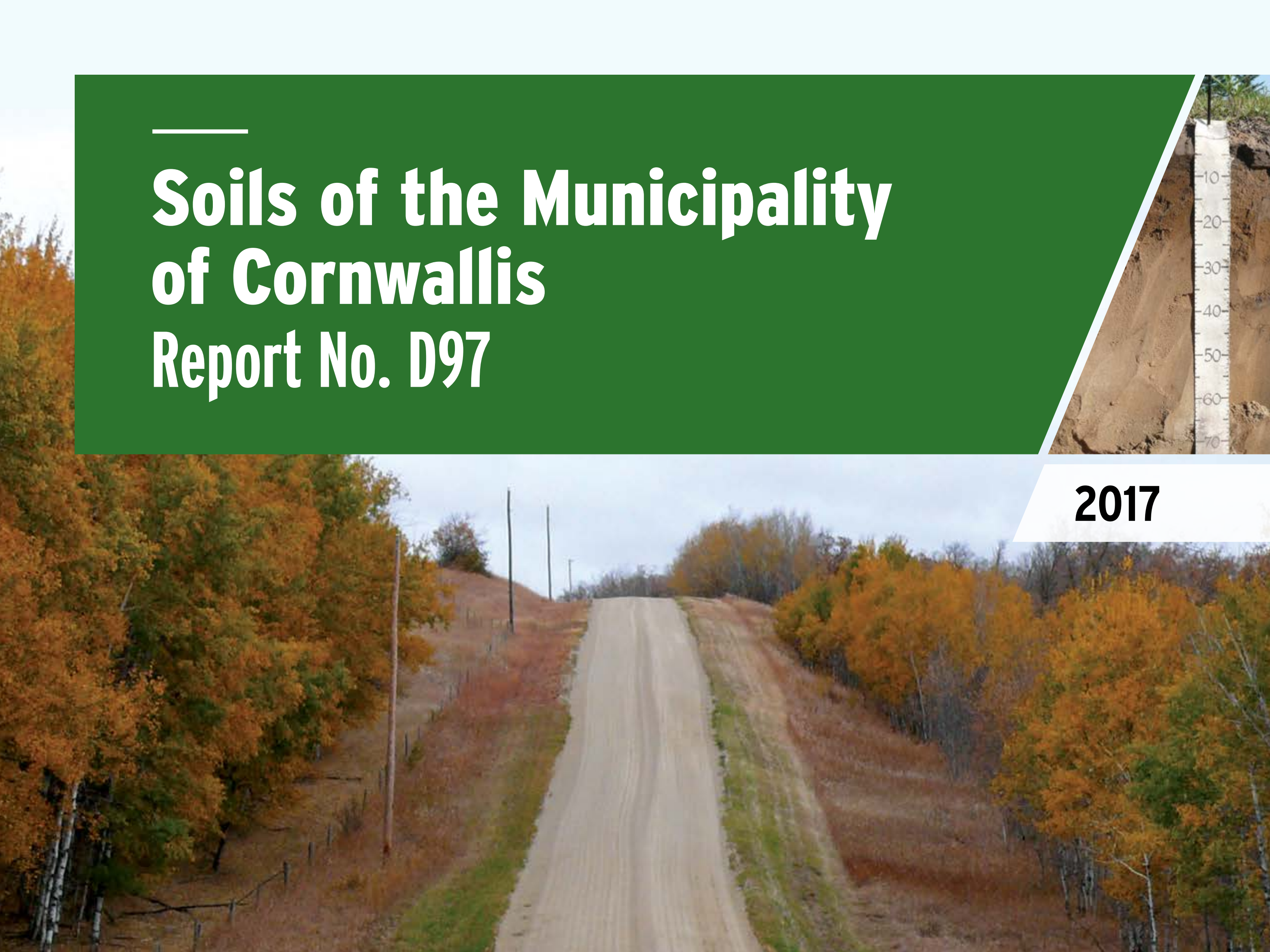
Soils of the Municipality of Cornwallis
Report No. D97

2017



Manitoba

Soils of the Municipality of Cornwallis

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Part 1 General Description of the Study Area

1.1 Location and Extent

The Rural Municipality (RM) of Cornwallis (COR) covers approximately 58,149 hectares (ha) or 143,689 acres (ac) of land within townships 9 and 10 in Ranges of 17W, 18W and 19W in the west of the Principal Meridian. The total land area includes unmapped 4,885 ha or 12,071 ac of Brandon City. The RM of Cornwallis borders by the RMs of North Cypress-Langford & Glenboro-South Cypress to the east, Elton to the north, Whitehead to the west and Oakland-Wawanesa to the south (Figure 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 1) *Rossburn and Virden Map Sheet Areas*, Soils Report No. 6 (Ehrlich et al., 1956; and 2) *Carberry Map Sheet Area*, Soils Report No. 7 (Ehrlich et al., 1957). Soil mapping from the previously surveyed (1:20,000) *Soils of the Brandon Region Study Area*, Report No. 30 (Michalyna et al., 1976), and *Soil of the Brandon Research Station with Interpretations for Agriculture, Engineering and Recreational Land Use,* Soils Report No. D7, (Hopkins and Jacques, 1985) is also incorporated into this report.

1.2 Physiography and Surface Deposits

The study area lies within three ecodistricts - the Shilo (757), the Stockton (758) and the Hilton (764) in the Aspen Parkland Ecoregion (ESWG, 1995, Smith et al., 1998), which were previously referred to as the outwash plain in the Upper Assiniboine Delta of Assiniboine Plain, Brandon Lakes Plain (Ehrlich et al., 1957), the Lake Souris Basin and Brandon Hills Area (Ehrlich et al., 1956). All those areas are within the commonly known Grassland Transition Ecoclimatic Region - subregion 2 (Gt2).

The RM of Cornwallis consists of different land features (Figure 2). The Brandon Hills, a bedrock high, comprises of interlobate morainal deposits of the northwest lobe towards the west and the Red River lobe towards the east. Unlike commonly seen glacial till (mixed of granite, limestone and shale), shale is rarely seen in the end morainal deposits around the Brandon Hills area.

The Upper Assiniboine Delta is an area of lacustrine and outwash plains above the Manitoba Escarpment. The lacustrine plain is composed of coarse, medium and fine-textured deposits. The coarse-textured deposits have been modified by wind and sand dunes occupy most of this area. The outwash deposits consist of gravels and very coarse materials.

The Souris Basin Area, also called Lake Souris Basin, is the lacustrine deposits. Soil texture varies considerably from one locale to another. In the southwest corner of the RM, the soil texture is heavier than those found in the western border of the RM of Cornwallis.

Two major landforms are commonly seen in the study area: undulating and level. The undulating is predominant, accounting for 77.9 percent. The hummocky, rolling and inclined landforms, totaling 7.2 percent, are found in the Brandon Hills area.

Most slopes are nearly level to very gentle in the RM of Cornwallis. For example, the occurrence of nearly level slopes (0.5-2%) is over 50 percent within the undulating landform; and 42 percent falls into the category of very gently sloping (2-5%).

The elevation of the study area ranges from 410 metres above sea level (a.s.l) in the northwest corner to 360 meters a.s.l. in the southeast corner, resulting in a general gradient of 0.14 percent. The highest elevation in the Brandon Hills is approximately 485 m a.s.l. The slopes can be as steep as 70 percent in some locales.

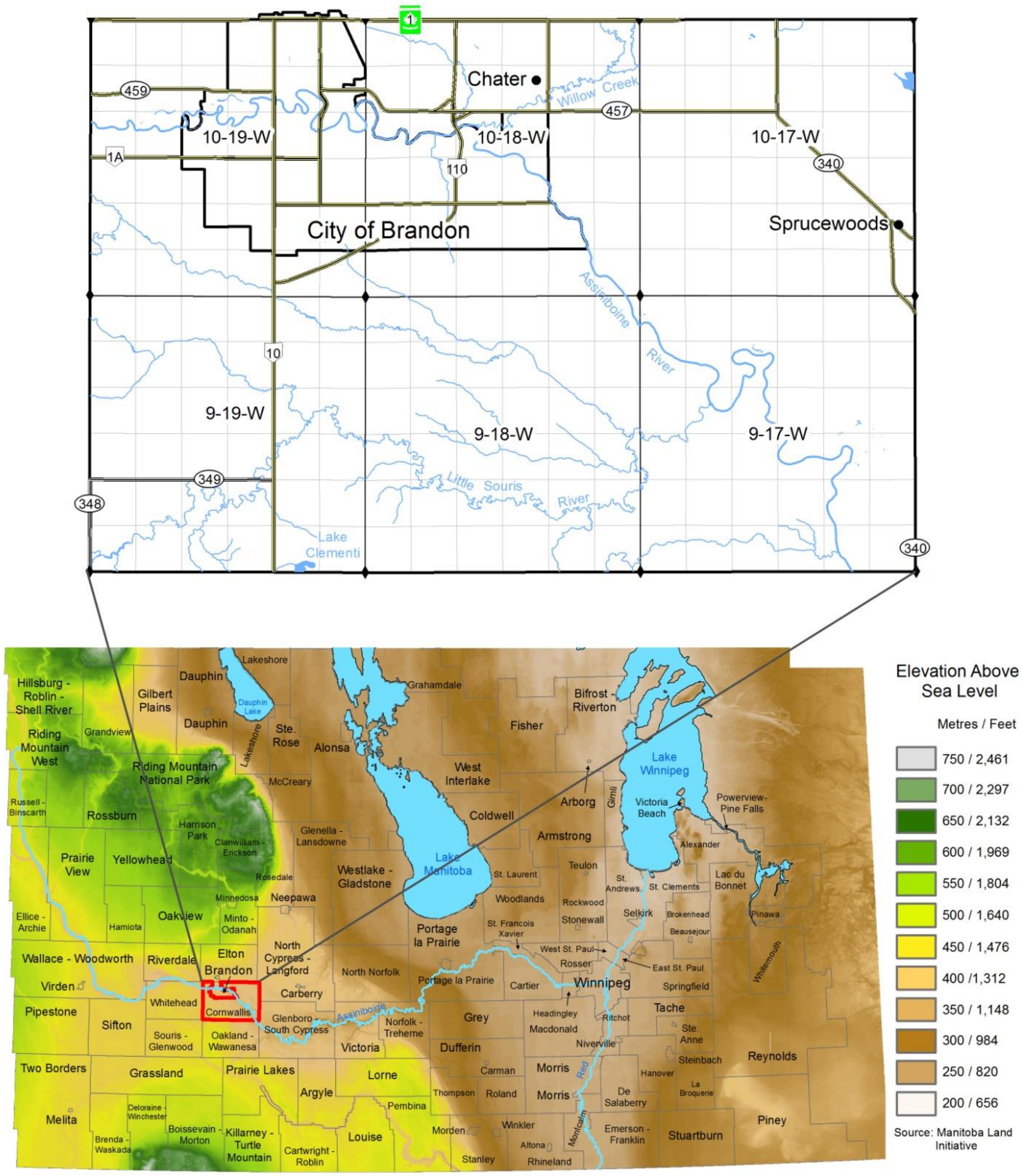


Figure 1. Location of the Study Area: The Rural Municipality of Cornwallis

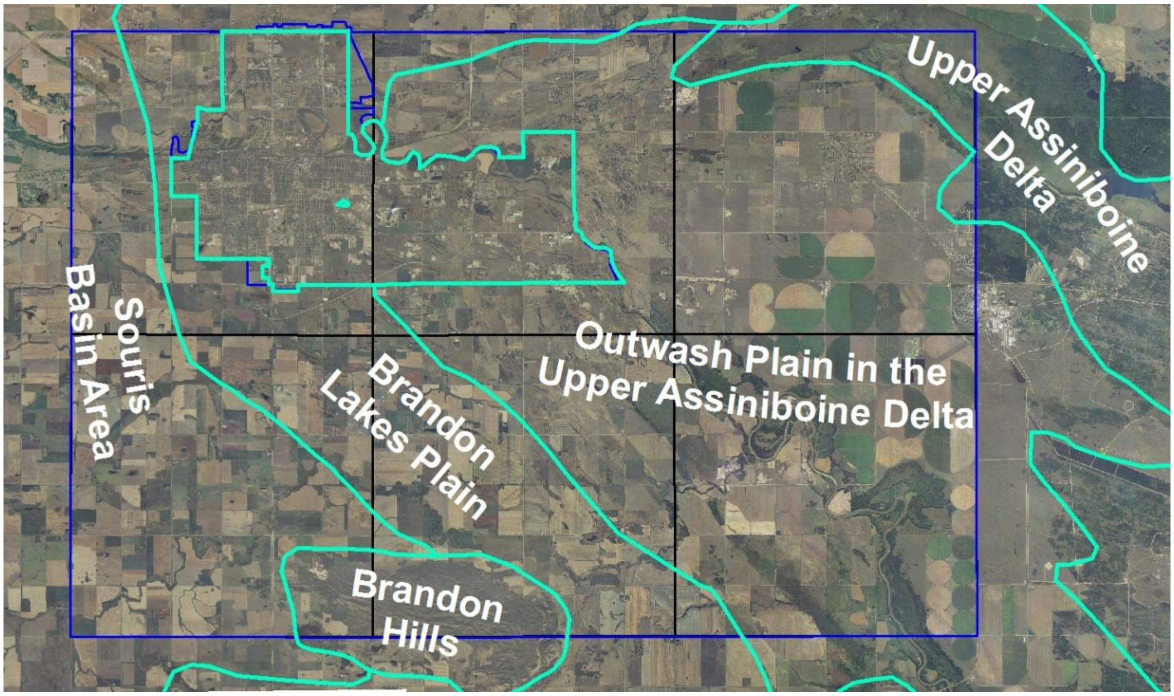


Figure 2. Surface Deposits in the Rural Municipality of Cornwallis

1.3 Geology

The underlying bedrock in the RM of Cornwallis is from Cretaceous shale. Figure 3 shows that there are four major shale within the study area.

- Riding Mountain Formation includes two kinds of shale 1) Millwood Member –soft green bentonitic shale and 2) Coulter Member – soft grey bentonitic clayed siltstone and shale.
- The Vermillion River Formation includes Morden, Boyne and Pembina members which consist of black, carbonaceous shale, calcareous and carbonaceous shale.
- Favel Formation – Calcareous speckled shale, minor limestone and shale.

The Vermillion River Formation is dominant in the RM, followed by the Riding Mountain Formation.

1.4 Soils

As the RM of Cornwallis is located almost entirely along the beaches of Lake Agassiz and two townships in the east are within the Assiniboine Delta Aquifer (Figure 4), most soils are developed from lacustrine over fluvial or deep lacustrine parent materials (Table 1). The soils derived from lacustrine over fluvial have a wide variety of surface texture, ranging from coarse to moderately fine, and are distributed primarily in eastern townships of 9 Range 17W and Township 10 Range 17W (Figure 5).

The common soil associations developed from lacustrine over fluvial parent material are Wheatland, Croyon and Miniota, accounting for 19.5, 10.8 and 4.8 percent of all soils in the study area, respectively. The three individual soil series of Whiteland, Croyon and Miniota are also major soil series in its soil association in the RM of Cornwallis.

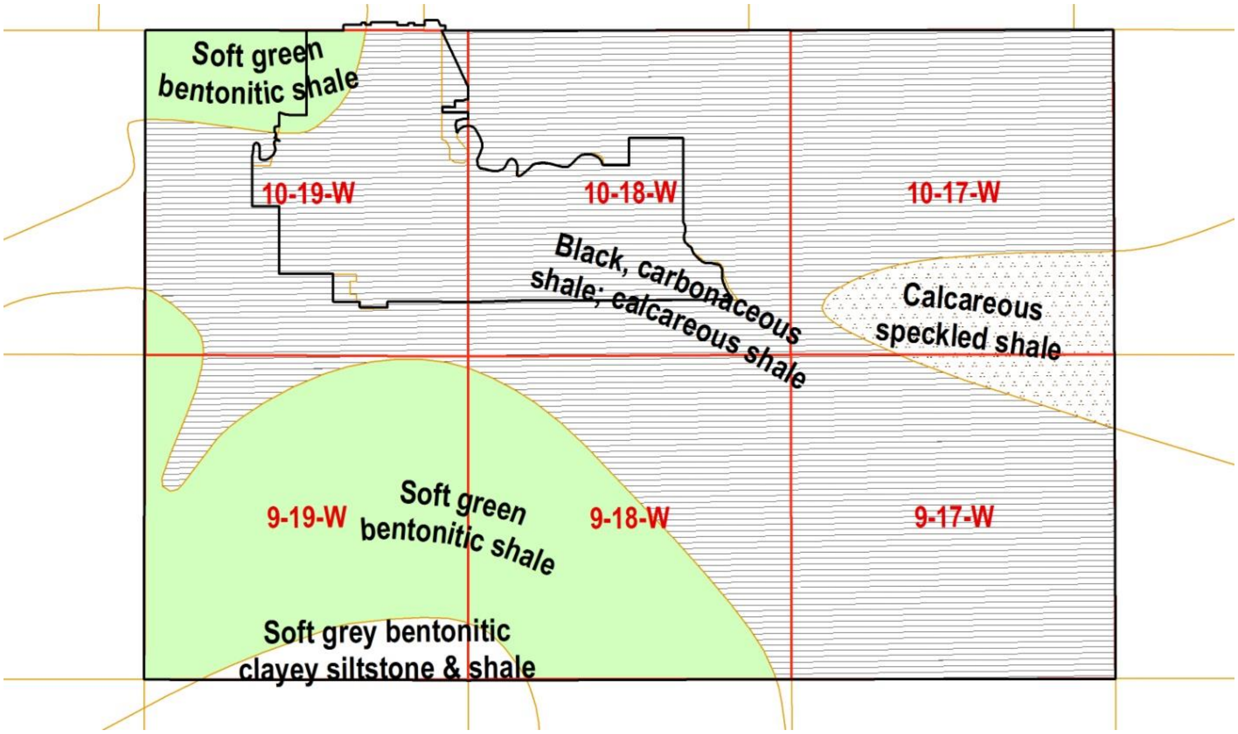


Figure 3. The Surface Contacts of the Rock Formations in the RM of Cornwallis

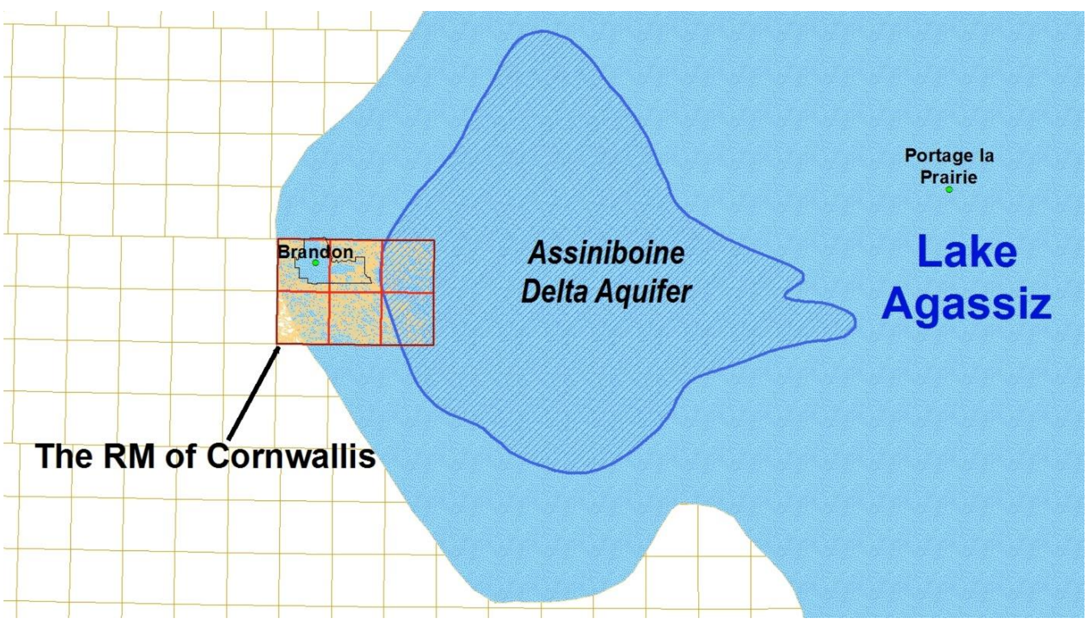


Figure 4. The boundaries of Assiniboine Delta Aquifer and Lake Agassiz in the RM of Cornwallis.

Table 1 Soil Parent Material in the Rural Municipality of Cornwallis

Parent material (0 to 100 cm)	Total area		% of RM
	ha	ac	
Lacustrine over fluvial	20,502	50,661	35.3
Lacustrine	16,532	40,854	28.4
Alluvium	3,345	8,265	5.75
Fluvial sediment	3,054	7,547	5.25
Glacial till	2,383	5,887	4.10
Lacustrine over fluvial over till	1,625	4,015	2.97
Lacustrine over glacial till	1,621	4,005	2.79
Organic soils	1,242	3,068	2.14
Eolian	242	597	0.42
Fluvial over till	103	254	0.18
Water body, eroded slope, marsh, urban & unclassified,	7,501	18,535	12.9
Total	**58,149**	**143,689**	**100.0**

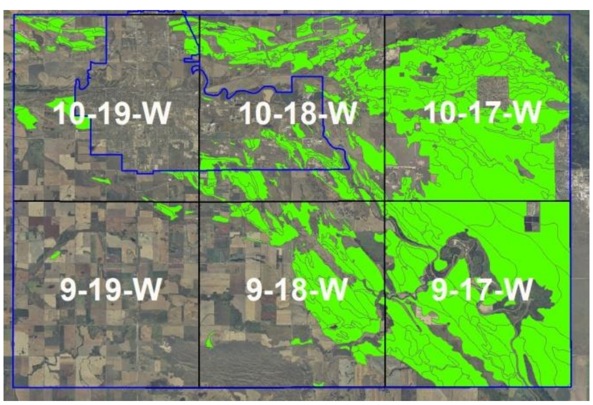


Figure 5. Lacustrine over fluvial soil distribution in the RM of Cornwallis

Soils developed from deep (>100 cm) lacustrine deposits in the RM of Cornwallis are distributed mainly in southwestern area of the RM (Figure 6). The Stockton soil association, coarse-textured soil series, is a major deep lacustrine association observed in the RM, accounting for 28.8 percent. This soil association is mainly distributed in the township of 9-19W. Fairland and Carroll soil associations consist of 26.0 and 25.7 percent of all deep lacustrine deposits, respectively.

The moderately fine soil association of Carroll is found primarily in the southwest corner of township 9-19W and the north side of the Brandon Hills in township 9-18W. These three associations are characterized by a relatively uniform texture profile within 100 cm. However, Glenboro and Wellwood soil associations, although their acreages are very small, have a finer texture in top layer(s), overlaying by a coarser texture group.

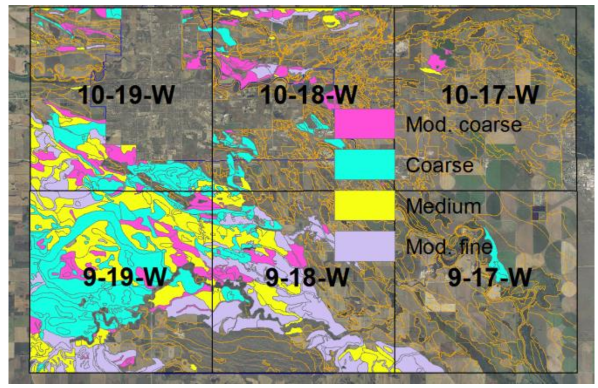


Figure 6. Deep lacustrine distribution in the RM of Cornwallis

Soils developed directly on glacial till comprises 4.1 percent of the study area, whereas those derived from lacustrine (<100 cm) over glacial till consist of 2.79 percent of the surveyed area (Table 1). Figure 7 clearly shows that almost all glacial till soils are located in the Brandon Hills area. The lacustrine over glacial till soils are scattered all over the RM except the township 10-17W; most of those soils are close to the Brandon Hills.

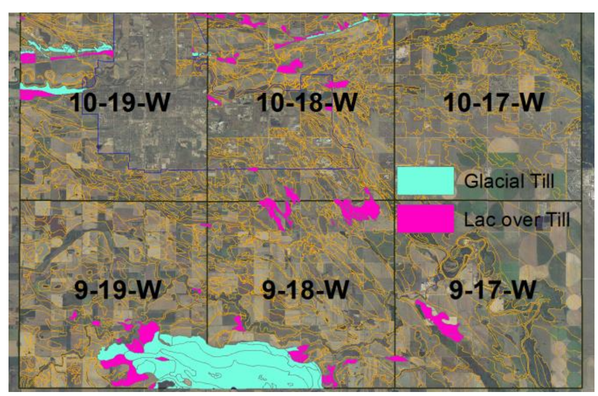


Figure 7. Glacial Till and Lacustrine over Glacial Till Distributions in COR

Soils developed directly from glacial till include two soil associations – Newdale and Statley. The Newdale association comprises well drained Black Chernozems (Cordova, Newdale and Rufford soil series), imperfectly drained Gleyed Chernozems (Lavinia, Moore Park and Varcoe soil series), Gleyed Eluviated Black Chernozem (Angusville soil series), and poorly drained Gleysols (Hamiota, Drokan and Penrith). However, well-drained soils are observed exclusively in the RM of Cornwallis.

The Statley association is characterized by strongly to extremely calcareous glacial till of limestone and granite origin. Statley soils occur in close association with Hilton and Barwood soils, but they differ from Hilton and Barwood because the till deposits of Statley soils consist of limestone and granite while Hilton soils deposits are mixed of limestone, shale and granite.

Among all soils developed from glacial till parent material, the Statley series is predominant, accounting for 50.8 percent, followed by the Stewart series, accounting for 28.2 percent. The Newdale soil association totals 11.2 percent.

The lacustrine overlying glacial till soils are classified as four associations, among which the Beresford association is predominant, accounting for 84.7 percent. The Beresford association includes three well drained soil series (Clementi - Orthic Black Chernozem, Kleysen – Calcareous Black Chernozem, and Chambers – Rego Black Chernozem), two imperfectly drained soil series (Cobfield – Gleyed Black Chernozem and Beresford – Gleyed Rego Black Chernozem) and one poorly drained soil series (Vodroff - Rego Humic Gleysol).

The well-drained Clementi and imperfectly drained Beresford comprise approximately 60 percent of all soils developed from lacustrine over glacial till, the Clementi soil series accounts for about 30.4 percent.

Soils developed from gravelly fluvial sediments consist of 5.25 percent of the study area. These soils are scattered mostly in Township 10-18W, few of them can be found in Townships 10-19W and 10-17W (Figure 8). The Dorset series, an Orthic Black Chernozem, and the Marringhurst series, a Calcareous Black Chernozem, are predominant in the Marringhurst association, consisting of 71 and 28 percent, respectively.

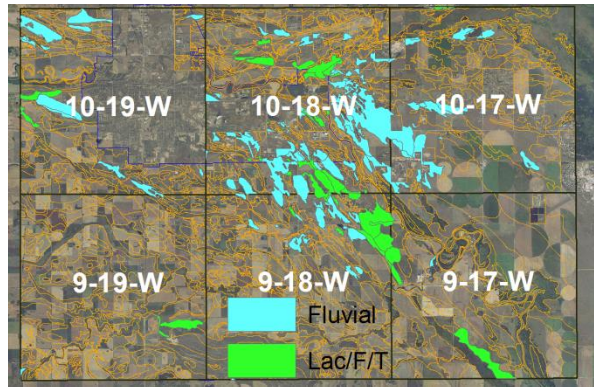


Figure 8. Fluvial Involved Deposits in the RM of Cornwallis

Lacustrine over fluvial over till soils have a strip like distribution from northwest to southeast (Figure 8). These types of soils cover only 2.79 percent of the study area. The Melland series, a Gleyed Rego Black Chernozem soil, covers approximately 46 percent of the total lacustrine over fluvial over till soils. The rest of the areas are covered by Marsden series (32%) and the Jaymar series (22%).

