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Rural Municipality of North Cypress

Information Bulletin 97-24

Soils and Terrain

An introduction
to the land resource

Land Resource Unit
Brandon Research Centre

Canada

Rural Municipality of North Cypress

Information Bulletin 97-24

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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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P. Haluschak and G. Podolsky, Manitoba Soil Resource Section, Soils and Crops Branch, Manitoba Agriculture.

Figure 3. Rural municipalities in southern Manitoba with digital soil and terrain map information.

INTRODUCTION

The location of North Cypress municipality is shown in Figure 1. The soil information was derived from semi-detailed 1:50 000 scale surveys (Soils of the Rural Municipality of North Cypress, Report D85). A brief overview of the database information assembled, and general environmental conditions is presented. A set of maps derived from the data for typical agricultural land use and planning applications is also included.

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

LAND RESOURCE DATA

The soil and terrain (landscape) 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.

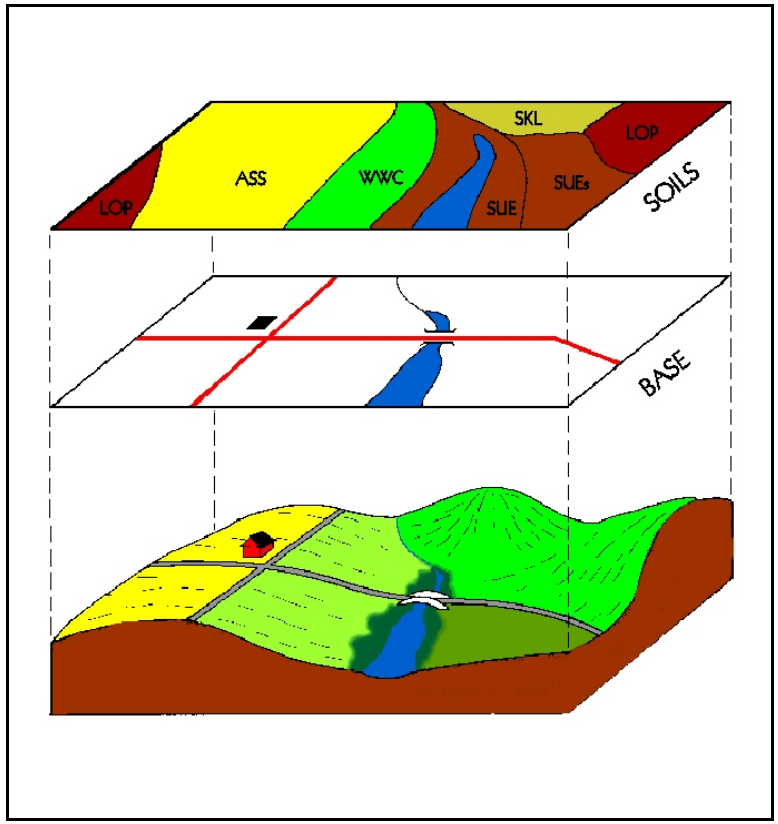


Figure 2. Soil and Base Map data.

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. The soil was added and aligned ("georeferenced") to the digital base map.

A comprehensive semi-detailed (1:50 000 scale) soil map (Podolsky and Podolsky, 1997), was 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 erosion, slope, stoniness, and salinity classes. Soil database information was produced for each polygon, to meet national standards (MacDonald and Valentine, 1992). Slope length classes were added, based on photo-interpretation.

Each soil polygon on the map was assigned the following legend characteristics:

soil series
modifier codes
polygon number

The soil and modifier codes provide a link to additional databases of soil properties. In this way, soil map polygons were related to drainage, surface texture, and other soil properties to produce the generalized, derived and interpretative maps presented in this bulletin.

SOIL AND TERRAIN OVERVIEW

The Rural Municipality of North Cypress covers 12.5 Townships (approximately 121 000 hectares) in south-central Manitoba. The town of Carberry is the largest population centre in the municipality. Land use is predominantly agricultural in the northern and central portions of the RM. Portions of the Spruce Woods Forest Reserve occur along the southern boundary of the RM.

Soils in the municipality of North Cypress have been mapped in the Reconnaissance Soil Survey of Carberry Map Sheet Area (Ehrlich et al., 1957). More recently, soils in the RM of North Cypress have been mapped in greater detail, at 1:20 000 scale (Podolsky et al., 1997). The digital soil and interpretive maps in this bulletin are derived from the more recent, detailed soils coverage.

Based on climatic data for Carberry (Environment Canada, 1993), the mean annual temperature is 2.1°C; mean annual precipitation is 472.3 mm; degree days above 5°C is 1726.9. The mean frost-free period is 117 days (Environment Canada, 1982). The seasonal moisture deficit for the period May to September is 250 mm; effective growing degree days (EGDD) above 5°C for the same period is 1500 to 1600. This parameter provides an indication of heat energy available for crop growth (Agronomic Interpretations Working Group, 1995). These conditions are adequate for cereal crop production.

Relief in the RM of North Cypress ranges from 320 m.a.s.l. in the extreme northeastern portion of the municipality to 420 m.a.s.l. in the extreme northwestern portion.

The major portion of the RM of North Cypress occurs within the Upper Assiniboine Delta with minor areas in the Newdale Till Plain and Lower Assiniboine Delta. In the central portion of the municipality, sandy deltaic deposits have been overlain by level to gently undulating lacustrine deposits. Many areas of coarse textured deltaic deposits have been modified by wind, and occur as stabilized dunes with relief of up to 20m and slopes up to 30%. The northeastern portion of the municipality has moderate relief, with numerous dissected stream channels. Slopes are moderate to steep, particularly along the sides of the eroded channels.

A small portion of the Lower Assiniboine delta occurs in the extreme northeastern portion of the municipality. Topography here is level to very gently undulating. Soils are mainly imperfectly and poorly drained lacustrine sands, with high watertables.

A portion of the Newdale till plain occurs in the northwestern corner of the municipality. This area is gently undulating, with 2 to 5% slopes, and numerous poorly drained depressions. The dominant soil is the Newdale series, an Orthic Black soil developed on loam to clay loam textured glacial till. Agricultural capability is class 2 to 3, with slight limitations due to stoniness and topography. Some of these soils are slightly to moderately eroded, and have a moderate risk of further water erosion if left unprotected.

Several different soil landscape types occur within the Upper Assiniboine delta. A large area of level, medium textured lacustrine deposits overlie the sandy deltaic deposits in the central and northwestern portions of the municipality. These soils are mainly well drained, fertile, Black Chernozems, with agriculture capability ratings of class 1 and 2. Typical soil series include Ramada, Wellwood and Fairland soils. In some areas the loamy lacustrine deposits are less than one meter in thickness (Glenboro series), or have coarser textures (Prosser series). These soils have agriculture capability ratings of 2 to 3, due to more limited moisture holding capacities. These soils are all well suited for irrigation.

Dark Gray Chernozemic soils developed on loam and clay loam lacustrine deposits (Halstead and Firdale series) occur in the northeastern portion of the RM. Topography is gently to steeply sloping, with steeper slopes along erosional channels. These are well drained, productive agricultural soils, with slope as the major limitation, due to an increased risk of water erosion. Seepage from the underlying sand aquifers occurs on the sides of the eroded channels, and organic soils are commonly found in the valley bottom of channels. Extensive areas of organic soils also occur in the south western corner of the RM, in a broad, shallow channel associated with Epinette Creek.

