.0	1.8	5.5	8.2	11.4	45.0	28.1	CL	7.30	0.7	3.4	-
	Ck	40 - 70	0.0	1.1	3.8	5.4	8.1	53.9	27.7	SiCL	7.90	18.5	1.0	-
Janick [§] (JIK)	Ap	0 - 18	0.8	0.1	0.1	0.9	3.8	37.5	56.8	C	7.36	0.7	3.2	1.4
	Bmk	18 - 34	0.0	0.0	0.0	0.4	2.8	39.3	57.5	C	7.60	11.6	1.3	0.5
	Ck	34 - 100	0.0	0.0	0.1	0.8	3.2	40.2	55.7	SiC	7.69	9.4	1.0	0.0
Justice (JUC)	Apk	0 - 16	0.0	0.9	2.4	5.8	10.2	44.5	36.2	SiCL	7.70	1.7	3.5	-
	Bmkgj	16 - 40	0.0	0.7	2.0	3.8	11.0	42.4	40.1	SiC	8.00	7.4	1.3	-
	II Ckgj	40 - 80+	0.0	0.5	1.5	2.3	3.4	43.8	48.5	SiC	8.30	29.3	0.6	-
Kemnay (KMY)	Ap	0 - 11	0.0	0.5	4.8	35.3	23.7	22.1	13.6	FSL	6.00	0.2	1.9	0.5
	Bmk	11 - 23	0.0	0.3	3.6	32.0	20.3	28.0	15.8	FSL	7.31	1.5	1.1	0.3
	Cca	23 - 42	0.0	0.0	1.1	29.4	25.0	27.7	16.8	FSL	7.58	12.9	0.7	-
	Ck	42 - 100	0.0	0.1	1.1	41.6	29.8	19.9	7.5	FSL	7.69	6.9	0.2	-

[§]classification variant.

Table 18. Soil Physical and Chemical Properties from Selected Soils in the MU of Souris-Glenwood (cont'd)

Soil name (code)	Horizon	Depth (cm)	Mechanical analysis (%)								pH (2:1)	CCE (%)	OC (%)	EC (mS/cm)
			VCo S	CoS	MS	FS	VFS	Silt	Clay	Texture				
Kleysen# (KYS)	Ap	0 - 15	0.4	1.5	2.9	9.0	26.8	34.7	24.7	L	7.60	0.6	3.1	-
	Bmk	32 - 50	0.4	1.0	2.4	8.5	38.8	28.1	20.8	L	7.70	2.2	1.3	-
	II Ckgj	50 - 100	0.4	0.7	1.2	1.1	3.0	53.7	39.9	SiCL	8.00	18.9	0.5	-
Kleysen (KYS)	Ap	0 - 26	0.0	0.8	2.4	4.7	9.7	46.0	36.4	SiCL	6.90	0.7	4.1	-
	Btk	26 - 48	0.0	0.5	1.9	3.6	6.6	37.2	50.2	C	7.80	5.7	1.6	-
	II Ck	48 - 80+	0.0	2.0	6.0	8.0	7.6	39.7	36.7	CL	8.30	16.6	0.5	-
Lauder (RTO)	Ah	0 - 9	0.2	0.6	21.8	59.6	8.4	3.5	5.9	FS	6.58	0.8	2.5	0.7
	Bmgj	9 - 21	0.3	0.7	29.6	55.0	9.9	0.9	3.6	FS	6.89	0.4	0.8	0.4
	Ckgj	21 - 100	0.5	0.6	25.3	59.3	8.8	0.6	4.9	FS	7.67	5.3	0.1	-
Lauder (LUD)	Ap	0 - 26	0.0	0.1	0.7	54.7	24.1	11.7	8.7	LFS	5.80	0.4	1.2	-
	Bmgj	26 - 65	0.0	0.0	0.4	53.5	26.0	10.9	9.2	LFS	7.20	0.4	0.4	-
	Ckgj	85 - 100	0.0	0.0	0.3	37.0	17.3	27.7	17.7	FSL	7.70	15.1	0.3	-
Lavenham (LVH)	Ah	0 - 33	0.3	0.5	21.7	53.3	16.1	0.6	7.5	FS	7.30	0.7	1.1	0.4
	Bmgj	33 - 41	0.3	0.4	7.7	65.4	19.1	0.4	6.7	FS	7.34	0.8	0.6	0.5
	Ckgj	41 - 100	0.2	0.3	11.0	66.9	14.9	0.3	6.4	FS	7.76	6.8	0.2	-
Lavinia (LAV)	Ap	0 - 14	1.9	4.8	6.7	6.5	11.7	36.5	31.9	CL	7.31	0.7	3.0	-
	Bmk	14 - 33	3.7	7.2	8.0	7.8	10.5	32.4	30.4	CL	7.57	3.6	1.9	-
	II Ckgj	33 - 80+	2.7	4.6	7.4	8.7	7.7	30.6	38.3	CL	8.16	21.1	0.6	-
Lyleton (LYT)	Ap	0 - 15	0.1	1.6	12.3	40.2	19.4	15.3	11.1	FSL	4.44	0.6	2.6	2.3
	Ah	15 - 36	0.0	0.7	10.3	41.9	21.2	13.9	12.0	FSL	6.86	0.5	2.5	0.7
	Bm	36 - 59	0.0	1.0	12.0	42.8	21.8	11.3	11.1	FSL	7.02	0.5	0.9	0.4
	Cgj	59 - 100	0.3	0.7	18.1	55.8	15.4	3.5	6.2	FS	7.53	0.6	0.1	-
Montgomery (MOT)	Ap	0 - 17	0.1	1.1	13.3	27.6	10.2	30.6	17.1	(M)SL	5.01	-	2.3	1.9
	Ah	17 - 38	0.0	1.0	14.6	26.6	13.6	24.2	20.0	SCL	7.46	0.7	1.7	1.8
	II Ckgj	38 - 61	0.0	0.1	7.1	12.0	7.8	24.6	48.4	C	7.84	25.8	0.9	1.7
	II Ckgj2	61 - 100	1.1	3.4	14.8	14.6	8.6	31.1	26.4	L	7.75	11.6	0.3	0.0
Plum Lake (PAK)	Apk	0 - 28	0.0	0.3	1.2	43.7	24.2	13.7	16.9	FSL	8.20	9.2	2.6	8.2
	ACkg	28 - 46	-	-	-	-	-	-	-	FSL*	-	6-15*	-	-
	Ckg	46 - 90	0.0	0.2	0.9	49.8	18.8	13.0	17.3	FSL	8.31	9.3	-	-
Poolex@ (POX)	Ahk	0 - 25	0.1	0.2	3.6	49.9	15.7	13.4	17.1	FSL	8.26	17.3	1.6	2.5
	Ckg	25 - 74	0.2	0.2	1.6	34.0	14.1	19.4	30.5	SCL	8.36	38.4	0.3	-
	Ckg	74 - 100	0.1	0.0	1.9	63.2	13.1	10.9	10.8	FSL	8.25	17.7	0.1	-

#loam surface texture variant; @texture variant; * Field test.

Table 18. Soil Physical and Chemical Properties from Selected Soils in the MU of Souris-Glenwood (cont'd)

Soil name (code)	Horizon	Depth (cm)	Mechanical analysis (%)								pH (2:1)	CCE (%)	OC (%)	EC (mS/cm)
			VCoS	CoS	MS	FS	VFS	Silt	Clay	Texture				
Prodan (PDA)	Ahk	0 - 18	0.0	0.2	1.7	11.6	12.1	41.9	32.5	CL	8.10	7.6	3.3	8.4
	ACkgj	18 - 36	0.0	0.2	1.5	7.7	16.7	39.1	34.8	CL	8.50	10.8	1.2	-
	Ckgj	36 - 100	0.0	0.0	0.3	1.7	20.9	46.7	30.4	CL	8.60	12.0	0.3	-
	Ahks	0 - 44	0.3	1.3	2.8	5.7	13.7	45.9	30.3	CL	7.62	1.0	6.5	5.0
	Ckgj	44 - 100	0.3	1.1	2.3	2.7	10.6	51.4	31.6	SiCL	8.24	14.0	1.6	-
Prosser [@] (PSE)	Ah	0 - 54	0.6	0.7	6.6	49.5	22.8	6.9	12.9	FSL	7.33	0.8	3.0	0.5
	Bmk	54 - 67	0.2	0.2	5.5	56.1	20.3	9.8	7.9	LFS	7.57	1.2	0.9	0.5
	Ck	67 - 100	0.4	0.5	1.7	18.1	36.5	21.0	21.8	SCL	7.91	19.5	0.8	-
Ramada (RAM)	Ap	0 - 20	0.0	1.4	3.4	5.0	7.9	50.8	31.5	SiCL	5.71	0.0	4.2	-
	Bm	20 - 49	0.0	0.1	0.4	1.4	14.1	52.7	31.3	SiCL	7.42	0.6	1.2	-
	Ck	49 - 80	-	-	-	-	-	-	-	SiCL*	-	1-5*	-	-
	Ck2	80 - 100	0.0	1.0	3.6	5.7	10.4	37.6	41.7	C	7.70	16.9	0.6	0.0
Rempel (RMP)	Ap	0 - 21	0.2	0.4	1.0	3.7	13.0	50.8	30.9	SiCL	5.36	0.4	7.3	0.7
	Bmk	21 - 38	0.4	0.3	0.4	0.9	2.9	63.6	31.5	SiCL	7.48	3.3	2.2	0.6
	Ck	38 - 100	0.3	0.3	0.3	0.6	1.5	69.4	27.6	SiCL	7.97	16.1	0.8	0.0
Scarth (SCH)	Ahk	0 - 32	0.3	0.4	2.9	55.2	25.6	8.2	7.4	LFS	7.22	1.1	2.5	0.6
	ACk	32 - 56	0.4	0.3	1.5	36.2	23.7	29.3	8.6	FSL	7.57	6.0	1.3	0.5
	Ck	56 - 100	0.4	0.4	1.4	69.3	19.1	5.1	4.3	FS	7.67	7.3	0.5	-
Schaffner (SFR)	Ap	0 - 30	0.0	4.6	2.2	12.3	22.2	45.5	13.2	L	6.35	0.2	2.7	0.8
	Bmk	30 - 46	0.1	0.1	1.0	21.8	18.9	40.4	17.7	L	7.54	1.9	1.6	0.3
	Cca	46 - 55	0.0	0.2	5.2	7.2	25.2	42.2	20.0	L	7.89	14.1	0.8	-
	Ck	55 - 92	0.0	0.0	0.3	21.4	30.4	32.8	15.1	VFSL	8.10	9.2	0.3	-
	Ck2	92 - 100	0.0	0.0	1.4	15.3	27.3	22.0	34.0	CL	8.21	9.3	0.3	-
Sigmund (SGO)	Ahks	0 - 38	0.0	0.3	2.5	10.7	11.7	32.3	42.5	C	8.20	6.4	3.7	11.3
	ACkgj	38 - 52	-	-	-	-	-	-	-	C*	-	6-15*	-	-
	Ckgj	52 - 100	0.0	0.2	0.7	2.0	2.9	44.3	49.9	SiC	8.40	16.1	0.6	-
Souris (SOU)	Apk	0 - 23	0.0	0.1	7.6	57.8	18.6	5.6	10.3	LFS	8.20	3.8	0.9	-
	Ckgj	23 - 45	0.1	0.1	6.2	57.8	18.5	4.9	12.4	LFS	8.10	7.9	0.3	-
	Ckgj2	45 - 100	0.0	0.1	6.3	69.2	15.5	3.1	5.8	FS	8.10	7.3	0.1	-
Stanton (STU)	Ap	0 - 15	0.1	0.1	2.5	58.8	28.3	5.1	5.1	FS	5.15	0.1	1.8	1.5
	Ah	15 - 38	0.3	0.3	2.3	50.8	34.2	6.0	6.1	LFS	5.73	-	1.8	0.3
	Bm	38 - 72	0.2	0.2	2.4	53.0	33.2	4.9	6.1	FS	6.63	-	1.1	0.4
	Ck	72 - 100	0.2	0.2	1.3	50.4	38.3	4.4	5.2	FS	7.54	1.8	0.6	-

[@]texture variant; * Field test.

Table 18. Soil Physical and Chemical Properties from Selected Soils in the MU of Souris-Glenwood (cont'd)

Soil name (code)	Horizon	Depth (cm)	Mechanical analysis (%)								pH (2:1)	CCE (%)	OC (%)	EC (mS/cm)
			VCoS	CoS	MS	FS	VFS	Silt	Clay	Texture				
Stockton (SCK)	Ah	0 - 25	0.1	0.1	8.9	76.1	8.1	4.7	2.0	FS	7.55	-	0.8	0.2
	Bm	25 - 78	0.0	0.1	10.9	73.6	7.2	5.8	2.4	FS	7.82	0.6	0.1	0.3
	Ckgj	78 - 100	0.2	0.1	5.6	72.6	9.1	3.2	9.2	LFS	7.78	6.5	0.3	0.0
Stockton [§] (SCK)	Ah	0 - 36	0.0	0.0	2.9	51.1	29.7	7.9	8.4	LFS	7.28	0.8	2.9	0.5
	Bmk	36 - 57	0.2	0.2	2.9	46.6	32.6	8.4	9.1	LFS	7.77	6.6	1.1	0.5
	Ck	57 - 100	0.0	0.0	2.0	49.6	32.1	8.0	8.3	LFS	8.00	7.9	0.5	-
Stockton (SCK)	Ap	0 - 15	0.1	0.2	4.8	58.5	24.6	6.8	5.0	FS	7.34	0.2	1.6	1.0
	Ah	15 - 50	0.1	0.4	5.8	47.9	27.6	9.9	8.3	LFS	7.34	-	2.2	0.7
	Bm	50 - 75	0.2	0.2	6.3	55.3	25.0	5.4	7.6	LFS	7.45	0.1	0.7	0.4
	C	75 - 100	0.1	0.2	3.4	52.1	31.2	6.2	6.8	LFS	7.48	0.3	0.5	-
Switzer (SWZ)	Ahk	0 - 32	0.2	0.4	15.4	50.4	9.8	10.7	13.1	FSL	8.00	5.2	1.6	1.1
	Ckgj	32 - 70	0.1	0.3	14.7	45.6	9.8	11.0	18.5	FSL	8.07	13.6	0.8	-
	Ckgj2	70 - 100	-	-	-	-	-	-	-	FS*	-	16-25*	-	-
Tadpole (TDP)	Ahs	0 - 38	0.0	0.3	1.7	9.6	11.6	40.9	35.9	CL	7.90	1.0	3.8	12.7
	ACgj	38 - 45	-	-	-	-	-	-	-	CL*	-	<1*	-	-
	Ckg	45 - 100	0.0	0.1	0.5	2.3	12.3	53.8	31.0	SiCL	8.10	26.7	0.7	5.8
Taggart (TGR)	Apks	0 - 24	0.1	0.2	0.9	9.7	28.9	30.9	29.3	CL	7.63	7.9	3.1	3.5
	Ckgj	24 - 90	0.2	3.7	8.6	8.4	5.5	70.8	2.8	SIL	7.61	3.0	0.2	3.2
Torcan [§] (TOC)	Ahk	0 - 29	0.0	0.0	0.7	10.1	20.9	61.1	7.2	SIL	7.75	3.7	3.3	3.6
	Bmk	29 - 38	0.0	0.1	2.2	16.4	18.5	53.1	9.7	SIL	7.90	4.9	1.5	2.9
	Ckgj	38 - 75	0.0	1.3	7.2	15.4	17.8	56.4	1.9	SIL	7.93	12.8	0.7	-
	Ckgj	75 - 100	0.0	0.0	0.4	2.1	8.4	72.1	17.0	SIL	7.87	12.0	0.5	-
Torcan (TOC)	Apk	0 - 15	0.0	0.6	2.1	7.8	28.2	41.8	19.5	L	7.44	0.5	2.6	-
	Ah	15 - 43	-	-	-	-	-	-	-	L*	-	<1*	-	-
	Bmgj	43 - 68	0.1	0.9	3.3	10.8	33.0	34.3	17.6	L	7.46	0.5	2.4	-
	Ckgj	68 - 100	0.1	0.3	1.2	12.9	36.5	28.5	20.5	L	7.68	6.8	0.9	-
Traverse (TAV)	Ap	0 - 26	0.0	0.2	0.7	11.2	14.8	53.7	19.4	SIL	7.15	0.2	3.0	-
	Bmk	26 - 42	0.0	0.0	0.4	14.5	27.9	42.3	14.9	L	7.56	4.4	1.3	-
	Ck	42 - 100	0.0	0.0	0.2	18.8	27.4	38.2	15.4	L	7.64	12.8	0.5	-
Two Creeks (TWC)	Aps	0 - 21	0.0	1.5	4.2	7.2	20.2	43.6	23.3	L	7.80	0.7	3.3	14.1
	Bmkgj	21 - 40	0.0	0.4	1.3	2.9	30.0	39.7	25.7	L	8.00	1.5	1.0	0.0
	Ckgj	40 - 65	0.0	0.1	0.5	2.2	36.1	42.8	18.3	L	8.40	12.8	0.5	0.0
	II Ckgj	65 - 100	-	-	-	-	-	-	-	SCL*	-	16-25*	-	-

[§]classification variant; *Field test.

Table 18. Soil Physical and Chemical Properties from Selected Soils in the MU of Souris-Glenwood (cont'd)

Soil name (code)	Horizon	Depth (cm)	Mechanical analysis (%)								pH (2:1)	CCE (%)	OC (%)	EC (mS/cm)
			VCoS	CoS	MS	FS	VFS	Silt	Clay	Texture				
Two Creeks (TWC)	Ap	0 - 15	0.1	0.7	1.7	3.2	26.3	43.5	24.5	L	6.85	0.3	2.7	1.2
	Bmgj	15 - 21	0.1	0.4	1.2	2.5	24.3	48.3	23.2	L	7.36	1.1	1.6	0.6
	II Ckgj	21 - 100	0.0	0.4	1.3	1.9	3.1	51.1	42.2	SiC	7.88	13.1	0.2	-
Underhill (UHL)	Ap	0 - 24	0.1	0.3	1.0	1.9	16.8	54.2	25.7	SiL	7.24	0.3	2.0	0.9
	Bmk	24 - 34	0.1	0.2	0.7	1.5	20.3	51.8	25.4	SiL	7.76	2.1	1.0	1.7
	Ccagj	34 - 58	0.0	0.4	1.4	1.7	11.4	53.2	31.9	SiCL	8.27	22.1	0.4	-
	Ckgj	58 - 100	0.0	0.0	0.2	0.4	0.9	78.9	19.6	SiL	8.50	10.8	0.2	-
Waskada (WKD)	Ap	0 - 21	0.0	0.2	0.8	3.9	33.0	42.3	19.8	L	6.53	0.2	2.2	0.7
	Bm	21 - 32	0.0	0.2	0.6	3.0	30.7	45.9	19.6	L	7.46	0.7	1.3	0.6
	Ck	32 - 85	0.0	0.0	0.4	2.1	34.2	46.4	16.9	L	8.05	12.1	0.6	-
	II Ckgj	85 - 105	0.1	1.0	3.2	11.0	26.6	28.9	29.2	CL	8.14	9.0	0.4	-
Woodfield (WDF)	Apk	0 - 15	0.0	3.3	10.7	10.3	9.8	35.1	30.8	CL	7.10	1.3	3.5	-
	Bmk	15 - 28	0.0	2.0	6.0	9.6	12.0	40.4	30.0	CL	7.70	4.5	1.8	-
	Ck	28 - 70+	0.0	1.8	6.4	9.5	9.8	43.8	28.7	CL	8.30	21.2	0.6	-

Part 5 Soil Suitability for Selected Engineering and Recreational Uses

5.1 Introduction

This section provides information that can be used by engineers and land-use planners. It is intended to supplement the information on the soil map with additional data on engineering properties of soils.

5.2 Soil Suitability for Selected Engineering Uses

The criteria used to evaluate soil suitability for selected engineering and related recreational uses are adopted from guides outlined by Coen et al (1977), and from guidelines developed by the Soil Conservation Service, United States Department of Agriculture (USDA, 1971), and the Canada Soil Survey Committee (CSSC, 1973).

The evaluation of soil suitability for engineering and recreation uses is based on both internal and external soil characteristics. Four soil suitability classes are used to evaluate both mineral and organic soils. These ratings express relative degrees of suitability or limitation for potential uses of natural or essentially undisturbed soils. The long-term effects of the potential use on the behaviour of the soil are considered in the rating.

The four suitability class ratings are defined as follows:

(G) Good - Soils in their present state have few or minor limitations that would affect the proposed use. The limitations can easily be overcome with minimal cost.

(F) Fair - Soils in their present state have one or more moderate limitations that would affect the proposed use. These moderate limitations can be overcome with special construction, design, planning or maintenance.

(P) Poor - Soils in their present state have one or more severe limitations that can severely affect the proposed use. Removing these limitations would be difficult or costly.

(V) Very Poor - Soils have one or more unfavourable features for the proposed use and the limitation is very difficult and expensive to overcome, or the soil would require such extreme alteration that the proposed use is economically impractical.

The basic soil properties that singly, or in combination with others, affect soil suitability for selected engineering and recreation uses are provided in Table 19. These subclass designations serve to identify the kind of limitation or hazard for a particular use.

In assessing soil suitability for various engineering uses, the degree of suitability is determined by the most restrictive or severe rating assigned to any one of the listed soil properties. For example, if the suitability is good for all but one soil property and it is estimated to be very poor, then the overall rating of the soil for that selected use is very poor. Suitability of individual soil properties, if estimated to be fair or poor, can be cumulative in their effect for a particular use. Judgement is required to determine whether the severity of the combined effects of several soil properties on suitability for a particular use will result in downgrading an evaluation. This is left to the discretion of the interpreter. It is incorrect to assume that each of the major soil properties influencing a particular use has an equal effect. Class limits established for rating the suitability of individual soil properties take this into account. For a selected use, therefore, only those soil properties, which most severely limit that use, are specified.

The suitability ratings of soils in the MU of Souris Glenwood for ten selected engineering uses are shown in Table A8 of Appendix 1. When using these interpretations, consideration must be given to the following assumptions:

1. Soil ratings do not include site factors such as proximity to towns and highways, water supply or aesthetic values.
2. Soil ratings are based on natural, undisturbed conditions.
3. Soil suitability ratings are usually given for the entire soil depth, but for some uses, they may be based on the limitations of an individual soil horizon or layer, because of its overriding importance. Ratings rarely apply to soil depths greater than 1 to 2 metres, but in some soils, reasonable estimates can be given for soil material at greater depths.
4. Poor and very poor soil ratings do not imply that a site cannot be changed to remove, correct or modify the limitations.
5. Interpretations of map units do not eliminate the need for on-site evaluation by qualified professionals. Because of the variable nature of soils and the scale of mapping, small, unmappable inclusions of soils with different properties may be present in an area where a development is planned.

Guides for evaluating soil suitability for engineering uses are presented in tables A9 to A18 of Appendix 1.

Table 19. Codes Used to Identify Subclass Limitations in Evaluating Soil Suitability for Selected Engineering Uses in Table A8 of Appendix 1

Code	Description
a	sub-grade properties
b	thickness of topsoil
c	coarse fragments on surface
d	depth to bedrock
e	erosion or erodibility
f	susceptibility to frost hazard
g	contamination hazard of groundwater
h	depth to seasonal water table
i	flooding or inundation
j	thickness of slowly permeable material
k	permeability or hydraulic conductivity
l	shrink-swell properties
m	moisture limitations or deficit
n	salinity or sulphate hazard
o	organic matter
p	stoniness
q	depth to sand or gravel
r	rockiness
s	surface texture
t	topographic slope class
u	moist consistency
w	wetness or soil drainage class
z	permafrost

5.3 Soil Suitability for Selected Recreational Uses

This section provides interpretations of the soil suitability for recreational development. All types of soil can be used for recreational activities of some kind.

Soils and their properties contribute to the determination of the type and location of recreational facilities. Wet soils are not suitable for campsites, roads, playgrounds or picnic areas. Soils that pond and dry out slowly after heavy rains present problems where intensive use is planned. It is difficult to maintain grass cover for playing fields and golf courses on dry soils. The feasibility of

many kinds of outdoor activities is determined by many basic soil properties such as depth to bedrock, stoniness, topography or land pattern, and the ability of the soil to support vegetation of different kinds as related to its natural fertility.

The suitability of the various soil series and phases in the MU of Souris Glenwood for selected recreational uses is shown in Table A8 of Appendix 1. The four classes, **Good, Fair, Poor and Very Poor**, are defined in the section on Engineering Uses. Subclasses are the same as described in Table 19. Guides for evaluating soil suitability for recreational uses are presented in tables A19 to A22 of Appendix 1.

Appendix 1

A: Definitions of the Agricultural Capability Classes

Class 1

Soils in this class have no important limitations for crop use. The soils have level or gently sloping topography, are deep, well to imperfectly drained and have moderate water holding capacity. The soils are naturally well supplied with plant nutrients, easily maintained in good tilth and fertility. Soils are moderately high to high in productivity for a wide range of cereal and special crops.

Class 2

Soils in this class have moderate limitations that reduce the choice of crops or require moderate conservation practices. The soils have good water holding capacity and are either naturally well supplied with plant nutrients or are highly responsive to the addition of fertilizer. They are moderate to high in productivity for a wide range of crops. The limitations are not severe and good soil management and cropping practices can be applied without serious difficulty.

Class 3

Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices. The limitations in Class 3 are more severe than those in Class 2 and conservation practices are more difficult to apply and maintain. The limitations affect the timing and ease of tillage, planting and harvesting, the choice of crops and maintenance of conservation practices. The limitations include one or more of the following: moderate climatic limitation, erosion, structure or permeability, low fertility, topography, overflow, wetness, low water holding capacity or slowness in release of water to plants, stoniness and depth of soil to consolidated bedrock. Under good management, these soils are fair to moderately high in productivity for a wide range of field crops.

Class 4

Soils in this class have severe limitations that restrict the choice of crops or require special conservation practices or both. These soils have such limitations that they are only suited for a few crops, the yield for a range of crops may be low, or the risk of crop failure is high. The limitations may seriously affect such farm practices as the timing and ease of tillage, planting and harvesting, and the application and maintenance of conservation practices. These soils are low to medium in productivity for a narrow range of crops but may have higher productivity for a specially adapted crop. The limitations include the adverse effects of one or more of the following: climate, accumulative undesirable soil characteristics, low fertility, reduced storage capacity or release of soil moisture to plants, structure or permeability, salinity, erosion, topography, overflow, wetness, stoniness, and depth of soil to consolidated bedrock.

Class 5

Soils in this class have very severe limitations that restrict their capability to producing perennial forage crops, and improvement practices are feasible. These soils have severe soil, climatic or other limitations and are not capable of sustained production of annual field crops. However, they may be improved by the use of farm machinery for the production of native or tame perennial forage species. Feasible improvement practices include clearing of bush, cultivation, seeding, fertilization and water control. Some soils in Class 5 can be used for cultivated field crops provided intensive management is used. Some of these soils are also adapted to special crops requiring soil conditions, unlike those needed by the common crops.

Class 6

Soils in this class are capable only of producing perennial forage crops and improvement practices are not feasible. Class 6 soils have some natural sustained grazing capacity for farm animals but have such serious soil, climatic or other limitations as to make impractical the application of improvement practices that can be carried out on Class 5 soils. Soils may be placed in this class because their physical nature prevents the use of farm machinery, or because the soils are not responsive to improvement practices, or because stock watering facilities are inadequate.

Class 7

Soils in this class have no capability for arable culture or permanent pasture because of extremely severe limitations. Bodies of water too small to delineate on the map are included in this class. These soils may or may not have a high capability for forestry, wildlife and recreation.

B: Agricultural Capability Subclass Limitations

C - Adverse climate: This subclass denotes a significant adverse climate for crop production, as compared to the median climate, which is defined as one with sufficiently high growing season temperatures to bring field crops to maturity and with sufficient precipitation to permit crops to be grown each year on the same land, without a serious risk of partial or total crop failures.

D - Undesirable soil structure or low permeability: This subclass is used for soils difficult to till, which absorb water very slowly or in which the depth of rooting zone is restricted by conditions other than a high water table or consolidated bedrock.

E - Erosion: Subclass E includes soils where damage from erosion is a limitation to agricultural use. Damage is assessed on the loss of productivity and on the difficulties in farming land with gullies.

F - Low fertility: This subclass is made up of soils having low fertility that, either is correctable with careful management in the use of fertilizers and soil amendments or is difficult to correct in a feasible way. The limitation may be due to lack of available plant nutrients, high acidity or alkalinity, low exchange capacity, high levels of carbonates or presence of toxic compounds.

I - Inundation by streams or lakes: This subclass includes soils subjected to inundation causing crop damage or restricting agricultural use.

L - Coarse wood fragments: In the rating of organic soils, woody inclusions in the form of trunks, stumps and branches (>10 cm diameter) in sufficient quantity to significantly hinder tillage, planting and harvesting operations.

M - Moisture limitation: This subclass consists of soils where crops are adversely affected by drought, owing to inherent soil characteristics. They are usually soils with low water-holding capacity.

N - Salinity: Designates soils, which are adversely affected by the presence of soluble salts.

P - Stoniness: This subclass is comprised of soils sufficiently stony to significantly hinder tillage, planting and harvesting operations. Stony soils are usually less productive than comparable non-stony soils.

R - Consolidated bedrock: This subclass includes soils where the presence of bedrock near the surface restricts their agricultural use. Consolidated bedrock at depths greater than 1 metre from the surface is not considered as a limitation, except on irrigated lands where a greater depth of soil is desirable.

T - Topography: This subclass is made up of soils where topography is a limitation. Both the percentage of slope and the pattern or frequency of slopes in different directions are important factors in increasing the cost of farming over that of smooth land, in decreasing the uniformity of growth and maturity of crops, and in increasing the hazard of water erosion.

W - Excess water: Subclass W is made up of soils where excess water other than that brought about by inundation is a limitation to their use for agriculture. Excess water may result from inadequate soil drainage, a high water table, seepage or runoff from surrounding areas.

X - Cumulative minor adverse characteristics: This subclass is made up of soils having a moderate limitation caused by the cumulative effect of two or more adverse characteristics which singly are not serious enough to affect the class rating.

Table A1. Dryland Agriculture Capability Guidelines for Manitoba*

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
Subclass Limitations	No significant limitations in use for crops.	Moderate limitations that restrict the range of crops or require moderate conservation practices.	Moderately severe limitation that restricts the range of crops or requires special conservation practices.	Severe limitations that restrict the range of crops or require special conservation practices or both.	Very severe limitations that restrict soil capability to produce perennial forage crops, and improvement practices are feasible.	Soils are capable only of producing perennial forage crops, and improvement practices are not feasible.	No capability for arable culture or permanent pasture.
Climate (C)	All Ecodistricts ¹ within ARDA boundary not explicitly listed under 2C and 3C.	Ecodistricts: 664, 666, 668, 670, 671, 672, 674, 675, 676, 677, 714, 715, 716	Ecodistricts: 356, 357, 358, 359, 363, 366, 663, 665	None within ARDA boundary			
Consolidated Bedrock (R)				> 50 - 100 cm	20 - 50 cm	< 20 cm	Surface bedrock Fragmental over bedrock
Moisture limitation² (M)		Stratified loams Moderate moisture holding capacity	Loamy sands Low moisture holding capacity	Sands Very low moisture holding capacity	Skeletal sands Very severe moisture deficiency	Stabilized sand dunes	Active sand dunes
Topography³ (T)	a, b (0 - 2%)	c (> 2 - 5%)	d (> 5 - 9%)	e (> 9 - 15%)	f (> 15 - 30%)	g (> 30 - 45%) Eroded slope complex	h (> 45 - 70%) i (> 70 - 100%) j (> 100%)
Structure or Permeability (D)	Granular clay	Massive clay or till soils ⁴ Slow permeability	Solonetzic intergrades Very slow permeability	Black Solonetz Extremely slow Permeability			
Salinity⁵ (N) 0 - 60 cm depth 60 - 120 cm depth	NONE < 2 dS/m < 4 dS/m	WEAK 2 - 4 dS/m 4 - 8 dS/m	MODERATE (s) > 4 - 8 dS/m > 8 - 16 dS/m	STRONG (t) > 8 - 16 dS/m > 16 - 24 dS/m	VERY STRONG (u) ⁶ > 16 - 24 dS/m > 24 dS/m		Salt Flats
Inundation⁷ (I)	No overflow during growing season	Occasional overflow (1 in 10 years)	Frequent overflow (1 in 5 years) Some crop damage	Frequent overflow (1 in 5 years) Severe crop damage	Very frequent (1 in 3 years) Grazing > 10 weeks	Very frequent Grazing 5 - 10 weeks	Land is inundated for most of the season
Excess Water (W)	Well and Imperfectly drained		Loamy to fine textured Gleysols with improved drainage	Coarse textured Gleysols with improved drainage	Poorly drained, no improvements	Very Poorly drained	Open water, marsh
Stoniness (P)	Nonstony (0) and Slightly Stony (1)	Moderately Stony (2)	Very Stony (3) ⁸	Exceedingly Stony (4) ⁹		Excessively Stony (5)	Cobbly Beach Fragmental
Erosion¹⁰ (E)		Moderate erosion (2)	Severe wind or water erosion (3) lowers the basic rating by one class to a maximum rating of Class 6 ¹¹ .				
Cumulative minor adverse Characteristics¹² (X)							

* Based on the Canada Land Inventory Soil Capability Classification for Agriculture (1965), with modifications made for soil application at larger mapping scales.

- 1 Smith, R.E., H. Veldhuis, G.F. Mills, R.G. Eilers, W.R. Fraser, M. Santry, 1996. Terrestrial Ecoregions and Ecodistricts of Manitoba, An Ecological Stratification of Manitoba's Natural Landscapes. Agriculture and Agri-Food Canada, Research Branch, Brandon Research Centre, Manitoba Land Resource Unit, Winnipeg, MB. Report and Provincial Map at scale of 1:1.5m.
- 2 With the exception of Class 2, ratings as indicated are based on the assumption of a single parent material, using the most readily drained representative of each textural class. Prevailing climatic conditions within the Ecodistrict, soil drainage and stratification will affect the moisture limitation accordingly.
- 3 Topographic classes are based on the most limiting slope covering a significant portion of an area of complex, variable slopes. Map units with long, unidirectional slopes may be considered equivalent or one class worse due to an increased erosion hazard.
- 4 Extremely calcareous loamy till soils with a high bulk density ($>1.7 \text{ g/cm}^3$) are rated 3D.
- 5 Soil Salinity is reported in DeciSiemens/metre (dS/m). Soil will be classed according to the most saline depth. For example, if a soil is non-saline from 0 to 60 cm, but moderately saline from 60 to 120 cm, the soil will be classed as moderately saline (3N).
- 6 Strongly saline (u) soils are rated 5N with the exception of poorly and very poorly drained soils, which are rated 6NW.
- 7 Inundation may be listed as a secondary subclass for some fluvial soils. In this case, inundation is not class determining, but may become a limitation if the soil is otherwise improved.
- 8 Extremely calcareous loamy till soils with a high bulk density ($>1.7 \text{ g/cm}^3$) and stony 3 are rated 4DP (4RP if depth to bedrock is 50 - 100 cm).
- 9 Stony 4 soils will be rated 4P unless their primary physical composition is sandy skeletal, or their parent material is till. In either or both of these cases, the soil will be rated 5P.
- 10 If erosion is moderate, a subclass of E is assigned as a secondary limitation, but the basic rating is not lowered. If erosion is severe, the basic soil rating is downgraded by one class, and E becomes the primary limitation. For example, if a soil has a basic rating of 4T, the presence of moderate erosion will result in a rating of 4TE. If erosion is severe, the rating will be lowered to 5ET. Erosion will be the sole limitation only if the basic rating has a subclass of X. For example, a soil with a rating of 3X will be assigned a rating of 3E if moderate erosion is present.
- 11 The rating is not lowered from Class 6 based on erosion. A rating of 6TE indicates a soil with g topography and either moderate or severe erosion.
- 12 Use only for soils with no other limitation except climate. The subclass represents soils with a moderate limitation caused by the cumulative effect of two or more adverse characteristics which are singly not serious enough to affect the rating. Because the limitation is moderate, soils may only be downgraded by one class from their initial climate limitation. Therefore, a soil with a climate limitation of 2C and 2 or more minor adverse characteristics will be rated as 3X. This symbol is always used alone.

