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Rural Municipality of Glenella

Information Bulletin 99-34

Soils and Terrain

An introduction to the land resource

Land Resource Unit
Brandon Research Centre

Canada

Rural Municipality of Glenella

Information Bulletin 99-34

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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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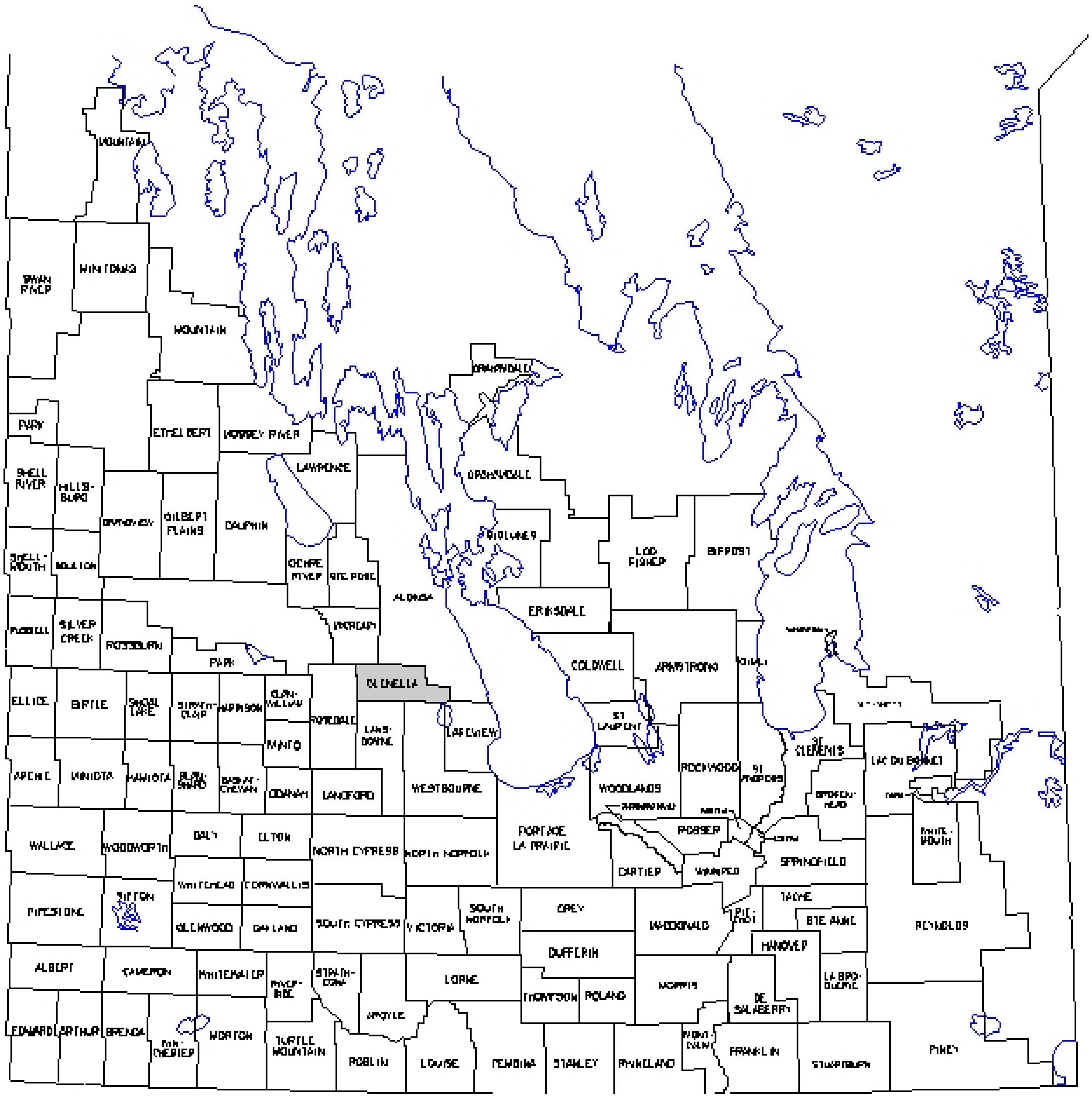


Figure 1. Rural municipalities of southern Manitoba.

INTRODUCTION

The location of the Rural Municipality of Glenella is shown in Figure 1. A brief overview of the database information, and general environmental conditions for the municipality are presented. A set of maps derived from the data for typical agricultural land use and planning applications are also included.

The soil map and database were compiled and registered using the Geographic Information System (PAMAP GIS) facilities of the Land Resource Unit. These databases were used in the GIS to create the generalized, derived and interpretive maps and statistics in this report. The final maps were compiled and printed using Coreldraw.

This bulletin is available in printed or digital format. The digital bulletin is a Windows based executable file which offers additional display options, including the capability to print any portion of the bulletin.

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 compiled and analysed in two distinct layers as shown in Figure 2.

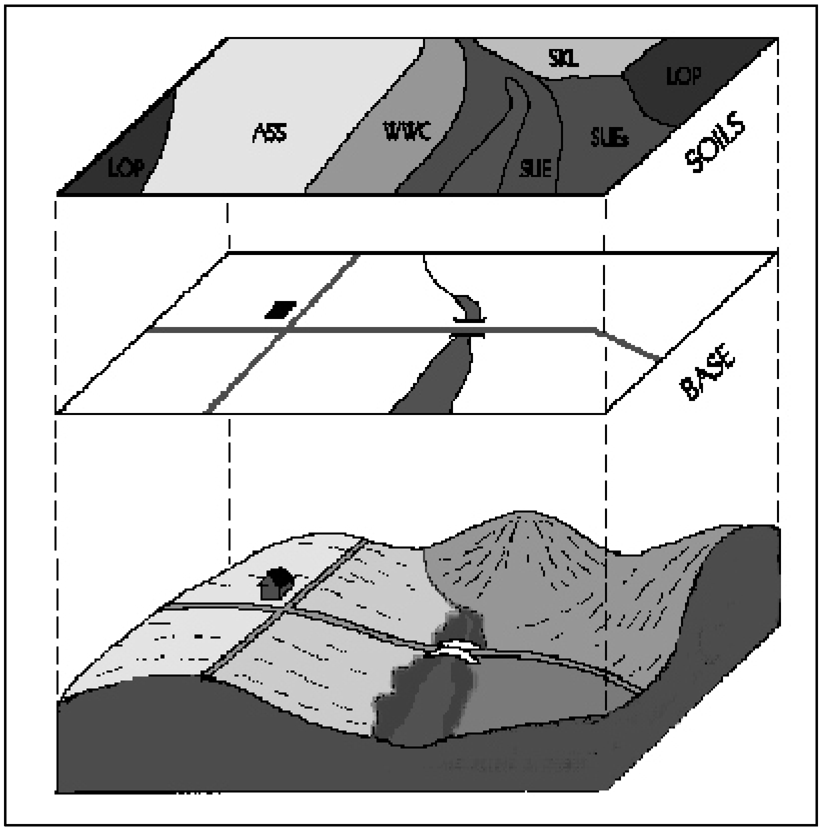


Figure 2. Soil and Base Map data.

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.

