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Rural Municipality of Clanwilliam

Information Bulletin 98-10

Soils and Terrain

An introduction
to the land resource

Land Resource Unit
Brandon Research Centre



Canada 

Rural Municipality of Clanwilliam

Information Bulletin 98-10

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PREFACE

This is one of a new series of information bulletins for individual rural municipalities of Manitoba. They serve to introduce the newly developed digital soil databases and illustrate several typical derived and interpretive map products for agricultural land use planning applications. The bulletins will also be available in diskette format for each rural municipality.

Information contained in this bulletin may be quoted and utilized with appropriate reference to the originating agencies. The authors and originating agencies assume no responsibility for the misuse, alteration, re-packaging, or re-interpretation of the information.

This information bulletin serves as an introduction to the land resource information available for the municipality. More detailed information, including copies of the primary soil and terrain maps at larger scales, may be obtained by contacting

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LAND RESOURCE DATA

The soil and terrain information presented in this bulletin was compiled as part of a larger project to provide a uniform level of land resource information for agricultural and regional planning purposes throughout Agro-Manitoba. This information was

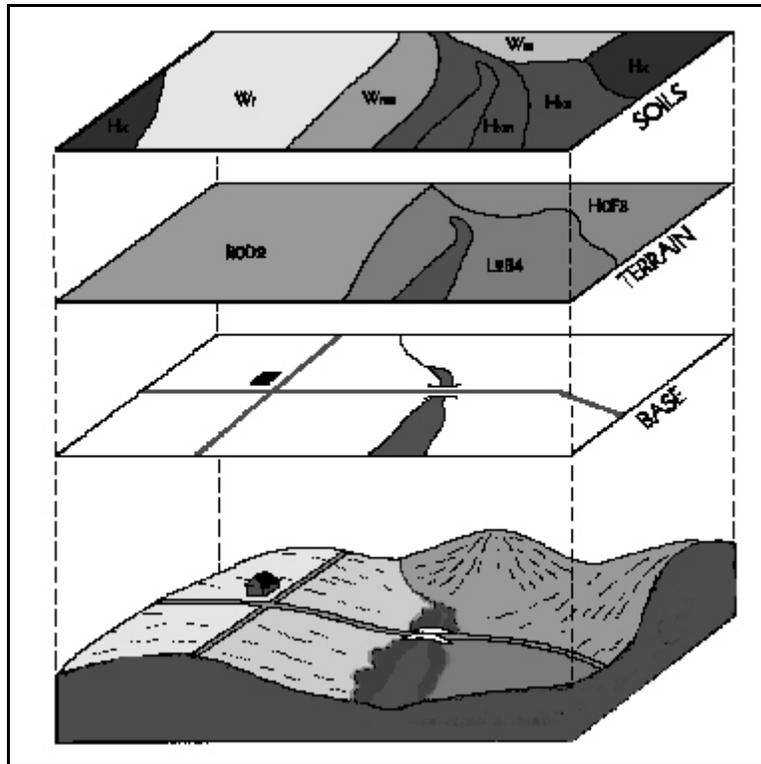


Figure 2. Soil, Terrain and Base Map data. compiled and analysed in two distinct layers as shown in Figure 2.

Base Layer

Digital base map information includes the municipality and township boundaries, along with major streams, roads and highways. Major rivers and lakes from the base layer were also used

as common boundaries for the soil map layer. Water bodies larger than 25 ha in size were digitized as separate polygons.

Terrain Layer

A separate terrain layer was produced for municipalities for which only reconnaissance scale soil map coverage was available. This was compiled by aerial photo-interpretation techniques, using recent 1:50 000 scale stereo airphoto coverage. The terrain information was transferred from the photographs onto the standard RM base and digitized in the GIS. Where the soil and terrain boundaries coincided, such as along prominent escarpments and eroded stream channels, the new terrain line was used for both layers. The terrain line, delineated from modern airphoto interpretation, was considered more positionally accurate than the same boundary portrayed on the historical reconnaissance soil map. Each digital terrain polygon was assigned the following legend characteristics:

Surface form	Wetland size
Slope	Erosional modifiers
Slope length	Extent of eroded knolls
Percent wetlands	

The four legend characteristics on the left are considered differentiating, that is, a change in any of these classes defines a new polygon.

Soil Layer

Older, reconnaissance scale soil maps (1:126 720 scale) represented the only available soil data source for many rural municipalities. These maps were compiled on a **soil association** basis, in which soil landscape patterns were identified with unique surficial geological deposits and textures. Each soil association consists of a range of different soils ("associates") each of which occurs in a repetitive position in the landscape. Modern soil series that best represent the soil association were identified for each soil polygon. The soil and modifier codes provide a link to additional databases of soil

properties. In this way, reconnaissance soil map polygons were related to soil drainage, surface texture, and other soil properties to produce various interpretive maps.

SOIL AND TERRAIN OVERVIEW

The Rural Municipality (RM) of Clanwilliam covers an area of 4 townships (approximately 38 669 hectares) of land in western Manitoba (page 3). The Town of Erickson is the main population and service centre in the municipality as most of the population is rural farm-based. Approximately 1920 hectares of land in the northeast part of the municipality is in the Riding Mountain National Park.

Climatic conditions in the municipality can be related to weather data from Wasagaming located about 6 km north of the municipality in Riding Mountain National Park. The mean annual temperature at Wasagaming is 0°C and precipitation is 508 mm (Environment Canada, 1993). The average frost-free period is 69 days and growing degree-days above 5°C are 1256 (Ash, 1991). The growing season is slightly warmer and longer in the southern half of the municipality. The calculated seasonal moisture deficit for the period between May and September ranges from slightly less than 200 mm in the north to slightly in excess of 200 mm in the south. The estimated effective growing degree days (EGDD) above 5°C accumulated from date of seeding to the date of the first fall frost varies from slightly less than 1100 in the north to slightly more than 1200 in the south (Agronomic Interpretations Working Group, 1995). These parameters provide an indication of length of growing season and moisture and heat energy available for crop growth.

Physiographically, the RM of Clanwilliam is located in the Riding Mountain Upland section of the Saskatchewan Plain (Canada-Manitoba Soil Survey, 1980). Elevations in the municipality range from 600 to 668 metres above sea level (m asl) in the north to about 600 m asl in the south. The land surface in the northern part of the municipality is sharply hummocky to hilly with local relief exceeding 8 metres and slopes ranging from 9 to 30 percent. Hummocky topography with average slopes of 5 to 9 percent and local relief of 3 to 8 metres is dominant in the south. Depressions throughout the municipality contain sloughs, small ponds or lakes. A few larger lakes exceed several hundred hectares in size (page 9).

The soil materials in this RM consist mainly of loamy textured glacial till (morainal) deposits. Areas of clayey textured till occur in the southern part of the municipality. Shallow to deep, sandy loam to loamy lacustrine sediments are associated with stream channels and river valleys, particularly along the Rolling River. Local areas of stratified alluvial deposits and small areas of gravel and coarse sand deposits occur along portions of the Whirlpool and Rolling Rivers (page 11).

Soils in the municipality have been mapped at a reconnaissance map scale of 1:126 720 and published in the soil survey report for the West-Lake Map Sheet Area (Ehrlich et al, 1958). Detailed 1:20 000 scale soil maps are published for small areas around Gertrude, South Pacey and Otter Lakes in Soils of the South Riding Mountain Planning District (Eilers and Lelyk, 1990). According to the Canadian System of Soil Classification (Expert Committee on Soil Survey, 1987), soils in the northern part of the municipality are classified dominantly as Gray Luvisol soils of the Waitville Association whereas Chernozemic Dark Gray soils of the Erickson, Meadowbrook and Onanole Associations are dominant in the southern half of the area. Local areas of poorly drained soils (Gleysols) and Organic (shallow and deep peat) soils occur in depressions throughout the municipality (page 11). A more detailed and complete description of the type, distribution and textural variability of soils in the municipality is provided in the published soil surveys.