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for irrigated potato production	ha	ac	
Agnew (AGW)	xcxx	2WT	4kx Bt2	Poor	5	8	19	0.01
	xxxs	3N	4kx A	Poor	5	8	20	0.01
Argue (ARG)	1cxx	2T	1 Bt2	Good	1	132	327	0.23
	xbxx	2X	1 A	Excellent	1	165	408	0.28
	xcxx	2T	1 Bt2	Good	1	148	367	0.26
Argue (ARG) _i <small>moderately fine tex. variant</small>	xxxx	2X	1 A	Excellent	3	14	36	0.02
Assiniboine (ASB)	xxxs	3IN	3kw Bi	Fair	5	16	40	0.03
Bankton (BAO)	xcxx	2TD	4kx Bt2	Poor	5	269	664	0.46
	xxxx	2D	4kx A	Poor	5	17	41	0.03
Barwood (BWO)	xcxx	2WT	3w Bt2	Fair	4	18	43	0.03
	xxxx	2W	3w A	Fair	4	9	21	0.01
Basker (BKR)	xcxx	5IW	4w Ci	Poor	5	10	25	0.02
	xbxx	5IW	4w Ci	Poor	5	9	23	0.02
	xxxx	5IW	4w Ci	Poor	5	13	31	0.02
Bermont (BMN)	1dxx	3T	2kx Ct2	Fair	4	12	29	0.02
Bearford (BEF)	xcxx	2T	2kx Bt2	Good	4	25	62	0.04
	xxxx	1	2kx A	Good	5	71	174	0.12
Bede (BED)	xd1x	5M	4m Ct2	Poor	5	2	5	0.00
Bell Creek (BEC)	xbxx	5W	4w A	Poor	5	28	70	0.05
Beresford (BSF)	xbxs	3N	3sw A	Fair	4	68	168	0.12
	xbxx	2W	3w A	Fair	3	383	946	0.66
	xcxs	3N	3sw Bt2	Fair	4	53	130	0.09
	xcxx	2WT	3w Bt2	Fair	3	401	990	0.69
	xxxs	3N	3sw A	Fair	4	219	542	0.38
	xxxu	5N	4s A	Poor	5	4	9	0.01
	xxxx	2W	3w A	Fair	3	197	486	0.34
Beresford (BSF) _i <small>loam surface tex. variant</small>	xcxx	2WT	3w Bt2	Fair	3	35	86	0.06
	xdxx	3T	3sw Ct2	Fair	4	28	70	0.05
Bornett (BOR)	xxxx	5W	4w A	Poor	5	6	14	0.01
Cactus (CCS)	1dxx	4M	2m Ct2	Fair	4	39	96	0.07
	2cxx	4M	2m Bt2	Good	2	35	86	0.06
	xcxx	4M	2m Bt2	Good	2	11	28	0.02
	xdxx	4M	2m Ct2	Fair	4	26	65	0.05
Cameron (CMR)	1cxx	2T	1 Bt2	Good	1	81	200	0.14
	1dxx	3T	1 Ct2	Fair	4	5	12	0.01
	xbxx	2X	1 A	Excellent	1	286	707	0.49
	xcxx	2T	1 Bt2	Good	1	1,016	2,511	1.75
	xdxx	3T	1 Ct2	Fair	4	47	117	0.08
	xxxx	2X	1 A	Excellent	1	356	880	0.61
Capell (CXT)	xbxx	2M	3w A	Fair	3	4	9	0.01

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood (cont'd)

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for potato production	ha	ac	
Carroll (CXF)	1cxx	2T	2k Bt2	Good	2	117	289	0.20
	1dxx	3T	2k Ct2	Fair	4	5	13	0.01
	xbxx	2X	2k A	Good	2	72	179	0.12
	xcxx	2T	2k Bt2	Good	2	183	452	0.31
	xdxx	3T	2k Ct2	Fair	4	122	301	0.21
Chambers (CBS)	xexx	4T	2kx Ct2	Fair	5	39	96	0.07
	1dxx	3T	2kx Ct2	Fair	4	13	31	0.02
	xdxx	3T	2kx Ct2	Fair	4	27	66	0.05
	xb1x	2X	2kx A	Good	4	23	57	0.04
	xbxx	2X	2kx A	Good	4	130	321	0.22
	xcxx	2T	2kx Bt2	Good	4	155	383	0.27
	xxxx	2X	2kx A	Good	4	84	206	0.14
Charman (CXV)	xdxx	3T	3w Ct2	Fair	4	23	56	0.04
	xbxs	3N	3sw A	Fair	4	132	326	0.23
	xbxx	2W	3w A	Fair	3	1,135	2,805	1.95
	xcxs	3N	3sw Bt2	Fair	4	54	133	0.09
	xcxx	2WT	3w Bt2	Fair	3	327	808	0.56
	xxxs	3N	3sw A	Fair	4	171	423	0.29
	xxxx	2W	3w A	Fair	3	325	802	0.56
Chater (CXW)	1cxx	5M	4gm Bt2	Poor	5	8	20	0.01
Chaucer (CUC)	xdxx	5M	4m Ct2	Poor	4	28	70	0.05
	xexx	5M	4m Ct2	Poor	5	3	8	0.01
Clementi (CLN)	1cxx	2T	2kx Bt2	Good	4	5	13	0.01
	1dxx	3T	2kx Ct2	Fair	4	11	26	0.02
	xbxx	1	2kx A	Good	4	1,456	3,598	2.50
	xcxx	2T	2kx Bt2	Good	4	1,223	3,023	2.10
	xdxx	3T	2kx Ct2	Fair	4	57	141	0.10
	xd2x	3T	2kx Ct2	Fair	5	24	59	0.04
	xxxx	1	2kx A	Good	4	317	784	0.55
Clementi (CLNt) loam surface variant	xb1x	1	2kx A	Good	4	9	21	0.01
	xbxx	1	2kx A	Good	4	41	101	0.07
Coatstone (CSE)	xxxx	2W	3w A	Fair	4	4	10	0.01
Cobfield (CBF)	xbxs	3N	3sw A	Fair	4	519	1,282	0.89
	xbxx	2W	3w A	Fair	4	1,471	3,636	2.53
	xcxt	4N	4s Bt2	Poor	5	44	108	0.08
	xcxx	2WT	3w Bt2	Fair	4	615	1,519	1.06
	xdxx	3T	3w Ct2	Fair	4	14	34	0.02
	xxxs	3N	3sw A	Fair	4	146	360	0.25
	xxxx	2W	3w A	Fair	4	631	1,558	1.08

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood (cont'd)

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for potato production	ha	ac	
Cobfield (CBF _t) loam surface variant	xbxx	2W	3w A	Fair	4	17	43	0.03
	xxxs	3N	3sw A	Fair	4	38	94	0.07
	xxxx	2W	3w A	Fair	4	27	67	0.05
Cordova (CVA)	1cxx	2T	2kx Bt2	Good	4	27	67	0.05
	xbxx	2X	2kx A	Good	4	76	187	0.13
	xc2x	2TP	2kx Bt2	Good	5	16	40	0.03
	xcxx	2T	2kx Bt2	Good	4	27	66	0.05
	xdxx	3T	2kx Ct2	Fair	4	8	19	0.01
	xxxx	2X	2kx A	Good	4	10	24	0.02
Coulter (COU)	xxxx	2IW	3w A	Fair	3	14	36	0.02
Cranmer (CME)	xbxx	2W	3w A	Fair	3	166	409	0.28
	xcxx	2WT	3w Bt2	Fair	3	52	127	0.09
	xxxs	3N	3sw A	Fair	4	10	25	0.02
	xxxx	2W	3w A	Fair	3	41	101	0.07
Croll (CLL)	xbxx	2W	3w A	Fair	3	33	83	0.06
	xcxx	2WT	3w Bt2	Fair	3	33	83	0.06
	xxxx	2W	3w A	Fair	3	171	421	0.29
Cromer (CRM)	xxxx	5W	4kw A	Poor	5	1	3	0.00
Croyon (CYN)	1dxx	3MT	2gm Ct2	Fair	4	7	18	0.01
Dalny (DNY)	1dxx	3T	2kx Ct2	Fair	4	12	31	0.02
	xb1x	2x	2kx A	Good	4	17	41	0.03
Deleau (DLU)	xbxx	4M	2m A	Good	2	26	63	0.04
	xcxx	4M	2m Bt2	Good	2	56	137	0.10
	xxxx	4M	2m Bt2	Good	2	21	53	0.04
Deloraine (DRI)	xbxx	5W	4w A	Poor	5	3	9	0.01
	xcxx	5W	4w Bt2	Poor	5	10	25	0.02
	xx1s	5W	4w A	Poor	5	7	18	0.01
	xxxs	5W	4w A	Poor	5	13	33	0.02
	xxxt	5W	4sw A	Poor	5	1	3	0.00
	xxxx	5W	4w A	Poor	5	37	91	0.06
Denbow (DBW)	xbxs	3N	3s A	Fair	4	28	68	0.05
	xbxx	2M	2w A	Good	3	1,003	2,478	1.72
	xcxs	3N	3s Bt2	Fair	4	27	66	0.05
	xcxx	2MT	2w Bt2	Good	3	721	1,781	1.24
	xdxx	3T	2w Ct2	Fair	4	31	76	0.05
	xxxx	2M	2w A	Good	3	353	873	0.61
Denbow (DBW _t) loam substrate variant	xbxx	2M	2w A	Good	3	8	21	0.01
	xxxs	3N	3s A	Fair	4	115	284	0.20
Desford (DFD)	xbxx	2W	3w A	Fair	4	262	648	0.45
	xxxt	4N	4s A	Poor	5	16	41	0.03
	xxxx	2W	3w A	Fair	4	55	135	0.09
Drokan (DRO)	xxxx	5W	4w A	Poor	5	15	37	0.03
	xcxx	5W	4w Bt2	Poor	5	19	47	0.03

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood (cont'd)

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for potato production	ha	ac	
Dromore (DOM)	xbxx	3M	2gm A	Good	3	3	6	0.00
	xcxx	3M	2gm Bt2	Good	3	7	17	0.01
	xxxx	3M	2gm A	Good	3	8	20	0.01
Druyman (DXM)	xbxx	2M	3w A	Fair	3	7	18	0.01
Durnan (DRN)	1cxx	2T	1 Bt2	Good	1	11	27	0.02
	1dxx	3T	1 Ct2	Fair	4	161	399	0.28
	xbxx	2X	1 A	Excellent	1	22	54	0.04
	xcxx	2T	1 Bt2	Good	1	180	445	0.31
	xdxx	3T	1 Ct2	Fair	4	145	358	0.25
Elva (ELV)	xbxx	1	2k A	Good	2	87	216	0.15
	xcxx	2T	2k Bt2	Good	2	4	9	0.01
	xxxx	1	2k A	Good	2	324	802	0.56
Elva (ELV _c) Calcareous variant	xxxx	1	4kx A	Poor	5	13	33	0.02
Emblem (EBL)	xbxs	5W	4w A	Poor	5	68	169	0.12
	xbxx	5W	4w A	Poor	5	132	326	0.23
	xcxx	5W	4w Bt2	Poor	5	15	36	0.03
	xxxs	5W	4w A	Poor	5	167	413	0.29
	xxxx	5W	4w A	Poor	5	304	752	0.52
Emblem (EBL _d) Drained Variant	xbxs	3NW	4w A	Poor	5	16	40	0.03
	xbxx	3W	4w A	Poor	5	172	425	0.30
	xcxx	3W	4w Bt2	Poor	5	24	59	0.04
	xxxx	3W	4w A	Poor	5	22	54	0.04
Everton (EVO)	xbxx	1	4k A	Poor	5	15	37	0.03
Fairfax (FFX)	xbxs	5W	4w A	Poor	5	2	4	0.00
	xbxx	5W	4w A	Poor	5	34	83	0.06
	xxxs	5W	4w A	Poor	5	16	40	0.03
	xxxx	5W	4w A	Poor	5	130	322	0.22
Fairfax (FFX _d) Drained variant	xbxx	3W	4w A	Poor	5	185	458	0.32
	xxxs	3NW	4w A	Poor	5	15	37	0.03
	xxxx	3W	4w A	Poor	5	51	125	0.09
Fairland (FND)	1cxx	2T	1 Bt2	Good	1	38	95	0.07
	xbxx	1	1 A	Excellent	1	126	312	0.22
	xcxx	2T	1 Bt2	Good	1	273	675	0.47
	xdxx	3T	1 Ct2	Fair	4	13	31	0.02
	xxxx	1	1 A	Excellent	1	17	42	0.03
Forrest (FRT)	xbxx	2W	4k A	Poor	5	19	47	0.03
	xcxx	2WT	4k Bt2	Poor	5	21	52	0.04
	xxxx	2W	4k A	Poor	5	6	14	0.01
Gateside (GTD)	xbxs	3N	3s A	Fair	4	20	50	0.04

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood (cont'd)

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for potato production	ha	ac	
Gateside (GTD)	xbxx	2M	2w A	Good	3	50	124	0.09
	xcxs	3N	3s Bt2	Fair	4	1	3	0.00
	xcxx	2MT	2w Bt2	Good	3	134	332	0.23
	xxxs	3N	3s A	Fair	4	8	19	0.01
	xxxx	2M	2w A	Good	3	64	158	0.11
George Lake (GGK)	xexx	4MT	2m Ct2	Fair	5	1	2	0.00
Glenview (GLN)	xcxx	2MT	3w Bt2	Fair	3	12	30	0.02
Goodlands (GOL)	xbxs	3N	3sw A	Fair	4	181	446	0.31
	xbxx	2W	3w A	Fair	3	950	2,347	1.63
	xcxs	3N	3sw Bt2	Fair	4	6	16	0.01
	xcxx	2WT	3w Bt2	Fair	3	92	227	0.16
	xxxs	3N	3sw A	Fair	4	214	529	0.37
	xxxt	4N	4s A	Poor	5	60	148	0.10
	xxxx	2W	3w A	Fair	3	262	647	0.45
Graham (GHM)	xbxx	5IW	4w Ci	Poor	5	1	4	0.00
	xcxx	5IW	4w Ci	Poor	5	7	16	0.01
	xxxx	5IW	4w Ci	Poor	5	41	101	0.07
Grande-Clairiere (GDC)	xcxx	6M	3m Bt2	Fair	4	12	29	0.02
	xexx	6M	3m Ct2	Fair	5	334	826	0.57
Grayson (GYS)	xxxx	5W	4w A	Poor	5	8	19	0.01
Grover (GRO)	xxxx	2W	2w A	Good	3	5	12	0.01
Harding (HRG)	xbxx	2W	4kx A	Poor	5	201	497	0.35
	xcxs	2WT	4kx Bt2	Poor	5	75	184	0.13
	xcxx	2WT	4kx Bt2	Poor	5	275	679	0.47
	xxxs	3N	4kx A	Poor	5	35	87	0.06
	xxxx	2W	4kx A	Poor	5	11	28	0.02
Hartney (HRY)	xbxs	3N	3s A	Fair	4	156	387	0.27
	xbxx	2W	2w A	Good	3	1,007	2,488	1.73
	xcxs	3N	3s Bt2	Fair	4	2	6	0.00
	xcxx	2WT	2w Bt2	Good	3	420	1,037	0.72
	xxxs	3N	3s A	Fair	4	98	243	0.17
	xxxx	2W	2w A	Good	3	541	1,336	0.93
Hayfield (HYF)	xxxx	2W	2w A	Good	3	6	14	0.01
Hickson (HKS)	xbxx	5W	4w A	Poor	5	6	15	0.01
	xcxx	5W	4w Bt2	Poor	5	34	84	0.06
	xxxx	5W	4w A	Poor	5	10	25	0.02
Hilton (HIT)	1cxx	2T	2kx Bt2	Good	4	50	123	0.09
	1dxx	3T	2kx Ct2	Fair	4	10	24	0.02

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood (cont'd)

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for potato production	ha	ac	
Hilton (HIT)	xcxx	2T	2kx Bt2	Good	4	13	32	0.02
	xdxx	3T	2kx Ct2	Fair	4	84	208	0.15
Hummerston (HMO)	xbxs	3MN	3s A	Fair	4	23	57	0.04
	xbxx	3MW	2mw A	Good	3	159	394	0.27
	xcxx	3MW	2mw Bt2	Good	3	75	185	0.13
	xdxx	3MT	2mw Ct2	Fair	4	3	8	0.01
	xxxx	3MW	2mw A	Good	3	48	118	0.08
Janick (JIK)	xbxx	1	4kx A	Poor	5	8	19	0.01
	xcxx	2T	4kx Bt2	Poor	5	188	464	0.32
Kemnay (KMY)	xbxx	3M	1 A	Excellent	1	66	162	0.11
	xcxx	3M	1 Bt2	Good	1	6	14	0.01
Kleysen (KYS)	xbxx	2X	2kx A	Good	4	112	277	0.19
	xc1x	2T	2kx Bt2	Good	4	20	50	0.03
	xcxx	2T	2kx Bt2	Good	4	46	115	0.08
	xxxx	2X	2kx A	Good	4	163	403	0.28
Langvale (LGV)	1dxx	3MT	2x Ct2	Fair	4	56	139	0.10
	xc1x	3M	2x Bt2	Good	4	18	44	0.03
	xexx	4T	2x Ct2	Fair	5	10	25	0.02
Lauder (LUD)	xbxx	3MW	2mw A	Good	3	976	2,412	1.68
	xcxs	3NM	3sw bt2	Fair	4	31	77	0.05
	xcxx	3MW	2mw Bt2	Good	3	682	1,686	1.17
	xxxx	3MW	2mw A	Good	3	367	908	0.63
Lavenham (LVH)	xbxx	3MW	2mw A	Good	3	206	509	0.35
	xcxx	3MW	2mw Bt2	Good	3	295	729	0.51
	xxxx	3MW	2mw A	Good	3	23	57	0.04
Lavinia (LAV)	xbxx	2W	3w A	Fair	3	13	31	0.02
	xcxx	2WT	3w Bt2	Fair	4	10	26	0.02
	xxxx	2W	3w A	Fair	3	8	20	0.01
Leighton (LGT)	xbxx	5IW	4w Ci	Poor	5	30	74	0.05
	xxxx	5IW	4w Ci	Poor	5	84	207	0.14
Lenore (LNO)	xd1x	3T	2kx Ct2	Fair	4	52	130	0.09
	xe2x	4T	2kx Ct2	Fair	5	26	64	0.04
	xexx	4T	2kx Ct2	Fair	5	7	18	0.01
	xfxx	5T	2kx Dt2	Poor	5	3	6	0.00
Levine (LEI)	xbxx	3I	3w Bi	Fair	3	4	11	0.01
	xcxx	3I	3w Bt2i	Fair	3	43	106	0.07
	xdxx	3IT	3w Ct2	Fair	4	10	25	0.02
	xexx	4T	3w Ct2	Fair	5	4	11	0.01
	xxxx	3I	3w Bi	Fair	3	19	48	0.03
Liege (LIG)	xbxx	3I	3w Bi	Fair	3	4	9	0.01
	xcxx	3I	3w Bt2i	Fair	3	194	478	0.33
	xxxx	3I	3w Bi	Fair	3	7	17	0.01
Lockhart (LKH)	xbxx	2M	2x A	Good	4	42	104	0.07
Lowton (LWN)	xbxs	5W	4sw A	Poor	5	12	30	0.02
	xbxx	5W	4kw A	Poor	5	44	109	0.08

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood (cont'd)

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for potato production	ha	ac	
Lowton (LWN)	xcxx	5W	4kw Bt2	Poor	5	11	27	0.02
	xxxs	5W	4kw A	Poor	5	46	114	0.08
	xxxx	5W	4kw A	Poor	5	355	878	0.61
Lyleton (LYT)	1cxx	3M	1 Bt2	Good	1	122	300	0.21
	1dxx	3MT	1 Ct2	Fair	4	67	166	0.12
	1xxx	3M	1 A	Excellent	1	135	332	0.23
	xbxx	3M	1 A	Excellent	1	339	838	0.58
	xcxx	3M	1 Bt2	Good	1	905	2,236	1.56
	xdxx	3MT	1 Ct2	Fair	4	146	360	0.25
	xexx	4T	1 Ct2	Fair	5	35	87	0.06
	xfxx	5T	1 Dt2	Poor	5	5	12	0.01
Maon (MON)	xxxx	3M	1 A	Excellent	1	297	734	0.51
	1dxx	3MT	1 Ct2	Fair	4	2	4	0.00
	1exx	4T	1 Ct2	Fair	5	17	43	0.03
	oxxx	3M	1 A	Excellent	1	25	61	0.04
	xbxx	3M	1 A	Excellent	1	33	81	0.06
	xcxx	3M	1 Bt2	Good	1	82	202	0.14
	xdxx	3MT	1 Ct2	Fair	4	62	152	0.11
	xexx	4T	1 Ct2	Fair	5	26	64	0.04
Maples (MPS)	xfxx	5T	1 Dt2	Poor	5	2	4	0.00
	xxxx	3M	1 A	Excellent	1	3	6	0.00
Martinville (MNV)	xcxx	4R	4r Bt2	Poor	5	5	12	0.01
	xexx	4RT	4r Ct2	Poor	5	8	19	0.01
Maskawata (MAW)	xbxx	5W	4w A	Poor	5	79	195	0.14
	xcxx	5W	4w Bt2	Poor	5	5	12	0.01
	xxxx	5W	4w A	Poor	5	70	173	0.12
Melita (MLT)	xbxx	2X	2kx A	Good	4	100	246	0.17
	xcxx	2T	2kx Bt2	Good	4	29	72	0.05
	xd1x	3T	2kx Ct2	Fair	4	19	46	0.03
Mentieth (MNH)	xcxx	2IT	2k Bt2	Good	1	14	34	0.02
	xdxx	3IT	2k ct2	Fair	1	7	17	0.01
	xxxx	2I	2k A	Good	1	3	6	0.00
Miniota (MXI)	xxxx	2M	3w A	Fair	4	9	23	0.02
Minto (MTO)	xdxx	4M	2m Ct2	Fair	4	16	38	0.03
Montgomery (MOT)	xxxx	2W	3kw A	Fair	3	1	2	0.00
	xbxs	3N	3sw A	Fair	4	41	102	0.07
	xbxx	2W	3w A	Fair	4	201	496	0.34
	xcxx	2WT	3w Bt2	Fair	4	21	51	0.04
Moore Park (MPK)	xxxx	2W	3w A	Fair	4	277	686	0.48
Mountainside (MUE)	xcxx	2W	3w A	Fair	4	59	145	0.10
Mowbray (MOW)	xcxx	4R	4r Bt2	Poor	5	7	17	0.01
Naples (NPS)	xxxx	2I	2k A	Good	1	1	4	0.00
Naples (NPS _d)	xbxx	5W	4w A	Poor	5	14	34	0.02
Drained variant	xxxs	3NW	4w A	Poor	5	7	17	0.01

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood (cont'd)

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for potato production	ha	ac	
Neelin (NEI)	xcxs	3IN	3sw Bt2i	Fair	4	37	91	0.06
	xcxx	3I	3w Bt2i	Fair	3	12	30	0.02
Newdale (NDL)	xc1x	2T	2kx Bt2	Good	4	57	141	0.10
	1c1x	2T	2kx Bt2	Good	4	8	20	0.01
	xcxx	2T	2kx Bt2	Good	4	38	95	0.07
	xd1x	3T	2kx Ct2	Fair	4	6	14	0.01
	xdxx	3T	2kx Ct2	Fair	4	14	34	0.02
	xxxx	2X	2kx A	Good	4	12	30	0.02
Oak Lake (OKL)	xbxx	5W	4w A	Poor	5	102	252	0.18
	xxxx	5W	4w A	Poor	5	94	232	0.16
Oak Lake (OKL _d) Drained variant	xbxx	4W	4w A	Poor	5	8	19	0.01
	xxxx	4W	4w A	Poor	5	25	62	0.04
Onahan (ONH)	xcxx	4M	2mw Bt2	Good	3	56	138	0.10
Pipestone (PPT)	xxxx	2W	4kx A	Poor	5	19	47	0.03
Pleasant (PLE)	xbxx	2M	2w A	Good	3	310	765	0.53
	xcxs	3N	3s Bt2	Fair	4	12	30	0.02
	xcxx	2MT	2w Bt2	Good	3	244	603	0.42
	xdxx	3T	2w Ct2	Fair	4	1	2	0.00
	xxxx	2M	2w A	Good	3	106	261	0.18
Plum Lake (PAK)	xbxs	5W	4w A	Poor	5	13	33	0.02
	xbxx	5W	4w A	Poor	5	264	653	0.45
	xcxx	5W	4w Bt2	Poor	5	65	162	0.11
	xxxs	5W	4w A	Poor	5	8	21	0.01
	xxxt	5W	4sw A	Poor	5	15	37	0.03
	xxxx	5W	4w A	Poor	5	278	687	0.48
Plum Lake (PAK _d) Drained variant	xbxs	3NW	4w A	Poor	5	11	27	0.02
	xbxx	3W	4w A	Poor	5	60	149	0.10
	xxxs	3NW	4w A	Poor	5	11	28	0.02
	xxxx	3W	4w A	Poor	5	72	179	0.12
Poolex (POX)	xbxs	5W	4w A	Poor	5	5	12	0.01
	xbxx	5W	4w A	Poor	5	289	713	0.50
	xcxx	5W	4w Bt2	Poor	5	171	421	0.29
	xxxs	5W	4w A	Poor	5	49	120	0.08
	xxxx	5W	4w A	Poor	5	390	964	0.67
Poolex (POX _d) Drained variant	xbxx	3W	4w A	Poor	5	9	23	0.02
Purple (POR)	1cxx	3M	1 Bt2	Good	1	68	168	0.12
	1dxx	3MT	1 Ct2	Fair	4	30	74	0.05
	xcxx	3M	1 Bt2	Good	1	18	46	0.03
	xdxx	3MT	1 Ct2	Fair	4	11	27	0.02
Prodan (PDA)	xbxs	3N	3sw A	Fair	4	333	822	0.57
	xbxx	2W	3w A	Fair	3	388	958	0.67
	xcxs	3N	3sw Bt2	Fair	4	71	176	0.12

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood (cont'd)

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for potato production	ha	ac	
Prodan (PDA)	xcxx	2WT	3w Bt2	Fair	3	427	1,056	0.74
	xdxx	3T	3w Ct2	Fair	4	9	21	0.01
	xxxs	3N	3sw A	Fair	4	148	366	0.25
	xxxx	2W	3w A	Fair	3	119	294	0.20
Prosser (PSE)	xcxx	3M	1 Bt2	Good	1	121	299	0.21
	xxxx	3M	1 A	Excellent	1	9	22	0.02
Ralston (RTO)	xcxx	4M	2mw Bt2	Good	3	122	301	0.21
	xxxx	4M	2mw A	Good	3	17	42	0.03
Ramada (RAM)	1cxx	2T	2k Bt2	Good	2	18	43	0.03
	1dxx	3T	2k Ct2	Fair	4	106	261	0.18
	xbxx	1	2k A	Good	2	486	1,202	0.84
	xcxx	2T	2k Bt2	Good	2	422	1,042	0.72
	xdxx	3T	2k Ct2	Fair	4	68	168	0.12
	xxxx	1	2k A	Good	2	54	133	0.09
Regent (RGT)	xxxx	2W	3w A	Fair	4	11	28	0.02
Rempel (RMP)	xbxx	1	2k A	Good	2	94	233	0.16
	xcxx	2T	2k Bt2	Good	2	57	141	0.10
Rufford (RUF)	1cxx	2T	2kx Bt2	Good	4	123	303	0.21
	1e1x	4T	2kx Ct2	Fair	5	9	22	0.02
	xcxx	2T	2kx Bt2	Good	4	3	8	0.01
	xd2x	3T	2kx Ct2	Fair	5	16	41	0.03
	xdxx	3T	2kx Ct2	Fair	4	69	170	0.12
	xe3x	4T	2kx Ct2	Fair	5	27	66	0.05
Ryerson (RYS)	xb1x	2X	2kx A	Good	4	35	85	0.06
	xfxx	5T	2kx Dt2	Poor	5	5	13	0.01
	xxxx	2X	2kx A	Good	4	10	24	0.02
Sanger (SGR)	xxxs	5W	4w A	Poor	5	7	16	0.01
Scarth (SCH)	1cxx	4M	2m Bt2	Good	2	42	103	0.07
	1dxx	4M	2m Ct2	Fair	4	31	76	0.05
	xbxx	4M	2m A	Good	2	26	64	0.04
	xcxx	4M	2m Bt2	Good	2	102	252	0.18
	xdxx	4M	2m Ct2	Fair	4	45	112	0.08
	xexx	4MT	2m Ct2	Fair	5	69	169	0.12
Schaffner (SFR)	xbxx	2X	1 A	Excellent	1	143	353	0.25
	xcxx	2T	1 Bt2	Good	1	253	626	0.44
	xdxx	3T	1 Ct2	Fair	4	7	17	0.01
	xxxx	2X	1 A	Excellent	1	19	46	0.03
Sewell (SEE)	xxxx	5W	4w A	Poor	5	342	845	0.59
Sewell (SEE _d) Drained variant	xbxx	4W	4w A	Poor	5	47	117	0.08
Shilox (SHX)	xexx	6M	3m Ct2	Fair	5	84	207	0.14

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood (cont'd)

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for potato production	ha	ac	
Sigmund (SGO)	xbxx	2W	4kx A	Poor	5	157	389	0.27
	xcxx	2WT	4kx Bt2	Poor	5	63	157	0.11
	xxxx	2W	4kx A	Poor	5	19	48	0.03
Souris (SOU)	1xxx	3MW	2mw A	Good	3	23	57	0.04
	oxxx	3MW	2mw A	Good	3	36	89	0.06
	xbxx	3MW	2mw A	Good	3	300	742	0.52
	xcxx	3MW	2mw Bt2	Good	3	219	541	0.38
	xexx	4T	2mw Ct2	Fair	5	14	34	0.02
	xxxx	3MW	2mw A	Good	3	305	754	0.52
	1cxx	4M	2m Bt2	Good	2	79	196	0.14
Stanton (STU)	1dxx	4M	2m Ct2	Fair	4	16	40	0.03
	1exx	4MT	2m Ct2	Fair	5	1	2	0.00
	1xxx	4M	2m A	Good	2	77	190	0.13
	xbxx	4M	2m A	Good	2	300	741	0.52
	xcxx	4M	2m Bt2	Good	2	1,400	3,460	2.41
	xdxx	4M	2m Ct2	Fair	4	464	1,147	0.80
	xexx	4MT	2m Ct2	Fair	5	140	345	0.24
	xxxx	4M	2m A	Good	2	66	162	0.11
	Stanton (STU) _i loamy substrate variant	xbxx	3M	2m A	Good	2	19	48
xcxx		3M	2m Bt2	Good	2	21	52	0.04
Stewart (SWR)	1dxx	3T	2kx Ct2	Fair	4	25	61	0.04
Stockton (SCK)	1cxx	4M	2m Bt2	Good	2	86	212	0.15
	1dxx	4M	2m Ct2	Fair	4	32	78	0.05
	xbxx	4M	2m A	Good	2	27	67	0.05
	xcxx	4M	2m Bt2	Good	2	411	1,017	0.71
	xdxx	4M	2m Ct2	Fair	4	41	102	0.07
Stockton (SCK) _c Calcareous variant	xcxx	4M	2m Bt2	Good	2	7	16	0.01
	xdxx	4M	2m Ct2	Fair	4	11	27	0.02
Switzer (SWZ)	oxxx	2M	2w A	Good	3	18	44	0.03
	xbxs	3N	3s A	Fair	4	62	153	0.11
	xbxx	2M	2w A	Good	3	301	743	0.52
	xcxs	3N	3s Bt2	Fair	4	14	35	0.02
	xcxx	2MT	2w Bt2	Good	3	254	627	0.44
	xxxs	3N	3s A	Fair	4	70	173	0.12
	xxxx	2M	2w A	Good	3	360	889	0.62
Switzer (SWZ) _i loam substrate variant.	xcxs	3N	3s Bt2	Fair	4	5	11	0.01
	xcxx	2MT	2w Bt2	Good	3	58	142	0.10
Tadpole (TDP)	xbxs	5W	4w A	Poor	5	42	103	0.07
	xbxx	5W	4w A	Poor	5	46	114	0.08
	xcxs	5W	4w Bt2	Poor	5	29	72	0.05
	xcxx	5W	4w Bt2	Poor	5	139	343	0.24
	xxxs	6W	4w A	Poor	5	92	227	0.16

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood (cont'd)

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for potato production	ha	ac	
Tadpole (TDP)	xxxt	5W	4sw A	Poor	5	13	33	0.02
	xxxu	6NW	4sw A	Poor	5	1	2	0.00
	xxxx	5W	4w A	Poor	5	389	961	0.67
Tadpole (TDP _d) Drained variant	xbxx	3W	4w A	Poor	5	14	36	0.02
	xxxx	3W	4w A	Poor	5	1	2	0.00
Taggart (TGR)	xbxs	3N	3s A	Fair	4	13	32	0.02
	xbxx	2W	2w A	Good	3	130	322	0.22
	xcxx	2WT	2w Bt2	Good	3	592	1,464	1.02
	xxxs	3N	3s A	Fair	4	37	91	0.06
	xxxx	2W	2w A	Good	3	109	270	0.19
Torcan (TOC)	xbxs	3N	3s A	Fair	4	21	51	0.04
	xbxt	4N	4s A	Poor	5	14	34	0.02
	xbxx	2W	2w A	Good	3	267	659	0.46
	xcxs	3N	3s Bt2	Fair	4	45	110	0.08
	xcxx	2WT	2w Bt2	Good	3	83	204	0.14
	xxxs	3N	3s A	Fair	4	70	172	0.12
	xxxx	2W	2w A	Good	3	240	592	0.41
Traverse (TAV)	1dxx	3T	1 Ct2	Fair	4	20	50	0.03
	xbxx	1	1 A	Excellent	1	9	21	0.01
	xcxx	2T	1 Bt2	Good	1	74	183	0.13
Two Creeks (TWC)	xbxs	3N	3sw A	Fair	4	76	188	0.13
	xbxx	2W	3w A	Fair	4	214	528	0.37
	xcxx	2WT	3w Bt2	Fair	4	70	172	0.12
	xxxs	3N	3sw A	Fair	4	268	661	0.46
	xxxt	4N	4s A	Poor	5	9	21	0.01
	xxxx	2W	3w A	Fair	4	344	850	0.59
Underhill (UHL)	xbxs	3N	3s A	Fair	4	403	997	0.69
	xbxx	2W	2w A	Good	3	1,953	4,826	3.36
	xcxs	3N	3s Bt2	Fair	4	11	27	0.02
	xcxx	2WT	2w Bt2	Good	3	652	1,610	1.12
	xxxs	3N	3s A	Fair	5	88	218	0.15
	xxxt	4N	4s A	Poor	5	5	12	0.01
	xxxx	2W	2w A	Good	3	384	948	0.66
Varcoe (VRC)	xbxx	2W	3w A	Fair	4	34	83	0.06
	xc1x	2WT	3w Bt2	Fair	4	21	53	0.04
	xcxx	2WT	3w Bt2	Fair	4	7	17	0.01
Vodroff (VFF)	xbxt	5W	4sw A	Poor	5	13	33	0.02
	xbxx	5W	4w A	Poor	5	25	62	0.04
	xcxs	5W	4w Bt2	Poor	5	12	29	0.02
	xcxx	5W	4w Bt2	Poor	5	51	127	0.09
	xxxs	5W	4w A	Poor	5	78	194	0.13
	xxxx	5W	4w A	Poor	5	249	614	0.43

Table A2. Ag Capability and Irrigation Suitability of Soils in the MU of Souris-Glenwood (cont'd)

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		% of MU
			Class	General rating	Rating for potato production	ha	ac	
Vodroff (VFF _d) Drained variant	xbxx	3W	4w A	Poor	5	35	86	0.06
	xcxs	3NW	4w Bt2	Poor	5	2	6	0.00
	xxxs	3NW	4w A	Poor	5	4	9	0.01
	xxxx	3W	4w A	Poor	5	11	26	0.02
Vordas (VDS)	xbxs	5W	4w A	Poor	5	19	47	0.03
	xbxx	5W	4w A	Poor	5	23	57	0.04
	xcxx	5W	4w Bt2	Poor	5	29	73	0.05
	xxxs	5W	4w A	Poor	5	16	41	0.03
	xxxt	5W	4sw A	Poor	5	18	44	0.03
	xxxx	5W	4w A	Poor	5	135	333	0.23
Vordas (VDS _d) Drained variant	xbxx	3W	4w A	Poor	5	33	81	0.06
	xcxx	3W	4w Bt2	Poor	5	36	88	0.06
Waskada (WKD)	xb1x	2X	2kx A	Good	4	51	127	0.09
	xbxx	2X	2kx A	Good	4	444	1,098	0.76
	xcxx	2T	2kx Bt2	Good	4	106	262	0.18
	xdxx	3T	2kx Ct2	Fair	4	9	22	0.02
	xxxx	2X	2kx A	Good	4	267	659	0.46
Wassewa (WSW)	xxxx	3W	3w A	Fair	5	12	29	0.02
Wawanesa (WWS)	xbxx	2W	2w A	Good	3	146	360	0.25
	xcxs	3N	3s Bt2	Fair	4	1	3	0.00
	xdxx	3T	2w Ct2	Fair	4	5	12	0.01
Wesley (WEL)	xcxx	2WT	3w Bt2	Fair	4	35	86	0.06
	xxxx	2W	3w A	Fair	4	9	23	0.02
Woodfield (WDF)	1cxx	2T	2kx Bt2	Good	4	15	36	0.03
	1dxx	3T	2kx Ct2	Fair	4	4	9	0.01
Eroded Slope Complex (\$ER)	1exx	6E	4m Ct2	Poor	5	46	114	0.08
	1f1x	6E	4m Dt2	Poor	5	20	48	0.03
	1f2x	6E	4m Dt2	Poor	5	130	322	0.22
	1fxx	6E	4m Dt2	Poor	5	212	525	0.37
	1g1x	6ET	4m Dt2	Poor	5	47	115	0.08
	1gxx	6ET	4m Dt2	Poor	5	149	369	0.26
	1hxx	7T	4m Dt2	Poor	5	2	5	0.00
	2exx	6E	4m Ct2	Poor	5	4	10	0.01
	xdxx	6E	4m Ct2	Poor	5	14	36	0.02
	xexx	6E	4m Ct2	Poor	5	13	33	0.02
	xfxx	6E	4m Dt2	Poor	5	519	1,284	0.89
xgxx	6T	4m Dt2	Poor	5	110	271	0.19	
Marsh (\$MH)		7W	4wx Di	Poor	5	156	386	0.27
Unclassified land (\$UL)						251	620	0.43
Urban area (\$UR)						271	669	0.47
Water (\$ZZ)						285	705	0.49
Total						58,153	143,698	100

Table A3. Description of Irrigation Suitability Classes

General Rating	Class	Degree of Limitation	Description
Excellent	1A	No soil or landscape limitations	These soils are medium textured, well drained and hold adequate available moisture. Topography is level to nearly level. Gravity irrigation methods may be feasible.
Good	1B	Slight soil or landscape limitations	The range of crops that can be grown may be limited. As well, higher development inputs and management are required. Sprinkler irrigation is usually the only feasible method of water application.
	2A		
	2B		
Fair	1C	Moderate soil or landscape limitations	Limitations reduce the range of crops that may be grown and increase development and improvement costs. Management may include special conservation techniques to minimize soil erosion, limit salt movement, limit water table build-up or flooding of depressional areas. Sprinkler irrigation is usually the only feasible method of water application.
	2C		
	3A		
	3B		
	3C		
Poor	1D	Severe soil or landscape limitations	Limitations generally result in a soil that is unsuitable for sustained irrigation. Some land may have limited potential when special crops, irrigation systems and soil and water conservation techniques are used.
	2D		
	3D		
	4A		
	4B		
	4C		
	4D		

Table A4. Landscape Features Affecting Irrigation Suitability

Symbol	Landscape Features		Degree of Limitation			
			None (A)	Slight (B)	Moderate (C)	Severe (D)
t1	Slope (per cent)	Simple	< 2	2 - 9	> 9 - 20	>20
t2		Complex	< 5		> 5 - 15	>15
E	Relief, average local (m)		< 1	1 - 3	> 3 - 5	>5
P	Stoniness	Classes	0, 1 & 2	3	4	5
		Cover (per cent)	(0 to 3)	(> 3 to 15)	(> 15 to 50)	(> 50)
I	Inundation – frequency of flooding (period)		1 in 10 years	1 in 5 years	Every year (annual spring)	Every year (seasonal)

* Suitability interpretations are based on the criteria for complex slopes.

Table A5. Soil Features Affecting Irrigation Suitability

Symbol	Soil Feature	Degree of Limitation			
		None (1)	Slight (2)	Moderate (3)	Severe (4)
d	Structure	Granular, Single Grained, Prismatic, Blocky, Subangular Blocky	Columnar, Platy	Massive	Massive
k	Ksat (mm/hr) (0 - 1.2 m)	> 50	50 - 15	< 15 - 1.5	< 1.5
x	Drainability (mm/hr) (1.2 - 3 m)	> 15	15 - 5	< 5 - 0.5	< 0.5
m	AWHC subhumid (mm/1.2 m) (per cent by volume)	> 120 (> 10)	120 - 100 (10 - 8)	< 100 - 75 (< 8 - 6)	< 75 (< 6)
	Subarid (mm/1.2 m) (per cent by volume)	> 150 (> 12)	150 - 120 (12 - 10)	< 120 - 100 (< 10 - 8)	< 100 (< 8)
q	Intake Rate (mm/hr)	> 15	15 - 1.5	15 - 1.5	< 1.5
s	Salinity (mS/cm or dS/m)				
	0 - 0.6 m depth	< 2	2 - 4	> 4 - 8	> 8
	0.6 - 1.2 m depth	< 4	4 - 8	> 8 - 16	> 16
	1.2 - 3 m depth	< 8	8 - 16	> 16	> 16
n	Sodicity (SAR)				
	0 - 1.2 m depth	< 6	6 - 9	> 9 - 12	> 12
	1.2 - 3 m depth	< 6	6 - 9	> 9 - 12	> 12
g	Geological (0 - 1.2 m) Uniformity	1 Textural Group	2 Textural Groups Coarser below	2 Textural Groups Finer below 3 Textural Groups Coarser below	3 Textural Groups Finer below
	(1.2 - 3 m)	2 Textural Groups	3 Textural Groups Coarser below	3 Textural Groups Finer below	
r	Depth to Bedrock (m)	> 3	3 - 2	< 2 - 1	< 1
h	Depth to Water Table (m)	> 2	2 - 1.2 (if salinity is a problem)	2 - 1.2 (if salinity is a problem)	< 1.2
w	Drainage class	Well, Moderately Well	Imperfect	Imperfect	Poor, Very Poor, Excessive, Rapid
	*Texture (classes) (0 - 1.2 m)	L, SiL, VFSL, FSL	CL, SiCL, SCL, SL, LVFS	C, SC, SiC VFS, FS, LS, CoSL	HC GR, CoS, LCoS, S
	*Organic Matter (per cent)	> 2	2 - 1	2 - 1	< 1
	*Surface Crusting Potential	Slight	Low	Low	Moderate

* Other important factors used to interpret type and degree of limitation, but which do not present a limitation to irrigation themselves. No symbol is proposed for these factors since they will not be identified as subclass limitations.

Table A6. Guidelines for Assessing Land Suitability for Irrigated Potato Production under Rapid, Well and Moderately Well-Drained Soil Conditions

In assessing suitability of land for irrigated potato production, the degree of suitability is determined by the most restrictive or severe rating assigned to any one of the listed characteristics or properties.

