SECTION 8.2

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Summary of Resources and Land Use Issues Related to Riparian Areas in the La Salle River Watershed Study Area

Agriculture and Agri-Food Canada - Prairie Farm Rehabilitation Administration
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Manitoba Rural Adaptation Council Inc.
ADVANCING CANADIAN AGRICULTURE AND AGRI-FOOD

Preface

This report is one of a series of watershed summary reports completed for the Agriculture Environmental Sustainable Initiative's Riparian Areas: Planning and Priority Setting project. Due to scale and data accuracy limitations, these reports do not replace the need for site-specific analysis; rather, they serve as a generalized guide for overall planning purposes on a watershed basis. These reports are available in .pdf format on the Manitoba Riparian Health Council's website (www.riparianhealth.ca), or can be obtained by contacting:

Agriculture and Agri-Food Canada - Prairie Farm Rehabilitation Administration
Prairies East Region,
200-303 Main Street
Winnipeg, Mb
R3C 3G7
Tel: (204)983-2243
Fax: (204)983-2178

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Professional expertise was provided by:
P. Michiels, T. Horechko, J. Fitzmaurice, J. Powers, R. Lewis, T. Scott, N. Mischuk, J. Tokarchuk

Technical support was provided by:
C. Wyrzykowski, K. Gottfried, R. Aquino, S. Garrick, S. Solivar, J. Bergthorson, N. Diehl, R. Rosario

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Background

Riparian areas play an important role in surface water quality and their ability to carry out this function can be affected by anthropogenic activities on the landscape. Agriculture is only one component, with other human activities such as industry, recreation and residences contributing to degraded riparian areas. The intent of this report is to be a first step towards addressing the issue of riparian health, with respect to agriculture, in the watershed study area. By providing information on the land resources and the agricultural activities in the study area, a better understanding of the issue can be obtained which will assist towards better planning and priority setting by local decision makers, land use planners and policy decision-makers. While this reports studies the agricultural aspect of the watershed study area, in a true watershed study, all factors of activities of all sectors must be considered.

This project is a component of the Agriculture and Agri-Food Canada – Prairie Farm Rehabilitation Administration (AAFC-PFRA) Agricultural Riparian Areas: Planning and Performance Monitoring project. Funding was provided by the Manitoba Rural Adaptation Council (MRAC), through the Agricultural Environmental Stewardship Initiative (AESI). The purpose of this project is to provide a central source of riparian-related resource information in a format that is easily accessible to land use planners and policy decision-makers. The information provided can assist in strategic planning for riparian areas in Manitoba. Through the identification of potential problem areas, decision makers can make informed land use decisions that target priority areas.

As part of the Agricultural Riparian Areas: Planning and Performance Monitoring project, AAFC-PFRA has collected, analyzed, and displayed riparian-related data using an Internet Map Server (IMS). The IMS web server is designed to be a one-stop source of riparian-related data and information relevant for analysis, land-use planning, and program design. The IMS site is available under the tools menu on the Riparian Health Council website (*www.riparianhealth.ca*).

The Riparian Health Council (RHC) is comprised of government and non-government agencies with an interest in increasing producer involvement and improving the coordination of cooperative efforts among agencies that develop riparian projects with landowners throughout Manitoba. The Council has developed a vision for cooperative programming that enhances riparian areas and surface water quality across agro-Manitoba while also supporting landowner needs. This project will provide information which can assist the RHC in achieving its vision.

The boundaries used in this report are based on the watershed layer produced by a joint venture between Manitoba Conservation and AAFC-PFRA. For reporting purposes, water flow direction data was used to amalgamate individual sub-watershed units into larger sub-watershed and watershed groups (refer to Appendix D). Due to scale and data accuracy limitations, neither this report nor the information and data provided on the RHC website can replace the need for site-specific analysis. However, these information sources can serve as a guide for general watershed planning purposes.

Importance of Riparian Areas

Although riparian areas occupy only a small percentage of the area of a watershed, they represent an extremely important component of the overall landscape. They are the transitional areas between the aquatic and surrounding upland area. These "green zones" are one of the most ecologically diverse ecosystems. A healthy riparian area can perform a number of ecological functions, including trapping sediment, building and maintaining streambanks, storing floodwater and energy, recharging groundwater, filtering and buffering water, reducing and dissipating stream energy, maintaining biodiversity and creating primary productivity. These functions are essential for sustaining a majority of fish and wildlife species, maintaining functioning watersheds, providing good water quality, forage for livestock and supporting people on the landscape. Disturbance and alteration of a riparian area will impact its ability to carry out these ecological functions. Impacted riparian areas will have a reduced capacity to trap and store sediment and nutrients and stabilizing streambanks (important for surface water quality), provide fish and wildlife habitat, etc.

Recognizing that many sectors contribute to the alteration of riparian areas, including agriculture, recreation, urban and residential development, and forestry, this report will focus on the agricultural impacts to riparian areas in an attempt to provide information that can be used by the agricultural industry to begin to address the issue of riparian health.

Watershed Overview

The La Salle River Watershed Study Area is approximately 240,625 ha in size and is comprised of four sub-watershed units (refer to Figure 1.0). The watershed drains into the La Salle River which originates east of Portage La Prairie and meanders its way south-east through the watershed to meet up with the Red River in St. Norbert (Winnipeg). There are no major waterbodies in this watershed, however there is an area of wetlands and prairie potholes located within the southwestern corner.

Elevation in the watershed ranges from 329 metres above sea level (masl) to 222 masl (refer to Figure 2.0). Though the change in elevation from west to east is about 107 m, the greatest change occurs in the southwestern part after which the land slopes gently eastward to reaches its minimum elevation near the Red River.

At the time of this report, the La Salle River Watershed Study Area was served by the La Salle-Redboine Conservation District and seven Rural Municipalities (RMs). The La Salle-Redboine Conservation District covers most of the area except for the eastern tip, which is part of the city of Winnipeg. Of the RMs in this watershed, Grey, Portage La Prairie, Cartier, and MacDonald cover most of the study area (refer to Figure 3). There are also small portions of the RMs of Richot and South Norfolk, and the City of Winnipeg. Some of the larger communities in the watershed include Oakville, Elie, St. Claude, Haywood, Elm Creek, Fannystelle, Starbuck, Oak Bluff, Sanford, La Salle as well as part of St. Norbert (a neighborhood of Winnipeg). Some of the communities close to Winnipeg serve as bedroom communities to Winnipeg. Intensive agriculture comprises the basis for the local economy within the watershed. The river is also used recreationally for fishing and canoeing.