Soils derived from alluvium deposits are located in riverbeds or on terraces well above present streams. Soil texture ranges from medium to fine. The fine-textured alluvium deposit including Assiniboine, Kerran and Manson series covers one quarter of the all alluvium soils. The remaining three quarters soils are from medium textured soil series.

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 Rural Municipality of Cornwallis. Soil profiles were examined to a depth of one meter at sites approximately 160 meters interval along traverses that were spaced 800 meters 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 30 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) 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 Brandon Region Study Area,* Report No. 30 (Michalyna et al., 1976), *Soil of the Brandon Research Station with Interpretations for Agriculture, Engineering and Recreational Land Use*, Soils Report No. D7, (Hopkins and Jacques, 1985) and unpublished soil survey information from the Assiniboine Delta Aquifer project in the 1990s.

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 that are 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 soils or non-soils 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 percent with up to 35 percent of non-limiting, similar components (components that are alike in most properties and behaviour), or up to 25 percent 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 percent 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 percent; or if other components are dissimilar and non-limiting no single component represents 75 percent or more; or if other components are dissimilar and limiting no single component represents 85 percent or more.

For the purpose of describing compound map units, components are considered dominant if they occupy over 40 percent of the unit. They are considered significant between 15 and 40 percent and minor if they occupy less than 15 percent. 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 9.

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 9).

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 9).

An example of a compound unit is as follows: 50 percent consists of Fairland (FND^5) series having no erosion (x), very gently sloping topography (c), stoniness 2 at the surface (2), no salinity (x), 30 percent Travers (TAV^3) series having slight erosion (1), very gently sloping topography (c), no stones (x) and no (x) salinity, and 20 percent Ramada (RAM^2) series having no erosion (x), nearly level sloping topography (b), no stones (x) and no (x) salinity (Figure 9). 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 9).

2.5 Soil Sampling and Analyzing

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.
CEC: Ammonia electrode.
EC: Saturated paste.
pH: 2:1 water to soil ratio.
Organic carbon: Walkley-Black method.
Particle size: Pipette method.

Figure 9. Map Unit Symbol

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

$\frac{\text{CAVp}}{\text{xbxx}}$

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:	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%

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

MXI ← 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)

$\frac{\text{FND}^{5}\text{–TAV}^{3}\text{–RAM}^{2}}{\text{xc2x \quad 1cxx \quad xbxx}}$

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

$\frac{\text{PDA}^{7}\text{-TDP}^{3}}{\text{xbxx}}$ ← 2 Soil Series with the same phase

$\text{LEI}^{7}\text{-BKR}^{3}$ ← 2 soil series, both with a phase of xxxx

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 RM of Cornwallis have developed under a cool subhumid boreal climate (Grassland Transition of Ecoclimatic Region) which provides sufficient moisture and heat for development of aspen-oak groves, tall 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 ex. Orthic, intergrades toward soils in other orders, ex. 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 Table 2. The proportion of soils in terms of land area and surface texture in the RM of Cornwallis is shown in Table 3. Each individual soil series is described in detail in Appendix 2.

Table 2-1. Relationship between Soil Series, Drainage, Parent Material and Classification (Grassland transition subregion 2, Gt2-North)

Drainage	Soil Classification	Till (L, CL, SCL)			Lacustrine over Till			
		Loamy Extremely calcareous Till (L, CL, SiCL)	Loamy Mixed, Calc.	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	Stewart (SWR)*	Rufford (RUF)				Chambers (CBS)	
	Orthic Dark Gray Chernozem	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	Wesley (WEL)*	Varcoe (VRC)		Killeen (KLL)	Lindstrom (LDM)	Beresford (BSF)	Forrest (FRT)
	Gl. Dark Gray Chernozem		Petlura (PTU)					
Poorly	Orthic 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), M = medium, S = sand(y), Si = silt(y), and V = very.
*: Observed in the Brandon Hills Area.

Table 2-2. Relationship between Soil Series, Drainage, Parent Material and Classification (Grassland transition subregion 2, Gt2-North)

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 2-3. Relationship between Soil Series, Drainage, Parent Material and Classification (Grassland transition subregion 2, Gt2)

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) (Hallboro (HAL)**	Prosser (PSE)	Fairland (FND)	Ramada (RAM)	Janick (JIK)	Glenboro (GBO)	Wellwood (WWD)	
	Calc. BL Chernozem				Traverse (TAV)	Rempel (RMP)				
	Rego BL Chernozem		Cactus (CCS)	Porple (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)
Very poorly	Terric Mesisol		Perillo (PER)@							
	Typic Mesisol		Xavier (XVI)@							

** HAL is a textural variant of the Stockton series. Clay loam to silty clay loam textures are frequently encountered within 100 cm.

@ PER & VXI are organic soils. They were also found in the Grassland Transition, subregion 4 (Gt4) and Low Boreal subhumid subregion 2 (LBs2) from previous soil survey reports.

Table 3-1. Soil Series, Drainage and Surface Texture in the RM of Cornwallis

Soil name	Soil code	Drainage	Surface texture	Textural group of soil profile	Total area ha	Total area ac	% of RM
Arizona	AIZ	Rapid	Fine sand to LFS*	Coarse	149	368	0.26
Ashmore	AHO	Well	LVFS* to fine sandy loam	Mod. Coarse over very coarse	30	73	0.05
Assiniboine	ASB	Imperfect	Clay	Fine	724	1,790	1.25
Barager	BAA	Imperfect	Loamy sand	Coarse over medium or mod. fine	28	68	0.05
Barren	BAE	Well	Clay loam	Moderately fine	39	95	0.07
Basker	BKR	Poor	Loam to clay loam	Medium to mod. fine	832	2,057	1.43
Beresford	BSF	Imperfect	Clay loam	Moderately fine	525	1,297	0.90
Bornett	BOR	Poor	Fine sandy loam	Mod. coarse over very coarse	277	684	0.48
Brownridge	BWD	Well	LVFS to fine sandy loam	Moderately coarse	59	146	0.10
Cactus	CCS	Well	Fine sand to LFS	Coarse	357	882	0.61
Capell	CXT	Imperfect	Loam to clay loam	Medium or mod. fine over very coarse	2,433	6,012	4.18
Carroll	CXF	Well	Clay loam	Moderately fine	296	732	0.51
Carvey **	CAV	Poor	Loam to clay loam	Medium or mod. fine over very coarse	1,794	4,434	3.09
Chambers	CBS	Well	Clay loam	Moderately fine	97	239	0.17
Charman	CXV	Imperfect	Clay loam	Moderately fine	230	568	0.39
Chater	CXW	Well	Loamy sand	Coarse over medium or mod. fine	75	186	0.13
Clementi	CLN	Well	Clay loam	Moderately fine	498	1,229	0.86
Cobfield	CBF	Imperfect	Clay loam	Moderately fine	113	280	0.20
Cordova	CVA	Well	Loam to clay loam	Medium or mod. fine	71	175	0.12
Crookdale	CKD	Imperfect	Clay loam	Mod. fine over coarse or mod. coarse	43	107	0.07
Croyon	CYN	Well	Loam to clay loam	Medium or mod. fine over very coarse	1,787	4,415	3.07
Dexter	DXT	Imperfect	Loamy sand	Very coarse	17	43	0.03
Dorset	DOT	Rapid	Loamy sand	Very coarse	2,158	5,333	3.71
Druxman	DXM	Imperfect	Loam to clay loam	Medium or mod. fine over very coarse	260	644	0.45
Durnan	DRN	Well	Loam	Medium	212	524	0.36
Fairland	FND	Well	Loam	Medium	2,113	5,222	3.63
Forrest	FRT	Imperfect	Clay	Fine over mod. fine	9	23	0.02
Gateside	GTD	Imperfect	Very fine sand to FSL*	Mod. coarse	470	1,161	0.81
Gendzel	GDZ	Imperfect	Fine sand to LFS	Coarse over very coarse	342	844	0.59
Glenboro	GBO	Well	Loam	Medium over coarse or mod. coarse	385	953	0.66
Grayson	GYS	Poor	Loam	Medium over coarse or mod. coarse	103	255	0.18
Grover	GRO	Imperfect	Loam	Medium over coarse or mod. coarse	88	218	0.15
Hallboro	HAL	Well	Fine sand to LFS	Coarse over mod. fine	2	5	0.003
Harding	HRG	Imperfect	Clay	Fine	122	301	0.21

* LFS = Loamy fine sand; FSL = fine sandy loam; LVFS =loamy very fine sand.

** A peaty variant is also included.

Table 3-2. Soil Series, Drainage and Surface Texture in the RM of Cornwallis (continued)

Soil name	Soil code	Drainage	Surface texture	Textural group of soil profile	Total area		% of RM
					ha	ac	
Hickson	HKS	Poor	Loam to clay loam	Medium or mod. fine	17	43	0.03
Hughes	HGH	Imperfect	Fine sand to LFS	Coarse over very coarse	244	602	0.42
Hummerston	HMO	Imperfect	Fine sand to LFS	Coarse	619	1,529	1.06
Janick	JIK	Well	Clay	Fine	20	49	0.03
Jaymar	JAY	Well	Loam to clay loam	Medium over very coarse over mod. fine	358	885	0.62
Kerran	KRN	Poor	Clay	Fine	181	448	0.31
Killeen	KLL	Imperfect	Fine sand to LFS	Coarse over medium or mod. fine	8	20	0.01
Kilmury	KUY	Imperfect	Very fine sand to FSL	Mod. coarse over very coarse	356	879	0.61
Kirkness	KKS	Well	Fine sand to LFS	Coarse over medium or mod. fine	29	72	0.05
Kleysen	KYS	Well	Clay loam	Moderately fine	119	294	0.20
Knolls	KLS	Well	Loam	Medium	86	214	0.15
Lavenham	LVH	Imperfect	Fine sand to LFS	Coarse	695	1,718	1.20
Levine	LEI	Imperfect	Loam to clay loam	Medium or mod. fine	1,368	3,380	2.35
Lindstrom	LDM	Imperfect	Fine sandy loam to LVFS	Mod. coarse over medium or mod. fine	34	83	0.06
Lockhart	LKH	Well	Fine sandy loam to LVFS	Mod. coarse over medium or mod. fine	27	66	0.05
Lonery	LOE	Poor	Fine sandy loam to LVFS	Mod. coarse over medium or mod. fine	6	15	0.01
Lowroy	LOW	Poor	Fine sand to LFS	Coarse over very coarse	115	283	0.20
Lowton	LWN	Poor	Clay	Fine	12	29	0.02
Mansfield	MFI	Imperfect	Loamy sand	Very coarse	10	25	0.02
Manson	MXD	Well	Clay	Fine	94	231	0.16
Marringhurst	MRH	Rapid	Loamy sand	Very coarse	868	2,146	1.49
Marsden	MDN	Poor	Loamy to clay loam	Medium over very coarse over mod. fine	520	1,284	0.89
Melland	MXT	Imperfect	Loamy to clay loam	Medium over very coarse over mod. fine	743	1,836	1.28
Miniota	MXI	Well	Very fine sand to FSL	Mod. coarse over very coarse	2,071	5,117	3.56
Mowbray	MOW	Well	Loam to clay loam	Medium to mod. fine	145	359	0.25
Newdale	NDL	Well	Loam to clay loam	Medium to mod. fine	17	41	0.03
Oberon	OBR	Imperfect	Clay loam	Mod. fine over coarse to mod. coarse	16	40	0.03
Onahan	ONH	Imperfect	Fine sand to LFS	Coarse	12	29	0.02
Perillo	PER	Very poor	Organic materials	Organic over Medium	733	1,812	1.26
Petrel	PTR	Imperfect	Loam	Medium over coarse to mod. coarse	134	331	0.23
Pleasant	PLE	Imperfect	Very fine sand to FSL	Mod. coarse	529	1,307	0.91
Poolex	POX	Poor	Very fine sand to FSL	Mod. coarse	41	101	0.07
Porple	POR	Well	Very fine sand to FSL	Mod. coarse	93	229	0.16

Table 3-3. Soil Series, Drainage and Surface Texture in the RM of Cornwallis (continued)

Soil name	Soil code	Drainage	Surface texture	Textural group of soil profile	Total area		% of RM
					ha	ac	
Prodan	PDA	Imperfect	Clay loam	Mod. fine	1,181	2,919	2.03
Prosser	PSE	Well	Very fine sand to FSL	Mod. coarse	596	1,474	1.03
Ramada	RAM	Well	Clay loam	Mod. fine	2,103	5,197	3.61
Rempel	RMP	Well	Clay loam	Mod. fine	12	30	0.02
Roddan	ROD	Well	Clay loam	Moderately fine	8	20	0.01
Rufford	RUF	Well	Loam to clay loam	Medium to mod. fine	180	444	0.31
Sewell	SEE	Poor	Fine sand to LFS	Coarse	464	1,147	0.80
Shilox	SHX	Rapid	FS to LFS	Coarse	230	568	0.40
Sigmund	SGO	Imperfect	Clay	Fine	363	897	0.62
Statley	SXB	Well	Loam to clay loam	Medium to mod. fine	1,210	2,991	2.08
Stewart	SWR	Well	Loam to clay loam	Medium to mod. fine	671	1,658	1.15
Stockton	SCK	Well	Fine sand to LFS	Coarse	2,476	6,118	4.26
Sutton	SXP	Poor	Clay loam	Mod. fine over coarse to mod. coarse	25	63	0.04
Tadpole	TDP	Poor	Clay loam	Mod. fine	398	984	0.68
Taggart	TGR	Imperfect	Loam	Medium	580	1,434	1.00
Torcan	TOC	Imperfect	Loam	Medium	618	1,527	1.06
Traverse	TAV	Well	Loam	Medium	308	760	0.53
Vodroff	VFF	Poor	Clay loam	Mod. fine	152	376	0.26
Vordas	VDS	Poor	Loam	Medium	367	906	0.63
Wellwood	WWD	Well	Clay loam	Mod. fine over coarse to mod. coarse	128	316	0.22
Wesley	WEL	Imperfect	Loam to clay loam	Medium to mod. fine	5	13	0.01
Wheatland	WHL	Rapid	Fine sand to LFS	Coarse over very coarse	10,758	26,582	18.50
Woodfield	WDF	Well	Loam to clay loam	Medium to mod. fine	211	522	0.36
Wytonville	WVI	Imperfect	Very fine sand to FSL	Mod. coarse over very coarse	37	91	0.06
Xavier	XVI	Very poor	Organic materials	Organic over Medium	509	1,257	0.87
Eroded Slope	$ER	-			115	283	0.20
Marsh	$MH	-			93	230	0.16
Unclassified land	$UL	-			1,994	4,928	3.43
Urban land*	$UR	-			4,917	12,151	8.46
Water	$ZZ	-			381	941	0.66
Total					**58,149**	**143,689**	**100**

* It mainly refers to unmapped city of Brandon.

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 irrigation 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 percent 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 (5 to 9%) 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. Most Gleysols with improved drainage are generally 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 soils usually have 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 (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 habitant 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.

The agriculture capability of lands in the RM of Cornwallis is summarized in Table 4. Approximately, one third of land in the RM is grouped into class 5; Class 2 and 3 lands are in the 2nd and 3rd place, composing of 18.2 and 15.8 percent of the study area, respectively. Class 4 land covers approximately 16,400 acres, or 11.4 percent of the total. Class 6, class 7 and organic soils account for only small portions.

The most limiting factors in Class 2 land are moisture (2M) accounting for one third of the class 2, followed by topography (2T) and excess water (2W).

Soils grouped as Class 3 are largely due to moisture limitation (3M) and inundation (3I), composing of 32 and 23 percent of class 3 area, respectively. Moderately saline soil ranks the third in this class.

Class 4 lands in the study area are predominantly covered by sandier soil texture, which limits crop production considerably. This sandier (4M) soil is approximately 13,650 acres, or 83 percent of the class 4.

Like class 4, class 5 lands are also predominantly covered by sandier soil texture, but these soils are much sandier than those in class 4. Poorly drained (5W & 5IW) soils are also very common in this class.

Class 6 land consists of only 1.4 percent of the study area. Soil moisture, topography and/or erosion seem have more impact on class 6.

Open water and mash composed of class 7 land, making up 0.16 percent of the study area.

Organic soil consists of 2.14 percent of the RM of Cornwallis.

It is evident that moisture is the most limiting factor in the RM of Cornwallis. All lands classified with a single letter M or a combination of M with other letters covers almost half of the total surveyed areas, consisting of 48.9 percent.

An interpretative map (Map 1) depicts the rating of the dominant soil series and landscape features for each polygon. The nature of the subclass limitations and the rating 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.

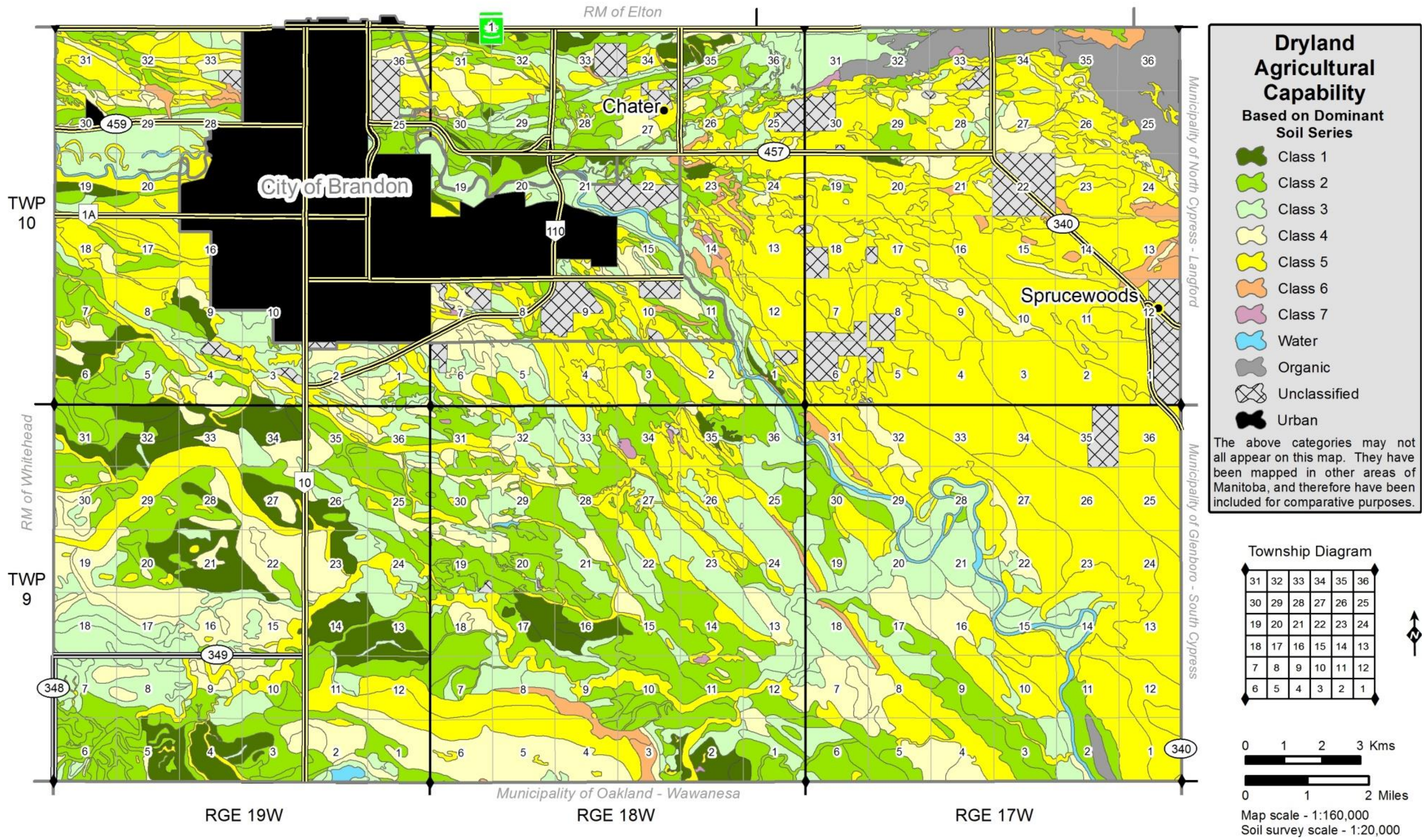
The Map 1 indicates that most class 1 and class 2 lands are distributed in the southwestern areas of the RM, particularly in township 9 Range 18W and 19W. The majority of class 5 lands are located in township 10 Range 17W and Township 9 Range 17W.

Table 4. Agriculture Capability of Land in the RM of Cornwallis

Agricultural Capability Class		Total area		% of RM
		ha	ac	
1		**2,143**	**5,269**	**3.69**
2	2I	87	214	0.15
	2IT	135	334	0.23
	2M	3,802	9,396	6.54
	2MP	176	435	0.30
	2MT	434	1,073	0.75
	2T	2,811	6,946	4.83
	2TE	4	9	0.01
	2TP	6	15	0.01
	2W	2,342	5,786	4.03
	2WP	57	141	0.10
	2WT	635	1,569	1.09
	2X	109	269	0.19
Subtotal		**10,598**	**26.188**	**18.2**
3	3E	99	244	0.17
	3I	2,092	5,170	3.60
	3M	2,898	7,161	4.98
	3MN	27	67	0.05
	3MP	11	27	0.02
	3MT	173	427	0.30
	3MW	1,170	2,891	2.01
	3N	1,393	3,442	2.40
	3NW	77	189	0.13
	3P	74	183	0.13
	3T	935	2,311	1.61
	3TE	247	611	0.43
	3TP	4	10	0.01
Subtotal		**9,200**	**22,736**	**15.8**
4	4M	5,526	13,656	9.50
	4ME	81	200	0.14
	4N	67	166	0.12
	4P	36	89	0.06
	4T	761	1,881	1.31
	4TE	165	408	0.28
Subtotal		**6,637**	**16,399**	**11.4**
5	5IW	1,014	2,505	1.74
	5M	13,028	32,192	22.40
	5ME	429	1,060	0.74
	5MP	457	1,130	0.79
	5T	942	2,328	1.62
	5TE	78	193	0.13
	5W	4,181	10,330	7.19
Subtotal		**20,128**	**49,738**	**34.6**
6	6E	115	283	0.20
	6M	230	568	0.40
	6NW	4	9	0.01
	6P	147	364	0.25
	6TE	212	525	0.37
	6W	107	265	0.18
Subtotal		**815**	**2,014**	**1.40**
7	7W	93	230	0.16
Organic	O3W	1,242	3,068	2.14
Unclassified, urban and water*		7,293	18,021	12.5
Grand Total		**58,149**	**143,689**	**100**

* including unmapped city of Brandon.

Map 1. Dryland Agricultural Capability Map of the RM of Cornwallis



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 assists 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 features 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:

Degree of Limitation Class → **3 sw Bt2** ← Degree of Limitation Class

Soil factors → **3 sw Bt2** ← Landscape feature

A maximum of 3 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).

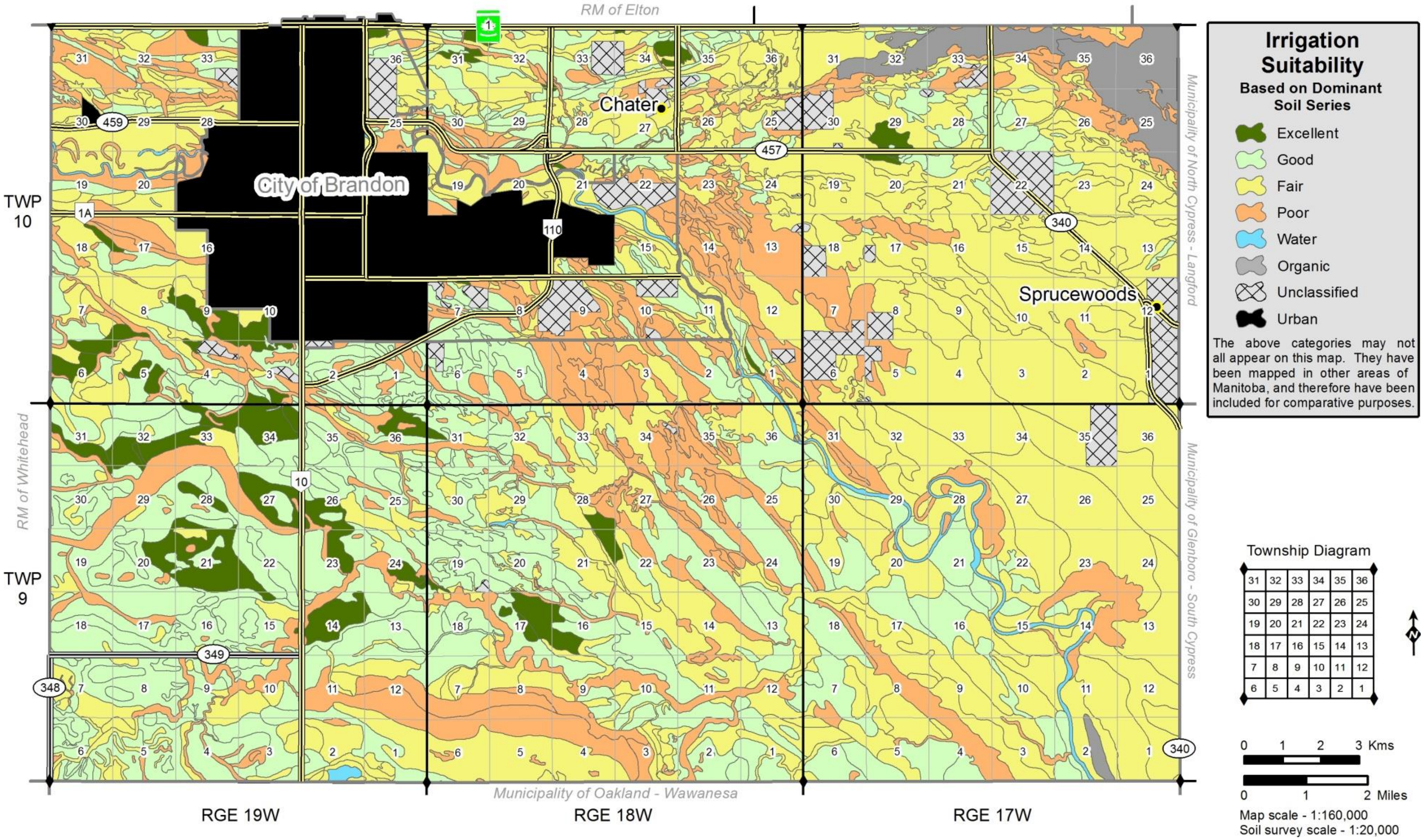
A summary of soils and their interpretive classification for irrigation suitability is presented in Table 5. The subdominant soil series and phases are considered when analyzing the data. Approximately, 3 percent of lands in the RM of Cornwallis are excellent for irrigation project development; one quarter of the lands are classified as “Good”. In this class, soil moisture (2m A) or combined with topography (2m Bt2) are attributed most to this class. The “Fair” class lands accounts for 39.3 percent. It is evident that moisture limitation (3m A) and drainage (3w A) are major factors attributing to this class. If soil drainability and moisture are improved, those soils could be upgraded to the “Good” category. Poorly drained conditions and coarse textured soils are grouped to the “Poor” class.

An interpretative map (Map 2) illustrates the rating of the dominant soil series and landscape features for each polygon. It shows that most lands in Township 9 Range 19W and some lands in Township 9 Range 18W are suitable for irrigation. Lands with “Fair” class and organic soils are mainly distributed in two eastern Townships – Township 9 & 10 Range 17W.