Characteristic or Property	Suitability Rating				
	Class 1	Class 2	Class 3	Class 4	Class 5
Texture Group*	CL CL/SF CL/SF/SC CL/FL/SF CL/LY LY/SF LY	SY,SY/SC, SY/CL, SY/LY, SY/FL, SY/SS/LY, SF, SY/UD/LY,SF/CS, SF/SC, SF/LY, SF/FL, SC/LY, SC, SF/SS/FL, CL/FL, SC/FL, CL/SS/FL, LY/FL, LY/SC, LY/LS, LY/SS/SF, LY/SS/SC, LY/FL/SF, LY/SS/LY, LY/SS/FL, FL FL/SF, FL/LY, FL/FL, FL/SY/SF, FL/SS/LY, FL/SS/FL, FL/CL	SY/SS, SY/CY/LY, SF/SS, CL/SS, SF/CY, CL/CY, SF/CY/LY, CL/CY/LY, CL/SS/CY, LY/CY, LY/SS, FL/SS	FL/CY, FL/CY/SF	SK, SS, SS/RK, SS/LY, SS/FL, SS/CY, SC/RK, SF/RK, CS, CL/RK, CL/FR, CL/FR/RK, LS/RK, LY/RK, LY/SY/RK, FL/LY/RK, CY, CY/SS, CY/SC, CY/SY, CY/SF, CY/CL, CY/LY, CY/FL, CY, CY/RK, CY/TX, CY/SS/CY, CY/LY/CY, CY/FL/CY, CY/LY/RK, CY/FL/RK, RK, TX, TX/LY, UD, UD/LY
Topography¹ (Slope)	0 - 5 per cent (a, b, c)			> 5 - 9 per cent (d)	> 9 per cent (e, f, g, h, i, j)
Stoniness² class	-			St. 1	St. 2, 3, 4, 5
Salinity³ (mS/cm)	< 2		2 - 4	> 4 - 8	> 8
Soil Order and / or Subgroup	Orthic Regosol				Organic Order, Solonetzic Order, Solonetzic Subgroups

Topography ¹	Stoniness ²	(Surface covered, per cent)	Salinity ³	(mS/cm)
< 5 per cent level to very gently sloping	- non-stony	< 0.01	very low	0 - 2
5 - 9 per cent gently sloping	1 slightly stony	0.01 - 0.1	low	> 2 - 4
> 9 per cent mod. to extremely sloping	2 moderately stony	> 0.1 - 3	weakly (s)	> 4 - 8
	3 very stony	> 3 - 15	moderately (t)	> 8 - 16
	4 exceedingly stony	> 15 - 50	strongly (u)	> 16
	5 excessively stony	> 50		

* SK = Skeletal SC = Sandy Coarse LY = Loamy FR = Fragmental
 SS = Sandy Skeletal SY = Sandy FL = Fine Loamy UD = Undifferentiated
 LS = Loamy Skeletal SF = Sandy Fine CY = Clayey TX = Texture Complex
 CS = Clayey Skeletal CL = Coarse Loamy RK = Bedrock

Table A7. Guidelines for Assessing Land Suitability for Irrigated Potato Production under Imperfect, Poor and Very Poor Soil Conditions

In assessing suitability of land for irrigated potato production, the degree of suitability is determined by the most restrictive or severe rating assigned to any one of the listed characteristics or properties.					
Characteristic or Property	Suitability Rating				
	Class 1	Class 2	Class 3	Class 4	Class 5
Texture Group*			SY, SY/SS, SY/SC, SY/CL, SY/LY, SC/LY, SY/SS/LY, SY/UD/LY, SC, SF, SF/SS, SF/CS, SF/LY, SF/SC, SF/FL, SY/FL, SF/SS/FL, CL, CL/SS, CL/SF, CL/LY, CL/FL, CL/SF/SC, CL/SS/FL, CL/FL/SF, LY/SS, LY/SC, LY/SF, LY/LS, LY/SS/SF, LY/SF/SC, SC/FL, LY, LY/FL, LY/SS/LY, LY/SS/FL, FL, FL/SF, FL/SS, FL/CL, FL/LY, FL/FL, FL/SY/SF, FL/SS/LY, FL/SS/FL	SF/CY, SY/CY/LYSF/CY/LY, SF/CY/FL, CL/CY, CL/FR, CL/CY/LY, CL/SS/CY, LY/CY, FL/CY/SF, FL/CY	SK, SS, SS/RK, SS/LY, SS/FL, SS/CY, SC/RK, SF/RK, CS, CL/RK, CL/FR, CL/FR/RK, LS/RK, LY/RK, LY/SY/RK, FL/LY/RK, CY, CY/SS, CY/SC, CY/SY, CY/SF, CY/CL, CY/LY, CY/FL, CY/RK, CY/TX, CY/SS/CY, CY/LY/CY, CY/FL/CY, CY/LY/RK, CY/FL/RK, RK, TX, TX/LY, UD, UD/LY
Topography ¹ (Slope)			0 - 5 per cent (a, b, c)	> 5 - 9 per cent (d)	> 9 per cent (e, f, g, h, i, j)
Stoniness ² class				St. 1	St. 2, 3, 4, 5
Salinity ³ (mS/cm)	< 2		< 4	4 - 8	> 8
Soil Order and / or Subgroup					Organic Order, Gleysolic Order, Solonchic Order, Solonchic Subgroups

Topography ¹	Stoniness ²	(Surface covered)	Salinity ³	(mS/cm)
< 5 per cent level to very gently sloping	- non-stony	< 0.01 per cent	very low	0 - 2
5 - 9 per cent gently sloping	1 slightly stony	0.01 - 0.1 per cent	low	> 2 - 4
> 9 per cent mod. to extremely sloping	2 moderately stony	> 0.1 - 3 per cent	weakly (s)	> 4 - 8
	3 very stony	> 3 - 15 per cent	Moderately (t)	> 8 - 16
	4 exceedingly stony	> 15 - 50 per cent	Strongly (u)	> 16
	5 excessively stony	> 50 per cent		

* SK = Skeletal
 SS = Sandy Skeletal
 LS = Loamy Skeletal
 CS = Clayey Skeletal

SC = Sandy Coarse
 SY = Sandy
 SF = Sandy Fine
 CL = Coarse Loamy

LY = Loamy
 FL = Fine Loamy
 CY = Clayey
 RK = Bedrock

FR = Fragmental
 UD = Undifferentiated
 TX = Texture Complex

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses

Soil Name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails	
						with	without											
Agnew	AGW	xcxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Ft	Vk	Pks	Psw	Pks	Ps	
		xxxs	Pns	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps	
Argue	ARG	1cxx, xcxx	G	Va	Fa	Fa	Fa	Fa	G	G	G	Fkt	Fk	Ft	G	G	G	
		xbxx	G	Va	Fa	Fa	Fa	Fa	G	G	G	Fak	Fk	G	G	G	G	
Argue *	ARGt	xxxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	PK	Fs	Fs	Fs	Fs	
Assiniboine	ASB	xxxs	Pns	Va	Pa	Piw	Pai	Pai	Pis	Pi	Ps	Pi	Vk	Ps	Ps	Pis	Ps	
Bankton	BAO	xcxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	Ft	Vk	Fkt	Fs	Fks	Fs	
		xxxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	G	Vk	Fks	Fs	Fks	Fs	
Barwood	BWO	xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw	
		xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw	
Basker	BKR	xxxx,xbxx,xcxx	Pi	Va	Pw	Viw	Vi	Vi	Viw	Viw	Pw	Vi	Vhi	Viw	Piw	Viw	Piw	
Bearford	BEF	xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	PK	Fst	Fs	Fs	Fs	
		xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	PK	Fs	Fs	Fs	Fs	
Bede	BED	xd1x	Ps	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pqt	Fms	Fs	G	
Bell Creek	BEC	xbxx	Vn	Fa	Pw	Vw	Pw	Pw	Vhw	Pkw	Pq	Vkg	Vhg	Pw	Pw	Pw	Pw	
Bermont	BMN	1dxx	Fbt	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	PK	Pt	Fs	Fs	Fs	
Beresford	BSF	xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw	
		xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Fnt	Fnw	Fnw	Fnw	Fsw
		xxxx, xbxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw	
		xxxs, xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fnw	Fsw
		xxxu	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Vn	Vn	Vn	Vn	Fsw
Beresford#	BSF _t	xcxx	Fb	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fkt	Phk	Ftw	Fw	Fw	Fw	
		xdxx	Ft	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Pt	Phk	Pt	Fsw	Fsw	Fsw	
Bornett	BOR	xxxx	Fb	Faq	Pw	Vhw	Phw	Pw	Vwg	Vwg	Pcq	Vak	Vhg	Pw	Pw	Pw	Pw	
Cactus	CCS	1dxx	Vb	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Pt	Fms	Fs	G	
		2cxx	Vb	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fst	Fms	Fs	G	
		xcxx	Pbs	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fst	Fms	Fs	G	
		xdxx	Ps	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Pt	Fms	Fs	G	
Cameron	CMR	1cxx	Fb	Va	Fa	Fa	Fa	Fa	G	G	G	Fkt	Fk	Ft	G	G	G	
		1dxx	Fbt	Va	Fa	Fa	Fa	Fa	G	G	G	Pt	Fk	Pt	G	G	G	
		xbxx, xxxx	G	Va	Fa	Fa	Fa	Fa	G	G	G	Fak	Fk	G	G	G	G	
		xcxx	G	Va	Fa	Fa	Fa	Fa	G	G	G	Fkt	Fk	Ft	G	G	G	
		xdxx	Ft	Va	Fa	Fa	Fa	Fa	G	G	G	Pt	Fk	Pt	G	G	G	
Capell	CXT	xbxx	Fbs	Faq	Fw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Fsw	Fsw	Fsw	Fsw	
Carroll	CXF	1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	PK	Fst	Fs	Fs	Fs	

* a moderately fine texture variant; #: a loam surface variant.

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses (cont'd)

Soil Name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
						with	without										
Carroll	CXF	1dxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		xbxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xcxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xdxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
Chambers	CBS	xb1x, xbxx xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1dxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		xdxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		xexx	Pt	Va	Fa	Fat	Fat	Fat	Fs	Ft	Fst	Vt	Pk	Vt	Fst	Fst	Fs
Charman	CXV	xbxx, xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Fnt	Fnw	Fnw	Fsw
		xbxs, xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xdxx	Fst	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Pt	Phk	Pt	Fsw	Fsw	Fsw
		xxxt	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Pn	Pn	Pn	Fsw
Chater	CXW	1cxx	Vb	Fx	G	Fa	G	G	Fsg	Gg	Fcs	Pk	Fk	Fst	Fms	Fs	G
Chaucer	CUC	xdxx	Ps	G	G	G	G	G	Vks	Vk	Vcs	Vkg	Gg	Pt	Fms	Fs	G
		xexx	Pst	G	G	Ft	Ft	Ft	Vks	Vk	Vcs	Vkg	Ftg	Vt	Fmt	Fst	G
Clementi	CLN	1cxx, xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1dxx, xdxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		xbxx, xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xd2x	Fpt	Va	Fa	Fap	Fa	Fa	Fps	G	Fps	Pt	Pk	Pt	Fs	Fps	Fs
Clementi#	CLN _t	xbxx, xb1x	G	Va	Fa	Fa	Fa	Fa	G	G	Fs	Fak	Pk	G	G	G	G
Coatstone	CSE	xxxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fw	Fw	Fw	Fw
Cobfield	CBF	xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xbxx, xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xcxt	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Pn	Pn	Pn	Fsw
		xdxx	Fst	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Pt	Phk	Pt	Fsw	Fsw	Fsw
		xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
Cobfield#	CBF _t	xbxx, xxxx	G	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Phk	Fw	Fw	Fw	Fw
		xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Phk	Fnw	Fnw	Fnw	Fw
Cordova	CVA	1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xbxx, xxxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs

#: a loam surface texture variant.

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses (cont'd)

Soil Name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
						with	without										
Cordova	CVA	xcxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs

		xc2x	Fbp	Va	Fa	Fap	Fa	Fa	Fps	G	Fps	Fkt	Pk	Fpt	Fs	Fps	Fs
		xdxx	Fbt	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
Coulter	COU	xxxx	Fs	Va	Faw	Piw	Pi	Pi	Piw	Pi	Fs	Pi	Pik	Fiw	Fsw	Pi	Fsw
Cranmer	CME	xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xbxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Croll	CLL	xbxx, xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
Cromer	CRM	xxxx	Ps	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	G	Vhk	Psw	Psw	Psw	Psw
Croyon	CYN	1dxx	Pb	Faq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Pt	G	G	G
Dalny	DNY	1dxx	Ft	Va	Fa	Fa	Fa	Fa	Fs	G	G	Pt	Pk	Pt	G	G	G
		xb1x	G	Va	Fa	Fa	Fa	Fa	Fs	G	G	Fak	Pk	G	G	G	G
Deleau	DLU	xcxx	Ps	Fa	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Fst	Fms	Fs	G
		xbxx, xxxx	Ps	Fa	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Fms	Fms	Fs	G
Deloraine	DRI	xcxx, xbxx, xxxx	Fb	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xx1s, xxxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxt	Vn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pnw	Pnw	Pnw	Pw
		xbxx, xxxx	Ps	Va	Fw	Pw	Fw	Fw	Pkw	Pk	G	Pk	Fh	Fw	Fw	Fw	Fw
Denbow	DBW	xbxs, xcxs	Pns	Va	Fw	Pw	Fw	Fw	Pkw	Pk	G	Pk	Fh	Fnw	Fnw	Fnw	Fw
		xcxx	Ps	Va	Fw	Pw	Fw	Fw	Pkw	Pk	G	Pk	Fh	Ftw	Fw	Fw	Fw
		xdxx	Ps	Va	Fw	Pw	Fw	Fw	Pkw	Pk	G	Pkt	Fh	Pt	Fw	Fw	Fw
		xbxx	Ps	Va	Faw	Pw	Faw	Faw	Pkw	Pk	G	Pk	Fh	Fw	Fw	Fw	Fw
Denbow ^s	DBW _t	xxxs	Pns	Va	Faw	Pw	Faw	Faw	Pkw	Pk	G	Pk	Fh	Fnw	Fnw	Fnw	Fw
		xbxx, xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Desford	DFD	xxxt	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Pn	Pn	Pn	Fsw
		xcxx, xxxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Drokan	DRO	xcxx, xxxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Dromore	DOM	xbxx, xxxx	Fb	Faq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	G	G	G	G
		xcxx	Fb	Faq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Ft	G	G	G
Druzman	DXM	xbxx	Fb	Faq	Faw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Fw	Fw	Fw	Fw
Durnan	DRN	1cxx, xcxx	Pb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Fst	Fs	Fs	Fs
		1dxx	Pb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Pt	Fk	Pt	Fs	Fs	Fs
		xbxx	Fb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fak	Fk	Fs	Fs	Fs	Fs
		xdxx	Fbt	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Pt	Fk	Pt	Fs	Fs	Fs

^s loamy substrate variant

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses (cont'd)

Soil Name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
						with	without										
Everton	EVO	xbxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	Fjk	Pk	Fs	Fs	Fs	Fs
Elva	ELV	xbxx, xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs

Elva [^]	ELVc	xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
Emblem	EBL	xbxs, xxxs	Pn	Va	Pw	Vw	Pw	Pw	Vw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xbxx, xcxx xxxx	G	Va	Pw	Vw	Pw	Pw	Vw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Fairfax	FFX	xbxs, xxxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xbxx, xxxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Fairland	FND	1cxx	Fb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Ft	G	G	G
		xbxx, xxxx	G	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	G	G	G	G
		xcxx	G	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Ft	G	G	G
		xdxx	Ft	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Ptg	Fk	Pt	G	G	G
Forrest	FRT	xcxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjt	Pk	Ps	Ps	Ps	Ps
		Xxxx, xbxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjk	Pk	Ps	Ps	Ps	Ps
Gateside	GTD	xbxs, xcxs xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pkw	Pk	G	Pk	Fh	Fnw	Fnw	Fnw	Fw
		xbxx, xxxx	G	Va	Faw	Pw	Faw	Faw	Pkw	Pk	G	Pk	Fh	Fw	Fw	Fw	Fw
		xcxx	G	Va	Faw	Pw	Faw	Faw	Pkw	Pk	G	Pk	Fh	Ftw	Fw	Fw	Fw
George Lake	GGK	xexx	Pt	Fq	G	G	Fa	Ft	Vks	Vkg	Pcq	Vak	Fgt	Vt	Fmt	Ft	G
Glenview	GLN	xcxx	Fb	Faq	Faw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Ftw	Fw	Fw	Fw
Goodlands	GOL	xbxs, xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xbxx, xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Fnt	Fnw	Fnw	Fsw
		xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xxxt	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Pn	Pn	Pn	Fsw
Graham	GHM	xxxx, xbxx xcxx	Pi	Va	Pw	Viw	Vi	Vi	Viw	Viw	Pw	Vi	Vhi	Viw	Piw	Vi	Piw
Grande-Clairiere	GDC	xcxx	Vb	Fa	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Pm	Pm	Fs	G
		xexx	Vb	Fa	G	Ft	Ft	Ft	Vks	Vk	Pq	Vkt	Ftg	Vt	Pm	Fst	Ps
Grayson	GYS	xxxx	G	Pha	Pw	Vhw	Phw	Pfw	Vwg	Pwg	Pqw	Vhg	Vhg	Pw	Pw	Pw	Pw
Grover	GRO	xxxx	G	Pa	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Vkg	Fhg	Fw	Fw	Fw	Fw
Harding	HRG	xbxx, xxxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
		xcxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Ft	Vk	Pks	Psw	Pks	Ps
		xxxs	Pn	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
		xcxs	Pn	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Ft	Vk	Pks	Psw	Pks	Ps

[^] Classification variant (Calcareous Black Chernozem)

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses (cont'd)

Soil Name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
						with	without										
Hartney	HRY	xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Ph	Fnw	Fnw	Fnw	Fw
		xbxt	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Ph	Pn	Pn	Pn	Fw
		xbxx, xxxx	G	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Ph	Fw	Fw	Fw	Fw
		xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fkt	Ph	Fnt	Fnw	Fnw	Fw

		xcxx	G	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fkt	Ph	Ftw	Fw	Fw	Fw	
		xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Ph	Fnw	Fnw	Fnw	Fw	
Hayfield	HYF	xxxx	G	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Ph	Fw	Fw	Fw	Fw	
Hickson	HKS	xcxx, xbxx, xxxx	Fb	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw	
Hilton	HIT	1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Ft	Fs	Fs	Fs	
		xcxx	Fb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Ft	G	G	G	
		1dxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs	
		xdxx	Fbt	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	G	G	G	
Hummerston	HMO	xbxx, xxxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Fsw	Fsw	Fsw	Fw	
		xcxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Ftw	Fsw	Fsw	Fw	
		xdxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Pt	Fsw	Fsw	Fw	
		xbxs	Pn	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Fnw	Fnw	Fnw	Fw	
Janick	JIK	xbxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	G	Vk	Fks	Fs	Fks	Fs	
		xcxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	Ft	Vk	Fst	Fs	Fks	Fs	
Kemnay	KMY	xbxx	Ps	Va	G	G	G	G	Pk	G	G	Pk	G	G	G	G	G	
		xcxx	Ps	Va	G	G	G	G	Pk	G	G	Pk	G	Ft	G	G	G	
Kleysen	KYS	xbxx, xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs	
		xc1x, xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs	
Langvale	LGV	1dxx	Ft	Va	Fa	Fa	Fa	G	Fs	G	G	Pt	Fk	Pt	G	G	G	
		xc1x	G	Va	Fa	Fa	Fa	G	Fs	G	G	Fkt	Fk	Ft	G	G	G	
		xexx	Pt	Va	Fa	Fat	Fat	Ft	Fs	Ft	Ft	Vt	Fkt	Vt	Ft	Ft	Ft	G
		xbxx, xxxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Fsw	Fsw	Fsw	Fw	
Lauder	LUD	xcxs	Pn	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Fwn	Fwn	Fwn	Fw	
		xcxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vk	Pq	Vk	Fhg	Ftw	Fsw	Fsw	Fw	
Lavenham	LVH	xbxx, xxxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Fsw	Fsw	Fsw	Fw	
		xcxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Ftw	Fsw	Fsw	Fw	
Lavinia	LAV	xbxx, xxxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw	
		xcxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Fst	Fsw	Fsw	Fsw	
Leighton	LGT	xxxx, xbxx	Pi	Va	Pw	Viw	Vi	Vi	Viw	Viw	Pw	Vi	Vhi	Viw	Piw	Viw	Piw	
Lenore	LNO	xd1x	Ft	Va	Fa	Fa	Fa	Fa	Fks	G	Fs	Pt	Fk	Pt	G	G	G	

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses(cont'd)

Soil Name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
						with	without										
Lenore	LNO	xexx, xe2x	Pt	Va	Fa	Fat	Fat	Fat	Fks	Ft	Fst	Vt	Fkt	Vt	Fst	Fst	G
		xfxx	Vt	Va	Fat	Pt	Pt	Pt	Fst	Pt	Pt	Vt	Pt	Vt	Pt	Pt	Fst
Levine	LEI	xbxx, xxxx	Fis	Va	Faw	Piw	Pi	Pi	Piw	Pi	Fs	Pi	Phi	Fiw	Fsw	Pi	Fsw
		xcxx	Fis	Va	Faw	Piw	Pi	Pi	Piw	Pi	Fs	Pi	Phi	Fit	Fsw	Pi	Fsw
		xdxx	Fst	Va	Faw	Piw	Pi	Pi	Piw	Pi	Fs	Pi	Phi	Pt	Fsw	Pi	Fsw
		xexx	Pt	Va	Faw	Piw	Pi	Pi	Piw	Pi	Fst	Pit	Phi	Vt	Fit	Pi	Ftw
Liege	LIG	xbxx, xxxx	Fi	Va	Faw	Piw	Pi	Pi	Piw	Pi	G	Pi	Phi	Fiw	Fw	Pi	Fw
		xcxx	Fi	Va	Faw	Piw	Pi	Pi	Piw	Pi	G	Pi	Phi	Fit	Fw	Pi	Fw

Lockhart	LKH	xbxx	Fb	Vax	Fa	Fa	Fa	G	Fs	G	G	Fk	Fk	G	G	G	G	
Lowton	LWN	xbxx, xxxx	Ps	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	G	Vhk	Psw	Psw	Psw	Psw	
		xcxx	Ps	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	Ft	Vhk	Psw	Psw	Psw	Psw	
		xxxs, xbxs	Pns	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	G	Vhk	Psw	Psw	Psw	Psw	
Lyleton	LYT	1cxx	Fb	Va	G	G	G	G	Pk	Pk	G	Pk	G	Ft	G	G	G	
		1xxx	Fb	Va	G	G	G	G	Pk	Pk	G	Pk	G	G	G	G	G	
		1dxx, xdxx	Ft	Va	G	G	G	G	Pk	Pk	G	Pkt	G	Pt	G	G	G	
		xbxx, xxxx	G	Va	G	G	G	G	Pk	Pk	G	Pk	G	G	G	G	G	
		xcxx	G	Va	G	G	G	G	Pk	Pk	G	Pk	G	Ft	G	G	G	
		xexx	Pt	Va	G	Ft	Ft	Ft	Pk	Pk	Ft	Vt	Ft	Vt	Ft	Ft	Ft	G
		xfxx	Vt	Va	Ft	Pt	Pt	Pt	Pk	Pkt	Pt	Vt	Pt	Vt	Pt	Pt	Pt	Ft
Maon	MON	1cxx, oxxx	Pb	Va	G	G	G	G	Pk	Pk	G	Pk	G	Ft	G	G	G	
		xcxx	G	Va	G	G	G	G	Pk	Pk	G	Pk	G	Ft	G	G	G	
		1dxx	Pb	Va	G	G	G	G	Pk	Pk	G	Pkt	G	G	G	G	G	
		xdxx	Ft	Va	G	G	G	G	Pk	Pk	G	Pkt	G	G	G	G	G	
		xexx	Pt	Va	G	Ft	Ft	Ft	Pk	Pk	Ft	Vt	Ft	Vt	Ft	Ft	Ft	G
		xfxx	Vt	Va	Ft	Pt	Pt	Pt	Pk	Pkt	Pt	Vt	Pt	Vt	Pt	Pt	Pt	Ft
		xbxx, xxxx	G	Va	G	G	G	G	Pk	Pk	G	Pk	G	G	G	G	G	G
Maples	MPS	xcxx	Fb	Vad	Fdw	Pdw	Fdw	Fad	Vdg	Pkg	Pd	Pd	Pd	Fdt	Fm	G	G	
		xexx	Pt	Vad	Fdw	Pdw	Fdw	Fdt	Vdg	Pkg	Pd	Vt	Pd	Vdt	Fmt	G	Fs	
Marsh	\$MH	xxxx	Vw	Vah	Vhw	Vhw	Vhw	Vaw	Vhw	Vhw	Vw	Vhi	Vhi	Vsw	Vsw	Vsw	Vw	
Martinville	MNV	xbxx, xxxx, xcxx	Fb	Pa	Pw	Vhw	Phw	Pw	Vwg	Pwg	Pqw	Vhk	Vh	Pw	Pw	Pw	Pw	
Maskawata	MAW	xbxx	Fb	Va	Fa	Fa	Fa	Fa	Fs	G	G	Fak	Pk	G	G	G	G	
		xcxx	Fb	Va	Fa	Fa	Fa	Fa	Fs	G	G	Fkt	Pk	Ft	G	G	G	
		xd1x	Fbt	Va	Fa	Fa	Fa	Fa	Fs	G	G	Pt	Pk	Pt	G	G	G	
Melita	MLT	xcxx	G	Va	Fa	Fa	Fa	Fa	Fi	Fi	G	Fat	Fk	Ft	G	Fis	G	
		xdxx	G	Va	Fa	Fa	Fa	Fa	Fi	Fi	G	Pt	Fk	Pt	G	Fis	G	
		xxxx	G	Va	Fa	Fa	Fa	Fa	Fi	Fi	G	Fak	Fk	G	G	Fis	G	

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses (cont'd)

Soil Name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
						with	without										
Mentieth	MNH	xxxx	Fb	Va	Faw	Pw	Fw	Fw	Pw	Fw	G	Fk	Ph	Fw	Fw	Fw	Fw
Miniota	MXI	xdxx	Fbt	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Pt	Fms	G	G
Minto	MTO	xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Montgomery	MOT	xbxx, xxxx	Fb	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Phk	Fw	Fw	Fw	Fw
		xcxx	Fb	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fkt	Phk	Ftw	Fw	Fw	Fw
		xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Phk	Fnw	Fnw	Fnw	Fnw
Moore Park	MPK	xcxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Fsw	Fsw	Fsw	Fsw
Mountainside	MUE	xcxx	Fb	Vad	Fdw	Pdw	Fdw	Fdw	Vdg	Fwg	Pd	Pd	Pd	Fdt	Fw	Fw	Fw
Mowbray	MOW	xxxx	Fis	Va	Fa	Fa	Fa	Fai	Fis	Fi	Fs	Fak	Fk	Fs	Fs	Fis	Fs

Naples	NPS	xbxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Neelin	NEI	xcxx	Fis	Va	Faw	Piw	Pi	Pi	Piw	Pi	Fs	Pi	Pik	Fiw	Fsw	Pi	Fsw
		xcxs	Pn	Va	Faw	Piw	Pi	Pi	Piw	Pi	Fs	Pi	Pik	Fnw	Fnw	Pi	Fsw
Newdale	NDL	xc1x, xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		1c1x	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xdxx, xd1x	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
Oak Lake	OKL	xbxx, xxxx	Ps	Pa	Pw	Vhw	Phw	Pw	Vwg	Vhk	Pqw	Vhk	Vhg	Pw	Pw	Pw	Pw
Onahan	ONH	xcxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Ftw	Fsw	Fsw	Fw
Pipestone	PPT	xxxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
Pleasant	PLE	xbxx, xxxx	G	Va	Fw	Pw	Faw	Faw	Pkw	Pkg	G	Pk	Fh	Fw	Fw	Fw	Fw
		xcxs	Pn	Va	Fw	Pw	Faw	Faw	Pkw	Pkg	G	Pk	Fh	Fnt	Fnw	Fnw	Fw
		xcxx	G	Va	Fw	Pw	Faw	Faw	Pkw	Pkg	G	Pk	Fh	Ftw	Fw	Fw	Fw
		xdxx	Ft	Va	Fw	Pw	Faw	Faw	Pkw	Pkg	G	Pkt	Fh	Pt	Fw	Fw	Fw
Plum Lake	PAK	xbxs, xxxs	Pn	Va	Phw	Vw	Phw	Pw	Vhw	Pkw	Pw	Vh	Vh	Pw	Pw	Pw	Pw
		xxxt	Vn	Va	Phw	Vw	Phw	Pw	Vhw	Pkw	Pw	Vh	Vh	Pnw	Pnw	Pnw	Pw
		xbxx, xcxx xxxx	Ps	Va	Phw	Vw	Phw	Pw	Vhw	Pkw	Pw	Vh	Vh	Pw	Pw	Pw	Pw
Poolex	POX	xbxs, xxxs	Pn	Va	Phw	Vw	Pw	Pw	Vhw	Pkw	Pw	Vh	Vh	Pw	Pw	Pw	Pw
		xbxx, xcxx xxxx	Fb	Va	Phw	Vw	Pw	Pw	Vhw	Pkw	Pw	Vh	Vh	Pw	Pw	Pw	Pw
Porple	POR	1cxx	Pb	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pk	G	Ft	G	G	G
		1dxx	Pb	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pkt	G	Pt	G	G	G
		xcxx	G	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pk	G	Ft	G	G	G
		xdxx	Ft	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pkt	G	Pt	G	G	G

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses (cont'd)

Soil Name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
						With	without										
Prodan	PDA	xbxs, xxxx	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Fnt	Fnw	Fnw	Fsw
		xbxx, xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xdxx	Fst	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Pt	Phk	Pt	Fsw	Fsw	Fsw
		xxxt	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Pn	Pn	Pn	Fsw
Prosser	PSE	xcxx	G	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pk	G	Ft	G	G	G
		xxxx	G	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pk	G	G	G	G	G
Ralston	RTO	xxxx	Ps	Fa	Fw	Pw	Fw	Fw	Vks	Vk	Pq	Vk	Fhg	Fsw	Fsw	Fsw	Fw
		xcxx	Ps	Fa	Fw	Pw	Fw	Fw	Vks	Vk	Pq	Vk	Fhg	Ftw	Fsw	Fsw	Fw
Ramada	RAM	1cxx, xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xbxx, xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xdxx, 1dxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
Regent	RGT	xxxx	Fb	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fw	Fw	Fw	Fw
Rempel	RMP	xbxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
Rufford	RUF	1c1x, 1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xd2x	Fpt	Va	Fa	Fap	Fa	Fa	Fps	G	Fps	Pt	Pk	Pt	Fs	Fps	Fs
		xdxx	Fbt	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		xe3x	Ppt	Va	Fap	Pp	Fpt	Fat	Pp	Ft	Pp	Vt	Pk	Vt	Fpt	Pp	Fps
		1e1x	Pbt	Va	Fa	Fat	Fat	Fat	Fs	Ft	Fst	Vt	Pk	Vt	Fst	Fst	Fst
		xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs
Ryerson	RYS	xb1x, xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	G	G	G	G
		xfxx	Vt	Va	Fat	Pt	Pt	Pt	Fst	Pt	Pt	Vt	Pkt	Vt	Pt	Pt	Ft
Sanger	SGR	xxxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Scarth	SCH	1cxx, xcxx	Ps	Pa	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Fst	Fms	Fs	G
		1dxx	Pbs	Pa	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Pt	Fms	Fs	G
		xbxx	Ps	Pa	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Fms	Fms	Fs	G
		xdxx	Ps	Pa	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Pt	Fms	Fs	G
		xexx	Pst	Pa	G	Ft	Ft	Ft	Vks	Vk	Pq	Vkt	Fgt	Vt	Fts	Fts	G
Schaffner	SFR	xbxx xxxx	G	Va	Fa	Fa	Fa	Fa	G	G	G	Fak	Fk	G	G	G	G
		xcxx	G	Va	Fa	Fa	Fa	Fa	G	G	G	Fkt	Fk	Ft	G	G	G
		xdxx	Ft	Va	Fa	Fa	Fa	Fa	G	G	G	Pt	Fk	Pt	G	G	G
Sewell	SEE	xbxx, xxxx	Ps	Pa	Pw	Vhw	Phw	Pw	Vwg	Vhk	Pqw	Vkg	Vhg	Pw	Pw	Pw	Pw
Sigmund	SGO	xbxx, xxxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
		xcxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Ft	Vk	Pks	Psw	Pks	Ps
Souris	SOU	1xxx	Vb	Pa	Fw	Pw	Fw	Fw	Vks	Vk	Pq	Vk	Fhg	Fsw	Fsw	Fsw	Fw

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses (cont'd)

Soil Name	Soil code	Soil phases	Top soil	Sand &	Road fill	Building - basement	Local roads/	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths &
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				gravel		with	without	streets		area							trails	
Souris	SOU	xcxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vk	Pq	Vk	Fhg	Ftw	Fsw	Fsw	Fw	
		xbxx, xxxx, oxxx	Ps	Pa	Fw	Pw	Fw	Fw	Fw	Vks	Vk	Pq	Vk	Fhg	Fsw	Fsw	Fsw	Fw
		xexx	Pst	Pa	Fw	Pw	Ftw	Ftw	Ftw	Vks	Vk	Pq	Vkt	Fht	Vt	Ftw	Ftw	Fw
Stanton	STU	1cxx	Pbs	Pa	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Fst	Fms	Fs	G	
		1dxx	Pbs	Pa	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Pt	Fms	Fs	G	
		1exx, xexx	Pst	Pa	G	Ft	Ft	Ft	Ft	Vks	Vk	Pq	Vkt	Ftg	Vt	Fst	Fst	G
		1xxx	Pbs	Pa	G	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Fms	Fms	Fs	G
		xbxx, xxxx	Ps	Pa	G	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Fms	Fms	Fs	G
		xcxx	Ps	Pa	G	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Fst	Fms	Fs	G
		xdxx	Ps	Pa	G	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Pt	Fms	Fs	G
Stanton ^s	STU _t	xcxx	Ps	Pa	Fa	G	G	G	Vks	Vk	Pq	Vk	Fk	Fst	Fms	Fs	G	
		xbxx	Ps	Pa	Fa	G	G	G	Vks	Vk	Pq	Vk	Fk	Fs	Fms	Fs	G	
Stewart	SWR	xdxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs	
Stockton	SCK	1cxx, xcxx	Ps	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fst	Fms	Fs	G	
		xdxx, 1dxx	Ps	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Pt	Fms	Fs	G	
		xbxx	Ps	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fms	Fms	Fs	G	
Stockton [^]	SCK _c	xcxx	Ps	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fst	Fms	Fs	G	
		xdxx	Ps	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Pt	Fms	Fs	G	
Switzer	SWZ	xxxx, xbxx xxxx	Fb	Va	Fw	Pw	Fw	Fw	Pkw	Pk	G	Pk	Fh	Fw	Fw	Fw	Fw	
		xbxs, xxxs	Pn	Va	Fw	Pw	Fw	Fw	Pkw	Pk	G	Pk	Fh	Fnw	Fnw	Fnw	Fw	
		xbxt	Vn	Va	Fw	Pw	Fw	Fw	Pkw	Pk	G	Pk	Fh	Pn	Pn	Pn	Fw	
		xcxs	Pn	Va	Fw	Pw	Fw	Fw	Pkw	Pk	G	Pk	Fh	Fnt	Fnw	Fnw	Fw	
		xcxx	Fb	Va	Fw	Pw	Fw	Fw	Pkw	Pk	G	Pk	Fh	Ftw	Fw	Fw	Fw	
Switzer ^s	SWZ _t	xcxs	Pn	Va	Fw	Pw	Fw	Fw	Pkw	Pk	G	Pk	Fa	Fnt	Fnw	Fnw	Fw	
		xcxx	Fb	Va	Fw	Pw	Fw	Fw	Pkw	Pk	G	Pk	Fa	Ftw	Fw	Fw	Fw	
Tadpole	TDP	xbxs, xxxs xcxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw	
		xbxx, xxxx, xcxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw	
		xxxt	Vn	Va	Pw	Vw	Pw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pnw	Pnw	Pnw	Pw
		xxxu	Vn	Va	Pw	Vw	Pw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Vn	Vn	Vn	Pw
Taggart	TGR	xbxx, xxxx	G	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fw	Fw	Fw	Fw	
		xcxx	G	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Ftw	Fw	Fw	Fw	
		xxxs, xbx	Pn	Va	Faw	Pw	Faw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fnw	Fnw	Fnw	Fw
Torcan	TOC	xbxs, xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fk	Ph	Fnw	Fnw	Fnw	Fw	

^sloamy substrate variant. [^] Classification variant (Calcareous Black Chernozem)

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses (cont'd)

Soil Name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
						with	without										
Torcan	TOC	xbxx, xxxx	G	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fk	Ph	Fw	Fw	Fw	Fw
		xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fk	Ph	Fnt	Fnw	Fnw	Fw
		xcxx	G	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fk	Ph	Ftw	Fw	Fw	Fw
		xbxt	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fk	Ph	Pn	Pn	Pn	Fw
Traverse	TAV	1dxx	Ft	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Ptg	Fk	Pt	Fs	Fs	Fs
		xbxx	G	Va	Fa	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Fs	Fs	Fs
		xcxx	G	Va	Fa	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Fst	Fs	Fs
Two Creeks	TWC	xbxx, xxxx	Fb	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Phk	Fw	Fw	Fw	Fw
		xcxx	Fb	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fkt	Phk	Ftw	Fw	Fw	Fw
		xxxs, xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Phk	Fnw	Fnw	Fnw	Fw
		xxxt	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Phk	Pn	Pn	Pn	Fw
Underhill	UHL	xbxs, xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Ph	Fnw	Fnw	Fnw	Fw
		xxxt	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Ph	Pn	Pn	Pn	Fw
		xbxx, xxxx	G	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fak	Ph	Fw	Fw	Fw	Fw
		xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	G	Fkt	Ph	Ftw	Fnw	Fnw	Fw
Varcoe	VRC	xbxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xcxx, xc1x	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
Vodroff	VFF	xbxt	Vn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pnw	Pnw	Pnw	Pw
		xbxx, xxxx xcxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xcxs, xxxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Vordas	VDS	xbxx, xcxx xxxx	G	Va	Pw	Vw	Pw	Pw	Vhw	Pwg	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxs, xbxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pwg	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxt	Vn	Va	Pw	Vw	Pw	Pw	Vhw	Pwg	Pw	Ph	Vh	Pnw	Pnw	Pnw	Pw
Waskada	WKD	xbxx, xb1x, xxxx	G	Va	Fa	Fa	Fa	Fa	Fs	G	G	Fak	Pk	G	G	G	G
		xcxx	G	Va	Fa	Fa	Fa	Fa	Fs	G	G	Fkt	Pk	Ft	G	G	G
		xdxx	Ft	Va	Fa	Fa	Fa	Fa	Fs	G	G	Pt	Pk	Pt	G	G	G
Wassewa	WSW	xxxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Wawanesa	WWS	xbxx	Fb	Pa	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Vkg	Fhg	Fw	Fw	Fw	Fw
		xcxs	Pn	Pa	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Vkg	Fhg	Fnw	Fnw	Fnw	Fw
		xdxx	Fbt	Pa	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Vkg	Fhg	Pt	Fw	Fw	Fw
Wesley	WEL	xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Woodfield	WDF	1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1dxx	Pb	Va	Fa	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs

Table A9. Guide for Assessing Soil Suitability as a Source of Topsoil

The term topsoil includes soil materials used to cover barren surfaces exposed during construction and materials used to improve soil conditions on lawns, gardens and flower beds. The factors to be considered include not only the characteristics of the soil itself, but also the ease or difficulty of excavation, and where removal of topsoil is involved, accessibility to the site.