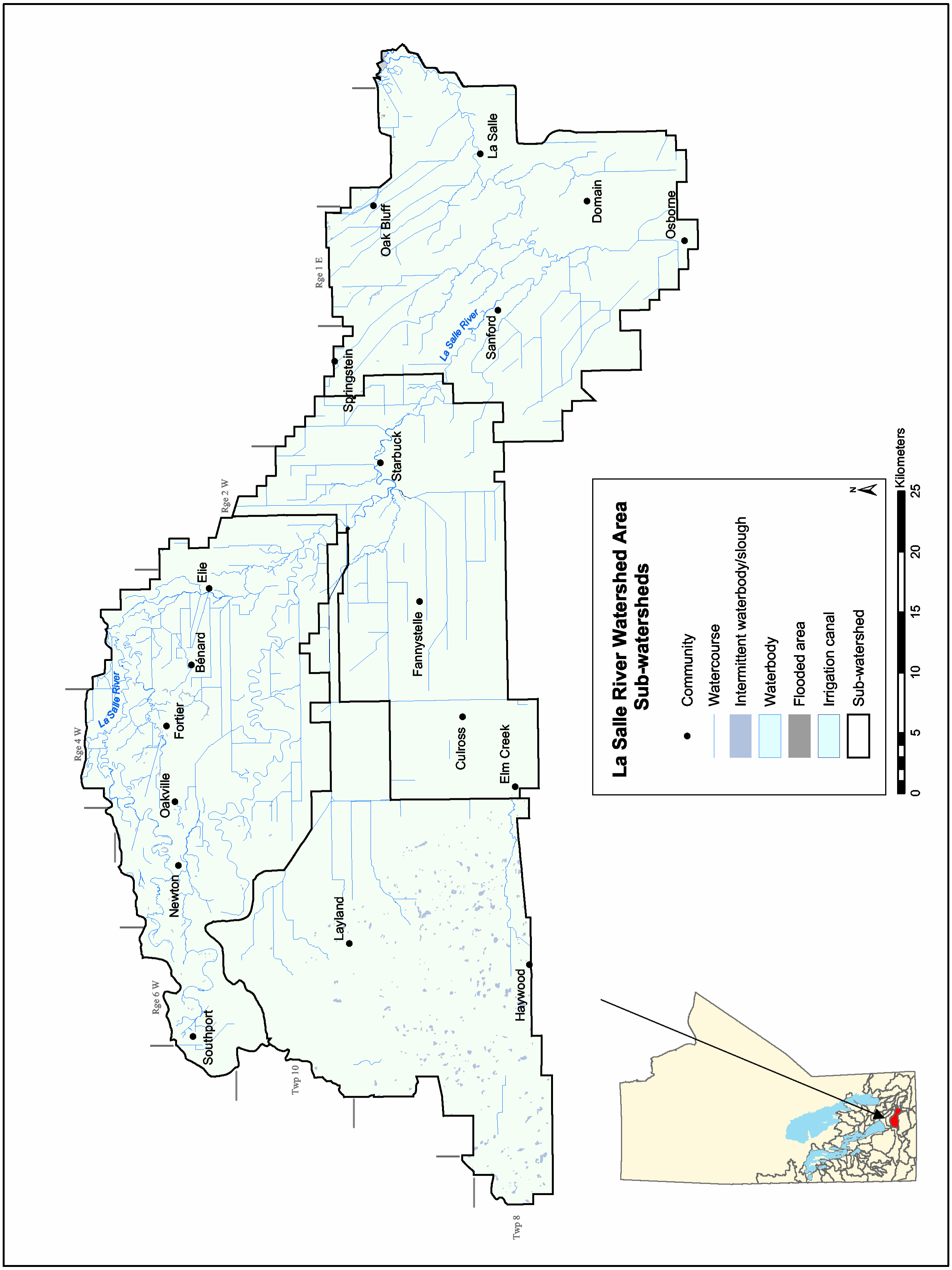

Figure 1.0 Sub-watersheds within the La Salle River Watershed Study Area (water shown at 1:50,000 scale)