Table 5. Soil Irrigation Suitability in the RM of Cornwallis

Class (%)	Soil & landscape features	Total area		% of RM
		ha	ac	
Excellent (3.14)	1 A	1,824	4,507	3.14
Good (24.8)	1 Bt2	1,503	3,713	2.58
	2gm A	743	1,836	1.28
	2gm Bp	11	27	0.02
	2gm Bt2	938	2,317	1.61
	2k A	952	2,352	1.64
	2k Bt2	1,236	3,055	2.13
	2kx A	167	413	0.29
	2kx Bt2	523	1,292	0.90
	2m A	2,663	6,580	4.58
	2m Bt2	2,198	5,432	3.78
	2m Bt2p	11	27	0.02
	2mw A	1,377	3,402	2.37
	2mw Bt2	198	489	0.34
	2mx Bt2	29	72	0.05
	2w A	1,425	3,521	2.45
	2w Bt2	463	1,145	0.80
	2x A	10	24	0.02
Fair (39.3)	1 Ct2	400	988	0.69
	2gm Ct2	95	235	0.16
	2k Ct2	535	1,322	0.92
	2kx Ct2	1,206	2,981	2.07
	2m Cp	23	57	0.04
	2m Ct2	455	1,124	0.78
	2x Ct2	12	30	0.02
	3kw Bi	618	1,526	1.06
	3kw Bt2i	107	264	0.18
	3kx A	27	66	0.05
	3kx Bt2	67	165	0.12
	3m A	5,236	12,938	9.00
	3m Bt2	5,405	13,357	9.30
	3m Ct2	517	1,279	0.89
	3mw A	497	1,229	0.86
	3mw Bt2	88	217	0.15
	3s A	431	1,065	0.74
	3s Bt2	208	513	0.36
	3sw A	685	1,693	1.18
	3sw Bt2	103	253	0.18
	3w A	4,281	10,579	7.36
	3w Bi	622	1,538	1.07
	3w Bp	16	39	0.03
	3w Bt2	393	972	0.68
	3w Bt2i	746	1,842	1.28
	3w Bt2p	27	68	0.05
	3w Cp	13	32	0.02
	3w Ct2	31	76	0.05
	3wx A	12	29	0.02
Poor (18.0)	2kx Dt2	1,185	2,928	2.04
	2m Dp	30	73	0.05
	2m Dt2	13	32	0.02
	2x Dt2	5	12	0.01
	3m Dt2	0.3	0.8	0.001
	4gm A	97	240	0.17
	4gm Ct2	6	14	0.01
	4k A	1	2	0.001
	4k Bt2	9	22	0.02
	4kw A	12	29	0.02
	4kw Ci	181	448	0.31
	4kx A	466	1,152	0.80
	4kx Bp	31	76	0.05
	4kx Bt2	8	19	0.01
	4m A	757	1,870	1.30
	4m Bp	36	89	0.06
	4m Bt2	1,303	3,221	2.24
	4m Bt2p	145	358	0.25
	4m Cp	374	925	0.64
	4m Ct2	331	818	0.57
	4m Ct2p	83	205	0.14
	4m Dp	118	291	0.20
	4m Dt2	22	55	0.04
	4s A	48	118	0.08
	4s Bt2	20	49	0.03
	4sw A	147	364	0.25
	4w A	3,904	9,647	6.71
	4w Bp	108	267	0.19
	4w Bt2	120	297	0.21
	4w Ci	832	2,057	1.43
	4wx Di	93	230	0.16
Organic (2.14)	0 A	1,242	3,068	2.14
Unclassified land, urban and water (12.5)		7,293	18,021	12.5
Total		**58,149**	**143,689**	**100**

Map 2. Irrigation Suitability Map of the RM of Cornwallis



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.

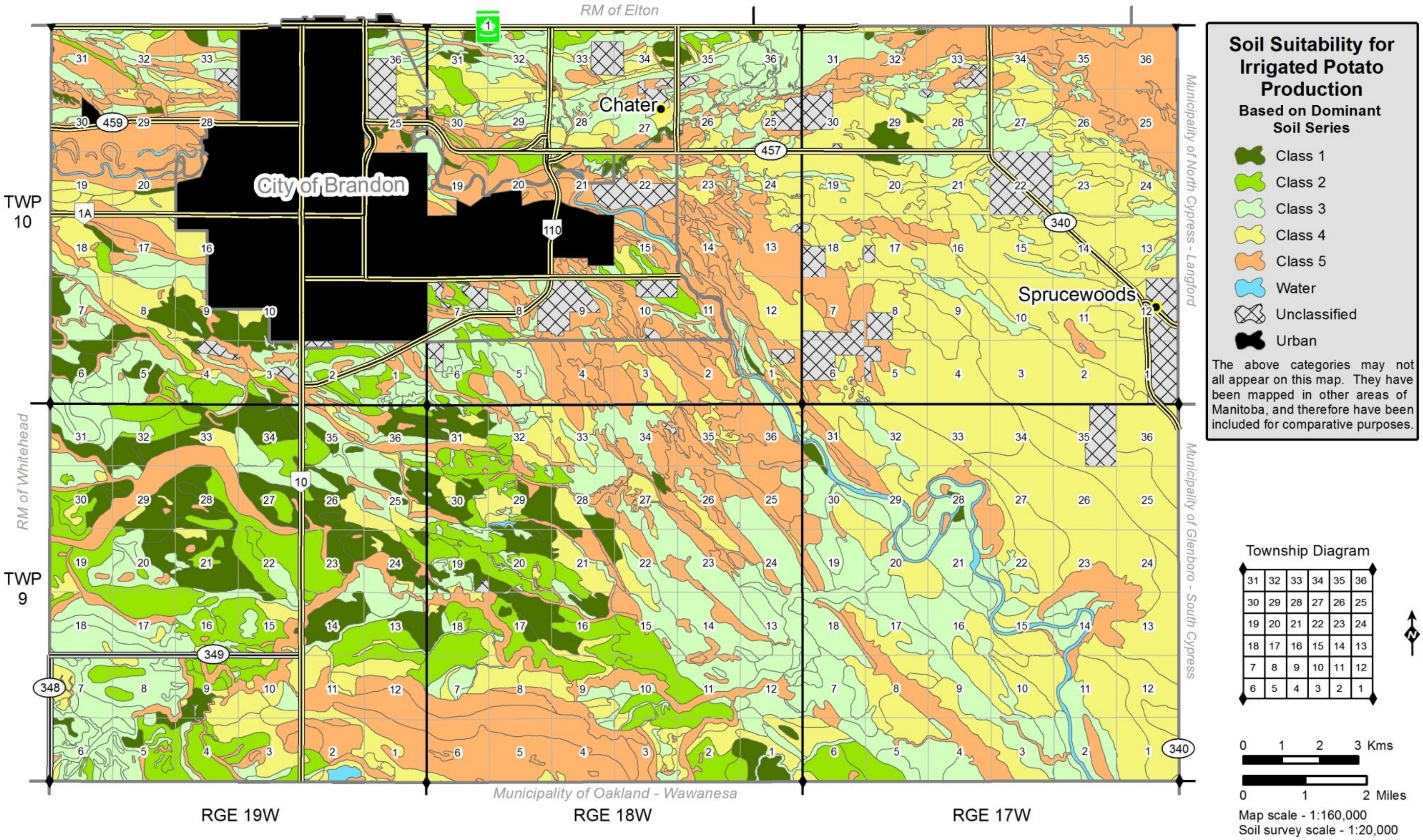
Integration of related databases in a GIS environment can be used to create a map that depicts the rating of the dominant soil and landscape feature for each soil polygon. The nature of the subclass limitations and the rating of subdominant soil and landscape components are not shown at this scale, but are indicated in Table A2 of Appendix 1. An interpretative map (Map 3) illustrates the rating of the dominant soil series and landscape features for each polygon.

Approximately, 14 percent of soils in the RM of Cornwallis are suitable for potato production (class 1 & 2 in Table 6). These soils are mainly located in the Townships 9, Range 19W and 18W (Map 3). More than half of the lands (Class 4 & 5) are not suitable for potato production, primarily due to soil moisture, topography and texture limitations.

Table 6. Soil Irrigation Suitability for Potato Production in the RM of Cornwallis

Potato Suitability Class	Total area		% of RM
	ha	ac	
Class 1	3,386	8,368	5.82
Class 2	4,594	11,352	7.90
Class 3	12,942	31,981	22.3
Class 4	15,727	38,861	27.0
Class 5	14,208	35,107	24.4
Water, urban & unclassified	7,293	18,021	12.5
Total	**58,149**	**143,689**	**100**

Map 3. Soil Suitability for Irrigated Potato in the RM of Cornwallis



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 10). 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

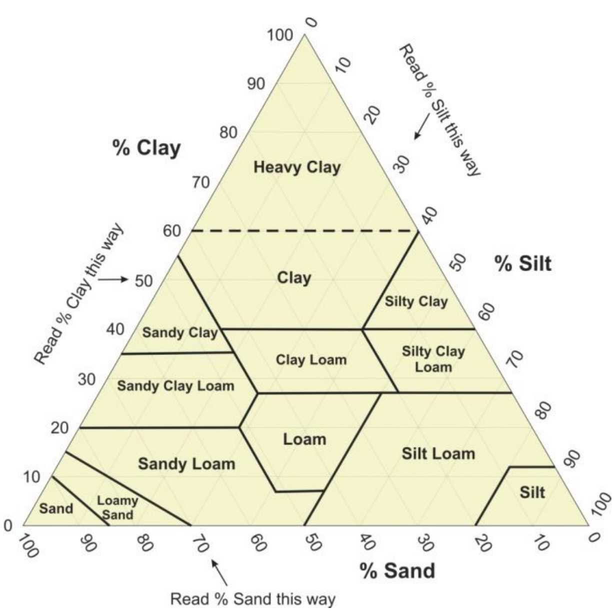


Figure 10. Soil Texture Triangle

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 classes are grouped as coarse, medium and fine (Table 7).

Table 7. Soil Texture Group

Texture group		Texture	
		Class	Symbol
Coarse	Very coarse	Very coarse sand	VCoS
		Coarse sand	CoS
		Medium sand	S or MS
	Coarse	Fine sand	FS
		Loamy coarse sand	LCoS
		Loamy sand	LS or LMS
		Loamy fine sand	LFS
	Mod. coarse	Very fine sand	VFS
		Loamy very fine sand	LVFS
		Coarse sandy loam	CoSL
		Sandy loam	SL or MSL
		Fine sandy loam	FSL
Medium	Medium	Very fine sandy loam	VFSL
		Loam	L
		Silt loam	SiL
		Silt	Si
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 298 soil samples randomly collected from A horizon in the study area, 39 samples were fine sandy loam, accounting for 13.1 percent (Table 8). Clay loam, sandy clay loam, sandy loam, loam and loamy sand consist of 12.4, 11.1, 10.7, 10.4, and 10.4 percent, respectively.

Table 8. Lab Results of Soil Surface Texture in the RM of Cornwallis

Texture	# of samples	% of total
Clay	4	1.34
Clay loam	37	12.4
Coarse sand	5	1.68
Coarse sandy loam	7	2.35
Fine sand	2	0.67
Fine sandy loam	39	13.1
Heavy clay	1	0.34
Loam	31	10.4
Loamy coarse sand	28	9.40
Loamy fine sand	8	2.68
Loamy medium sand	31	10.4
Sand	6	2.01
Sandy loam	32	10.7
Sandy clay loam	33	11.1
Silt loam	4	1.34
Silty clay	2	0.67
Silty clay loam	20	6.71
Very fine sandy loam	8	2.68
Total	**298**	**100**

Based on soil polygons, the different texture groups and their proportions in terms of land area in the RM of Cornwallis are listed in Table 9. Soil texture determined in the laboratory and those delineated from soil polygons did not show the same trend as previously surveyed RMs. This is because 1) relatively fewer samples were collected in 1995 and 1996 when most coarse soils were surveyed; and 2) few samples were collected in the Brandon Hill area.

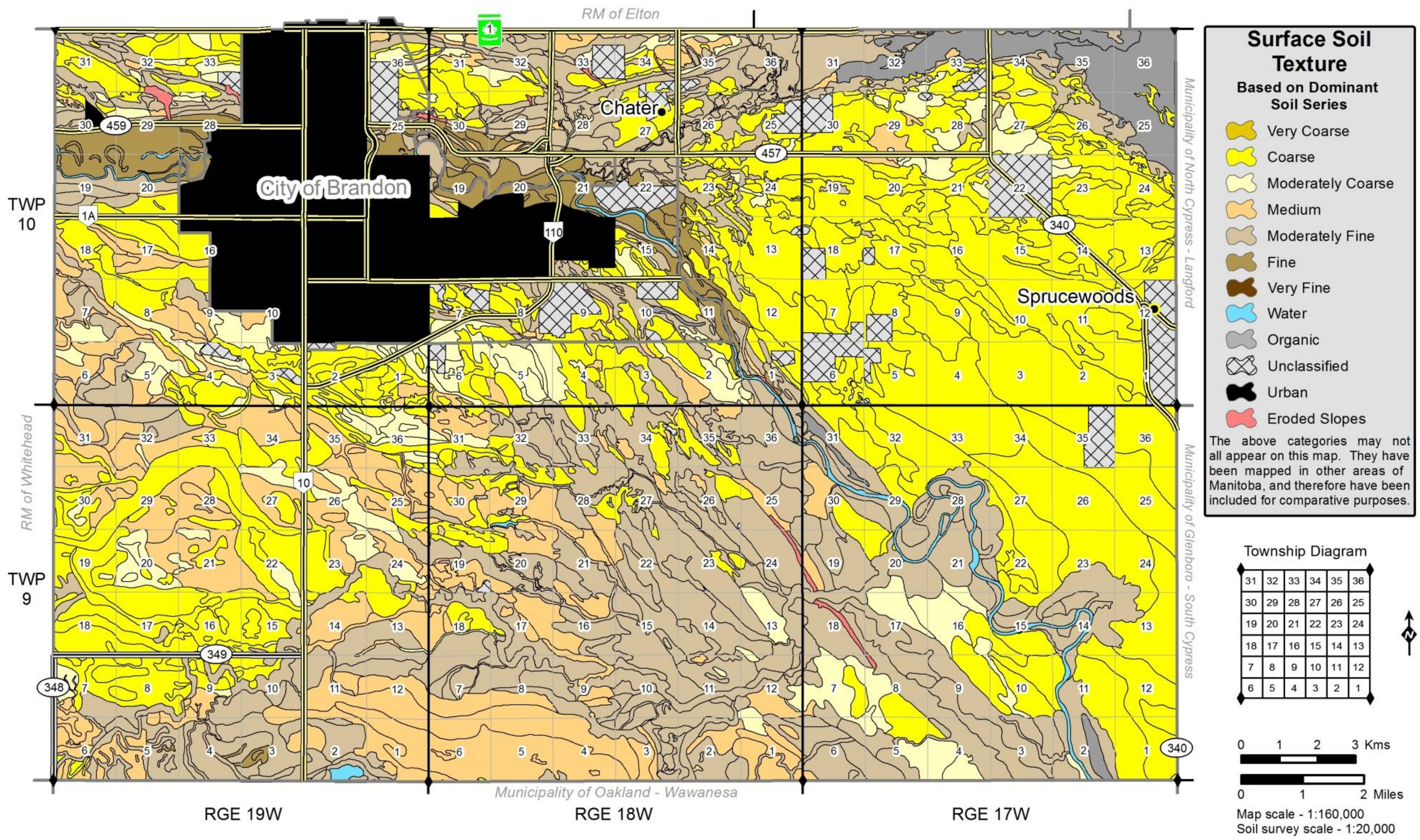
Table 9. Soil Surface Texture and their Proportions in the Study Area

Texture group	Texture	Total area		% of RM
		ha	ac	
Very coarse (1.49%)	GRSL*	868	2,146	1.49
Coarse (32.3%)	FS	230	568	0.40
	LCOS	12,894	31,861	22.2
	LFS	5,169	12,773	8.89
	LS	494	1,221	0.85
Mod. coarse (7.90)	FSL	2,069	5,113	3.56
	LVFS	97	240	0.17
	SL	2,426	5,996	4.17
Medium (12.5%)	L	5,112	12,632	8.79
	SIL	886	2,190	1.52
	VFSL	1,256	3,104	2.16
Mod. fine (28.1%)	CL	10,748	26,558	18.5
	SCL	4,720	11,663	8.12
	SICL	871	2,152	1.50
Fine (2.63%)	C	154	380	0.26
	SIC	1,372	3,389	2.36
Organic (2.23%)	M	1,349	3,333	2.32
Unclassified, eroded slope, urban & water		7,407	18,304	12.7
Total		**58,149**	**143,689**	**100**

* GRSL = gravelly sandy loam.

Surface soil texture shown in Map 4 illustrates the textural group of the dominant soil for each polygon.

Map 4. Soil Surface Texture in the RM of Cornwallis



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 underground 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 removed from the soil rapidly 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 and/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 and/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.

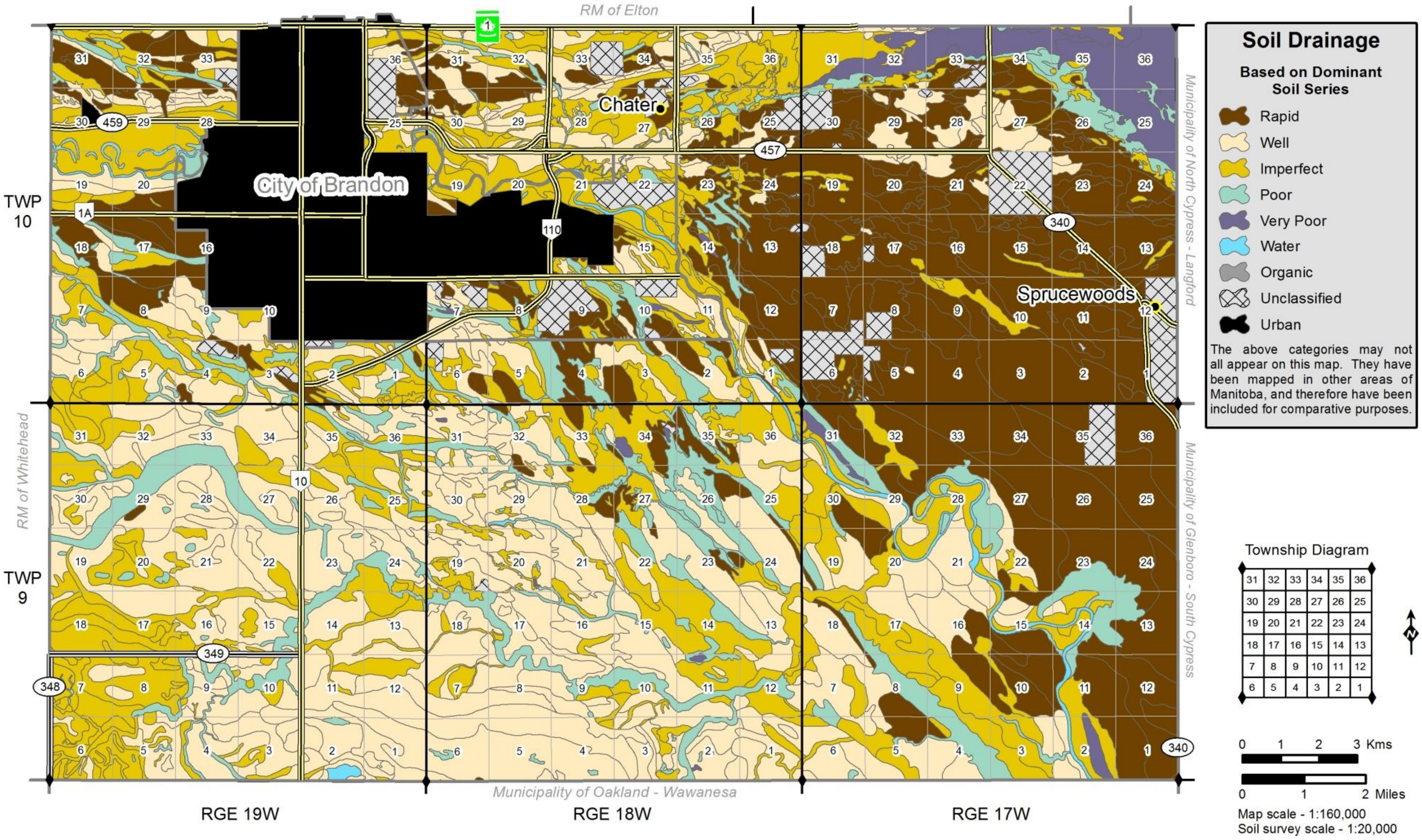
Soil drainage in Table 10 indicates that over 50 percent of the soils in the RM of Cornwallis are well- and rapidly-drained. The imperfectly drained soils comprise approximately 22 percent of the lands. The poorly and very poorly drained soils in the RM account for approximately 11 percent.

Table 10. Soil Drainage Classes in the RM of Cornwallis

Drainage Class	Total area		% of RM
	ha	ac	
Rapid	14,278	35,281	24.6
Well	16,982	41,964	29.2
Imperfect	12,956	32,015	22.3
Poor	5,198	12,844	8.94
Very poor	1,442	3,563	2.48
Water, urban & unclassified	7,294	18,021	12.5
Total	**58,149**	**143,689**	**100**

The soil drainage map (Map 5) shows that rapidly drained soils are mainly found in Township 10 Range 17W and some in Township 9 Range 17W. The majority of well-drained soils are located in two southwest townships. The imperfectly drained soils are scattered throughout whole RM, but concentrated in the Northwest Township and southwest corner of Township 9 Range 19W.

Map 5. Soil Drainage in the RM of Cornwallis



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, rill, gully and channel bank erosion. Sheet and rill erosion are usually least apparent in the landscape but often the most damaging since it causes 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.

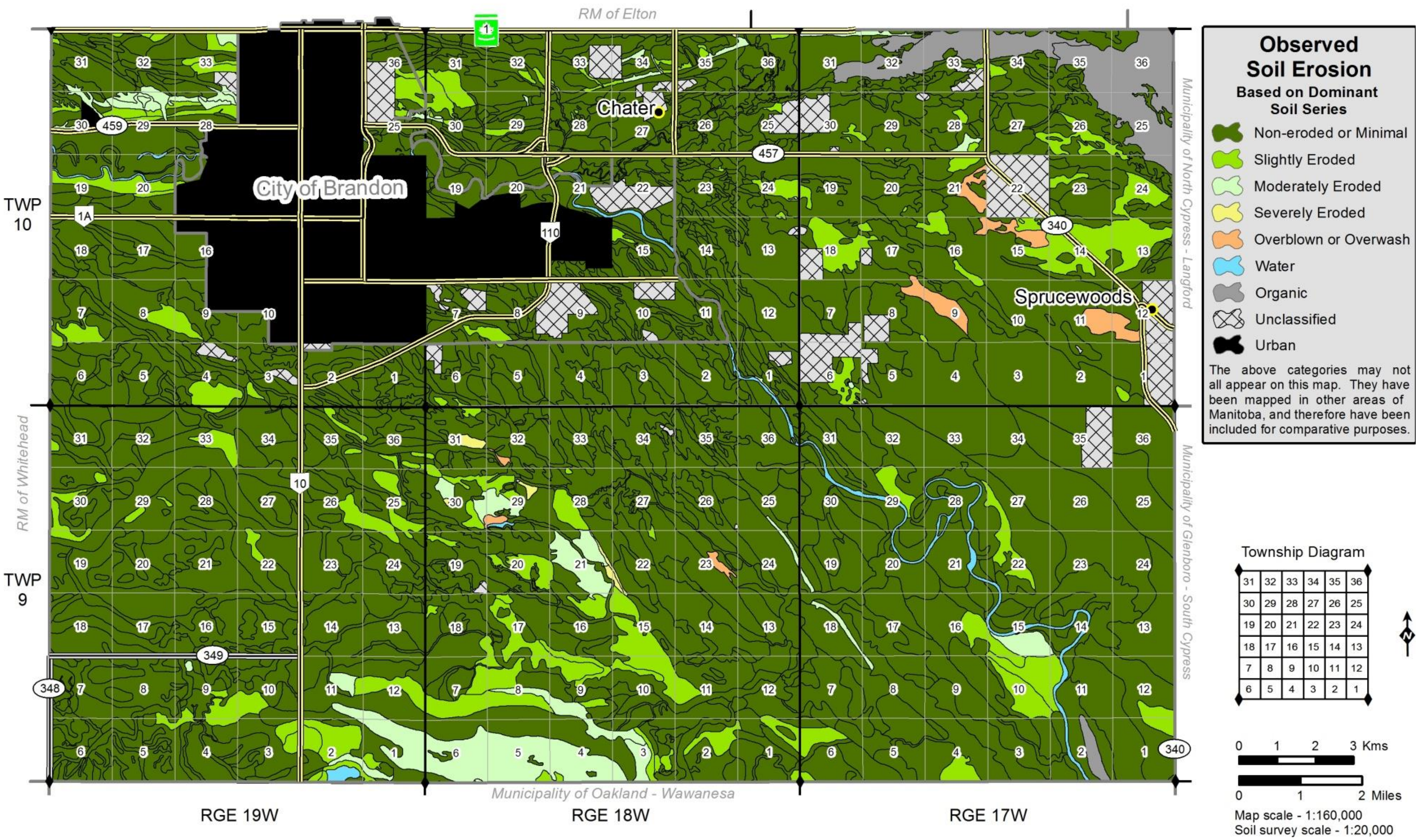
Severely eroded - soils which have practically all of the original surface soil removed and the tilled layer consists mainly of C-horizon material. This condition occurs on knolls and steep upper slope positions.

In general, soil erosion in the RM of Cornwallis is not severe. Approximately, 74 percent of the study area has minimal or non-eroded lands (Table 11). The slightly eroded areas comprise 8.4 percent, and moderate to severely eroded lands consist of small proportion of the lands. The degree of observed soil erosion shown on Map 6 is based on the dominant soil for each polygon.

Table 11. Soil Erosion Classes in the RM of Cornwallis

Observed Erosion Class	Total area		% of RM
	ha	ac	
Non-eroded or minimal	42,871	105,936	73.7
Slightly	4,893	12,091	8.41
Moderately	1,402	3,464	2.41
Severely	86	214	0.15
Overblown	362	894	0.62
Organic soil	1,242	3,068	2.14
Water, urban & unclassified	7,294	18,022	12.5
Total	**58,149**	**143,689**	**100**

Map 6. Soil Erosion Observed in the RM of Cornwallis



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 12).

Table 12. Slope Classes Used in Soil Map

Slope Class	Slope Description	% Slope
x	Level	0 - 0.5
b	Nearly level	>0.5 - 2.0
c	Very gently sloping	>2.0 - 5.0
d	Gently sloping	>5.0 - 9.0
e	Moderately sloping	>9.0 -15.0
f	Strongly sloping	>15.0-30.0
g	Very strongly sloping	>30.0-45.0
h	Extremely sloping	>45.0-70.0
i	Steeply sloping	>70.0-100
j	Very steeply sloping	>100

Because the RM of Cornwallis consists of two plains and Souris low area, the land slopes in the study area are relatively flat in general (Table 13).