Soil Layer

The most detailed soil information currently available was selected as the data source for the digital soil layer for each rural municipality.

Comprehensive detailed soil maps (1:20 000 to 1:50 000 scale) have been published for many rural municipalities. Where they were available, the individual soil map sheets were digitized and compiled as a single georeferenced layer to match the digital RM base. Map polygons have one or more soil series components, as well as slope and stoniness classes. Soil database information was produced for each polygon, to meet national standards (MacDonald and Valentine, 1992). Slope length classes were also added.

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, both detailed and reconnaissance soil map polygons were related to soil drainage, surface texture, and other soil properties to produce various interpretive maps. Slope length classes were also added.

SOIL AND TERRAIN OVERVIEW

The Rural Municipality (RM) of Glenella covers an area of 50 117 ha (approximately 5.4 townships) located in the southern portion of the Westlake district in southern Manitoba (page 3). Most of the population is rural farm-based with local concentrations of people resident in Glenella and Waldersee. Agricultural services are generally provided from larger towns in the surrounding region.

The climate in the area can be related to weather data from Grass River located in the eastern part of the municipality. The mean annual temperature at Grass River is 2.2˚C and the mean annual precipitation is 480 mm (Environment Canada, 1993). The average frost-free period is 112 days and degree-days above 5˚C accumulated from May to September average 1610 (Ash, 1991). An evaluation of growing conditions in this region of Manitoba can be related to estimates of seasonal moisture deficit and effective growing degree-days (EGDD) above 5˚C. The seasonal moisture deficit calculated between May and September averages about 250 mm. The estimated effective growing degree-days accumulated from May to September range from 1300 in the west to slightly in excess of 1500 in central and eastern portions of the municipality (Agronomic Interpretations Working Group, 1995). These parameters provide an indication of moisture and heat energy available for crop growth and are generally adequate to support a wide range of crops adapted to western Canada.

The municipality occupies portions of three physiographic areas. The western part is located in the Dauphin Lake Plain physiographic subsection while the eastern part is in the Westlake Till Plain and the Red River Valley subsections. A series of narrow beach ridges marking the lower portion of the Manitoba Escarpment cross the southwest corner of the municipality (Canada-Manitoba Soil Survey, 1980). Elevation of the land surface ranges from 338 metres above sea level (m asl) at the toe of the Escarpment area in the in the southwest corner to 263 m asl on the eastern side of the municipality. The land surface slopes at a rate of 2 metres/km (10 ft/mi) toward the east and local relief is generally under 3 metres. Slopes are generally under 2 percent in the Dauphin Lake Plain and the Red River Valley sections and range from 2 to 5 percent in the till landscape of the Westlake Till Plain (page 9). Much of the municipality is characterized by high groundwater levels, particularly at the north end of the Big Grass Marsh. Surface drainage of the municipality is via the Big Grass River and a ditch system constructed to carry runoff from the Manitoba Escarpment and to assist in removal of surface waters for agricultural purposes.

Soil materials in the municipality were deposited during the last glaciation and during the time of glacial Lake Agassiz. The Dauphin Lake Plain is a complex area of waterworked glacial till, narrow beach ridges and thin, sandy to clayey lacustrine materials underlain by glacial till whereas the northern end of the Red River Valley subsection is characterized by a level to depressional area of loam textured lacustrine sediments. In contrast, the Westlake Till Plain is a gently undulating and ridged area consisting mainly of extremely calcareous, waterworked, stony, loam textured glacial till (page 11). The dominantly gently sloping landscape results in a complex association of well, imperfectly and poorly drained soils throughout the area (page 13).

Soils in the municipality have been mapped at a reconnaissance level (1:126 720 scale) and published in the soil survey report for the West-Lake map sheet area (Ehrlich et al.,1958). According to the Canadian System of Soil Classification (Soil Classification Working Group, 1998), well to imperfectly drained Black Chernozem soils developed on stony, loam textured glacial till (Isafold association), sandy lacustrine materials (Almassipi association) and loamy to clay loam lacustrine sediments (Lakeland association) are dominant. Weakly developed Chernozemic Dark Gray soils occur with Black soils developed on sandy deposits (Selina association) in the northern part of the municipality. Poorly drained sites in these landscapes, many with thin peaty surface layers, are classified as Humic Gleysols.

Major management considerations are related to coarse texture and wetness (page 15). Seasonal high water tables (at 1 to 2 metres) and saturated soils are common. Surface water ponds in poorly drained depressional areas during wet seasons. The sandy and loamy textured soils are subject to potential wind erosion and droughtiness. Moderately to excessively stony conditions are associated with the till soils and beach deposits throughout the area. Scattered areas of weak salinity are most common in depressional sites characterized by imperfectly and poorly drained soils.

Thirty-three percent of the soils are rated in **Class 2** for agricultural capability and 9 percent in **Class 3** recognizing increasing severity of stoniness and droughtiness. 34 percent of the soils are placed in **Class 4**, primarily due to sandy texture and low moisture holding capacity and 15 percent rated in **Class 5** due to droughtiness and excess wetness. **Class 6** soils affected by excessive wetness occupy 8 percent of the area and organic soils which have very limited capability for agriculture in their native state cover less than 1 percent of the area (page 17). The irrigation suitability (page 19) of soils in this municipality varies from **Good** (9 percent) to **Fair** (59 percent) and **Poor** (32 percent).

One of the issues 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 shown on page 21 is dominantly **Low** with local areas rated as **Minimal**, **Moderate** and **High**. Areas at **High** potential risk consist of highly permeable gravel soils and sandy soils with high watertables. 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. Areas with potential for water erosion are shown on page 23. About 66 percent of the land in the municipality is at a **Negligible** risk of degradation due to water erosion. Sandy to loamy lacustrine sediments underlain by glacial till are at a **Low** risk while deeper sediments are at a **Moderate** risk. The sandy and loamy soils are at a greater risk of erosion by wind. Current management practices focus on maintaining adequate crop residues to provide sufficient surface cover to adequately protect the soils from both wind and water erosion.

Agriculture is the dominant land use in the RM of Glenella. An assessment of the status of land use in 1994, obtained through an analysis of satellite imagery, showed annual crops occupying 46 percent of the area, forages 2 percent, grasslands about 40 percent and treed areas nearly 6 percent. The grassland and treed areas provide forage and grazing capacity as well as wildlife habitat. Wetlands occupying between 2 and 3 percent of the area also provide wildlife habitat. Various non-agricultural uses such as infrastructure for urban areas, transportation and recreation occupy 3 percent of the municipality (page 25).

The majority of soils in the RM of Glenella have moderate to moderately severe limitations for arable agriculture. The glacial till soils require periodic stone clearing under annual cultivation. Sandy soils require protection against wind erosion. This includes leaving adequate crop residues on the surface during the early spring period, provision of shelter belts and use of minimum tillage practices and crop rotations which include forages. A large portion of the municipality has low relief and a dominance of imperfectly to poorly drained soils. These soils are frequently saturated and subject to surface ponding, particularly during spring runoff or following heavy rains. In addition, the subdued ridge and swale topography associated with the till soils impedes drainage improvement. Where the land pattern permits, improvement and maintenance of water management infrastructure on a regional basis is required to reduce surface ponding while maintaining adequate soil moisture for crop growth.