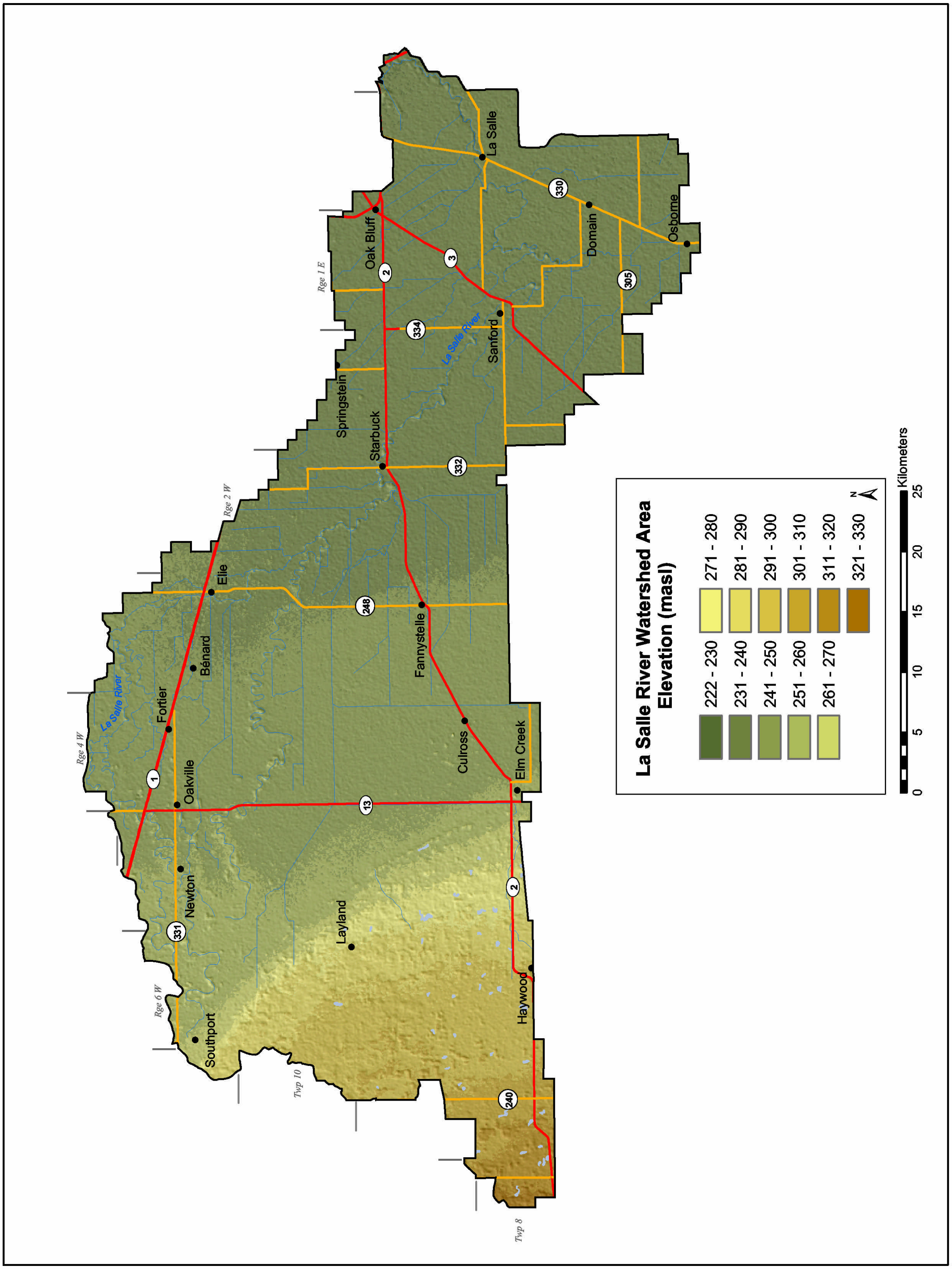

Figure 2.0 Digital elevation model of the La Salle River Watershed Study Area (radar image was obtained by the Shuttle Radar Topography Mission, 2000)

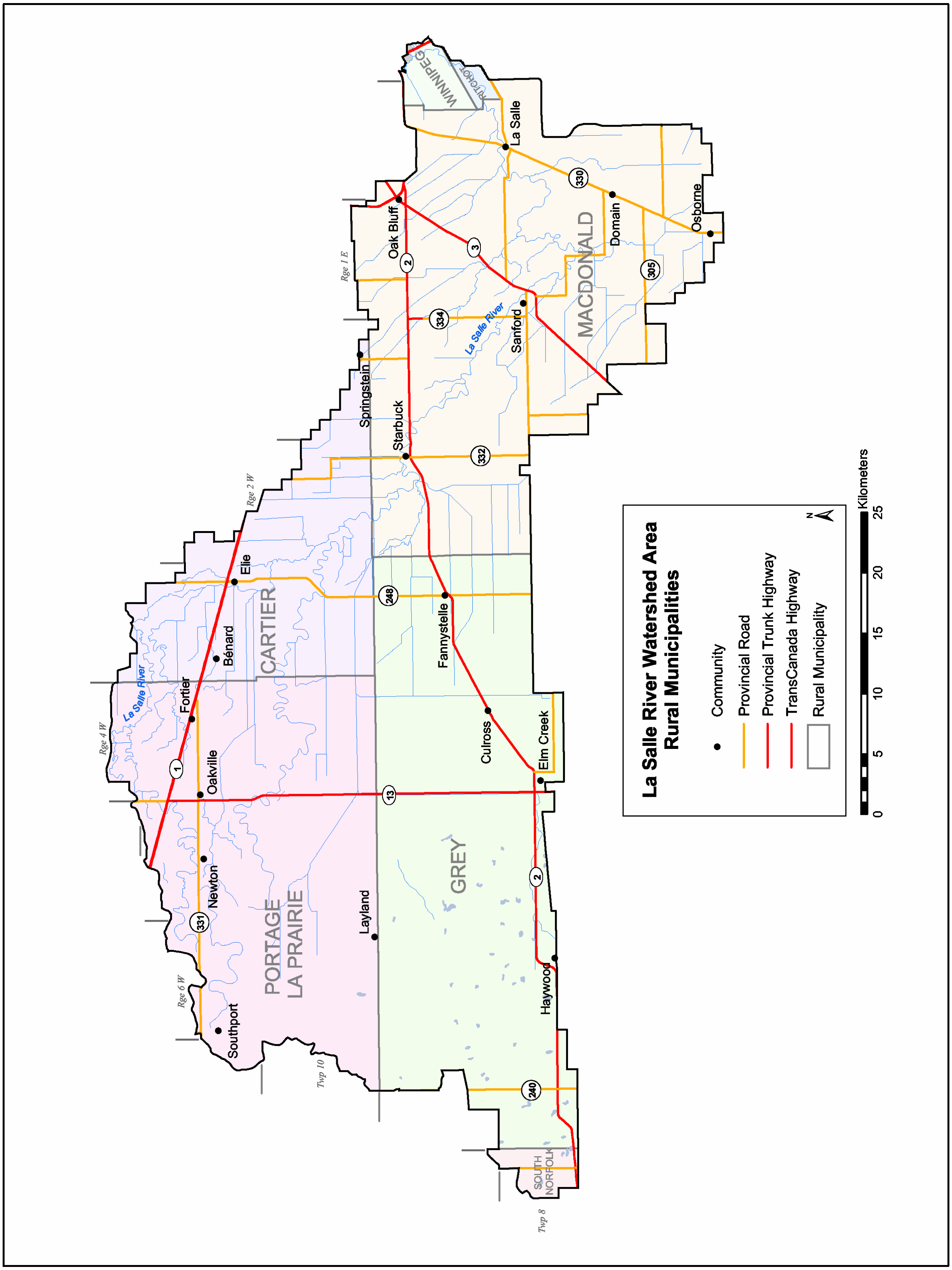

Figure 3.0 Rural municipalities in the La Salle River Watershed Study Area

Climate and Ecology

The Canadian Ecological Land Classification System divides Canada's natural landscapes into terrestrial ecozones, which are further sub-divided into ecoregions and ecodistricts. The classification system was developed by integrating surface vegetation cover, underlying geology, physiography, soils, and climate data (Smith et al. 1998).

Ecozones, the most generalized level in Environment Canada's ecological land classification system, are defined by Smith et al. (1998) as "areas of the earth's surface representative of very generalized ecological units that consist of a distinctive assemblage of physical and biological characteristics". Ecoregions are broad, integrated map units characterized by a unique combination of landscape physiography and ecoclimate. Ecodistricts are integrated map units characterized by relatively homogeneous physical landscape and climatic conditions and they contain Soil Landscapes of Canada polygons nested within them (Smith et al. 1998).