Symbol ¹	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
u	Moist Consistency²	Very friable, friable	Loose, firm	Very firm	Cemented
l	Flooding	None	May flood occasionally for short periods	Frequent flooding (every year)	Constantly flooding
w	Wetness²	Wetness is not determining if better than very poorly drained.			Very poorly drained and permanently wet soils
t	Slope	≤5% (a, b, c)	> 5 - 9% (d)	> 9 - 15% (e)	> 15% (f, g, h, i, j)
p	Stoniness²	Stones > 10 m apart (Class 0 and 1)	Stones > 2 - 10 m apart (Class 2)	Stones 0.1 - 2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
c	Coarse fragments² (% by volume)	≤ 3%	> 3 - 15%	> 15 - 35%	> 35%
s	Texture²	SL, FSL, VFSL, L, SiL; SC if 1:1 clay is dominant	SCL, CL, SiCL; SC if 2:1 clay is dominant; C and SiC if 1:1 clay is dominant	S, LS; SiC and C if 2:1 clay is dominant. organic soils ³	Marl, diatomaceous earth
b	Depth of Topsoil⁴	> 40 cm	> 15 - 40 cm	8 - 15 cm	< 8 cm
n	Salinity of Topsoil⁵	EC < 1	EC 1 - 4	EC > 4 - 8 (s)	EC > 8 (t, u)

¹ The symbol is used to indicate the property affecting use.

² For an explanation of texture, consistence, stoniness, coarse fragments and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

³ Non-woody organic materials are assessed as good sources for topsoil if mixed with or incorporated into mineral soil.

⁴ The remaining soil material (at least 8 cm) must be reclaimable after the uppermost soil is removed.

⁵ EC = Electrical Conductivity (milliSiemens/cm).

Additional Notes:

Well-drained Till soils with erosion 1, rated as **Fb** for depth of topsoil; erosion 2 rated as **Pb** for depth of topsoil; and erosion 3 rated as **Vb** for depth of topsoil.

Well-drained Luvisols and Dark Gray Chernozems with erosion 2 or 3 rated as **Vb** for depth of topsoil.

Regosols rated as **Vb** for depth of topsoil.

Poorly-drained organic soils rated as **Vw** for topsoil and Organic soils, drained phase, are rated as **Ps** for topsoil.

Table A10. Guide for Assessing Soil Suitability as a Source of Sand and Gravel

The purpose of this table is to provide guidance for assessing the probable supply as well as quality of the sand or gravel for use as road base material and in concrete. The interpretation pertains mainly to the characteristics of substratum to a depth of 150 cm, augmented by observations made in deep cuts as well as geological knowledge where available.

Symbol ¹	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
a	Unified Soil Group²	GW GP SW SP	GW - GM GP - GM SW - SM SP - SM	GM GW - GC GP - GC SM SW - SC SP - SC	All other groups and bedrock (ML, CL, OL, MH, CH, OH, PT)
h	Depth to Seasonal Water Table	Not class determining if deeper than 50 cm		< 50 cm	
q	Depth to Sand and Gravel	< 25 cm	25 - 75 cm ³	> 75 cm ³	
p	Stoniness⁴	Not class determining if stones > 0.5 m apart (Class 0, 1, 2 and 3)		Stones 0.1 - 0.5 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
d	Depth to Bedrock	> 100 cm	50 - 100 cm	< 50 cm	
x	Thickness of sand and gravel	> 100 cm	50 - 100 cm	< 50 cm	

¹ The symbol is used to indicate the property affecting use.

² Shaly gravels rated as Poor (Pa). Meanings of the definition letters can be found at http://en.wikipedia.org/wiki/Unified_Soil_Classification_System

³ Rated good if it is known that the underlying gravel or sand deposit is thick (> 100 cm).

⁴ For an explanation of stoniness and rockiness, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

Table A11. Guide for Assessing Soil Suitability as a Source of Road fill

Fill material for building or roads are included in this use. The performance of the material when removed from its original location and placed under load at the building site or road bed is to be considered. **Since surface materials are generally removed during road or building construction, their properties are disregarded.** Aside from this layer, **the whole soil to a depth of 150-200 cm should be evaluated.** Soil materials which are suitable for fill can be considered equally suited for road subgrade construction.

Symbol ¹	Property Affecting Use ²	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
a	Subgrade ³ a.) AASHO Group Index ⁴	< 5	5 - 8	> 8	
	b.) Unified Soil Group	GW, GP, SW, SP SM, GC ⁵ and SC ⁵	CL (with P.I. ⁶ <15) and ML	CL (with P.I. ⁶ of 15 or more), CH and MH ⁷	OL, OH and PT
l	Shrink-swell potential	Low	Moderate	High	
f	Susceptibility to frost action ⁸	Low	Moderate	High	
t	Slope	≤15% (a, b, c, d, e)	> 15 - 30% (f)	> 30 - 45% (g)	> 45% (h, i, j)
p	Stoniness ⁹	Stones > 2 m apart (Class 0, 1 and 2)	Stones > 0.5 - 2 m apart (Class 3)	Stones 0.1 - 0.5 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
r	Rockiness ⁹	Rock exposures > 35 m apart and cover < 10% of the surface	Rock exposure > 10 - 35 m apart and cover 10 - 25% of the surface	Rock exposure 3.5 - 10 m apart and cover > 25 - 50% of the surface	Rock exposure < 3.5 m apart and cover > 50 - 90% of the surface
w	Wetness ⁹	Excessively drained to moderately well drained	Imperfectly drained	Poorly drained	Very poorly drained or permanently wet soils
d	Depth to Bedrock	> 100 cm	> 50 - 100 cm	20 - 50 cm	< 20 cm
h	Depth to Seasonal Water Table	> 150 cm	> 75 - 150 cm	50 - 75 cm	< 50 cm

¹ The symbol is used to indicate the property affecting use.

² The first, three properties pertain to soil after it is placed in a fill; the last six properties pertain to soil in its natural condition before excavation for road fill.

³ This property estimates the strength of the soil material, that is, its ability to withstand applied loads.

⁴ Use AASHO group index only where laboratory data are available for the kind of soil being rated; otherwise, use Unified Soil Groups.

⁵ Downgrade suitability rating to fair if content of fines is more than about 30 per cent.

⁶ P.I. means plasticity index.

⁷ Upgrade suitability rating to fair if MH is largely kaolinitic, friable, and free of mica.

⁸ Use this property only where frost penetrates below the paved or hardened surface layer and where moisture transportable by capillary movement is sufficient to form ice lenses at the freezing front.

⁹ For an explanation of stoniness, rockiness and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

Table A12. Guide for Assessing Soil Suitability for Permanent Buildings¹

This guide applies to undisturbed soils to be evaluated for single-family dwellings and other structures with similar foundation requirements. The emphasis for rating soils for buildings is on foundation requirements. But soil slope, susceptibility to flooding and other hydrologic conditions, such as wetness, that have effects beyond those related exclusively to foundations are considered as well. Also considered are soil properties, particularly depth to bedrock, which influence excavation, landscaping and septic tank absorption fields.

Symbol ²	Property Affecting Use	Degree of Soil Suitability ³			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness ⁴	<u>With Basements:</u> Very rapidly, rapidly and well drained <u>Without Basements:</u> Very rapidly, rapidly well and moderately well drained	<u>With Basements:</u> Moderately well drained <u>Without Basements:</u> Imperfectly drained	<u>With Basements:</u> Imperfectly drained <u>Without Basements:</u> Poorly drained	<u>With Basements:</u> Poorly, and very poorly drained Permanently wet soils <u>Without Basements:</u> Very poorly drained Permanently wet soils.
h	Depth to Seasonal Water Table	<u>With Basements:</u> > 150 cm <u>Without Basements:</u> > 75 cm	<u>With Basements:</u> > 75 - 150 cm <u>Without Basements:</u> > 50 - 75 cm	<u>With Basements:</u> 25 - 75 cm <u>Without Basements:</u> 25 - 50 cm	<u>With Basements:</u> < 25 cm <u>Without Basements:</u> < 25 cm
i	Flooding	None	None	Occasional flooding or ponding (once in 5 years)	Frequent flooding or ponding (every year)
t	Slope ⁵	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i, j)
a	Subgrade ⁶ a.) AASHO Group Index ⁷ b.) Unified Soil Group	< 5 GW, GP, SW, SP, GC, SM and SC	5 - 8 CL (with P.I. ⁸ < 15) and ML	> 8 CL (with P.I. ⁸ of 15 or more), CH and MH	OH, OL and PT
f	Potential Frost Action ^{9, 13}	Low (F1, F2)	Moderate (F3)	High (F4)	
p	Stoniness ⁴	Stones > 10 m apart (Class 0 to 1)	Stones > 2 - 10 m apart (Class 2 ¹⁰)	Stones 0.1 - 2 m apart (Class 3 ¹⁰ to 4)	Stones < 0.1 m apart (Class 5 ¹⁰)
r	Rockiness ^{4, 11}	Rock exposure > 100 m apart and cover < 2% of the surface	Rock exposure 30 - 100 m apart and cover 2 - 10% of the surface	Rock exposure < 30 m apart and cover > 10% of the surface	Rock exposure too frequent to allow location of permanent buildings
d	Depth to Bedrock ¹¹	<u>With Basements:</u> > 150 cm <u>Without Basements:</u> > 100 cm	<u>With Basements:</u> > 100 - 150 cm <u>Without Basements:</u> 50 - 100 cm	<u>With Basements:</u> 50 - 100 cm <u>Without Basements:</u> < 50 cm	<u>With Basements:</u> < 50 cm

¹ By halving the slope limits, this table can be used for evaluating soil suitability for buildings with large floor areas, but with foundation requirements not exceeding those of ordinary three-storey dwellings.

² The symbol is used to indicate the property affecting use.

³ Some soils are assessed as fair or poor sites from an aesthetic or use standpoint, but they will require more site preparation or maintenance.

⁴ For an explanation of rockiness, stoniness and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

⁵ Reduce the slope limits by one-half for those soils subject to hillside slippage.

⁶ This property estimates the strength of the soil, that is, its ability to withstand applied loads. When available, AASHO Group Index values from laboratory tests were used; otherwise the estimated Unified Soil Groups were used.

⁷ Group Index values were estimated from information published by the Portland Cement Association (PCA, 1962), pp. 23 - 25.

⁸ P.I. means plasticity index.

⁹ Frost heave only applies where frost penetrates to the assumed depth of the footings and the soil is moist. The potential frost action classes are taken from the United States Army Corps of Engineers (1962), pp. 5 - 8. Use z for permanently frozen soils.

¹⁰ Rate one class better for building without basements.

¹¹ Rate one class better if the bedrock is soft enough so it can be dug with light power equipment, such as backhoes.

Table A13. Guide for Assessing Soil Suitability for Local Roads and Streets¹

This guide applies to soils to be evaluated for construction and maintenance of local roads and streets. These are improved roads and streets having some kind of all-weather surfacing, commonly asphalt or concrete, and are expected to carry automobile traffic all year. They consist of: (1) the underlying local soil material (either cut or fill) called the subgrade; (2) the base material of gravel, crushed rock, lime or soil cement, stabilized soil called the subbase; and (3) the actual road surface or pavement, either flexible or rigid. They are also graded to shed water and have ordinary provisions for drainage. With the probable exception of the hardened surface layer, the roads and streets are built mainly from the soil at hand and cuts and fills are limited, usually less than 2 metres. Excluded from consideration in this guide are highways designed for fast moving, heavy trucks.

Properties that affect design and construction of roads and streets are those that affect the load supporting capacity and stability of the subgrade, and those that affect the workability and amount of cut and fill. The AASHO and Unified Classification give an indication of the traffic supporting capacity. Wetness and flooding affect stability. Slope, depth of bedrock, stoniness, rockiness and wetness affect the ease of excavation and the amount of cut and fill to reach an even grade.

Symbol ²	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness ³	Very rapidly, rapidly, well and moderately well drained	Imperfectly drained	Poorly and very poorly drained	Permanently wet soils
i	Flooding	None	Infrequent (once in 5 years)	Occasional (once in 2 - 4 years)	Frequent (every year)
t	Slope	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i, j)
d	Depth to Bedrock ⁴	> 100 cm	50 - 100 cm	< 50 cm	
a	Subgrade ⁵ a.) AASHO Group Index ⁶ b.) Unified Soil Group	< 5 GW, GP, GC ⁷ , SW, SP, SM, and SC ⁷	5 - 8 CL (with P.I. ⁸ < 15) and ML	> 8 CL (with P.I. ⁸ of 15 or more), CH and MH	OH, OL and PT and loose sand with high organic matter
f	Susceptibility to Frost Heave ⁹	Low (F1, F2)	Moderate (F3)	High (F4)	
p	Stoniness ³	Stones > 2 m apart (Class 0 to 2)	Stones > 0.5 - 2 m apart (Class 3)	Stones 0.1 - 0.5 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
r	Rockiness ³	Rock exposures > 100 m apart and cover < 2% of the surface	Rock exposures 30 -100 m apart and cover 2 - 10% of the surface	Rock exposures < 30 m apart and cover >10% of the surface	Rock exposures too frequent to permit location of roads and streets

¹ These guidelines, with some adjustments of slope and rockiness limits, will also be useful for assessing soils for use as parking lots.

² The symbol is used to indicate the property affecting use.

³ For an explanation of stoniness, rockiness and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

⁴ Rate one class better if the bedrock is soft enough so it can be dug with light power equipment and is rippable by machinery.

⁵ This property estimates the strength of soil materials as it applies to roadbeds. When available, AASHO Group Index values from laboratory tests were used; otherwise, the estimated Unified Soil Groups were used. The limitations were estimated assuming that the roads would be surfaced. On unsurfaced roads, rapidly drained, very sandy, poorly graded soils may cause washboard or rough roads.

⁶ Group index values were estimated from information published by the Portland Cement Association (PCA, 1962) pp. 23 - 25.

⁷ Downgrade to moderate if content of fines (less than 200 mesh) is greater than about 30 per cent.

⁸ P.I. means plasticity index.

⁹ Frost heave is important where frost penetrates below the paved or hardened surface and moisture movement by capillary action sufficient to form ice lenses at the freezing point. The susceptibility classes are taken from the United States Army Corps of Engineers (1962) pp. 5 - 8.

Table A14. Guide for Assessing Soil Suitability for Trench-type Sanitary Landfills¹

The trench-type sanitary landfill involves the daily burial of dry garbage and trash in an open trench that is covered with a layer of soil material. Suitability of the site depends on the potential for pollution of water sources through groundwater contact with the refuse or leachate arising from the site. Those properties affecting ease of excavation of the site must be supplemented with geological and hydrological knowledge to provide subsurface soil and groundwater data to a depth of at least 3 to 4.5 m, a common depth of landfills.

Symbol ²	Property Affecting Use	Degree of Soil Suitability			
		Good - G ³	Fair - F	Poor - P	Very Poor - V
h	Depth to Seasonal High Water Table	Not class determining if deeper than 180 cm		100 - 180 cm	< 100 cm
w	Wetness⁴	Not class determining if better than imperfectly drained		Imperfectly drained	Poorly and very poorly drained or permanently wet soils
i	Flooding	None	Rare	Occasional (Once in 2 - 4 years)	Frequent (Every year)
k	Permeability^{4,5,8}	< 5 cm/hr	< 5 cm/hr	5 - 15 cm/hr	> 15 cm/hr
t	Slope	≤ 15% (a, b, c, d, e)	> 15 - 30% (f)	> 30 - 45% (g)	> 45% (h, i, j)
s	Soil Texture^{4,6} (dominant to a depth of 150 cm)	Si, SiL, L, SCL, VFSL, SL, LVFS, LFS, VFS	SiCL ⁷ , CL, SC, LS	SiC, C	Muck, peat, sand (CoS, MS, FS) and gravel
d	Depth to Hard Bedrock	> 150 cm	> 150 cm	100 - 150 cm	< 100 cm
	Rippable Bedrock	> 150 cm	100 - 150 cm	100 - 150 cm	< 100 cm
p	Stoniness⁴	Stones > 10 m apart (Class 0 and 1)	Stones > 2 - 10 m apart (Class 2)	Stones 0.1 - 2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
r	Nature of Bedrock	Impermeable			Highly permeable, fractured, easily soluble.

¹ Based on soil depth (120 cm) commonly investigated in making soil surveys.

² The symbol is used to indicate the property affecting use.

³ If probability is high that the soil material to a depth of 3 to 4.5 m will not alter a rating of good or fair, indicate this by an appropriate footnote, such as "Probably good to a depth of 3.5 m", or "Probably fair to a depth of 3.5 m".

⁴ For an explanation of stoniness, texture and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

⁵ Reflects ability of soil to retard movement of leachate from the landfills; may not reflect a limitation in arid and semiarid areas.

⁶ Reflects ease of digging, moving (workability) and trafficability in the immediate area of the trench where there may not be surfaced roads.

⁷ Soil high in expansive clays may need to be given a suitability rating of poor.

⁸ Contamination hazard (g) may apply at high permeability.

Table A15. Guide for Assessing Soil Suitability for Area-type Sanitary Landfills

In the area-type sanitary landfill, refuse is placed on the surface of the soil in successive layers. The daily and final cover material is generally imported. A final cover of soil material at least 60 cm thick is placed over the fill when it is completed.

The soil under the proposed site should be investigated to determine the probability that leachates from the landfill may penetrate the soil and pollute water supplies.

Symbol ¹	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
h	Depth to Seasonal Water Table²	> 150 cm	> 100 - 150 cm	50 - 100 cm	< 50 cm
w	Wetness^{2,3}	Rapid to moderately well drained	Imperfectly drained	Poorly drained	Very poorly drained or permanently wet soils
i	Flooding	None	Rare	Occasional (Once in 2 - 4 years)	Frequent (Every year)
k	Permeability^{4,5,6}	Not class determining if less than 5 cm/hr		5 - 15 cm/hr	> 15 cm/hr
t	Slope	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i, j)

¹ The symbol is used to indicate the property affecting use.

² Reflects influence of wetness on operation of equipment.

³ For an explanation of drainage, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

⁴ Reflects ability of the soil to retard movement of leachate from landfills; may not reflect a limitation in arid and semiarid areas.

⁵ Because of possible groundwater contamination, impermeable bedrock is considered poor and permeable bedrock is rated very poor.

⁶ Contamination hazard (g) may apply at high permeability or proximity of the site to water supplies.

Table A16. Guide for Assessing Soil Suitability as Cover Material for Area-type Sanitary Landfills

The term cover material includes soil materials used to put a daily and final covering layer in area-type sanitary landfills. This cover material may be derived from the area of the landfill or may be brought in from surrounding areas.

Symbol ¹	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
u	Moist Consistence²	Very friable, friable	Loose, firm	Very firm	Cemented
s	Texture^{2,3}	Si, SiL, SCL, L, VFSL, FSL, LVFS, VFS	SiCL, CL, SC, LFS, LS	SiC, C	Muck, peat, sand, gravel
d	Depth to bedrock⁴	> 150 cm	> 100 - 150 cm	50 - 100 cm	< 50 cm
c	Coarse fragments² (% by volume)	≤ 15%	> 15 - 35%	> 35%	
p	Stoniness²	Stones > 10 m apart (Class 0 and 1)	Stones > 2 - 10 m apart (Class 2)	Stones 0.1 - 2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
t	Slope	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i, j)
w	Wetness²	Not class determining if better than poorly drained.		Poorly drained	Very poorly drained or permanently wet soils.
q	Depth to Sand and Gravel	> 1.5 m	1 - 1.5 m	< 1 m	

¹ The symbol is used to indicate the property affecting use.

² For an explanation of consistence, texture, coarse fragments, stoniness and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

³ Soils having a high proportion of non-expansive clays may be given a suitability rating one class better than is shown for them in this table.

⁴ Thickness of material excluding topsoil, which will be stockpiled (see guide for topsoil).

Table A17. Guide for Assessing Soil Suitability for Reservoirs and Sewage Lagoons

Factors affecting the ability of undisturbed soils to impound water or sewage and prevent seepage, are considered for evaluating the suitability of soils for reservoir and lagoon areas. This evaluation considers soil both as a vessel for the impounded area and as material for the enclosing embankment. As the impounded liquids could be **potential sources of contamination of nearby water supplies**, e.g. sewage lagoons, the landscape position of the reservoir as it affects risk of flooding must also be considered.

Symbol ¹	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
h	Depth to Water Table²	> 150 cm	> 100 - 150 cm	50 - 100 cm	< 50 cm
i	Flooding³	None	None	Subject to infrequent flooding (once in 50 years)	Subject to frequent high level flooding
k	Soil Permeability⁴	< 0.05 cm/hr	0.05 - 0.5 cm/hr	> 0.5 - 5 cm/hr	> 5 cm/hr
t	Slope	≤ 2% (a, b)	> 2 - 5% (c)	> 5 - 9% (d)	> 9% (e, f, g, h, i, j)
o	Organic Matter	≤ 2 %	> 2 - 10%	> 10 - 30%	> 30%
c	Coarse Fragments⁵ < 25 cm in diameter, (% by volume)	≤ 20%	> 20 - 35%	> 35%	
p	Stoniness⁵, >25 cm diameter, (% of surface area)	≤ 3% (Class 0, 1 and 2)	> 3 - 15% (Class 3)	> 15 - 50% (Class 4)	> 50% (Class 5)
d	Depth to Bedrock⁶	> 150 cm	> 100 - 150 cm	50 - 100 cm	< 50 cm
j	Thickness of Slowly Permeable Layer	> 100 cm	> 50 - 100 cm	50 - 25 cm	< 25 cm
a	Sub-grade Unified Soil Group	CH	GC, SC and CL	GM, SM, ML & MH	GW, GP, SW & SP, OL, OH & PT

¹ The symbol is used to indicate the property affecting use.

² If the floor of the lagoon has nearly impermeable material at least 50 cm thick, disregard depth to water table.

³ Disregard flooding if it is not likely to enter or damage the lagoon (flood waters have low velocity and depth less than 150 cm).

⁴ Contamination hazard (g) may apply at high permeability or proximity of the site to water supplies.

⁵ For an explanation of coarse fragments and stoniness classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

⁶ Surface exposures of non rippable rock are rated poor. If underlying bedrock is impermeable, rating should be one class better.

⁷ Material must be capable of compaction to 10^{-7} m/sec (0.04 cm/hr) for use as liner or embankment.

Table A18. Guide for Assessing Soil Suitability for Septic Tank Absorption Fields

This guide applies to soils to be used as an absorption and filtering medium for effluent from septic tank systems. A subsurface tile system laid in such a way that effluent from the septic tank is distributed reasonably uniformly into the natural soil is assumed when applying this guide. A rating of poor does not mean a septic system should not be installed in the given soil, but rather, may suggest the difficulty, in terms of installation and maintenance, which can be expected.

Symbol ¹	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
k	Permeability^{2,7}	Rapid to moderately rapid	Moderate	Slow	Very Slow
	Percolation Rate³ (Auger hole method)	≤ 8 - 18 min/cm (> 3.3 - 7.5 cm/hr)	> 18 - 24 min/cm (2.5 - 3.3 cm/hr)	> 24 min/cm (< 2.5 cm/hr)	
h	Depth to Seasonal Water Table⁴	> 150 cm ⁵	> 100 - 150 cm	50 - 100 cm	< 50 cm
i	Flooding	Not subject to flooding	Not subject to flooding	Subject to occasional flooding (once in 5 years)	Floods every year
t	Slope	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i, j)
d	Depth to Hard Rock, bedrock or other impervious materials	> 150 cm	> 100 - 150 cm ⁶	50 - 100 cm	< 50 cm

¹ The symbol is used to indicate the property affecting use.

² The suitability ratings should be related to the permeability of soil layers at and below depth of the graded filter bed (50 - 75 cm depth).

³ Soils having a percolating rate less than about 8 min/cm are likely to present a pollution hazard to adjacent waters. This hazard must be noted, but the degree of hazard must, in each case, be assessed by examining the proximity of the proposed installation to water bodies, water table, and related features. **The symbol g is used to indicate this condition.** Refer to U.S. Dept. of Health, Education and Welfare (1969) for details of this procedure.

⁴ Seasonal means for more than one month. It may, with caution, be possible to make some adjustment for the severity of a water table limitation in those cases where seasonal use of the facility does not coincide with the period of high water table.

⁵ A seasonal water table should be at least 100 cm below the bottom of the trench at all times for soils rated Good (U.S. Dept. of Health, Education and Welfare, 1969). The depths used to water table are based on an assumed tile depth of 50 cm. Where relief permits, the effective depth above a water table or rock can be increased by adding appropriate amounts of fill.

⁶ Where the slope is greater than 9 per cent, a depth to bedrock of 100 - 150 cm is assessed as poor.

⁷ Contamination hazard (g) may apply at high permeability, e.g. (Gg).

Table A19. Guide for Assessing Soil Suitability for Playgrounds

This guide applies to soils to be used intensively for playgrounds, football, badminton and for other similar organized games. These areas are subject to intensive foot traffic. A nearly level surface, good drainage and a soil texture and consistence that provide a firm surface generally are required. The most desirable soils are free of rock outcrops and coarse fragments. Soil suitability for growing and maintaining vegetation is not a part of this guide, except as influenced by moisture, but is an important item to consider in the final evaluation of the site.

Symbol ¹	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness ²	Rapidly, well and moderately well-drained soils with no ponding or seepage. Water table below 75 cm during season of use.	Moderately well-drained soils subject to occasional ponding or seepage for short duration and imperfectly drained soils. Water table below 50 cm during season use.	Imperfectly drained soils subject to ponding or seepage, and poorly drained soils. Water table above 50 cm during season of use.	Very poorly drained and permanently wet soils.
i	Flooding	None during season of use.	Occasional flooding. May flood once every 2 - 3 years during season of use.	Floods every year during season of use.	Prolonged flooding during season of use.
k	Permeability	Very rapid to moderate	Moderately slow and slow	Very slow	
t	Slope	≤ 2% (a, b)	> 2 - 5% (c)	> 5 - 9% (d)	> 9% (e, f, g, h, i, j)
d	Depth to Bedrock	> 100 cm	50 - 100 cm ³	< 50 cm ³	
c	Coarse fragments on surface ²	Relatively free of coarse fragments	≤ 20% coarse fragments	> 20% coarse fragments	
p	Stoniness ²	Stones > 10 m apart (Class 0 to 1)	Stones > 2 - 10 m apart (Class 2)	Stones 0.1 - 2 m apart (Class 3, 4)	Stones < 0.1 m apart (Class 5)
r	Rockiness ²	Rock exposures > 100 m apart and cover < 2% of the surface	Rock exposures 30 - 100 m apart and cover about 2 - 10% of the surface	Rock exposures < 30 m apart and cover > 10% of the surface	Rock outcrops too frequent to permit playground location
s	Surface Soil Texture ^{2,4}	L, VFSL, FSL, SL, LVFS, VFS	SiL, CL, SiCL, SCL, LFS, LS, FS	SiC, C, SC ⁵ , Si, S	Peaty soils; S and LS subject to blowing
q	Depth to Sand or Gravel ⁶	> 100 cm	50 - 100 cm	< 50 cm	
m	Useful Moisture ⁷	Water storage capacity ⁸ >15.0 cm and/or adequate rainfall and/or low evapotranspiration	Water storage capacity ⁸ 7.5 - 15 cm and/or moderate rainfall or moderate evapotranspiration	Water storage capacity ⁸ < 7.5 cm and/or low rainfall or high evapotranspiration	
n	Salinity ⁹	EC < 4 mS/cm	EC 4 - 8 mS/cm (s)	EC > 8 - 16 mS/cm (t)	EC > 16 mS/cm (u)

¹ The symbol is used to indicate the property affecting use.
² See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada 2007).
³ Downgrade to a very poor suitability rating if the slope is greater than 5 per cent.
⁴ Surface soil texture influences soil ratings as it affects foot trafficability, surface wetness, dust and maintenance. Adverse soil textures may be partially or completely overcome with the addition of topsoil.
⁵ Moderately well and well-drained SiC, C and SC soils may be rated fair.
⁶ Depth to sand or gravel is considered a limitation if the levelling operations expose sand or gravel, thereby bringing about adverse surface textures and undesirable amounts of coarse fragments. Adding topsoil after the levelling process would overcome this limitation.
⁷ This property attempts to evaluate the adequacy of moisture for vegetative growth. It incorporates the concept of supply through rainfall, loss through evapotranspiration and storage within the rooting zone. In soils where the water table is within rooting depth for a significant portion of the year, water storage capacity may not significantly influence vegetation growth.
⁸ Consult glossary for definitions of terms used.
⁹ EC = Electrical conductivity (milliSiemens/cm, mS/cm or deciSiemens/m, or dS/m).

Table A20. Guide for Assessing Soil Suitability for Picnic Areas

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

Symbol ¹	Property affecting use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness ²	Very rapidly, rapidly, well and moderately well-drained soils not subject to seepage or ponding. Water table below 50 cm during season of use.	Moderately well-drained soils subject to occasional seepage or ponding and imperfectly drained soils not subject to seepage or ponding. Water Table above 50 cm for short periods during season of use	Imperfectly drained soils subject to seepage or ponding. Poorly drained soil. Water table above 50 cm and often near surface for a month or more during season of use.	Very poorly drained and permanently wet soils.
i	Flooding	None during season of use.	May flood 1 or 2 times per year for short periods during season of use.	Floods more than 2 times during season of use.	Prolonged flooding during season of use.
t	Slope	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i, j)
s	Surface Soil Texture ^{2,3}	L, VFSL, FSL, SL, LVFS, VFS	SiL, CL, SiCL, SCL, LFS, LS, FS and sand other than loose sand.	SiC, C, SC ⁴ , Si	Peaty soils; loose sand subject to blowing.
c	Coarse Fragments on Surface ²	< 20%	20 - 50%	> 50%	
p	Stoniness ²	Stones > 2 m apart (Class 0 to 2)	Stones > 1 - 2 m apart (Class 3)	Stones 0.1 - 1 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
r	Rockiness ^{2,5,6}	Rock exposure roughly > 30 - 100 m or more apart and cover < 10% of the surface.	Rock exposure roughly 10 - 30 m apart and cover 10 - 25 % of the surface.	Rock exposure < 10 m apart and cover > 25% of the surface.	Rock exposure too frequent to permit location of picnic areas.
m	Useful Moisture ⁷	Water storage capacity ⁸ > 15 cm or adequate rainfall or low evapotranspiration.	Water storage capacity ⁸ 7.5 - 15 cm or moderate rainfall or moderate evapotranspiration.	Water storage capacity ⁸ < 7.5 cm or low rainfall or high evapotranspiration.	
n	Salinity ⁹	EC < 4 mS/cm	EC 4 - 8 mS/cm (s)	EC > 8 - 16 mS/cm (t)	EC > 16 mS/cm (u)

¹ The symbol is used to indicate the property affecting use.

² See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada 2007). Coarse fragments for the purpose of this rating include gravel and cobbles. Some gravelly soils may be rated as having a slight limitation if the content of gravel exceeds 20 per cent by only a small margin, providing the gravel is embedded in the soil matrix or the fragments are less than 2 cm in size.

³ Surface soil texture influences soil ratings as it affects foot trafficability, dust and soil permeability.

⁴ Moderately well and well-drained SiC, C and SC soils may be rated fair.

⁵ Very shallow soils are rated as having severe or very severe limitations for stoniness or rockiness.

⁶ The nature and topography of the bedrock exposures may significantly alter these ratings. As such, on-site investigations will be necessary in map units containing bedrock when these are considered as possible sites.

⁷ This property attempts to evaluate the adequacy of moisture for vegetative growth. It incorporates the concept of supply through rainfall, loss through evapotranspiration and storage within the rooting zone. In soils where the water table is within rooting depth for a significant portion of the year, water storage capacity may not significantly influence vegetation growth.

⁸ Consult glossary for definitions of terms used.

⁹ EC = Electrical conductivity (milliSiemens/cm, mS/cm or deciSiemens/m, or dS/m).

Table A21. Guide for Assessing Soil Suitability for Camp Areas

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

Back-country campsites differ in design, setting and management but require similar soil attributes. These guides should apply to evaluations for back-country campsites but, depending on the nature of the facility, the interpreter may wish to adjust the criteria defining a given degree of limitation to reflect the changed requirement. For example, small tent sites may allow rock exposures greater than 10 m apart to be considered slight limitations.

Symbol ¹	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness ²	Very rapidly, rapidly, well and moderately well-drained soils with no seepage or ponding. Water table below 75 cm during season of use.	Moderately well-drained soils subject to occasional seepage or ponding and imperfectly drained soils with no seepage or ponding. Water table below 50 cm during season of use	Imperfectly drained soils subject to seepage or ponding and poorly drained soils. Water table above 50 cm during season of use.	Very poorly drained and permanently wet soils.
i	Flooding	None	Very occasional flooding during season of use. (Once in 5 - 10 years)	Occasional flooding during season of use. (Once in 2 - 4 years)	Flooding during every season of use.
k	Permeability	Very rapid to moderate	Moderately slow and slow	Very slow	
t	Slope	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i, j)
s	Surface Soil Texture ^{2,3}	L, VFSL, FSL, SL, LVFS, VFS	SiL, CL, SiCL, SCL, LFS, LS, FS and sand other than loose sand.	SiC, C, SC ⁴ , Si	Peaty soils; loose sand subject to blowing.
c	Coarse Fragments on Surface ^{2,5}	< 20%	20 - 50%	> 50%	
p	Stoniness ^{2,6}	Stones > 10 m apart (Class 0 and 1)	Stones > 2 - 10 m apart (Class 2)	Stones 0.1 - 2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
r	Rockiness ^{2,6}	No rock exposures	Rock exposures 10 m apart and cover 25 per cent or less of the area.	Rock exposures < 10 m apart and cover > 25 per cent of the area.	Rock exposures too frequent to permit campground location.
n	Salinity ⁷	EC < 4 mS/cm	EC 4 - 8 mS/cm (s)	EC > 8 - 16 mS/cm (t)	EC > 16 mS/cm (u)

¹ The symbol is used to indicate the property affecting use.

² See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

³ Surface soil texture influences soil rating as it affects foot trafficability, dust and soil permeability.

⁴ Moderately well and well drained SiC, C and SC soils may be rated fair.

⁵ Coarse fragments for the purpose of this table include gravels and cobbles. Some gravelly soils may be rated as having slight limitations if the content of gravel exceeds 20 per cent by only a small margin, providing the gravel is embedded in the soil matrix or the fragments are less than 2 cm in size.

⁶ Very shallow soils are rated as having a limitation for rockiness or stoniness.

⁷ EC = Electrical conductivity (milliSiemens/cm, mS/cm or deciSiemens/m, or dS/m).

Table A22. Guide for Assessing Soil Suitability for Paths and Trails

It is assumed that the trails will be built at least 45 cm wide and that obstructions such as cobbles and stones will be removed during construction. It is also assumed that a dry, stable tread is desirable and that muddy, dusty, worn or eroded trail treads are undesirable. Hiking and riding trails are not treated separately, but as the design requirements for riding trails are more stringent, a given limitation will be more difficult to overcome. Poor or very poor suitability does not indicate that a trail cannot or should not be built. It does, however, suggest higher design requirements and maintenance to overcome the limitations.

Symbol ¹	Property ² Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
s	Texture^{3,4}	L, VFSL, FSL, SL, LVFS, LFS, LS, VFS	CL, SiCL, SiL, SCL	SiC, C, SC ⁵ , Si, FS, S	Peaty soils; loose sand subject to blowing
c	Coarse Fragment Content^{4,6}	< 20%	20 - 50%	> 50%	
p	Stoniness⁴	Stones > 2 m apart (Class 0 to 2)	Stones > 1 - 2 m apart (Class 3)	Stones 0.1 - 1 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
w	Wetness⁴	Very rapidly, rapidly well, and moderately well-drained soils. Water table below 50 cm during season of use.	Moderately well-drained soils subject to occasional seepage and ponding and imperfectly drained soils. Water table may be above 50 cm for short periods during season of use.	Poorly and very poorly drained soils. Water table above 50 cm and often near surface for a month or more during season of use.	Permanently wet soils.
r	Rockiness^{4,7}	Rock exposures > 30 m apart and cover < 10% of the surface.	Rock exposures 10 - 30 m apart and cover 10 - 25% of the surface.	Rock exposures < 10 m apart and cover > 25% of the surface.	Rock exposures too frequent to permit location of paths and trails.
t	Slope⁸	≤ 15% (a, b, c, d, e)	> 15 - 30% (f)	> 30 - 45% (g)	> 45% (h, i, j)
i	Flooding	Not subject to flooding during season of use.	Floods 1 or 2 times during season of use.	Floods more than 2 times during season of use.	Subject to prolonged flooding during season of use.

¹ The symbol is used to indicate the property affecting use.

² The properties affecting use listed in this table are those which have been shown to cause significant differences in trail response. Elevation, aspect, position on slope and snow avalanching may have slight effects or influence trail management and should be considered in the final site evaluation. Items such as vegetation, fauna and scenic value are not considered in the guidelines.

³ Texture refers to the soil texture which will form the tread texture. This is the surface texture on level areas but may be a subsurface texture on slopes. Textural classes are based on the less than 2 mm soil fraction. Texture influences soil ratings as it influences foot trafficability, dust, design or maintenance of trails and erosion hazards.

⁴ See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

⁵ Moderately well and well drained SiC, C and SC soils may be rated fair.

⁶ Coarse fragments for the purpose of this table, include gravels and cobbles. Gravels tend to cause unstable footing when present in high amounts and are also associated with increased erosion. Cobbles (and stones) must be removed from the trail tread, increasing construction and maintenance difficulties. Some gravelly soils may be rated as having a slight limitation if the content of gravel exceeds 20 per cent by only a small margin, providing the gravel is embedded in the soil matrix or the fragments are less than 2 cm in size.

⁷ The type of rock outcrop (flat lying vs cliffs), and the orientation of the structure (linear cliffs vs massive blocks) can greatly alter the degree of the limitation. Each site with a Rockiness limitation, based on the per centage of rock outcrop above, should be evaluated on its own merits and the degree of limitation should then be modified appropriately if necessary.

⁸ Slope, in this context, refers to the slope of the ground surface, not the slope of the tread.

Appendix 2 Soil Series Description

Agnew Series (AGW)

The Agnew series consists of imperfectly drained Gleyed Black Chernozem soils of the Pipestone Association, developed on weakly to moderately calcareous, fine textured (SC, SiC, C) lacustrine sediments. These soils generally occur in areas of nearly level topography with the water table at approximately 1.8 to 2.1 metres (m) during the growing season. This soil has a dominantly clay surface texture, occasionally stratified parent materials, low permeability and slow surface runoff cause these soils to be imperfectly drained.

Argue Series (ARG)

The Argue series consists of well drained Rego Black Chernozem soils of the Cameron Association, developed on deep (> 100 cm), strongly calcareous, medium textured (VFSL, L, SiL) lacustrine sediments. These soils are moderately well drained and occur in areas of level to very gently sloping topography. Surface runoff is generally slow with moderately slow permeability. Argue soils are typically non-stony and cultivated. The water table usually occurs at approximately 2.4 m during the growing season. These soils are occasionally eroded to the extent that cultivation occurs into the Ck and Cca horizons, thereby incorporating lime into the Ap. As a result of erosion and cultivation, Argue soils can sometimes be recognized by a light or buff coloured soil pattern in the field and on aerial photographs.

The Apk horizon in cultivated soils is usually very dark gray to dark gray and 7 to 15 cm thick while in the uncultivated state the Ahk may be 20 to 30 cm thick and very dark grayish brown to light yellowish brown in colour. The Ck horizon is usually dark grayish brown to light yellowish brown in colour. In the native condition the vegetation consists of brome grass, willows and small shrubs.

Argue, clay loam variant (ARG1), has similar solum and horizon descriptions as the normal Argue series but differs in texture. Since this variant occurs in a small area, it is not justified to assign a new series in the moderately fine texture category of Elva association.

Assiniboine Series (ASB)

The Assiniboine series consists of imperfectly drained Gleyed Cumulic Regosol soils developed on moderately to strongly calcareous, stratified, clayey (SiC, C) deposits. These soils occur in lower slope positions of very gentle slopes on flood plain landscapes and have moderately slow permeability, slow surface runoff, and a medium water table during the growing season. Assiniboine soils are slightly water eroded, non-stony and non-saline. They have high available water-holding capacity, medium organic matter content and medium natural fertility. Native vegetation includes ash, elm, tall prairie and meadow grasses. The majority of these soils are currently cultivated.