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.

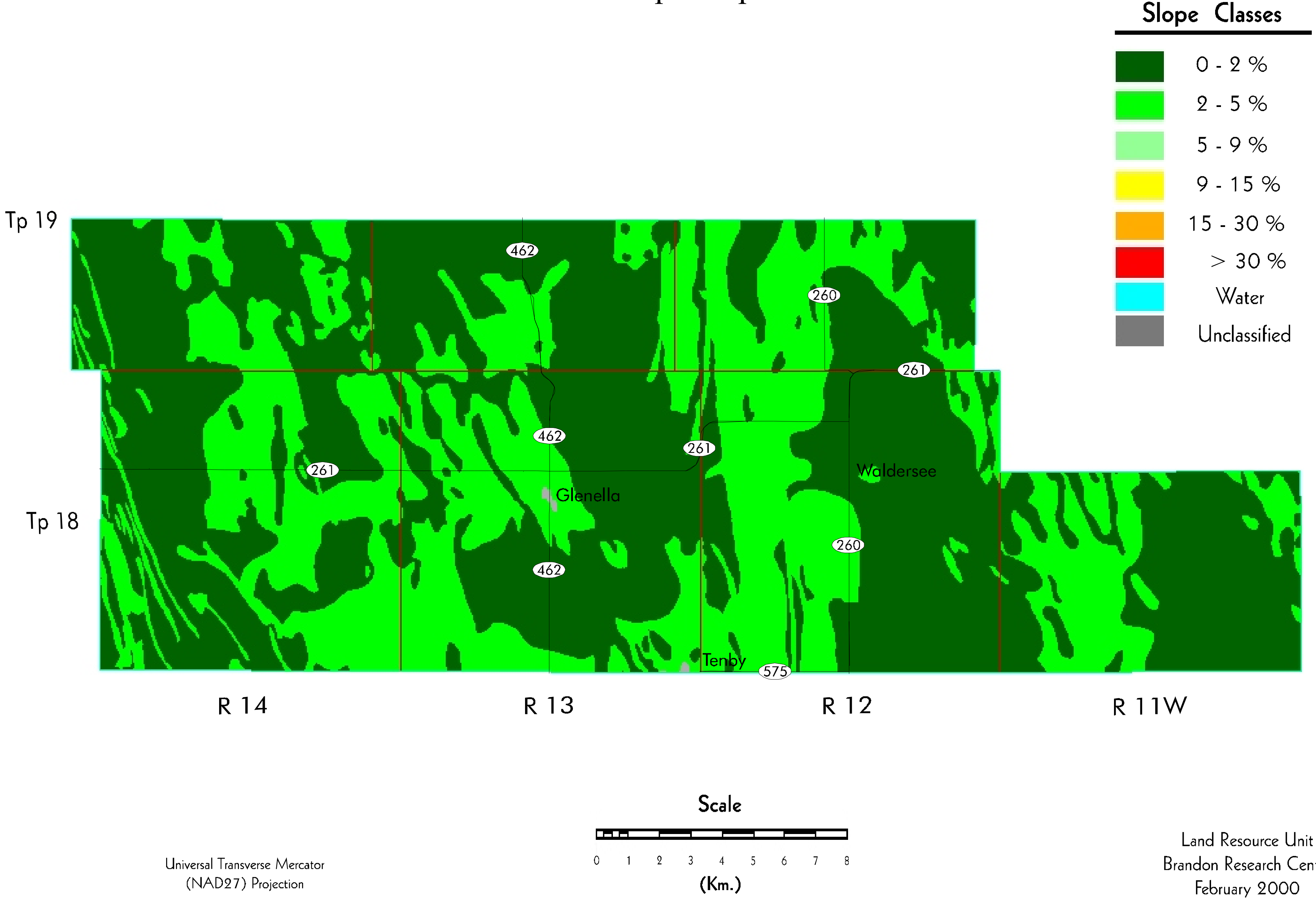
Slope describes the steepness of the landscape surface. The slope classes shown on this map are derived from the digital soil and terrain layer database. Specific colours are used to indicate the dominant slope class for each polygon in the RM. Additional slope classes may occur in each polygon area,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

Table 1. Slope Classes[1]

Slope Class	Area (ha)	Percent of RM
0 - 2 %	30636	61.1
2 - 5 %	19451	38.8
5 - 9 %	0	0.0
9 - 15 %	0	0.0
15 - 30 %	0	0.0
> 30 %	0	0.0
Unclassified	30	0.1
Water	0	0.0
Total	50117	100.0

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

Slope Map



Universal Transverse Mercator
(NAD27) Projection

Land Resource Unit
Brandon Research Centre
February 2000

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.

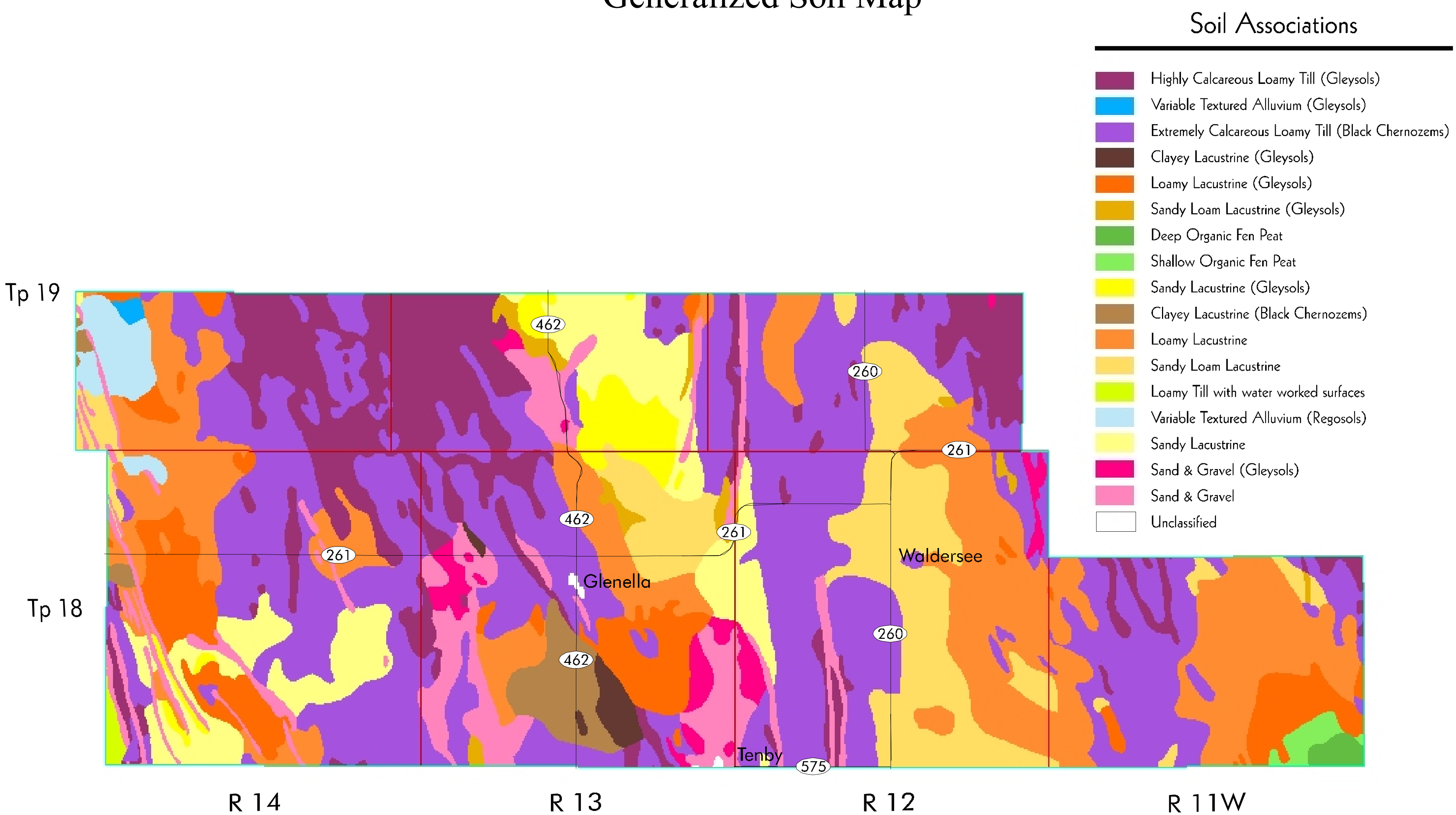
More detailed maps showing the dominant and subdominant soils in each polygon can also be produced at larger map scales.