Based on the Terrestrial Ecozones of Canada (Smith et al. 1998), the entire La Salle River Watershed Study Area falls within the Prairie Ecozone, and contains the Lake Manitoba Plain Ecoregion (refer to Figure 4). This can be further divided into Ecodistricts, where the watershed contains parts of the Portage, MacGregor, Winkler and Winnipeg Ecodistricts.

The vegetation of the watershed varies with elevation and moisture, as well as land modifications. The native vegetation includes tall-grass prairie and meadow grass communities, along with sedges, aspen groves and forest cover (Smith et al. 1998). Native forest is found on floodplains and in strips of streams and rivers with species such as white elm, basswood, cottonwood, Manitoba maple and green ash. These species indicate periods of inundation. Today, better drained areas contain species such as trembling aspen, snowberry and red-osier dogwood, ferns and willows in the understorey. Saskatoon and high bush cranberry shrubs are found in areas not prone to flooding and on floodplains, while bur oak is only present upland where flooding is not an issue. As a result of cultivation, development of drainage ditches and urban development, natural vegetation has largely disappeared, however some local pockets do occur in poorly-drained locales and on unbroken land. As a general rule, trees in this watershed now grow naturally in strips along waterways and water channels. Poorly drained sites and riparian areas also support slough grasses, marsh reed grasses, sedges, cattails, sedges, and willow.

Despite weather similarities within the watershed, localized temperature and precipitation conditions do exist. Based on the climate data for the ecodistricts within the La Salle River Watershed Study Area, mean annual precipitation ranges from 500 to 515 mm, while mean annual temperature ranges from 2.4 to 3.1 °C (refer to Table 1.0). The average number of growing season days ranges from 182 to 185 and the average number of growing degree days ranges from 1700 to 1800. Mean annual moisture deficit ranges between 170 to 210 mm (Ecoregions Working Group, 1989).

Table 1.0 Climate data for ecoregion within the La Salle River Watershed Study Area

Ecozone	Ecoregion	Mean Annual Air Temp (°C)	Mean Growing Season (days)	Mean Growing Degree Days	Mean Annual Precipitation (mm)	Mean Annual Moisture Deficit (mm)
Prairies	***Lake Manitoba Plain***	2.4-3.1	182-185	1700- 1800	500-515	170-210

Note: Climate data is based on eco-climatic data (Ecoregions Working Group, 1989)

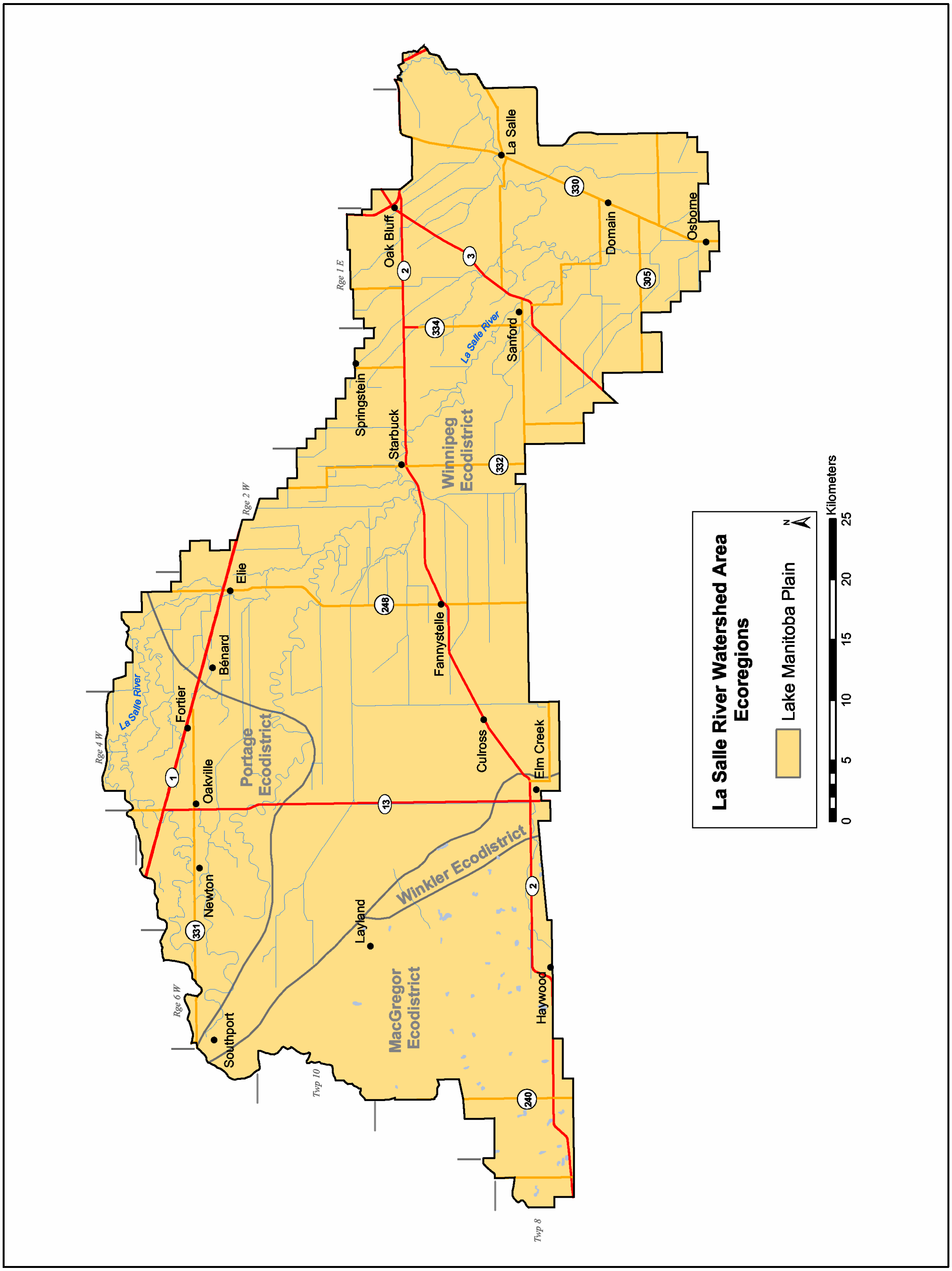

Figure 4.0 Ecoregions and ecodistricts in the La Salle River Watershed Study Area

Water Resources

Hydrology

The La Salle River is an important tributary to the Red River which is one of the primary waterways of Southern Manitoba. The La Salle River meanders southeast from its source ten km southeast of the city of Portage la Prairie, and eventually meets with the Red River in St. Norbert, at the south end of the City of Winnipeg. The La Salle River is about 140 km long when taking into account its meanders and movements across the land. Based on the 1:50,000 National Topographic Series (NTS) data sheets, this watershed contains approximately 2,762 km of river, stream and creek shoreline (both sides of the waterways are included in the calculation). As well, the area has 312 km of waterbody shoreline, three quarters of which surround sloughs or wetlands.