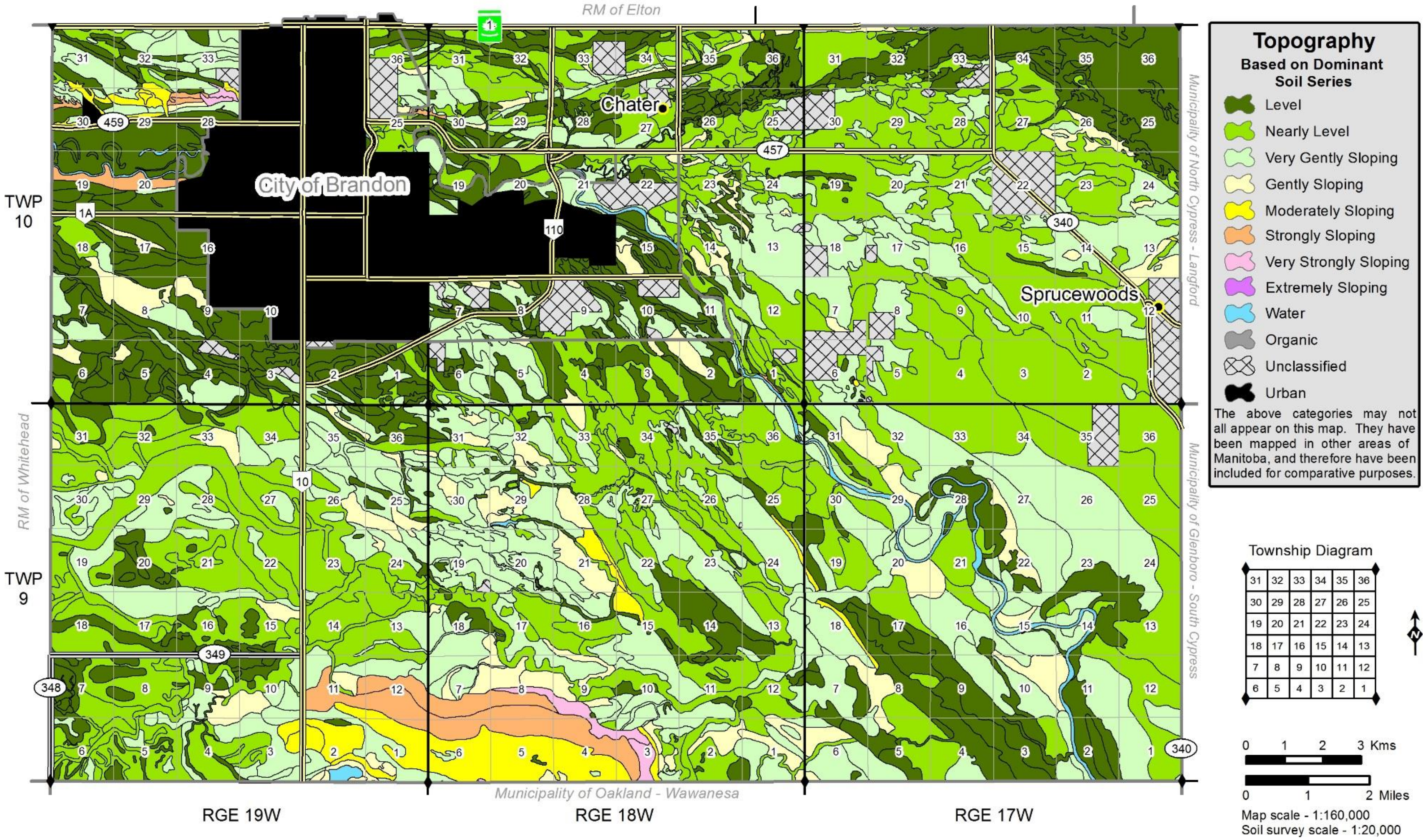
Approximately, over half of lands are level or nearly level slopes. Very gentle slope accounts for 27.5 percent. The steep slopes are not common in this RM.

Table 13. Topography observed in the RM of Cornwallis

Topography (slope classes)	Total area		% of RM
	ha	ac	
x	12,592	31,116	21.7
b	17,221	42,553	29.6
c	16,006	39,551	27.5
d	2,814	6,953	4.84
e	997	2,465	1.72
f	1,013	2,503	1.74
g	212	525	0.37
Water, urban & unclassified	7,294	18,023	12.5
Total	**58,149**	**143,689**	**100**

Topography classes shown on Map 7 are based on the dominant soil for each polygon. It clearly shows most lands in the RM of Cornwallis are level to nearly level, i.e. slopes are less than two percent. Relatively steeper slopes such as moderately sloping and strongly sloping are mainly observed in the Brandon Hill area.

Map 7. Topography of the RM of Cornwallis



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 or x. (Non-stony) - Land having less than 0.01% of surface occupied by stones.

Stones 1. (Slightly stony) - Land having 0.01 to 0.1% of surface occupied by stones. Stones are 15 to 30 cm in diameter, 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% of surface occupied by stones. Stones are 15 to 30 cm in diameter, 2 to 10 m apart. Stones cause some interference with cultivation.

Stones 3. (Very stony) - Land having 3 to 15% of surface occupied by stones. Stones are 15 to 30 cm in diameter, 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% of surface occupied by stones. Stones are 15 to 30 cm in diameter, 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% of surface occupied by stones. Stones are 15 to 30 cm in diameter, less than 0.7 m apart. The land is too stony to permit cultivation until considerable clearing has occurred.

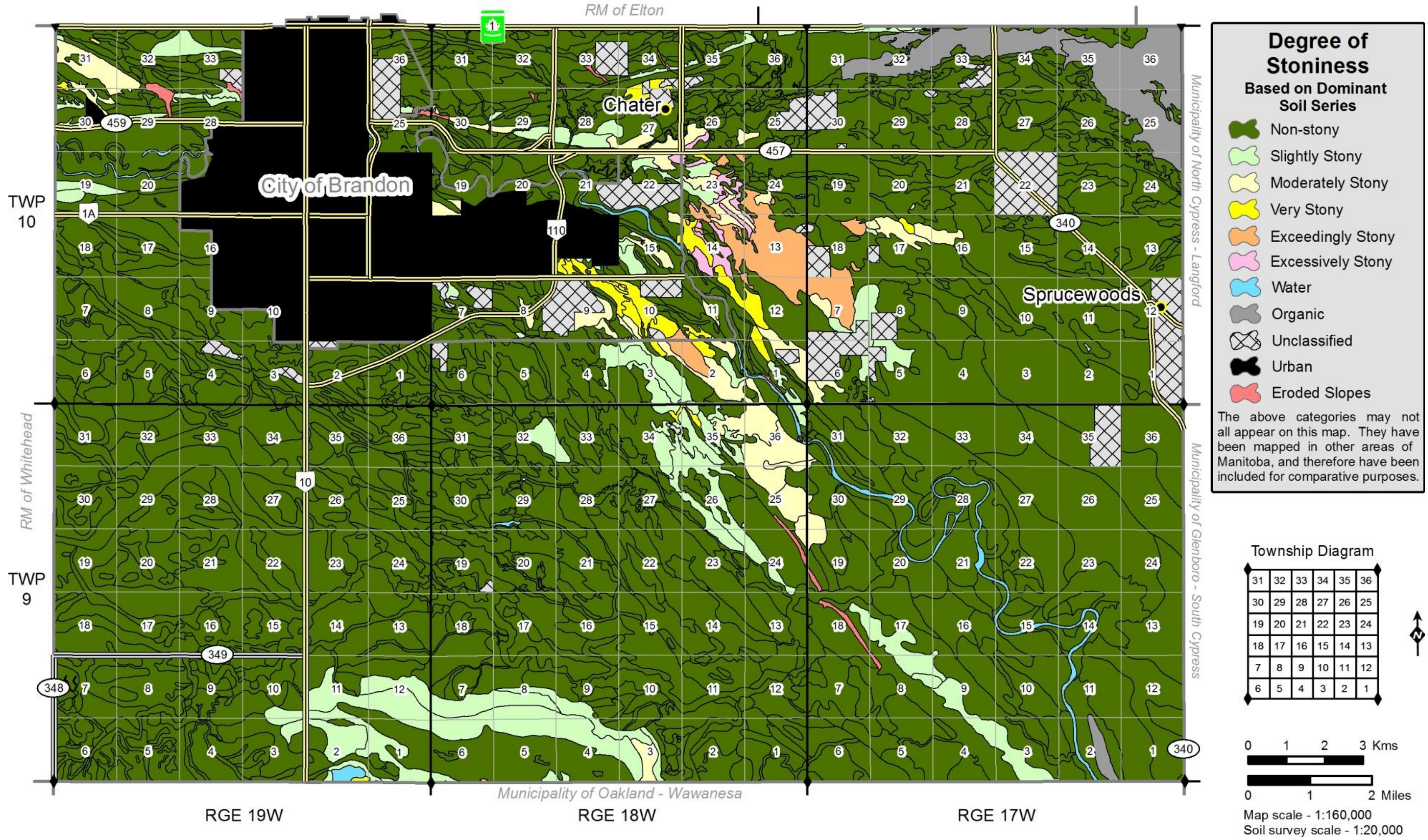
Lands in the RM of Cornwallis are not considered stony as approximately 76 percent of the lands fall into the non-stony category (Table 14). Slightly stony soils account only for roughly five percent of the study area.

The degree of stoniness shown on Map 8 is based on the dominant soil for each polygon. Most stony lands are located in southeastern Township 10 Range 18W, and the northeast corner of Township 9 Range 18W. The Brandon Hill area is a little bit stonier than around areas. Some previous stony fields have been improved because producers have kept removing stones from their fields since the early 1970s.

Table 14. Stoniness Classes in the RM of Cornwallis

Degree of Stoniness	Total area		% of RM
	ha	ac	
Non-stony	44,031	108,803	75.7
Slightly stony	2,776	6,859	4.77
Moderately stony	1,506	3,722	2.59
Very stony	544	1,345	0.94
Exceedingly stony	495	1,222	0.85
Excessively stony	147	364	0.25
Organic soil	1,242	3,068	2.14
Eroded slope, water, urban, & unclassified	7,408	18,306	12.7
Total	**58,149**	**143,689**	**100**

Map 8. Degree of Stoniness of the RM of Cornwallis



4.10 Soil 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 meter (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 is 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

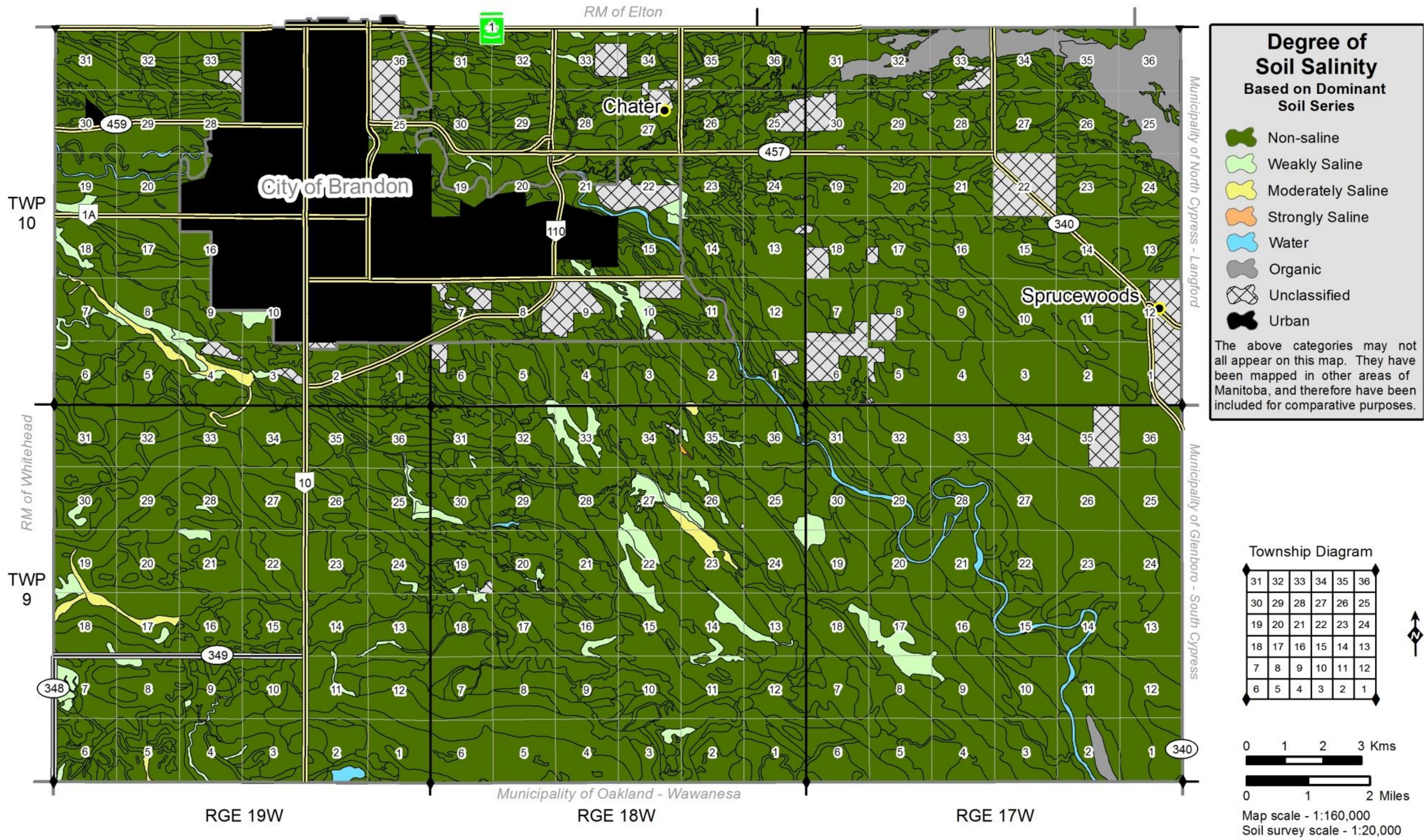
Note: mS/cm is equivalent to dS/m

Soil salinity is not a big problem for most soils in the RM of Cornwallis (Table 15). Saline soils account for approximately four percent. The class of salinity shown on Map 9 is based on the dominant soil for each polygon. It is indicated that weakly and moderately saline soils are scattered in all townships except Township 10 Range 17W where organic soils exist (Map 9).

Table 15. Soil Salinity Classes in the RM of Cornwallis

Class of Salinity	Total area		% of RM
	ha	ac	
Non-saline	47,187	116,600	81.1
Weakly saline	2,213	5,468	3.81
Moderately saline	211	521	0.36
Strongly saline	4	9	0.01
Organic soil	1,242	3,068	2.14
Water, urban & unclassified	7,293	18,022	12.5
Total	**58,149**	**143,689**	**100**

Map 9. Soil Salinity in the RM of Cornwallis



4.10.2 Soil organic carbon, pH and $CaCO_3$

Selected soil chemical properties are summarized based on 301 soil organic carbon, 299 soil pH and 128 soil carbonate calcium determinations. Soil organic carbon (SOC) in A horizon is affected by several factors. One of these factors is soil texture. Data analysis from 301 soil samples from A horizon shows that SOC increases when soil particles become finer under well-drained condition, except fine textured Janick soil (Table 16). For example, coarse-textured Stockton soil averaged 16.8 g per kg (or 1.68 percent) of SOC, while moderately coarse Prosser and medium-textured Fairland SOC increased to 26.6 and 34.5 g/kg, respectively. The difference of SOC content between medium and moderately fine textured soils is very small from the soils analyzed. A further study of this change pattern is needed.

Table 16. SOC in A horizon Affected by Soil Texture and drainage in the RM of Cornwallis

Drainage	Deep lacustrine soils		SOC
	Soil texture	Soil & Code	g/kg
Well	Coarse	Stockton (SCK)	16.8
	Mod. coarse	Prosser (PSE)	26.6
	Medium	Fairland (FND)	34.5
	Mod. fine	Ramada (RAM)	33.5
	Fine	Janick (JIK)	14.4
Imperfect	Coarse	Lavenham (LVH)	11.5
	Mod. coarse	Gateside (GTD)	29.5
	Medium	Torcan (TOC)	34.2
	Mod. fine	Charman (CXV)	39.2
	Fine	Harding (HRG)	31.6

Soil organic carbon changes under imperfect drainage condition follow a similar trend as those in well- or moderately well-drained condition (Table 16). Imperfectly drained soils usually result in higher SOC content. However, analysis data from the same parent material soils in the RM of Cornwallis did not show this trend in Gleyed Black Chernozem soil series. It does indicate in Gleyed Rego Black Chernozem soil series such as coarse-textured Hummerston soil (40.7 g/kg), moderately coarse-textured Pleasant soil (38.9 g/kg), medium-textured Taggart soil (40.0 g/kg) and fine-textured soil of Prodan (46.1 g/kg) (Table 17).

Soil pH in A horizon ranges from 6.39 to 8.16. Large variations are due to different chemical processes occurring in the A horizon. All carbonate is basically leached out from A horizon in well-drained Orthic Black Chernozems (Clementi, Croyon, Dorset, Janick, Miniota, and Ramada) (Table 17). Imperfectly drained Gleyed Black Chernozemic soils, regardless of soil texture, (Lavenham, Gateside, Torcan, Charman and Harding) also show less carbonate presented in A horizon.

Table 17. Soil Chemical Properties in A horizon from Selected Soils in the RM of Cornwallis

Soil name	Soil code	Organic C (g/kg)		Soil pH		Ca carbonate (g/kg)	
		#	Ave	#	Ave	#	Ave
Beresford	BSF	6	47.9	6	7.76	6	52.4
Cactus	CCS	2	14.4	2	6.97	1	86.0
Capell	CXT	7	48.5	7	7.57	6	103.0
Carroll	CXF	2	27.1	2	7.68	2	68.1
Carvey	CAV	3	61.8	3	8.10	3	134.0
Chambers	CBS	2	39.3	2	7.75	1	28.1
Charman	CXV	12	39.2	12	7.95	9	51.8
Chater	CXW	2	45.1	2	7.52	1	26.4
Clementi	CLN	4	47.1	4	6.80	1	0.0
Cobfield	CBF	2	38.4	2	7.77	2	10.1
Croyon	CYN	11	30.0	11	6.46	1	0.0
Dorset	DOT	6	33.2	6	6.90	1	0.0
Durnan	DRN	6	28.9	6	7.35	6	72.2
Fairland	FND	14	34.5	14	6.90	5	10.2
Gateside	GTD	6	29.5	6	7.34	4	38.8
Glenboro	GBO	11	24.1	11	7.16	2	39.8
Harding	HRG	2	31.6	2	7.30	1	154.0
Hummerston	HMO	3	40.7	3	7.87	3	61.4
Janick	JIK	2	17.9	2	6.54	1	0.0
Kilmury	KUY	2	29.5	2	7.50	1	21.5
Lavenham	LVH	3	11.5	3	7.33	2	17.7
Levine	LEI	2	44.0	2	7.35	1	147.0
Miniota	MXI	18	20.8	18	6.39	1	0.0
Petrel	PTR	3	39.8	3	8.05	3	11.6
Prodan	PDA	12	46.1	12	8.00	10	119.0
Pleasant	PLE	2	3.89	2	7.84	2	169.7
Prosser	PSE	8	26.6	8	6.84	5	0.0
Ramada	RAM	12	33.5	12	7.10	4	3.7
Rempel	RMP	2	37.0	2	7.29	2	0.0
Sigmund	SGO	3	30.3	3	8.16	3	123.3
Statley	SXB	3	71.0	3	6.89	1	75.3
Stewart	SWR	3	35.2	3	7.28	3	196.7
Stockton	SCK	6	16.8	6	6.98	1	78.2
Tadpole	TDP	6	85.6	5	8.03	4	120.7
Taggart	TGR	8	40.0	8	7.91	8	113.7
Torcan	TOC	5	34.2	5	8.11	6	79.4
Wellwood	WWD	2	24.8	2	6.85	1	21.0
Wheatland	WHL	82	16.4	81	6.42	2	32.9

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. To overcome these severe limitations, the removal of the limitation 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 18. 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 accumulative 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 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, aesthetic values, etc.

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. Due to 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 of A9 to A18 of Appendix 1.

Table 18. 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 consistence
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 droughty soils.The feasibility of many kinds of outdoor activities are 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 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 18. Guides for evaluating soil suitability for recreational uses are presented in Tables of 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 or 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 and/or low permeability:** This subclass is used for soils difficult to till, or 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 droughtiness 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 percent 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 restrict the range of crops or require 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 prac-tices 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 limitation[2] (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
Topography[3] (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 and/or Permeability (D)	Granular clay	Massive clay or till soils[4] Slow permeability	Solonetzic intergrades Very slow permeability	Black Solonetz Extremely slow permeability			
Salinity[5] (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
Inundation[7] (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
Erosion[10] (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 Characteristics[12] (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 g/cm^3) are rated 3D.

5 Soil Salinity is reported in DeciSiemens/metre (dS/m). Soil will be classed according the most saline depth. For example, if a soil is non-saline from 0-60 cm but moderately saline from 60 - 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 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 RM of Cornwallis

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Arizona (AIZ)	xcxx	5ME	3m Bt2	Fair	3	30.0	74.2	0.52
	xdxx	5ME	3m Ct2	Fair	4	55.2	136.4	0.95
	xxxx	5ME	3m A	Fair	3	63.6	157.1	1.09
Ashmore (AHO)	2f1x	5TE	2m Dt2	Poor	5	12.9	31.9	0.22
	xcxx	4M	2m A	Good	3	6.5	16.1	0.11
	xxxx	4M	2m A	Good	3	10.2	25.2	0.18
Assiniboine (ASB)	xbxx	3I	3kw Bi	Fair	5	88.4	218.4	1.52
	xcxx	3I	3kw Bt2i	Fair	5	106.9	264.1	1.84
	xxxx	3I	3kw Bi	Fair	5	529.2	1,307.7	9.10
Barager (BAA)	xxxx	4M	4gm A	Poor	5	27.6	68.1	0.47
Barren (BAE)	xdxx	4TE	2k Ct2	Fair	4	22.1	54.6	0.38
	xxxx	3E	2k A	Good	4	16.5	40.8	0.28
Basker (BKR)	xbxx	5IW	4w Ci	Poor	5	447.4	1,105.6	7.69
	xcxx	5IW	4w Ci	Poor	5	27.4	67.6	0.47
	xxxx	5IW	4w Ci	Poor	5	357.7	883.8	6.15
Beresford (BSF)	1cxx	2WT	3w Bt2	Fair	3	20.7	51.2	0.36
	xb1x	2W	3w A	Fair	4	38.3	94.7	0.66
	xb2x	2WP	3w A	Fair	5	57.2	141.4	0.98
	xbxs	3N	3sw A	Fair	4	87.0	215.1	1.50
	xbxx	2W	3w A	Fair	3	31.0	76.6	0.53
	xc1t	4N	4s Bt2	Poor	5	9.2	22.8	0.16
	xcxs	3N	3sw Bt2	Fair	4	32.1	79.4	0.55
	xcxx	2WT	3w Bt2	Fair	3	22.0	54.3	0.38
	xdxx	3T	3w Ct2	Fair	4	9.5	23.4	0.16
	xx1s	3N	3sw A	Fair	4	82.7	204.3	1.42
	xx1x	2W	3w A	Fair	4	45.8	113.1	0.79
	xxxs	3N	3sw A	Fair	4	19.7	48.7	0.34
	xxxx	2W	3w A	Fair	3	69.6	172.0	1.20
Bornett (BOR)	xbxx	5W	4w A	Poor	5	110.5	273.0	1.90
	xxxx	5W	4w A	Poor	5	166.1	410.5	2.86
Brownridge (BWD)	1cxx	4ME	1 Bt2	Good	3	28.1	69.4	0.48
	xdxx	4ME	1 Ct2	Fair	3	17.2	42.6	0.30
	xxxx	4ME	1 A	Excellent	3	13.8	34.0	0.24
Cactus (CCS)	1cxx	4M	2m Bt2	Good	2	45.6	112.6	0.78
	1dxx	4M	2m Ct2	Fair	4	88.3	218.1	1.52
	1xxx	4M	2m A	Good	2	9.9	24.5	0.17
	2cxx	4M	2m Bt2	Good	2	4.8	11.8	0.08
	2dxx	4M	2m Ct2	Fair	4	4.6	11.3	0.08
	xbxx	4M	2m A	Good	2	24.0	59.2	0.41
	xcxx	4M	2m Bt2	Good	2	86.6	214.1	1.49
	xxxx	4M	2m A	Good	2	93.2	230.3	1.60
Capell (CXT)	xb1x	2M	3w A	Fair	4	75.2	185.8	1.29
	xbxs	3N	3sw A	Fair	4	88.7	219.3	1.53

Table A2-2. Ag Capability and Irrigation Suitability of Soils with Different Phases

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Capell (CXT)	xbxx	2M	3w A	Fair	3	890.8	2201.3	15.32
	xc3x	3P	3w Bt2p	Fair	5	27.5	67.9	0.47
	xcxx	2MT	3w Bt2	Fair	3	27.3	67.4	0.47
	xx3x	3P	3w Bp	Fair	5	9.5	23.4	0.16
	xxxx	2M	3w A	Fair	3	1,314.1	3,247.2	22.60
Carroll (CXF)	1cxx	2T	2k Bt2	Good	2	141.4	349.3	2.43
	1dxx	3T	2k Ct2	Fair	4	31.4	77.7	0.54
	xbxx	2X	2k A	Good	2	19.0	46.9	0.33
	xcxx	2T	2k Bt2	Good	2	63.1	155.8	1.08
	xdxx	3T	2k Ct2	Fair	4	26.0	64.3	0.45
	xxxx	2X	2k A	Good	2	15.5	38.2	0.27
Carvey (CAV)	xb1x	5W	4w A	Poor	5	110.2	272.2	1.89
Carvey (CAV)	xbxs	5W	4w A	Poor	5	48.0	118.5	0.82
	xbxx	5W	4w A	Poor	5	295.0	728.9	5.07
	xx2x	5W	4w A	Poor	5	55.9	138.1	0.96
	xx3s	5W	4w Bp	Poor	5	93.7	231.5	1.61
	xxxs	5W	4w A	Poor	5	198.2	489.7	3.41
	xxxx	5W	4w A	Poor	5	886.6	2,190.8	15.25
Carvey, peaty (CAVp)	xxxx	6W	4w A	Poor	5	107.0	264.5	1.84
Chambers (CBS)	1c1x	2T	2kx Bt2	Good	4	2.9	7.1	0.05
	1dxx	3T	2kx Ct2	Fair	4	6.8	16.7	0.12
	1e1x	4T	2kx Ct2	Fair	5	17.2	42.4	0.30
	xbxx	2X	2kx A	Good	4	18.7	46.2	0.32
	xcxx	2T	2kx Bt2	Good	4	43.7	107.9	0.75
	xdxx	3T	2kx Ct2	Fair	4	2.8	6.9	0.05
	xxxx	2X	2kx A	Good	4	4.9	12.0	0.08
Charman (CXV)	xbxs	3N	3sw A	Fair	4	76.6	189.2	1.32
	xbxt	4N	4s Bt2	Poor	5	10.4	25.8	0.18
	xbxx	2W	3w A	Fair	3	54.9	135.7	0.94
	xcxs	3N	3sw Bt2	Fair	4	48.0	118.5	0.82
	xcxx	2WT	3w Bt2	Fair	3	12.4	30.6	0.21
	xxxx	2W	3w A	Fair	3	27.4	67.8	0.47
Chater (CXW)	1d1x	5M	4gm Ct2	Poor	5	5.7	14.1	0.10
	xx1x	5M	4gm A	Poor	5	61.6	152.1	1.06
	xxxx	5M	4gm A	Poor	5	8.0	19.8	0.14
Clementi (CLN)	1c1x	2T	2kx Bt2	Good	4	0.7	1.7	0.01
	1c2x	2TP	2kx Bt2	Good	5	6.0	14.9	0.10
	1cxx	2T	2kx Bt2	Good	4	5.9	14.7	0.10
	1dxx	3T	2kx Ct2	Fair	4	32.5	80.4	0.56
	2e1x	4TE	2kx Ct2	Fair	5	7.4	18.2	0.13
	xb1x	1	2kx A	Good	4	45.2	111.8	0.78
	xbxx	1	2kx A	Good	4	54.6	134.8	0.94
	xc1x	2T	2kx Bt2	Good	4	37.8	93.3	0.65
	xcxx	2T	2kx Bt2	Good	4	234.0	578.2	4.02

Table A2-3. Ag Capability and Irrigation Suitability of Soils with Different Phases