Approximately 50% of the RM has coarse textured, sandy soils In some areas, soils are developed on the the original deltaic glaciofluvial deposts, particularly in the south western portion of the RM. These were mapped as the Marringhurst and Miniota soil associations on the Carberry reconnaissance soil map. These areas are further differentiated into more specific soil series, such as Wheatland, Miniota, Dorset, and Stockton series, on the more recent, detailed digital soil maps. These soils are predominantly well drained, Orthic Black Chernozems, with low organic matter contents, and low moisture holding capacities. Topography is usually level to gently undulating. Soil capability for dryland agriculture is 4M to 6M, primarily due to droughtiness, and they are quite susceptible to wind erosion. Although these soils can be irrigated, the coarse textures and low water holding capacity result in a high risk of potential leaching.

Most of the original sandy deltaic deposts, covering approximately 25% of the RM, have been modified by wind. These areas of stabilized dunes typically have an irregular pattern of stongly undulating to ridged topography, with slopes from 15 to 30%. Soils are predominantly well drained, Orthic Regosols (Shilox series). These soils have a very low agricultural capability, due to very low moisture holding capacity and steep slopes (6M, 6MT). They have a very high risk of further wind erosion if cultivated or disturbed, and are generally unsuited for irrigation. Many of these soils are used for limited native grazing, or as recreational land. Most of the Spruce Woods Provincial Park, along the southern border of the RM, consists of stabilized dunes.

Approximately 40% of the RM is used for annual crop production. These are predominantly the medium textured lacustrine soils with a high capability for dryland agriculture, and a high suitability for irrigation. Most of the areas classified as grasslands or trees are in coarser textured deltaic or eolian soils with a lower capabilty for agriculture.

DERIVED AND INTERPRETIVE MAPS

A large variety of computer derived and interpretive maps can be generated, once the soil and landscape data are stored in digital format. 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 surface soil texture, drainage, salinity, or slope class).

Interpretive maps portray more complex land evaluations based on information presented in the legend. 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 included in this information bulletin are:

Derived Maps
Slope Classes
Surface Texture
Soil Drainage
Soil Salinity
Management Considerations

Interpretative Maps
Agricultural Capabilities
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 scales 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 Manitoba Land Resource Unit.

Slope Map.

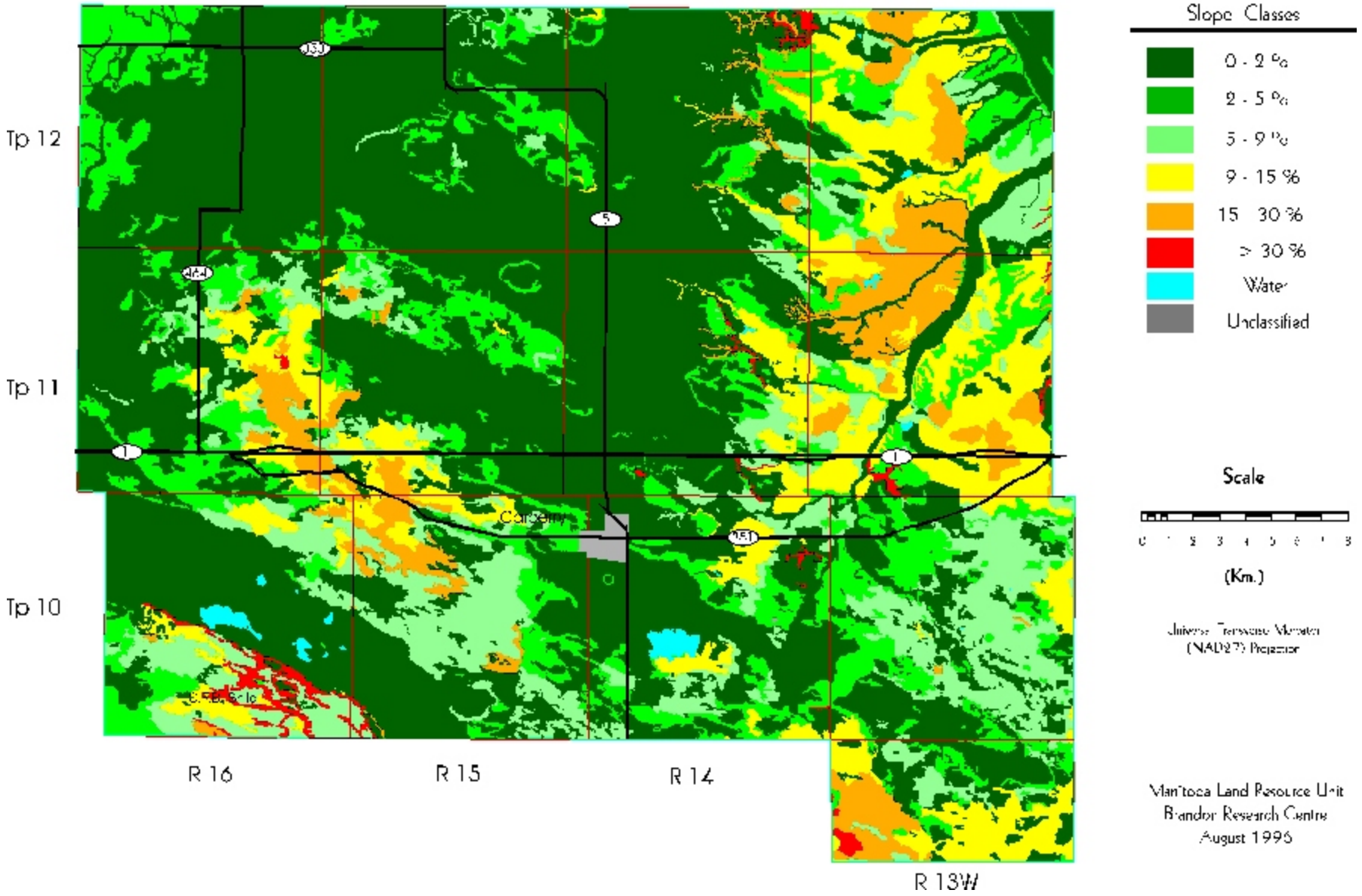
Slope describes the steepness and complexity of the landscape surface. The slope classes shown on this map are derived from the digital soil layer database. Specific colours are used to indicate the dominant slope class for each soil polygon in the R.M. Additional slope classes may occur in each polygon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

Table 1. Slope Classes[1]

Slope Class	Area (ha)	Percent of RM
0 - 2 %	64609	53.3
2 - 5 %	18197	15.0
5 - 9 %	15505	12.8
9 - 15 %	14185	11.7
15 - 30 %	6927	5.7
> 30 %	1047	0.9
Unclassified	130	0.1
Water	511	0.4
Total	121110	100.0

[1] Based on **dominant** slope gradient of each soil polygon.

Rural Municipality of North Cypress Slope Map



Surface Texture Map.