Surface water in the municipality flows to the south via tributaries of the Rolling River draining into the Little Saskatchewan River and eventually to the Assiniboine River. The soils are dominantly well drained in hilly and hummocky landscapes with minor areas of imperfectly drained soils on lower slopes. Surface runoff collects in depressional areas of the landscape which are characterized by poorly drained soils with a thin surface layer of peat, deeper organic soils or shallow intermittent ponds and small lakes (page 13).

Major management considerations are related to topography and wetness (page 15). Steeper sloping soils are not arable and numerous undrained depressions varying in size from small potholes

and sloughs to large meadows and intermittent and shallow lakes break up the landscape and limit agricultural use. Many of the poorly drained soils are non-arable because of inundation during the spring season or wet seasons. Variably stony soils occur throughout the municipality but do not constitute a serious problem to cultivation except on higher ridges and knolls which may be excessively stony.

Approximately 13 percent of the land in the RM is rated as **Class 2** and 51 percent is rated as **Class 3** for agriculture capability (page 17). About 19 percent of the land area is rated **Good** for irrigation suitability and 42 percent is rated **Fair** (page 19). Topography, wetness and organic soils are the main limitations for agriculture capability. Well drained sandy and gravelly soils in level landscapes are rated as **Class 5** for agriculture and **Poor** for irrigation. Poor drainage affects some 12 percent of the soils in the RM which are rated in **Class 5** for agriculture capability and **Poor** for irrigation. Organic soils are very poorly drained and have little or no capability for agriculture in their natural state.

A major issue currently receiving considerable attention is the sustainability of agricultural practices and their potential impact on the soil and groundwater environment. To assist in highlighting this concern to land planners and agricultural producers, an assessment of potential environmental impact (EI) under irrigation has been included in this bulletin (page 21). As shown, extensive areas of steeply sloping soils are at **Moderate to High** risk of degradation due to greater runoff to streams and water bodies in the landscape. Sandy and gravelly soils are at **High** risk of deep leaching of potential contaminants on the soil surface. Loamy textured soils in undulating terrain are at a **Low** risk of degradation. This EI map is intended to be used in association with the irrigation suitability map.

Another issue of concern to producers, soil conservationists and land use specialists is soil erosion caused by agricultural cropping and tillage practices. To highlight areas with potential for water erosion, a risk map has been included to show where special practices should be adopted to mitigate this risk (page 23). About 46 percent of the land in the RM is at **Severe** risk of degradation and

an additional 14 percent of the area has a **High** risk. Slightly over one-quarter of the land in the RM is considered to have a **Negligible to Low** risk of water erosion. Management practices for these soils most at risk from water erosion focus primarily on maintaining adequate crop residues to provide sufficient surface cover during the early spring period. These practices include minimum tillage and suitable crop rotations.

An assessment of the status of land use in the RM of Clanwilliam in 1994 was obtained through analysis of satellite imagery. It showed that 20 percent of the land in the RM is in annual cropland and an additional 33 percent of the area is in grassland. Treed areas occupy 34 percent of the municipality, mostly on steeper sloping lands. Production of perennial forages occurs on 0.2 percent of the area. Natural wetlands constitute 4.4 percent of the RM and water bodies cover an additional 6 percent of the area. Various non-agricultural uses such as recreation and infrastructure for urban areas and transportation occupy 2.5 percent of the RM (page 25).

While the majority of the soils in the RM of Clanwilliam have severe to moderately severe limitations for arable agriculture, careful choice of crops and maintenance of adequate surface cover is essential for the management of sensitive lands with coarse texture or steep slopes. Implementation of minimum tillage practices and crop rotations including forage on a site by site basis will help to reduce the risk of soil degradation, maintain productivity and insure that agriculture land-use is sustainable over the long-term.

DERIVED AND INTERPRETIVE MAPS

A large variety of computer derived and interpretive maps can be generated from the digital soil and landscape databases. These maps are based on selected combinations of database values and assumptions.

Derived maps show information that is given in one or more columns in the computer map legend (such as soil drainage or slope class).

Interpretive maps portray more complex land evaluations based on a combination of soil and landscape information. Interpretations are based on soil and landscape conditions in each polygon. Interpretative maps typically show land capabilities, suitabilities, or risks related to sustainability.

Several examples of derived and interpretive maps are included in this information bulletin:

Derived Maps

Slope

Generalized Soil

Drainage

Management Considerations

Interpretative Maps

Agricultural Capability

Irrigation Suitability

Potential Environmental Impact

Water Erosion Risk

Land Use

The maps have all been reduced in size and generalized (simplified) in order to portray conditions for an entire rural municipality on one page. These generalized maps provide a useful overview of conditions within a municipality, but are not intended to apply to site specific land parcels. On-site evaluations are recommended for localized site specific land use suitability requirements.

Digital databases derived from recent detailed soil inventories contain additional detailed information about significant inclusions of differing soil and slope conditions in each map polygon. This information can be portrayed at larger map scale than shown in this bulletin.

Information concerning particular interpretive maps, and the primary soil and terrain map data, can be obtained by contacting the Manitoba Soil Resource Section of Manitoba Agriculture, the local PFRA office, or the Land Resource Unit.

Slope Map.

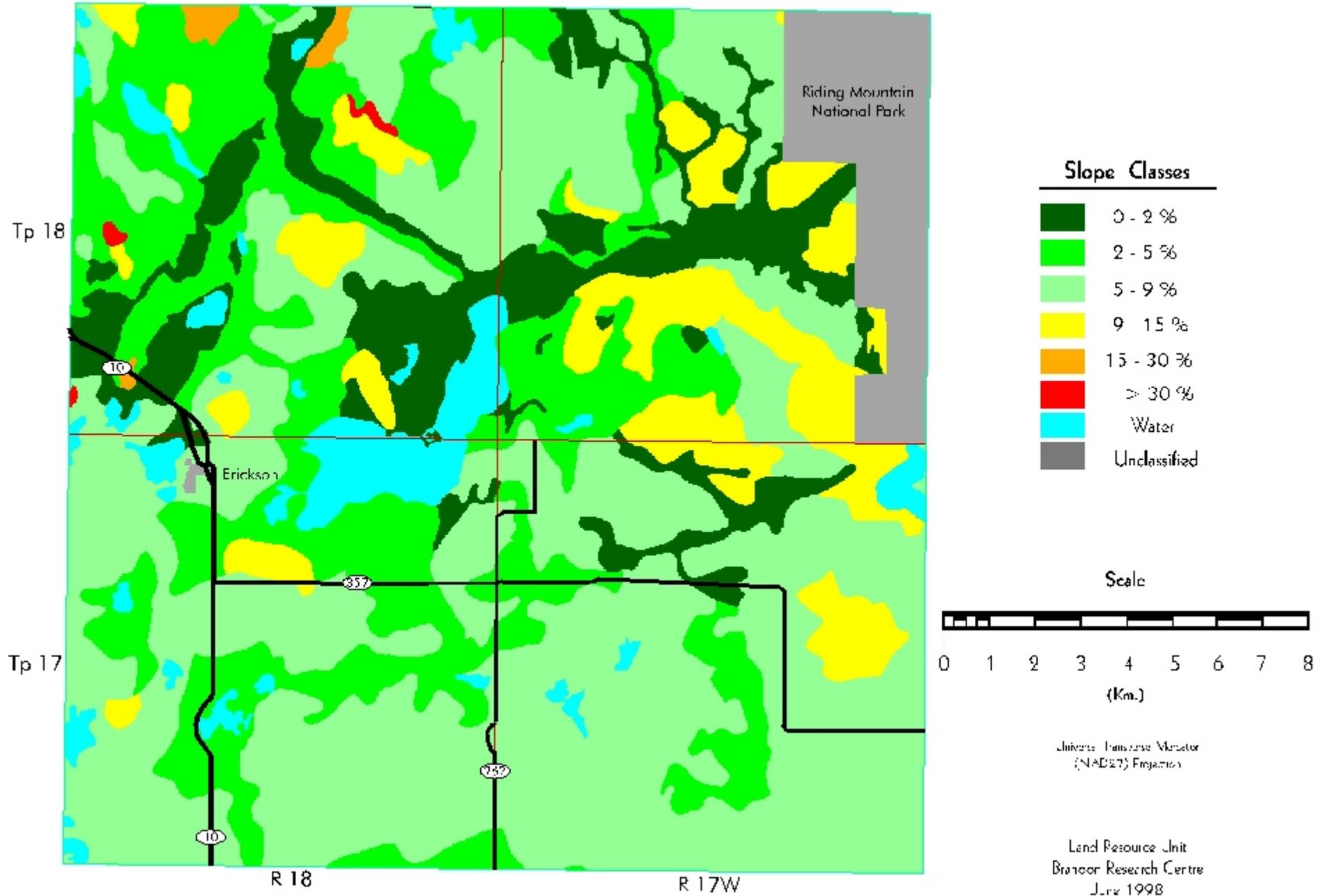
Slope describes the steepness of the landscape surface. The slope classes shown on this map are derived from the digital soil and terrain layer database. Specific colours are used to indicate the dominant slope class for each polygon in the RM. Additional slope classes may occur in each polygon area, but cannot be portrayed at this reduced map scale.