Hydrometric gauging stations within the province provide surface water level and stream-flow data which is used for the operation of water control works, flood forecasting, water management investigations, and hydrologic studies (Manitoba Conservation 2003). A network of nineteen hydrometric gauging stations have been installed within the watershed (refer to Figure 5.0). Mean annual flow rate of the river, at Sanford, as measured by gauging station 05OG001, is 2.18 m^3/s. Table 2.0 depicts the mean annual monthly flows as measured from station 05OG001 over a 49-year period. Spring snowmelt, along with spring and summer rain events, create higher flow rates from March through to July, with the peak flow generally occurring in the month of April.

Table 2.0 Mean stream flow on the La Salle River as recorded by hydrometric station 05OG001, located near Sanford, MB (1922-2002)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan-Dec
Discharge (m^3/s)	.053	.037	1.47	15.0	6.6	1.01	1.41	1.02	.367	.286	.142	.095	2.18

Water Quality

Nutrient loading is an important concern with many large and small streams throughout Manitoba. As a result, Manitoba Conservation has developed a long-term nutrient management strategy for surface waters in Manitoba. A comprehensive trend analysis using existing water quality data has been done to detect temporal trends in nutrient concentrations in the streams and rivers in Manitoba (Jones and Armstrong 2001).

Long term water quality monitoring data is available from sampling station WQ0068, located on the La Salle River, near St. Norbert, about 1.5 km upstream of the convergence with the Red River. Using water quality monitoring data from station WQ0068, along with flow data from hydrometric station 05OG001, Jones and Armstrong (2001) determined that from 1974 to 1999 the concentrations of Total Nitrogen (TN) and Total Phosphorus (TP) increased quite dramatically, (note that no samples were collected from 1978 to mid-1988). Their analysis showed the median flow-adjusted trend for TN increased 145.5%, while the TP increased 193.8%. These results suggest that the nutrient loading in this area has increased substantially in this time period, however the missing data gap does introduce some error.

According to Bourne et al. (2002) the La Salle River contributed 1.5% of the TN load, and 1.3% of the TP load, into the Red River in 2001.

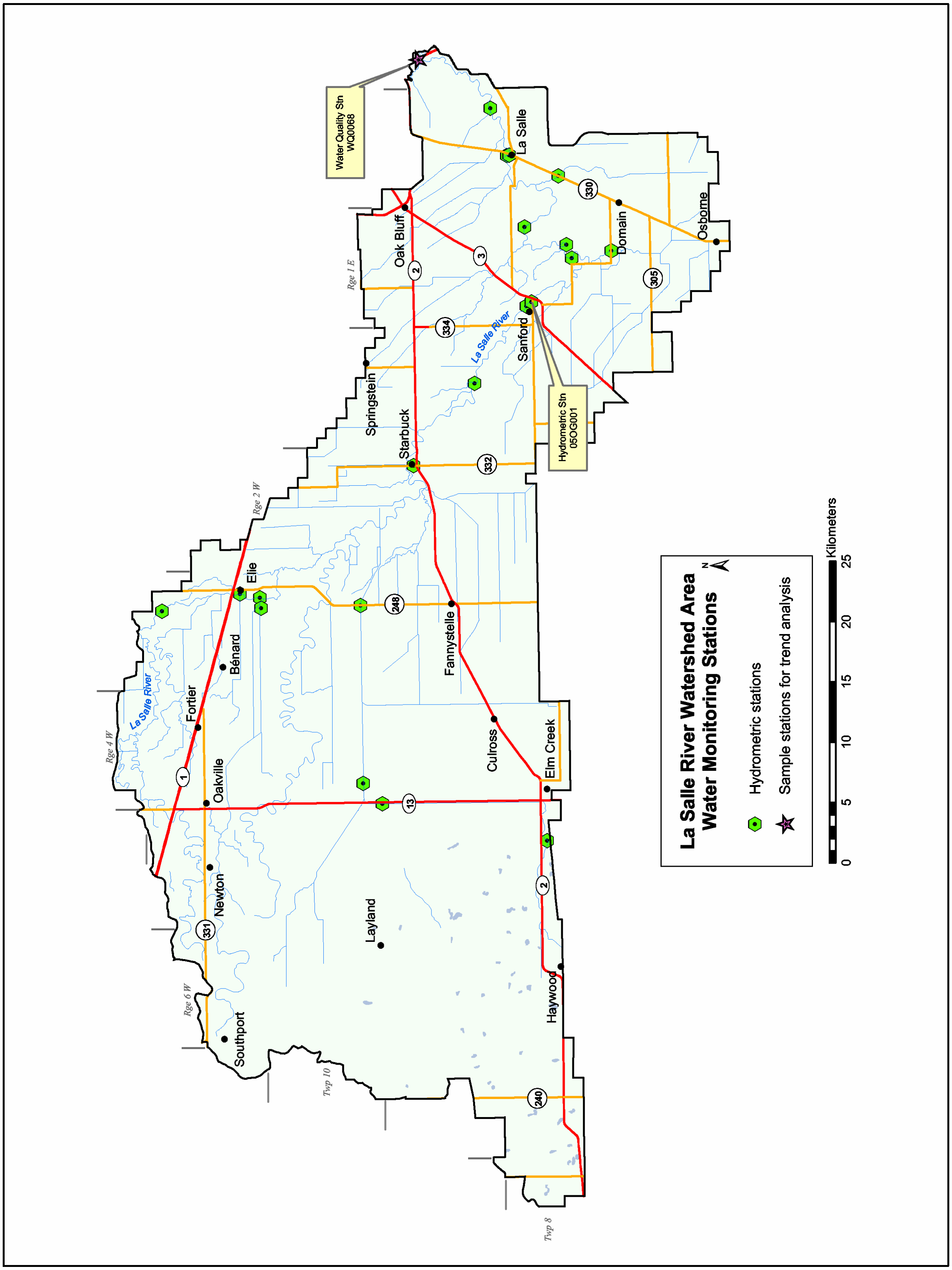

Figure 5.0 Hydrometric gauging and water quality sampling stations in the La Salle River Watershed Study Area

Land Cover

The land cover classification of the watershed has been interpreted from LANDSAT satellite imagery (which has a 30 metre resolution), using computerized classification techniques. Individual spectral signatures were classified and grouped into the seven land cover classes: annual crop land, forage, grassland, trees, wetlands, water, urban and transportation (refer to Appendix A for land cover class descriptions). Figure 6.0 provides a general representation of the 2001 land cover within the watershed, which is based on land cover imagery data taken on September 3, 2001.