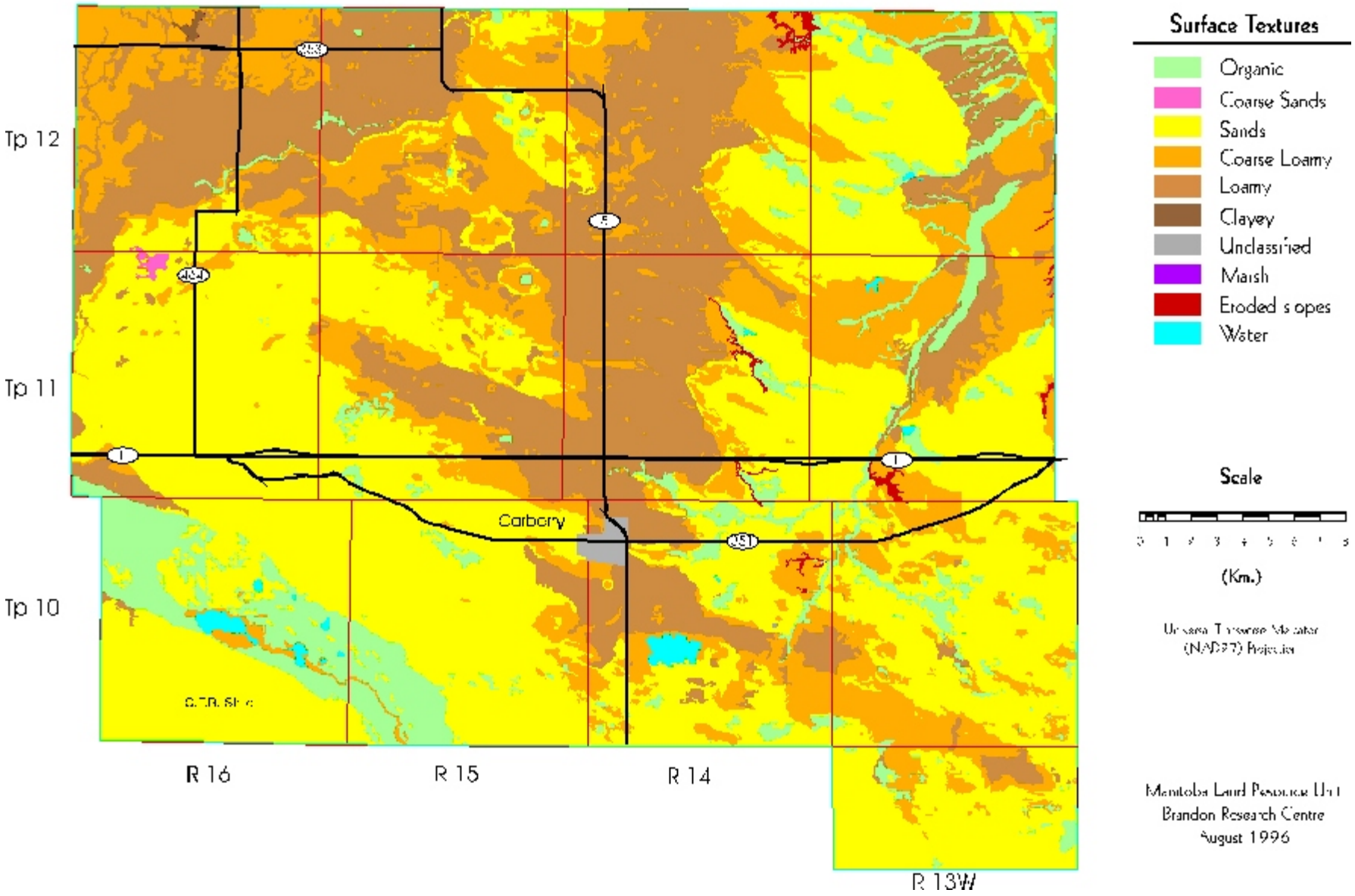
The soil textural class for the upper most soil horizon of the dominant soil series within a soil polygon was utilized for classification. Texture may vary from that shown with soil depth and location within the polygon.

Table 2. Surface Texture[1]

Surface Texture	Area (ha)	Percent of RM
Organics	8986	7.4
Coarse Sands	93	0.1
Sands	55458	45.8
Coarse Loamy	10333	8.5
Loamy	45186	37.3
Clayey	61	0.1
Eroded Slopes	352	0.3
Marsh	0	0.0
Unclassified	130	0.1
Water	511	0.4
Total	121110	100.0

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

Rural Municipality of North Cypress Surface Texture Map



Soil Drainage Map.

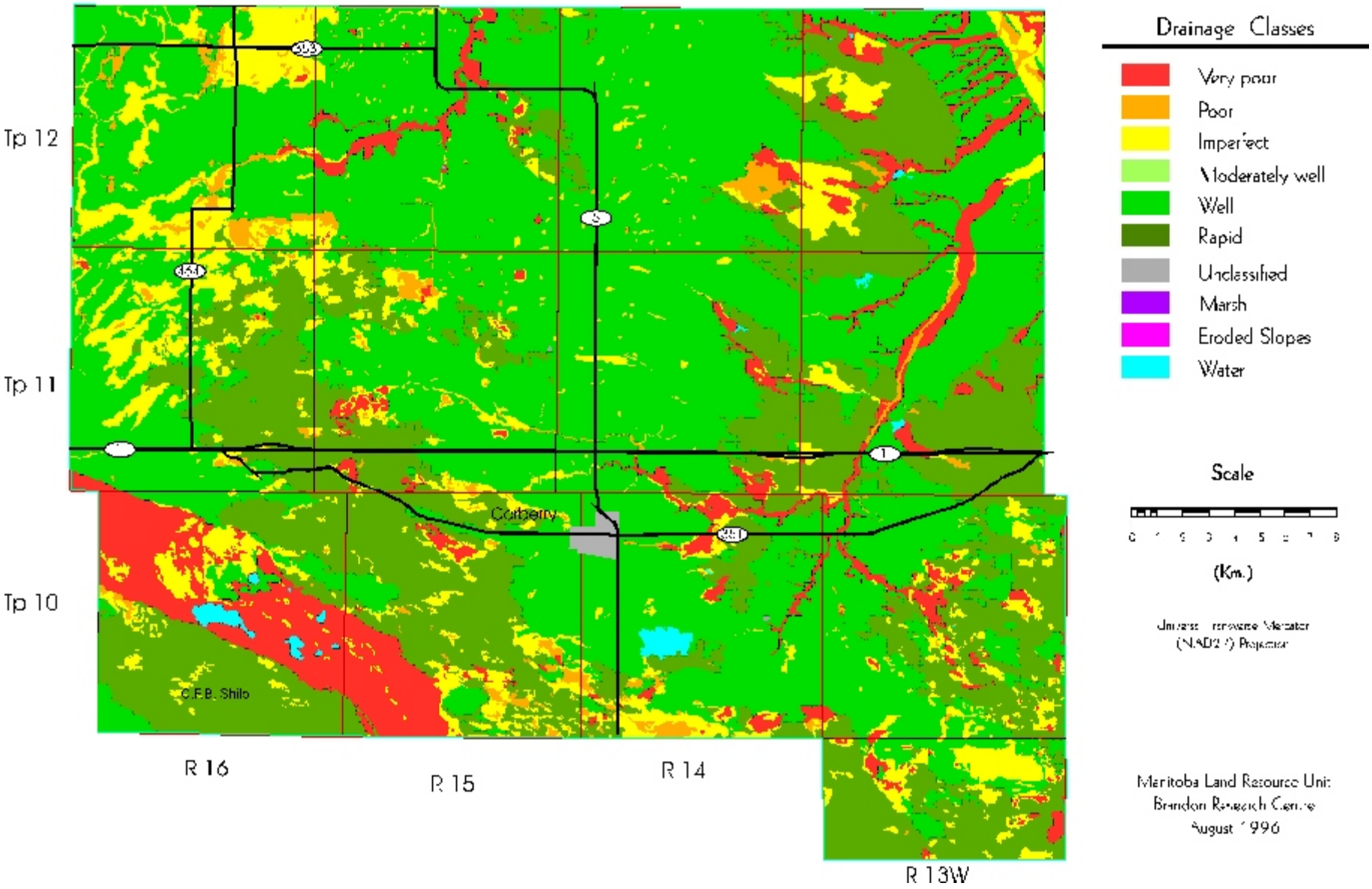
Drainage is described on the basis of actual moisture content in excess of field capacity, and the length of the saturation period within the plant root zone. Drainage classification was based upon the dominant soil series of each individual soil polygon. A description of the various soil drainage classes can be found in Soils of the Rural Municipality of North Cypress, Report No. D85 (Podolsky and Podolsky, 1997).