Table 1. Slope Classes¹

Slope Class	Area (ha)	Percent of RM
0 - 2 %	4308	11.1
2 - 5 %	8702	22.5
5 - 9 %	17792	46.0
9 - 15 %	3554	9.2
15 - 30 %	178	0.5
> 30 %	61	0.2
Unclassified	2173	5.6
Water	1901	4.9
Total	38669	100.0

¹ Area has been assigned to the dominant slope in each soil polygon.

Slope Map



Generalized Soil Map.

The most recently available soil maps were digitized to produce the new digital soil map. For older reconnaissance soil maps, areas of overprinted symbols or significant differences in topography have been delineated as new polygons. All soil polygons have been digitized and translated into modern soil series equivalents.

The general soil groups provide a very simplified overview of the soil information contained in the digital soil map. The hundreds of individual soil polygons have been simplified into broad groups of soils with similar parent material origins, textures, and drainage classes. The dominant soil in each polygon determines the soil group, area, and colour for the generalized soil map. Gleysolic soils groups have poor to very poor drainage, while other mineral soil groups typically have a range of rapid, well, or imperfectly drained soils.

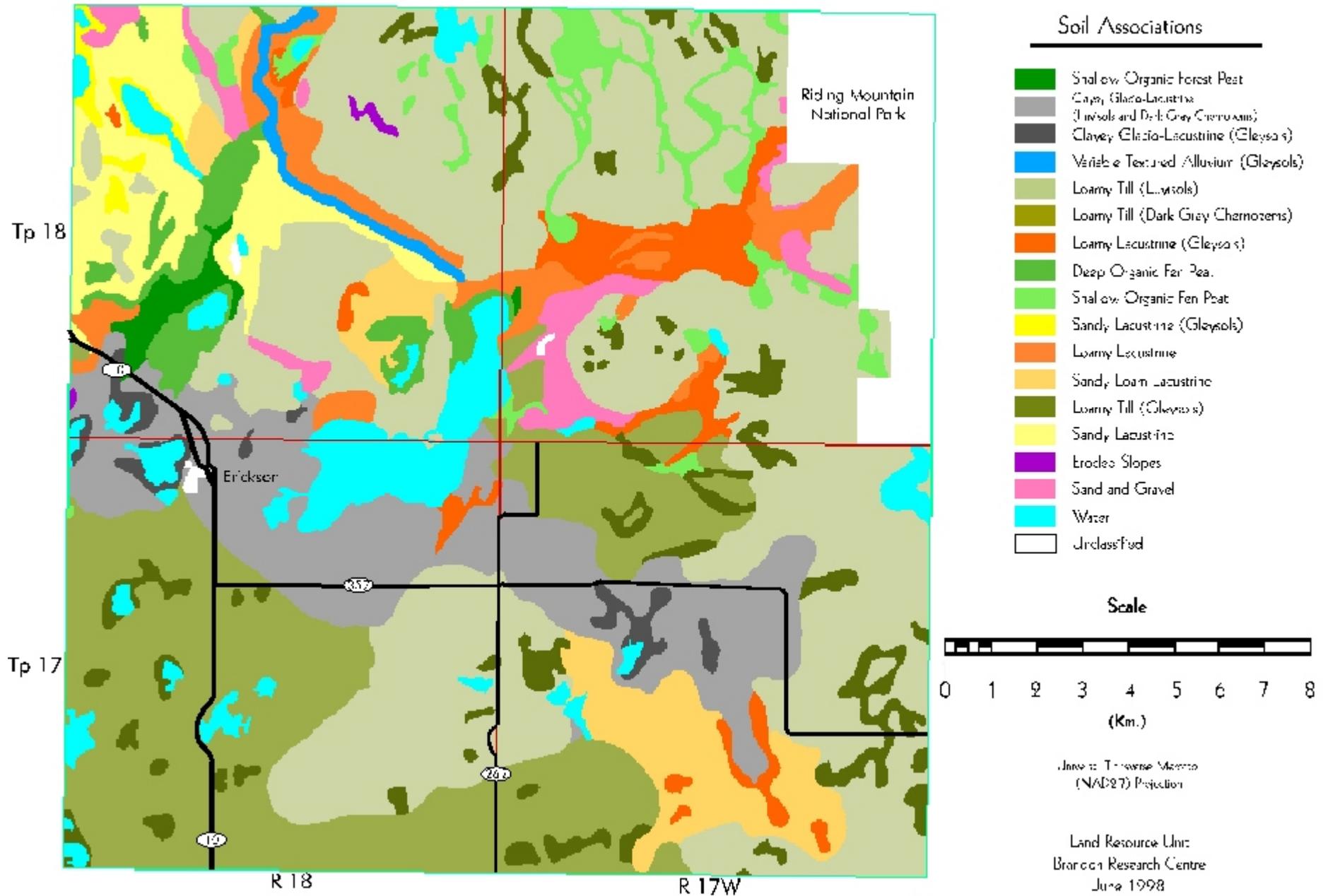
More detailed maps showing the dominant and subdominant soils in each polygon can also be produced at larger map scales.

Table 2. Generalized Soil Groups¹

Soil Groups	Area (ha)	Percent of RM
Shallow Organic Forest Peat	266	0.7
Clayey Lacustrine (Luvisols and Dark Gray Chernozems)	4147	10.7
Clayey Lacustrine (Gleysols)	377	1.0
Variable Textured Alluvium (Gleysols)	236	0.6
Loamy Till (Luvisols)	12766	33.0
Loamy Till (Dark Gray Chernozem)	6660	17.2
Loamy Lacustrine (Gleysols)	1149	3.0
Deep Organic Fen Peat	844	2.2
Shallow Organic Fen Peat	1074	2.8
Sandy Lacustrine (Gleysols)	196	0.5
Loamy Lacustrine	1128	2.9
Sandy Loam Lacustrine	1718	4.4
Loamy Till (Gleysols)	1669	4.3
Sandy Lacustrine	1542	4.0
Eroded Slopes	40	0.1
Sand and Gravel	784	2.0
Water	1901	4.9
Unclassified	2173	5.6
Total	38669	100.0

¹ Based on the **dominant** soil series for each soil polygon.