Table 2. Generalized Soil Groups[1]

Soil Groups	Area (ha)	Percent of RM
Highly Calcareous Loamy Till (Gleysols)	6383	12.7
Variable Textured Alluvium (Gleysols)	56	0.1
Extremely Calcareous Loamy Till (Black Chernozems)	16288	32.5
Clayey Lacustrine (Gleysols)	286	0.6
Loamy Lacustrine (Gleysols)	2949	5.9
Sandy Loam Lacustrine (Gleysols)	439	0.9
Deep Organic Fen Peat	144	0.3
Shallow Organic Fen Peat	186	0.4
Sandy Lacustrine (Gleysols)	921	1.8
Clayey Lacustrine (Black Chernozems)	877	1.7
Loamy Lacustrine	8969	17.9
Sandy Loam Lacustrine	4542	9.1
Loamy Till with water worked surfaces	104	0.2
Variable Textured Alluvium (Regosols)	644	1.3
Sandy Lacustrine	3387	6.8
Sand and Gravel (Gleysols)	749	1.5
Sand and Gravel	3163	6.3
Unclassified	30	0.1
Total	50117	100.0

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

Generalized Soil Map



Scale

0 1 2 3 4 5 6 7 8

(Km.)

Universal Transverse Mercator
(NAD27) Projection

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February 2000

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.

Poor, drained - Water is removed slowly in relation to supply and the soil remains wet for a significant portion of the growing season. Although these soils may retain characteristics of poor internal drainage, extensive surface drainage improvements enable these soils to be used for annual crop production.

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.

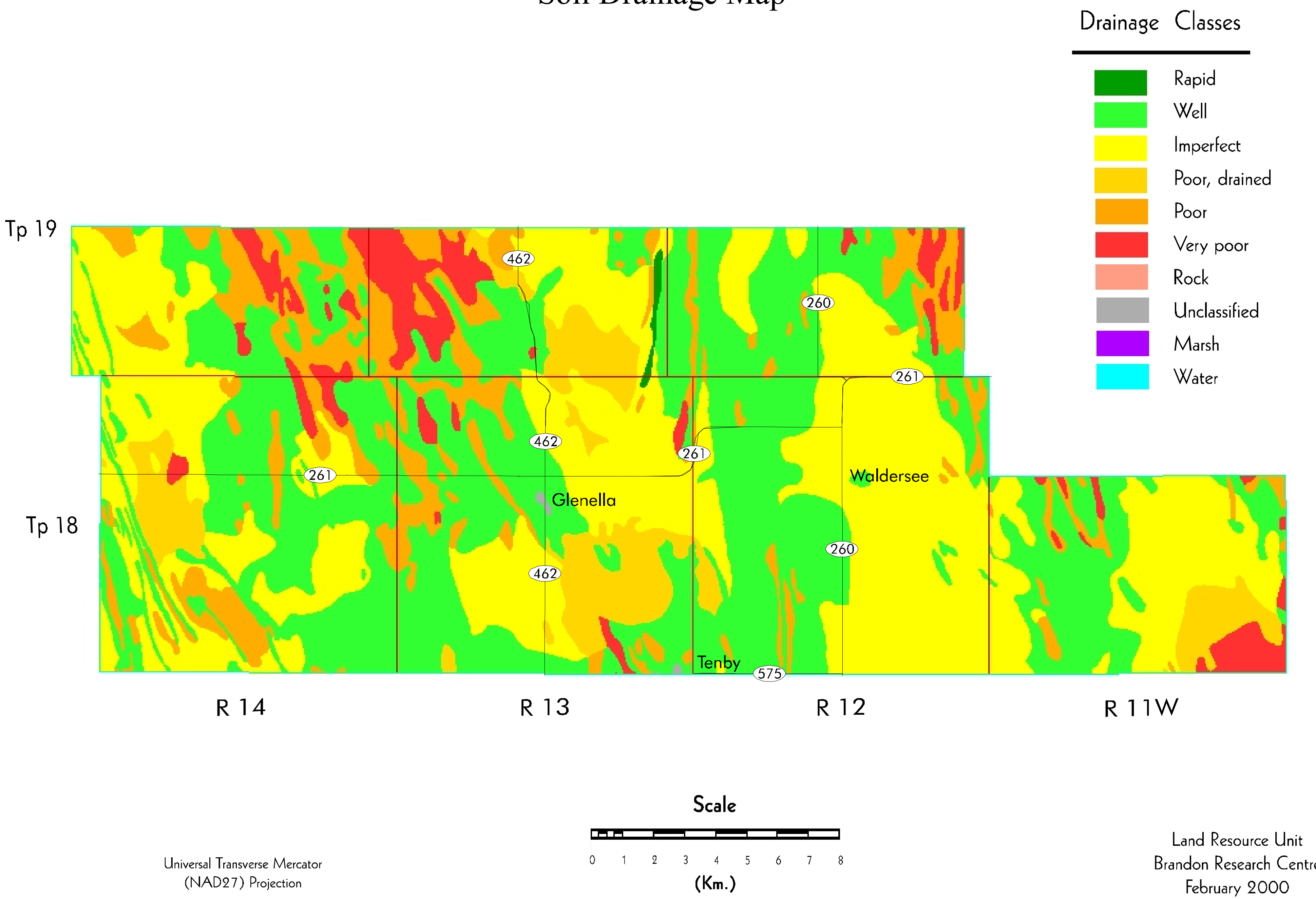
Drainage classification is based on the dominant soil series within each individual soil polygon.

Table 3. Drainage Classes[1]

Drainage Class	Area (ha)	Percent of RM
Very Poor	2537	5.1
Poor	6064	12.1
Poor, drained	3513	7.0
Imperfect	18522	37.0
Well	19365	38.6
Rapid	86	0.2
Rock	0	0.0
Marsh	0	0.0
Unclassified	30	0.1
Water	0	0.0
Total	50117	100.0

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

Soil Drainage Map



Universal Transverse Mercator
(NAD27) Projection

Land Resource Unit
Brandon Research Centre
February 2000

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.