Table 3. Drainage Classes[1]

Drainage Class	Area (ha)	Percent of RM
Very Poor	9730	8.0
Poor	2437	2.0
Imperfect	13706	11.3
Moderately Well	0	0.0
Well	63193	52.2
Rapid	31403	25.9
Eroded Slopes	0	0.0
Marsh	0	0.0
Unclassified	130	0.1
Water	511	0.4
Total	121110	100.0

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

Rural Municipality of North Cypress Soil Drainage Map



Soil Salinity Map.

A saline soil contains soluble salts in such quantities that they interfere with the growth of most crops. Soil salinity is determined by the electrical conductivity of the saturation extract in decisiemens per metre (dS/m). Approximate limits of salinity classes are:

non-saline	0 to 4 dS/m
slightly saline	4 to 8 dS/m
moderately saline	8 to 16 dS/m
strongly saline	> 16 dS/m.

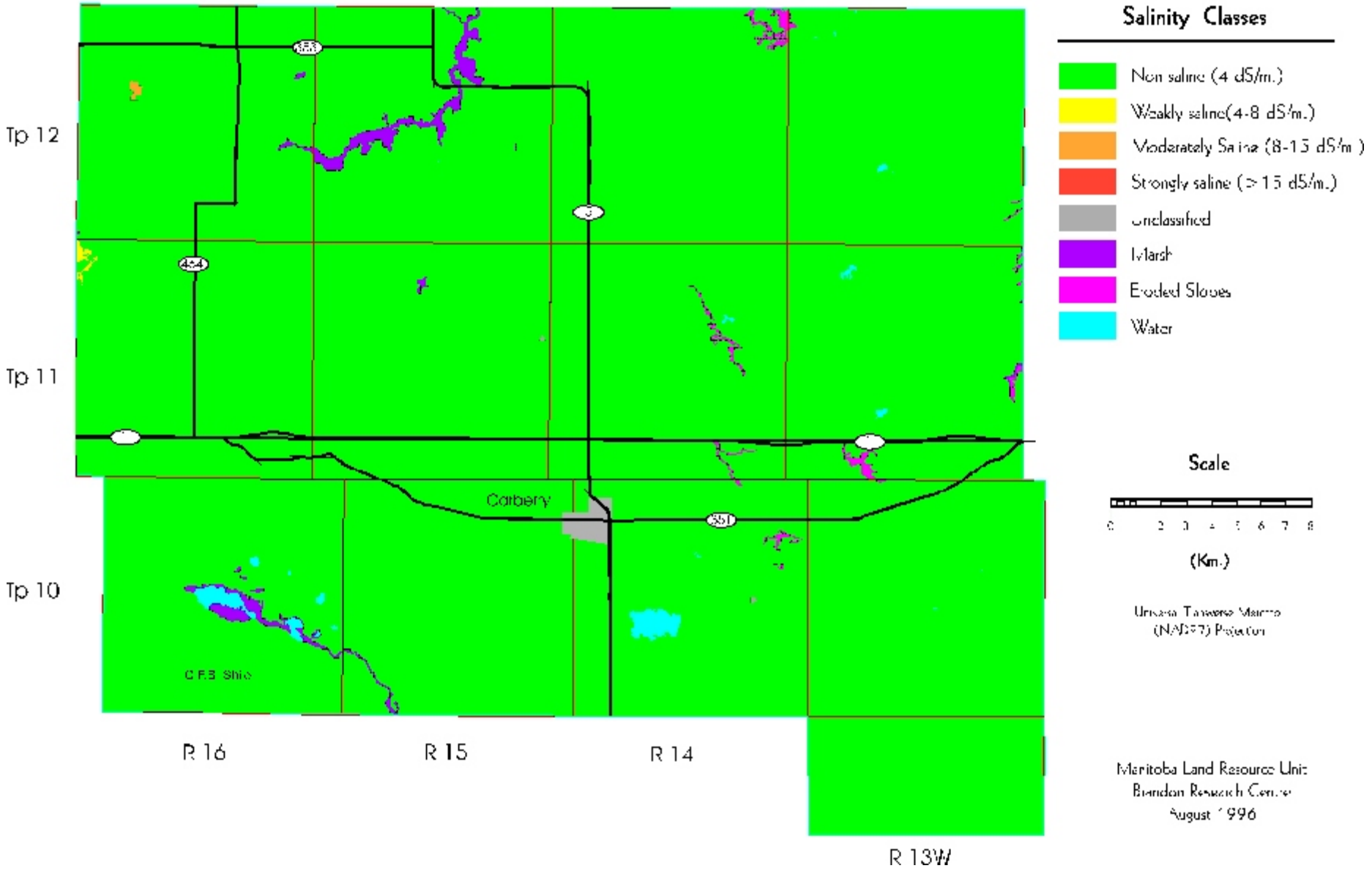
The salinity classification of each individual soil polygon was determined by the most severe salinity classification present within that polygon.

Table 4. Salinity Classes[1]

Salinity Class	Area (ha)	Percent of RM
Non Saline	119147	98.4
Weakly Saline	44	0.0
Moderately Saline	28	0.0
Strongly Saline	0	0.0
Eroded Slopes	352	0.3
Marsh	897	0.7
Unclassified	130	0.1
Water	511	0.4
Total	121110	100.0

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

Rural Municipality of North Cypress Soil Salinity Map



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

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

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

C = Coarse texture - soil landscapes that have **coarse to very coarse textured soils (loamy sands, sands and gravels)** and hence a high permeability throughout the profile, 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.

M = Medium texture - soil landscapes that have medium to moderately fine texture **(loams to clay loams)** and hence have good water and nutrient retention properties, require good management and cropping practices to minimize leaching and the risk of erosion.

T = Topography - soil landscapes that have **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 that have organic soils, require special management considerations of drainage, tillage, and cropping to sustain productivity and minimize subsidence and erosion.