In a representative profile of Assiniboine soil, there is no solum. The profile is characterized by a dark gray to gray Ah horizon, 5 to 20 cm thick and a dark gray Ckgj horizon with many prominent mottles. The parent material is typically stratified and may contain dark strata, representing former surfaces.

Bankton Series (BAO)

The Bankton Series consists of well to moderately well-drained Rego Black Chernozem soils, developed on moderately to strongly calcareous silty clay, to clay lacustrine deposits. They occur adjacent to the creeks in a level to very gently sloping topography. Permeability is slow; runoff is moderately slow. The natural vegetation consists of tall prairie grasses.

The soil is characterized by a very dark gray to black Ah horizon 16 to 22 cm thick and a calcareous, dark gray AC horizon of irregular thickness (due to past cracking and in-filling) grading to the grayish brown C horizon. Some mottles and duller colours occur below the 75 cm depth.

Barwood Series (BWO)

The Barwood series consists of imperfectly drained Gleyed Rego Black Chernozem soils developed on strongly to extremely calcareous (~40 % CaCO₃), deep uniform, fine loamy (L, CL, SiCL), boulder till of limestone and granitic origin. These soils occur in toe and lower slope positions of strong slopes on hummocky landscapes and have moderately slow permeability, moderately slow surface runoff and a medium water table during the growing season. Barwood soils are non-eroded, slightly stony and

occasionally slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie grasses. The majority of these soils are currently used for improved pasture and grain crop production.

In a representative profile of Barwood soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray to black Ap or Ah horizon 10 to 15 cm thick, a thin transitional, calcareous AC horizon 15 to 20 cm thick and a very pale brown extremely calcareous Ck horizon with iron stains. A typical profile also contains lime and manganese concretions at depth.

Barwood soils occur in close association with Hilton and Tiger Hills soils. They are similar to Ferris soils by having a Gleyed Rego Black profile developed in calcareous till but differ from Ferris soils because of the extreme calcareous nature of Hilton till material and its relatively shallow profile. Barwood soils were previously mapped as imperfectly drained inclusions of the Hilton Association in the reconnaissance soil survey of South-Central Manitoba (1943).

Basker Series (BKR)

The Basker series consists of poorly to very poorly drained Rego Humic Gleysol soils developed on moderately to strongly calcareous, stratified, loamy (FSL, VFSL, L, SiL, CL, SiCL) recent alluvial deposits. These soils occur in depressional positions of nearly level slopes on flood plain landscapes and have slow permeability, very slow surface runoff and a high water table during the growing season. Basker soils are slightly water eroded, non-stony, and occasionally slightly saline. They have a high available water holding capacity, medium organic matter content and low natural fertility. Native vegetation includes sedges, rushes and willows. The majority of these soils are currently in native vegetation because they are subject to flooding and saturated conditions in the spring.

In a representative profile of Basker soil, there is no soil solum. The profile is characterized by light grayish brown Ahk horizon, 5 to 20 cm thick with iron stains, and a stratified, olive brown Ckg horizon with prominent iron mottles in the sandy strata. A typical profile also contains thin organic layers indicating former surfaces.

Basker soils occur in close association with Levine soils. They are similar to Kerran soils by having a poorly drained profile developed in recent alluvium but differ from them in having mostly loam, rather than clay textures. Basker soils were previously mapped as Meadow associates of the Assiniboine Complex in the South-Central (Ellis and Shafer, 1943) and Carberry (Ehrlich et al., 1957) reports.

Bearford Series (BEF)

The Bearford series consists of well drained Orthic Black Chernozem soils of the Croll Association, developed on thin (25 to 100 cm), strongly calcareous, moderately fine textured, lacustrine deposits overlying strongly calcareous, medium to moderately fine textured glacial till. A very thin (less than five cm) pebble line may be evident at the contact. This soil has simple very gently sloping topography, a clay loam or sandy clay loam surface texture, moderate slow permeability and moderate surface runoff. The depth to water table is estimated to be three metres during the growing season. This soil is non-stony and is generally cultivated. An increase in the concentration of soluble salts near the contact zone of the underlying till is an occasional feature of these soils.

Bede Series (BED)

The Bede series consists of well drained Orthic Black Chernozem soils of the Bede Association, developed on strongly calcareous, coarse textured (sand and gravel) deltaic, beach and outwash deposits. This soil commonly has complex, very gently sloping topography, good drainage, very rapid permeability and minimal surface runoff. The depth of water table is estimated to be at about three metres during the growing season. This soil is non-saline and when cropped, tends to be droughty for most of the growing season. Most cereal crops and even some deep rooting forage crops can be severely affected by early summer heat and lack of moisture because of the low water holding capacity of the soil.

The surface texture of this soil ranges from a sandy loam to loamy sand grading to coarser materials with depth. The soil profile usually consists of a black Ah horizon 5 to 10 cm thick, a very dark brown Bm horizon 15 to 20 cm thick and a pale brown, very coarse textured C horizon. The Bm horizon is usually well developed as indicated by the strong prismatic to sub-angular blocky structure. A transitional BC and a prominent Cca horizon are also common in these soils. A representative Bede soil is described below (Soils of the Boissevain-Melita Area, Manitoba Soil Survey Report No. 20, 1978).

Bell Creek Series (BEC)

The Bell Creek series is a poorly drained Orthic Humic Gleysol of the Souris Association, developed on deep, weakly to moderately calcareous, coarse textured (FS, LCoS, LS,LFS) lacustrine sediments. This soil is characterized by a loamy fine sand surface texture, nearly level to depressional topography, slow surface runoff and moderately rapid permeability, but the permeability is usually restricted by a high water table. As a result of the high water table and because it occupies a depressional position in the landscape, this soil is poorly drained. Bell Creek soils are nonsaline and support native hydrophytic vegetation.

A typical profile of the Bell Creek series consists of a thick black Ah horizon overlying a dull very dark brown Bmg horizon. Structural development in the Bmg horizon is usually weak.

Beresford Series (BSF)

The Beresford series consists of imperfectly drained Gleyed Rego Black Chernozem soils developed on a thin mantle (<1 m) of loamy (L, SiL, CL, SiCL) lacustrine sediments over strongly to very strongly calcareous, loam to clay loam glacial till of shale, limestone and granitic origin. These soils occur on near level to undulating topographic landscapes in association with the Clementi (Orthic Black Chernozem) soils. They occur in landscapes which are considered to be in a discharge to weak recharge (groundwater) area and may have soluble salts within the rooting zone or subsoil. The runoff is slow, and permeability is moderately slow to slow.

The Beresford soils are characterized by a very dark gray to black Ah horizon 20 to 30 cm, a dark gray ACk horizon of 6 to 12 cm thick. A lime accumulation zone may occur in the loamy lacustrine sediments if the overlay is thick. The underlying, strongly calcareous till of shale limestone and granitic origin is generally more compact.

The Beresford, texture variant, BSF1, has similar solum properties as the normal Beresford but differs in texture of the lacustrine deposits. The lacustrine deposit is medium texture, rather than moderately fine material.

Bermont Series (BMN)

The Bermont series consists of well-drained Rego Black Chernozem soils developed on a thin mantle (50 to 75 cm) of very strongly to extremely calcareous loamy glacial till of limestone and granitic origin overlying strongly calcareous loam to clay loam glacial till of shale, limestone and granitic origin. These soils occur in the upper slope and knoll positions of gently undulating to moderately rolling topography. Runoff is rapid; permeability is moderate to moderately slow in the upper till and slow in the lower till, which generally is more compact and weakly fissile.

The Bermont soil is characterized by a shallow Ah or Ahk horizon 10 to 16 cm thick and an ACk horizon of 4 to 8 cm. This soil profile is similar to the Stewart series. It is associated with the well-drained Hilton series, the imperfectly drained Barwood series and the poorly drained Hickson series.

Bornett Series (BOR)

The Bornett series consists of poorly drained Rego Humic Gleysol, carbonated soils developed on a thin mantle (25 to 90 cm) of moderately to strongly calcareous very fine sand to sandy loam sediments overlying moderately to strongly calcareous medium sand to gravelly textured deposits. These soils occur in a level to depressional topographic landscape and are closely associated with the imperfectly drained Wytonville and Kilmury series and the well-drained Miniota series. Runoff is slow to negligible; permeability is rapid but restricted by a high water table throughout the growing season.

The soil is characterized by a thin, moderately decomposed organic layer of 2 to 3 cm thick, a very dark gray to black Ahk horizon of 15 to 24 cm thick, a dark gray ACkg 4 to 6 cm thick and lime accumulation layer. The subsoil is light olive brown to olive with yellowish brown mottles of iron. Bornett soils are more permeable than the similar, finer textured Carvey series.

Cactus Series (CCS)

The Cactus series consists of well drained Rego Black Chernozem soils developed on moderately calcareous, deep, stratified, coarse (FS, LFS, LS), lacustrine and deltaic deposits. These soils occur in upper slope and crest positions of gentle slopes on undulating duned landscapes and have moderately

rapid to rapid permeability, minimal surface runoff, and a low water table during the growing season. Cactus soils are highly prone to wind erosion and are non-stony and non-saline. They have a low available water-holding capacity, medium organic matter content and medium natural fertility. Native vegetation includes aspen, bur oak and tall prairie grasses. The majority of these soils are currently used for natural grazing.

In a representative profile of Cactus soil, the solum is approximately 15 cm thick. The profile is characterized by a very dark gray Ah horizon 12 to 16 cm thick, a dark gray AC horizon, 4 to 8 cm thick, which is calcareous, a thin Cca horizon, 5 to 10 cm thick with lime accumulation and a light gray to pale brown Ck horizon. Cactus soils occur in close association with Stockton soils. They are similar to Stockton soils by having a well-drained profile developed in sandy deposits but differ from them in having no Bm horizon. Cactus soils were previously mapped as minor Blackearth associates of the Stockton Association in the Carberry soil report (Ehrlich et al., 1957).

Cameron Series (CMR)

The Cameron series consists of well drained, Orthic Black Chernozem soils of the Cameron Association, developed on deep, strongly calcareous, medium textured lacustrine sediments. These soils have dominantly a loam surface texture, very gently sloping to gently undulating topography, moderately rapid permeability and moderate surface runoff. This soil is moderately to well drained with an estimated depth to water table of three metres during the growing season. These soils are non-saline, non-stony, fertile agricultural soils.

Cameron soils generally occupy slightly higher landscape positions than the Hartney and Denbow soils and are commonly found in close association with Lyleton soils. Cameron soils with low amounts of crop residue are quite susceptible to erosion.

A modal Cameron soil has a black Ap horizon 5 to 15 cm thick, a very dark gray Ah horizon 5 to 12 cm thick, a dark grayish brown Bm horizon 15 to 20 cm thick, a light gray Cca horizon 7 to 12 cm thick and an olive yellow Ck horizon. In the Gt2 climatic subregion, these soils equal the Fairland series.

Capell Series (CXT)

The Capell series consists of imperfectly drained Gleyed Rego Black Chernozem soils, developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, stratified, loamy (SiL, L, CL, SiCL) lacustrine sediments over moderately to strongly calcareous, deep stratified, sandy to sandy-skeletal (GrS, GrLS) and glaciofluvial deposits. These soils occur in lower slope positions of gentle to moderate slopes on hummocky landscapes and have moderate to rapid permeability, moderate surface runoff and a medium water table during the growing season. Capell soils are occasionally slightly saline. They have medium available water-holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie and meadow grasses. The majority of these soils are currently used for grain crop production.

In a representative profile of Capell soil, the solum is approximately 25 cm thick. The profile is characterized by a very dark gray to black Apk or Ahk horizon 15 to 25 cm thick, a dark gray to gray, calcareous AC horizon, 5 to 15 cm thick, a light gray II Cca horizon, 5 to 10 cm thick with secondary carbonate accumulation and a light yellowish brown IICkgj horizon with common, distinct iron mottles.

Carroll Series (CXF)

The Carroll series is a Rego Black Chernozem soil developed on moderately well to well drained, strongly to very strongly calcareous, moderately fine (CL, SiCL) lacustrine deposits. These soils occur in the Upper Assiniboine Delta and Brandon Lakes Plain on very gently sloping to undulating topography, in association with Ramada, Charman, Prodan and Tadpole soils. Surface runoff is moderately slow and permeability is moderate. Careful management is required to reduce water or wind erosion, especially in undulating topography.

The Carroll soil profile has a very dark gray to black Ah or Ahk horizon 15 to 20 cm thick, a dark gray AC horizon 10 to 15 cm thick and a Cca horizon of lime carbonate accumulation, 8 to 14 cm thick. The silty textured, pale brown Ck horizon is very erosive. This soil differs only slightly from the Ramada soil in not having a prominent Bm horizon. Carroll soils were previously mapped as the well drained associate of the

Carroll Association in both the South-Central (Ellis and Shafer, 1943) and Carberry (Ehrlich et al., 1957) soil reports.

Chaucer Series (CUC)

The Chaucer series consists of well drained Orthic Black Chernozem soils, developed on thin (25 to 100 cm), weakly to moderately calcareous, coarse textured (LFS, LCoS, LS, LFS) lacustrine sediments overlying very coarse textured, gravelly, deltaic beach and outwash deposits. This soil has a loamy sand surface texture, a complex, smooth to gently undulating topography, good to excessive drainage, rapid permeability and low surface runoff. The estimated depth to water table during the growing season is three metres. The surface sometimes has a few small stones. Undisturbed native vegetation consists of gumweed and June grass. Most of these soils are cultivated and used for crop production with the deeper soils comparable to Stanton soils and the thin soils comparable to the Bede soils.

This soil is characterized by a black Ap horizon 5 to 13 cm thick, very dark grayish brown Bm horizon 10 to 15 cm thick, a dark gray II Cca horizon 5 to 8 cm thick and a dark grayish brown II Ck horizon. Soils of the Boissevain-Melita soil report (1978).

A morphological description for a representative soil profile is presented below:

Ap - 0 to 13 cm, black (10YR 2/1 moist), very dark gray (10YR 3/1 dry) loamy coarse sand; weakly columnar breaking to coarse sub-angular blocky, friable; non-calcareous; neutral; abrupt boundary.
Bm - 13 to 25 cm, very dark grayish brown (10YR 3/2 moist), dark grayish brown (10YR 4/2 dry) loamy sand; weak columnar breaking, to coarse sub-angular blocky; friable; neutral; non-calcareous; clear boundary.

BC - 25 to 30 cm, dark brown (10YR 3/3 moist), brown (10YR 4/3 dry) sandy loam; loose; friable; diffuse boundary; weakly calcareous; slightly alkaline.

II Cca - 30 to 36 cm, dark gray (10YR 4/1 moist), gray (10YR 5/1 dry) sand and gravel; loose; slightly alkaline; very strongly calcareous; clear boundary.

II Ck - 36 cm +, dark grayish brown (10YR 4/2 moist), grayish brown (10YR 5/2 dry) sand and gravel; loose; strongly calcareous; slightly alkaline.

Chambers Series (CBS)

The Chambers series is a Rego Black Chernozem soil developed on moderately well to well drained loamy (L, CL, SiCL) lacustrine sediments, less than one metre in depth, overlying moderately to strongly calcareous loamy (L, CL) glacial till deposits. These soils occur in the upper slope positions of gently sloping to hummocky, moderately rolling topography. Surface runoff is moderately rapid to rapid, depending on the slope gradient. Permeability is moderate in the lacustrine sediments and moderately slow to slow in the glacial till deposit. The Chambers soil profile is characterized by a very dark gray to black Ah or Ahk horizon of 10 to 15 cm thick, a thin dark gray to grayish brown ACk horizon of three to eight cm thick and a thin lime accumulation zone. The underlying till is a light yellowish brown colour. Chambers soil series tend to be less stony than the very similar Rufford soils.

Charman Series (CXV)

The Charman series consists of imperfectly drained Gleyed Black Chernozem soils developed on strongly to very strongly calcareous, fine loamy (CL, SiCL) lacustrine deposits. In areas of seepage or discharge, soluble salts in the subsoil can be translocated near the surface in sufficient quantities to affect crop growth. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate permeability, slow surface runoff and a medium high water table during the growing season. Charman soils are non-eroded, non-stony and frequently slightly saline. They have a moderately high available water holding capacity, high organic matter content and medium natural fertility. Native vegetation includes aspen, willows, shrubs and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of Charman soil, the solum is approximately 40 cm thick. The profile is characterized by very dark gray to black Ah horizon 15 to 25 cm thick, a dark grayish brown Bmgj horizon 12 to 30 cm thick, a transitional BC horizon five to eight cm thick and a pale brown, silty textured Ckgj horizon with iron mottles and frequently gypsum crystals.

Charman soils occur in close association with Ramada, Carroll and Tadpole soils. They are similar to Prodan soils by having an imperfectly drained profile and fine loamy deposits but differ from them in having

a Bmgj horizon. Charman soils were previously mapped as Black-Meadow associates of the Holland Association in the Carberry (Ehrlich et al., 1957) soil report.

Chater Series (CXW)

The Chater series is a Calcareous Black Chernozem soil developed on moderately well to well drained, moderately to strongly calcareous, sandy (S, CoS) to sandy-skeletal (GrS, GrCoS) outwash and glaciofluvial deposits, less than one metre in depth, overlying moderately to strongly calcareous loamy (L, CL) glacial till deposits. These soils occur in gently undulating to moderately rolling topography. Surface runoff is low, while permeability is rapid in the coarser deposits and moderate to moderately slow in the underlying till material. These soils are in favorable topographic positions to allow excess water above the till to flow laterally to down slope positions.

The Chater soil profile is characterized by a 12 to 18 cm thick, very dark gray Ah horizon and a grayish brown to brown Bmk horizon 8 to 15 cm thick, with a lime accumulation horizon (Cca) in the coarser stratum. Chater soils are coarser textured and tend to be drier than lacustrine over glacial till soils like Kleysen series.

Clementi Series (CLN)

The Clementi series consists of moderately well to well-drained Orthic Black Chernozem soils developed on a thin mantle (25 to 90 cm) of loamy lacustrine sediments over moderately to very strongly calcareous morainal till of limestone, granitic and shale origin. These soils are moderately well drained and occur in mid to upper slope positions of very gently undulating or rolling topography. Runoff is moderate; permeability is moderate in the loamy overlay and moderately slow to slow in the underlying till.

The soil is characterized by a very dark gray to black Ah horizon 10 to 20 cm thick and a dark brown to brown Bm horizon, 8 to 12 cm thick. The solum is developed dominantly within the overlay and may extend into the till material.

The Clementi, texture variant, CLN1, has similar solum properties as the commonly seen well-drained Clementi soils but differs in texture of the lacustrine deposit. This Clementi variant is characterized by a medium textured lacustrine, rather than moderately fine material.

Coatstone Series (CSE)

The Coatstone series consists of imperfectly drained Gleyed Rego Black Chernozem, carbonated soils of the Ryerson Association, developed on deep, strongly calcareous, medium to moderately fine textured glacial till. The till is composed of material derived from shale, limestone and granitic rock. The surface 25 cm may vary slightly in texture. Coatstone soils usually have a clay loam surface texture, very gently sloping topography, moderately slow permeability, and moderate surface runoff. They are imperfectly drained and occasionally slightly stony. They may be weakly to moderately saline. The estimated depth to water table is 1.5 metres. Coatstone soils usually occur in intermediate to level positions between the better drained Ryerson and Medora soils and the poorer drained Ewart, Tilston and Stoney Creek soils. Gleyed Calcareous Black Chernozem soils are closely associated with Coatstone soils and may be found in the same vicinity. In undisturbed areas where native vegetation exists Aspen is quite common.

Coatstone soils are characterized by black Apk horizons 8 to 13 cm thick, dark gray AC horizons 5 to 10 cm thick, weakly mottled light brownish gray Ccagj horizons 10 to 13 cm thick and gleyed prominently iron mottled, brown to yellowish brown Ckgj horizons.

Cobfield Series (CBF)

The Cobfield series is a Gleyed Black Chernozem soil developed on imperfectly drained loamy (L, CL, SiCL) lacustrine sediments, less than one metre in depth, overlying moderately to strongly calcareous loamy (L, CL) glacial till deposits. These soils occur in the mid to lower slope position of gently sloping to undulating topography of dominantly weak recharge areas. The runoff is moderately slow with permeability being moderate in the upper lacustrine sediments and moderately slow to slow in the underlying glacial till. The Cobfield soil profile is characterized by a very dark gray to black Ap or Ah horizon, 10 to 18 cm thick, a brown to dark yellowish Bm horizon, 8 to 12 cm thick, with few, yellowish brown to strong brown mottles and a lime accumulation horizon (Ccagj). The underlying till is olive brown to light olive brown, which is indicative of periodic saturation and reducing conditions.

The Cobfield, texture variant, CBF1, has a similar solum properties as the typical Cobfield soils but differs in texture of the surface deposit. This variant is characterized by a medium textured lacustrine, rather than moderately fine material.

Cordova Series (CVA)

The Cordova series is characterized by a Calcareous Black Chernozem solum on moderately to strongly calcareous, fine loamy (L, CL, SCL) morainal till of mixed limestone, granitic and shale rock origin. These soils are well to rapidly drained and occur in the upper slope and crest positions of undulating to hummocky landscapes, in close association with the well-drained Rufford and Newdale series. Surface runoff is moderately rapid to rapid, depending on slope. Permeability is moderately slow. Native vegetation consists of mixed tall prairie grasses and herbs.

The Cordova soil profile has a thin, very dark gray Ap (k) horizon 12 to 18 cm thick, a calcareous, yellowish brown to dark yellowish brown Bmk horizon, 5 to 15 cm thick, a thin transitional BCK horizon and a light gray lime carbonate accumulation layer 25 to 35 cm thick. Secondary carbonates may be found along vertical cracks within the underlying grayish brown (dry) or dark grayish brown (moist) Ck horizon. In many areas, these soils have been altered by wind and water erosion. The crest positions have lost most of the A horizon and part of the B horizon has been cultivated. In a few areas, the Cca horizon has been incorporated into the plow layer, imparting a light gray surface colour.

The Cordova series differs from the Rufford series, a carbonated Rego Black in having a Bmk horizon. Both Cordova and Rufford series differ from the Newdale series, the former having free lime carbonate present in the solum, while the latter has an A and B horizon free of carbonates.

Coulter Series (COU)

The Coulter series consists of imperfectly drained Gleyed Carbonated Rego Black Chernozem soils developed on deep, moderately calcareous, moderately fine to fine textured (SCL, CL, SiCL to SiC, C), recent alluvial sediments. These soils have nearly level to depressional topography, clay loam surface texture, moderately slow permeability and a moderate surface runoff. The Coulter series is associated with the poorly drained Leighton series. Drainage is imperfect and the estimated depth to water table during the growing season is 2 to 3 metres. These soils may be weakly saline and non-stony and are used for crop production.

Cranmer Series (CME)

The Cranmer series consists of imperfectly drained Gleyed Rego Black Chernozem (carbonated) soils, developed on deep, strongly calcareous, moderately fine lacustrine sediments. These soils usually have a clay loam surface texture, nearly level to very gently sloping topography, and slow to moderate permeability and surface runoff. This soil can be weakly to moderately saline and is imperfectly drained. The estimated depth to water table during the growing season is less than two metres. Most of these soils are cultivated and, depending on the degree of salinity, produce good crops.

The soil is characterized by black Ap horizons 10 to 20 cm thick, black to dark gray AC horizons 18 to 25 cm thick and brown to yellowish brown Ccagj horizons. The C horizons are occasionally stratified and banded.

The Cranmer series resembles the imperfectly drained soils of the Croll Association except that the Cranmer series is not underlain by glacial till. Cranmer is equal to the Prodan series of climatic subregion Gt2.

Croll Series (CLL)

The Croll series consists of imperfectly drained Gleyed Carbonated Rego Black Chernozem soils of the Croll Association developed on thin (25 to 100 cm), strongly calcareous, moderately fine textured (SCL, CL, SiCL), discontinuous aeolian and lacustrine mantle overlying strongly calcareous, medium to moderately fine textured, glacial till. The surface texture is dominantly clay loam, the topography is gently undulating, permeability is slow and runoff is moderate. This soil is imperfectly drained and may be weakly saline. The estimated depth to water table during the growing season is two metres. The Croll series is associated with the imperfectly drained Gleyed Calcareous Black Chernozem Desford series and the well drained Bearford series (Soils of the Boissevain-Melita Area, 1978).

Cromer Series (CRM)

The Cromer series is the poorly drained Carbonated Rego Humic Gleysol member of the Pipestone Association, developed on deep, weakly to moderately calcareous, fine textured (SiC, C), and stratified lacustrine and alluvial sediments. The topography is nearly level; permeability and surface runoff are very slow. These soils generally have a clay surface texture, poor drainage and occur in depressions. Associated soils are the imperfectly drained Agnew and Pipestone series. These soils are characterized by surface water ponding throughout most of the year. The estimated depth to water table is less than one metre during the growing season. These soils rarely produce a crop due to flooding and delayed seeding in the spring and to re-flooding in the summer during periods of high precipitation. They can be recognized by native hydrophytic vegetation such as cattails and bulrushes.

Salinity can be a problem in these soils. Many Cromer soils are situated in local groundwater discharge areas and as a result, soluble salts accumulate in the soil profile in sufficient concentration to severely limit the growth of many non-tolerant plants.

Croyon Series (CYN)

The Croyon series consists of moderately well to well-drained Orthic Black Chernozem soils developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, uniform, loamy (L, SiL, CL) lacustrine sediments over moderately to strongly calcareous, stratified, deep sandy-skeletal (GrS, GrLS), glacio-fluvial deposits. These soils occur in middle and upper slope positions of very gentle slopes on undulating landscapes and have medium over rapid permeability, moderately rapid surface runoff and a low water table during the growing season. Croyon soils have medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation often includes tall prairie grasses interspersed with aspen-oak groves. The majority of these soils are currently used for grain crop production.

In a representative profile of Croyon soil, the solum is approximately 35 cm thick. The profile is characterized by a very dark gray Ah or Ap horizon, 10 to 15 cm thick, a dark brown Bm horizon, 10 to 25 cm thick, a yellowish brown II Cca horizon, 10 to 20 cm thick with secondary carbonate accumulation and a light yellowish brown IIcK horizon. The parent material is typically stratified with thin (< 5 cm) layers of SiL, CoS, GrS and SL textures.

Dalny Series (DNY)

The Dalny series consists of well drained, Calcareous Black Chernozem soils of the Waskada Association developed on thin (25 to 100 cm), strongly calcareous, medium textured (VFSL, L, SiL), discontinuous eolian and lacustrine sediments overlying strongly calcareous, medium to moderately fine textured glacial till; a very thin (< 5 cm) gravelly stratum may occur at the contact. These soils have a very fine sandy loam to loam surface texture, gently undulating topography, slow permeability and moderate surface runoff. The soil is non-stony and is used for crop production. This series is associated with the well-drained Maskawata and Waskada series and the imperfectly drained Two Creeks and Montgomery series of the Waskada Association. The Dalny series resembles the Schaffner series of the Cameron Association; the only difference is that the Dalny series is underlain by glacial till (Soils of the Boissevain-Melita Area, 1978).

Deleau Series (DLU)

The Deleau series consists of well-drained Calcareous Black Chernozem soils of the Souris Association, developed on deep, weakly to moderately calcareous, coarse textured (FS, LCoS, LS, LFS) lacustrine sediments. This soil has a fine sandy surface texture, very gently sloping to undulating topography, rapid permeability and low surface runoff. The estimated depth to water table is two to three metres during the growing season. The surface is non-stony and non-saline. Most of these soils are cultivated. This soil is associated with the well drained Stanton and Scarth series, the imperfectly drained Lauder and Souris soils, and the poorly drained Oak Lake and Bell Creek soils.

This soil is characterized by a dark grayish brown Ap horizon 7 to 13 cm thick, grayish brown Bmk horizon 7 to 10 cm thick, a light gray Cca horizon 13 to 15 cm thick and a light olive brown Ck horizon. Surface soil colours have high chromas as a result of erosion and incorporation of underlying horizons during cultivation (Soils of the Boissevain-Melita Area, 1978).

Deloraine Series (DRI)

The Deloraine series consists of poorly drained, carbonated Rego Humic Gleysol soils of the Waskada Association, developed on thin (25 to 100 cm), strongly calcareous, medium textured (VFSL, L, SiL), discontinuous eolian and lacustrine sediments overlying strongly calcareous, medium to moderately fine textured glacial till. These soils have a loam surface texture, nearly level topography, slow permeability and very slow runoff. They occur in depressions and stream channels. The estimated depth to water table during the growing season is usually less than one metre. Flooding and surface ponding are a common occurrence. They are rarely cultivated and usually support hydrophytic vegetation such as cattails, bullrushes and horsetail.

Denbow Series (DBW)

The Denbow series is the imperfectly drained Gleyed Black Chernozem member of the Lyleton Association, developed on deep, moderately calcareous, coarse loamy, lacustrine sediments. This soil occurs in areas of complex very gently sloping topography and is characterized by imperfect drainage, moderately rapid permeability and slow surface runoff. The estimated depth to water table during the growth season is two metres. This soil is non-saline, non-stony and cultivated. It often occurs in close association with the Switzer series.

Denbow soils are characterized by a black Ap horizon 10 to 12 cm thick, a weakly stained gleyed very dark grayish brown Bmgj horizon 10 to 12 cm thick, an olive gray to grayish brown iron stained Ccagj horizon 25 to 30 cm thick and a gleyed, iron stained and mottled, light yellowish brown Ckg horizon.

The Denbow, fine loamy substrate variant, DBW1, has relatively finer (usually loam, very fine sandy loam, and clay loam) texture that commonly occur at 50 to 100 cm.

Desford Series (DFD)

The Desford series consists of imperfectly drained Gleyed Black Chernozem soils of the Croll Association, developed on thin (25 to 100 cm), strongly calcareous, moderately fine textured, discontinuous lacustrine mantle overlying strongly calcareous medium to moderately fine textured glacial till. A very thin (less than 5 cm) gravelly stratum may occur at the contact. This soil has a clay loam surface texture, depressional to gently undulating topography, slow permeability and slow surface runoff. The estimated depth to water table is two metres during the growing season. It is occasionally saline, non-stony and generally cultivated.

Associated soils are the well drained Bearford series, the imperfectly drained Croll series and the poorly drained Wassewa series. The Desford series resembles the Goodlands series of the Elva Association. The only difference is the Desford series is underlain by glacial till (Soils of the Boissevain-Melita Area, 1978).

Drokan Series (DRO)

The Drokan series is characterized by a Rego Humic Gleysol (carbonated) solum, developed on moderately to strongly calcareous, fine loamy (L, CL, SCL) morainal till of limestone, granitic and shale rock origin. They are poorly to very poorly drained and occur in depressional positions of the undulating to hummocky morainal landscape. Surface runoff is negligible and the soils may remain in a ponded condition unless the surface drainage had been improved. Permeability is moderately slow to slow. In some landscapes, these areas are influenced by seepage from adjacent higher lands and may have a considerable content of soluble salts. Native vegetation consists of sedges, cattails, rushes and willows. Saline areas have Baltic rush, wild barley and saline goosefoot.

The Drokan soil profile has a moderately decomposed organic layer, 2 to 5 cm thick, a very dark gray Ah horizon 10 to 18 cm thick, a mottled transitional AC horizon, 4 to 8 cm thick and a lime accumulation layer, 8 to 12 cm thick. The C horizon is olive gray to olive with yellowish brown mottles. Gypsum crystals are common in the lime accumulation layer and C horizon. In saline areas, white flecks of salt and gypsum are present in the Ah and AC horizons; soils with appreciable soluble salt are delineated as Drokan saline phase.

Generally, the average A horizon is 22 cm thick and varies from 15 to 35 cm; the average depth of its solum is 35 cm and varies from 15 to 70 cm. It differs from the closely related Penrith soil series in being less well developed and having shallower, less distinct horizons.

Dromore Series (DOM)

The Dromore series consists of well drained Orthic Black Chernozem soils of the Dromore Association, developed on thin (25 to 100 cm), strongly calcareous, medium to moderately fine textured (VFSL, L, SiL to SCL, CL, SiCL) lacustrine sediments overlying coarse textured (FS, LCoS, LS, LFS), gravelly, deltaic beach and outwash deposits. This soil has a fine sandy loam to loam surface texture, gently undulating topography, moderately rapid permeability and low surface runoff. This soil is very slightly stony, well drained and non-saline. This soil occurs in areas adjacent to outwash deposits and is usually cultivated. The presence of the underlying gravel tends to make these thin soils somewhat droughty during periods of low precipitation.

Dromore soils are characterized by black Ap horizons 10 to 15 cm thick, very dark brown Bm horizons 15 to 25 cm thick overlying a coarse textured II C horizon. The Dromore series resembles the Newstead series of the Newstead Association. The difference is the Newstead Association is underlain by glacial till.

Druyman Series (DXM)

The Druyman series consists of imperfectly drained Gleyed Black Chernozem soils developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, stratified, fine loamy (SiL, L, CL, SiCL) lacustrine sediments over moderately to strongly calcareous, deep, sandy-skeletal (GrS, GrLS), glacio-fluvial deposits. These soils occur in lower slope positions of very gentle slopes on undulating landscapes and have medium over rapid permeability, low surface runoff and a medium water table during the growing season. Druyman soils have medium available water holding capacity, medium organic matter content and medium natural fertility. Native vegetation often includes meadow and tall prairie grasses interspersed with willow clumps. The majority of these soils are currently used for grain crop production.

In a representative profile, the solum is approximately 50 cm thick. The profile is characterized by a very dark gray Ah or Ap horizon 15 to 25 cm thick, a dark yellowish brown to olive brown Bmgj horizon 20 to 30 cm thick with many, fine, distinct, yellowish brown iron mottles, a transitional dark yellowish brown BC five to 10 cm thick, occasionally a yellowish brown II Ccagj horizon five to 10 cm thick and light yellowish brown II Ckgj horizon with many, large prominent iron mottles.

Durnan Series (DRN)

The Durnan series consists of moderately well to well drained Rego Black Chernozem soils developed on strongly to very strongly calcareous, deep, stratified, medium textured (VFSL, L, SiL) lacustrine deposits. These soils occur in upper slope and crest positions of gentle slopes on hummocky to undulating landscapes and have moderate to moderately rapid permeability, moderate to rapid surface runoff and a low water table during the growing season. Durnan soils are occasionally slightly eroded, non-stony and non-saline. They have medium available water holding capacity, medium organic matter content and high natural fertility. Native vegetation includes aspen, oak, prairie grasses and shrubs. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 10 cm thick. The profile is characterized by a very dark gray Ahk horizon 10 to 15 cm thick, frequently a Cca horizon, 4 to 7 cm thick and a pale brown, calcareous C horizon.

Durnan soils occur in close association with Fairland, Torcan and Vordas soils. They are similar to Traverse soils by having a well drained profile in medium textured deposits but differ from them in having no Bmk horizon. Durnan soils were previously mapped as Blackearth associates of the Holland Association in the Carberry (Ehrlich et al., 1957) soil report.

Eroded Slope Complex (\$ER)

This soil complex includes all the land occupied by the eroded slopes of river valleys and walls, incised stream channels and ravines that have down-cut through the surface deposits and shale bedrock. These are generally well drained, strongly to steeply sloping landforms that have variable soils development on materials that are variable in composition, depending on the nature of the surrounding deposits. Due to its complexity, this is a miscellaneous land type rather than a unit of normal soil. These areas are typically influenced by mass wasting processes such as slump, creep, solifluction and erosion.

The soils range from Orthic Black Chernozems to Regosols. The slopes are characterized by numerous major seepage zones where the water table intersects the slope walls or scarps, generally in the mid to lower slopes. The maintenance of vegetation on the eroded slopes is essential for their stability.

Elva Series (ELV)

The Elva series consists of well drained Orthic Black Chernozem soils of the Elva Association, developed on deep, strongly calcareous, moderately fine textured (SCL, CL, SiCL) lacustrine sediments. This soil has a clay loam surface, nearly level to gently undulating topography, slow to moderate permeability and moderate surface runoff. Elva soils are non-saline, non-stony, generally cultivated and have an estimated depth to water table of 2 to 3 m during the growing season. These are highly productive soils. They occur generally in the Souris Basin in the vicinity of Elva and Hartney and have a limited occurrence in the Whitewater Basin area. This soil is associated with the imperfectly drained Goodlands, Cranmer, Minto and Ninga series; and the poorly drained Naples, Bunclody and Fairfax series (Soils of the Boissevain-Melita Area, 1978).

The Elva, classification variant (Elvc), has similar solum as the normal Elva series but differs in having carbonate in B horizon. Since this variant occurs in a small area, it is not justified to assign a new Calcareous Black Chernozem in the moderately fine textured Elva association.

Emblem Series (EBL)

The Emblem series consists of poorly drained carbonated Rego Humic Gleysols of the Cameron Association developed on deep, strongly calcareous, medium textured lacustrine sediments. These soils usually have depressional to level topography, loam surface textures, moderate permeability and very slow surface runoff. These soils are poorly drained due to a combination of depressional topography and high groundwater levels. The estimated depth to water table is less than 1.5 m during the growing season. These soils occur in drainage channels and depressions and are frequently flooded by ponded or flowing water. Emblem soils support hydrophytic vegetation, are non-stony and rarely cultivated.

Everton Series (EVO)

The Everton series consists of moderately well to well-drained Orthic Black Chernozem soils developed on a thin mantle (25 to 75 cm) of silty clay to clay sediments over a thin strata (10 to 40 cm) of very strongly calcareous loamy glacial till of shale, limestone and granitic origin over a strongly calcareous till of shale, limestone and granitic origin. The soils occur on gently sloping topography. Runoff is moderate and permeability is moderately slow to slow.

The soil is characterized by a granular, very dark gray to black Ah horizon 10 to 15 cm thick, a dark grayish brown to brown, fine subangular blocky Bm horizon 8 to 14 cm thick and a pale brown BCk horizon. In areas where the clay overlay is not too deep, the solum extends to the contact of the clay and the very strongly calcareous glacial till which appears as a prominent Cca horizon.

Fairfax Series (FFX)

The Fairfax series consists of poorly drained Carbonated Rego Humic Gleysols of the Elva Association; developed on deep, strongly calcareous, moderately fine textured (SCL, CL, SiCL) lacustrine sediments. These soils have a clay loam surface texture, nearly level to depressional topography, slow permeability and very slow surface runoff. These soils are poorly drained with the water table at or near the surface most of the year. Surface ponding and flooding are very common. These soils are not cultivated and generally support a lush growth of hydrophytic vegetation such as cattails, reeds and slough grass; some willows may also occur (Soils of the Boissevain-Melita Area, 1978).

Fairland Series (FND)

The Fairland series consists of moderately well to well-drained Orthic Black Chernozem soils developed on strongly to very strongly calcareous, deep, stratified, medium textured (VFSL, L, SiL) lacustrine deposits. These soils occur in upper positions of gentle slopes on rolling landscapes and have moderate permeability, moderate surface runoff and a low water table during the growing season. Fairland soils are often slightly eroded, non-stony and non-saline. They have a medium available water holding capacity, medium organic matter content and high natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 25 cm thick. The profile is characterized by a very dark gray to very dark grayish brown Ap horizon 10 to 15 cm thick, a brown to dark brown Bm horizon 10 to 15 cm thick, a pale brown BC horizon, 5 to 10 cm thick with carbonates and a light gray Cca horizon, 5 to 10 cm thick with lime accumulation. The parent material is typically very pale brown and calcareous.

Fairland soils occur in close association with Traverse, Taggart and Vordas soils. They are similar to Durnan soils by having well developed profile in loamy deposits but differ from them in having a strongly developed Bm horizon. Fairland soils were previously mapped as Blackearth associates of the Holland Association in the Carberry (Ehrlich et al., 1957) soil report.