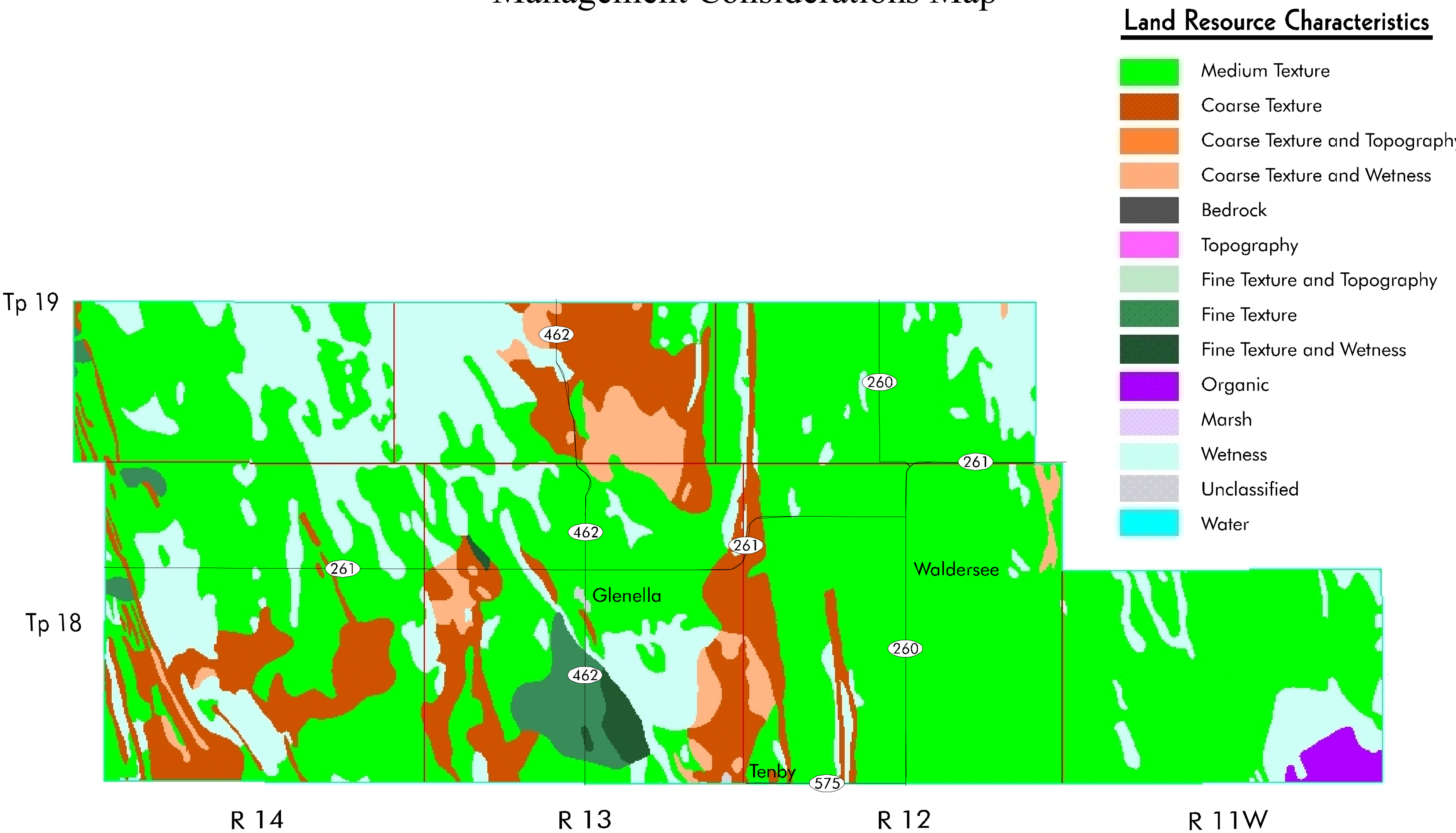
R = Bedrock - soil landscapes that have shallow depth to bedrock (< 50 cm) and/or exposed bedrock which may prevent the use of some or all tillage practices as well as the range of potential crops. They require special cropping and management practices to sustain agricultural production.

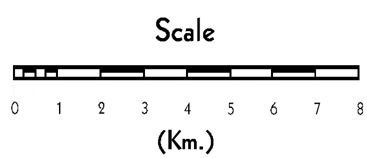
Table 4. Management Considerations[1]

Land Resource Characteristics	Area (ha)	Percent of RM
Fine Texture	953	1.9
Fine Texture and Wetness	286	0.6
Fine Texture and Topography	0	0.0
Medium Texture	30470	60.8
Coarse Texture	6550	13.1
Coarse Texture and Wetness	1670	3.3
Coarse Texture and Topography	0	0.0
Topography	0	0.0
Bedrock	0	0.0
Wetness	9827	19.6
Organic	330	0.7
Marsh	0	0.0
Unclassified	30	0.1
Water	0	0.0
Total	50117	100.0

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

Management Considerations Map





Universal Transverse Mercator
(NAD27) Projection

Land Resource Unit
Brandon Research Centre
February 2000

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 modifers 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.