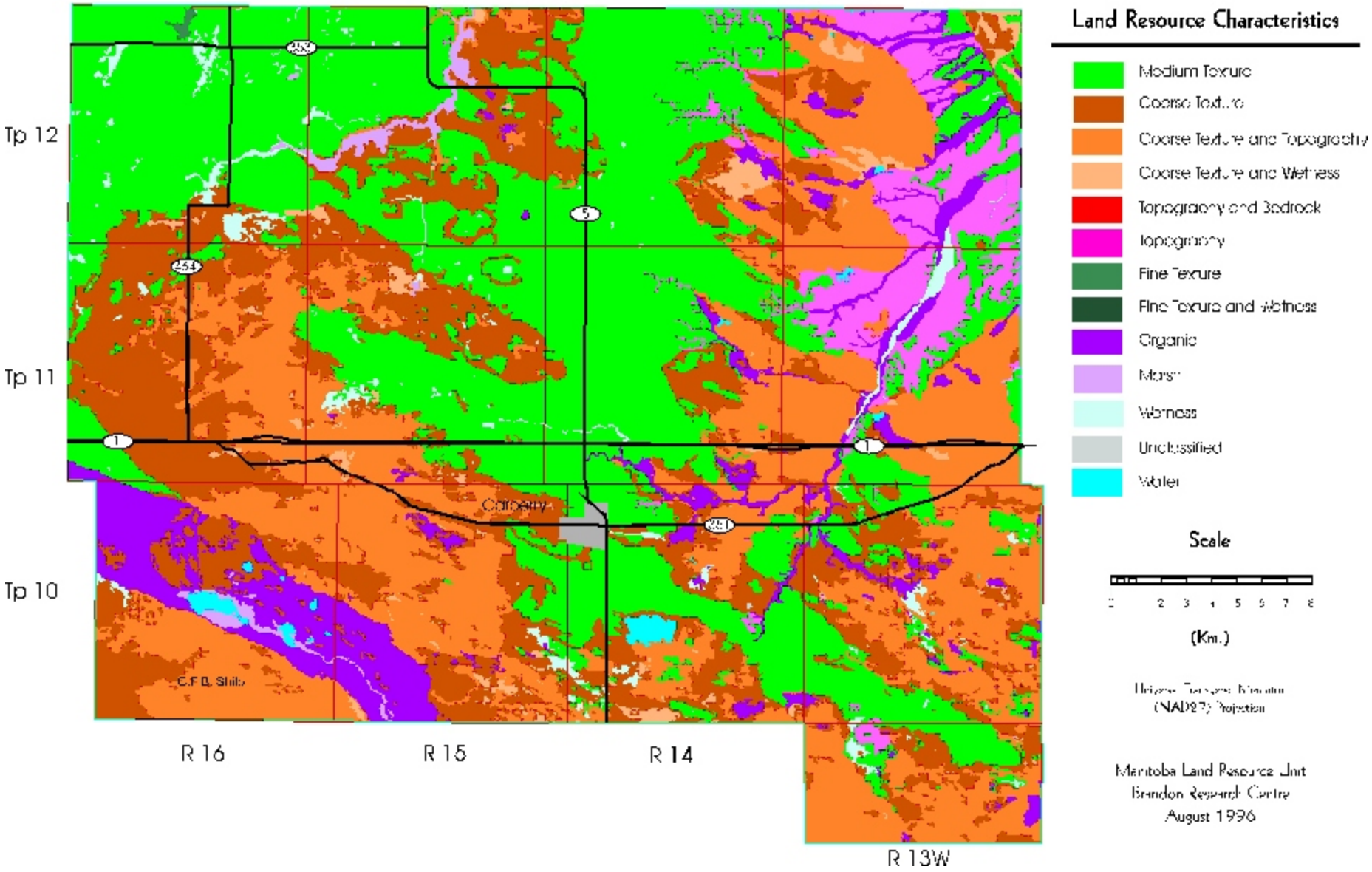
R = Bedrock - soil landscapes that have shallow depth to bedrock (< 50 cm) and/or exposed bedrock which may prevent the use of some or all tillage practices as well as the range of potential crops. They require special cropping and management practices to sustain agricultural production.

Table 5. Management Considerations[1]

Land Resource Characteristics	Area (ha)	Percent of RM
Fine Texture	61	0.1
Fine Texture and Wetness	0	0.0
Fine Texture and Topography	0	0.0
Fine Texture, Wetness and Topography	0	0.0
Medium Texture	43461	35.9
Coarse Texture	27117	22.4
Coarse Texture and Wetness	1697	1.4
Coarse Texture and Topography	31753	26.2
Coarse Texture, Wetness and Topography	0	0.0
Topography	5910	4.9
Topography and Bedrock	0	0.0
Wetness	1888	1.6
Wetness and Topography	0	0.0
Bedrock	0	0.0
Organic	7685	6.3
Marsh	897	0.7
Unclassified	130	0.1
Water	511	0.4
Total	121110	100.0

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

Rural Municipality of North Cypress 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 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).

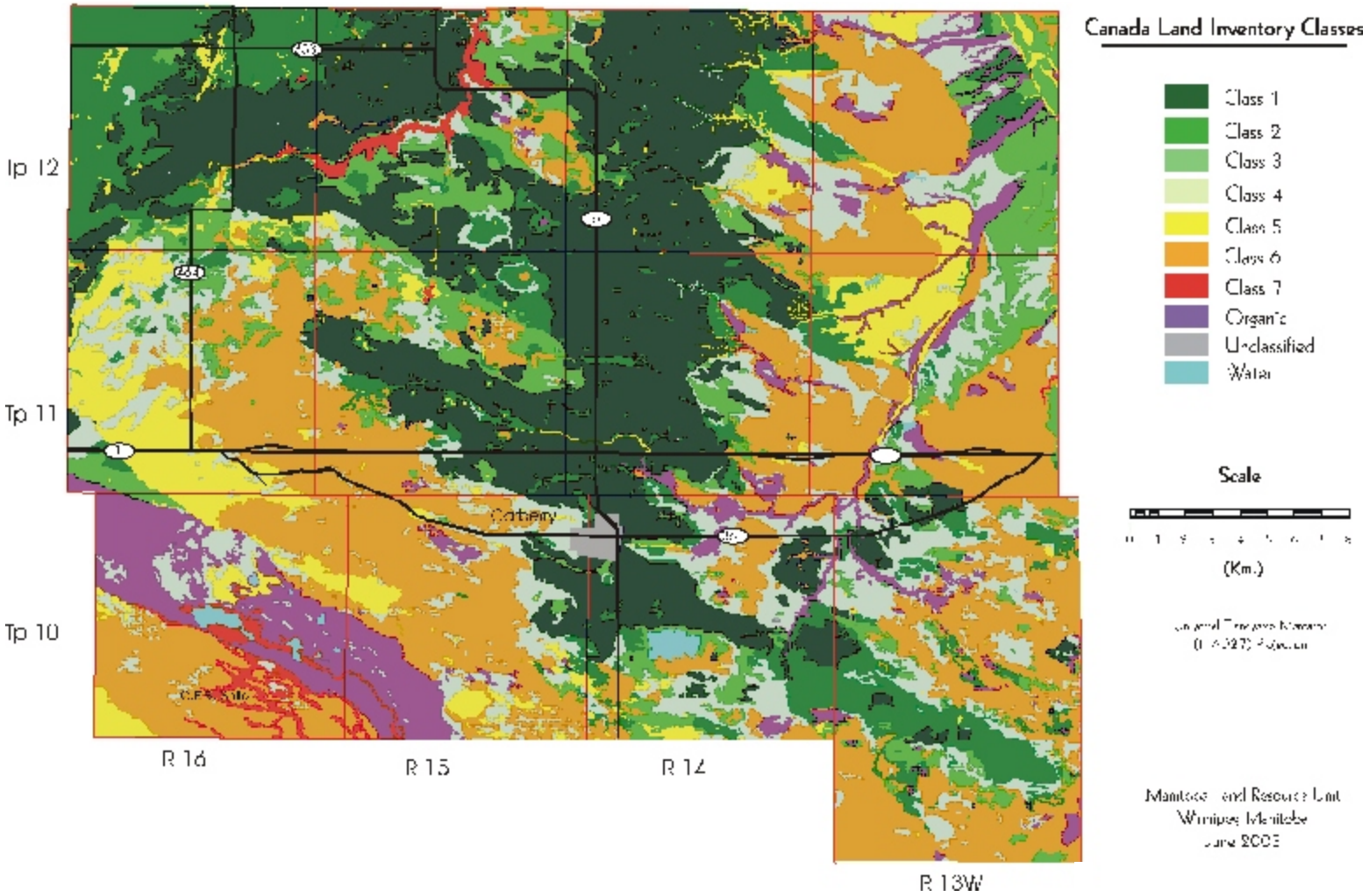
This generalized interpretive map is based on the dominant soil series and phases for each soil polygon. The CLI subclass limitations cannot be portrayed at this generalized map scale.