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Clementi (CLN)	xd1x	3T	2kx Ct2	Fair	4	14.6	36.0	0.25
	xd2x	3T	2kx Ct2	Fair	5	6.9	17.0	0.12
	xdxx	3T	2kx Ct2	Fair	4	6.3	15.5	0.11
	xe2x	4T	2kx Ct2	Fair	5	5.0	12.4	0.09
	xx1x	1	2kx A	Good	4	25.1	61.9	0.43
	xxxx	1	2kx A	Good	4	15.6	38.6	0.27
Cobfield (CBF)	xcxx	2WT	3w Bt2	Fair	4	65.1	160.9	1.12
	xd1x	3T	3w Ct2	Fair	4	4.0	9.9	0.07
	xxxx	2W	3w A	Fair	4	44.3	109.5	0.76
Cordova (CVA)	1e1x	4T	2kx Ct2	Fair	5	4.5	11.0	0.08
	1fxx	5T	2kx Dt2	Poor	5	55.6	137.5	0.96
	xcxx	2T	2kx Bt2	Good	4	9.0	22.3	0.16
	xe1x	4T	2kx Ct2	Fair	5	1.9	4.7	0.03
Crookdale (CKD)	xxxs	3N	3sw A	Fair	4	1.4	3.4	0.02
	xxxx	2W	3w A	Fair	3	41.7	103.1	0.72
Croyon (CYN)	1cxx	3M	2gm Bt2	Good	3	11.8	29.1	0.20
	2g4x	6TE	3m Dt2	Poor	5	0.3	0.8	0.01
	xb1x	3M	2gm A	Good	4	41.0	101.3	0.70
	xbxx	3M	2gm A	Good	3	632.6	1,563.2	10.88
	xc1x	3M	2gm Bt2	Good	4	44.2	109.2	0.76
	xc2x	3M	2gm Bt2	Good	5	13.6	33.7	0.23
	xcxx	3M	2gm Bt2	Good	3	868.0	2,144.9	14.93
	xdxx	3MT	2gm Ct2	Fair	4	95.0	234.8	1.63
	xx2x	3M	2gm A	Good	5	10.5	26.0	0.18
	xx3x	3MP	2gm Bp	Good	5	10.9	27.0	0.19
	xxxx	3M	2gm A	Good	3	58.8	145.3	1.01
Dexter (DXT)	xcxx	4M	4m Bt2	Poor	5	14.0	34.5	0.24
	xxxx	4M	4m A	Poor	5	3.4	8.4	0.06
Dorset (DOT)	1bxx	5M	4m A	Poor	5	9.4	23.2	0.16
	1c1x	5M	4m Bt2	Poor	5	1.1	2.8	0.02
	1c2x	5M	4m Bt2	Poor	5	6.9	17.0	0.12
	1cxx	5M	4m Bt2	Poor	5	28.5	70.4	0.49
	1dxx	5M	4m Ct2	Poor	5	2.3	5.7	0.04
	oc1x	5M	4m Bt2	Poor	5	15.3	37.7	0.26
	ocxx	5M	4m Bt2	Poor	5	26.3	65.0	0.45
	xb1x	5M	4m A	Poor	5	117.0	289.0	2.01
	xb2x	5M	4m Bt2	Poor	5	279.5	690.6	4.81
	xb3x	5M	4m Bp	Poor	5	36.1	89.1	0.62
	xb4x	5MP	4m Cp	Poor	5	7.4	18.2	0.13
	xbxx	5M	4m A	Poor	5	102.7	253.9	1.77
	xc1x	5M	4m Bt2	Poor	5	84.7	209.4	1.46
	xc2x	5M	4m Bt2	Poor	5	122.5	302.8	2.11
	xc3x	5M	4m Bt2p	Poor	5	137.2	339.0	2.36
	xc4x	5MP	4m Cp	Poor	5	366.9	906.6	6.31

Table A2-4. Ag Capability and Irrigation Suitability of Soils with Different Phases

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Dorset (DOT)	xc5x	6P	4m Dp	Poor	5	7.0	17.3	0.12
	xcxx	5M	4m Bt2	Poor	5	451.0	1,114.5	7.76
	xd1x	5M	4m Ct2	Poor	5	19.7	48.8	0.34
	xd2x	5M	4m Ct2	Poor	5	2.6	6.5	0.05
	xd4x	5MP	4m Ct2p	Poor	5	20.9	51.6	0.36
	xd5x	6P	4m Dp	Poor	5	110.8	273.9	1.91
	xdxx	5M	4m Ct2	Poor	5	131.2	324.2	2.26
	xx1x	5M	4m A	Poor	5	4.5	11.2	0.08
	xxxx	5M	4m A	Poor	5	66.7	164.8	1.15
Druxman (DXM)	xbxx	2M	3w A	Fair	3	201.4	497.6	3.46
	xc2x	2MT	3w Bt2	Fair	5	4.8	11.8	0.08
	xcxx	2MT	3w Bt2	Fair	3	11.1	27.4	0.19
	xx3x	3P	3w Bp	Fair	5	2.6	6.4	0.04
	xxxx	2M	3w A	Fair	3	40.6	100.4	0.70
Durnan (DRN)	1bxx	2X	1 A	Excellent	1	3.2	8.0	0.06
	1cxx	2T	1 Bt2	Good	1	42.3	104.6	0.73
	1dxx	3T	1 Ct2	Fair	4	90.2	222.9	1.55
	1xxx	2X	1 A	Excellent	2	26.9	66.4	0.46
	xcxx	2T	1 Bt2	Good	1	23.9	59.0	0.41
	xdxx	3T	1 Ct2	Fair	4	7.5	18.5	0.13
	xxxx	2X	1 A	Excellent	1	18.0	44.5	0.31
Fairland (FND)	1cxx	2T	1 Bt2	Good	1	207.6	513.0	3.57
	1dxx	3T	1 Ct2	Fair	4	42.3	104.5	0.73
	1xxx	1	1 A	Excellent	1	3.3	8.1	0.06
	2dxx	3TE	1 Ct2	Fair	4	64.5	159.4	1.11
	2exx	4TE	1 Ct2	Fair	5	8.1	20.0	0.14
	3cxx	3E	2m Bt2	Good	2	1.4	3.4	0.02
	3exx	5TE	2m Ct2	Fair	5	6.4	15.9	0.11
	odxx	3T	1 Ct2	Fair	4	17.6	43.6	0.30
	xbxx	1	1 A	Excellent	1	812.2	2,007.1	13.97
	xcxx	2T	1 Bt2	Good	1	782.8	1,934.3	13.46
	xdxx	3T	1 Ct2	Fair	4	25.7	63.5	0.44
	xxxx	1	1 A	Excellent	1	141.3	349.1	2.43
Forrest (FRT)	xc2s	3N	4k Bt2	Poor	5	8.8	21.7	0.15
	xxxx	2W	4k A	Poor	5	0.6	1.6	0.01
Gateside (GTD)	xbxs	3N	3s A	Fair	4	19.2	47.4	0.33
	xbxx	2M	2w A	Good	3	173.0	427.4	2.97
	xcxs	3N	3s Bt2	Fair	4	85.1	210.3	1.46
	xcxx	2MT	2w Bt2	Good	3	41.2	101.7	0.71
	xxxx	2M	2w A	Good	3	151.5	374.4	2.61
Gendzel (GDZ)	xbxx	4M	3mw A	Fair	3	193.1	477.1	3.32
	xcxx	4M	3mw Bt2	Fair	3	18.8	46.4	0.32
	xxxx	4M	3mw A	Fair	3	129.9	321.0	2.23
Glenboro (GBO)	1cxx	2MT	1 Bt2	Good	1	55.6	137.3	0.96

Table A2-5. Ag Capability and Irrigation Suitability of Soils with Different Phases

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Glenboro (GBO)	1dxx	3T	1 Ct2	Fair	4	7.5	18.6	0.13
	2exx	4TE	2m Ct2	Fair	5	32.5	80.2	0.56
	ocxx	2MT	1 Bt2	Good	1	36.6	90.4	0.63
	xbxx	2M	1 A	Excellent	1	127.2	314.3	2.19
	xcxx	2MT	1 Bt2	Good	1	120.2	296.9	2.07
	xxxx	2M	1 A	Excellent	1	6.0	14.9	0.10
Grayson (GYS)	xbxs	5W	4w A	Poor	5	6.6	16.4	0.11
	xbxx	5W	4w A	Poor	5	28.3	70.0	0.49
	xxxx	5W	4w A	Poor	5	68.4	169.0	1.18
Grover (GRO)	xbxx	2W	2w A	Good	3	15.3	37.9	0.26
	xcxx	2WT	2w Bt2	Good	3	44.9	111.0	0.77
	xxxx	2W	2w A	Good	3	27.8	68.7	0.48
Hallboro (HAL)	xcxx	3M	2m Bt2	Good	2	2.0	5.0	0.03
Harding (HRG)	xb3x	3P	4kx Bp	Poor	5	30.8	76.2	0.53
	xbxx	2W	4kx A	Poor	5	8.6	21.3	0.15
	xxxx	2W	4kx A	Poor	5	82.4	203.7	1.42
Hickson (HKS)	xcxx	5W	4w Bt2	Poor	5	11.8	29.1	0.20
	xxxx	5W	4w A	Poor	5	5.7	14.0	0.10
Hughes (HGH)	xbxx	4M	3mw A	Fair	3	106.6	263.3	1.83
	xcxx	4M	3mw Bt2	Fair	3	69.0	170.6	1.19
	xxxx	4M	3mw A	Fair	3	68.0	168.0	1.17
Hummerston (HMO)	1cxx	3MW	2mw Bt2	Good	3	24.7	61.1	0.43
	xbxx	3MW	2mw A	Good	3	63.8	157.7	1.10
	xcxs	3MN	3s Bt2	Fair	4	27.1	66.9	0.47
	xcxx	3MW	2mw Bt2	Good	3	47.6	117.7	0.82
	xxxs	3NW	3s A	Fair	4	76.6	189.2	1.32
	xxxx	3MW	2mw A	Good	3	379.0	936.6	6.52
Janick (JIK)	xbxx	1	4kx A	Poor	5	4.0	9.9	0.07
	xcxx	2T	4kx Bt2	Poor	5	7.7	19.1	0.13
	xxxx	1	4kx A	Poor	5	8.1	20.1	0.14
Jaymar (JAY)	1c2x	3M	2m Bt2	Good	5	13.7	33.9	0.24
	xb1x	3M	2m A	Good	4	28.6	70.7	0.49
	xb2x	3M	2m A	Good	5	172.0	425.1	2.96
	xbxx	3M	2m A	Good	4	11.9	29.5	0.21
	xc1x	3M	2m Bt2	Good	4	34.0	84.1	0.59
	xc2x	3M	2m Bt2	Good	5	19.3	47.7	0.33
	xc4x	4P	2m Cp	Fair	5	23.0	56.8	0.40
	xcxx	3M	2m Bt2	Good	4	26.0	64.2	0.45
	xd5x	6P	2m Dp	Poor	5	29.5	72.9	0.51
Kerran (KRN)	xxxx	5IW	4kw Ci	Poor	5	181.3	448.1	3.12
Killeen (KLL)	xcxs	3N	3s Bt2	Fair	4	4.1	10.2	0.07
	xxxx	2M	3w A	Fair	4	4.0	9.8	0.07
Kilmury (KUY)	xb1x	3M	2mw A	Good	4	13.7	33.9	0.24
	xbxx	3M	2mw A	Good	3	57.3	141.6	0.99

Table A2-6. Ag Capability and Irrigation Suitability of Soils with Different Phases

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Kilmury (KUY)	xcxx	3M	2mw Bt2	Good	3	45.6	112.7	0.78
	xxxx	3M	2mw A	Good	3	238.9	590.3	4.11
Kirkness (KKS)	1cxx	3M	2mx Bt2	Good	4	9.6	23.7	0.16
	xcxx	3M	2mx Bt2	Good	4	19.5	48.2	0.34
Kleysen (KYS)	1d1x	3T	2kx Ct2	Fair	4	18.0	44.4	0.31
	1dxx	3T	2kx Ct2	Fair	4	37.0	91.4	0.64
	xcxx	2T	2kx Bt2	Good	4	64.1	158.4	1.10
Knolls (KLS)	1cxx	3E	2m Bt2	Good	3	21.1	52.2	0.36
	1xxx	3E	2m A	Good	3	0.6	1.4	0.01
	xcxx	3E	2m Bt2	Good	3	51.3	126.8	0.88
	xdxx	3TE	2m Ct2	Fair	3	13.4	33.2	0.23
Lavenham (LVH)	xbxx	3MW	2mw A	Good	3	429.4	1,061.0	7.38
	xcxx	3MW	2mw Bt2	Good	3	79.8	197.2	1.37
	xxxt	4N	4s A	Poor	5	40.5	100.0	0.70
	xxxx	3MW	2mw A	Good	3	145.7	360.1	2.51
Levine (LEI)	xbxx	3I	3w Bi	Fair	3	306.8	758.1	5.28
	xcxx	3I	3w Bt2i	Fair	3	745.6	1,842.4	12.82
	xxxx	3I	3w Bi	Fair	3	315.6	779.9	5.43
Lindstrom (LDM)	xxxs	3N	3sw A	Fair	4	21.6	53.4	0.37
	xxxx	2W	3wx A	Fair	4	11.9	29.4	0.20
Lockhart (LKH)	1dxx	3T	2x Ct2	Fair	4	7.2	17.7	0.12
	1fxx	5T	2x Dt2	Poor	5	4.9	12.1	0.08
	xbxx	2M	2x A	Good	4	9.8	24.2	0.17
	xdxx	3T	2x Ct2	Fair	4	4.9	12.1	0.08
Lonery (LOE)	xxxs	5W	4w A	Poor	5	3.0	7.3	0.05
	xxxx	5W	4w A	Poor	5	3.1	7.6	0.05
Lowroy (LOW)	xcxx	5W	4w Bt2	Poor	5	86.8	214.6	1.49
	xxxx	5W	4w A	Poor	5	27.8	68.7	0.48
Lowton (LWN)	xxxx	5W	4kw A	Poor	5	11.9	29.3	0.20
Mansfield (MFI)	xbxx	4M	4m A	Poor	5	6.0	14.9	0.10
	xxxx	4M	4m A	Poor	5	4.2	10.4	0.07
Manson (MXD)	xcxx	2IT	3kx Bt2	Fair	5	66.9	165.4	1.15
	xxxx	2I	3kx A	Fair	5	26.6	65.8	0.46
Marringhurst (MRH)	2exx	5ME	4m Ct2	Poor	5	11.5	28.5	0.20
	2g4x	6TE	4m Dt2	Poor	5	1.3	3.2	0.02
	xbxx	5M	4m A	Poor	5	234.9	580.4	4.04
	xc1x	5M	4m Bt2	Poor	5	46.0	113.7	0.79
	xc2x	5M	4m Bt2	Poor	5	85.4	211.1	1.47
	xc3x	5M	4m Bt2p	Poor	5	7.5	18.5	0.13
	xcxx	5M	4m Bt2	Poor	5	142.1	351.1	2.44
	xd3x	5M	4m Ct2	Poor	5	8.7	21.6	0.15
	xd4x	5MP	4m Ct2p	Poor	5	62.0	153.2	1.07
	xdxx	5M	4m Ct2	Poor	5	61.1	151.1	1.05
	xx2x	5M	4m A	Poor	5	19.1	47.2	0.33

Table A2-7. Ag Capability and Irrigation Suitability of Soils with Different Phases

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Marringhurst (MRH)	xxxx	5M	4m A	Poor	5	188.7	466.3	3.25
Marsden (MDN)	xb1x	5W	4w A	Poor	5	60.3	149.0	1.04
	xb3x	5W	4w Bp	Poor	5	14.5	35.9	0.25
	xbxs	5W	4w A	Poor	5	9.2	22.8	0.16
	xbxx	5W	4w A	Poor	5	41.5	102.5	0.71
	xcxx	5W	4w Bt2	Poor	5	12.5	30.8	0.21
	xx1s	5W	4w A	Poor	5	17.4	42.9	0.30
	xx1x	5W	4w A	Poor	5	66.2	163.5	1.14
	xxxs	5W	4w A	Poor	5	33.3	82.2	0.57
	xxxx	5W	4w A	Poor	5	264.8	654.4	4.55
Melland (MXT)	xb1x	2M	3w A	Fair	4	126.8	313.3	2.18
	xb2x	2MP	3w A	Fair	5	140.7	347.7	2.42
	xb3x	3P	3w Bp	Fair	5	3.6	8.8	0.06
	xbxs	3N	3sw A	Fair	4	13.7	33.8	0.24
	xbxx	2M	3w A	Fair	4	32.3	79.8	0.56
	xc1x	2MT	3w Bt2	Fair	4	2.8	6.9	0.05
	xc2x	2MT	3w Bt2	Fair	5	3.4	8.5	0.06
	xc4x	4P	3w Cp	Fair	5	12.9	31.8	0.22
	xcxx	2MT	3w Bt2	Fair	4	52.8	130.4	0.91
	xx1x	2M	3w A	Fair	4	180.8	446.7	3.11
	xx2s	3N	3sw A	Fair	5	40.5	100.2	0.70
	xx2x	2MP	3w A	Fair	5	35.3	87.2	0.61
	xxxs	3N	3sw A	Fair	4	23.4	57.7	0.40
	xxxx	2M	3w A	Fair	4	74.2	183.4	1.28
Miniota (MXI)	1bxx	4M	2m A	Good	3	1.9	4.8	0.03
	1cxx	4M	2m Bt2	Good	3	79.8	197.2	1.37
	3dxx	5ME	3m Ct2	Fair	4	22.3	55.2	0.38
	xb2x	4M	2m A	Good	5	11.9	29.3	0.20
	xbxx	4M	2m A	Good	3	964.0	2,382.2	16.58
	xc3x	4M	2m Bt2p	Good	5	11.0	27.3	0.19
	xcxx	4M	2m Bt2	Good	3	702.1	1,735.0	12.07
	xd1x	4M	2m Ct2	Fair	4	32.1	79.4	0.55
	xdxx	4M	2m Ct2	Fair	4	58.3	144.0	1.00
	xx2x	4M	2m A	Good	5	84.7	209.2	1.46
	xxxx	4M	2m A	Good	3	102.7	253.7	1.77
Mowbray (MOW)	xbxx	2I	2k A	Good	1	60.1	148.4	1.03
	xcxx	2IT	2k Bt2	Good	1	68.3	168.7	1.17
	xdxx	3T	2k Ct2	Fair	4	16.8	41.5	0.29
Newdale (NDL)	1b1x	2X	2kx A	Good	5	3.0	7.4	0.05
	1c1x	2T	2kx Bt2	Good	4	3.0	7.3	0.05
	1d1x	3T	2kx Ct2	Fair	4	5.6	13.8	0.10
	2c1x	2TE	2kx Bt2	Good	4	3.6	9.0	0.06
	xc1x	2T	2kx Bt2	Good	4	1.6	4.0	0.03
Oberon (OBR)	xbxx	2W	3w A	Fair	3	10.8	26.6	0.19

Table A2-8. Ag Capability and Irrigation Suitability of Soils with Different Phases

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Oberon (OBR)	xxxx	2W	3w A	Fair	3	5.3	13.1	0.09
Onahan (ONH)	xbxx	4M	2mw A	Good	3	11.8	29.2	0.20
Perillo (PER)	xxxx	O3W	0 A	Organic	5	733.2	1,811.7	12.61
Petrel (PTR)	xbxs	3N	3s A	Fair	4	80.7	199.4	1.39
	xbxx	2W	2w A	Good	3	38.4	94.9	0.66
	xcxs	3N	3s Bt2	Fair	4	12.4	30.7	0.21
	xxxx	2W	2w A	Good	3	2.3	5.6	0.04
Pleasant (PLE)	1cxx	2MT	2w Bt2	Good	3	33.6	83.1	0.58
	xbxs	3N	3s A	Fair	4	58.5	144.6	1.01
	xbxx	2M	2w A	Good	3	99.6	246.0	1.71
	xcxs	3N	3s Bt2	Fair	4	24.6	60.9	0.42
	xcxx	2MT	2w Bt2	Good	3	45.0	111.1	0.77
	xxxs	3N	3s A	Fair	4	96.1	237.4	1.65
	xxxx	2M	2w A	Good	3	171.7	424.3	2.95
Poolex (POX)	xxxs	5W	4w A	Poor	5	9.3	23.1	0.16
	xxxx	5W	4w A	Poor	5	31.4	77.7	0.54
	1cxx	3M	1 Bt2	Good	1	9.0	22.2	0.15
	1dxx	3MT	1 Ct2	Fair	4	49.2	121.5	0.85
	1xxx	3M	1 A	Excellent	1	22.7	56.1	0.39
	xxxx	3M	1 A	Excellent	1	12.0	29.6	0.21
Prodan (PDA)	xbxs	3N	3sw A	Fair	4	204.7	505.9	3.52
	xbxx	2W	3w A	Fair	3	204.0	504.0	3.51
	xcxs	3N	3sw Bt2	Fair	4	22.5	55.5	0.39
	xcxx	2WT	3w Bt2	Fair	3	167.8	414.6	2.89
	xdxx	3T	3w Ct2	Fair	4	15.4	38.0	0.26
	xxxs	3N	3sw A	Fair	4	24.9	61.6	0.43
	xxxt	4N	4s A	Poor	5	7.2	17.8	0.12
	xxxx	2W	3w A	Fair	3	534.7	1,321.2	9.19
Prosser (PSE)	1dxx	3MT	1 Ct2	Fair	4	7.5	18.5	0.13
	xbxx	3M	1 A	Excellent	1	216.6	535.3	3.73
	xcxx	3M	1 Bt2	Good	1	123.4	304.9	2.12
	xdxx	3MT	1 Ct2	Fair	4	21.0	52.0	0.36
	xxxx	3M	1 A	Excellent	1	227.8	562.9	3.92
Ramada (RAM)	1cxx	2T	2k Bt2	Good	2	248.4	613.8	4.27
	1dxx	3T	2k Ct2	Fair	4	177.7	439.0	3.06
	1exx	4T	2k Ct2	Fair	5	40.1	99.1	0.69
	2dxx	3TE	2k Ct2	Fair	4	75.7	187.0	1.30
	3exx	5TE	2k Ct2	Fair	5	8.6	21.3	0.15
	xbxx	1	2k A	Good	2	712.2	1,759.8	12.25
	xcxx	2T	2k Bt2	Good	2	690.0	1,705.0	11.87
	xdxx	3T	2k Ct2	Fair	4	89.6	221.5	1.54
	xxxx	1	2k A	Good	2	61.0	150.8	1.05
Rempel (RMP)	xcxx	2T	2k Bt2	Good	2	11.9	29.5	0.21
Roddan (ROD)	xcxx	3E	2kx Bt2	Good	4	7.9	19.6	0.14

Table A2-9. Ag Capability and Irrigation Suitability of Soils with Different Phases

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Rufford (RUF)	1c1x	2T	2kx Bt2	Good	4	0.6	1.4	0.01
	1d1x	3T	2kx Ct2	Fair	4	5.4	13.4	0.09
	1e1x	4T	2kx Ct2	Fair	5	5.5	13.6	0.09
	1e2x	4T	2kx Ct2	Fair	5	3.2	7.8	0.05
	1f1x	5T	2kx Dt2	Poor	5	7.9	19.5	0.14
	1fxx	5T	2kx Dt2	Poor	5	11.5	28.3	0.20
	2d1x	3TE	2kx Ct2	Fair	4	44.6	110.2	0.77
	2e2x	4TE	2kx Ct2	Fair	5	17.5	43.2	0.30
	2exx	4TE	2kx Ct2	Fair	5	25.2	62.3	0.43
	2fxx	5TE	2kx Dt2	Poor	5	37.1	91.7	0.64
	2g1x	6TE	2kx Dt2	Poor	5	21.4	52.9	0.37
Sewell (SEE)	xbxx	5W	4w A	Poor	5	259.6	641.4	4.46
	xxxt	5W	4sw A	Poor	5	16.1	39.7	0.28
	xxxx	5W	4w A	Poor	5	188.6	466.1	3.24
Shilox (SHX)	xbxx	6M	3m A	Fair	3	1.0	2.5	0.02
	xcxx	6M	3m Bt2	Fair	3	130.1	321.6	2.24
	xdxx	6M	3m Ct2	Fair	4	96.9	239.4	1.67
	xexx	6M	3m Ct2	Fair	5	1.9	4.6	0.03
Sigmund (SGO)	xbxs	3N	4kx A	Poor	5	49.7	122.8	0.85
	xbxx	2W	4kx A	Poor	5	110.8	273.7	1.90
	xxxs	3N	4kx A	Poor	5	12.1	30.0	0.21
	xxxx	2W	4kx A	Poor	5	190.3	470.2	3.27
Statley (SXB)	1d1x	3T	2kx Ct2	Fair	4	40.6	100.4	0.70
	1dxx	3T	2kx Ct2	Fair	4	12.3	30.4	0.21
	1e1x	4T	2kx Ct2	Fair	5	16.6	41.0	0.29
	1exx	4T	2kx Ct2	Fair	5	32.1	79.4	0.55
	1f1x	5T	2kx Dt2	Poor	5	127.6	315.3	2.19
	2dxx	3TE	2kx Ct2	Fair	4	27.6	68.1	0.47
	2g2x	6TE	2kx Dt2	Poor	5	30.3	74.8	0.52
	xc1x	2T	2kx Bt2	Good	4	89.8	222.0	1.54
	xe2x	4T	2kx Ct2	Fair	5	400.2	989.0	6.88
	xf1x	5T	2kx Dt2	Poor	5	433.1	1,070.2	7.45
Stewart (SWR)	1cxx	2T	2kx Bt2	Good	4	12.3	30.4	0.21
	1d1x	3T	2kx Ct2	Fair	4	20.0	49.5	0.34
	1d2x	3T	2kx Ct2	Fair	5	28.7	70.9	0.49
	1dxx	3T	2kx Ct2	Fair	4	62.8	155.3	1.08
	1e1x	4T	2kx Ct2	Fair	5	53.9	133.2	0.93
	1f1x	5T	2kx Dt2	Poor	5	168.2	415.6	2.89
	1f2x	5T	2kx Dt2	Poor	5	133.4	329.7	2.29
	2dxx	3TE	2kx Ct2	Fair	4	21.4	52.9	0.37
	2exx	4TE	2kx Ct2	Fair	5	20.0	49.3	0.34
	2g1x	6TE	2kx Dt2	Poor	5	61.0	150.8	1.05
	2g2x	6TE	2kx Dt2	Poor	5	85.1	210.2	1.46
	xd3x	3TP	2kx Ct2	Fair	5	4.2	10.3	0.07

Table A2-10. Ag Capability and Irrigation Suitability of Soils with Different Phases