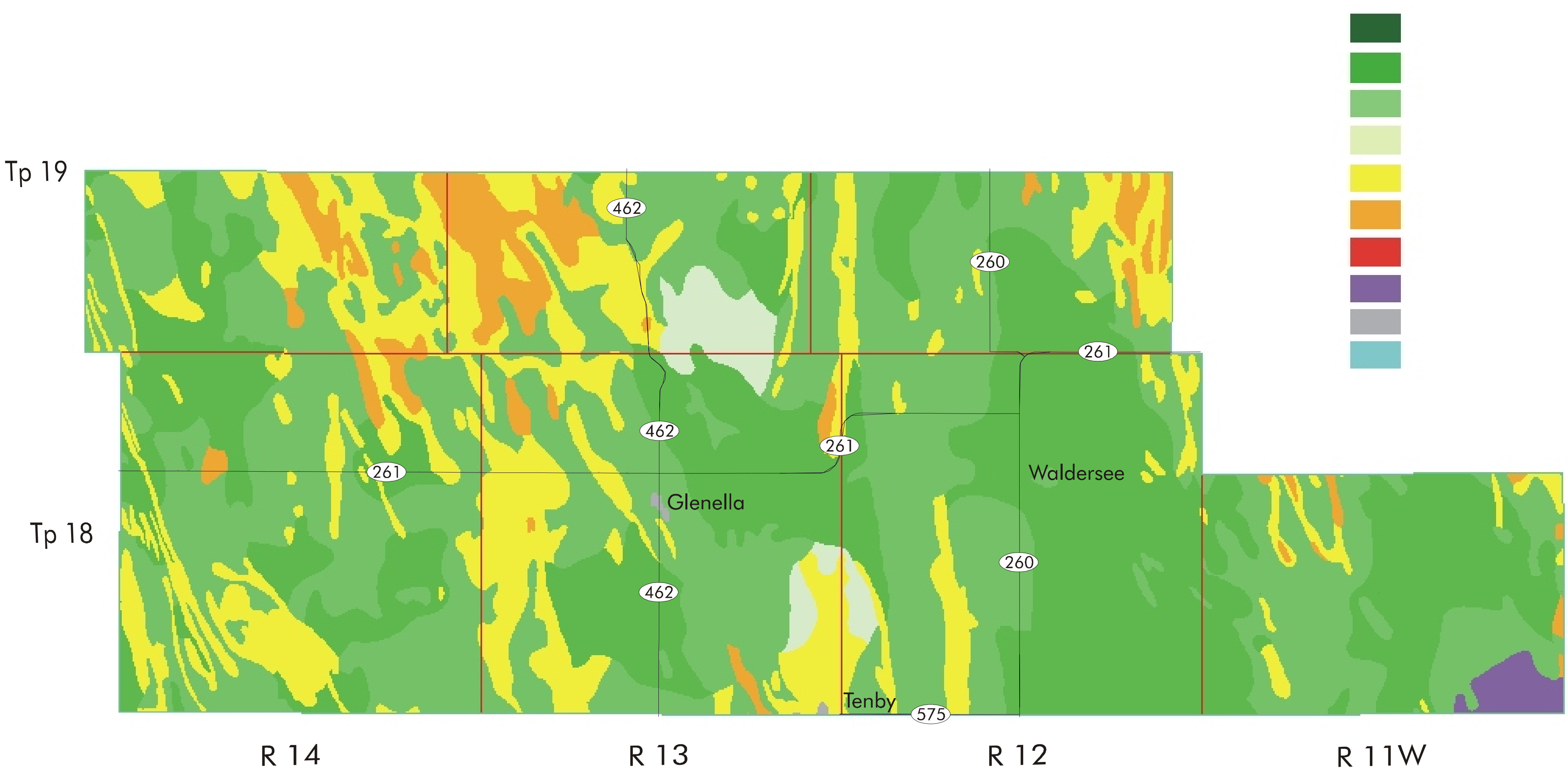
Table 5. Agricultural Capability[1]

Class Subclass	Area (ha)	Percent of RM
2	**16359**	**32.3**
2M	6297	12.5
2W	9901	19.7
2WP	160	0.3
3	**4733**	**9.4**
3I	572	1.1
3M	1635	3.3
3W	2526	5.0
4	**17193**	**34.2**
4DP	16197	32.2
4W	996	2.0
5	**7751**	**15.4**
5M	3167	6.3
5W	4527	9.0
5WI	56	0.1
6	**3840**	**7.6**
6W	3840	7.6
Unclassified	**29**	**0.1**
Organic	**332**	**0.7**
Total	**50237**	**100.0**

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

Agriculture Capability Map

Canada Land Inventory Classes



Scale

0 1 2 3 4 5 6 7 8

(Km.)

Universal Transverse Mercator
(NAD27) Projection

Land Resource Unit
Winnipeg, Manitoba
June 2003

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.

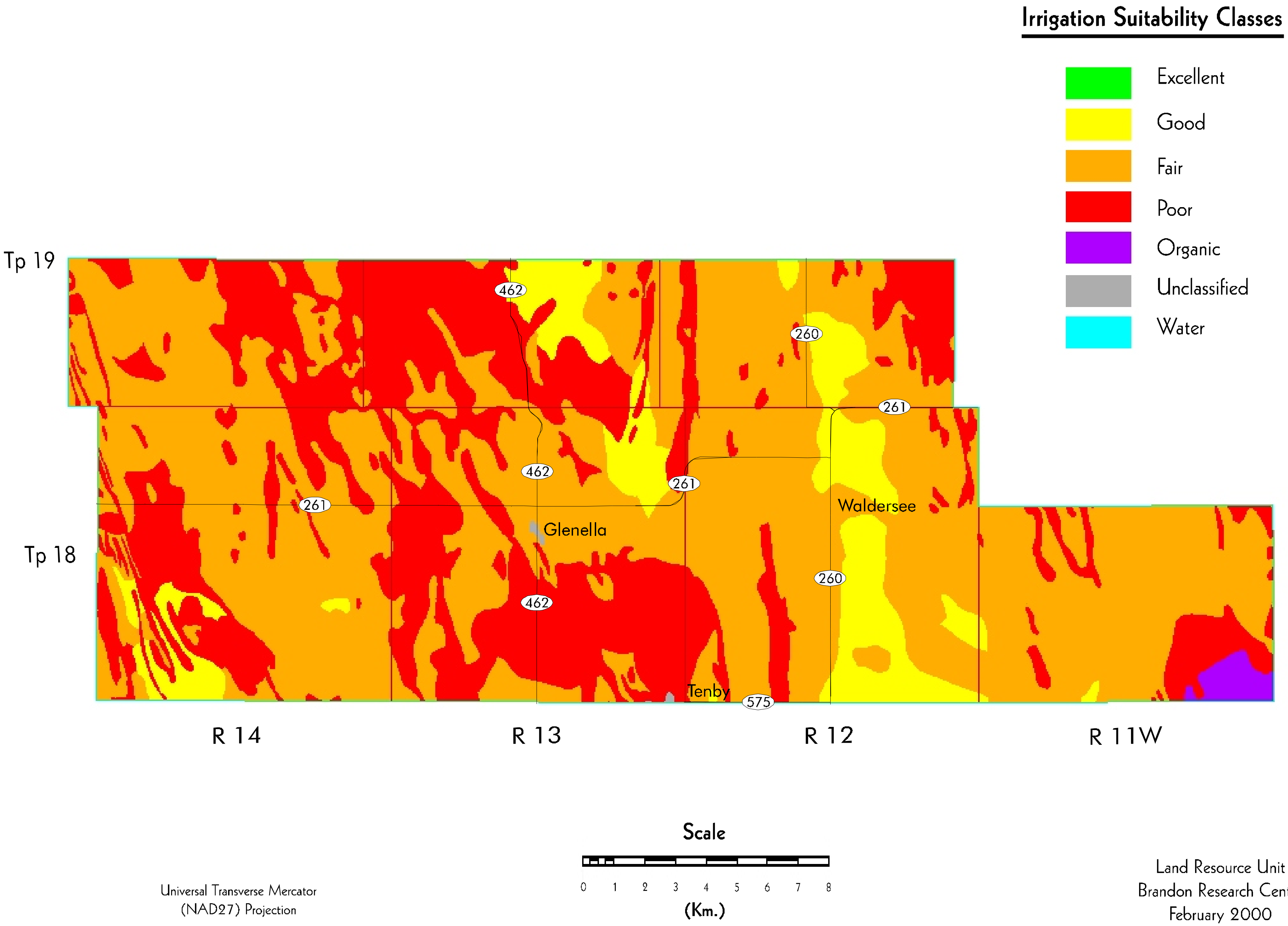
This generalized interpretive map is based on the dominant soil series for each soil polygon, in combination with the dominant slope class. The nature of the subclass limitations and the classification of subdominant components is not shown at this generalized map scale.