Generalized Soil Map



Soil Drainage Map.

Drainage is described on the basis of actual moisture content in excess of field capacity, and the length of the saturation period within the plant root zone. Five drainage classes plus three land classes are shown on this map.

Very Poor - Water is removed from the soil so slowly that the water table remains at or on the soil surface for the greater part of the time the soil is not frozen. Excess water is present in the soil throughout most of the year.

Poor - Water is removed so slowly in relation to supply that the soil remains wet for a large part of the time the soil is not frozen. Excess water is available within the soil for a large part of the time.

Imperfect - Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. Excess water moves slowly down the profile if precipitation is the major source.

Well - Water is removed from the soil readily but not rapidly. Excess water flows downward readily into underlying materials or laterally as subsurface flow.

Rapid - Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep slopes during heavy rainfall.

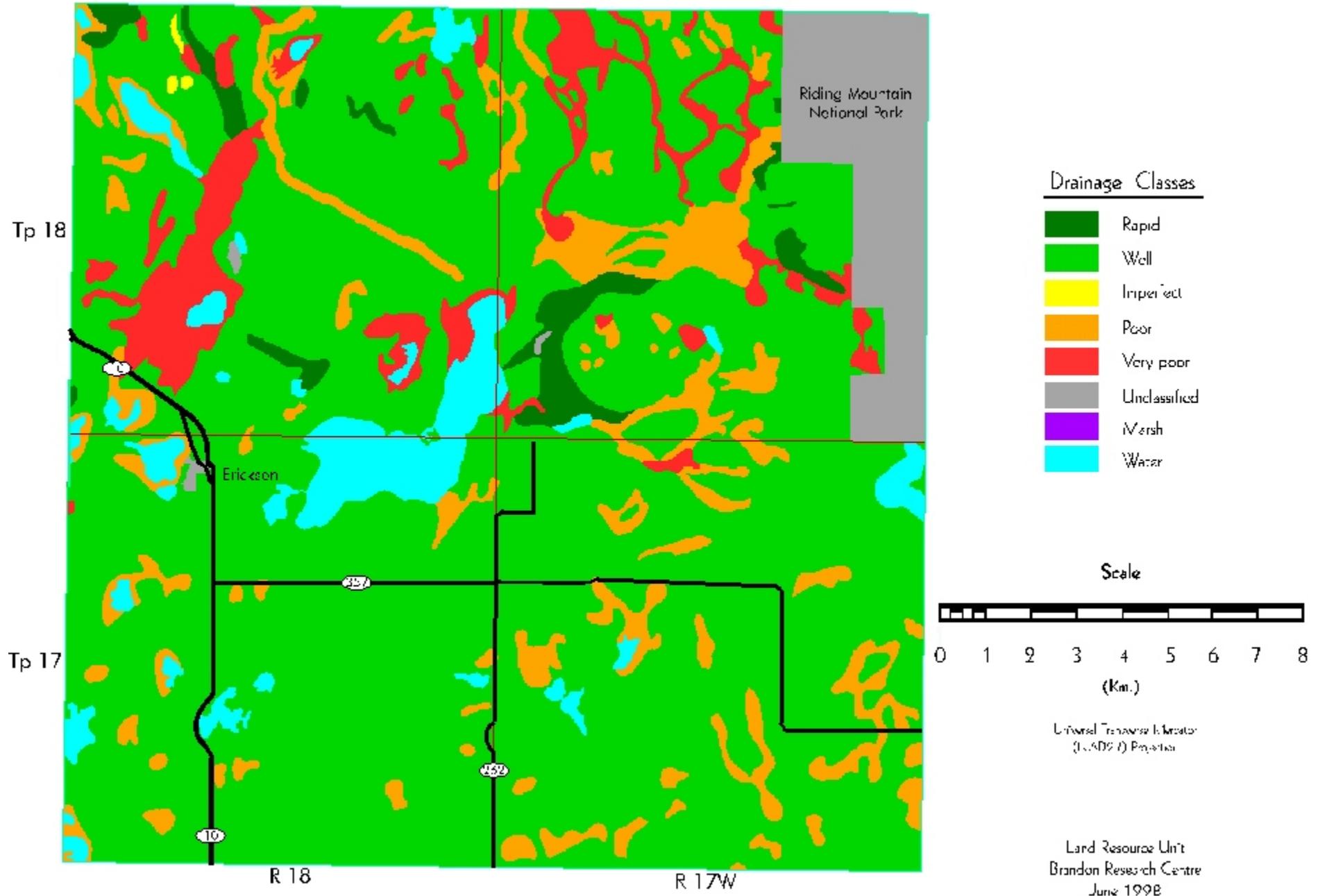
Drainage classification is based on the dominant soil series within each individual soil polygon.

Table 3. Drainage Classes¹

Drainage Class	Area (ha)	Percent of RM
Very Poor	2185	5.6
Poor	3626	9.4
Imperfect	26	0.1
Well	27935	72.2
Rapid	823	2.1
Marsh	0	0.0
Unclassified	2173	5.6
Water	1901	4.9
Total	38669	100.0

¹ Area has been assigned to the dominant drainage class for each soil polygon.

Soil Drainage Map



Universal Transverse Mercator
(UTM) Projection

Land Resource Unit
Brandon Research Centre
June 1998

Management Considerations Map.

Management consideration maps are provided to focus on awareness of land resource characteristics important to land use. This map does not presume a specific land use. Rather it portrays the most common and wide spread attributes that apply to most soil landscapes in the province.

These maps **highlight attributes** of soil-landscapes that the land manager must consider for any intended land use.

- **Fine texture**
- **Medium texture**
- **Coarse texture**
- **Topography**
- **Wetness**
- **Organic**
- **Bedrock**

F = Fine texture - soil landscapes with **fine textured soils (clays and silty clays)**, and thus low infiltration and internal permeability rates. These require special considerations to mitigate surface ponding (water logging), runoff, and trafficability. Timing and type of tillage practices used may be restricted.

M = Medium texture - soil landscapes with medium to moderately fine textures (**loams to clay loams**), and good water and nutrient retention properties. Good management and cropping practices are required to minimize leaching and the risk of erosion.

C = Coarse texture - soil landscapes with **coarse to very coarse textured soils (loamy sands, sands and gravels)**, have a high permeability throughout the profile, and require special management practices related to application of agricultural chemicals, animal wastes, and municipal effluent to protect and sustain the long term quality of the soil and water resources. The risk of soil erosion can be minimized through the use of shelterbelts and maintenance of crop residues.

T = Topography - soil landscapes with **slopes greater than 5 %** are steep enough to require special management practices to minimize the risk of erosion.

W = Wetness - soil landscapes that have **poorly drained soils and/or >50 % wetlands** (due to seasonal and annual flooding, surface ponding, permanent water bodies (sloughs), and/or high water tables), require special management practices to mitigate adverse impact on water quality, protect subsurface aquifers, and sustain crop production during periods of high risk of water logging.

O = Organic - soil landscapes with organic soils, requiring special management considerations of drainage, tillage, and cropping to sustain productivity and minimize subsidence and erosion.