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Stockton (SCK)	1cxx	4M	2m Bt2	Good	2	357.1	882.3	6.14
	1dxx	4M	2m Ct2	Fair	4	164.1	405.6	2.82
	2cxx	4ME	2m Bt2	Good	2	21.7	53.6	0.37
	3dxx	5ME	2m Ct2	Fair	4	2.2	5.5	0.04
	ocxx	4M	2m Bt2	Good	2	15.5	38.2	0.27
	odxx	4M	2m Ct2	Fair	4	21.4	52.8	0.37
	xbxx	4M	2m A	Good	2	631.6	1,560.7	10.86
	xcxx	4M	2m Bt2	Good	2	721.2	1,782.2	12.40
	xdxx	4M	2m Ct2	Fair	4	31.8	78.5	0.55
	xxxx	4M	2m A	Good	2	509.2	1,258.2	8.76
Sutton (SXP)	xxxx	5W	4w A	Poor	5	25.4	62.7	0.44
Tadpole (TDP)	xbxs	5W	4w A	Poor	5	76.9	190.1	1.32
	xbxt	5W	4sw A	Poor	5	34.4	85.1	0.59
	xbxx	5W	4w A	Poor	5	90.5	223.6	1.56
	xcxs	5W	4w Bt2	Poor	5	4.7	11.7	0.08
	xxxs	5W	4w A	Poor	5	23.8	58.7	0.41
	xxxx	5W	4w A	Poor	5	167.9	414.8	2.89
Taggart (TGR)	xbxx	2W	2w A	Good	3	190.5	470.7	3.28
	xcxs	3N	3s Bt2	Fair	4	13.1	32.4	0.23
	xcxx	2WT	2w Bt2	Good	3	77.8	192.3	1.34
	xxxs	3N	3s A	Fair	4	99.9	246.9	1.72
	xxxx	2W	2w A	Good	3	199.0	491.7	3.42
Torcan (TOC)	xbxx	2W	2w A	Good	3	291.0	719.1	5.00
	xcxs	3N	3s Bt2	Fair	4	41.2	101.7	0.71
	xcxx	2WT	2w Bt2	Good	3	220.9	545.9	3.80
	xxxx	2W	2w A	Good	3	64.9	160.4	1.12
Traverse (TAV)	1cxx	2T	1 Bt2	Good	1	24.3	60.0	0.42
	xbxx	1	1 A	Excellent	1	193.0	476.8	3.32
	xcxx	2T	1 Bt2	Good	1	49.0	121.0	0.84
	xdxx	3T	1 Ct2	Fair	4	41.4	102.3	0.71
Vodroff (VFF)	xb1u	6NW	4sw A	Poor	5	3.7	9.2	0.06
	xb1x	5W	4w A	Poor	5	36.7	90.7	0.63
	xbxx	5W	4w A	Poor	5	87.0	214.9	1.50
	xcxx	5W	4w Bt2	Poor	5	4.2	10.5	0.07
	xx1x	5W	4w A	Poor	5	5.5	13.7	0.10
	xxxt	5W	4sw A	Poor	5	1.6	3.9	0.03
	xxxx	5W	4w A	Poor	5	13.3	32.9	0.23
Vordas (VDS)	xbxs	5W	4w A	Poor	5	9.4	23.2	0.16
	xxxs	5W	4w A	Poor	5	182.5	450.9	3.14
	xxxt	5W	4sw A	Poor	5	91.5	226.2	1.57
	xxxx	5W	4w A	Poor	5	83.2	205.7	1.43
Wellwood (WWD)	3dxx	4TE	2k Ct2	Fair	4	32.4	80.1	0.56
	3exx	5TE	2k Ct2	Fair	5	13.0	32.2	0.22
	xbxx	1	2k A	Good	2	67.7	167.2	1.16

Table A2-11. Ag Capability and Irrigation Suitability of Soils with Different Phases

Soil name (Soil code)	Soil phase	Agriculture capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Wellwood (WWD)	xcxx	2T	2k Bt2	Good	2	13.4	33.0	0.23
	xdxx	3T	2k Ct2	Fair	4	1.4	3.5	0.02
Wesley (WEL)	xc1x	2WT	3w Bt2	Fair	4	3.4	8.3	0.06
	xd2x	3T	3w Ct2	Fair	5	1.8	4.4	0.03
Wheatland (WHL)	1bxx	5M	3m A	Fair	4	101.5	250.8	1.75
	1c1x	5M	3m Bt2	Fair	4	0.3	0.7	0.005
	1cxx	5M	3m Bt2	Fair	4	1,242.9	3,071.2	21.37
	1dxx	5M	3m Ct2	Fair	4	191.7	473.7	3.30
	2bxx	5ME	3m A	Fair	4	39.6	97.8	0.68
	2cxx	5ME	3m Bt2	Fair	4	171.8	424.6	2.95
	2dxx	5ME	3m Ct2	Fair	4	30.3	74.8	0.52
	2exx	5ME	3m Ct2	Fair	5	2.5	6.1	0.04
	obxx	5M	3m A	Fair	4	104.2	257.4	1.79
	ocxx	5M	3m Bt2	Fair	4	124.8	308.5	2.15
	xbxx	5M	3m A	Fair	4	4,728.7	11,684.9	81.32
	xcxx	5M	3m Bt2	Fair	4	3,705.4	9,156.2	63.72
	xdxx	5M	3m Ct2	Fair	4	116.7	288.3	2.01
	xxxx	5M	3m A	Fair	4	197.3	487.5	3.39
Woodfield (WDF)	1d1x	3T	2kx Ct2	Fair	4	8.6	21.2	0.15
	1dxx	3T	2kx Ct2	Fair	4	8.5	21.1	0.15
	1e1x	4T	2kx Ct2	Fair	5	47.8	118.0	0.82
	1e3x	4T	2kx Ct2	Fair	5	133.4	329.7	2.29
	2g3x	6TE	2kx Dt2	Poor	5	13.0	32.1	0.22
Wytonville (WVI)	xbxx	3M	2mw A	Good	3	32.1	79.2	0.55
	xxxx	3M	2mw A	Good	3	4.9	12.0	0.08
Xavier (XVI)	xxxx	O3W	0 A	Organic	5	508.6	1,256.7	8.75
Eroded Slope Complex ($ER)	1dxx	6E	4m Ct2	Poor	5	10.2	25.1	0.17
	2dxx	6E	4m Ct2	Poor	5	2.0	4.9	0.03
	2exx	6E	4m Ct2	Poor	5	81.7	201.8	1.40
	2fxx	6E	4m Dt2	Poor	5	20.9	51.6	0.36
Marsh ($MH)	xxxx	7W	4wx Di	Poor	5	93.1	230.1	1.60
Unclassified land ($UL)		-	-	-	-	1,994.4	4,928.2	34.30
Urban land ($UR)		-	-	-	-	4,917.4	12,151.2	84.57
Water ($ZZ)		-	-	-	-	380.9	941.3	6.55
Total						**58,149**	**143,689**	**1000**

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** **2A** **2B**	Slight soil and/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.
Fair	**1C** **2C** **3A** **3B** **3C**	Moderate soil and/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.
Poor	**1D** **2D** **3D** **4A** **4B** **4C** **4D**	Severe soil and/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.

Table A4. Landscape Features Affecting Irrigation Suitability

Symbol	Landscape Features	Degree of Limitation			
		None (A)	**Slight (B)**	**Moderate (C)**	**Severe (D)**
t1	Slope - Simple %	<2	2 - 9	> 9 - 20	>20
t2	- Complex %	<5		> 5 - 15	>15
E	Relief (m) (Average Local)	<1	1 - 3	> 3 - 5	>5
P	Stoniness -Classes -Cover (%)	0, 1 & 2 (0 to 3%)	3 (> 3 to 15%)	4 (> 15 to 50%)	5 (>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) (% by volume) Subarid (mm/1.2 m) (% by volume)	> 120 (> 10) > 150 (> 12)	120 - 100 (10 - 8) 150 - 120 (12 - 10)	< 100 - 75 (< 8 - 6) < 120 - 100 (< 10 - 8)	< 75 (< 6) < 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 0.6 - 1.2 m depth 1.2 - 3 m depth	 < 2 < 4 < 8	 2 - 4 4 - 8 8 - 16	 > 4 - 8 > 8 - 16 > 16	 > 8 > 16 > 16
n	Sodicity (SAR) 0 - 1.2 m depth 1.2 - 3 m depth	 < 6 < 6	 6 - 9 6 - 9	 > 9 - 12 > 9 - 12	 > 12 > 12
g	Geological (0 - 1.2 m) Uniformity (1.2 – 3 m)	1 Textural Group 2 Textural Groups	2 Textural Groups Coarser below 3 Textural Groups Coarser below	2 Textural Groups Finer below 3 Textural Groups Coarser below 3 Textural Groups Finer 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 %	> 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
Topography[1] (Slope)	0 - 5% (a, b, c)			> 5 - 9% (d)	> 9% (e, f, g, h, i, j)
Stoniness[2] Class	-			St. 1	St. 2, 3, 4, 5
Salinity[3] (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)**	**Salinity[3]**	**(mS/cm)**
< 5 %	level to very gently sloping	- non-stony	< 0.01 %	very low	0 - 2
5 - 9 %	gently sloping	1 slightly stony	0.01 - 0.1 %	low	> 2 - 4
> 9 %	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, 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 A7. Guidelines for Assessing Land Suitability for Irrigated Potato Production under Imperfectly, Poorly and Very Poorly 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/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 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%	> 5 - 9%	> 9%
Stoniness[2] Class				St. 1	St. 2, 3, 4, 5
Salinity[3] (mS/cm)			< 4	4 - 8	> 8
Soil Order and / or Subgroup					Organic Order, Gleysolic Order, Solonetzic Order, Solonetzic Subgroups

Topography[1]		**Stoniness[2]**	**(Surface covered)**		**Salinity[3]**	**(mS/cm)**
< 5 %	level to very gently sloping	-	non-stony	< 0.01 %	very low	0 - 2
5 - 9 %	gently sloping	1	slightly stony	0.01 - 0.1 %	low	> 2 - 4
> 9 %	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, 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 A8-1. 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										
Arizona	AIZ	xcxx	Vb	Fa	G	G	G	G	Vks	Vk	Pq	Vkg	Gg	Fst	Fms	Fs	Ps
		xdxx	Vb	Fa	G	G	G	G	Vks	Vk	Pq	Vkg	Gg	Pt	Fms	Fs	Ps
		xxxx	Vb	Fa	G	G	G	G	Vks	Vk	Pq	Vkg	Gg	Fms	Fms	Fs	Ps
Ashmore	AHO	2f1x	Vbt	Faq	Ft	Pt	Pt	Pt	Vks	Vkg	Pqt	Vkt	Ptg	Vt	Pt	Pt	Fst
		xcxx, xxxx	Fb	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Fq	Fms	G	G
Assiniboine	ASB	xbxx, xcxx xxxx	Ps	Va	Pa	Piw	Pai	Pai	Pis	Pi	Ps	Pi	Vk	Ps	Ps	Pis	Ps
Barager	BAA	xxxx	Pbs	Fx	Faw	Pw	Fw	Fw	Phw	Fwg	Fcs	Pk	Phk	Pq	Fsw	Fsw	Fw
Barren	BAE	xdxx	Vb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		xxxx	Vb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
Basker	BKR	xbxx, xcxx xxxx	Pi	Va	Pw	Viw	Vi	Vi	Viw	Viw	Pw	Vi	Vhi	Viw	Piw	Viw	Piw
Beresford	BSF	xb2x	Fps	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fps	Fak	Phk	Fpw	Fsw	Fpw	Fsw
		xbxs, xx1x xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xbxx, xb1x xx1x, xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xc1t	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Pn	Pn	Pn	Fsw
		xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Fnt	Fnw	Fnw	Fsw
		1cxx, 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
Bornett	BOR	xbxx, xxxx	Fb	Faq	Pw	Vhw	Phw	Pw	Vwg	Vwg	Pcq	Vak	Vhg	Pw	Pw	Pw	Pw
Brownridge	BWD	1cxx	Pb	Va	G	G	G	G	Pk	Pk	G	Pk	G	Ft	G	G	G
		xdxx	Fbt	Va	G	G	G	G	Pk	Pk	G	Pkt	G	Pt	G	G	G
		xxxx	Fb	Va	G	G	G	G	Pk	Pk	G	Pk	G	G	G	G	G
Cactus	CCS	1xxx	Vb	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fms	Fms	Fs	G
		1cxx, 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
		xbxx, xxxx	Pbs	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fms	Fms	Fs	G
		1dxx, 2dxx	Vb	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Pt	Fms	Fs	G
Capell	CXT	xbxs	Pn	Faq	Fw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Fnw	Fnw	Fnw	Fsw
		xbxx, xb1x xxxx	Fbs	Faq	Fw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Fsw	Fsw	Fsw	Fsw
		xc3x, xx3x	Pp	Faq	Fpw	Ppw	Fap	Fpw	Vks	Pkg	Ppq	Vak	Phg	Pp	Fpw	Pp	Fpw
		xcxx	Fbs	Faq	Fw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Ftw	Fsw	Fsw	Fsw

Table A8-2. 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										
Carroll	CXF	1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xcxx	Fbs	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
		xbxx, xxxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
Carvey	CAV	xxxs, xbxs	Pn	Fhq	Pw	Vhw	Phw	Pw	Vwg	Vhk	Pqw	Vkg	Vhg	Pw	Pw	Pw	Pw
		xx3s	Pnp	Fhq	Pw	Vhw	Phw	Pw	Vwg	Vhk	Ppw	Vkg	Vhg	Ppw	Pw	Ppw	Pw
		xx2x	Fps	Fhq	Pw	Vhw	Phw	Pw	Vwg	Vhk	Pqw	Vkg	Vhg	Pw	Pw	Pw	Pw
		xbxx, xb1x xxxx	Fs	Fhq	Pw	Vhw	Phw	Pw	Vwg	Vhk	Pqw	Vkg	Vhg	Pw	Pw	Pw	Pw
	CAV*	xxxx	Vw	Vhq	Vw	Vhw	Vaw	Pw	Vwg	Vhw	Vsw	Vkg	Vhg	Vsw	Vsw	Vsw	Vs
Chambers	CBS	1c1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Ft	Fs	Fs	Fs
		1dxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		1e1x	Pbt	Va	Fa	Fat	Fat	Fat	Fs	Ft	Fst	Vt	Pk	Vt	Fst	Fst	Fs
		xcxx	Fs	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
		xbxx, xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
Charman	CXV	xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xbxt	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Pn	Pn	Pn	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
		xbxx, xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Chater	CXW	1d1x	Vb	Fx	G	Fa	G	G	Fsg	Gg	Fcs	Pkt	Fk	Pt	Fms	Fs	G
		xx1x, xxxx	Pbs	Fx	G	Fa	G	G	Fsg	Gg	Fcs	Pk	Pk	Fs	Fms	Fs	G
Clementi	CLN	xb1x, xbxx xx1x, xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		1c1x, 1cxx xc1x, xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1c2x	Fps	Va	Fa	Fap	Fa	Fa	Fps	G	Fps	Fkt	Pk	Fpt	Fs	Fps	Fs
		1dxx, xd1x xdxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		xd2x	Fpt	Va	Fa	Fap	Fa	Fa	Fps	G	Fps	Pt	Pk	Pt	Fs	Fps	Fs
		2e1x	Vb	Va	Fa	Fat	Fat	Fat	Fs	Ft	Fst	Vt	Pk	Vt	Fst	Fst	Fs
		xe2x	Pt	Va	Fa	Fpt	Fat	Fat	Fps	Ft	Fpt	Vt	Pk	Vt	Fst	Fpt	Fs

***** a peaty phase of Carvey

Table A8-3. Suitability Ratings of Soils for Selected Engineering and Recreational Uses

Soil name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement with	Building - basement without	Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
Cobfield	CBF	xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xd1x	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Pt	Phk	Pt	Fsw	Fsw	Fsw
		xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Cordova	CVA	1e1x, xe1x	Pt	Va	Fa	Fat	Fat	Fat	Fs	Ft	Fst	Vt	Pk	Vt	Fst	Fst	Fs
		1fxx	Vt	Va	Fat	Pt	Pt	Pt	Fst	Pt	Pt	Vt	Pkt	Vt	Pt	Pt	Fst
		xcxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
Crookdale	CKD	xxxs	Pn	Va	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Pkg	Fhg	Fnw	Fnw	Fnw	Fsw
		xxxx	Fbs	Va	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Pkg	Fhg	Fsw	Fsw	Fsw	Fsw
Croyon	CYN	xb1x, xbxx xxxx	Fb	Faq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Fs	Fs	Fs	Fs
		xx3x	Pp	Faq	Fp	Pp	Fap	Fap	Vks	Pkg	Ppq	Vak	Gg	Pp	Fp	Pp	Fp
		1cxx, xc1x xcxx	Pb	Faq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Ft	G	G	G
		xc2x	Fbp	Faq	G	Fp	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Fpt	G	Fp	G
		xx2x	Fbp	Faq	G	Fp	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Fp	G	Fp	G
		xdxx	Fbt	Faq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Pt	G	G	G
		2g4x	Vbt	Pp	Ppt	Vt	Vt	Vt	Vks	Vtg	Vt	Vkt	Vtg	Vt	Vt	Vt	ppy
Dexter	DXT	xcxx, xxxx	Ps	G	Fw	Pw	Fw	Fw	Vks	Vkg	Vcs	Vck	Fhg	Pq	Fsw	Fsw	Fw
Dorset	DOT	xxxx, xx1x. xbxx xb1x, 1bxx, 1c1x 1cxx, oc1x ocxx, xc1x xcxx	Pbs	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pq	Fms	Fs	G
		xb2x, xc2x 1c2x	Pbs	G	G	Fp	G	G	Vks	Vkg	Vcs	Vck	Gg	Pq	Fms	Fps	G
		1dxx, xd1x xdxx	Pbs	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pqt	Fms	Fs	G
		xd2x	Pbs	G	G	Fp	G	G	Vks	Vkg	Vcs	Vck	Gg	Pqt	Fms	Fps	G
		xb3x, xc3x	Pps	G	Fp	Pp	Fp	Fp	Vks	Vkg	Vcs	Vck	Gg	Ppq	Fps	Pp	Fp
		xb4x, xc4x	Pps	Pp	Pp	Pp	Fp	Pp	Vks	Vkg	Vcs	Vck	Gg	Ppq	Pp	Pp	Pp
		xd4x	Pps	Pp	Pp	Pp	Fp	Pp	Vks	Vkg	Vcs	Vck	Gg	Ppt	Pp	Pp	Pp
		xc5x, xd5x	Vp	Vp	Vp	Vp	Pp	Vp	Vkp	Vkg	Vps	Vkp	Gg	Vpq	Vp	Vp	Vp
Druxman	DXM	xbxx, xxxx	Fb	Faq	Faw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Fw	Fw	Fw	Fw
		xc2x	Fbp	Faq	Faw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Fpt	Fw	Fpw	Fw
		xcxx	Fb	Faq	Faw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vkg	Phg	Ftw	Fw	Fw	Fw

Table A8-4. 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										
Druxman	DXM	xx3x	Pp	Faq	Fpw	Ppw	Fap	Fpw	Vks	Pkg	Ppq	Vak	Phg	Pp	Fpw	Pp	Fpw
Durnan	DRN	1bxx, xxxx	Fb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fak	Fk	Fs	Fs	Fs	Fs
		1xxx	Pb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Fs	Fs	Fs	Fs
		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
		xdxx	Fbt	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Pt	Fk	Pt	Fs	Fs	Fs
Fairland	FND	xxxx, xbxx	G	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	G	G	G	G
		1xxx	Fb	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
		1cxx	Fb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Ft	G	G	G
		1dxx	Fbt	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Ptg	Fk	Pt	G	G	G
		2dxx	Pb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Ptg	Fk	Pt	G	G	G
		3cxx	Vb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Fst	Fs	Fs	Fs
		2exx	Pbt	Va	Fa	Fat	Fat	Fat	Gg	Ftg	Ft	Vtg	Fkt	Vt	Fst	Fst	Fs
		3exx	Vb	Va	Fa	Fat	Fat	Fat	Gg	Ftg	Ft	Vtg	Fkt	Vt	Fst	Fst	Fs
		odxx, xdxx	Ft	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Ptg	Fk	Pt	G	G	G
Forrest	FRT	xc2s	Pns	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjt	Pk	Ps	Ps	Ps	Ps
		xxxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjk	Pk	Ps	Ps	Ps	Ps
Gateside	GTD	xxxx, xbxx	G	Va	Faw	Pw	Faw	Faw	Pkw	Fwg	G	Pk	Fh	Fw	Fw	Fw	Fw
		xbxs, xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pkw	Pk	G	Pk	Fh	Fnw	Fnw	Fnw	Fw
		xcxx	G	Va	Faw	Pw	Faw	Faw	Pkw	Pk	G	Pk	Fh	Ftw	Fw	Fw	Fw
Gendzel	GDZ	xbxx, xxxx	Ps	G	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Phg	Fsw	Fsw	Fsw	Fw
		xcxx	Ps	G	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Phg	Fst	Fsw	Fsw	Fw
Glenboro	GBO	xxxx, xbxx	G	Pa	G	G	Fa	G	Vks	Gg	Pq	Vkg	Gg	G	G	G	G
		ocxx, xcxx	G	Pa	G	G	Fa	G	Vks	Gg	Pq	Vkg	Gg	Ft	G	G	G
		1cxx	Fb	Pa	G	G	Fa	G	Vks	Gg	Pq	Vkg	Gg	Ft	G	G	G
		1dxx	Fbt	Pa	G	G	Fa	G	Vks	Gg	Pq	Vkg	Gg	Pt	G	G	G
		2exx	Pbt	Pa	G	Ft	Fat	Fat	Vks	Ftg	Pq	Vkg	Ftg	Vt	Fmt	Fst	Fs
Grayson	GYS	xbxx, xxxx	G	Pha	Pw	Vhw	Phw	Pfw	Vwg	Pwg	Pqw	Vhg	Vhg	Pw	Pw	Pw	Pw
		xbxs	Pn	Pha	Pw	Vhw	Phw	Pfw	Vwg	Pwg	Pqw	Vhg	Vhg	Pw	Pw	Pw	Pw
Grover	GRO	xbxx,xxxx	G	Pa	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Vkg	Fhg	Fw	Fw	Fw	Fw
		xcxx	G	Pa	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Vkg	Fhg	Ftw	Fw	Fw	Fw
Hallboro	HAL	xcxx	Ps	Pax	Fa	Fa	G	G	Vks	Gg	Fs	Vkg	Fk	Fst	Fms	Fs	G
Harding	HRG	xbxx, xxxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
		xb3x	Pps	Va	Pa	Pap	Pa	Pa	Pps	Fw	Pps	Fp	Vk	Pps	Psw	Ppw	Ps

Table A8-5. 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										
Hickson	HKS	xxxx, xcxx	Fb	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxx	Fb	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Hughes	HGH	xxxx, xbxx	Ps	G	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Phg	Fsw	Fsw	Fsw	Fw
		xcxx	Ps	G	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Phg	Ftw	Fsw	Fsw	Fw
Hummers ton	HMO	xxxx, xbxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Fsw	Fsw	Fsw	Fw
		xxxs	Pn	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Fnw	Fnw	Fnw	Fw
		xcxs	Pns	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Fnt	Fnt	Fnw	Fw
		1cxx	Pbs	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Ftw	Fsw	Fsw	Fw
		xcxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Ftw	Fsw	Fsw	Fw
Janick	JIK	xxxx, 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
Jaymar	JAY	xbxx, xb1x	Fb	Pax	Fa	Fa	Fa	Fa	Fsg	Gg	Fcs	Pkg	Gg	G	G	G	G
		xcxx, xc1x	Fb	Pax	Fa	Fa	Fa	Fa	Fsg	Gg	Fcs	Pkg	Gg	Ft	G	G	G
		xb2x	Fbp	Pax	Fa	Fap	Fa	Fa	Fps	Gg	Fps	Pkg	Gg	Fp	G	Fp	G
		1c2x, xc2x	Fbp	Pax	Fa	Fap	Fa	Fa	Fps	Gg	Fps	Pkg	Gg	Fpt	G	Fp	G
		xc4x	Pp	Pap	Pp	Pp	Fap	Pp	Ppg	Gg	Pp	Pkp	Gg	Pp	Pp	Pp	Pp
		xd5x	Vp	Vp	Vp	Vp	Pp	Vp	Vpg	Gg	Vp	Vp	Gg	Vp	Vp	Vp	Vp
Kerran	KRN	xxxx	Pis	Va	Paw	Viw	Vi	Vi	Viw	Viw	Psw	Vi	Vhi	Viw	Piw	Viw	Piw
Killeen	KLL	xxxx	Ps	Pax	Fw	Pw	Fw	Fw	Pw	Fw	Fs	Pk	Ph	Fsw	Fsw	Fsw	Fw
		xcxs	Pn	Pax	Fw	Pw	Fw	Fw	Pw	Fw	Fs	Pk	Ph	Fnt	Fnw	Fnw	Fw
Kilmury	KUY	xxxx, xb1x xbxx	Fb	Faq	Fw	Pw	Faw	Fw	Vks	Vkg	Pcq	Vak	Phg	Fqw	Fw	Fw	Fw
		xcxx	Fb	Faq	Fw	Pw	Faw	Fw	Vks	Vkg	Pcq	Vak	Phg	Fqt	Fw	Fw	Fw
Kirkness	KKS	1cxx, xcxx	Ps	Pax	Fa	Fa	G	G	Fs	G	Fs	Pk	Fk	Fst	Fms	Fs	G
Kleysen	KYS	xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1d1x, 1dxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
Knolls	KLS	1xxx	Vb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	G	G	G	G
		1cxx, xcxx	Vb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Ftg	Fk	Ft	G	G	G
		xdxx	Vb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Ptg	Fk	Pt	G	G	G
Lavenham	LVH	xxxx, xbxx	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
		xxxt	Vn	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Pn	Pn	Pn	Ps
Levine	LEI	xxxx, xbxx	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
Lindstrom	LDM	xxxx	Fb	Vax	Faw	Pw	Fw	Fw	Pw	Fw	G	Fk	Ph	Fw	Fw	Fw	Fw

Table A8-6. Suitability Ratings of Soils for Selected Engineering and Recreational Uses

Soil name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement with	Building - basement without	Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
Lindstrom	LDM	xxxs	Pn	Vax	Faw	Pw	Fw	Fw	Pw	Fw	G	Fk	Ph	Fw	Fw	Fw	Fw
Lockhart	LKH	xbxx	Fb	Vax	Fa	Fa	Fa	G	Fs	G	G	Fk	Fk	G	G	G	G
		xdxx	Fbt	Vax	Fa	Fa	Fa	G	Fs	G	G	Pt	Pk	Pt	G	G	G
		1dxx	Pb	Vax	Fa	Fa	Fa	G	Fs	G	G	Pt	Pk	Pt	G	G	G
		1fxx	Vt	Vax	Fat	Pt	Pt	Pt	Fst	Pt	Pt	Vt	Pt	Vt	Pt	Pt	Ft
Lonery	LOE	xxxx	Fb	Vax	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxs	Pn	Vax	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Lowroy	LOW	xxxx, xcxx	Ps	Pa	Pw	Vhw	Phw	Pw	Vwg	Vhk	Vs	Vkg	Vhg	Pw	Pw	Pw	Pw
Lowton	LWN	xxxx	Ps	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	G	Vhk	Psw	Psw	Psw	Psw
Mansfield	MFI	xxxx, xbxx	Ps	G	Fw	Pw	Fw	Fw	Vks	Vkg	Vcs	Vck	Fhg	Pq	Fsw	Fsw	Fw
Manson	MXD	xxxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	Fi	Ps	G	Vk	Fks	Fs	Fis	Fs
		xcxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	Fi	Ps	Ft	Vk	Fst	Fs	Fis	Fs
Marringh urst	MRH	2exx	Vb	G	G	Ft	Ft	Ft	Vks	Vkg	Vcs	Vkt	Ftg	Vqt	Fst	Fst	G
		2g4x	Vt	Pp	Ppt	Vt	Vt	Vt	Vks	Vkt	Vst	Vkt	Vtg	Vqt	Vt	Vt	Ppt
		xxxx, xbxx xcxx, xc1x	Pbs	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pq	Fms	Fs	G
		xx2x, xc2x	Pbs	G	G	Fp	G	G	Vks	Vkg	Vcs	Vck	Gg	Pq	Fms	Fps	G
		xc3x	Pbp	G	Fp	Pp	Fp	Fp	Vks	Vkg	Vcs	Vck	Gg	Ppq	Fps	Pp	Fp
		xdxx	Pbs	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pqt	Fms	Fs	G
		xd3x	Pbp	G	Fp	Pp	Fp	Fp	Vks	Vkg	Vcs	Vck	Gg	Ppt	Fps	Pp	Fp
		xd4x	Pbp	Pp	Pp	Pp	Fp	Pp	Vks	Vkg	Vcs	Vck	Gg	Ppt	Pp	Pp	Pp
Marsden	MDN	xxxx, xx1x xbxx, xb1x xcxx	Fb	Pax	Pw	Vw	Pw	Pw	Vwg	Phw	Pw	Pkg	Vhg	Pw	Pw	Pw	Pw
		xxxs, xx1x xbxs,	Pn	Pax	Pw	Vw	Pw	Pw	Vwg	Phw	Pw	Pkg	Vhg	Pw	Pw	Pw	Pw
		xb3x	Pp	Pax	Pw	Vw	Pw	Pw	Vwg	Phw	Ppw	Pkg	Vhg	Ppw	Pw	Ppw	Pw
Melland	MXT	xxxx, xx1x xb1x ,xbxx	Fb	Pax	Faw	Pw	Faw	Faw	Pwg	Fwg	Fcs	Pkg	Fhg	Fw	Fw	Fw	Fw
		xc1x, xcxx	Fb	Pax	Faw	Pw	Faw	Faw	Pwg	Fwg	Fcs	Pkg	Fhg	Ftw	Fw	Fw	Fw
		xx2x, xb2x	Fbp	Pax	Faw	Pw	Faw	Faw	Pwg	Fwg	Fps	Pkg	Fhg	Fpw	Fw	Fpw	Fw
		xxxs, xbxs	Pn	Pax	Faw	Pw	Faw	Faw	Pwg	Fwg	Fcs	Pkg	Fhg	Fnw	Fnw	Fnw	Fw
		xx2s	Pn	Pax	Faw	Pw	Faw	Faw	Pwg	Fwg	Fps	Pkg	Fhg	Fnp	Fnw	Fnp	Fw
		xb3x	Pp	Pax	Fpw	Ppw	Fpw	Fpw	Ppw	Fwg	Pp	Pkg	Fhg	Pp	Fpw	Pp	Fpw
		xc2x	Fbp	Pax	Faw	Pw	Faw	Faw	Pwg	Fwg	Fps	Pkg	Fhg	Fpt	Fw	Fpw	Fw