Table 6. Agricultural Capability[1]

Class Subclass	Area (ha)	Percent of RM
1	**28032**	**23.1**
2	**13151**	**10.9**
2E	4	0.0
2M	4011	3.3
2MT	1644	1.4
2P	243	0.2
2T	1209	1.0
2TE	97	0.1
2TP	1400	1.2
2TW	53	0.0
2W	4252	3.5
2X	237	0.2
3	**11032**	**9.1**
3I	69	0.1
3M	9176	7.6
3ME	206	0.2
3MT	834	0.7
3N	35	0.0
3P	62	0.1
3T	500	0.4
3W	150	0.1
4	**18039**	**14.9**
4EM	4	0.0
4ET	13	0.0
4M	15194	12.5
4ME	576	0.5
4MT	100	0.1
4N	28	0.0
4T	2103	1.7
4TE	21	0.0
5	**8899**	**7.3**
5	255	0.2
5EM	103	0.1
5M	4284	3.5
5ME	10	0.0
5T	1862	1.5
5TE	102	0.1
5W	2173	1.8
5WI	110	0.1
6	**32181**	**26.6**
6ET	20	0.0
6M	30352	25.1
6ME	14	0.0
6MT	132	0.1
6T	362	0.3
6W	1179	1.0
6WI	123	0.1
7	**1451**	**1.2**
7T	553	0.5
7W	898	0.7
Organic	**7683**	**6.3**
Unclassified	**130**	**0.1**
Water	**511**	**0.4**
Total	**121109**	**100.0**

[1] Based on **dominant** soil, slope gradient, and slope length of each soil polygon.

Rural Municipality of North Cypress 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 limitation 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.

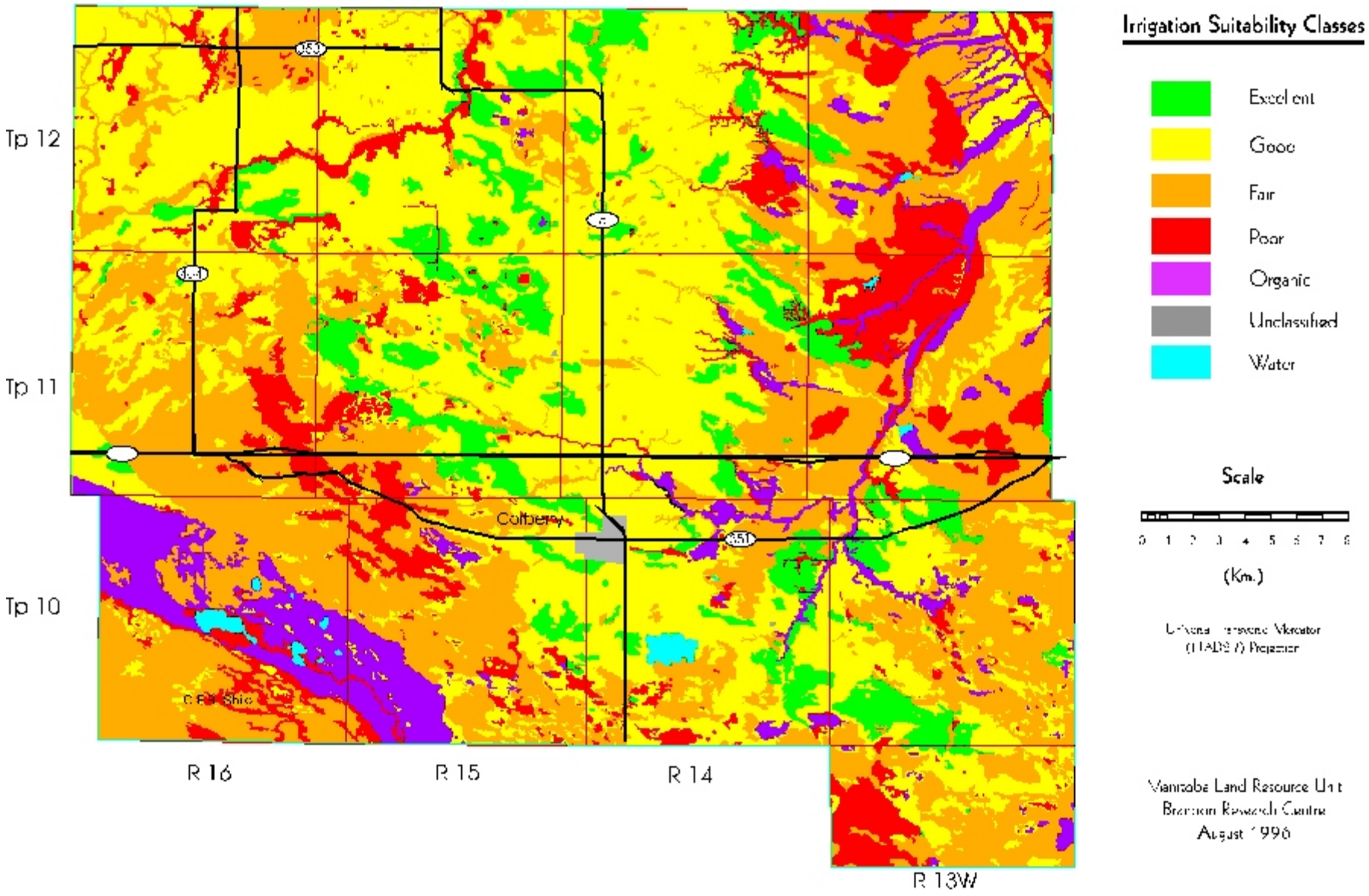
This generalized interpretive map is based on the dominant soil series for each soil polygon, in combination with the dominant slope class. The nature of the subclass limitations and the classification of subdominant components is not shown at this generalized map scale.