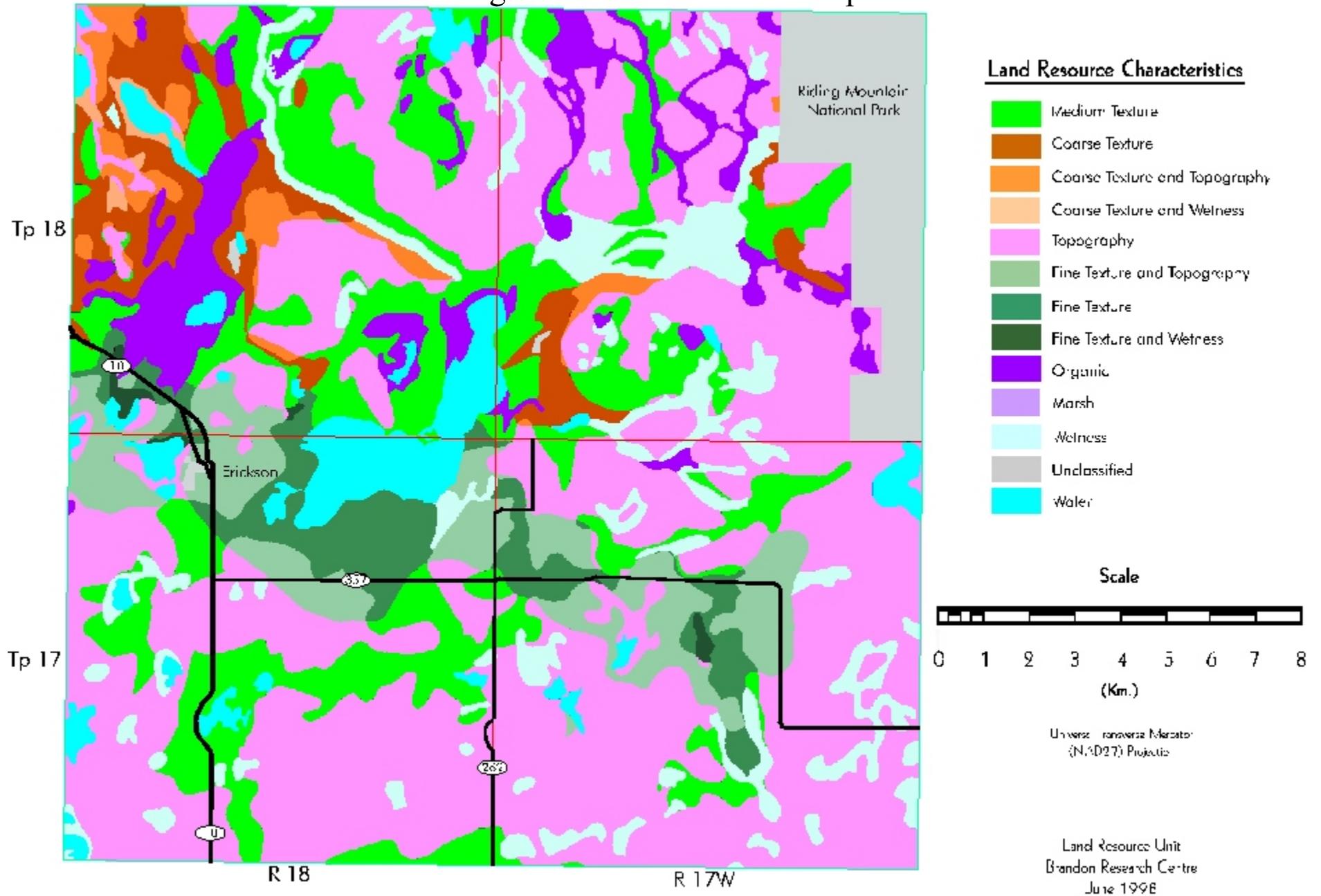
R = Bedrock - soil landscapes that have **shallow depth to bedrock (< 50 cm) and/or exposed bedrock** which may prevent the use of some or all tillage practices as well as the range of potential crops. They require special cropping and management practices to sustain agricultural production.

Table 4. Management Considerations¹

Land Resource Characteristics	Area (ha)	Percent of RM
Fine Texture	1650	4.3
Fine Texture and Wetness	114	0.3
Fine Texture and Topography	2497	6.5
Medium Texture	6156	15.9
Coarse Texture	1662	4.3
Coarse Texture and Wetness	120	0.3
Coarse Texture and Topography	664	1.7
Topography	16493	42.7
Bedrock	0	0.0
Wetness	3054	7.9
Organic	2185	5.6
Marsh	0	0.0
Unclassified	2173	5.6
Water	1901	4.9
Total	38669	100.0

¹ Based on the **dominant** soil series and slope gradient within each polygon.

Management Considerations Map



Agricultural Capability Map.

This evaluation utilizes the 7 class Canada Land Inventory system (CLI, 1965). Classes 1 to 3 represent the prime agricultural land, class 4 land is marginal for sustained cultivation, class 5 land is capable of perennial forages and improvement is feasible, class 6 land is capable of producing native forages and pasture but improvement is not feasible, and class 7 land is considered unsuitable for dryland agriculture. Subclass modifiers include structure and/or permeability (D), erosion (E), inundation (I), moisture limitation (M), salinity (N), stoniness (P), consolidated bedrock (R), topography (T), excess water (W) and cumulative minor adverse characteristics (X).

This generalized interpretive map is based on the dominant soil series and phases for each soil polygon. The CLI subclass limitations cannot be portrayed at this generalized map scale.