Based on 2001 land cover data, approximately 75% (181,268 ha) of land within the watershed has been classified as annual crop land, and is predominant throughout the watershed except for the western portion, where grassland and tree cover is more common (refer to Table 3.0, Figure 6.0). Forages cover 4.1% (9,843 ha) of the study area and are scattered evenly throughout. Roads, water and wetlands cover the remaining area of the watershed.

Land cover information is also available from 1994 satellite imagery, taken October 26, 1994 (refer to Figure 7.0). Comparison between the two datasets can result in the emergence of general trends in land cover of the seven-year period, though this will be a rough estimate due to factors such as time/season of satellite image capture, climatic variability and classification requirements.

From 1994 to 2001, there has been a substantial change in forage cover, with an approximate increase of 44% in forages (refer to Table 3). During this period there was also a 6% increase in grasslands. Along with these is a 2% decrease in annual crop land, much of which was likely converted to forages. Wetland classification showed an increase in area though this may be over estimated due to:

- Precipitation amounts - Records from Environment Canada indicate that total precipitation at stations in Starbuck, were slightly higher in 2001, as compared to 1994 with a mean increase of approximately 80 mm.
- Classification effort - The 1994 image classification concentrated specifically on annual cropland to aid in delivery of the Western Grains Transportation Payment Program. Greater attention was paid to all classification categories on the 2001 image classification.

Due to the small size, and tightly integrated nature of wetlands with other land cover categories such as grasslands and shrubs, they can be very difficult to quantify using course resolution imagery. A Prairie Habitat Joint Venture Habitat Monitoring Program coordinated by the Canadian Wildlife Service provides a detailed evaluation of wetland habitat trends in targeted areas of the prairies. . Preliminary analysis indicated that in the targeted areas in Manitoba, there has been a net change of -3.0% in wetland areas from 1985 to circa 2000.

Table 3.0 Land cover (2001) and general trend over a seven-year period (1994 – 2001) in the La Salle River Watershed Study Area

Class	Area[1] (ha)	Percent of Watershed	Change in Area (ha)	Percent Change Since 1994[2]
Annual Crop Land	181,268	75.3	-4,129	-2.2
Trees	15,313	6.4	-327	-2.1
Water	419	0.2	-97	-18.8
Grassland	23,657	9.8	1,267	5.7
Wetlands	262	0.1	193	279.1
Forages	9,843	4.1	3,015	44.2
Urban/Transportation	9,865	4.1	110	1.1
Total	240,626	100	--	--

1. Area totals are approximate due to the nature of the image analysis procedure
2. Negative changes indicate area has decreased since 1994, positive indicates an increase.