Table 6. Irrigation Suitability[1]

Class	Area (ha)	Percent of RM
Excellent	**0**	**0.0**
Good	**4460**	**8.9**
Fair	**29473**	**58.8**
Poor	**15823**	**31.6**
Organic	**330**	**0.7**
Unclassified	**30**	**0.1**
Water	**0**	**0.0**
Total	**50117**	**100.0**

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

Irrigation Suitability Map



Universal Transverse Mercator
(NAD27) Projection

Land Resource Unit
Brandon Research Centre
February 2000

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.

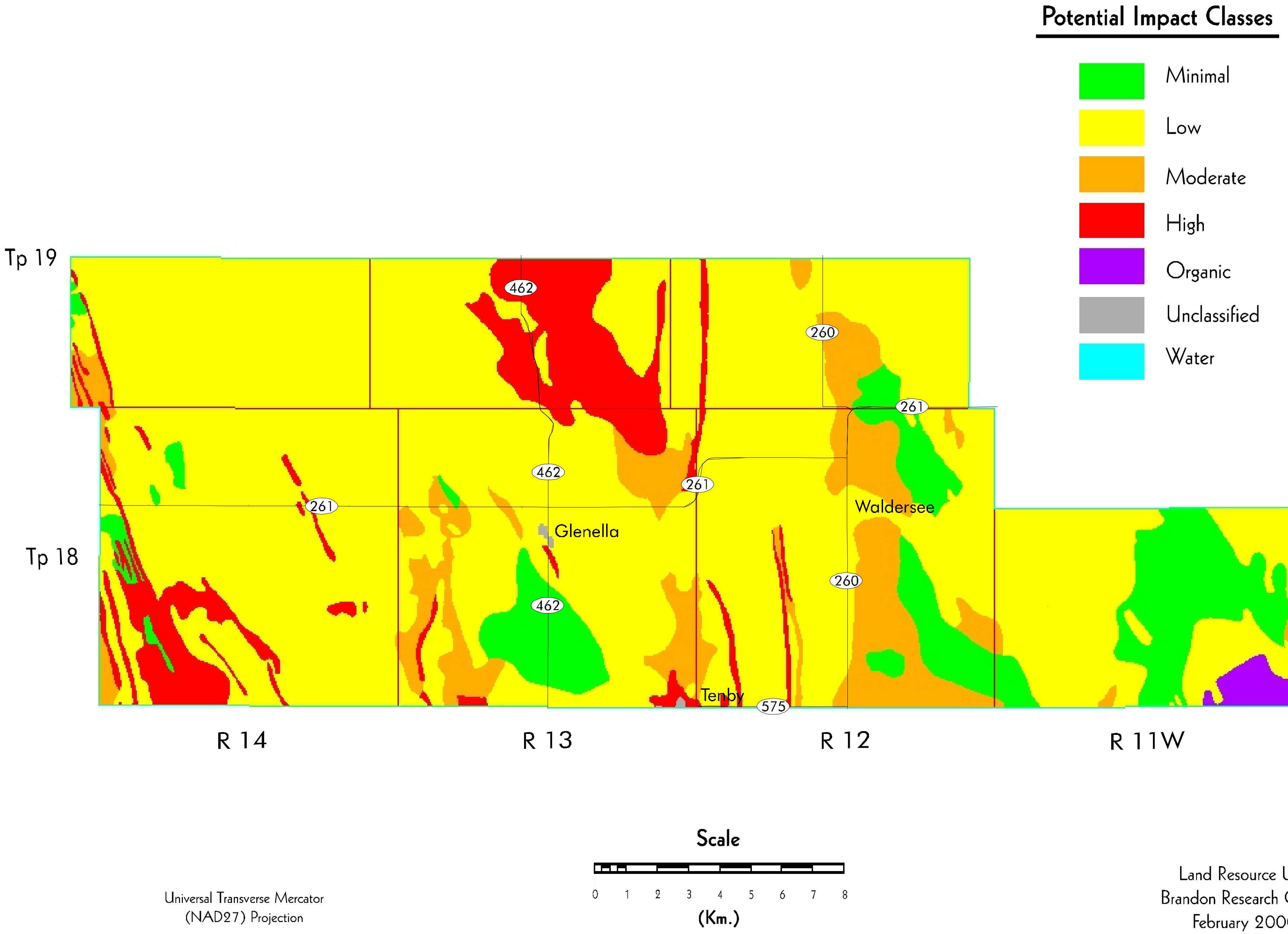
This generalized interpretive map is based on the dominant soil series and slope class for each soil polygon. The nature of the subclass limitations, and the classification of subdominant components is not shown at this generalized map scale.

Table 7. Potential Environmental Impact Under Irrigation[1]

Class	Area (ha)	Percent of RM
Minimal	**4866**	**9.7**
Low	**35809**	**71.5**
Moderate	**4811**	**9.6**
High	**4271**	**8.5**
Organic	**330**	**0.7**
Unclassified	**30**	**0.1**
Water	**0**	**0.0**
Total	**50117**	**100.0**

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

Potential Environmental Impact Under Irrigation



Universal Transverse Mercator
(NAD27) Projection

Land Resource Unit
Brandon Research Centre
February 2000

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, average and maximum rainfall intensity, 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

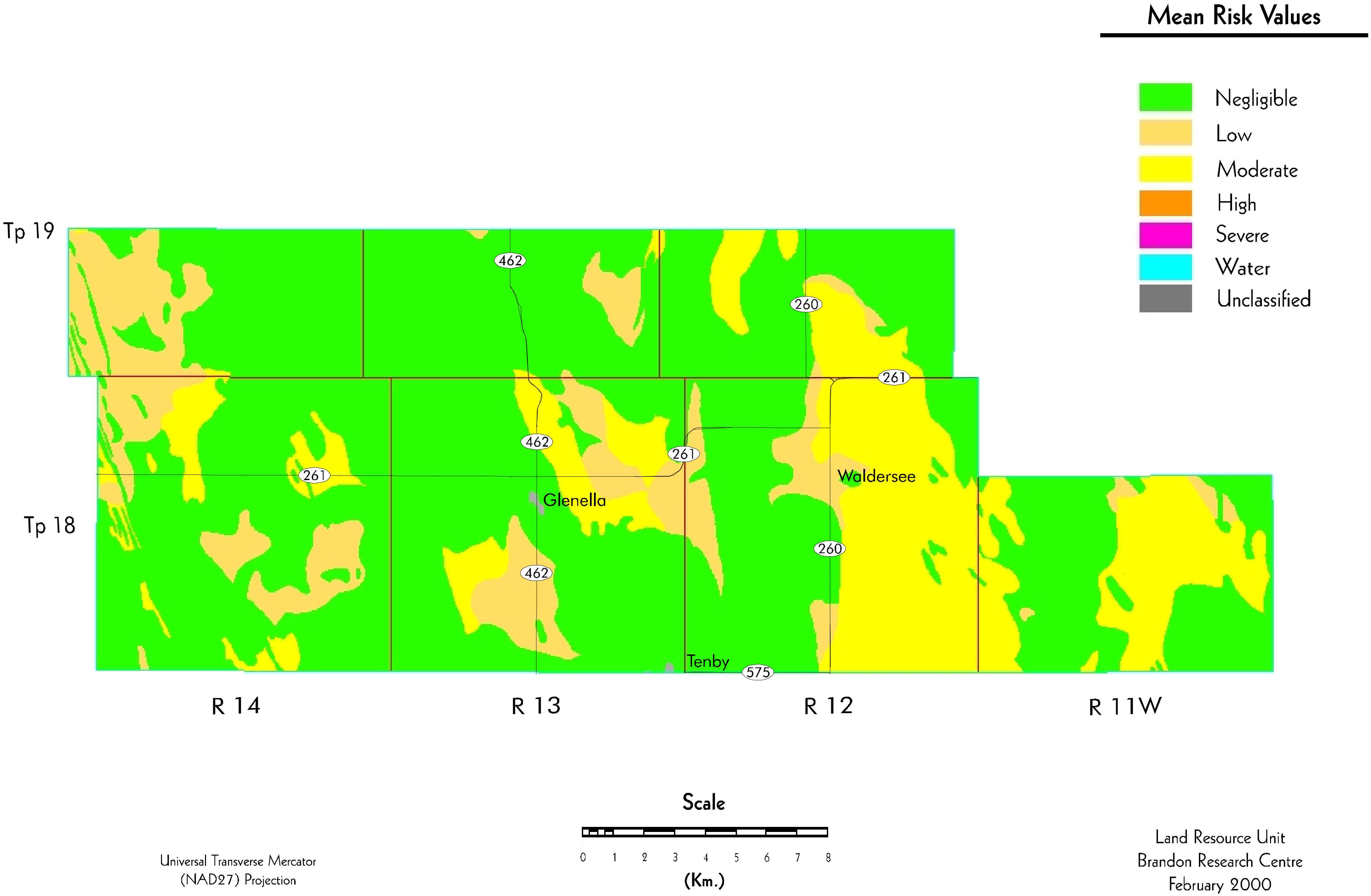
Cropping and residue management practices will significantly reduce this risk depending on crop rotation program, soil type, and landscape features.