Table 5. Agricultural Capability¹

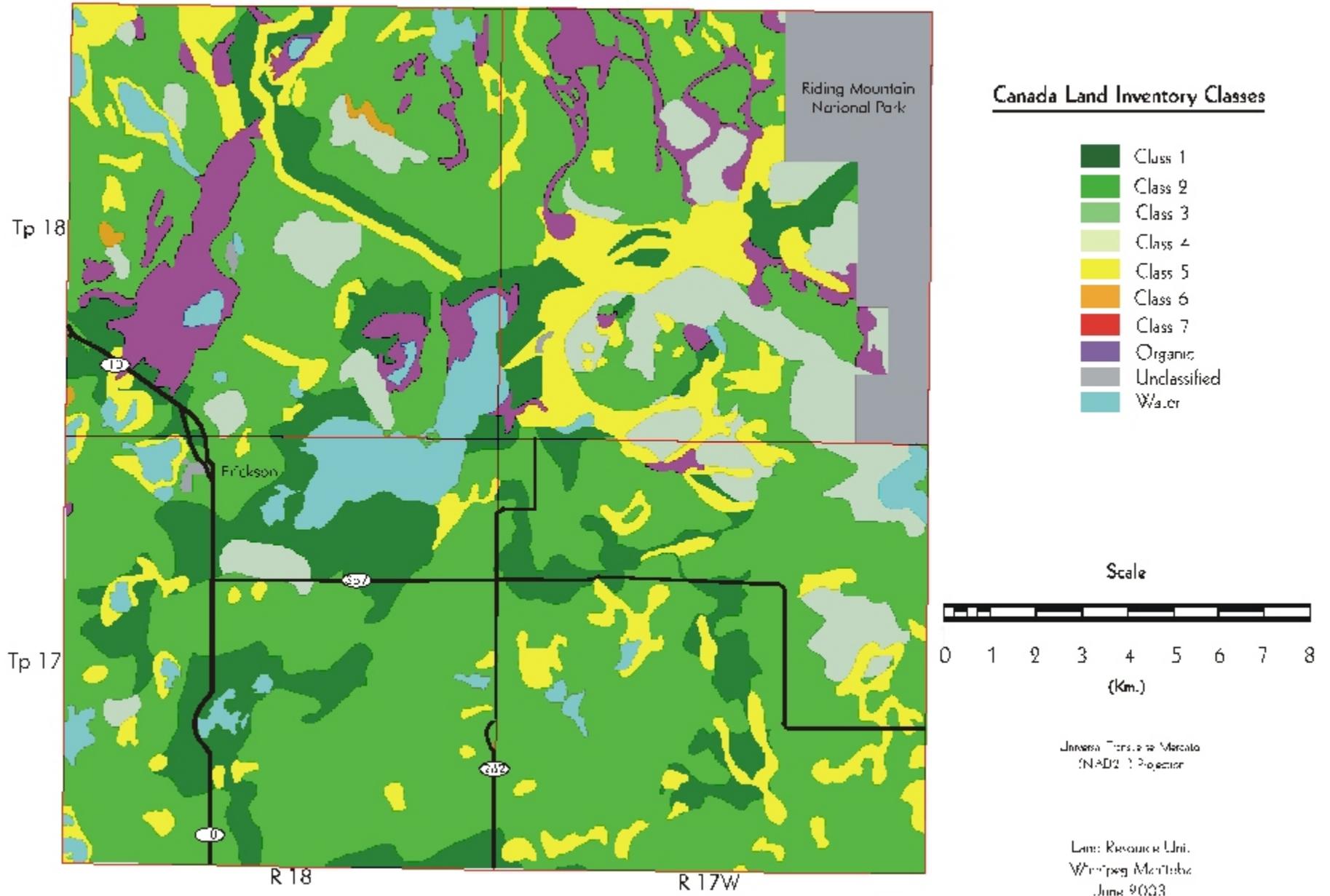
Class Subclass	Area (ha)	Percent of RM
2	4906	12.6
2T	3457	8.9
2X	1449	3.7
3	19808	51.0
3M	1192	3.1
3MT	359	0.9
3T	15425	39.8
3X	2834	7.3
4	3160	8.1
4T	3160	8.1

Table 5. Agricultural Capability¹(cont)

Class Subclass	Area (ha)	Percent of RM
5	4586	11.8
5	782	2.0
5M	780	2.0
5MT	12	0.0
5T	155	0.4
5W	2650	6.8
5WI	207	0.5
6	61	0.2
6T	61	0.2
Unclassified	2181	5.6
Water	1911	4.9
Organic	2191	5.6
Total	38804	100.0

¹ Based on the **dominant** soil series and slope gradient within each polygon.

Agriculture Capability Map



Irrigation Suitability Map.

Irrigation ratings are based on an assessment of the most limiting combination of soil and landscape conditions. Soils in the same class have a similar relative suitability or degree of limitation for irrigation use, although the specific limiting factors may differ. These limiting factors are described by subclass symbols at detailed map scales. The irrigation rating system does not consider water availability, method of application, water quality, or economics of irrigated land use.

Irrigation suitability is a four class rating system. Areas with no or slight soil and/or landscape limitations are rated **Excellent** to **Good** and can be considered irrigable. Areas with moderate soil and/or landscape limitations are rated as **Fair** and considered marginal for irrigation providing adequate management exists so that the soil and adjacent areas are not adversely affected by water application. Soil and landscape areas rated as **Poor** have severe limitations for irrigation.

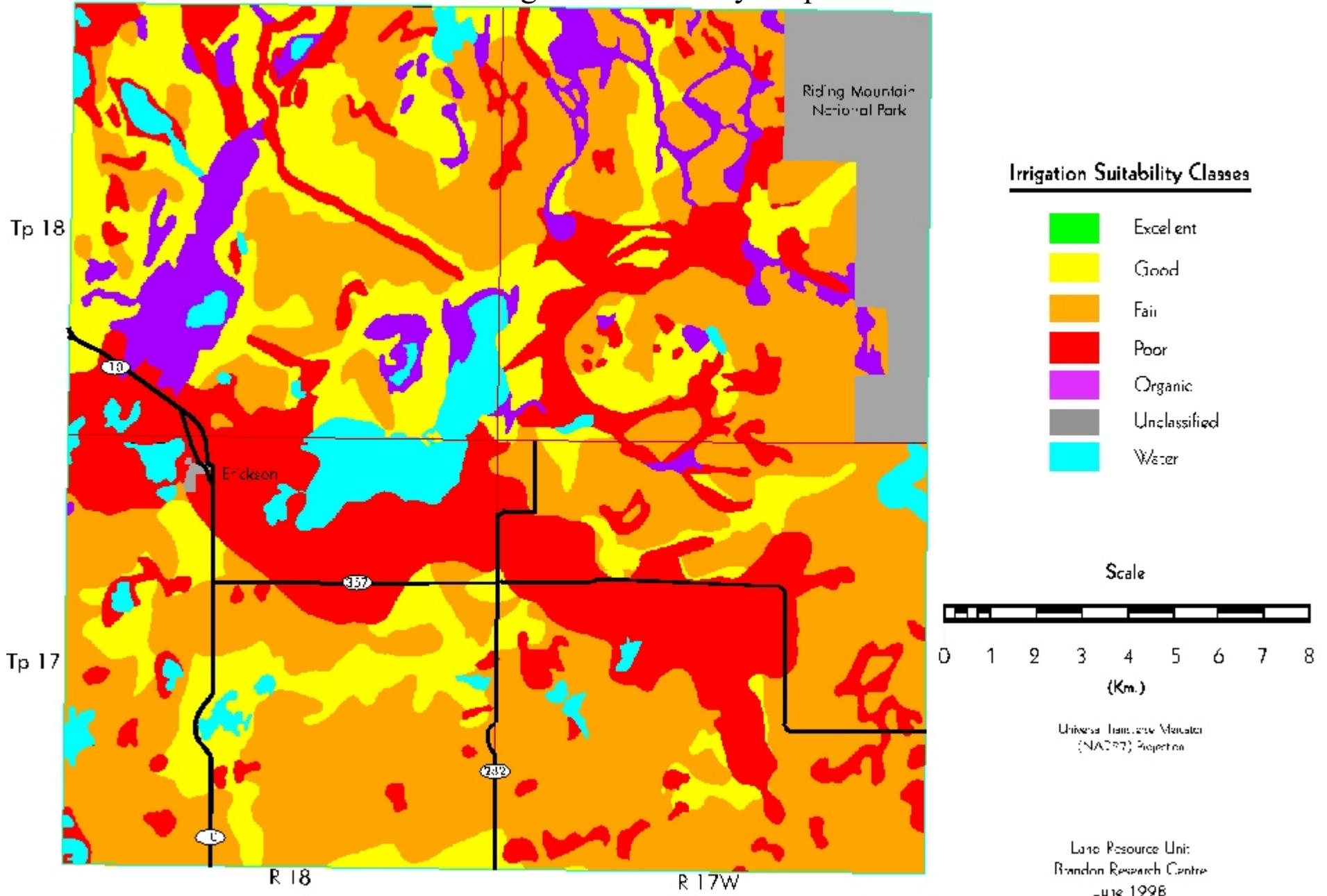
This generalized interpretive map is based on the dominant soil series for each soil polygon, in combination with the dominant slope class. The nature of the subclass limitations and the classification of subdominant components is not shown at this generalized map scale.

Table 6. Irrigation Suitability¹

Class	Area (ha)	Percent of RM
Excellent	0	0.0
Good	7246	18.7
Fair	16403	42.4
Poor	8762	22.7
Organic	2185	5.6
Unclassified	2173	5.6
Water	1901	4.9
Total	38669	100.0

¹ Based on the **dominant** soil series and slope gradient within each polygon.