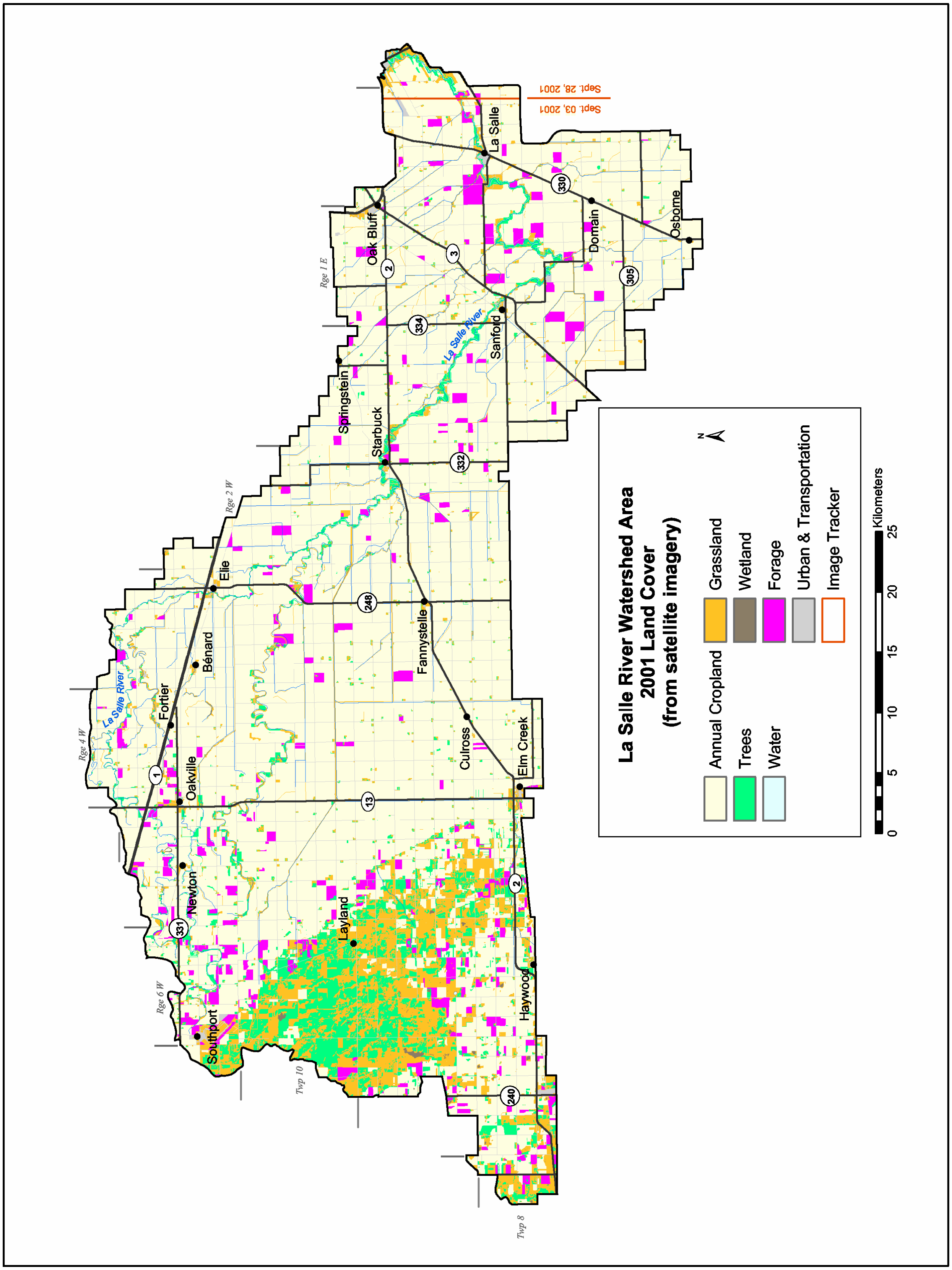

Figure 6.0 2001 Land cover in the La Salle River Watershed Study Area

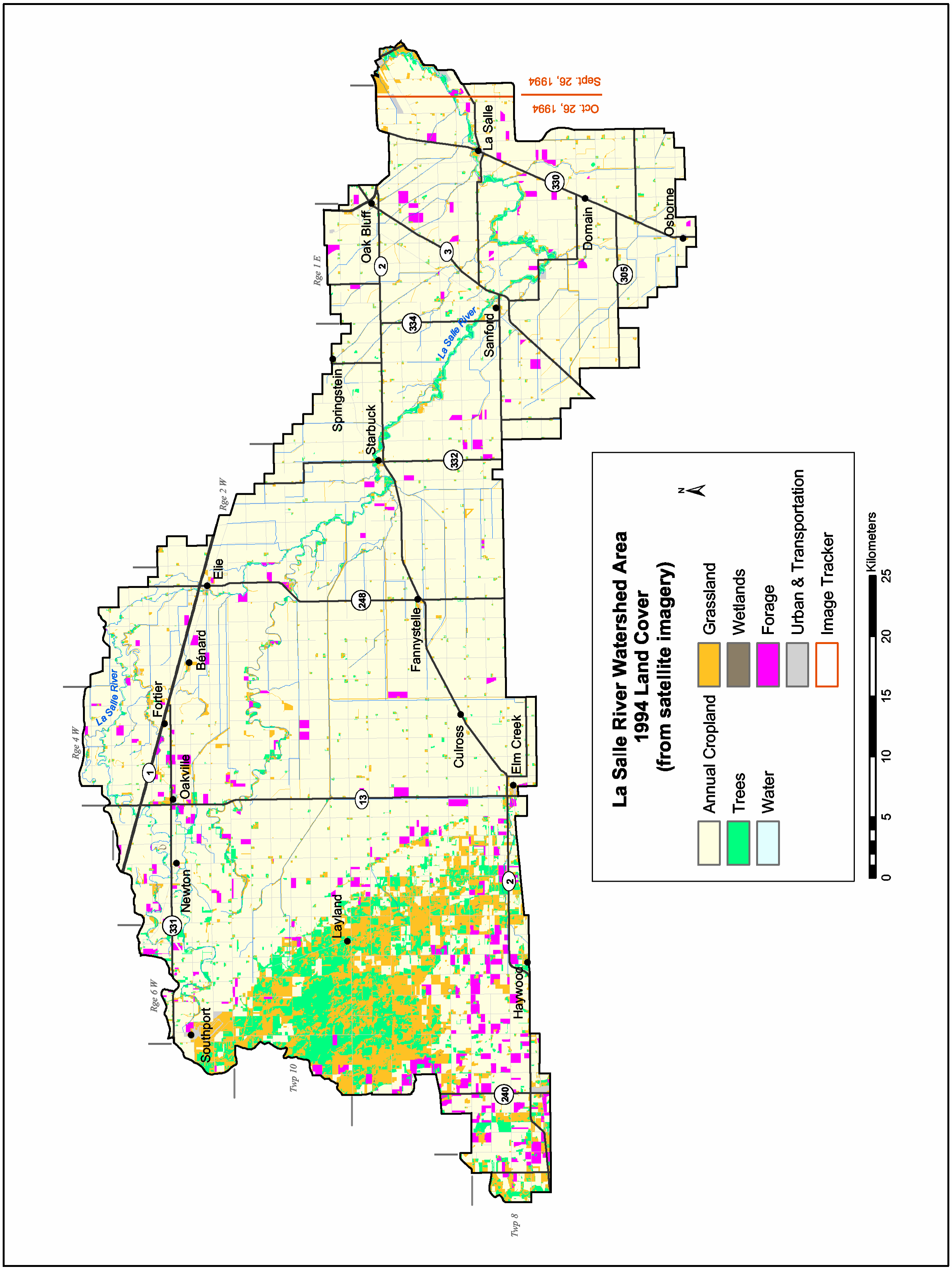

Figure 7.0 1994 Land cover in the La Salle River Watershed Study Area

Soil Resources

Soils data is a critical component of land-use planning. Soil characteristics can be used to determine agricultural capability and to predict risks of erosion, leaching, and run-off. This type of information is important for determining suitable land uses, identifying sensitive areas, and targeting land-use improvement efforts. In terms of riparian health, analysis of soil characteristics can help to identify soils at high risk for erosion and run-off that could contribute to riparian degradation.

Soils data is available for all areas within the watershed. The soils data used in this report was mapped at a detailed scale of 1:20,000 in the RM of Portage La Prairie and Grey, some areas around the eastern La Salle River, the west Portage-MacGregor area, the towns of La Salle and Sanford and the area around Winnipeg. The remaining area has been surveyed at the reconnaissance scale of 1:126,720. Soils information provided in this report is based on the characteristics of the dominant soil series within the soils polygon. A more detailed and complete description of the type, distribution and textural variability of soils in the watershed can be found in the published soil surveys for the area.

The watershed is split into two physiographic regions, the Lower Assiniboine Delta, which covers the western area, and the Red River Valley, which covers the remaining area. The soils within the watershed are predominantly Chernozemic soils, interspersed with pockets of Gleysolic soils. The Red River Valley is an area of clayey, lacustrine sediments with extensive local ditching and drainage improvements (Mills et al. 1990). The Lower Assiniboine Delta is covered mainly by sandy soils, with lacustrine sediments underlain with clayey lacustrine sediments 2-4 meters below. In amongst the sandy soils of this region, there are also some Gleysolic and Organic soils. These areas are likely depressional areas which are poorly drained or have periods of standing water.

Soil Surface Texture

Soil surface texture strongly influences the soil's ability to retain moisture, its general level of fertility, and the ease or difficulty of cultivation. For example, water moves easily through coarse-textured (sandy) soils, so little moisture is retained and these soils dry out more quickly than fine-textured (clayey) soils. Sandy soils are often characterized by a loose or single-grained structure which is very susceptible to wind erosion. On the other hand, clay soils have a high proportion of very small pore spaces which hold moisture tightly. Clay soils are usually fertile because they are able to retain plant nutrients better than sandy soils. However, they transmit water very slowly and are therefore susceptible to excess moisture conditions.