Forrest Series (FRT)

The Forrest series consists of imperfectly drained Gleyed Rego Black Chernozem soils developed on a thin mantle (25 to 75 cm) of silty clay to clay sediments over a thin stratum (10 to 40 cm) of very strongly calcareous loamy glacial till of shale, limestone and granitic origin. The topography is level to very gently sloping; runoff is moderately slow to slow and permeability is moderately slow to slow. These soils are influenced by a subsoil seepage condition in the very strongly calcareous till and an upward pressure of groundwater. Soluble salts are usually found in the subsoil.

The soil is characterized by an irregular, very dark gray Ah or Ahk horizon 10 to 15 cm thick with tongues to 25 cm, and a dark gray to olive gray AC, 4 to 8 cm thick. A weakly mottled, calcareous light olive brown Ckgj horizon is also present.

Gateside Series (GTD)

The Gateside series consists of imperfectly drained Gleyed Black Chernozem soils developed on moderately to strongly calcareous, deep, coarse loamy (VFS, LVFS, FSL, SL) lacustrine deposits. These soils occur in middle positions of very gentle to nearly level slopes on undulating landscapes and have moderately rapid permeability, moderately slow surface runoff and a high water table during the growing season. Gateside soils are non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content and medium natural fertility. Native vegetation includes tall prairie grasses, aspen-oak groves, shrubs and meadow grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 35 cm thick. The profile is characterized by a very dark gray to black Ah horizon 12 to 18 cm thick, a brown to olive brown Bmgj horizon 15 to 30 cm thick with faint iron mottles, a light olive brown BC horizon 5 to 15 cm thick with carbonates and a light olive brown to yellowish brown Ckgj horizon with distinct yellowish-brown mottles.

Gateside soils occur in close association with Prosser, Pleasant and Poolex soils. They are similar to Pleasant soils by having imperfect drainage in coarse loamy deposits but differ from them in having a Bmgj horizon. Gateside soils were previously mapped as Black Meadow associates of the Holland Association in the Carberry soil report (Ehrlich et al., 1957).

Goodlands Series (GOL)

The Goodlands series consists of imperfectly drained Gleyed Black Chernozem soils of the Elva Association, developed on deep, strongly calcareous, moderately fine textured (SCL, CL, SiCL) lacustrine sediments. The surface texture is clay loam, the topography is nearly level to gently sloping, permeability is slow and runoff is slow. Depth to water table is estimated at two metres during the growing season. This soil is usually non-stony and may be weakly to moderately saline in subsurface horizons.

This soil is characterized by black to very dark gray Ap horizons 10 to 25 cm thick, black to very dark brown gleyed Bmgj horizons 13 to 20 cm thick, very dark gray to dark gray gleyed BCgj horizons 18 to 25 cm thick and gleyed, light olive brown to pale olive Cgj horizons (Soils of the Boissevain-Melita Area, 1978).

Graham Series (GHM)

The Graham series consists of poorly drained, carbonated Rego Humic Gleysols of the Melita Association, developed on deep, moderately calcareous, medium textured (VFSL, L, SiL) recent alluvial sediments. These deposits are stratified and contain numerous dark coloured bands of former surface horizons in the profile. Graham soils generally occur in the channels of Pembina and Long Rivers and in the Souris River channel south of Melita and in the vicinity of Gainsborough, Antler and Graham Creeks that empty into the Souris River from the west. Graham soils have complex gently undulating topography, a silt loam surface texture, slow permeability and very slow surface runoff. Surface ponding and flooding are a common occurrence on Graham soils. The vegetation consists mainly of hydrophytic species and many of these soils are used only for pasture.

Associated soils are the well-drained Melita series and the imperfectly drained Liege series. The Graham series of the Melita Association resembles the Leighton series of the Coulter Association. They are both alluvial deposits. The major difference between the two is that the Melita Association consists of stratified medium textured sediments while the Coulter Association consists of more uniform, moderately fine textured (Soils of the Boissevain-Melita Area, 1978).

Grande-Clairiere Series (GDC)

The Grande-Clairiere series consists of rapidly drained Orthic Regosols of the Grande-Clairiere Association, developed on deep, weakly calcareous to non calcareous, coarse textured aeolian deposits. This soil has a fine sand surface texture, complex duned topography ranging from undulating to strongly rolling, rapid permeability and no surface runoff. In these rapidly drained soils, depth to water level occurs at depths greater than four metres. Native vegetation consists of groves of white poplar (*Populus tremuloides*) dominantly, hazel nut (*Corylus* spp.), poison oak, some low creeping juniper (*Juniperus horizontalis*) and various grasses and shrubs. They are very droughty and generally low in fertility, and very few are cultivated. Most Grande-Clairiere soils are managed as rangeland. The Grande-Clairiere Association is similar to the Souris Association, in respect to the parent material being coarse textured. The main difference is the Grande-Clairiere Association is composed of Regosolic soils on duned sand, while the Souris Association is composed mainly of Chernozemic soils developed on lacustrine sands (Soils of the Boissevain-Melita Area, 1978).

Grayson Series (GYS)

The Grayson series consists of poorly drained Rego Humic Gleysol soils developed on a thin mantle (25 to 75 cm) of moderately to strongly calcareous medium-textured (VFSL, L, SiL) sediments grading to moderately calcareous sandy (FS, LFS, LS) deposits. The soils occur in level to depressional topography and have a saturation zone at or very near the surface for a considerable time. Runoff is very slow to negligible; permeability of the soil material is moderate but restricted during periods when the soil is saturated. The soil is characterized by a thin, moderately decomposed organic layer 2 to 5 cm thick, a very dark Ah or Ahk horizon 8 to 12 cm thick and a dark gray AC. In some soils, thin cumulic layers of organic and mineral matter may be present at the surface. A lime carbonate horizon is often present below the AC. The subsoil is light olive brown to olive and may have yellowish brown mottles.

Grover Series (GRO)

The Grover series consists of imperfectly drained Gleyed Rego Black Chernozem soils developed on a mantle (25 to 75 cm) of moderately to strongly calcareous, shallow, medium (VFSL, L, SiL) textured, lacustrine deposits over moderately calcareous, deep, sandy (FS,LFS,LS) lacustrine deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate over moderately rapid permeability, moderately slow surface runoff and a high water table during the growing season. Grover soils are non-eroded, non-stony, and non-saline. They have medium available water holding capacity, high organic matter content and medium natural fertility. Native vegetation includes aspen oak, ash and tall prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a very dark gray to black Ah or Ahk horizon 15 to 25 cm thick, a dark grayish brown AC horizon 15 to 20 cm thick with faint mottles, a Ccagj horizon, 5 to 8 cm thick and a light yellowish brown, sandy Ckgj horizon, with yellowish brown mottles.

Grover soils occur in close association with Glenboro and Grayson soils. They are similar to Crookdale soils by being imperfectly drained with a sandy substrate but differ from them by having a loamy, rather than fine loamy surface. Grover soils were previously mapped as Black Meadow associates of the Glenboro Association in the Carberry soil report (Ehrlich et al., 1957).

Harding Series (HRG)

The Harding series consists of imperfectly drained Gleyed Black Chernozem soils developed on moderately to strongly calcareous, silty clay to clay lacustrine deposits. These soils occur on level to very gently sloping topography. Runoff is slow; permeability is moderately slow to slow. Most of these soils occur within a discharge region characterized by an upward pressure of groundwater or a lateral flow of water through the underlying very strongly calcareous till, which may occur at a depth of one to two

metres. Appreciable soluble salts may be present within the rooting zone and gypsum crystals are common.

The soil is characterized by a very dark gray Ah horizon 12 to 22 cm thick, a dark grayish brown, prismatic to subangular blocky Bmgj horizon 15 to 20 cm thick with fine yellowish brown mottles; a lime accumulation horizon (Ccagj) is common. Salt pseudo mycelium and gypsum concretions are common in the olive brown to olive Ckgj horizon.

Hartney Series (HRY)

The Hartney series consists of the imperfectly drained Gleyed Rego Black Chernozem carbonated member of the Cameron Association developed on deep, strongly calcareous, medium textured lacustrine sediments. This soil has level to very gently sloping complex topography, moderate permeability, slow surface runoff and a loam surface texture. The estimated depth to water table is less than two metres during the growing season. This soil is used for crop production.

Hartney soils are characterized by black Apk horizons 10 to 12 cm thick, dark gray AC horizons 5 to 7 cm thick, light olive gray Cca horizons 7 to 10 cm thick overlying a pale olive to pale yellow Ckgj horizon.

Hayfield Series (HYF)

The Hayfield series consists of imperfectly drained Gleyed Eluviated Black Chernozem soils of the Cameron Association, developed on deep, strongly calcareous, medium textured lacustrine sediments. This soil commonly has a fine sandy loam surface texture, gently undulating topography, moderate permeability and slow surface runoff. These soils are very susceptible to surface flooding and ponding. The estimated depth to water level during the growing season is less than two metres. These soils are saturated in the spring and after heavy rains in the summer; as a result, crop yields may be low. The fact that they dry readily facilitates management in that machinery is able to cross them in dry periods.

The Hayfield series resemble the Glenlorne series of the Waskada Association. The only difference is the Glenlorne series is underlain by glacial till.

Hickson Series (HKS)

The Hickson series consists of poorly drained carbonated Rego Humic Gleysol soils developed on a thin mantle (50 to 75 cm) of very strongly to extremely calcareous fine loamy (L, SiL, SiCL, CL) glacial till of limestone and granitic origin overlying strongly calcareous loam to clay loam glacial till of shale, limestone and granitic origin. They occur in level to depressional (pothole) topography and are subject to ponding and prolonged saturation. Runoff is negligible and permeability is very slow. Soluble salts may occur in the soil in areas of seepage or upward movement of groundwater containing appreciable soluble salts toward the surface.

The soil is characterized by a moderately decomposed organic layer 2 to 5 cm thick, a very dark gray, carbonated Ah horizon and a thin gray to olive gray ACg horizon with mottles. The Ckg horizon is pale olive and may contain yellowish brown mottles.

Hilton Series (HIT)

The Hilton series consists of well-drained Orthic Black Chernozem soils developed on strongly to extremely calcareous, thin, uniform, fine loamy (L, CL, SiCL) glacial till of limestone, shale and granite origin. These soils occur in upper slope positions of moderate slopes on hummocky landscapes and have moderate permeability, rapid surface runoff and a low water table during the growing season. Hilton soils are moderately eroded, moderately stony and non-saline. They have medium available water holding capacity, medium organic matter content and medium natural fertility. Native vegetation often includes tall prairie grasses interspersed with aspen-oak groves. The majority of these soils are currently used for forage crop production and improved pasture.

In a representative profile the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah or Ap horizon 10 to 20 cm thick, a dark brown Bm horizon, 5 to 15 cm thick, a very pale brown Cca horizon 10 to 40 cm thick and a yellowish brown Ck horizon.

Hilton soils occur in close association with the imperfectly drained Barwood series and the poorly drained Hickson soils. They are similar to Tiger Hills soils by having a well drained, very thin soil profile developed in strongly to extremely calcareous glacial till but differ from them in having a less strongly leached soil

profile. Tiger Hills soils have Ae or Ahe horizons and Bt horizons while Hilton soils do not. Hilton soils were previously mapped as dominant associates of the Hilton association in the reconnaissance soil survey of South-Central Manitoba (1943).

Hummerston Series (HMO)

The Hummerston series consists of imperfectly drained Gleyed Rego Black Chernozem soils developed on weakly to moderately calcareous, deep, uniform, coarse-textured (FS, LFS, LS) lacustrine deposits. These soils occur in middle to lower positions of very gentle slopes on undulating landscapes and have moderately rapid permeability, low surface runoff and a high water table during the growing season. Hummerston soils are often slightly wind eroded, non-stony and slightly saline. They have a low available water holding capacity, medium to low organic matter content and medium to low natural fertility. Native vegetation includes aspen-oak groves, shrubs, tall prairie and meadow grasses. The majority of these soils are currently cultivated for forage and grain crops.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon 15 to 20 cm thick, a dark gray AC horizon 10 to 18 cm thick with moderate calcareousness and a yellowish brown Ckgj horizon with prominent yellow mottles.

Hummerston soils occur in close association with Stockton, Lavenham and Sewell soils. They are similar to Lavenham soils by having an imperfectly drained profile in sandy deposits but differ from them in having no diagnostic Bm Horizon. Hummerston soils were previously mapped as Black Meadow associates of the Stockton Association in the Carberry soil report (Ehrlich et al., 1957).

Janick Series (JIK)

The Janick series consists of well to moderately well-drained Orthic Black Chernozem soils developed on moderately to strongly calcareous, deep, uniform, clayey (C, SiC) lacustrine deposits. These soils occur in upper positions of nearly level slopes on undulating landscapes and have slow permeability, moderately slow surface runoff and a medium water table during the growing season. Janick soils are non-eroded, non-stony and non-saline. They have a high available water holding capacity, high organic matter content and high natural fertility. Native vegetation includes prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 30 cm thick. The profile is characterized by a very dark gray to black Ah horizon 10 to 18 cm thick, a dark grayish brown to brown Bm horizon, 8 to 15 cm thick with fine subangular blocky structure, a pale brown BC horizon, 5 to 10 cm thick, weakly calcareous, and a light grayish brown to pale brown Ck horizon with a few faint mottles.

Kemnay Series (KMY)

The Kemnay series is the well-drained, Calcareous Black Chernozem member of the Lyleton Association, developed on deep, moderately calcareous, coarse to moderately coarse textured lacustrine deposits. This soil has a sandy loam surface texture, a complex, very gently sloping topography, moderately good drainage, moderately rapid permeability and moderate surface runoff. The depth of the water table is estimated at two to three metres during the growing season. Kemnay soils can be found in close association with Lyleton soils. The Nesbitt series of the Mentieth Association resembles the Kemnay series. The only difference is the Nesbitt series is underlain at shallow depth by glacial till.

Kemnay soils are characterized by a thick black Ah horizon 10 to 28 cm thick of which the upper 15 cm constitute the Ap horizon. The dark brown Bmk horizon is 25 to 30 cm thick and the Cca horizon when present is grayish brown and 8 to 13 cm thick. The parent material or Ck horizon is pale brown, stratified and has a few faint iron mottles.

Kleysen Series (KYS)

The Kleysen series consists of moderately well to well drained Calcareous Black Chernozem soils developed on a thin mantle (25 to 60 cm) of loamy lacustrine sediments over a thin stratum (10 to 40 cm) of very strongly calcareous loamy glacial till of limestone and granitic origin over a strongly calcareous loam to clay loam till of shale, limestone and granitic origin. These soils in the upper slope positions are of gently sloping, undulating or rolling topography. Runoff is moderate to moderately rapid; permeability is moderate in the lacustrine sediments and in the loose, very strongly calcareous till and moderately slow to slow in the more compact, somewhat fissile loam to clay loam till.

The soil is characterized by a very dark gray to black Ah horizon 10 to 14 cm thick and a brown to dark brown calcareous Bmk horizon 8 to 12 cm thick. The solum usually extends to the contact of the very strongly calcareous till.

Langvale Series (LGV)

The Langvale series is the well-drained Orthic Black Chernozem member of the Mentieth Association, developed on thin (25 to 100 cm), moderately calcareous, moderately coarse (VFS, LVFS, SL, FSL) textured, lacustrine sediments overlying strongly calcareous, medium to moderately fine textured glacial till. The profile may contain a very thin (<5 cm), gravelly stratum or pebble line at the till contact. Langvale soils usually have a loamy very fine sand surface texture, gently undulating topography, moderate permeability and moderately slow surface runoff. The estimated depth to water level is two to three metres during the growing season. They usually occur in the well drained middle and upper slope positions in the landscape. These soils are cultivated, non-stony and non-saline. The Langvale series resembles the Lyleton series, except that the Langvale soils are underlain by glacial till.

Lauder Series (LUD)

The Lauder series is the imperfectly drained Gleyed Black Chernozem member of the Souris Association, developed on deep, weakly to moderately calcareous, coarse textured lacustrine sediments. Lauder soils generally have a loamy fine sand to fine sand surface texture, level topography, moderately rapid permeability and very little surface runoff. These soils are non-stony, rarely saline and have an estimated depth to water table of less than two metres during the growing season. Most are cultivated and produce cereal crops.

The profile is characterized by black Ah horizons 10 to 25 cm thick, gleyed, faintly mottled very dark brown Bmgj horizons 20 to 51 cm thick, light gray, gleyed Ccagj horizons 15 to 25 cm thick and light brownish gray Ckg horizons with iron staining and mottling.

Lavenham Series (LVH)

The Lavenham series is a Gleyed Black Chernozem soil developed on imperfectly drained, weakly to moderately calcareous, sandy (FS, LFS, LS) lacustrine sediments. These soils occur in the Upper Assiniboine Delta on level to very gently sloping topography, in association with Stockton, Cactus, Hummerston and Sewell soils. Surface runoff is slow, and permeability is moderately rapid. Downward movement of water is restricted in the subsoil during periods of high water table. The water table ranges from one metre shortly after spring runoff, to three metres below the surface in late fall and winter. These soils are also susceptible to erosion.

The Lavenham soil profile has a very dark gray to very dark brown Ah horizon 18 to 25 cm thick, a dark brown to yellowish brown Bmgj horizon, 20 to 40 cm thick, with distinct brown mottles in the lower part of the horizon, a lime carbonate accumulation (Ccagj) horizon 12 to 20 cm thick, and a pale brown Ckgj horizon with distinct to prominent brown mottles. This soil profile differs from the very similar Hummerston soil series in having a prominent Bmgj horizon. Lavenham and Hummerston soils are coarser and more permeable than the finer textured Gateside and Pleasant soils. Lavenham soils were mapped as Black Meadow associates of the Stockton Association in the Carberry soil report (Ehrlich et al., 1957).

Lavinia Series (LAV)

The Lavinia series is imperfectly drained Gleyed Calcareous Black Chernozem member of the Newdale Association, developed on deep (100 cm) moderately to strongly calcareous, fine loamy (L, CL, SCL) morainal till of mixed limestone, granitic and shale rock origin. The topography is gently sloping with either undulating or hummocky landscapes. The permeability is moderate to slow, and surface run off is slow. These soils occur in lower slope and depressional positions and are cultivated.

The Lavinia soil profile has a thin, very dark gray Ap(k) or Ah(k) horizon 10 to 29 cm thick, a calcareous, dark grayish brown Bmkgj horizon, 5 to 34 cm thick, and a carbonate accumulation horizon (Ccagj) is commonly present but may be discontinuous. The Ckgj horizon averages 38 cm thick, from 15 to 75 cm, light olive brown and strongly calcareous.

Leighton Series (LGT)

The Leighton series is the poorly drained carbonated Rego Humic Gleysol member of the Coulter Association, developed on deep moderately calcareous, moderately fine to fine textured (SCL, CL, SiCL to SiC, C) recent alluvial sediments. These soils generally have a clay loam to clay surface texture, nearly level to depressional topography, slow to very slow permeability and very little surface runoff. These soils occur in channels usually in the low-lying alluvial flood plains. They are poorly drained and have a water table within one metre for most of the growing season. Leighton soils are very susceptible to spring flooding from high river levels and after heavy rains. A few areas of Leighton soils are cultivated but many are left as natural sites with native hydrophytic vegetation.

Lenore Series (LNO)

The Lenore series is characterized by an Orthic Black Chernozem soil developed in weakly to moderately calcareous loamy (L to CL) morainal till of dominantly shale rock origin with minor amounts of limestone and granitic material. These soils are moderately well to rapidly drained and occur in the mid to upper slope positions of undulating, hummocky or ridged landscapes. Surface runoff is moderately rapid; permeability is moderate. Native vegetation is mixed tall prairie grasses and aspen groves.

The Lenore solum has a very dark gray Ah horizon 20 to 30 cm thick and a dark brown to dark yellowish brown Bm horizon 15 to 30 cm thick, and a variable transitional BC horizon. The thickness of the transitional horizon varies with the amount of carbonate present in the shaley till; solum thickness can exceed 75 cm in material with lower carbonate levels.

These soils differ from the similar Newdale series in having a thicker or deeper solum, greater shale content and lower carbonate content. In the northern part of the Russell study area, the shaley, weakly to moderately calcareous till underlies the mixed till at depths below 1.5 m; in the northeastern part, the shaley till frequently occurs within one metre of the surface.

Levine Series (LEI)

The Levine series consists of imperfectly drained Gleyed Cumulic Regosol soils developed on moderately to strongly calcareous, deep, stratified, coarse loamy to fine loamy (VFSL, L, CL) recent alluvial deposits. These soils occur in flood plains on level slopes in level landscapes. They have rapid permeability, moderately slow surface runoff and a medium water table during the growing season. Levine soils are occasionally slightly saline and are subject to periodic inundation during spring runoff or after heavy rains. They have a moderate to low available water holding capacity, low organic matter content and medium natural fertility. The majority of these soils are currently used for crop production.

In a representative profile, the solum is approximately 15 cm thick and the profile is characterized by a dark gray Apk or Ahk horizon 10 to 20 cm thick, and a light yellowish brown Ckgj horizon. The underlying strata may vary in colour from light to dark. The thin dark coloured mineral and organic layers are former surface horizons that have been exposed to soil forming processes for a significant period before burial by alluvial deposits. Medium, distinct yellowish brown iron mottles occur through the soil. Levine soils were previously mapped as inclusions of Eroded Slope Complexes in the reconnaissance soil survey of South-Central Manitoba (Ellis and Shafer, 1943).

Liege Series (LIG)

The Liege series is the imperfectly drained Gleyed Cumulic Regosol member of the Melita Association, developed on deep, moderately calcareous, medium textured alluvial sediments. These deposits are stratified and contain numerous dark coloured bands of former surface horizons. These soils generally have a silt loam to very fine sandy loam surface texture, nearly level to gently undulating topography, moderate permeability and moderate surface runoff. The drainage is imperfect and the estimated depth to water table is less than two metres. These soils are very susceptible to spring flooding due to high water levels in the creeks and Souris River. Some of these soils are cultivated and produce excellent crops.

This soil is characterized by dark gray Ap horizons seven to 12 cm thick, gleyed carbonated dark gray Ahkgj horizons five to seven cm thick, gleyed gray brown Ckgj horizons overlying recurring dark gray brown Ahk horizons and light brownish gray to gray brown Ckgj horizons.

Lockhart Series (LKH)

The Lockhart series consists of moderately well to well drained Orthic Black Chernozem soils developed on a thin mantle (25 to 60 cm) of moderately coarse sediments (VFS, LVFS, FSL) over a thin stratum (10 to 50 cm) of very strongly calcareous loamy glacial till of limestone and granitic origin, over a strongly calcareous loam to clay loam glacial till of shale, limestone and granitic origin. These soils occur on gently sloping to undulating topography. Runoff is moderate to moderately rapid. Permeability is moderately rapid in the upper sandy strata and moderately slow in the underlying till. These soils have been slightly eroded.

The soil is characterized by a very dark gray Ah horizon 18 to 25 cm thick, and a grayish brown to brown Bm horizon 12 to 20 cm thick. The depth of solum varies with the depth of the sandy overlay with the BC terminating at the contact of the sandy surface and very strongly calcareous till.

Lowton Series (LWN)

The Lowton series consists of poorly drained Rego Humic Gleysol soils developed on moderately to strongly calcareous, clayey (SiC, C) lacustrine deposits. These soils occur in lower to depressional positions of nearly level landscapes and have very slow permeability, very slow surface runoff and a high water table during the growing season. Lowton soils are non-eroded, non-stony and moderately saline. They have a high available water holding capacity, high organic matter content and low natural fertility. Native vegetation includes native grasses, willows and sedges. The majority of these soils are currently under native vegetation.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a moderately decomposed LFH horizon, 1 to 5 cm thick, a very dark gray Ah horizon, 5 to 20 cm thick with carbonates and a dark gray to olive gray Ckg horizon with many mottles and carbonate concentrations. A typical profile also contains till at 1 to 2.5 m below the surface. Lowton soils occur in close association with Sigmund and Janick soils. They are similar to Landseer soils by having a Rego Humic Gleysol profile developed in clayey sediments but differ from them in having uniform textures throughout, while Landseer soils are stratified at depth. Lowton soils were previously mapped as minor inclusions of the Oliver Association in the South-Central Manitoba soil survey (Ellis and Shafer, 1943).

Lyleton Series (LYT)

The Lyleton series is the well drained Orthic Black Chernozem member of the Lyleton Association, developed on deep, moderately calcareous, moderately coarse (VFS, LVFS, FSL) lacustrine sediments. This soil usually has sandy loam to loamy very fine sand surface texture, complex gently sloping to gently undulating topography, moderately rapid permeability and moderate surface runoff. The depth to groundwater is estimated at two metres during the growing season. The surface is non-stony and non-saline. Under cultivation these soils are moderately susceptible to erosion, somewhat droughty and generally low in natural fertility. The majority of these soils occur in the southwestern portion of the Souris River Basin.

The profiles are often deep and consist of black to very dark brown Ap horizons 12 to 15 cm thick, very dark gray to black Ah horizons 18 to 25 cm thick, very dark grayish brown Bm horizons 12 to 18 cm thick, light brownish gray Cca horizons 15 to 20 cm thick and calcareous, light brownish gray Ck horizons.

Maon Series (MON)

The Maon series is the well drained Rego Black Chernozem member of the Lyleton Association, developed on deep, moderately calcareous, moderately coarse lacustrine sediments. This soil has a loamy very fine sand surface texture, gently sloping to gently undulating topography, moderate permeability and slow surface runoff. The drainage is moderately good and the estimated depth to water table is two metres during the growing season. In the cultivated state this soil is moderately susceptible to erosion as is indicated by the gray-white buff-coloured spots in the field where C material has been incorporated into the Ap horizon.

Maples Series (MPS)

The Maples series is the well-drained Orthic Black Chernozem member of the Maples Association, developed on thin (< 1 m) weakly to moderately calcareous medium to moderately coarse textured

lacustrine sediments deposited on hard gray siliceous (Riding Mountain Formation) shale. This soil commonly has a loam to fine sandy loam surface texture, very gently sloping topography, moderate permeability and moderate surface runoff. These well-drained soils are usually cultivated. The thin profile usually makes this soil droughty in periods of low precipitation. The soil consists of black Ap horizons 10 to 20 cm thick, dark brown Bm horizons 12 to 15 cm thick overlying dark reddish gray to dark gray shale.

Marsh Complex (\$MH)

The Marsh complex consists of very poorly drained Rego Gleysol soils developed on lacustrine clay or thin mucky loam deposits over extremely calcareous till or moderately calcareous clay. These soils occur on level to depressional areas that are covered with water and are usually saturated for most of the year. The native vegetation consists entirely of reeds and sedges.

These soils have a thin surface layer of either muck or mineral material, high in organic matter content, and are underlain by strongly gleyed, olive gray mineral materials. A very thin Ahg horizon, less than three cm thick, may be present below the muck surface layer. Marsh soils are undifferentiated with respect to texture and composition of their parent material. They are also much more poorly drained than other Gleysolic soils.

Martinville Series (MNV)

The Martinville series is the poorly drained, carbonated Rego Humic Gleysol member of the Wawanesa Association developed on thin (25 to 100 cm), strongly calcareous, medium textured (VFSL, L, SiL) lacustrine deposits overlying moderately calcareous, coarse textured (FS, LCoS, LFS) lacustrine deposits. These soils have a silt loam to loam surface texture, nearly level to depressional topography, moderate permeability and virtually no surface runoff. The water table is usually at or very near the soil surface. Most of these soils have hydrophytic native vegetation and may be used as pasture or left undisturbed.

Maskawata Series (MAW)

The Maskawata series consists of well-drained Rego Black Chernozem soils of the Waskada Association, developed on thin (25 to 100 cm), strongly calcareous, medium textured, discontinuous eolian and lacustrine sediments overlying strongly calcareous, medium to moderately fine textured glacial till. The dominant surface texture is a loam or very fine sandy loam, topography is gently undulating, permeability and surface runoff are moderate. They are moderately well-drained soils and usually occur in the upper mid slope position. Maskawata soils are found in close association with Waskada soils. The estimated depth to water level is three metres during the growing season. In the cultivated state these soils are moderately eroded and in many of these soils, most of the Ah horizon has been eroded by accelerated removal by wind and water as a result of cultivation. The surface soils have a general gray colour due to the incorporation of AC and Ck horizons in the Ap.

Recognition of the overlay in these soils is sometimes difficult because the underlying till is relatively stone free. The Maskawata series is similar to the Argue series of the Cameron Association, except for the underlying glacial till.

Melita Series (MLT)

The Melita series is the well drained, Cumulic Regosol member of the Melita Association developed on deep, moderately calcareous, medium textured, recent alluvial sediments. These deposits are stratified and contain numerous dark coloured bands of former Ah horizons in the profile. The soil has a very fine sandy loam to silt loam surface texture, nearly level to depressional topography, moderate permeability and moderate surface runoff. They are moderately well-drained soils and have an estimated depth to water table of two metres. In the uncultivated state they are covered by lush growth of native vegetation such as western snowberry, elm, maple, forbs, grasses and chokecherry. In the cultivated state these soils produce excellent crops.

The Melita soil usually consists of thick dark gray-brown Ah horizons 15 to 30 cm thick and very dark grayish brown C horizons. They also have buried surface horizons as indicated by dark bands in the profile. The Melita series corresponds with the Mowbray series in Ecoclimatic subregion Gt2.

Mentieth Series (MNH)

The Mentieth series is the imperfectly drained Gleyed Rego Black Chernozem, carbonated member of the Mentieth Association, developed on thin moderately calcareous, coarse loamy lacustrine sediments overlying strongly calcareous loamy glacial till. A very thin (< 5 cm) gravelly pebble line may occur at the

contact. This soil has a very fine sand to loamy very fine sand surface texture, nearly level topography, moderate permeability and moderately slow surface runoff. These soils are imperfectly drained because of their position in the landscape and the proximity of the underlying less permeable till. Although ponded surface waters are not common the profile is frequently saturated due to the high water table. The surface is non-stony and cultivated.

The Mentieth series resemble the Switzer series of the Souris Association, the difference is that Mentieth series is underlain by glacial till.

Miniota Series (MXI)

The Miniota series consists of moderately well to well drained Orthic Black Chernozem soils developed on a thin mantle (<1 m) of moderately to strongly calcareous very fine sand, to fine sandy loam textured sediments, over moderately to strongly calcareous, medium sand to gravelly textured deposits. The topography varies from gently sloping to irregular, moderately rolling. Runoff is moderate to moderately rapid, and permeability is rapid in the sandy strata and very rapid in the lower coarser strata. They occur in close association with the imperfectly drained Wytonville and Kilmury soils and the poorly drained Burnett series.

The soil is characterized by a very dark gray to very dark grayish brown Ah horizon 12 to 20 cm thick, a dark brown to brown Bm horizon 10 to 18 cm thick, and a pale brown BC horizon. The depth of solum varies with the depth of the sandy strata. The lime accumulation (Cca) horizon usually occurs at the transition from sandy to coarser sediments. Miniota soils are less permeable and less droughty than the very similar coarser textured Wheatland and Dorset soils. The similar, finer textured Croyon soils are less droughty.

Minto Series (MTO)

The Minto series is the imperfectly drained Gleyed Eluviated Black Chernozem member of the Elva Association, developed on deep (> 100 cm), strongly calcareous moderately fine textured (SCL, CL, SiCL) lacustrine sediments. This soil usually has a silty clay loam surface texture, occurs in the depressions of gently undulating topography, and has moderately slow permeability and slow surface runoff. The estimated depth to water table is less than two metres. This imperfectly drained soil is usually cultivated and is moderately susceptible to flooding and surface ponding particularly after heavy rains.

Montgomery Series (MOT)

The Montgomery series is the imperfectly drained, carbonated Gleyed Rego Black Chernozem member of the Waskada Association, developed on thin (25 to 100 cm), strongly calcareous, medium textured, discontinuous aeolian and lacustrine sediments overlying strongly calcareous medium to moderately fine textured glacial till. A very thin (<5 cm), pebbly stratum may occur at the contact. This soil has a loamy surface texture, gently sloping to depressional topography, moderate permeability and moderate surface runoff. This soil has an estimated depth to water table within 2 metres. The cultivated surface may be slightly stony. The soil consists of very dark gray Apk horizons 10 to 20 cm thick, light gray Ccagj horizons 20 to 30 cm thick, light gray Ckgj horizons 25 to 33 cm thick overlying light brownish gray, loam to clay loam, II Ckgj horizons.

Moore Park (MPK)

The Moore Park series is characterized by a Gleyed Black Chernozem solum on moderately to strongly calcareous, fine loamy (L, CL, SCL) textured morainal till of limestone, granite and shale origin. This soil is imperfectly drained and occur in the lower slope positions of undulating to hummocky landscapes in close association with Angusville soils. Permeability is moderate, and surface runoff is slow. These soils are occasionally weakly saline and sometimes have a few isolated stones on the surface.

The Moore Park series has a black Ap or Ah horizon 10 to 34 cm thick, a very dark grayish brown Bmgj five to 44 cm thick, and a light olive brown Ckgj horizon 45 to 87 cm thick. The Moore Park soils are similar to Lavinia soils by having a B horizon but differ from them by having a non-calcareous B horizon.

Mountainside Series (MUE)

The Mountainside series is the imperfectly drained, carbonated Gleyed Rego Black Chernozem member of the Maples Association, developed on thin (< 100 cm), weakly to moderately calcareous, moderately

coarse to medium textured (VFS, LVFS, FSL, to VFSL, L, SiL) lacustrine sediments deposited on hard gray siliceous (Riding Mountain) shale. This soil occurs below the escarpment in a prominent glacial melt water channel near Dand. The surface texture is loam, topography is very gently sloping and permeability and surface runoff are moderate. These imperfectly drained soils are non-stony, occasionally saline in the lower part of the profile.

This soil consists of gleyed, dark grayish brown Ap horizons 10 to 15 cm thick, gleyed, non-to-weakly calcareous Cg horizons 20 to 30 cm thick with very dark gray, II Cgj horizons of underlying shale bedrock.

Mowbray Series (MOW)

The Mowbray series consists of a well drained, Cumulic Regosol soil, developed on deep, moderately to strongly calcareous, loamy (L, SiL, CL, SiCL) recent alluvial sediments. These deposits are stratified and contain dark coloured bands of former Ah horizons in the profile. The soils are located in upper terrace and flood plain areas that have been inundated during years of high flood waters. Topography is very gently to moderately sloping; runoff is moderate and permeability is moderate.

The soil is characterized by a dark gray to gray surface horizon (Ah or Ap), 8 to 20 cm thick and a lighter coloured (C) substratum with dark bands consisting of former organic layers or buried Ah horizons. These soils may exhibit weak profile development. They occur in association with the Levine and Basker soils.

Naples Series (NPS)

The Naples series is the poorly drained Orthic Humic Gleysol member of the Elva Association, developed on deep, strongly calcareous fine loamy (CL, SiCL) lacustrine sediments. These soils have a dominantly clay loam surface texture, nearly level to depressional topography, slow permeability and no surface runoff. Naples soils are poorly drained and have an estimated depth to water table of less than one metre during the summer. Naples soils are rarely cultivated and usually support lush growth of slough grass. In late summer they are frequently dry enough to permit access for haying purposes. These soils sometimes occur in the bottom of depressions with Bunclody soils around the outer edge or they sometimes occur around the edge of depressions which have Fairfax soils in the central portion. They may also occur in stream channels.

Neelin Series (NEI)

The Neelin series is the imperfectly drained Gleyed Cumulic Regosol member of the Coulter Association, developed on deep, moderately calcareous, moderately fine to fine (CL, SiCL SCL to SiC, C) textured recent alluvial sediments. Neelin soils are frequently stratified with layers ranging in texture from very fine sand to clay. The topography is level to depressional, surface runoff is very slow and permeability is slow. The depth to water table is estimated to be within two metres. Some of these soils are cultivated; others are still in their native state with vegetation consisting of elm, oak, poplar and various shrubs and grasses. Soluble salts may occur to a moderate degree in some of the Neelin soils. This soil usually consists of dark gray Ah horizons less than 20 cm thick and light brownish gray, stratified and banded Ckgj horizons.

Newdale Series (NDL)

The Newdale series is characterized by an Orthic Black Chernozem solum on moderately to strongly calcareous, fine loamy (L, CL, SCL) morainal till of limestone, granitic and shale origin. These soils are moderately well to well drained and occur in mid to upper slope positions of undulating to hummocky landscapes. Surface runoff is moderate to moderately rapid; permeability is moderately slow. Most of these soils are presently cultivated; they have formed under intermixed aspen grove and grassland vegetation.

The Newdale solum has a very dark gray Ap or Ah horizon, commonly 25 cm thick and ranging from 15 to 35 cm, a dark brown Bm horizon 10 to 30 cm thick, and a transitional BC horizon, 3 to 15 cm thick. A lime carbonate horizon 10 to 15 cm thick is often present in shallower soils but is not evident in deeper profiles. Its solum depth averages 58 cm and ranges from 25 to 90 cm. Minor amounts of well drained Eluviated Black Chernozem soils are included within the Newdale mapping units. They have solum thickness ranging from 75 cm to greater than one metre. They also have thicker A (combined Ah, Ahe) horizons 30 to 60 cm and Bt horizons that are 40 cm thick.

The Newdale soils differ from Erickson soils in being less strongly leached and having less distinct and shallower solum. Newdale soils, on the other hand, differ from the very similar Rufford and Cordova soils in being more strongly leached, deeper and free of lime carbonate in the A and B horizons.

Oak Lake Series (OKL)

The Oak Lake series is the poorly drained Rego Humic Gleysol, carbonated member of the Souris Association, developed on deep, weakly to moderately calcareous, sandy lacustrine sediments. This poorly drained soil generally has level to depressional topography; a loamy fine sand surface texture, moderately slow permeability and slow surface runoff. The depth to water table is usually less than one metre. These soils are seldom under cultivation because of their poor drainage. These soils are generally used for native hay production. The profiles are often strongly iron stained and contain prominent, abundant iron and manganese concretions.

A typical profile would have very dark gray Ah horizons 10 to 30 cm thick; gleyed, gray AC horizons 12 to 18 cm thick and stratified, strongly gleyed gray brown Ckg horizons containing prominent mottles and iron concretions.

Onahan Series (ONH)

The Onahan series consists of Gleyed Regosol soils developed on imperfectly drained, weakly to noncalcareous, sandy (FS, LS, S), eolian sediments. These soils occur in lower and mid-slope positions on complex hummocky topography in association with the Shilox series, which is found on upper slopes, and Mockry soils in associated depressions. Surface runoff is low, and permeability is rapid but can be restricted by a high-water table in the spring and early summer. These soils have been stabilized for more than 60 years as indicated by tree growth. Some areas have been seeded to grasses and used for pasture.

The Onahan soil profile has a partially decomposed LH horizon 1 to 3 cm thick, and a gray to dark gray Ah horizon, 5 to 18 cm thick. The Cgj horizon is pale brown with strong brown to yellowish brown mottles.

This profile differs from the somewhat similar Hummerston soil series, in not having a Chernozemic A horizon. Onahan soils were included in duned landscape areas of the Stockton Association in the Carberry soil report (1957).

Pipestone Series (PPT)

The Pipestone series is the imperfectly drained, carbonated Gleyed Rego Black Chernozem member of the Pipestone Association, developed on deep (> 100 cm), weakly to moderately calcareous, fine textured (SiC, C) lacustrine and alluvial sediments. These soils have nearly level topography, light clay surface texture, very slow permeability and slow surface runoff. This soil has an estimated depth to water table of two to three metres. These soils are usually cultivated and produce excellent crops. Weak to moderate salinity may be present in some areas.

Pleasant Series (PLE)

The Pleasant series consists of imperfectly drained Gleyed Rego Black Chernozem soils developed on moderately to strongly calcareous, deep, uniform, moderately coarse (VFS, LVFS, FSL) lacustrine deposits. These soils occur in middle positions of irregular to undulating landscapes and have moderate permeability, moderately slow surface runoff and a high water table during the growing season. Pleasant soils are non-eroded, non-stony, and frequently slightly saline. They have a medium available water holding capacity, medium organic matter content and medium natural fertility. Native vegetation includes tall prairie grasses, prairie-meadow grasses, shrubs and aspen-oak groves. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon 15 to 25 cm thick, a dark grayish brown AC horizon, 6 to 10 cm thick, a Ccagj horizon 10 to 15 cm thick and a light olive brown Ckgj horizon, with yellowish brown mottles. A typical profile also contains gypsum crystals below the Ccagj horizon.