Irrigation Suitability Map



Potential Environmental Impact Under Irrigation Map.

A major environmental concern for land under irrigated crop production is the possibility that surface and/or ground water may be impacted. The potential environmental impact assessment provides a relative rating of land into 4 classes (minimal, low, moderate and high) based on an evaluation of specific soil factors and landscape conditions that determine the impact potential.

Soil factors considered are those properties that determine water retention and movement through the soil; topographic features are those that affect runoff and redistribution of moisture in the landscape. Several factors are specifically considered: soil texture, hydraulic conductivity, salinity, geological uniformity, depth to water table and topography. The risk of altering surface and subsurface soil drainage regimes, soil salinity, potential for runoff, erosion and flooding is determined by specific criteria for each property.

Use of this rating is intended to serve as a warning of potential environmental concern. It may be possible to design and/or give special consideration to soil-water-crop management practices that will mitigate any adverse impact.

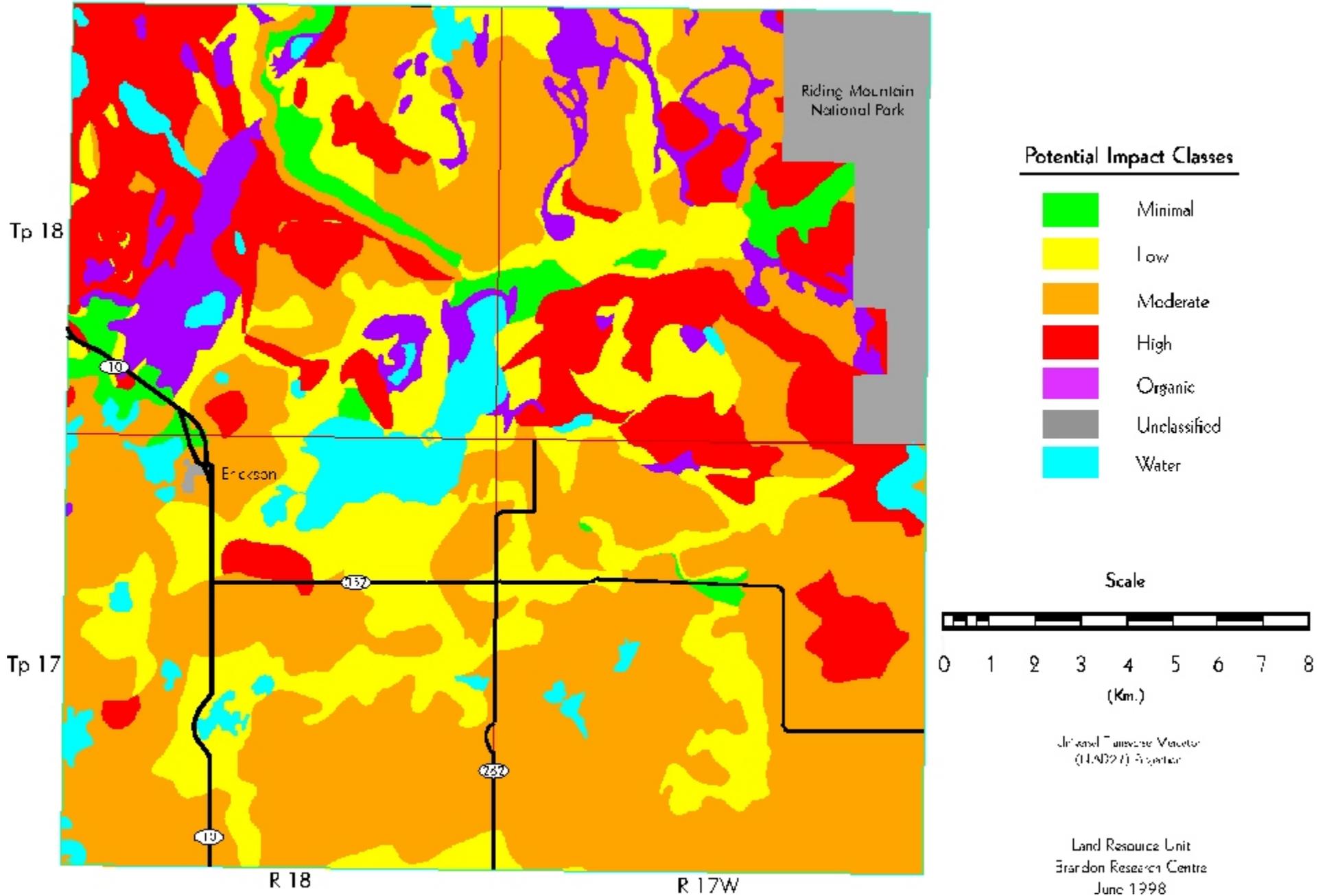
This generalized interpretive map is based on the dominant soil series and slope class for each soil polygon. The nature of the subclass limitations, and the classification of subdominant components is not shown at this generalized map scale.

Table 7. Potential Environmental Impact Under Irrigation¹

Class	Area (ha)	Percent of RM
Minimal	1157	3.0
Low	7815	20.2
Moderate	17388	45.0
High	6050	15.6
Organic	2185	5.6
Unclassified	2173	5.6
Water	1901	4.9
Total	38669	100.0

¹ Based on the **dominant** soil series and slope gradient within each polygon.

Potential Environmental Impact Under Irrigation



Water Erosion Risk Map.

The risk of water erosion was estimated using the universal soil loss equation (USLE) developed by Wischmeier and Smith (1965). The USLE predicted soil loss (tons/hectare/year) is calculated for each soil component in each soil map polygon. Erosion risk classes are assigned based on the weighted average soil loss for each map polygon. Water erosion risk factors include mean annual rainfall, slope length, slope gradient, vegetation cover, management practices, and soil erodibility. The map shows 5 classes of soil erosion risk based on bare unprotected soil:

negligible
low
moderate
high
severe

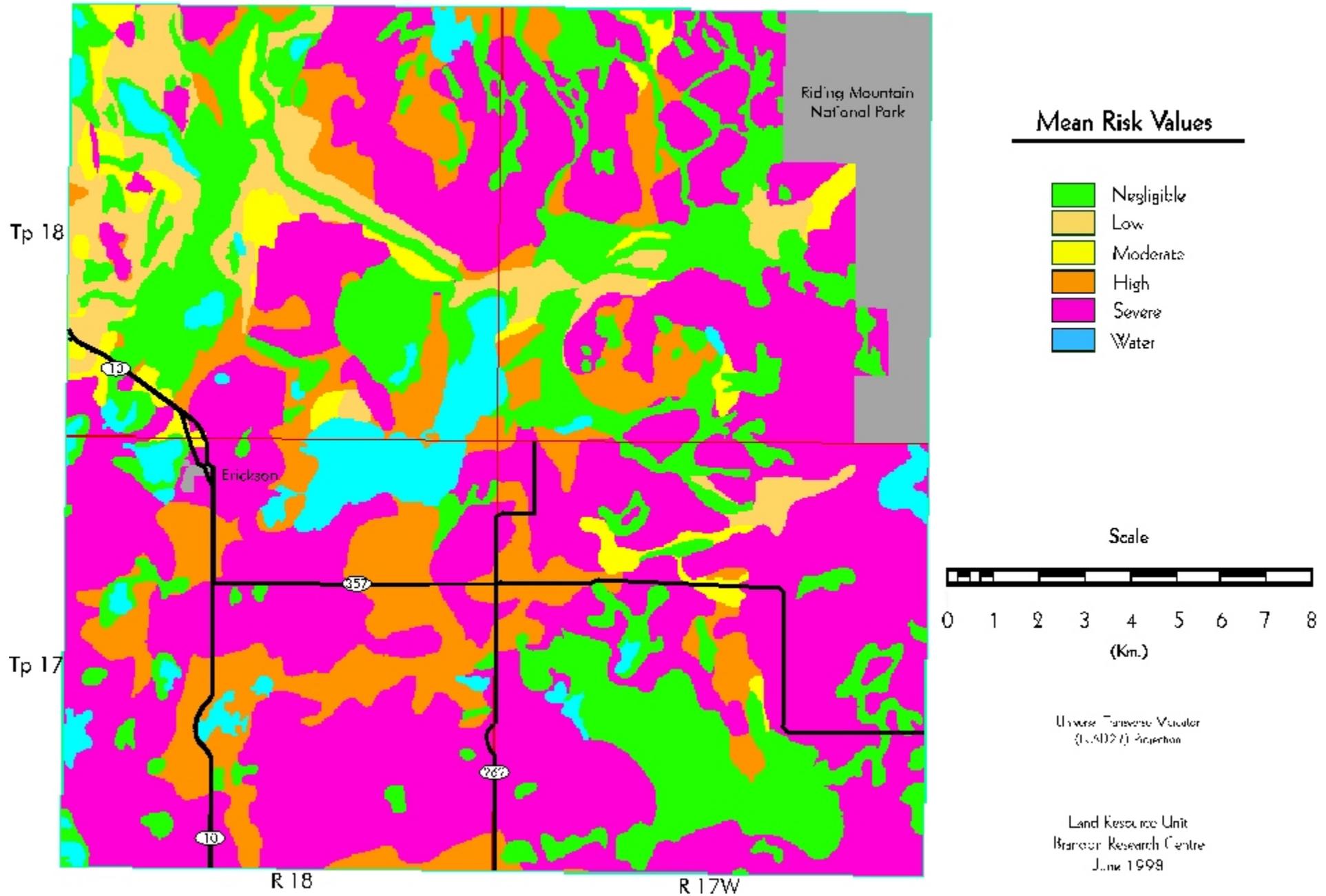
Cropping and residue management practices will significantly reduce this risk depending on crop rotation program, soil type, and landscape features.

Table 8. Water Erosion Risk¹

Class	Area (ha)	Percent of RM
Negligible	8196	21.2
Low	2135	5.5
Moderate	1195	3.1
High	5286	13.7
Severe	17784	46.0
Unclassified	2173	5.6
Water	1901	4.9
Total	38669	100.0

¹ Based on the **weighted average** USLE predicted soil loss within each polygon, assuming a bare unprotected soil.

Water Erosion Risk Map



Land Use Map.

The land use classification of the RM has been interpreted from LANDSAT satellite imagery, using supervised computer classification techniques. Many individual spectral signatures were classified and grouped into the seven general land use classes shown here. Although land use changes over time, and some land use practices on individual parcels may occasionally result in similar spectral signatures, this map provides a general representation of the current land use in the RM.

The following is a brief description of the land use classes:

Annual Crop Land - land that is normally cultivated on an annual basis.

Forage - perennial forages, generally alfalfa or clover with blends of tame grasses.

Grasslands - areas of native or tame grasses, may contain scattered stands of shrubs.

Trees - lands that are primarily in tree cover.

Wetlands - areas that are wet, often with sedges, cattails, and rushes.

Water - open water - lakes, rivers streams, ponds, and lagoons.

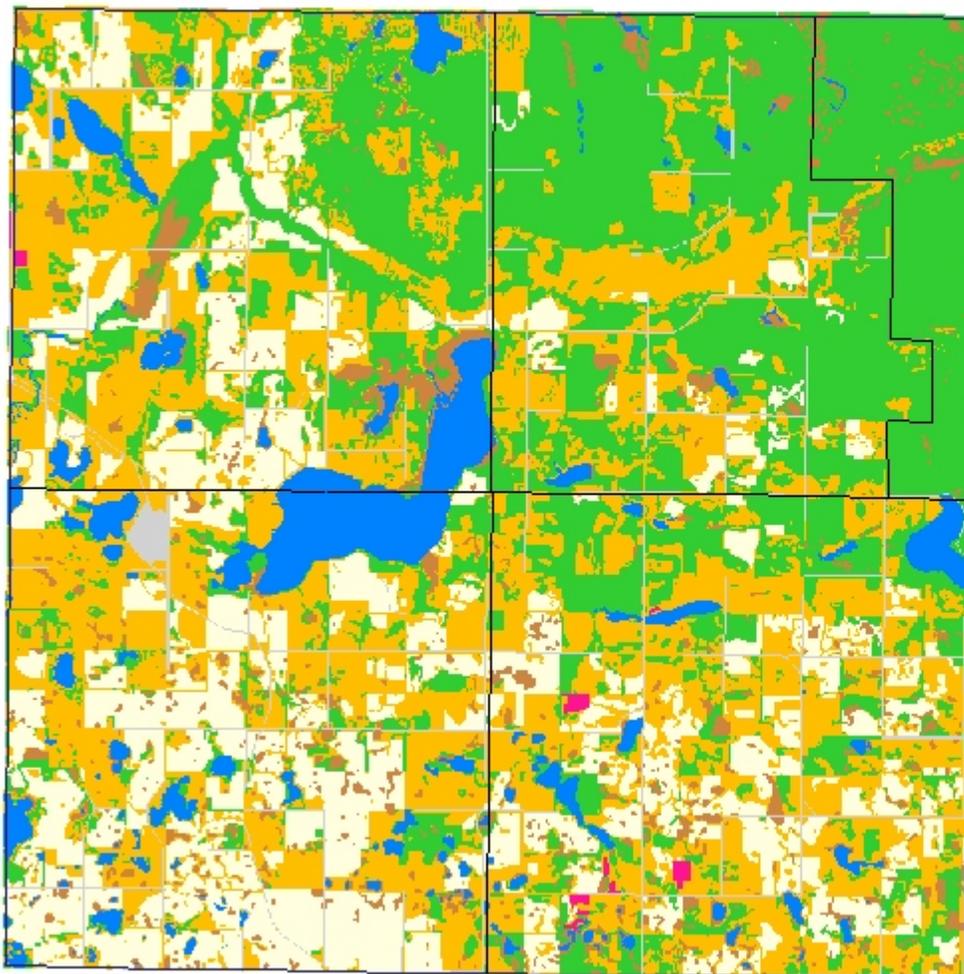
Urban and Transportation - towns, roads, railways, quarries.

Table 9. Land Use¹

Class	Area (ha)	Percent of RM
Annual Crop Land	7907	20.2
Forage	73	0.2
Grasslands	12946	33.0
Trees	13163	33.6
Wetlands	1736	4.4
Water	2371	6.1
Urban and Transportation	980	2.5
Total	39176	100.0

¹ Land use information (1995) and map supplied by Prairie Farm Rehabilitation Administration. Areas may vary from previous maps due to differences in analytical procedures.

RURAL MUNICIPALITY OF CLANWILLIAM LAND USE

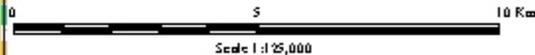


Reference:

Satellite imagery obtained from R.S.I.
LandSAT IM (30 m pixel resolution)
Date of image May 5, 1993.
Classification by Manitoba Remote
Sensing Centre.

LAND USE

-  Annual Crop land
-  Trees
-  Water
-  Grassland
-  Wetlands
-  Forage
-  Urban & Transportation
-  Municipal Boundary



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