Table 8. Water Erosion Risk[1]

Class	Area (ha)	Percent of RM
Negligible	33202	66.2
Low	6199	12.4
Moderate	10687	21.3
High	0	0.0
Severe	0	0.0
Unclassified	30	0.1
Water	0	0.0
Total	50117	100.0

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

Water Erosion Risk Map



Universal Transverse Mercator
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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.

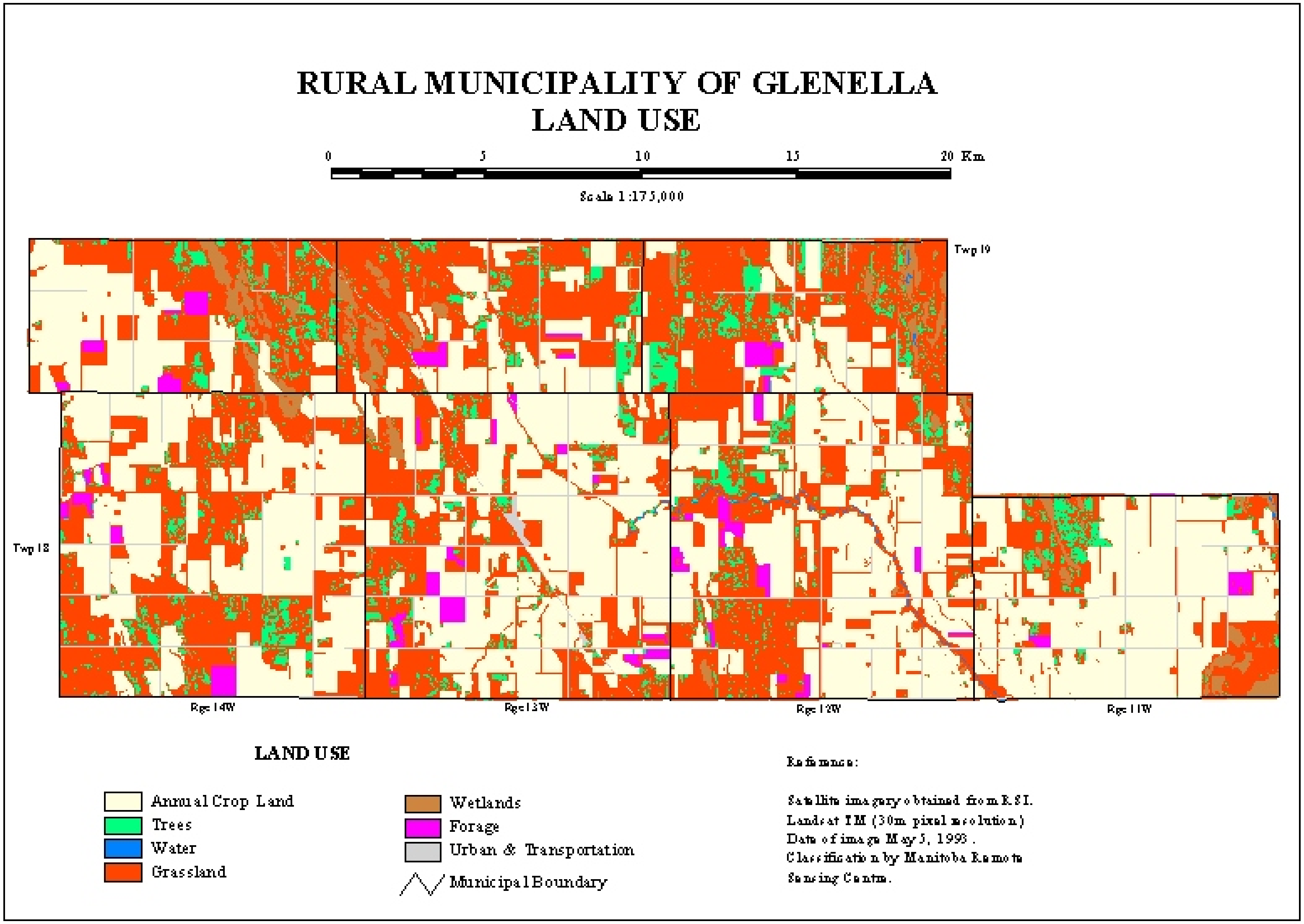
Water - open water - lakes, rivers streams, ponds, and lagoons.

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

Table 9. Land Use[1]

Class	Area (ha)	Percent of RM
Annual Crop Land	**23444**	**46.3**
Forage	**1046**	**2.1**
Grasslands	**20196**	**39.9**
Trees	**2947**	**5.8**
Wetlands	**1404**	**2.8**
Water	**61**	**0.1**
Urban and transportation	**1515**	**3.0**
Undifferentiated	**0**	**0.0**
Total	**50613**	**100.0**

[1] Land use information (1994) and map supplied by Prairie Farm Rehabilitation Administration. Areas may vary from previous maps due to differences in analytical procedures.


RURAL MUNICIPALITY OF GLENELLA
LAND USE
0 5 10 15 20 Km
Scale 1:175,000
Twp 19
Twp 18
Rge 14W
Rge 13W
Rge 12W
Rge 11W
LAND USE
Annual Crop Land
Trees
Water
Grassland
Wetlands
Forage
Urban & Transportation
Municipal Boundary
Reference:
Satellite imagery obtained from RSI.
Landsat TM (30m pixel resolution)
Date of image May 5, 1993.
Classification by Manitoba Remote
Sensing Centre.

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