Pleasant soils occur in close association with Prosser, Gateside and Poolex soils. They are similar to Taggart soils by having an imperfectly drained Gleyed Rego Black Chernozem profile but differ from them in having coarse loamy, rather than loamy deposits. Pleasant soils were previously mapped as Black Meadow associates of the Holland Association in the Carberry soil report (Ehrlich et al., 1957).

Plum Lake Series (PAK)

The Plum Lake series is the poorly drained Rego Humic Gleysol, carbonated member of the Lyleton Association, developed on deep moderately calcareous, coarse loamy lacustrine sediments. A water table within one metre of ground level occurs throughout most of the year. They have a loamy very fine sand surface texture and occur in depressional areas. They have moderately good permeability but no surface runoff, and surface ponding or flooding is a common occurrence in the spring and after heavy summer rains. Some of these soils may be saline.

Poolex Series (POX)

The Poolex series consists of poorly drained Rego Humic Gleysol soils developed on moderately to strongly calcareous, deep, uniform, coarse loamy (VFS, LVFS, FSL, SL) lacustrine deposits. These soils occur in level to depressional positions on undulating landscapes and have moderate permeability, slow surface runoff and a high to ponded water table during the growing season. Poolex soils are non-eroded, non-stony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content and low natural fertility. Native vegetation includes sedges, rushes, seeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a moderately decomposed organic horizon, 1 to 4 cm thick, a very dark gray Ah horizon 15 to 22 cm thick, an olive gray to gray AC horizon six to 12 cm thick, moderately calcareous, and a Ccag horizon 10 to 15 cm thick. The parent material is typically olive brown to pale olive with yellowish brown mottles.

Poolex soils occur in close association with Purple, Pleasant and Gateside soils. They are similar to Vordas soils by having a poorly drained profile in loamy deposits but differ from them by having slightly coarser textures. Poolex soils were previously mapped as Meadow associates of the Poolex Association in the Carberry soil report (Ehrlich et al., 1957).

Purple Series (POR)

The Purple series is a Rego Black Chernozem soil developed on moderately well to well-drained, moderately to strongly calcareous, moderately coarse (VFS, LVFS, FSL, SL) lacustrine sediments. These soils occur on the upper slope positions of gently undulating topography associated with Prosser and Pleasant soils. Surface runoff is moderately rapid, and permeability is moderate to moderately rapid. These soils have had some erosion and are susceptible to both wind or water erosion, if not protected.

The Purple series is characterized by a very dark gray Ap or Ah horizon 15 to 20 cm thick and a calcareous AC horizon, 8 to 15 cm thick. A layer of lime carbonate accumulation (Cca horizon) may be present. This soil differs from the similar Prosser soils in not having a prominent Bm horizon. Purple soils are finer textured and less permeable than the sandy Cactus soils, and in turn are coarser textured and more permeable than the very similar loamy textured Durnan soils.

Prodan Series (PDA)

The Prodan series is a Gleyed Rego Black Chernozem, carbonated soil developed on imperfectly drained, strongly to very strongly calcareous, moderately fine (CL, SiCL) lacustrine sediments. These soils occur in the Upper Assiniboine Delta and Brandon Lakes Plain on gently sloping topography in association with Ramada, Charman, Carroll and Tadpole soils. Surface runoff is moderately slow and permeability is moderate to moderately slow. A seasonal water table frequently occurs within 70 cm of the surface.

The Prodan soil profile has a very dark gray Ah horizon 18 to 25 cm thick, a dark gray to gray AC horizon, 8 to 15 cm thick and a Ccagj horizon. The Ckgj horizon is light brownish gray with yellowish brown mottles. This soil differs from the similar Charman series in not having a prominent Bmgj horizon. Prodan soils are finer textured and less permeable than the similar loamy textured Taggart and Torcan soils. The very similar Capell soils have coarse, sandy and gravelly textured subsoils that are very rapidly permeable. Prodan soils were previously mapped as Black Meadow associates of the Holland Association in the reconnaissance soil survey of South-Central Manitoba (Ellis and Shafer, 1943).

Prosser Series (PSE)

The Prosser series is an Orthic Black Chernozem soil developed on moderately well to well-drained, moderately to strongly calcareous, coarse loamy (VFS, LVFS, FSL, SL) lacustrine sediments. These soils occur in the Upper Assiniboine Delta and Brandon Lakes Plain in association with Purple, Gateside, Pleasant and Poolex soils, on mid and upper slopes of undulating to gently rolling topography. Surface runoff is moderate to rapid and permeability is moderate to moderately rapid.

The Prosser soil profile has a very dark gray Ah horizon 18 to 25 cm thick, a dark brown to brown Bm horizon 12 to 20 cm thick, a pale brown BCk horizon and usually a Cca horizon, 12 to 18 cm thick. This soil differs from the similar Purple series in having a prominent Bm horizon. The coarse loamy Prosser soils are somewhat finer textured and less permeable than the sandy Stockton and Cactus soils, and in turn, are coarser textured and more permeable than the similar loamy textured Fairland and Durnan soils.

Ralston Series (RTO)

The Ralston series is the imperfectly drained Gleyed Regosol member of the Grande Clairiere Association, developed on deep, weakly to noncalcareous, sandy eolian deposits. This soil has a fine sand surface texture, rapid permeability, no surface runoff and occurs in lower slope and depressional positions of undulating duned topography. The drainage is imperfect and the water table occurs within three metres of the surface. The vegetation consists of poplar, aspen, rose bushes, willows, saskatoons and various shrubs. These soils have a weakly developed Ah horizon and have been stabilized for 30 to 60 years as is indicated by the tree growth. Occasionally, these soils are cultivated but most are used for grazing. Many Ralston soils have a dark gray to black band 5 to 10 cm thick, containing iron and manganese concretions within one metre of the surface. This layer appears to affect the moisture regime of this soil because it is less permeable than the soil above and below.

This soil is characterized by partially decomposed L-H horizons 5 to 10 cm thick, gray to dark gray Ah horizons 5 to 20 cm thick, pale brown Cgj horizons and commonly a grayish brown to brown band 30 to 60 cm thick containing abundant iron and manganese concretions, mottles and stains.

Ramada Series (RAM)

The Ramada series is an Orthic Black Chernozem soil developed on well to moderately well drained, strongly to very strongly calcareous, moderately fine (CL, SiCL) lacustrine sediments. These soils occur in the Upper Assiniboine Delta and Brandon Lakes Plain on very gently sloping topography or on mid and upper slope positions of undulating topography associated with Barren, Carroll, Charman, Prodan and Tadpole soils. Surface runoff is moderately rapid, and permeability is moderate to moderately slow.

The Ramada soil profile has a very dark gray Ah horizon 10 to 20 cm thick, a dark grayish brown to brown Bm horizon 8 to 12 cm thick and a BC horizon 6 to 10 cm thick. A Cca horizon is usually present. The Ck horizon is pale brown to light yellowish brown. This soil differs slightly from the Carroll soil in having a prominent Bm horizon. Ramada soils are finer textured and less permeable than the similar coarser textured, loamy Fairland soils, as well as the Croyon and Zarnet soils which have coarse sandy and gravelly textured subsurface layers and very rapid permeability. Ramada soils were previously mapped as the dominant associate of the Holland Association in the reconnaissance soil survey of South-Central Manitoba (Ellis and Shafer, 1943).

Regent Series (RGT)

The Regent series is the imperfectly drained Gleyed Black Chernozem member of the Ryerson Association, developed on deep (> 100 cm) strongly calcareous, medium to moderately fine (VFSL, L, SiL, to CL, SiCL, SCL) textured glacial till. The till is composed of mixed materials derived from shale, limestone and granitic rock. A thin overlay (< 25 cm) may occur on some soils. The topography is gently sloping, permeability is moderate and surface runoff is slow. These soils occur in lower slope and depressional positions and are cultivated. Ryerson and Hazeldean soils are commonly found in close association with Regent soils. The depth to water table in Regent soils is estimated at approximately 2 metres during the growing season. These soils are occasionally weakly saline and sometimes have a few isolated stones on the surface.

A typical profile of the Regent series has a black Ap 10 to 15 cm thick, a very dark grayish brown Bmgj 10 to 15 cm thick, a grayish brown to white Cca horizon 18 to 25 cm thick and a light olive brown Ck horizon.

Analytical and morphological data are presented below.

Ap - 0 to 15 cm, black to very dark gray (10YR 2.5/1 moist), very dark gray to dark gray (10YR 3.5/1 dry), loam; massive; friable when moist; abrupt, smooth boundary; pH 6.3.

Bmgj - 15 to 28 cm, very dark grayish brown to dark brown (10YR 3/2.5 moist), dark yellowish brown to yellowish brown (10YR 4.5/4 dry), loam; moderate coarse to medium columnar breaking to moderate, fine subangular blocky; friable when moist; abrupt, smooth boundary; pH 6.5.

BCgj - 28 to 30 cm, dark brown (10YR 3/3 moist), yellowish brown to light yellowish brown (10YR 5.5/4 dry), loam; moderate, coarse to medium columnar breaking to moderate, fine subangular blocky; friable when moist; clear, irregular boundary; moderately calcareous; pH 6.3.

Ckgj - 30 cm +, yellowish brown (10YR 5/4 moist), very pale brown (10YR 7/3 dry), loam; massive; friable when moist; few, fine, faint iron mottles; strongly calcareous; pH 8.3.

Rempel Series (RMP)

The Rempel series consists of moderately well to well-drained Calcareous Black Chernozem soils developed on strongly to very strongly calcareous, deep, uniform, moderately fine (CL, SiCL) lacustrine deposits. These soils occur in upper positions of undulating landscapes and have moderate permeability, moderately rapid surface runoff and a low water table during the growing season. Rempel soils are occasionally slightly eroded, non-stony and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses, meadow grasses and aspen-oak groves. The majority of these soils are cultivated for crop production.

In a representative profile, the solum is approximately 20 cm thick. The profile has a weakly calcareous, very dark gray to very dark grayish brown Ah horizon 15 to 22 cm thick, a dark grayish brown to brown Bmk horizon 10 to 15 cm thick, a pale brown BCk horizon, 5 to 10 cm thick, moderately calcareous, and a light gray to white Cca horizon 10 to 15 cm thick. Rempel soils occur in close association with Ramada, Prodan and Tadpole soils. They are similar to Ramada soils by having well drained, fine loamy soils but differ from them in having a Bmk rather than Bm horizon. Rempel soils were previously mapped as Blackearth associate of the Holland Association in the Carberry soil report (Ehrlich et al., 1957).

Rufford Series (RUF)

The Rufford series is characterized by a Rego Black Chernozem solum on moderately to strongly calcareous, fine loamy (L, CL, SCL) morainal till of limestone, granite and shale origin. These soils are moderately well to well drained and occur on the upper slopes and knoll positions in undulating to hummocky landscapes in close association with Cordova and Newdale soils. Runoff is moderately rapid to rapid; permeability is moderately slow.

Rufford profiles have a very dark gray to very dark grayish brown Ah horizon 12 to 18 cm thick and a thin ACK horizon, 6 to 10 cm thick. A carbonate accumulation (Cca) layer, 5 to 15 cm thick is usually present. Rufford soils differ from Cordova soils in being less leached and having thinner, less distinct horizons. Both Rufford and Cordova differ from Newdale in being less leached and having free lime carbonate in their A or B horizons.

Ryerson Series (RYS)

The Ryerson series is the well drained Orthic Black Chernozem member of the Ryerson Association, developed on deep (> 100 cm), strongly calcareous, medium to moderately fine textured (L, CL, SiCL, SCL) glacial till. Coarse fragments in the till are composed of shale, limestone, and granite rocks. The surface 25 cm may have a variable texture although the most common textures range from loam to clay loam. These soils are found in the upper and mid slope of undulating to gently rolling topography. This soil has moderate permeability and moderate surface runoff. In some areas it is slightly to moderately stony. The depth to water table is estimated at three to four metres during the growing season.

Ryerson profiles are generally thin with the entire Ah and occasionally the upper part of the Bm horizon incorporated into the Ap horizon. The Ap horizon, therefore, tends to be dark gray in colour. The Bm horizon is quite variable in thickness ranging from 10 to 30 cm depending on the topography and amount of mechanical disturbance. The Bm horizons are characterized by moderate, fine prismatic to weak, moderate, medium granular structure and a dark grayish brown colour. A light gray Cca horizon 20 to 30 cm thick commonly occurs below the Bm horizon. The pale brown to yellowish brown Ckgj horizon may contain weak concentrations of soluble salts, lime carbonates and prominent iron mottles and concretions.

Sanger Series (SGR)

The Sanger series is the poorly drained Orthic Humic Gleysol member of the Cameron Association, developed on deep (> 100 cm), strongly calcareous, medium textured (VFSL, L, SiL) lacustrine sediments. This soil has a loam to fine sandy loam surface texture, nearly level to depressional topography, moderately slow permeability and no surface runoff. These soils have a high seasonal water table and are very susceptible to flooding and surface ponding. Sanger soils are not cultivated and generally support hydrophytic slough grasses that in dry years are sometimes harvested for hay.

Scarth Series (SCH)

The Scarth series is the well-drained Rego Black Chernozem member of the Souris Association, developed on deep (> 100 cm), weakly to moderately calcareous, coarse textured (FS, LCoS, LFS) lacustrine sediments. This soil has a fine sand to loamy fine sand surface texture, gently undulating topography, moderate permeability, slow surface runoff and moderately good drainage. The depth to water table is estimated at two to three metres during the growing season. Most of these soils are cultivated.

Schaffner Series (SFR)

The Schaffner series is the well-drained Calcareous Black Chernozem member of the Cameron Association, developed on deep, strongly calcareous, medium textured (VFSL, L, SiL) lacustrine deposits. This soil has simple smooth topography, moderately good drainage, a fine sandy loam to loam surface texture, moderately slow permeability and slow surface runoff. The depth to water table is estimated at two to three metres and the subsoil may occasionally be weakly saline. Under cultivation, the upper part of the B horizon is usually incorporated into a very dark gray brown Ap horizon 10 to 15 cm thick. The weakly calcareous, dark grayish brown Bmk horizon generally has weak granular structure and is 10 to 15 cm thick; a grayish brown BC horizon, 5 to 13 cm thick and a stratified light yellowish brown to pale olive brown Ck horizon occur below.

Sewell Series (SEE)

The Sewell series consists of poorly drained Rego Humic Gleysol soils developed on weakly to moderately calcareous, deep, uniform, coarse (FS, LS, LFS) lacustrine deposits. These soils occur in depressional positions of gentle slopes on hummocky landscapes and have moderately rapid permeability, very slow surface runoff and a high to ponded water table during the growing season. Sewell soils are non-eroded, non-stony and often slightly saline. They have a low available water holding capacity, high organic matter content and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile, the solum is approximately 15 cm thick. The profile is characterized by moderately decomposed organic horizon, 2 to 5 cm thick, a very dark gray Ah horizon 10 to 18 cm thick, a dark gray to gray ACkg horizon 10 to 15 cm thick with carbonates and mottles, and usually a Ccag horizon, five to eight cm thick. A typical profile also contains an olive to pale olive Ckg horizon with yellowish brown mottles and manganese concretions.

Sewell soils occur in close association with Stockton, Lavenham and Hummerston soils. They are similar to Poolex soils by having poor drainage and a Rego Humic Gleysol profile but differ from them in having

sandy, rather than coarse loamy deposits. Sewell soils were previously mapped as Meadow associates of the Stockton Association in the Carberry soil report (Ehrlich et al., 1957).

Shilox Series (SHX)

The Shilox series consists of moderately well to excessively drained Orthic Regosol soils developed on weakly to noncalcareous, deep, uniform, sandy (FS, LS, S) eolian deposits. These soils occur in middle and upper positions of moderate to strong slopes on hummocky to duned landscapes and have rapid to very rapid permeability, minimal surface runoff and a low water table during the growing season. Shilox soils are severely wind eroded, non-stony and non-saline. They have low available water holding capacity, low organic matter content and low natural fertility. Native vegetation includes oak, black spruce, juniper and prairie grasses. The majority of these soils are currently wooded.

In a representative profile the solum is not developed. The profile is characterized by a partially decomposed LH horizon, 1 to 2 cm thick, a grayish brown to pale brown Ah horizon, 6 to 10 cm thick and a light yellowish brown to pale brown C horizon. A typical profile also contains an occasional buried Ah horizon, 2 to 4 cm thick.

Shilox soils occur in close association with Onahan and Mockry soils. They are similar to Arizona soils by having a Regosol profile in sandy deposits but differ from them in having less stratification and more uniform textures. Shilox soils were previously mapped as duned associates of the Stockton Association in the Carberry soil report (1957).

Sigmund Series (SGO)

The Sigmund series consists of imperfectly drained Gleyed Rego Black Chernozem soils developed on moderately to strongly calcareous, deep, uniform clayey (SiC, C) lacustrine deposits. These soils occur in lower slope positions of very gentle slopes on undulating landscapes and have slow permeability, moderately slow surface runoff and a high water table during the growing season. Sigmund soils are non-eroded, non-stony and frequently slightly saline. They have a high available water holding capacity, medium organic matter content and medium natural fertility. Native vegetation includes aspen-oak groves, willow and prairie grasses. The majority of these soils are currently annual crop production.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon 15 to 25 cm thick, a dark gray ACgj horizon, 5 to 18 cm thick with many faint mottles, a light gray Ccagj horizon, 5 to 15 cm thick with many prominent mottles and a light olive brown Ckgj horizon with many prominent mottles. A typical profile also contains gypsum crystals in the subsoil.

Sigmund soils occur in close association with Janick, Harding and Lowton soils. They are similar to Harding soils by having an imperfectly drained profile in clayey deposits but differ from them by having no B horizon. Sigmund soils were previously mapped as minor inclusions of the Oliver Association in the soil survey of South-Central Manitoba (Ellis and Shafer, 1943).

Souris Series (SOU)

The Souris series is the imperfectly drained, carbonated Gleyed Rego Black Chernozem member of the Souris Association, developed on deep (> 100 cm), weakly to moderately calcareous, sandy lacustrine deposits. This soil has a fine sand to loamy fine sand surface texture, nearly level to depressional topography with simple and complex slopes, no surface runoff and moderately rapid permeability. The depth to water table is estimated at about 1.5 metres during the growing season. This soil is generally cultivated or used for pasture.

A typical profile usually has a black Apk horizon 12 to 15 cm thick, a black Ahk horizon, 5 to 7 cm thick, a gleyed, dark grayish brown AC horizon, 7 to 12 cm thick and a gleyed yellowish brown stratified Ckgj horizon. The soil parent materials have strata ranging in texture from fine sand to coarse gravel.

Stanton Series (STU)

The Stanton series is the well-drained Orthic Black Chernozem member of the Souris Association, developed on deep (> 1 m), weakly to moderately calcareous, coarse textured lacustrine sediments. This soil has a fine sand to loamy fine sand surface texture, complex undulating topography, good internal drainage, rapid permeability and low surface runoff. The depth to water table is estimated to be 3 m during the growing season. These soils are susceptible to wind erosion.

Stanton soils usually have deep profiles consisting of black Ap horizons 10 to 15 cm thick, very dark gray Ah horizons 20 to 25 cm thick, dark brown to brown Bm horizons 25 to 50 cm thick and stratified grayish brown Ck horizons. Stanton is equivalent to the Stockton soils in climatic subregion Gt2.

The Standon, fine loamy substrate variant, STU1, has relatively finer (usually loam, very fine sandy loam, and clay loam) texture that commonly occur at 50 to 100 cm.

Stewart Series (SWR)

The Stewart series consists of well to excessively drained Rego Black Chernozem soils developed on stony, very strongly to extremely calcareous loamy glacial drift of limestone and granitic origin, and usually has some coarser strata with depth. They occur on the upper slope and knoll positions of irregular, undulating to moderately rolling topography in the Brandon Hills. Runoff is rapid; permeability is moderate. Under cultivation, these soils have had some soil loss of topsoil due to wind and water erosion.

A partially decomposed leaf mat 2 to 4 cm thick; a very dark gray to very dark grayish brown Ahk horizon 10 to 15 cm thick and a thin AC horizon characterize the soil. A white lime accumulation (Cca) horizon, 8 to 12 cm thick is usually present.

Stockton Series (SCK)

The Stockton series is an Orthic Black Chernozem soil developed on moderately well to well-drained, weakly to moderately calcareous, coarse textured (FS, LFS, LS) lacustrine sediments. These soils occur in the Upper Assiniboine Delta, the Brandon Lakes Plain and a few areas within the Lower Assiniboine Delta on very gently sloping to irregular undulating topography in association with Cactus, Lavenham, Hummerston and Sewell soils. Surface runoff is low, and permeability is rapid. Wind erosion is common if the soil is not protected with adequate surface residue.

The Stockton soil profile has a very dark gray to very dark grayish brown Ah horizon 18 to 25 cm thick, a brown to grayish brown Bm horizon 12 to 22 cm thick, a pale brown to light yellowish brown BC horizon, 8 to 12 cm thick and a very pale brown Ck horizon with a few yellowish brown mottles at approximately 70 cm depth. A Cca horizon is also frequently present. This soil differs from the very similar Cactus series by having a prominent Bm horizon. The sandy Stockton soils are coarser textured and significantly more rapidly permeable than the finer textured Prosser, Fairland and Ramada soils.

The Stockton, fine loamy substrate variant (SCK2), has relatively finer (usually loam, very fine sandy loam, and clay loam) texture that commonly occur at 50 to 100 cm.

The Stockton, classification variant (SCKc), has similar solum as the normal Stockton series but differs in having carbonate in Bm horizon. Since this variant occurs in a small area, it is not justified to assign a new Calcareous Black Chernozem in this coarse textured association.

Switzer Series (SWZ)

The Switzer series is the imperfectly drained, carbonated Gleyed Rego Black Chernozem member of the Lyleton Association, developed on deep, moderately calcareous, moderately coarse (LVFS, FSL, VFS) lacustrine deposits. This soil has a loamy very fine sand surface texture, complex gently undulating topography, imperfect drainage, moderate permeability, and no surface runoff. The depth to groundwater during the growing season is estimated at less than two metres.

The soil profile consists of black Apk horizons 12 to 15 cm thick, dark gray AC horizons 12 to 15 cm thick, gleyed gray Ccagj horizons 12 to 15 cm thick and stratified gleyed Ckgj horizons.

The Switzer, fine loamy substrate variant, has relatively finer (usually loam, very fine sandy loam and clay loam) texture that commonly occur at 50 to 100 cm.

Tadpole Series (TDP)

The Tadpole series is a Rego Humic Gleysol, developed on poorly drained, strongly to very strongly calcareous, moderately fine (CL, SiCL) lacustrine sediments. These soils occur in level to depressional positions of gently sloping to undulating topography in association with Carroll, Firdale, Charman and Danlin soils. Surface runoff is very slow and permeability is restricted. Free water occurs at or near the surface for a considerable part of the year. In areas where seepage water contains appreciable soluble

salt, a sufficient salt accumulation can occur to inhibit or retard the growth of normal hydrophytic vegetation.

The Tadpole soil profile has a moderately decomposed organic layer two to six cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a dark gray AC horizon, 4 to 6 cm thick, a Ccag horizon 10 to 15 cm thick and an olive to olive gray Ckg horizon with distinct yellowish brown mottles. In areas affected by salts, white pseudomycelia are common in the surface horizons. Tadpole soils are finer textured and less permeable than the very similar and coarser textured Vordas, Poolex and sandy Mockry and Sewell soils. The similar Carvey soils have coarser textured sandy to gravelly subsurface layers that are much more rapidly permeable than the Tadpole soils.

Taggart Series (TGR)

The Taggart series consists of imperfectly drained Gleyed Rego Black Chernozem soils developed on strongly to very strongly calcareous, deep, uniform, medium textured (VFSL, L, SiL) lacustrine deposits. These soils occur in middle to lower positions of undulating landscapes and have moderate permeability, slow surface runoff and a high water table during the growing season. Taggart soils are non-eroded, non-stony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content and medium natural fertility. Native vegetation includes aspen, oak, willow and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon 15 to 24 cm thick, a dark gray AC horizon, 5 to 15 cm thick, moderately calcareous, a Cca horizon, 8 to 12 cm thick with a carbonate accumulation and an olive brown Ckgj horizon with yellowish brown mottles. A typical profile also contains gypsum crystals below the Cca horizon.

Taggart soils occur in close association with Fairland, Durnan and Vordas soils. They are similar to Torcan soils by having imperfect drainage and loamy deposits but differ from them by having no prominent Bm horizon. Taggart soils were previously mapped as associates of the Holland Association in the Carberry soil report (Ehrlich et al., 1957).

Torcan Series (TOC)

The Torcan series consists of imperfectly drained Gleyed Black Chernozem soils developed on strongly to very strongly calcareous, deep, uniform, medium textured (VFSL, L, SiL) lacustrine deposits. These soils occur in middle to lower positions of undulating to rolling landscapes and have moderate permeability, moderately slow surface runoff and a medium water table during the growing season. Torcan soils are non-eroded, non-stony and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content and high natural fertility. Native vegetation includes aspen, willow, shrubs and meadow grasses. The majority of these soils are cultivated for crop production.

In a representative profile, the solum is approximately 45 cm thick. The profile is characterized by a very dark gray Ah horizon 18 to 25 cm thick, a light brown Bmgj horizon 10 to 18 cm thick with yellowish brown mottles, a Ccagj horizon, 8 to 12 cm thick and a light olive brown Ckgj horizon with yellowish brown mottles. Torcan soils occur in close association with Fairland, Taggart and Vordas soils. They are similar to Taggart soils by having imperfect drainage and loamy deposits but differ from them by having a prominent Bm horizon. Torcan soils were previously mapped as associates of the Holland Association in the Carberry soil report (Ehrlich et al., 1957).

Traverse Series (TAV)

The Traverse series consists of well to moderately well-drained Calcareous Black Chernozem soils developed on strongly to very strongly calcareous, deep, uniform, medium textured (VFSL, L, SiL) lacustrine deposits. These soils occur in middle and upper positions of very gentle slopes on undulating landscapes and have moderate permeability, moderate to rapid surface runoff and a low water table during the growing season. Traverse soils are often slightly eroded, non-stony and non-saline. They have a medium available water holding capacity, medium organic matter content and high natural fertility. Native vegetation includes oak, aspen, shrubs and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 25 cm thick. The profile is characterized by a very dark gray Ah horizon 10 to 18 cm thick, a dark grayish brown Bmk horizon, 8 to 15 cm thick, moderately calcareous, a brown to pale brown BC horizon 10 to 15 cm thick, moderately calcareous, and a white Cca

horizon, 8 to 12 cm thick with carbonate accumulation. The parent material is typically dark yellowish brown.

Traverse soils occur in close association with Fairland, Taggart and Vordas soils. They are similar to Rempel soils by having a Calcareous Black Chernozem profile but differ from them by having loamy rather than fine loamy deposits. Traverse soils were mapped as Calcareous Black associates of the Holland Association in the Carberry soil report (Ehrlich et al., 1957).

Two Creeks (TWC)

The Two Creeks series is the imperfectly drained Gleyed Black Chernozem member of the Waskada Association. It is developed on thin (25 to 100 cm), strongly calcareous, medium textured discontinuous eolian and lacustrine sediments overlying strongly calcareous, medium to moderately fine textured glacial till. A very thin (less than 5 cm), gravelly pebble line may occur at the contact. This soil has complex, very gently sloping topography, a very fine sandy loam to loam surface texture, moderately slow permeability and slow surface runoff. The estimated depth to water table is two to three metres during the growing season. These soils are usually cultivated.

A typical profile has a very dark gray Ap horizon eight, 8 to 15 cm thick, a dark grayish brown Bmgj horizon 13 to 18 cm thick, a gleyed light gray Ccagj horizon, 8 to 15 cm thick and light olive brown II Ckgj horizon

Underhill Series (UHL)

The Underhill series is the imperfectly drained Gleyed Black Chernozem member of the Cameron Association, developed on deep, strongly calcareous, medium textured stratified lacustrine sediments. This soil has smooth, very gently sloping topography, a loam to fine sandy loam surface texture, moderate permeability and moderately slow surface runoff. The estimated depth to water table during the growing season is 1.5 metres. The surface soil is cultivated and non-stony although small pebbles may be present.

A typical profile has a black Ap horizon, 5 to 13 cm thick, a black Ah horizon 10 to 18 cm thick, sometimes a very thin, very dark brown AB horizon, 2 to 5 cm thick and a very dark grayish brown Bmgj horizon 10 to 18 cm thick which may have weak lime carbonates present in the lower portion. The parent material is usually stratified light yellowish brown to light brownish gray in colour.

Varcoe Series (VRC)

The Varcoe series is characterized by a Gleyed Rego Black Chernozem (carbonated) solum on moderately to strongly calcareous, fine loamy (L, CL, SCL) morainal till of limestone, granite and shale origin. These soils are imperfectly drained and occur in the lower slope positions of undulating to hummocky landscapes in close association with Angusville soils. They receive runoff from the upper slopes, and in some landscapes, may be influenced by seepage. Permeability is slow and may be restricted during periods of subsoil saturation. In areas where upward groundwater or seepage waters contain appreciable salts, accumulation of salts may occur within the soil.

Varcoe profiles average 42 cm in thickness and range from 20 to 60 cm. The A horizon is usually 28 cm thick and ranges from 20 to 50 cm, very dark gray in colour and is underlain by a dark gray transitional AC horizon, four to eight cm thick. A carbonate accumulation horizon (Ccagj) is commonly present but may be discontinuous. Gypsum crystals are usually present below and within the carbonate accumulation layer. Varcoe soils containing significant soluble salts in the A horizon, as well as gypsum, have been identified as the saline phase of the series.

Vodroff Series (VFF)

The Vodroff series consists of poorly drained Rego Humic Gleysol soils developed on a thin mantle (<100 cm) of loamy (L, CL, SiCL) lacustrine sediments over a strongly calcareous loam to clay loam glacial till of shale, limestone and granitic origin. These soils have free water at or near the surface for a considerable period of the year. The topography is level to depressional; runoff is negligible; permeability is restricted during periods of free water within a metre. In areas where the inflowing waters contain appreciable soluble salts, the salt may accumulate in the soil in sufficient amount to affect the growth of normal hydrophytic vegetation.

The soil is characterized by a moderately decomposed organic layer, 2 to 5 cm thick, a very dark gray Ah horizon 10 to 18 cm thick, a mottled dark gray ACg horizon, 5 to 8 cm thick and a carbonate accumulation horizon eight to 12 cm thick. The Ckg horizon is olive to pale olive and usually contains yellowish brown mottles.

Vordas Series (VDS)

The Vordas series consists of poorly drained Rego Humic Gleysol soils developed on strongly to very strongly calcareous, deep, uniform, medium textured (VFSL, SiL, L) lacustrine deposits. These soils occur in level to depressional positions of undulating landscapes and have moderate permeability, very slow surface runoff and a high to ponded water table during the growing season. Vordas soils are non-eroded, non-stony and often slightly saline. They have a medium available water holding capacity, high organic matter content and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile, the solum is approximately 15 cm thick. The profile is characterized by a moderately decomposed organic horizon, 2 to 5 cm thick, a very dark gray Ah horizon 10 to 18 cm thick, a dark gray ACkg horizon, 4 to 6 cm thick with carbonates and mottles, and an olive to pale olive Ckg horizon with yellowish brown iron mottles. A typical profile also contains white pseudomycelia of salt in the Ah and AC horizons in saline areas.

Vordas soils occur in close association with Fairland, Taggart and Torcan soils. They are similar to Tadpole soils by having poor drainage but differ from them by having slightly coarser textures. Vordas soils were previously mapped as Meadow associates of the Holland Association in the Carberry soil report (Ehrlich et al., 1957).

Waskada Series (WKD)

The Waskada series is the well-drained Orthic Black Chernozem member of the Waskada Association and is developed on thin (<100 cm), strongly calcareous, medium textured (VFSL, L, SiL) lacustrine sediments overlying strongly calcareous, loamy glacial till. A very thin (< 5 cm), gravelly pebble line may occur at the contact. These soils have complex, gently sloping topography, moderately good drainage, loam surface texture, moderate permeability and moderate surface runoff. The depth to water table is approximately three metres during the growing season. Most of these soils are cultivated for crop production. Waskada soils usually occur in intermediate and upper slope positions. The knolls are sometimes slightly to moderately eroded. The Waskada series resembles the Cameron series of the Cameron Association. The only difference is the Waskada series is underlain by glacial till. The presence of few stones in the till makes it difficult to determine the depth of overlay.

A typical profile has very dark gray Ap horizons 10 to 15 cm thick, dark brown Bm horizons 12 to 15 cm thick; sometimes a brown BC horizon occurs above the pale brown II Ck horizon.

Wassewa Series (WSW)

The Wassewa series is the poorly drained carbonated Rego Humic Gleysol member of the Croll Association, developed on thin (25 to 100 cm), strongly calcareous, moderately fine textured (SCL, CL, SiCL), discontinuous lacustrine sediments overlying strongly calcareous, medium to moderately fine textured (VFSL, L, SiL to SCL, CL, SiCL) glacial till. A very thin (less than five cm), gravelly stratum may occur at the till contact. This soil has depressional topography, silty clay loam to clay loam surface texture; no surface runoff and very slow permeability. The depth to water table is estimated at less than one metre during the growing season. Under dry conditions these soils may be cultivated, but due to frequent flooding and surface ponding, they rarely produce a crop. In some instances, these soils may be weakly saline.

Wawanesa Series (WWS)

The Wawanesa series is the imperfectly drained, carbonated Gleyed Rego Black Chernozem member of the Wawanesa Association and is developed on thin (25 to 100 cm), moderately to strongly calcareous, medium textured (VFSL, L, SiL) lacustrine sediments overlying strongly calcareous, coarse textured (FS, LCoS, LFS) lacustrine deposits. This soil has a silt loam to loam surface texture, gently undulating topography, moderate permeability and slow surface runoff. The depth to water table is estimated at between one and two metres during the growing season. The proximity of the sandy subsoil causes the surface soil to remain saturated for longer periods after rains than would normally be expected from this type of soil. The majority of these soils are cultivated.

Wesley Series (WEL)

The Wesley series consists of imperfectly drained, carbonated Gleyed Rego Black Chernozem soils developed on stony, very strongly to extremely calcareous loamy glacial till of limestone and granitic origin; some coarser material may occur at variable depths below the surface. The soils occur on the lower slopes of irregular, undulating to moderately rolling topography; they receive the runoff from the upper slopes as well as seepage waters during the spring. Free water may occur within a metre for a considerable part of the year. Permeability is moderate but is restricted during periods of free water in the soil.

The soil is characterized by a very dark gray Ah(k) horizon 15 to 20 cm thick, a very dark gray AC horizon 6 to 10 cm thick and a lime accumulation (Cca) horizon, 8 to 12 cm thick that is often not adequately discernible from the extremely calcareous, pale yellow Ckgj horizon. This soil is similar to the Barwood series in physical and chemical properties.

Woodfield (WDF)

The Woodfield series consists of moderately well to well-drained Calcareous Black Chernozem soils developed on stony, very strongly to extremely calcareous loamy glacial drift of limestone and granitic origin. Some coarser materials may occur at variable depths. These soils occur on the mid and upper slopes of irregular undulating to moderately rolling topography of the Brandon Hills. They are more common on the south and west facing slopes which receive greater amounts of radiation per area resulting in a greater moisture deficiency than Statley soils on north and east slopes. Runoff is moderately rapid to rapid; permeability is moderate.

The soil is characterized by a very dark gray Ah horizon 10 to 15 cm thick and a calcareous dark grayish brown to brown Bmk horizon, 8 to 12 cm thick. A white lime accumulation (Cca) horizon is common below the solum but is often difficult to differentiate from the very strongly calcareous till. The cultivated soils are susceptible to wind and water erosion and have had some of the Ah horizon removed.

Appendix 3 Glossary

AASHO classification (soil engineering) - The official classification of soil materials and soil aggregate mixtures for highway construction used by the American Association of State Highway Officials.

Acid soil - A soil having a pH less than seven. See pH and Reaction, soil.

Alkali soil - (i) A soil having a high degree of alkalinity (pH of 8.5 or higher) or having a high exchangeable sodium content (15% or more of the exchangeable capacity), or both. (ii) A soil that contains enough alkali (sodium) to interfere with the growth of most crop plants.

Alkaline soil - A soil having a pH greater than seven. See pH and Reaction, soil.

Alluvium - A general term for all deposits of rivers and streams. Sediments can be different sizes depending upon the location in the floodplain of the river.

Arable soil - Soil suitable for plowing and cultivation.

Association - A sequence of soils of about the same age, derived from similar parent material and occurring under similar climatic conditions but showing different characteristics due to variations in relief and in drainage.

1/3 Atmosphere Moisture - The moisture percentage on dry weight basis of a soil sample that has been air dried, screened, saturated and subjected to a soil moisture tension of 345 cm of water through a permeable membrane for a period of 48 hours. It approximates the soil moisture at field capacity for loam textured soils.

Atterberg limits - See **liquid limit** and **plastic limit**.

Available nutrient - The portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants.

Available water - The portion of water in a soil that can be readily absorbed by plant roots. It is generally considered to be that water held in the soil against a pressure of up to approximately 15 atmospheres. See also **field capacity** and **wilting point**.

Bearing capacity - Capacity of soil (in moist to wet conditions) to support loads such as buildings, people, vehicles, and animals. The average load per unit area that is required to rupture a supporting soil mass.

Bedrock - The solid rock that underlies soil and the regolith or that is exposed at the surface.

Blocky structure - Aggregates arranged with faces rectangular and flattened, vertices sharply angular.

Bog - A peat-covered or peat-filled area, generally nutrient-poor, in which mosses and especially sphagnum are dominant. The water table is at the surface for most of the year.

Boulders - Rock fragments larger than 60 cm (two ft) in diameter.

Brunisolic - An order of soils whose horizons are developed sufficiently to exclude the soils from the Regosolic order but lack the degrees or kinds of horizon development specified for soils of the other orders.

Bulk density - The weight of oven dry soil (105 degrees C) divided by its volume at field moisture conditions, expressed in grams per cubic centimetre.

Buried soil - Soil covered by an alluvial, loessial, or other deposit, usually to a depth greater than the thickness of the solum.

Calcareous soil - Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with (1N) hydrochloric acid.

Calcium Carbonate Equivalent - Refers to the per cent of carbonates in the soil, expressed on the basis of calcium carbonate. Terms used to express the carbonate contents of soils are:

non-calcareous. < 1 per cent
weakly calcareous. 1 to per cent
moderately calcareous. 6 to 15 per cent
strongly calcareous. 16 to 25 per cent
very strongly calcareous 26 to 40 per cent
extremely calcareous > 40 per cent

Capillary fringe - A zone of essentially saturated soil just above the water table. The size distribution of the pores determines the extent and degree of the capillary fringe.

Carbon-nitrogen ratio (C/N ratio) - The ratio of the weight of organic carbon to the weight of total nitrogen in a soil or in an organic material.

Cation Exchange Capacity (CEC) - A measure of the total amount of exchangeable cations that can be held by a soil. It is expressed in milliequivalents per 100 g of soil.

Channery - A descriptive term used for thin and flat limestone, sandstone, or schist fragments up to 15 cm (six inches) in length.

Chernozemic - An order of soils that have developed under grassland or grassland-forest transition vegetation, in cool to cold, subarid to subhumid climates. The soils have a dark-coloured surface horizon and a B or C horizon, or both, of high base saturation.

Clay - As a soil separate, the mineral soil particles < 0.102 mm in diameter: usually consisting largely of clay minerals. As a soil textural class, soil materials that contain 40 per cent or more clay, less than 45 per cent sand and less than 40 per cent silt.

Clod - A compact, coherent mass of soil produced by digging or plowing. Clods usually slake easily with repeated wetting and drying.

Coarse fragments - Rock or mineral particles greater than two mm in diameter.

Cobbles - Rock fragments eight to 25 cm (three to 10 inches) in diameter.