Table 7. Irrigation Suitability[1]

Class	Area (ha)	Percent of RM
Excellent	**9623**	**7.9**
Good	**49941**	**41.2**
Fair	**40585**	**33.5**
Poor	**12635**	**10.4**
Organic	**7685**	**6.3**
Unclassified	**130**	**0.1**
Water	**511**	**0.4**
Total	**121110**	**100**.0

[1] Based on **dominant** soil, slope gradient, and slope length of each soil polygon.

Rural Municipality of North Cypress Irrigation Suitability Map



Potential Environmental Impact Under Irrigation Map.

A major 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.

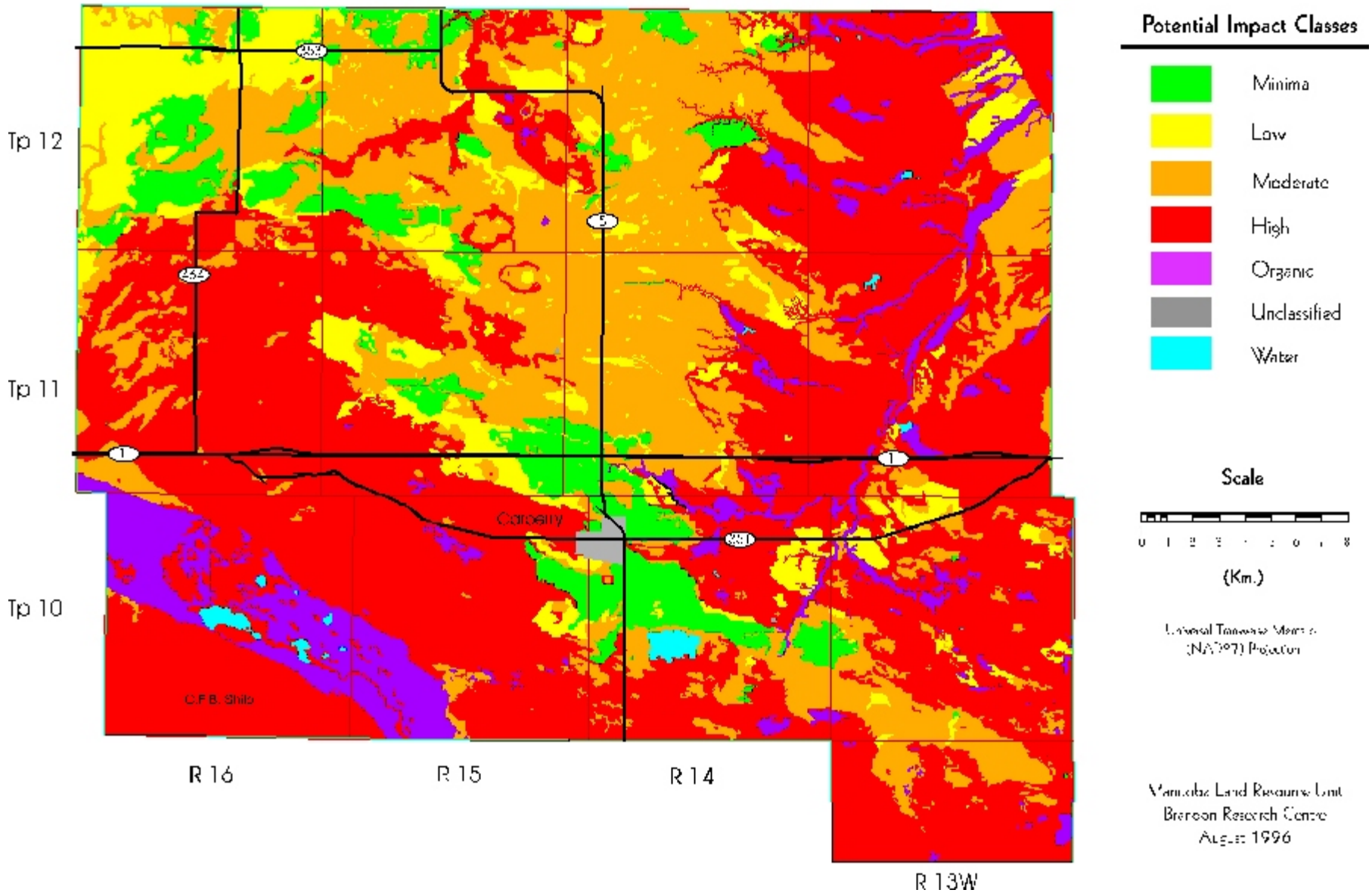
This generalized interpretive map is based on the dominant soil series and slope class for each soil polygon. The nature of the subclass limitations, and the classification of subdominant components is not shown at this generalized map scale.

Table 8. Potential Environmental Impact Under Irrigation[1]

Class	Area (ha)	Percent of RM
Minimal	7860	6.5
Low	11169	9.2
Moderate	32813	27.1
High	60943	50.3
Organic	7685	6.3
Unclassified	130	0.1
Water	511	0.4
Total	121110	100.0

[1] Based on **dominant** soil, slope gradient, and slope length of each soil polygon.

Rural Municipality of North Cypress **PotPotential 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 map shows 5 classes of soil erosion risk based on bare unprotected soil:

negligible
low
moderate
high
severe.