Table A8-7. Suitability Ratings of Soils for Selected Engineering and Recreational Uses

Soil name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement with	Building - basement without	Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
Melland	MXT	xc4x	Pp	Pap	Pp	Ppw	Fap	Pp	Ppw	Fwg	Pp	Pkp	Fhg	Pp	Pp	Pp	Pp
Miniota	MXI	xxxx, xbxx 1bxx	Fb	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Fq	Fms	G	G
		xx2x, xb2x	Fbp	Faq	G	Fp	G	G	Vks	Vkg	Pcq	Vak	Gg	Fpq	Fms	Fp	G
		xcxx, 1cxx	Fb	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Fqt	Fms	G	G
		xc3x	Pp	Faq	Fp	Pp	Fp	Fp	Vks	Vkg	Ppq	Vak	Gg	Pp	Fmp	Pp	Fp
		3dxx	Vb	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Pt	Fms	Fs	Fs
		xd1x, xdxx	Fbt	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Pt	Fms	G	G
Mowbray	MOW	xbxx	Fis	Va	Fa	Fa	Fa	Fai	Fis	Fi	Fs	Fak	Fk	Fs	Fs	Fis	Fs
		xcxx	Fis	Va	Fa	Fa	Fa	Fai	Fis	Fi	Fs	Fkt	Fk	Fst	Fs	Fis	Fs
		xdxx	Fst	Va	Fa	Fa	Fa	Fa	Fis	Fi	Fs	Pt	Fk	Pt	Fs	Fi	Fs
Newdale	NDL	1b1x	Fbs	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
		1d1x	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		2c1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xc1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
Oberon	OBR	xxxx, xbxx	Fs	Faq	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Pkg	Fhg	Fsw	Fsw	Fsw	Fsw
Onahan	ONH	xbxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Fsw	Fsw	Fsw	Fw
Perillo	PER	xxxx	Vw	Vah	Vah	Vaw	Vaw	Vaw	Vhw	Vhw	Vsw	Vah	Vh	Vsw	Vsw	Vsw	Vsw
Petrel	PTR	xxxx, xbxx	G	Pa	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Vkg	Fhg	Fw	Fw	Fw	Fw
		xbxs, xcxs	Pn	Pa	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Vkg	Fhg	Fnw	Fnw	Fnw	Fw
Pleasant	PLE	xxxx, xbxx	G	Va	Fw	Pw	Faw	Faw	Pkw	Pkg	G	Pk	Fh	Fw	Fw	Fw	Fw
		xxxs, xbxs	Pn	Va	Fw	Pw	Faw	Faw	Pkw	Pkg	G	Pk	Fh	Fnw	Fnw	Fnw	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
		1cxx	Fb	Va	Fw	Pw	Faw	Faw	Pkw	Pkg	G	Pk	Fh	Ftw	Fw	Fw	Fw
Poolex	POX	xxxs	Pn	Va	Phw	Vw	Pw	Pw	Vhw	Pkw	Pw	Vh	Vh	Pw	Pw	Pw	Pw
		xxxx	Fb	Va	Phw	Vw	Pw	Pw	Vhw	Pkw	Pw	Vh	Vh	Pw	Pw	Pw	Pw
Porple	POR	xxxx	G	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pk	G	G	G	G	G
		1xxx	Pb	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pk	G	G	G	G	G
		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
Prodan	PDA	xxxs, xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xxxx, xbxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xxxt	Vn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Pn	Pn	Pn	Fsw

Table A8-8. 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										
Prodan	PDA	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
		xdxx	Fst	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Pt	Phk	Pt	Fsw	Fsw	Fsw
Prosser	PSE	xxxx, xbxx	G	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pk	G	G	G	G	G
		xcxx	G	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pk	G	Ft	G	G	G
		1dxx	Fbt	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pkt	G	Pt	G	G	G
		xdxx	Ft	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pkt	G	Pt	G	G	G
Ramada	RAM	xxxx, xbxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xcxx, 1cxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xdxx, 1dxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		2dxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		1exx	Pt	Va	Fa	Fat	Fat	Fat	Fs	Ft	Fst	Vt	Pk	Vt	Fst	Fst	Fs
		3exx	Vb	Va	Fa	Fat	Fat	Fat	Fs	Ft	Fst	Vt	Pk	Vt	Fst	Fst	Fs
Rempel	RMP	xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
Roddan	ROD	xcxx	Vb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fst	Fs	Fs	Fs
Rufford	RUF	1c1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1d1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		2d1x	Vb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		1e1x	Pbt	Va	Fa	Fat	Fat	Fat	Fs	Ft	Fst	Vt	Pk	Vt	Fst	Fst	Fs
		1e2x	Pbt	Va	Fa	Fat	Fat	Fat	Fps	Ft	Fpt	Vt	Pk	Vt	Fst	Fpt	Fs
		2e2x	Vb	Va	Fa	Fpt	Fat	Fat	Fps	Ft	Fpt	Vt	Pk	Vt	Fst	Fpt	Fs
		2exx	Vb	Va	Fa	Fat	Fat	Fat	Fs	Ft	Fst	Vt	Pk	Vt	Fst	Fst	Fs
		1fxx, 1f1x	Vt	Va	Fat	Pt	Pt	Pt	Fst	Pt	Pt	Vt	Pkt	Vt	Pt	Pt	Fst
		2fxx	Vbt	Va	Fat	Pt	Pt	Pt	Fst	Pt	Pt	Vt	Pkt	Vt	Pt	Pt	Fst
		2g1x	Vbt	Va	Pt	Vt	Vt	Vt	Pt	Vt	Vt	Vt	Vt	Vt	Vt	Vt	Pt
Sewell	SEE	xxxx, xbxx	Ps	Pa	Pw	Vhw	Phw	Pw	Vwg	Vhk	Pqw	Vkg	Vhg	Pw	Pw	Pw	Pw
		xxxt	Vn	Pa	Pw	Vhw	Phw	Pw	Vwg	Vhk	Pqw	Vkg	Vhg	Pnw	Pnw	Pnw	Pw
Shilox	SHX	xbxx, xcxx	Vb	Fa	G	G	G	G	Vks	Vk	Pq	Vkg	Gg	Pm	Pm	Fs	Ps
		xdxx	Vb	Fa	G	G	G	G	Vks	Vk	Pq	Vkg	Gg	Pmt	Pm	Fs	Ps
		xexx	Vb	Fa	G	Ft	Ft	Ft	Vks	Vk	Pq	Vkt	Ftg	Vt	Pm	Fst	Ps
Sigmund	SGO	xxxx, xbxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
		xxxs, xbxs	Pn	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
Statley	SXB	xc1x	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Ft	G	G	G
		1dxx, 1d1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	G	G	G
		2dxx	Vb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	G	G	G

Table A8-9. 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										
Statley	SXB	1exx, 1e1x	Pbt	Va	Fa	Fat	Fat	Fat	Fs	Ft	Fs	Vt	Pk	Vt	Ft	Ft	Fs
		xe2x	Pt	Va	Fa	Fpt	Fat	Fat	Fs	Ft	Fps	Vt	Pk	Vt	Ft	Ftp	G
		xf1x, 1f1x	Vt	Va	Fat	Pt	Pt	Pt	Fts	Pt	Fs	Vt	Pkt	Vt	Pt	Pt	Ft
		2g2x	Vtb	Va	Pt	Vt	Vt	Vt	Pt	Vt	Fps	Vt	Vt	Vt	Vt	Vt	Pt
Stewart	SWR	1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xd3x	Pp	Va	Fap	Pp	Fap	Fap	Pp	G	Pp	Pt	Pk	Ppt	Fp	Pp	Fps
		1dxx, 1d1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		1d2x	Pb	Va	Fa	Fap	Fa	Fa	Fps	G	Fps	Pt	Pk	Pt	G	Fps	Fs
		2dxx	Vb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		1e1x	Pbt	Va	Fa	Fat	Ft	Fat	Fs	Ft	Ft	Vt	Pk	Vt	Ft	Ft	Fs
		2exx	Vb	Va	Fa	Fa	Ft	Fa	Fs	Ft	Ft	Vt	Pk	Vt	Ft	Ft	Fs
		1f1x	Vt	Va	Fat	Pt	Pt	Pt	Fts	Pt	Pt	Vt	Pt	Vt	Pt	Pt	Ft
		1f2x	Vt	Va	Fat	Pt	Pt	Pt	Ftp	Pt	Pt	Vt	Pt	Vt	Pt	Pt	Ft
		2g1x, 2g2x	Vbt	Va	Pt	Vt	Vt	Vt	Pt	Vt	Vt	Vt	Vt	Vt	Vt	Vt	Pt
Stockton	SCK	xxxx, xbxx	Ps	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fms	Fms	Fs	G
		xcxx, 1cxx ocxx	Ps	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fst	Fms	Fs	G
		2cxx	Pbs	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fst	Fms	Fs	G
		xdxx, 1dxx odxx	Ps	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Pt	Fms	Fs	G
		3dxx	Vb	Pa	G	G	G	G	Vks	Vkg	pq	Vkg	Gg	Fms	Fms	Fs	Ps
Sutton	SXP	xxxx	Fs	Fq	Pw	Vhw	Phw	Pw	Vhw	Pwg	Pqw	Vgh	Vhg	Pw	Pw	Pw	Pw
Tadpole	TDP	xxxx, xbxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxs, xbxs xcxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xbxt	Vn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pnw	Pnw	Pnw	Pw
Taggart	TGR	xxxx, xbxx	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	Pn	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fnw	Fnw	Fnw	Fw
		xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fnt	Fnw	Fnw	Fw
Torcan	TOC	xxxx, xbxx	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
		xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fnt	Fnw	Fnw	Fnw
Traverse	TAV	xbxx	G	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Fs	Fs	Fs	Fs
		xcxx	G	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Fst	Fs	Fs	Fs

Table A8-10. 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										
Traverse	TAV	1cxx	Pb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Fs	Fs	Fs	Fs
		xdxx	Ft	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Ptg	Fk	Pt	Fs	Fs	Fs
Vodroff	VFF	xxxx, xx1x, xbxx, xb1x xcxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Vodroff	VFF	xxxt	Vn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pnw	Pnw	Pnw	Pw
		xb1u	Vn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Vn	Vn	Vn	Pw
Vordas	VDS	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
Wellwood	WWD	xbxx	Fs	Faq	Fa	G	Fa	Fa	Vks	Gg	Fs	Pkg	Fkg	Fs	Fs	Fs	Fs
		xcxx	Fs	Faq	Fa	G	Fa	Fa	Vks	Gg	Fs	Pkg	Fkg	Fst	Fs	Fs	Fs
		xdxx	Fst	Faq	Fa	G	Fa	Fa	Vks	Gg	Fs	Pkt	Fkg	Pt	Fs	Fs	Fs
		3dxx	Vb	Faq	Fa	G	Fa	Fa	Vks	Gg	Fs	Pkg	Fkg	Pt	Fs	Fs	Fs
		3exx	Vb	Faq	Fa	Ft	Fat	Fat	Vks	Ftg	Fst	Vt	Fkt	Vt	Fst	Fst	Fst
Wesley	WEL	xc1x	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xd2x	Fpt	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fps	Pt	Phk	Pt	Fsw	Fpw	Fsw
Wheat-land	WHL	xxxx, xbxx, 1bxx, obxx	Ps	G	G	G	G	G	Vks	Vkg	Vq	Vkg	Gg	Fms	Fms	Fs	G
		ocxx, xcxx 1cxx, 1c1x	Ps	G	G	G	G	G	Vks	Vkg	Vq	Vkg	Gg	Fst	Fms	Fs	G
		xdxx, 1dxx	Ps	G	G	G	G	G	Vks	Vkg	Vq	Vkg	Gg	Pt	Fms	Fs	G
		2bxx	Vb	G	G	G	G	G	Vks	Vkg	Vq	Vkg	Gg	Fms	Fms	Fs	Fs
		2cxx	Vb	G	G	G	G	G	Vks	Vkg	Vq	Vkg	Gg	Fst	Fms	Fs	Fs
		2dxx	Vb	G	G	G	G	G	Vks	Vkg	Vq	Vkg	Gg	Pt	Fms	Fs	Fs
		2exx	Vb	G	G	Ft	Ft	Ft	Vks	Vkg	Vq	Vkt	Ftg	Vt	Fmt	Fst	Fs
Wood-field	WDF	1dxx, 1d1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		1e1x	Pbt	Va	Fa	Fa	Fat	Fa	Fs	G	Fs	Vt	Pk	Vt	Fst	Fst	Fs
		1e3x	Pbt	Va	Fap	Pp	Fpt	Fpt	Pp	Ft	Pp	Vt	Pk	Vt	Fpt	Pp	Fps
		2g3x	Vbt	Va	Pt	Vt	Vt	Vt	Ppt	Vt	Vt	Vt	Vt	Vt	Vt	Vt	Pt
Wyton-ville	WVI	xxxx, xbxx	Fb	Faq	Fw	Pw	Faw	Fw	Vks	Vkg	Pcq	Vak	Phg	Fqw	Fw	Fw	Fw
Xavier	XVI	xxxx	Vw	Vah	Vaw	Vaw	Vaw	Vaw	Vhw	Vhw	Vsw	Vah	Vhg	Vsw	Vsw	Vsw	Vsw
Marsh	$MH	xxxx	Vw	Vah	Vhw	Vhw	Vhw	Vaw	Vhw	Vhw	Vw	Vhi	Vhi	Vsw	Vsw	Vsw	Vw

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, flower beds, etc. The factors to be considered include not only the characteristic 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 Consistence[2]**	Very friable, friable	Loose, firm	Very firm	Cemented
i	**Flooding**	None	May flood occasionally for short periods	Frequent flooding (every year)	Constantly flooding
w	**Wetness[2]**	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	**Stoniness[2]**	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 fragments[2] (% by volume)**	≤ 3%	> 3 - 15%	> 15 - 35%	> 35%
s	**Texture[2]**	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 Topsoil[4]**	> 40 cm	> 15 - 40 cm	8 - 15 cm	< 8 cm
n	**Salinity of Topsoil[5]**	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 Group** [2]	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	**Stoniness**[4]	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 Roadfill

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 are 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 percent.
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 Buildings[1]

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]**	With Basements: Very rapidly, rapidly and well drained Without Basements: Very rapidly, rapidly well and moderately well drained	With Basements: Moderately well drained Without Basements: Imperfectly drained	With Basements: Imperfectly drained Without Basements: Poorly drained	With Basements: Poorly, and very poorly drained Permanently wet soils Without Basements: Very poorly drained Permanently wet soils.
h	**Depth to Seasonal Water Table**	With Basements: > 150 cm Without Basements: > 75 cm	With Basements: > 75 - 150 cm Without Basements: > 50 - 75 cm	With Basements: 25 - 75 cm Without Basements: 25 - 50 cm	With Basements: < 25 cm Without Basements: < 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]**	With Basements: > 150 cm Without Basements: > 100 cm	With Basements: > 100 - 150 cm Without Basements: 50 - 100 cm	With Basements: 50 - 100 cm Without Basements: < 50 cm	With Basements: < 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 and/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 that it can be dug with light power equipment such as backhoes.

Table A13. Guide for Assessing Soil Suitability for Local Roads and Streets[1]

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: (1) those that affect the load supporting capacity and stability of the subgrade, and (2) those that affect the workability and amount of cut and fill. The AASHO and Unified Classification 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]**	< 5	5 - 8	> 8	
	b.) Unified Soil Group	GW, GP, GC[7], SW, SP, SM, and SC[7]	CL (with P.I.[8] < 15) and ML	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 adjustment 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 that 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 percent.
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 Landfills[1]

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 is dependent upon 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	**Wetness[4]**	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	**Stoniness[4]**	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 thereby 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 Table[2]**	> 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 Due to possible groundwater contamination, impermeable bedrock is considered poor and permeable bedrock is rated very poor.
6 Contamination hazard (**g**) may apply at high permeability and/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 Consistence[2]**	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 bedrock[4]**	> 150 cm	> 100 - 150 cm	50 - 100 cm	< 50 cm
c	**Coarse fragments[2] (% by volume)**	≤ 15%	> 15 - 35%	> 35%	
p	**Stoniness[2]**	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	**Wetness[2]**	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 Table[2]**	> 150 cm	> 100 - 150 cm	50 - 100 cm	< 50 cm
i	**Flooding[3]**	None	None	Subject to infrequent flooding (once in 50 years)	Subject to frequent high level flooding
k	**Soil Permeability[4]**	< 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 Fragments[5] < 25 cm in diameter, (% by volume)**	≤ 20%	> 20 - 35%	> 35%	
p	**Stoniness[5], >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 Bedrock[6]**	> 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 and/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 need not mean that 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 Rate[3] (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 Table[4]**	> 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%, 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 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 and/or moderate evapotranspiration	Water storage capacity[8] < 7.5 cm and/or low rainfall and/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%.
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. The addition of 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 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 and/or adequate rainfall and/or low evapotranspiration.	Water storage capacity[8] 7.5 - 15 cm and/or moderate rainfall and/or moderate evapotranspiration.	Water storage capacity[8] < 7.5 cm and/or low rainfall and/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% by only a small margin providing (a) the gravel is embedded in the soil matrix, or (b) 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 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% or less of the area.	Rock exposures < 10 m apart and cover > 25% 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% by only a small margin, providing (a) the gravel is embedded in the soil matrix, or (b) the fragments are less than 2 cm in size.
6 Very shallow soils are rated as having a limitation for rockiness and/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	**Stoniness[4]**	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	**Wetness[4]**	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 trials.
t	**Slope[8]**	≤ 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 affects 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% by only a small margin providing (a) the gravel is embedded in the soil matrix or (b) 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 percent 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

Arizona Series (AIZ)
The Arizona series consists of moderately well to well drained Orthic Regosol soils developed on weakly to moderately calcareous, sandy (FS, LS, LFS), lacustrine and deltaic deposits. These soils occur in upper slope and knoll positions of gentle slopes on hummocky landscapes and have rapid permeability, low surface runoff, and a low water table during the growing season. Arizona soils are severely wind eroded, nonstony, and non-saline. They have low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes scrub oak, black spruce and prairie grasses. The majority of these soils are currently wooded or used for natural grazing.

In a representative profile of Arizona soil there is no solum. The profile is characterized by a gray to light gray Ah horizon, 5 to 15 cm thick, and a brown to very pale brown Ck horizon, with faint reddish brown mottles.

Arizona soils occur in close association with Cactus soils and are similar to Shilox soils by having a Regosolic profile in sand deposits but differ from them by having deposits of lacustrine origin while Shilox soils are eolian. Arizona soils were previously mapped as eroded phases of the Stockton Association in the Carberry (Ehrlich et al., 1957) soil report.

Ashmore Series (AHO)
The Ashmore series consists of moderately well to well drained Rego Black Chernozem soils developed on a thin mantle (25 to 50 cm) of moderately to strongly calcareous sediments of VFS, LVFS, FSL and SL texture overlying moderately to strongly calcareous medium sand to gravelly; glaciofluvial deposits. These soils occur in irregularly sloping terrain ranging from gently undulating to strongly rolling. They have moderately rapid permeability in the upper sediments and very rapid permeability in the gravelly deposits; runoff is moderate to rapid depending on the degree of slope. The stoniness varies from few to very stony land. The native vegetation consists of bur oak and aspen.

A very dark gray Ahk horizon 10 to 17 cm thick and a thin AC horizon characterize the soil. A lime accumulation layer (Cca) may be present. Cultivated soils on the gently undulating and undulating slopes may be slightly eroded.

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, many prominent mottles. The parent material is typically stratified and may contain dark strata representing former surfaces.

Barager Series (BAA)
The Barager series consists of imperfectly drained, carbonated, Gleyed Rego Black Chernozem soils developed on a variable mantle (30 to 90 cm) of moderately to strongly calcareous outwash and glacio-fluvial sediments of medium sand to gravel texture overlying very strongly calcareous loamy glacial till. Strongly calcareous loam to clay loam till of shale, limestone and granitic origin usually occurs within a two meter depth. The soils occur in a level to gently undulating topography. The soil drainage is imperfect because of a perched water condition above the slowly permeable till and to lateral flow and seepage from adjacent upland areas. The permeability of the upper sediments is rapid.

The Barager soil is characterized by a black to very dark gray Ah horizon 12 to 18 cm thick; and an AC horizon which grades to a carbonate accumulation (Cca) horizon. The solum is relatively shallow and varies with depth from loamy sand to sand. Yellowish brown mottles occur above the contact of the coarse materials and the till.

Barren Series (BAE)
The Barren series is an Orthic Regosol soil found on well to rapidly drained, strongly to very strongly calcareous, fine loamy (SCL, SiCL, CL), lacustrine sediments. This soil occurs above the escarpment in association with Ramada, Carroll, Charman, Prodan and Tadpole soils in the upper slope and knoll positions of gently undulating to moderately rolling topography. Surface runoff is moderate to rapid, and permeability is moderate to moderately slow. Originally, Barren soils had a dark surface horizon and a weak B horizon, but erosion has removed virtually all of the original solum. Wind and water erosion continues to be a problem for these soils.

The Barren soil profile has a gray to light gray, calcareous Ap horizon, 10 to 15 cm thick, and a light yellowish brown to pale brown Ck horizon.

Basker Series (BKR)
The Basker series consists of poorly to very poorly drained Rego Humic Gleysol soil 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.

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.

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.

Brownridge Series (BWD)
The Brownridge series consists of well to moderately well drained Orthic Regosol soils on weakly to moderately calcareous, moderately coarse textured (VFS, LVFS, FSL) lacustrine and deltaic sediments. These soils occur in association with the Halstead (Orthic Dark Gray) or Pleasant (Gleyed Rego Black, carbonated) soils and occupy the upper slope and knoll positions. Originally, these soils had a dark surface and profile development, but have been sufficiently eroded that little of the original horizons remain. These soils have moderately rapid permeability; runoff is moderately rapid to rapid depending on the slope gradient. The topography is undulating to moderately rolling. The soil is characterized by a 10 to 15 cm light gray to light brownish gray calcareous plow layer and a light yellowish brown to very pale brown C horizon.

Cactus Series (CCS)
The Cactus series consists of well drained Rego Black Chernozem soil 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 and Arizona 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).

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), 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 IICca 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 (SCL, 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 and/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.

Carvey Series (CAV)
The Carvey series consists of poorly drained Rego Humic Gleysol soil developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, uniform, fine loamy (SiL, L, CL, SCL) lacustrine sediments over moderately to strongly calcareous, sandy to sandy skeletal glaciofluvial deposits. These soils occur in depressional positions of nearly level slopes on level landscapes and have moderate permeability slow surface runoff and a high water table during the growing season. Carvey soils are occasionally slightly saline. They have medium over low available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation often includes sedges and meadow grasses. The majority of these soils are currently used for natural grazing. In a representative profile of Carvey soil the solum is approximately 20 cm thick. The profile is characterized by a thin (2 to 5 cm) moderately decomposed LFH horizon a very dark gray, calcareous Ah horizon, 7 to 15 cm thick and a dark gray, calcareous, transition ACg horizon, 10 to 20 cm thick, and a pale brown, calcareous II Ckg horizon with yellowish brown mottles. A typical profile also contains manganese concretions in the subsoil and shells at the surface.

Carvey soils occur in close association with Capell, and Croyon soils. They are similar to Tadpole soils by having a Rego Humic Gleysol profile developed in loamy lacustrine deposits, but differ from Tadpole soils by having a sandy to sandy-skeletal substrate within a meter of the mineral surface. Carvey soils were previously mapped as a Meadow associate with a loamy veneer of the Agassiz Association in the Carberry (Ehrlich et al., 1957) soil report.

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 meter 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 3 to 8 cm thick and a thin lime accumulation zone. The underlying till is a light yellowish brown color. 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, 5 to 8 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 meter 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 droughtier than glacial till soils like Kleysen series.

Clementi Series (CLN)
The Clementi series is characterized by an Orthic Black Chernozem profile 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 solum has 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.

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 meter 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 of 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.

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 upon 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 color.

Crookdale Series (CKD)
The Crookdale series consists of imperfectly drained Gleyed Rego Black Chernozem soil developed on a mantle (25 to 100 cm) of strongly calcareous, stratified, fine loamy (CL, SiCL) lacustrine sediments over strongly calcareous, deep uniform sandy (LFS, FS, S) fluvial lacustrine deposits. These soils occur in lower slope positions of level to nearly level slopes on level landscapes and have moderate permeability, moderately slow surface runoff and a medium water table during the growing season. Crookdale soils are non-eroded, non-stony and slightly saline. They have high 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 grain crop production.

In a representative profile of Crookdale soil the solum is approximately 25 cm thick. The profile is characterized by a black Ah horizon, 10 to 25 cm thick, a dark grayish brown transitional AC horizon, 10 to 20 cm thick with faint iron mottles, a white Ccagj horizon, 5 to 10 cm thick of lime accumulation and a light olive brown II Ckgj horizon with prominent iron mottles.

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.

Dexter Series (DXT)
The Dexter series consists of imperfectly drained Gleyed Black Chernozem soils developed on moderately to strongly calcareous, deep, stratified, sandy skeletal (FS, CoS, GrS), glaciofluvial deposits. These soils occur in middle positions of very gentle to gentle slopes on undulating landscapes and have rapid permeability, low surface runoff, and a medium water table during the growing season. Dexter soils are slightly eroded, non-stony, and non-saline. They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes bur oak, aspen, shrubs and prairie grasses. The majority of these soils are currently used for forage crops and grazing.

In a representative profile the solum is approximately 40 cm thick. The profile is characterized by very dark gray Ah horizon, 15 to 20 cm thick, a grayish brown to brown Bm horizon, 10 to 25 cm thick, a Cca (lime accumulation) horizon, 5 to 8 cm thick and a mottled and calcareous Ckgj horizon. A typical profile also varies in depth depending on the thickness of finer textured surface layers.

Dexter soils occur in close association with Dorset Marringhurst and Fortina soils. They are similar to Mansfield soils by having an imperfectly drained profile developed in sandy skeletal deposits in having a Bm horizon.