Colour - Soil colours are compared with a Munsell colour chart. The Munsell system specifies the relative degrees of the three simple variables of colour: hue, value and chroma. For example: 10YR 6/4 means a hue of 10YR, a value of six, and a chroma of four.

Columnar structure - Having prism-like aggregates with vertical edges near the top of columns, not sharp.

Complex (soil) - A mapping unit used in detailed and reconnaissance soil surveys, where two or more soil defined soil units are so intimately intermixed in an area that it is impractical to separate them at the scale of mapping used.

Concretion - Hard grains, pellets or nodules from concentration of chemical compounds (such as calcium carbonate or iron oxide) in the soil that cement soil grains together.

Conductivity, electrical - A physical quantity that measures the readiness with which a medium (irrigation water and soil extracts) transmits electricity. It expresses the concentration of salt in terms of the conductance (reciprocal of the electric resistance in ohms) in milliSiemens per cm (mS/cm) or deciSiemens per metre (dS/m).

Consistence (soil) - The mutual attraction of the particles in a soil mass, or their resistance to separation or deformation. Terms such as loose, soft, friable, firm, hard, sticky, plastic or cemented are used to describe consistence at various soil moisture contents.

Consumptive use factor (CU) - The ratio of consumptive use of water by a crop to potential evapo-transpiration and transpiration. An actively growing crop that completely covers the soil over a large area and that has an ample supply of readily available soil water has a consumptive use factor of 1.0.

Consumptive use of water - The sum of the depths of water transpired by the plants and evaporated from the soil surface and from intercepted precipitation. It may be less or greater than potential evapo-transpiration.

Contour - An imaginary line connecting points of equal elevation on the surface of the soil.

Cover - This term generally has one of the following meanings:

- (i) Vegetation or other material providing protection; (ii) In forestry, low growing shrubs and herbaceous plants under trees (i.e., ground cover vs. tree cover); (iii) Any vegetation producing a protective mat on or just above the soil surface.

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

Crotovina - A former animal burrow in one soil horizon that has become filled with organic matter or material from another horizon. It is also spelled krotovina.

Crust - A surface layer of soil, from a few millimetres to 2.5 cm (one inch) thick, that when dry is much more compact, hard and brittle than the soil material below.

Cryic layer - A perennially frozen layer.

Cryosolic - An order of mineral or organic soils that have permafrost, either within one metre of the surface or within two metres if the soil has been strongly cryoturbated laterally within the active layer, as indicated by disrupted, mixed or broken horizons.

Cryoturbation - Frost action, including frost heaving.

Cultivation - Tillage to prepare land for seeding or transplanting, and later to control weeds and loosen the soil.

Decile portion - A one-tenth portion. As used in the soil map symbol A^7-B^3 means that soil A covers seven tenths and soil B covers three tenths of the map unit.

Deflocculate - To separate or to break up soil aggregates into individual particles by chemical or physical means or both.

Degradation (of soils) - The changing of a soil to a more highly leached and more highly weathered condition, usually accompanied by morphological changes such as the development of an eluviated, light-coloured (Ae) horizon.

Delta - A fluvial or glaciofluvial fan-shaped deposit at the mouth of a river that empties into a lake or sea.

Deposit - Material left in a new position by a natural transporting agent such as water, wind, ice, gravity, or by human activity.

Dispersion - Is rated high, moderate or low, depending on how readily the soil structure breaks down or slakes because of excess moisture. A rating of high indicates that soil aggregates slake readily. A rating of low indicates that aggregates are resistant to dispersion and remain clumped together.

Drainage (soil) - (i) The rate and extent of the removal of water from the soil by runoff and flow through the soil to underground spaces. (ii) As a condition of the soil, it refers to the frequency and duration of periods when the soil is free of saturation.

Drainage in soil reports is described on the basis of actual moisture content in excess of field capacity and length of the saturation period within the plant root zone. The terms are as follows:

Very rapidly drained - Water is removed from the soil very rapidly in relation to supply. Excess water flows downward very rapidly if underlying material is pervious. There may be very rapid subsurface flow during heavy rainfall, provided there is a steep gradient. Soils have very low available water storage capacity within the control section, and are usually coarse in texture, or shallow, or both. Water source is precipitation.

Rapidly drained - Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep gradients during heavy rainfall. Soils have low available water storage capacity within the control section, and are usually coarse in texture, or shallow, or both. Water source is precipitation.

Well-drained - Water is removed from the soil readily, but not rapidly. Excess water flows downward readily into underlying pervious material, or laterally as subsurface flow. Soils have intermediate available water storage capacity within the control section and are generally intermediate in texture and depth. Water source is precipitation. On slopes, subsurface flow may occur for short durations, but additions are equalled by losses. Soil horizons are usually bright coloured. These soils are usually free of mottles within 100 cm of the surface but may be mottled below this depth.

Moderately well-drained - Water is removed from the soil somewhat slowly in relation to supply. Excess water is removed somewhat slowly due to low perviousness, shallow water table, lack of gradient, or some combination of these. Soils have intermediate to high water storage capacity within the control section and are usually medium to fine in texture. Soils are commonly mottled in the 50 to 100 cm depth. Colours are dull brown in the subsoil with stains and mottles.

Imperfectly drained - Water is removed from the soil sufficiently slowly in relation to supply, to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is major supply. If subsurface water, groundwater, or both, is the main source, flow rate may vary, but the soil remains wet for a significant part of the growing season. Precipitation is the main source if available water storage capacity is high. Contribution by subsurface flow, groundwater flow, or both, increases as available water storage capacity decreases. Soils have a wide range in available water supply, texture, and depth, and are gleyed phases of well-drained subgroups. These soils generally have mottling below the surface layers and generally have duller colours with depth, generally brownish gray with mottles of yellow and gray.

Poorly drained - Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface flow, groundwater flow, or both, in addition to precipitation, are main water sources; there may also be a perched water table, with precipitation exceeding evapotranspiration. Poorly drained soils have a wide range in available water storage capacity, texture and depth.

Very poorly drained - Water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen. Excess water is present in the soil for the greater part of the time. Groundwater flow and subsurface flow are major water sources. Precipitation is less important, except where there is a perched water table with precipitation exceeding evapotranspiration. These soils have a wide range in available water storage capacity, texture and depth.

Drained phase - Soils with extensive surface or subsurface (tile) drainage improvements.

Drumlin - An elongate or oval hill of glacial drift, commonly glacial till, deposited by glacier ice and having its long axis parallel to the direction of ice movement.

Dryland farming - The practice of crop production in low rainfall areas, without irrigation.

Dunes - Wind-built ridges and hills of sand formed in the same manner as snowdrifts.

Eluvial horizon - A horizon from which material has been removed in solution or in water suspension.

Eolian - Soil material accumulated through wind action.

Erosion - The wearing away of the land surface by detachment and transport of soil and rock material through the action of moving water, wind or other geological processes. The ratings of erosion are:

Erosion 1 slightly eroded - soil with a sufficient amount of the A horizon removed that ordinary tillage will bring up and mix the B horizon or other lower lying horizons with surface soil in the plow layer.

Erosion 2 moderately eroded - soil with all of the A horizon and a part of the B or other lower lying horizons removed. The plow layer consists mainly of the original horizons below the A or below the original plow layer.

Erosion 3 severely eroded - soils have practically all of the original surface soil removed. The plow layer consists mainly of C horizon material, especially on knolls and steep upper slope positions.

Esker - A winding ridge of irregularly stratified sand, gravel and cobbles deposited under the ice by a rapidly flowing glacial stream.

Evapotranspiration - The combined loss of water from a given area, and during a specific period of time, by evaporation from the soil surface and transpiration from plants.

Exchange acidity - The amount of hydrogen and aluminium that can be replaced from the adsorption complex by a neutral salt solution. It is usually expressed as milliequivalents per 100 g of soil (meq/100 g soil).

Exchangeable sodium percentage - The extent to which the adsorption complex of a soil is occupied by sodium. It is expressed as:

$$ESP = \frac{\text{exchangeable sodium (meq/100 g soil)}}{\text{cation exchange capacity (meq/100 g soil)}} \times 100.$$

Extract, soil - The solution separated from a soil suspension or from a soil by filtration, centrifugation, suction or pressure.

Fen - A peat-covered or peat-filled area, generally not acidic, in which grasses, sedges or reeds are dominant. The water table is at the surface for most of the year.

Fibric - The least decomposed of all organic materials. There is a large amount of well-preserved fibre that is readily identifiable as to botanical origin. Fibres retain their character upon rubbing.

Field Moisture Equivalent - The minimum moisture content at which a drop of water placed on a smoothed surface of the soil will not be absorbed immediately by the soil but will spread out over the surface and give it a shiny appearance.

Field capacity - The percentage of water remaining in the soil two or three days after the soil has been saturated and free drainage has practically ceased. It is also defined as the maximum amount of water that will normally be held in the soil and be useful to plants. The percentage may be expressed in terms of weight or volume.

Fifteen - atmosphere percentage - The percentage of water contained in a soil that has been saturated, subjected to, and is in equilibrium with, an applied pressure of 15 atm. Pressure is applied in a pressure membrane or ceramic pressure plate apparatus. This moisture content approximates the permanent wilting point of a soil.

Flood plain - The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Fluvial deposits - All sediments past and present, deposited by flowing water, including glaciofluvial deposits.

Fragipan - A natural subsurface horizon having a higher bulk density than the solum above. It is seemingly cemented when dry but showing moderate to weak brittleness when moist.

Friable - A consistence term pertaining to soil aggregates that are soft and easily crushed between thumb and forefinger.

Frost heave - The raising of the surface caused by ice in the subsoil.

Glacio-fluvial deposits - Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. These deposits are stratified and may occur in the form of outwash plains, deltas, kames, eskers and kame terraces.

Glacial-lacustrine deposits - Silt and clay sediments formed in the quiet waters of lakes that received meltwater from glaciers.

Glacial outwash - Well sorted sand, or sand and gravel, deposited by meltwater from a glacier.

Gleyed soil - An imperfectly or poorly drained soil in which the material has been modified by reduction or alternating reduction and oxidation. These soils have lower chromas or more prominent mottling or both, in some horizons than the associated well-drained soil.

Gleysolic - An order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas or prominent mottling or both, in some horizons.

Gravel - Rock fragments two mm to 7.5 cm in diameter.

Granular structure - The arrangement of soil particles into spheroidal aggregates, characterized by rounded vertices.

Ground moraine - An unsorted mixture of rocks, boulders, sand, silt and clay deposited by glacial ice. The predominant material is till. Most till is thought to have accumulated under the ice by lodgment but some till has been let down from the upper surface of the ice by ablation. Resorting and modification may have taken place to some extent by wave action of glacial melt waters. The topography is most commonly in the form of undulating plains, with gently sloping hills and enclosed depressions.

Groundwater - Water beneath the soil surface, usually under conditions where the voids are completely filled with water (saturation).

Grumic - Very fine textured soils with self-mulching horizons (A and B), that occur in the Chernozemic, Gleysolic, and Solonchic orders. Redefined as vertic features in 1998, Third Edition of the Canadian System of Soil Classification.

Halophytic vegetation - Vegetation that grows naturally in soils having a high content of various salts. It usually has fleshy leaves or thorns and resembles desert vegetation.

Heavy soil - A soil having a high content of fine particles, particularly clay, or a soil having a high drawbar pull and therefore hard to cultivate.

Horizon (soil) - A layer in the soil profile approximately parallel to the land surface, with more or less well-defined characteristics that have been produced through soil forming processes. It differs from adjacent layers in properties such as colour, structure, texture, consistence and chemical, biological and mineralogical composition.

Horizon boundary - The lower boundary of each horizon is described by indicating its distinctness and form. The distinctness depends on the abruptness of vertical change (thickness). The form refers to the variation of the boundary plane.

Distinctness

abrupt - < 2 cm
clear - 2 to 5 cm
gradual - 5 to 15 cm
diffuse - > 15 cm

Form

smooth - nearly plain
wavy - pockets are wider than deep
irregular - pockets are deeper than wide
broken - parts of the horizon are unconnected with other parts

Humic - Highly decomposed organic soil material. Small amounts of fibre are present that can be identified as to their botanical origin. Fibres are easily destroyed by rubbing.

Humus - The fraction of the soil organic matter that remains after most of the added plant and animal residues have decomposed. It is usually dark coloured.

Hydraulic conductivity - Refers to the effective flow velocity or discharge velocity in soil at unit hydraulic gradient. It approximates the permeability of the soil and is expressed in cm per hour. The classes are described in general or specific terms as:

High >15 cm/hr
Medium 0.5 -15 cm/hr
Low < 0.5 cm/hr

Hydrologic cycle - The conditions through which water naturally passes from the time of precipitation until it is returned to the atmosphere by evaporation and is again ready to be precipitated.

Hydromorphic soil - A general term for soils that develop under conditions of poor drainage in marshes, swamps, seepage areas or flats.

Hydrophyte - Plants growing in water or dependent upon wet or saturated soil conditions for growth.

Illuvial horizon - A soil horizon in which material carried from an overlying layer has been precipitated from solution or deposited from suspension as a layer of accumulation.

Impeded drainage - A condition that hinders the movement of water by gravity through the soils.

Impervious - Resistance to penetration by fluids or roots.

Inclusion - Soil type (series) found within a mapping unit that is not extensive enough to be mapped separately or as part of a complex.

Infiltration - The downward entry of water into the soil.

Irrigation - The artificial application of water to the soil for the benefit of growing crops.

Irrigation requirement (IR) - Refers to the amount of water exclusive of effective precipitation that is required for crop production.

Kame - An irregular ridge or hill of stratified glacial drift deposited by glacial meltwater.

Kettle - Depression left after the melting of a detached mass of glacier ice buried in drift.

Lacustrine deposits - Material deposited by, or settled out of lake waters, and exposed by lowering of the water levels or elevation of the land. These sediments range in texture from sand to clay and are usually varved (layered annual deposits).

Land classification - The arrangement of land units into various categories, based on the properties of the land or its suitability for some particular purpose.

Landforms - The various shapes of the land surface resulting from a variety of actions, such as deposition or sedimentation. Mineral landforms are described by terms such as apron, blanket, fan, hummocky, level, pitted, ridged, rolling, terrace, undulating, veneer, inclined and steep.

Apron - A relatively gentle slope at the foot of a steeper slope and formed by materials from the steeper, upper slope.

Blanket - A mantle of unconsolidated materials that is thick enough to mask minor irregularities in the underlying unit but still conforms to the general underlying topography.

Fan - A fan-shaped form similar to the segment of a cone and possessing a perceptible gradient from the apex to the toe.

Hummocky - A very complex sequence of slopes extending from somewhat rounded depression or kettles of various sizes of irregular or conical knolls or knobs. There is a general lack of concordance between knolls and depressions. Slopes are generally five to 70 per cent (3 to 35°).

Level - A flat or very gently sloping, unidirectional surface with a generally constant slope not broken by marked elevations and depressions. Slopes are generally less than two per cent (1°).

Pitted - A level to gently undulating surface containing a number of pits or hollows.

Ridged - A long, narrow elevation of the surface, usually sharp crested with steep sides. The ridges may be parallel, sub-parallel or intersecting.

Rolling - A very regular sequence of moderate slopes, extending from rounded, sometime confined, concave depressions to broad, rounded convexities with a wavelike pattern of moderate relief. Slope length is often 1.6 km or greater and gradients greater than five per cent (3°).

Terrace - Scarp face and the horizontal; or gently inclined surface (tread) above it.

Undulating - A very regular sequence of gentle slopes that extend from rounded, sometimes confined concavities to broad, rounded convexities, producing a wavelike pattern of low local relief. Slope length is generally less than 0.8 km and the dominant slope gradient is two to five per cent (1 to 3°).

Veneer - Unconsolidated materials too thin to mask the minor irregularities of the underlying unit surface. A veneer ranges from 10 cm to one metre in thickness and possesses no form typical of the materials' genesis.

Inclined - A sloping, unidirectional surface with a generally constant slope not broken by marked irregularities. Slopes are two to 70 per cent (1 to 35°). The form of inclined slopes is not related to the initial mode of origin of the underlying material.

Steep - Erosional slopes, greater than 70 per cent (35°), on both consolidated and unconsolidated materials. The form of steep erosional slopes on unconsolidated materials is not related to the initial mode of origin of the underlying material.

Landscape - All the natural features such as fields, hills, forest, water, etc., which distinguish one part of the earth's surface from another part.

Leaching - The removal from the soil of materials in solution.

Lime, agricultural - A soil amendment consisting principally of calcium carbonate and including magnesium carbonate and perhaps other materials. It is used to supply calcium and magnesium as essential elements for growth of plants and to neutralize soil acidity.

Liquid limit (upper plastic limit) - The water content corresponding to an arbitrary limit between the liquid and plastic states of consistency of a soil. The water content at this boundary is defined as that at which a part of soil cut by a groove of standard dimensions will flow together for a distance of 1.25 cm under the impact of 25 blows in a standard liquid limit apparatus.

Lineal shrinkage - This is the decrease in one dimension expressed as a percentage of the original dimension of the soil mass when the moisture content is reduced from a stipulated percentage (usually field moisture equivalent) to the shrinkage limit.

Lithic phase - Soils having a lithic contact (consolidated bedrock) within the control section below a depth of 10 cm.

Luvisolic - An order of soils that have eluvial (Ae) horizons and illuvial (Bt) horizons, in which silicate clay is the main accumulation product. The soils developed under forest or forest-grassland transition in a moderate to cool climate.

Mapping Unit - Any delineated area shown on a soil map that is identified by a symbol. A mapping unit may be a soil unit, a miscellaneous land type, or a soil complex.

Marsh - Periodically flooded or continually wet areas having the surface not deeply submerged. It is covered dominantly with sedges, cattails, rushes or other hydrophytic plants. The waters are rich in nutrients, varying from fresh to highly saline.

Mature soil - A soil having well-developed soil horizons produced by the natural processes of soil formation.

Mesic - Organic material in an intermediate stage of decomposition. Intermediate amounts of fibre are present that can be identified as to their botanical origin.

Mesophyte - Plants requiring intermediate moisture conditions and are not very resistant to drought.

Microrelief - Small-scale, local differences in relief, including mounds, swales or hollows.

Milliequivalent (meq) - One-thousandth of an equivalent. An equivalent is the weight in grams of an ion or compound that combines with or replaces one gram of hydrogen. The atomic or formula weight divided by valence.

Mineral soil - A soil consisting predominantly of, and having its properties by, mineral matter. It contains less than 17 per cent organic carbon, except for an organic layer that may be up to 40 cm (16 inches) thick if formed from mesic and humic peat, or 60 cm (24 inches) if of fibric peat.

Monolith, soil - A vertical section of a soil profile removed from the soil and mounted for display or study.

Mottles - Irregularly marked spots or streaks, usually yellow or orange, but sometimes blue. They are described in order of abundance (few, common, many), size (fine, medium, coarse) and contrast (faint, distinct, prominent). Mottles in soils indicate poor aeration and lack of good drainage.

Neutral soil - A soil in which the surface layer, to plow depth, is neither acid nor alkaline in reaction.

Organic carbon - Carbon derived from plant and animal residues.

Organic - An order of soils that have developed dominantly from organic deposits. The majority of organic soils are saturated for most of the year, unless artificially drained. They contain more than 17 per cent organic carbon and the organic layer must be up to 40 cm (16 inches) if formed from mesic and humic peat, or 60 cm (24 inches) if of fibric peat.

L, F, and H - These organic horizons developed primarily from the accumulation of leaves, twigs and woody materials, with or without a minor component of mosses. They are normally associated with upland forested soils, with imperfect drainage or drier conditions.

Organic matter - The fraction of the soil that consists of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population. It is determined on soils that have been sieved through a 2.0 mm sieve. It is estimated by multiplying the organic carbon by a factor of 1.72.

Outwash - Sediments washed out beyond the glacier by flowing water and laid down in thin beds or strata. Particle size may range from boulders to silt.

Ovendry soil - Soil that has been dried at 105 degrees C until it has reached constant weight.

Parent material - The unaltered or essentially unaltered mineral or organic material from which the soil profile develops by pedogenic processes.

Particle size, soil - The grain size distribution of the whole soil including the coarse fraction. It differs from texture, which refers to the fine earth (less than two mm) fraction only. In addition, textural classes are usually assigned to specific horizons, whereas soil family particle-size classes indicate a composite particle size of a part of the control section that may include several horizons. The particle-size classes for family groupings are as follows:

Fragmental - Stones, cobbles and gravel, with too little fine earth to fill interstices larger than one mm.

Sandy-skeletal - Particles coarser than two mm occupy 35 per cent or more by volume, with enough fine earth to fill interstices larger than one mm. The fraction finer than two mm is that defined for the sandy particle size class.

Loamy-skeletal - Particles two mm to 25 cm occupy 35 per cent or more by volume, with enough fine earth to fill interstices larger than one mm. The fraction finer than two mm is that defined for the loamy, particle-size class.

Clayey-skeletal - Particles two mm to 25 cm occupy 35 per cent or more by volume with enough fine earth to fill interstices larger than one mm. The fraction finer than two mm is that defined for the clayey particle size class.

Sandy - The texture of the fine earth includes sands and loamy sands, exclusive of loamy, very fine sand and very fine sand textures. Particles two mm to 25 cm occupy less than 35 per cent by volume.

Loamy - The texture of the fine earth includes loamy, very fine sand, very fine sand and finer textures with less than 35 per cent clay. Particles two mm to 25 cm occupy less than 35 per cent by volume.

Coarse-loamy - A loamy particle size that has 15 per cent or more by weight of fine sand (0.25 - 0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has less than 18 per cent clay in the fine earth fraction.

Fine-loamy - A loamy particle size that has 15 per cent or more by weight of fine sand (0.25 - 0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has 18 to 35 per cent clay in the fine earth fraction.

Coarse-silty - A loamy particle size that has less than 15 per cent of fine sand (0.25 - 0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has less than 18 per cent clay in the fine earth fraction.

Fine-silty - A loamy particle size that has less than 15 per cent of fine sand (0.25 - 0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has 18 to 35 per cent clay in the fine earth fraction.

Clayey - The fine earth contains 35 per cent or more clay by weight and particles two mm to 25 cm occupy less than 35 per cent by volume.

Fine-clayey - A clayey particle size that has 35 to 60 per cent clay in the fine earth fraction.

Very fine-clayey - A clayey particle size that has 60 per cent or more clay in the fine earth fraction.

Peat - Soil material consisting largely of undecomposed, or slightly decomposed, organic matter.

Peaty phase - Any mineral soil having a surface horizon 15 to 60 cm thick of fibric organic material, or 15 to 40 cm of mesic or humic organic material.

Ped - An individual soil aggregate such as granule, prism or block, formed by natural processes (in contrast with a clod, which is formed artificially).

Pedology - Those aspects of soil science dealing with the origin, morphology, genesis, distribution, mapping and classification of soils.

Percolation - The downward movement of water through soil. Specifically, the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of 1.0 or less.

Permafrost - (i) Perennially frozen material underlying the solum. (ii) A perennially frozen soil horizon.

Permafrost table - The upper boundary of permafrost, usually coincident with the lower limit of seasonal thaw (active layer).

Permeability - The ease with which water and air pass through the soil to all parts of the profile. See hydraulic conductivity.

pH - The intensity of acidity and alkalinity, expressed as the negative logarithm of the hydrogen ion concentration. A pH of seven is neutral, lower values indicate acidity and higher values alkalinity (see Reaction, soil).

Phase, soil - A soil phase is used to characterize soil and landscape properties that are not used as criteria in soil taxonomy. The major phase components are: erosion, slope, stones, salinity, texture, deposition and calcareousness.

Plastic Limit - The water content corresponding to an arbitrary limit between the plastic and the semisolid states of consistency of a soil.

Plasticity Index - The numerical difference between the liquid and the plastic limit. The plasticity index gives the range in moisture content, within which a soil exhibits plastic properties.

Platy structure - Consisting of soil aggregates that have developed predominantly along the horizontal axes; laminated; flaky.

Podzolic - An order of soils having B horizons (Bh, Bhf, Bf) in which amorphous combinations of organic matter, Al, and usually Fe are accumulated.

Pore space - The part of the bulk volume of soil not occupied by soil particles, interstices or voids.

Potential evapotranspiration (PE) - The maximum quantity of water capable of being lost as water vapor, in a given climate, by a continuous stretch of vegetation covering the whole ground and well supplied with water.

Prismatic structure - A soil structure type having prism-like aggregates that have vertical axes longer than the horizontal axes.

Profile, soil - A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil - The degree of acidity or alkalinity of a soil, usually expressed as a pH value.
Soil reaction classes are characterized as follows:

	<u>pH value</u>
extremely acid	<4.5
very strongly acid	4.5 to 5.0
strongly acid	5.1 to 5.5
medium acid	5.6 to 6.0
slightly acid	6.1 to 6.5
neutral	6.6 to 7.3
mildly alkaline	7.4 to 7.8
moderately alkaline	7.9 to 8.4
strongly alkaline	8.5 to 9.0
very strongly alkaline	>9.0

Regolith - The unconsolidated mantle of weathered rock and soil material on the earth's surface.

Regosolic - An order of soils having no horizon development or development of the A and B horizons insufficient to meet the requirements of the other soil orders.

Relief - The elevation of inequalities of the land surface when considered collectively.

Runoff - The portion of the total precipitation on an area that flows away through stream channels. Surface runoff does not enter the soil. Groundwater runoff or seepage flow from groundwater enters the soil before reaching the stream.

Saline soil - A non alkali soil that contains enough soluble salts to interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than four millisiemens/cm (mS/cm), the exchangeable-sodium percentage is less than 16, and the pH is usually less than 8.5. Approximate limits of salinity classes are:

non-saline	0 to 4 mS/cm
weakly saline	> 4 to 8 mS/cm
moderately saline	> 8 to 16 mS/cm
strongly saline	>16 mS/cm

Salinization - The process of accumulation of salts in the soil.

Salt-affected soil - Soil that has been adversely modified for the growth of most crop plants by the presence of certain types of exchangeable ions or of soluble salts. It includes soils having an excess of salts, or an excess of exchangeable sodium or both.

Sand - (i) A soil particle between <0.15 and two mm in diameter. (ii) Any one of five soil separates: very coarse sand, coarse sand, medium sand, fine sand or very fine sand. The textural class name for any soil containing 85per cent or more of sand and not more than 10 per cent of clay.

Saturation extract - The extract from a soil sample that has been saturated with water.

Saturation percentage - The moisture percentage of a saturated soil paste, expressed on an oven dry weight basis.

Seepage - (i) The escape of water downward through the soil. (ii) The emergence of water from the soil along an extensive line of surface, in contrast to a spring, where water emerges from a local spot.

Series, soil - A category in the Canadian System of Soil Classification. It consists of soils that have soil horizons similar in their differentiating characteristics and arrangement in the profile, except for surface texture, and are formed from a particular type of parent material.

Shrinkage limit - This is the moisture content at which an equilibrium condition of volume change is reached and further reduction in moisture content will not cause a decrease in the volume of the soil mass.

Shrinkage ratio - This is the ratio between the volume change and a corresponding change in moisture content. It equals the apparent specific gravity of the dried soil.

Silt - (i) Individual mineral particles of soil that range in diameter between <0.15 to <0.102 mm. (ii) Soil of the textural class silt contains greater than 80 per cent silt and less than 12 per cent clay.

Single-grained structure - A soil structure in which the soil particles occur almost completely as individual or primary particles. It is usually found in coarse (sandy) textured soils.

Slickenside - Smoothed surfaces along planes of weakness, resulting from the movement of one mass of soil against another in soils dominated by swelling clays.

Sodic soil - (i) A soil containing sufficient sodium to interfere with the growth of most crop plants. (ii) A soil having an exchangeable-sodium percentage of 15 or more.

Sodium-Adsorption Ratio (S.A.R.) - A ratio for soil extracts and irrigation waters used to express the relative activity of sodium ions in exchange reactions with other cations in the soil. $SAR = Na/((Ca+Mg)/2)^{1/2}$ where the concentrations are expressed as milliequivalents per litre.

Soil - The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. Soil has been subjected to, and influenced by, genetic and environmental factors of: parent material, climate (including moisture and temperature effects), macro- and micro-organisms, and topography, all acting over a period of time.

Solonetzic - An order of soils thought to have developed from parent materials that were more or less uniformly salinized with salts high in sodium. The soils have a stained brownish solonetzic B (Bnt or Bn) horizon and a saline C horizon.

Solum - The upper horizons of a soil above the parent material and in which the processes of soil formation are active. It usually consists of A and B horizons.

Stones - Rock fragments greater than 25 cm (10 inches) in diameter.

Stoniness - The percentage of land surface occupied by stones. The classes of stoniness are defined as follows:

Stones 0. non-stony - Land having less than <0.11 per cent of surface occupied by stones.

Stones 1. slightly stony - Land having <0.11 to 0.1 per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter and 10 to 30 m apart. The stones offer only slight to no hindrance to cultivation.

Stones 2. moderately stony - Land having 0.1 to three per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter and 2 to 10 m apart. Stones cause some interference with cultivation.

Stones 3. very stony - Land having three to 15 per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter and one to two m apart. There are sufficient stones to constitute a serious handicap to cultivation.

Stones 4. exceedingly stony - Land having 15 to 50 per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter and 0.7 to 1.5 m apart. There are sufficient stones to prevent cultivation until considerable clearing has been done.

Stones 5. excessively stony - Land having more than 50 per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter and less than 0.7 m apart. The land is too stony to permit cultivation.

Storage capacity - Refers to the maximum amount of readily available water that can be stored within the rooting zone of a crop in a given soil. For practical irrigation purposes, 50 per cent of the total soil water between field capacity and wilting point may be considered as readily available.

Stratified materials - Unconsolidated sand, silt and clay arranged in strata or layers. In stratified materials, a bed is a unit layer distinctly separable from other layers and is one or more cm thick, but a lamina is a similar layer less than one cm thick.

Structure, soil - The combination or arrangement of primary soil particles into aggregates of secondary soil particles, units or peds, which are separated from each other by surfaces of weakness. Structure is expressed in terms of

grade, size class and shape type. Grade refers to the distinctness of aggregate development, and is described as structureless, weak, moderate or strong. Structureless refers to the absence of observable aggregation of definite orderly arrangement. The term amorphous is used if soil is massive or coherent, single-grained if non-coherent. The weak to strong aggregates vary in size and are described by class as fine, medium, coarse, and very coarse, depending on the shape types. The shape types refer to the dominant configuration of the aggregates and the way they are accommodated. The general shape types are plate-like, block-like and prism-like. The terms are:

Platy - Having thin, plate-like aggregates, with faces mostly horizontal.

Prismatic - Having prism-like aggregates, with the tops and edges appearing plane, level and somewhat angular.

Columnar - Having prism-like aggregates, with vertical edges near the top of columns, not sharp.

Granular - Having block-like aggregates that appear as spheroids or polyhedrons having plane or curved surfaces, which have slight or no accommodation to the faces of the surrounding peds.

Blocky - Having block-like aggregates with sharp, angular corners.

Subangular blocky - Having block-like aggregates, with rounded and flattened faces and rounded corners.

By convention, an aggregate is described in the order of grade, class and type (e.g. strong, medium, blocky). In the parent material of soils, the material with structural shapes may be designated as pseudo-blocky, pseudo-platy, etc.

Soil survey - The systematic examination, description, classification and mapping of soil in an area.

Subangular blocky structure - Having block-like aggregates with rounded and flattened faces and rounded corners.

Sulfate hazard - Refers to the relative degree of attack on concrete by soil and water containing various amounts of sulfate ions. It is estimated from electrolyte measurements and salt analysis on selected profiles and soil samples, and by visual examination of free gypsum within the profile during the course of soil investigation.

Swamp - A mineral wetland or peatland with standing water or water gently flowing, through pools or channels. The water table is usually at or near the surface. The vegetation is characterized by a cover of deciduous or coniferous trees or shrubs, herbs, and some mosses.

Texture, soil - The relative proportions of the fine earth (less than two mm) fraction of a soil. Textural classes are usually assigned to specific horizons whereas family particle size classes indicate a composite particle size of a portion of the control section that may include several horizons.

<u>Name of separate</u>	<u>Diameter (mm)</u>
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to <0.15
Silt	<0.15 to <0.102
Clay	< <0.102
Fine clay	< <0.1002

Textural Classes

Sand - Sand is a soil material that contains 85 per cent or more sand. The percentage of silt, plus 1.5 times the percentage of clay, does not exceed 15.

Coarse sand – Twenty-five per cent or more very coarse and coarse sand, and less than 50 per cent any other one grade of sand.

(Medium) Sand – Twenty-five per cent or more very coarse, coarse, and medium sand (but less than 25 per cent very coarse and coarse sand), and less than 50 per cent of either fine or very fine sand.

Fine sand – Fifty per cent or more fine sand, or less than 25 per cent very coarse, coarse and medium sand and less than 50 per cent very fine sand.

Very fine sand – Fifty per cent or more very fine sand.

Loamy sand - Loamy sand is a soil material that contains at the upper limit 85 to 90 per cent sand, and the percentage of silt, plus 1.5 times the percentage of clay, is not less than 15. At the lower limit, it contains not less than 70 to 85 per cent sand, and the percentage of silt plus twice the percentage of clay does not exceed 30.

Loamy coarse sand – Twenty-five per cent or more very coarse and coarse sand, and less than 50 per cent any other one grade of sand.

Loamy sand – Twenty-five per cent or more very coarse, coarse, and medium sand (but less than 25 per cent very coarse and coarse sand), and less than 50 per cent fine or very fine sand.

Loamy fine sand – Fifty per cent or more fine sand, or less than 50 per cent very fine sand and less than 25 per cent very coarse, coarse, and medium sand.

Loamy very fine sand – Fifty per cent or more very fine sand.

Sandy loam - Sandy loam is a soil material that contains either 20 per cent clay or less, with the percentage of silt plus twice the percentage of clay exceeding 30, and 52 per cent or more sand, or less than seven per cent clay, less than 50 per cent silt, and 43 to 52 per cent sand.

Coarse sandy loam – Twenty-five per cent or more very coarse and coarse sand, and less than 50 per cent any other one grade of sand.

(Medium) Sandy loam – Thirty per cent or more very coarse, coarse, and medium sand (but less than 25% very coarse and coarse sand), and less than 30 per cent of either very fine or fine sand.

Fine sandy loam – Thirty per cent or more fine sand and less than 30 per cent very fine sand, or between 15 to 30 per cent very coarse, coarse and medium sand, or more than 40 per cent fine and very fine sand, at least half of which is fine sand, and less than 15 per cent very coarse, coarse and medium sand.

Very fine sandy loam – Thirty per cent or more very fine sand, or more than 40 per cent fine and very fine sand, at least half of which is very fine sand, and less than 15 per cent very coarse, coarse, and medium sand.

Loam - Loam is a soil material that contains seven to 27 per cent clay, 28 to 50 per cent silt, and less than 52 per cent sand.

Silt loam - Silt is a soil material that contains 50 per cent or more silt and 12 to 27 per cent clay, or 50 to 80 per cent silt and less than 12 per cent clay.

Silt - Silt is a soil material that contains 80 per cent or more silt and less than 12 per cent clay.

Sandy clay loam - Sandy clay loam is a soil material that contains 20 to 35 per cent clay, less than 28 per cent silt, and 45 per cent or more sand.

Clay loam - Clay loam is a soil material that contains 27 to 40 per cent clay and 20 to 45 per cent sand.

Silty clay loam - Silty clay loam is a soil material that contains 27 to 40 per cent clay and less than 20 per cent sand.

Sandy clay - Sandy clay is a soil material that contains 35 per cent or more clay and 45 per cent or more sand.

Silty clay - Silty clay is a soil material that contains 40 per cent or more clay and 40 per cent or more silt.

Clay - Clay is a soil material that contains 40 per cent or more clay, less than 45 per cent sand and less than 40 per cent silt.

Heavy clay - Heavy clay is a soil material that contains more than 60 per cent clay.

In addition to these 13 basic soil textural classes, three of which are modified according to the predominant sand fraction, other modifiers are added. The word mucky is used as an adjective modifying the textural class name for horizons of mineral soils, especially of Humic Gleysols that contain 15 to 30 per cent organic matter (nine to 17 per cent organic carbon).

Rock fragments in the soil are also used to modify the textural class name. These are gravel, cobbles, stones, and boulders (see the descriptions of size classes). The adjective form of the rock fragment class name is used as a modifier according to the following rules:

Less than 15 per cent by volume: No special term is used, or non-gravelly and non-stony are used in writing for contrast with soils having more than 15 per cent pebbles, cobbles, stones or boulders.

15 to 35 per cent by volume: The adjective term of the dominant kind of rock fragment is used as a modifier of the textural terms: gravelly loam, stony loam and bouldery loam.

35 to 60 per cent by volume: The adjective term of the dominant kind of rock fragment is used with the word very as a modifier to the textural terms: very gravelly loam and very bouldery loam.

More than 60 per cent by volume: If enough fine earth is present to determine the texture class (approximately five per cent or more by volume), the adjective term of the dominant kind of rock fragment is used with the word extremely as a modifier of the textural terms: extremely gravelly loam and extremely bouldery loam. If there is too little fine earth to determine the texture class (less than about five per cent by volume) the terms gravel, cobbles, stones and boulders are used in the place of fine earth texture.

Till, glacial - Unstratified glacial drift deposited by ice and consisting of clay, sand, gravel and boulders intermingled in any proportion.

Tilth - The physical condition of soil as related to its ease of tillage, fitness as a seedbed and its impedance to seedling emergence and root penetration.

Topography - Refers to the per cent slope and the pattern or frequency of slopes in different directions. A set of 10 slope classes are used to denote the dominant but not necessarily most abundant slopes within a mapping unit.

<u>Slope Class</u>	<u>Slope Name</u>	<u>Per cent slope</u>	<u>Approximate degrees</u>
1	level	0 - 0.5	0
2	nearly level	0.5 - 2.5	0.3 - 1.5
3	very gentle	2 - 5	1 - 3
4	gentle	6 - 9	3.5 - 5
5	moderate	10 - 15	6 - 8.5
6	strong	16 - 30	9 - 17
7	very strong	31 - 45	17 - 24
8	extreme	46 - 70	25 - 35
9	steep	71 - 100	35 - 45
10	very steep	> 100	> 45

Underground runoff (or seepage) - Water flowing towards stream channels after infiltration into the ground.

Unified Soil Classification System (engineering) - A classification system based on the identification of soils according to their particle size, gradation, plasticity index and liquid limit.

Urban Land - Areas so altered or obstructed by urban works or structures that identification of soils is not feasible.

Variant, soil - A soil whose properties are believed to be sufficiently different from other known soils to justify a new series name but comprising such a limited geographic area that creation of a new series is not justified.

Varve - A distinct band representing the annual deposit in sedimentary materials, regardless of origin and usually consisting of two layers: one thick light-coloured layer of silt and fine sand laid down in the spring and summer, and the other a thin, dark coloured layer of clay laid down in the fall and winter.

Water balance, soil - Is the daily amount of readily available water retained by the soil. The daily soil-water balance is decreased by the amount that the daily consumptive use exceeds the daily rainfall. When daily rainfall exceeds the consumptive use, the daily balance increases by the amount of the difference, unless the soil-water balance is at storage capacity, in which case the excess is assumed to be lost by runoff or deep percolation.

Water table - (groundwater surface; free water surface; groundwater elevation) Elevation at which the pressure in the water is zero with respect to the atmospheric pressure.

<u>Water table depths</u>	<u>(cm)</u>
Generally High	< 100
Very High	0 - 50
Moderately High	250 - 100
Medium High	100 - 150
Generally Low	> 150
Medium Low	150 - 200
Low	> 200
Moderately Low	200 - 300
Very Low	> 300

Water-holding capacity - The ability of a soil to hold water against the force of gravity in a freely drained soil.

Weathering - The physical and chemical disintegration, alteration and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.

Wilting point - The moisture content of a soil, at which plants wilt and fail to recover their turgidity when placed in a dark, humid atmosphere. The wilting point is commonly estimated by measuring the 15-atmosphere moisture content of a soil.

Xerophyte - Plants capable of surviving extended periods of soil drought.

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