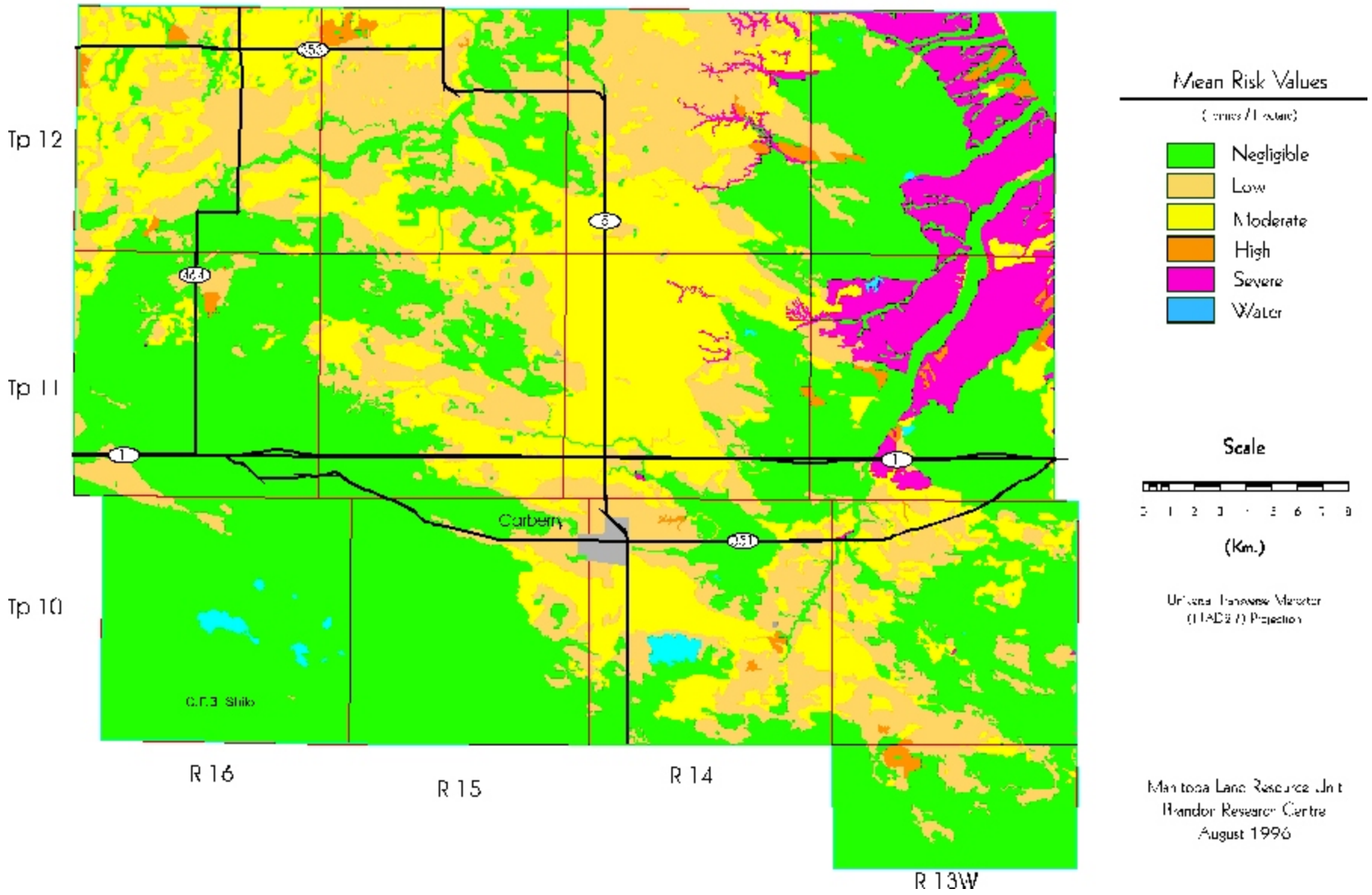
Cropping and residue management practices will significantly reduce this risk depending on crop rotation program, soil type, and landscape features.

Table 9. Water Erosion Risk[1]

Class	Area (ha)	Percent of RM
Negligible	**60562**	**50**
Low	**26320**	**21.7**
Moderate	**25677**	**21.2**
High	**1094**	**0.9**
Severe	**6817**	**5.6**
Unclassified	**130**	**0.1**
Water	**511**	**0.4**
Total	**121110**	**100.0**

[1] Based on **dominant** soil, slope gradient, and slope length of each soil polygon.

Rural Municipality of North Cypress Water Erosion Risk Map



Land Use Map.

The land use classification of the R.M. 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 R.M..

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.

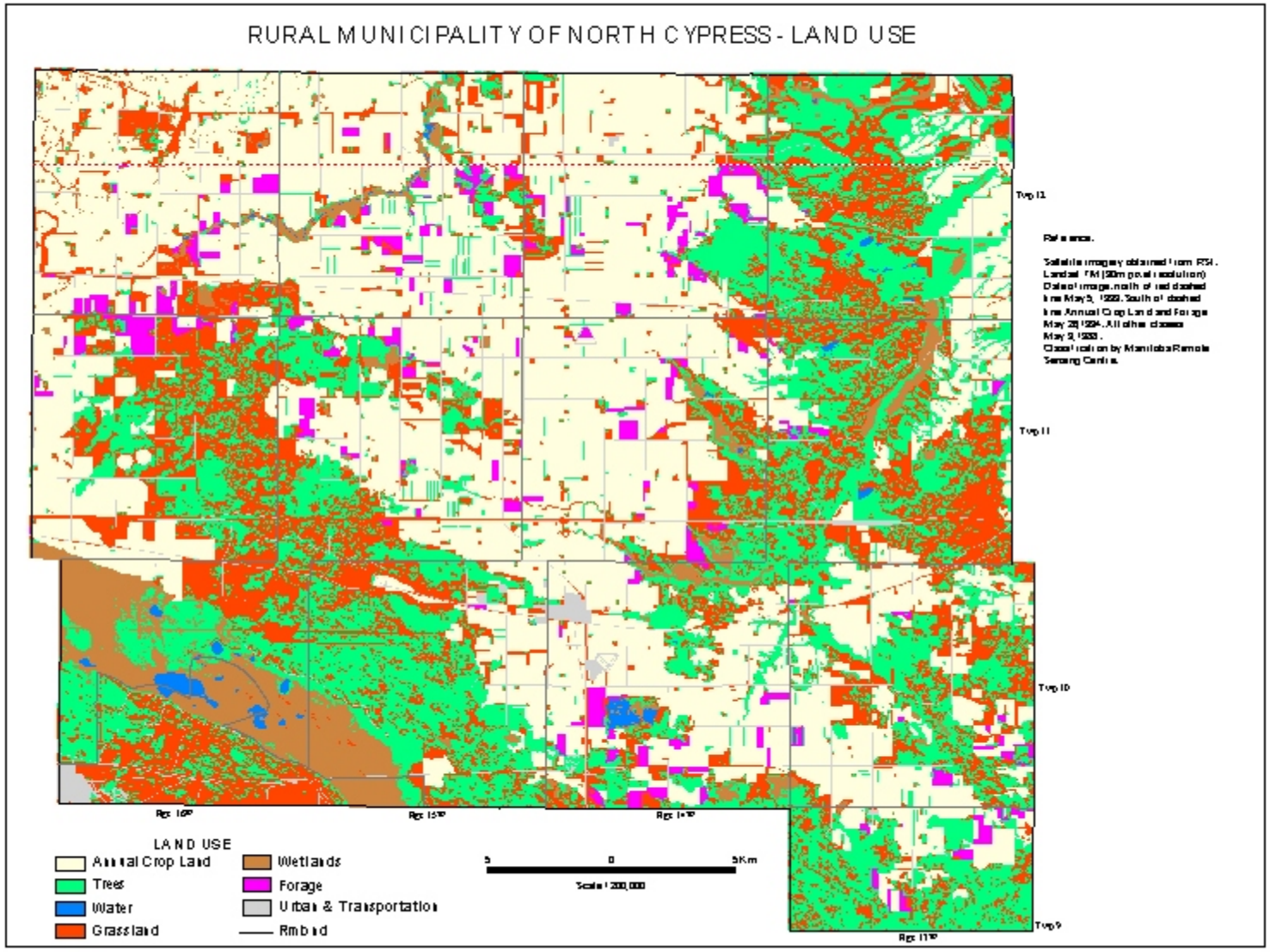
Water - open water lakes, rivers streams, ponds, and lagoons.

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

Table 10. Land Use[1]

Class	Area (ha)	Percent of RM
Annual Crop Land	50014	41.1
Forage	3344	2.7
Grasslands	26559	21.8
Trees	31201	25.6
Wetlands	6352	5.2
Water	577	0.5
Urban and Transportation	3615	3.0
Total	121602	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 NORTH CYPRESS - LAND USE
Twp 12
Twp 11
Twp 10
Twp 9
Rge 16W
Rge 15W
Rge 14W
Rge 13W
LAND USE
Annual Crop Land
Trees
Water
Grassland
Wetlands
Forage
Urban & Transportation
Rmbnd
5 0 5Km
Scale 1:200,000

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