Dorset Series (DOT)
The Dorset series consists of moderately well to well drained Orthic Black Chernozem soils developed on moderately to strongly calcareous, deep , stratified, sandy to sandy skeletal (S, GrS, GrCoS), outwash and glaciofluvial deposits. These soils occur in upper positions of gentle slopes on hummocky landscapes and have very rapid permeability, low rapid surface runoff, and a low water table during the growing season. Dorset soils are non-eroded, non-stony, and non-saline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes aspen-oak stands and tall prairie grasses. The majority of these soils are currently used for grazing or are excavated for gravel deposits.

In a representative profile the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah horizon, 12 to 18 cm thick, a dark brown Bm horizon, 15 to 22 cm thick, a Cca (lime accumulation) horizon, 6 to 12 cm thick and a light brown Ck horizon, with stratified sand and gravel.

Dorset soils occur in close association with Mansfield soils. They are similar to Marringhurst soils by having well drained profile in glaciofluvial deposits but differ from them in having a Bm horizon. Dorset soils were previously mapped as Blackearth associates of the Marringhurst Association in the Carberry soil report (Ehrlich et al., 1957).

Druxman Series (DXM)
The Druxman 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. Druxman 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, 5 to 10 cm thick, occasionally a yellowish brown II Ccagj horizon, 5 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 coarse loamy 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.

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 strata (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 nonstony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and high 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).

Gendzel Series (GDZ)
The Gendzel series consists of imperfectly drained, carbonated, Gleyed Rego Black Chernozem soils developed on a thin mantle (25 to 60 cm) of moderately to strongly calcareous sandy textured sediments overlying moderately to strongly calcareous medium sand to gravelly textured sediments. The soil occurs in a level to gently sloping topography. Runoff is moderately slow; permeability is moderately rapid to rapid, but may be restricted in the subsoil during periods when the water table is high.

The soil is characterized by a very dark gray to black Ahk horizon, 10 to 16 cm thick, a dark gray to light gray AC horizon 5 to 9 cm thick; and a lime accumulation (Cca) horizon 6 to 12 cm thick. In the soils with a shallow solum, the lime accumulation (Cca) horizon occurs at the transition of the sandy to gravelly sediments.

Glenboro Series (GBO)
The Glenboro series consists of moderately well to well drained Orthic Black Chernozem soil developed on a mantle (25 to 90 cm) of moderately to strongly calcareous, shallow, medium textured (VFSL, L, SiL), lacustrine deposits over moderately calcareous, stratified, deep, sandy (FS, LFS, LS) deposits. These soils occur in upper positions of gentle slopes on sloping to undulating landscapes and have moderate over moderately rapid permeability, moderately slow surface runoff, and a low water table during the growing season. Glenboro soils are often slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses and aspen-oak groves. 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, 12 to 18 cm thick, with granular structure, a dark brown to brown Bm or Btj horizon 10 to 16 cm thick with subangular blocky structure, a brown to pale brown BC horizon, 6 to 14 cm thick and a light gray to very pale brown Cca horizon, 5 to 8 cm thick. The parent material is typically pale brown to light yellowish brown sandy. Some stratified sands to loams may occur in the loam/sand transition.

Glenboro soils occur in close association with Grover and Grayson soils. They are similar to Fairland soils by having an Orthic Black Chernozem profile and loamy surface mantle but differ from them in having a sandy substrate. Glenboro soils were previously mapped as Blackearth associates of the Glenboro Association in the Carberry soil report (Ehrlich et al., 1957).

Grayson Series (GYS)
The Grayson series consists of poorly drained Rego Humic Gleysol soils developed on a thin mantle (25-95 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 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).

Hallboro Series (HAL)
The Hallboro series is an Orthic Black Chernozem soil developed on moderately well to well drained, weakly to moderately calcareous, coarse (FS, LFS, LS), lacustrine sediments underlain by moderately calcareous, moderately fine (CL, SiCL) textured lacustrine deposits. These soils occur in the Upper Assiniboine Delta on level to gently sloping topography in association with Stockton and Shilox soils. Surface runoff is low, and permeability is rapid in the fine sand to loamy fine sand sediments and moderately slow in the clay loam to silty clay loam subsoil. Wind erosion is common if the soil is not protected with adequate surface residue.

The Hallboro soil profile has a very dark gray to very dark grayish brown Ah, 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, 10 to 20 cm thick. The BC horizon is underlain by loam to clay loam II Ahb and II Bm and a yellowish brown to pale brown, clay loam to silty clay loam, II Ckgj horizon.

The SCK1 variant (mapped in previous areas) has a clay loam to silty clay loam substrate and is currently described as the Hallboro series.

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 pseudomycelium and gypsum concretions are common in the olive brown to olive Ckgj horizon.

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.

Hughes Series (HGH)
The Hughes series consists of imperfectly drained, Gleyed Black Chernozem soils developed on a thin mantle (25 to 60 cm) of sandy textured sediments overlying weakly to non calcareous medium to coarse sand and occasional gravel sediments. The soil occurs in lower position of level to gently sloping topography. Permeability is moderately rapid to rapid, but may be restricted in the subsoil during periods when the water table is high (within 1 m of the surface).

The soil is characterized by a very dark gray to black Ah or Ap horizon, 10 to 30 cm thick, a brown to dark brown, weakly mottled Bmgj horizon, 15 to 22 cm thick, a light yellowish brown BC with strong brown mottles and a Cgj horizon 30 to 50 cm thick. They occur in close association with the imperfectly drained Gendzel soils, the well drained Wheatland soils and the poorly drained Lowry series.

Hummerston Series (HMO)
The Hummerston series consists of imperfectly drained Gleyed Rego Black Chernozem soil 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 ACgj 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.

Jaymar Series (JAY)
The Jaymar series consists of well drained, Orthic Black Chernozem soils developed on stratified materials composed of a thin mantle (40 to 70 cm) of moderately to strongly calcareous, loamy (L, CL, SiCL), lacustrine sediments over a thin 30 to 60 cm, contact zone of sandy skeletal (S, GrS) materials, overlying moderately to strongly calcareous, loamy (L, CL, SiCL), glacial till of shale, limestone and granitic rock origin. The soils occur on very gently to gently sloping topography, runoff is moderate, and permeability is moderate to rapid in the upper loamy and sandy skeletal strata and moderately slow in the underlying till. These soils are often stony due to the modification of the till.

The soil is characterized by a very dark gray Ah horizon 10 to 15 cm thick, a dark brown to brown Bm horizon 8 to 15 cm thick and a lime accumulation layer (Cca) that occurs at the contact of the loamy sediments and underlying coarser wash zone. Jaymar soils occur as well drained inclusions of the Heaslip Complex in the South-Central soil report (Ellis and Shafer, 1943).

Kerran Series (KRN)
The Kerran series consists of poorly to very poorly drained Rego Humic Gleysol soils developed on moderately to strongly calcareous, deep, stratified, clayey (SiC, C), recent alluvial deposits with strata of silty clay loam and clay loam textures. These soils occur in depressional positions of level slopes on flood prone terraced landscapes and have very slow permeability, very slow surface runoff, and a high water table during the growing season. Kerran soils are non-eroded, non-stony, and frequently moderately saline. They have a high available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes reeds, rushes, sedges and willows. The majority of these soils are currently in native vegetation.

In a representative profile the solum is not developed. The profile is characterized by a thin organic horizon, 2 to 4 cm thick, a weakly developed dark gray Ahk horizon, 10 to 15 cm thick, and a pale brown to light gray Ckg horizon, with prominent iron mottles. The parent material is typically stratified, mottled, and may contain buried former Ah horizons. Kerran soils occur in close association with Assiniboine soils. They are similar to Basker soils by having a poorly drained profile in recent alluvium but differ from them in having finer textures throughout the profile. Kerran soils were previously mapped as associates of the Assiniboine Complex in the Carberry soil report (Ehrlich et al., 1957).

Killeen Series (KLL)
The Killeen series consists of imperfectly drained, carbonated, Gleyed Rego Black Chernozem soils developed on a thin mantle (25 to 60 cm) of sandy sediments (FS, LFS, LS) over a moderately to very strongly calcareous loam to clay loam 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 rapid in the upper sandy strata and decreases to moderately slow to slow in the lower, more compact, weakly to moderately fissile till.

The soil is characterized by a very dark gray Ah horizon, 15 to 20 cm thick, a dark gray to grayish brown, weakly mottled ACgj horizon, and a light gray lime accumulation (Ccagj) layer. Where the overlay is relatively shallow, the lime accumulation horizon occurs at the contact of very strongly calcareous till.

Kilmury Series (KUY)
The Kilmury series consists of imperfectly drained Gleyed Rego Black carbonated soils developed on a thin mantle (<1 m) of moderately to strongly calcareous sediments of VFS, LVFS, SL and FSL texture overlying moderately to strongly calcareous stratified medium sands to gravelly textured deposits. They occur in close association with Wytonville series, the well drained Miniota series and the poorly drained Bornett series. The topography is level to very gently sloping; runoff is moderately slow; permeability is moderately rapid in the

very fine sandy sediments and rapid in the subsoil, but restricted by a high water table during spring and early summer.

The soil is characterized by a very dark gray Ah horizon, 20 to 35 cm thick, a dark gray to grayish brown AC horizon 10 to 16 cm thick and a Cca horizon 10 to 18 cm thick. Yellowish brown mottles are common in the sandy and coarser subsoil. Kilmury profiles differ from Wytonville profiles in not having a Bmgj horizon and in having free lime carbonate in their Ah horizons.

Kirkness Series (KKS)
The Kirkness series consists of moderately well to well drained Orthic Black Chernozem soils developed on a thin mantle (25 to 60 cm) of sandy sediments (FS, LFS, LS) over a moderately to very strongly calcareous loam to clay loam glacial till of shale, limestone and granitic origin. They occur on gently sloping to gently undulating topography. Runoff is low; permeability is rapid in the upper strata and moderately slow in the underlying till deposits.

The soil is characterized by a very dark gray Ah horizon 15 to 22 cm thick and a brown Bm horizon 12 to 18 cm thick. The depth of the solum varies with the thickness of the overlay. Generally the BC horizon extends to the contact of the sandy strata and the very strongly calcareous loamy till, which appears as a prominent Cca horizon.

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 moderately to very 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.

Lavenham Series (LVH)
The Lavenham series is a Gleyed Black Chernozem soils 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 1 metre shortly after spring runoff, to 3 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).

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 colored 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).

Lindstrom Series (LDM)
The Lindstrom series consists of imperfectly drained, carbonated, Gleyed Rego Black Chernozem soils developed on a thin mantle (25 to 60 cm) of moderately coarse sediments (VFS, LVFS, FSL) over a thin strata (10 to 50 cm) of very strongly calcareous loamy glacial till of limestone and granitic origin over strongly calcareous glacial till of shale, limestone and granitic origin. Topography is level to very gently sloping; runoff is moderately slow; permeability is moderate in the sandy strata and moderately slow in the underlying till.

The soil is characterized by a very dark gray Ah (k) horizon, 18 to 25 cm thick, a dark gray to grayish brown ACgj horizon, 10 to 18 cm thick and a lime accumulation horizon (Ccagj), 6 to 10 cm thick. Where the sandy stratum is shallow, the lime accumulation layer grades to the very strongly calcareous glacial till. A few yellowish brown mottles may be present in the ACgj and Ccagj 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 strata (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.

Lonery Series (LOE)
The Lonery series consists of poorly drained, carbonated Rego Humic Gleysol soils developed on a thin mantle (25 to 60 cm) of moderately coarse sediments (VFS, LVFS, FSL) over a thin strata (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 level to depressional topography. Runoff is very slow to negligible; permeability is very slow.

The soil is characterized by a thin, moderately decomposed organic layer, 2 to 5 cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, and a dark gray to olive gray ACg horizon, 6 to 10 cm thick. A lime accumulation horizon (Ccag) is usually present in the sandy strata and may extend to the very strongly calcareous till. Yellowish brown mottles are usually present below the Ah horizon.

Lowroy Series (LOW)
The Lowroy series consists of poorly drained Rego Humic Gleysol (carbonated) soils developed on a thin mantle (<1 m) of moderately to strongly calcareous sandy (FS, LFS, LS) sediments overlying moderately to strongly calcareous, medium sand to gravelly textured deposits. They occur in level to depressional sites which have a water table at or near the surface for part of the year. Runoff is negligible; permeability of the sandy sediments is moderate to moderately rapid above the saturation zone. In areas where the seepage water contains soluble salts, a sufficient concentration of salts may occur in the soil to inhibit the growth of the normal sedge and meadow grasses.

The soil is characterized by a moderately decomposed organic layer 2 to 5 cm thick, a very dark gray Ahk horizon 7 to 15 cm thick, a thin dark gray ACg horizon and a Ccag horizon. Yellowish brown mottles are common in the ACg and Ccag horizon and subsoil.

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 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).
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Mansfield Series (MFI)
The Mansfield series consists of imperfectly drained Gleyed Rego Black Chernozem soils developed on moderately to strongly calcareous, stratified, deep, sandy skeletal (S, GrS, CoS), glaciofluvial deposits. These soils occur in middle positions of nearly level landscapes and have rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Mansfield soils are non-eroded, non-stony, and non-saline. They have a low available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes prairie grasses, shrubs, aspen and bur oak. The majority of these soils are currently used for grazing or forage 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 25 cm thick, a dark gray to grayish brown AC horizon, 8 to 15 cm thick, moderately calcareous, a Ccagj horizon, 5 to 8 cm thick and a Ckgj horizon, with distinct yellowish brown mottles.

Mansfield soils occur in close association with Dorset and Fortina soils. They are similar to Dexter soils by having an imperfectly drained profile in sandy skeletal deposits but differ from them in having no Bm horizon. Mansfield soils were mapped as associates of the Marringhurst and Agassiz Associations in the South-Central or Carberry soil reports.

Manson Series (MXD)
The Manson series consists of moderately well drained Cumulic Regosol soils on moderately to strongly calcareous, stratified dominantly clayey (SiC, C) alluvial deposits with layers of silty clay loam and clay loam. These soils are located in flood plain areas that have been inundated during years of high flood waters. They occur in association with Assiniboine and Kerran soils. Topography is gently sloping to gently undulating; runoff is moderate; permeability is moderately slow to slow.

The soil is characterized by a dark gray to gray surface horizon (Ah or Ap) 8 to 15 cm thick and generally lighter colored (C) substratum, but some dark stratum consisting of former organic material or Ah horizon may be present. Weak profile development may occur on the upper terrace positions.

Marringhurst Series (MRH)
The Marringhurst series consists of moderately well to well drained Calcareous Black Chernozem soils developed on moderately strongly to strongly calcareous, stratified, deep, sandy (CoS, S) and sandy skeletal (GrS, GrCoS) glaciofluvial deposits. These soils occur in upper positions of very gentle slopes on rolling to irregular landscapes and have very rapid permeability, low surface runoff, and a low water table during the growing season. Marringhurst soils are often moderately eroded, non-stony, and non-saline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes shrubs, bur oak, and prairie grasses. The majority of these soils are currently excavated for gravel or used for grazing.

In a representative profile soil the solum is approximately 25 cm thick. The profile is characterized by a very dark gray to very dark grayish brown Ah horizon, 14 to 18 cm thick, a dark brown to brown Bmk horizon, 10 to 18 cm thick, a Cca horizon, 20 to 30 cm thick with coarser gravelly strata and a Ck horizon.

Marsden Series (MDN)
The Marsden series consists of poorly drained Rego Humic Gleysol, carbonated soils developed on a sequence of strata consisting of a thin lacustrine mantle (25 to 60 cm) of moderately to strongly calcareous loamy sediments (VFSL to SiCL) over thin (10 to 40 cm) of medium sand to gravel strata over strongly calcareous loam to clay loam glacial till of shale, limestone and granitic origin. The topography is level to depressional; runoff is negligible, and permeability is restricted during periods when free water is at or near the surface.

The soils are characterized by a thin, moderately decomposed organic layer, 1 to 4 cm, a very dark gray Ah horizon, 12 to 18 cm and an olive brown ACg frequently developed in the sand strata. The Cg horizon is olive gray with many prominent mottles and usually occurs at the till contact. Marsden soils were previously mapped as minor associates of the Heaslip complex in the Reconnaissance soil survey of South-Central Manitoba (Ellis and Shafer, 1943).

Melland Series (MXT)
The Melland series consists of the imperfectly drained, Gleyed Rego Black Chernozem, carbonated soils developed on a sequence of materials consisting of a thin mantle (25 to 60 cm) of moderately to strongly calcareous loamy (VFSL to SiCL) sediment over a thin (10 to 40 cm) layer of medium sand to gravel strata over strongly calcareous loam to clay loam glacial till of shale, limestone, and granitic origin. Topography is level to gently sloping; runoff is moderately slow; permeability is moderate in the upper strata, but restricted above the till due to perched water conditions. Lateral flow of water occurs through the gravel strata during the spring or following heavy rains.

The soil is characterized by a very dark gray Ah horizon 18 to 25 cm thick, and a dark gray to grayish brown AC horizon, 10 to 15 cm thick. A lime accumulation (Ccagj) horizon is usually present at the transition from loamy to gravel strata. Melland soils are more permeable than the very similar, finer textured Beresford series.

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 Bornett 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.

Mowbray Series (MOW)
The Mowbray series consists of a well drained, Cumulic Regosol soils developed on deep, moderately to strongly calcareous, loamy (L, SiL, CL, SiCL) recent alluvial sediments. These deposits are stratified and contain dark colored 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 colored (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.

Newdale Series (NDL)
The Newdale series is characterized by an Orthic Black Chernozem solum on moderately to strongly calcareous, fine loamy (L, SCL, CL) 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.

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.

Oberon Series (OBR)
The Oberon series consists of imperfectly drained Gleyed Black Chernozem soils developed on a thin mantle (<1 m) of strongly calcareous clay loam to sandy clay loam sediments grading to moderately calcareous sandy (FS, LFS, LS) deposits. They occur on level to gently sloping topography. Runoff is moderate to moderately slow; permeability is moderate in the upper loamy strata and moderately rapid in the sandy subsoil when not restricted by a high water table in early spring or summer.

The soil is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, a subangular blocky brown to olive brown Bmgj horizon, 12 to 22 cm thick with yellowish brown mottles in the lower part of the horizon; a BC horizon, 8 to 16 cm thick. Carbonate accumulation (Ccagj horizon) is usually present within the loamy strata. The sandy substrata is light yellowish brown with yellowish brown to strong brown mottles of iron.

Onahan Series (ONH)
The Onahan series is a Gleyed Regosol soil 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 (Ehrlich et al., 1957).

Perillo Series (PER)
The Perillo series consists of very poorly drained Terric Mesisol soils developed on a mantle (40 to 160 cm) of moderately decomposed organic, material composed of fen peat over moderately to strongly calcareous, deep, uniform, coarse loamy (LFS, FS), lacustrine deposits. These soils occur in depressional positions on rolling to hummocky landscapes and have slow permeability very slow surface runoff and a very high water table during the growing season. Perillo soils are occasionally slightly saline. They have a high available water holding capacity, very high organic matter content, and low natural fertility. Native vegetation often includes sedges, reeds, and clumps of willow or swamp birch. The majority of these soils are currently used for natural grazing.

In a representative profile the solum is approximately 50 cm thick. The profile is characterized by a black Om horizon, 5 to 15 cm thick, a black Oh horizon, 20 to 45 cm thick, a black Ah horizon, 15 to 25 cm thick, with a few large iron mottles and a light brownish gray ACg horizon 10 to 25 cm thick, with many large prominent iron mottles. The mineral soil parent material is typically light gray in color with numerous prominent mottles and manganese concretions. A typical profile also contains snail shells on the surface and throughout the profile.

Perillo soils occur in association with sloughs, lakes and areas of restricted drainage. They are similar to Tadpole peaty phase soils but differ from them in having an organic surface horizon greater than 40 cm thick to the mineral soil substrate. Perillo soils were previously mapped as meadow or marsh inclusions of many soil associates in the reconnaissance soil survey of South-Central Manitoba (Ellis and Shafer, 1943).

Petrel Series (PTR)
The Petrel series consists of imperfectly drained Gleyed Black Chernozem soils developed on a mantle (25 to 75 cm) of moderately to strongly calcareous, shallow, medium textured (VFSL, L, SiL), deposits over moderately calcareous, uniform, deep, moderately coarse (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. Petrel soils are non-eroded, 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 prairie grasses, shrubs, aspen and oak. The majority of these soils are currently cultivated for crop production.

In a representative profile the solum is approximately 40 cm thick. The profile is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, a brown Bm horizon, 14 to 20 cm thick, a BCgj horizon, 20 to 30 cm thick with faint mottles and a light yellowish brown Ckgj horizon, with yellowish brown to strong brown mottles. A typical profile also contains a weak Cca in the upper part of the sandy substrate.

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

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).

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, 6 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 Porple, 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).

Porple Series (POR)
The Porple 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 susceptible to both wind or water erosion if not protected.

The Porple series is characterized by a very dark gray Ap and 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. Porple soils are finer textured and less permeable than the sandy Stockton soils, and in turn, are coarser textured and more permeable than the very similar loamy textured Durnan and Fairland 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 (SCL, 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 Porple, 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 Porple 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.

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).

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.

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, 5 to 8 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 (Ehrlich et al., 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).

Statley Series (SXB)
The Statley Series consists of well to moderately well drained Orthic Dark Gray Chernozem soils developed on very strongly to extremely calcareous loamy glacial drift of limestone and granitic origin. The soil occurs mainly on the mid and upper slopes of irregular undulating to moderately rolling topography, generally near or above an elevation of 457 metres (1500 ft) in the Brandon Hills, and may occur at lower elevations on the north and east facing slopes. Runoff is moderately rapid; permeability is moderately slow. Under cultivation, these soils are susceptible to both wind and water erosion, particularly on the steeper gradients. Native vegetation consists of bur oak, trembling aspen, shrubs and grasses. Stone content is quite variable.

The soil is characterized by a partially decomposed leaf mat (LH), 2 to 4 cm thick, a dark gray to dark grayish brown Ahe horizon 5 to 10 cm thick, a dark brown to brown Btj or Bt horizon, 10 to 15 cm thick, a pale brown BC horizon, 4 to 6 cm thick, and a white lime accumulation (Cca) horizon.

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, 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.

Sutton Series (SXP)
The Sutton series consists of poorly drained Rego Humic Gleysol soils developed on a mantle (25 to 100 cm) of moderately calcareous, moderately fine (CL, SiCL), lacustrine deposits over moderately calcareous, deep, stratified, sandy (FS, LFS, LS), fluvial lacustrine deposits. These soils occur in depressional positions on nearly level landscapes and have restricted permeability, negligible surface runoff, and a near surface water table during the growing season. Sutton soils are non-eroded, non-stony, and frequently weakly saline. They have a moderate available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, hydrophytic grasses 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, 2 to 4 cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a dark gray ACk horizon, 4 to 8 cm thick with carbonates and a light gray Ccag horizon, 5 to 8 cm thick with many distinct mottles. The parent material is typically olive brown in colour with many prominent mottles. A typical profile also contains gypsum crystals at depth.

Sutton soils occur in close association with Wellwood soils. They are similar to Tadpole soils by having a poorly drained profile and a fine loamy surface but differ by having a sandy substrate while Tadpole soils are fine loamy throughout. Sutton soils were previously mapped as poorly drained associates of the Wellwood Association in the soil survey of South-Central Manitoba (Ellis and Shafer, 1943).

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, 2 to 6 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 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).

Vodroff Series (VFF)
The Vodroff series consists of poorly drained Rego Humic Gleysol soils developed on a thin mantle (<1 m) 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, 4 to 8 cm thick and a carbonate accumulation horizon, 8 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 ACkg 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 and loamy deposits 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).

Wellwood Series (WWD)
The Wellwood series consists of well to moderately well drained Orthic Black Chernozem soils developed on a thin mantle (25 to 75 cm) of strongly calcareous fine loamy (CL, SCL,SiCL) sediments grading to moderately calcareous sandy (FS, LS, LFS) deposits. Topography is nearly level to very gently sloping; runoff is moderate to moderately slow; permeability is moderate in the upper loamy strata and rapid in the sandy strata.

The soil is characterized by a deep black to very dark gray, loam to clay loam, Ah horizon, 18 to 30 cm thick; a dark brown to brown, prismatic to subangular blocky, clay loam to silty clay loam, Bm horizon, 16 to 24 cm thick, and a yellowish brown to pale brown, clay loam to silty clay loam, BC horizon, 8 to 14 cm thick. A Cca horizon may be present, underlain by a II Ck that ranges from fine sand to loamy fine sand.

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.

Wheatland Series (WHL)
The Wheatland series consists of well to moderately well drained Orthic Black Chernozem soils developed on a mantle (60 to 95 cm) of moderately to strongly calcareous, shallow sandy (FS, LS), deposits over moderately to strongly calcareous, deep, stratified, sandy-skeletal (CoS, MS), fluvial deposits. These soils occur in upper positions of gentle to very gentle slopes on undulating landscapes and have rapid over very rapid permeability, moderately slow surface runoff, and a low water table during the growing season. Wheatland soils are occasionally slightly eroded, non-stony, and non-saline. They have a low available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes oak, aspen, shrubs and prairie grasses. The majority of these soils are currently used for grazing and for some crop production.

In a representative profile the solum is approximately 40 cm thick. The profile is characterized by very dark gray to very dark grayish brown Ah horizon, 18 to 25 cm thick, a brown to yellowish brown Bm horizon, 12 to 24 cm thick, a light yellowish brown BCk horizon, 10 to 15 cm thick with carbonates and a Cca horizon, 5 to 8 cm thick at the sand/gravel contact. They are similar to Dorset soils by having an Orthic Black Chernozem profile and sandy-skeletal substrate but differ from them in having a sandy surface mantle. Wheatland soils were previously mapped as associates of the Agassiz Association in the Carberry soil report (Ehrlich et al., 1957).

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.

Wytonville Series (WVI)
The Wytonville series consists of imperfectly drained Gleyed Black Chernozem soils developed on a thin mantle (<1 m) of moderately to strongly calcareous, coarse loamy (VFS, LVFS, SL, FSL) sediments, overlying moderately to strongly calcareous medium sand to gravelly textured deposits. Topography is gently sloping to irregular, undulating. Runoff is moderately slow; permeability is moderately rapid on the upper strata, and very rapid in the lower strata unless restricted by a water table within a metre of the surface during the spring or following heavy rains.

The soil is characterized by a very dark gray to very dark grayish brown Ah horizon, 18 to 25 cm thick, a brown to dark brown, weakly mottled Bmgj horizon, 14 to 22 cm thick and a light yellowish brown BCgj with strong brown mottles. A carbonate accumulation horizon (Ccagj) occurs at the upper boundary of the coarse strata. Wytonville profiles differ from Kilmury soil profiles in not having the presence of carbonates in their Ah. They are also more permeable than the very similar Druxman soils. They occur in close association with the Kilmury soils, the well drained Miniota soils and the poorly drained Bornett series.

Xavier Series (XVI)
The Xavier series consists of very poorly drained, Typic Mesisol soils developed on deep (>160 cm), moderately decomposed, mesic fen peat deposits. These soils occur in depressional positions of undulating landscapes and have moderately slow permeability, very slow surface runoff, and a high to ponded water table during the growing season. Xavier soils are non-eroded, non-stony, and non-saline. They have a high available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes sedges, rushes, reeds and willow. The majority of these soils are currently in native vegetation.

Xavier soil is characterized by a dark yellowish brown Of horizon, 10 to 30 cm thick, which is medium acid to neutral and a thick, very dark brown, medium acid to neutral Om horizon, grading into a black, weakly acid to weakly calcareous Oh horizon. Underlying mineral strata range in texture from loam to clay. Xavier soils are similar to Perillo soils by having very poor drainage and organic deposits but differ from them in having deep (>160 cm) rather than shallow (40-160 cm) organic deposits.

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