There are two predominant soil surface textures within this watershed; clayey and sand (refer to Table 4.0, Figure 8.0). The sands (14%) predominately occur in the western region, whereas clay (74%) covers the majority of the remaining area. There are also ribbons of fine-loamy textures along some of the watercourses in the north, and along the La Salle River. Organic (2%) and coarse-loamy (5%) textures are found in the western region as well.

Table 4.0 Soil surface texture in the La Salle River Watershed Study Area[1]

Class	Area (ha)	Percent of Watershed
Clayey	177,857	73.9
Fine Loamy	13,075	5.4
Coarse Loamy	10,958	4.6
Sand	34,043	14.1
Organic	4,195	1.7
Water	226	0.1
Unclassified	270	0.1
Total	240,624	100

1. Soil surface texture is based on the dominant soils series for each soil polygon

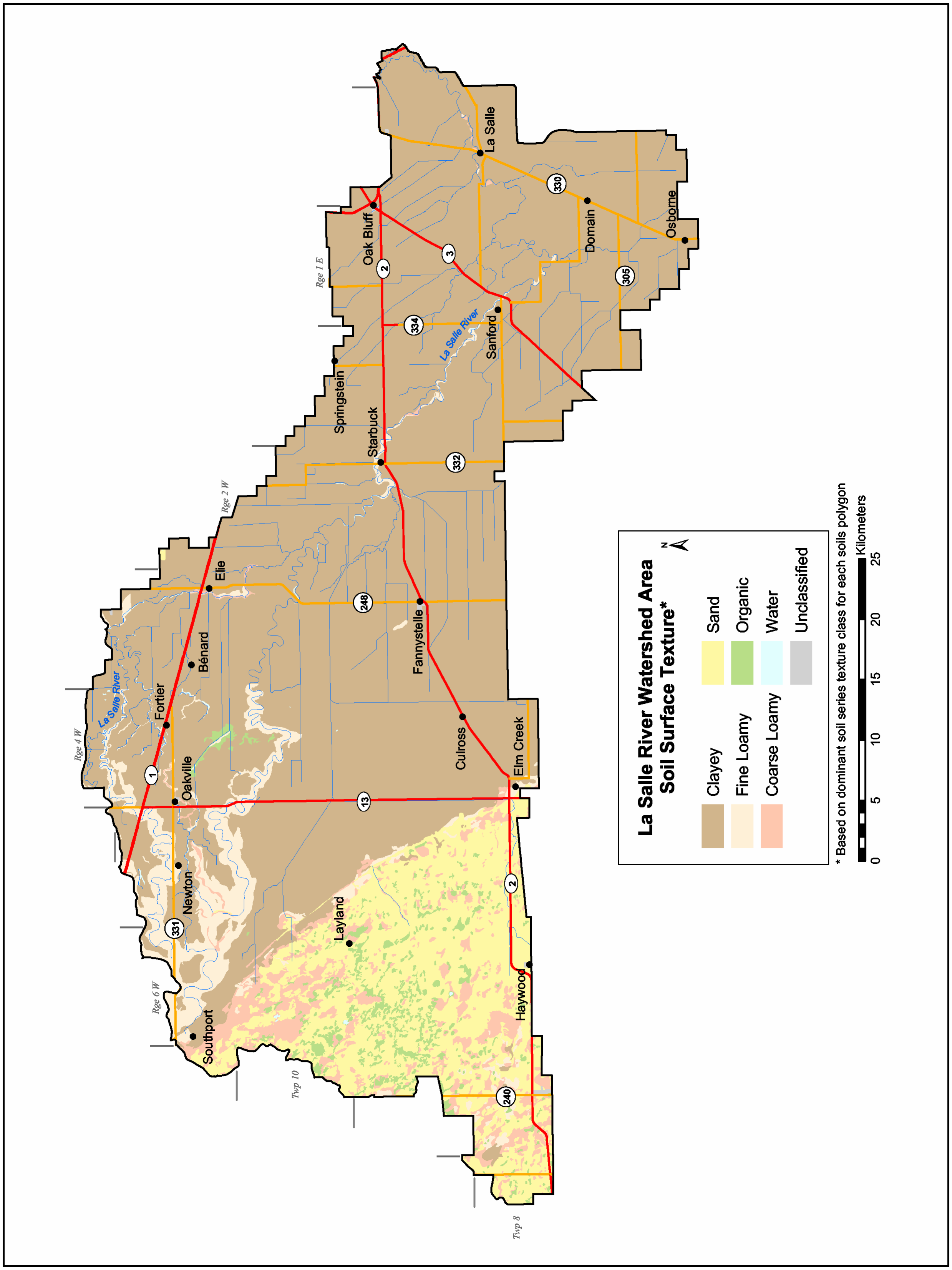

Figure 8.0 Soil surface texture in the La Salle River Watershed Study Area

Soil Drainage

Soil 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. Excessive water content in the soil limits the free movement of oxygen and decreases the efficiency of nutrient uptake. Delays in spring tillage and planting are more frequent in depressional or imperfectly- to poorly-drained areas of a field. Surface drainage improvements and tile drainage are management practices that can be used to manage excess moisture conditions in soils. Agriculture and Agri-Food Canada's Land Resource Unit has divided soil drainage into five classes:

1) *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.

2) *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.

3) *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.

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

5) *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.

According to the drainage classes defined above, over 60% of the soils within the watershed are considered to be imperfectly-drained (refer to Table 5.0, Figure 9.0). Scattered areas of poorly (2%), very poorly (2%) and rapidly (1%) drained soils also occur within the watershed, mainly in the western region. Well-drained areas (5%) occur along the LaSalle River and associated watercourses. There is also a large area of poor but improved drainage (28%) in the eastern part of the study area. Improved drainage indicates areas where a network of surface drains enhances surface run-off and reduces the duration of surface ponding, which is important for crop production.

Table 5.0 Soil drainage classes for the La Salle River Watershed Study Area [1]

Class	Area (ha)	Percent of Watershed
Rapid	3,152	1.3
Well	13,085	5.4
Imperfect	147,146	61.2
Poor	5,364	2.2
Very Poor	3,571	1.5
Poor (Improved)	67,558	28.1
Water	226	.09
Marsh	250	0.1
Unclassified	270	0.1
Total	240,624	100

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

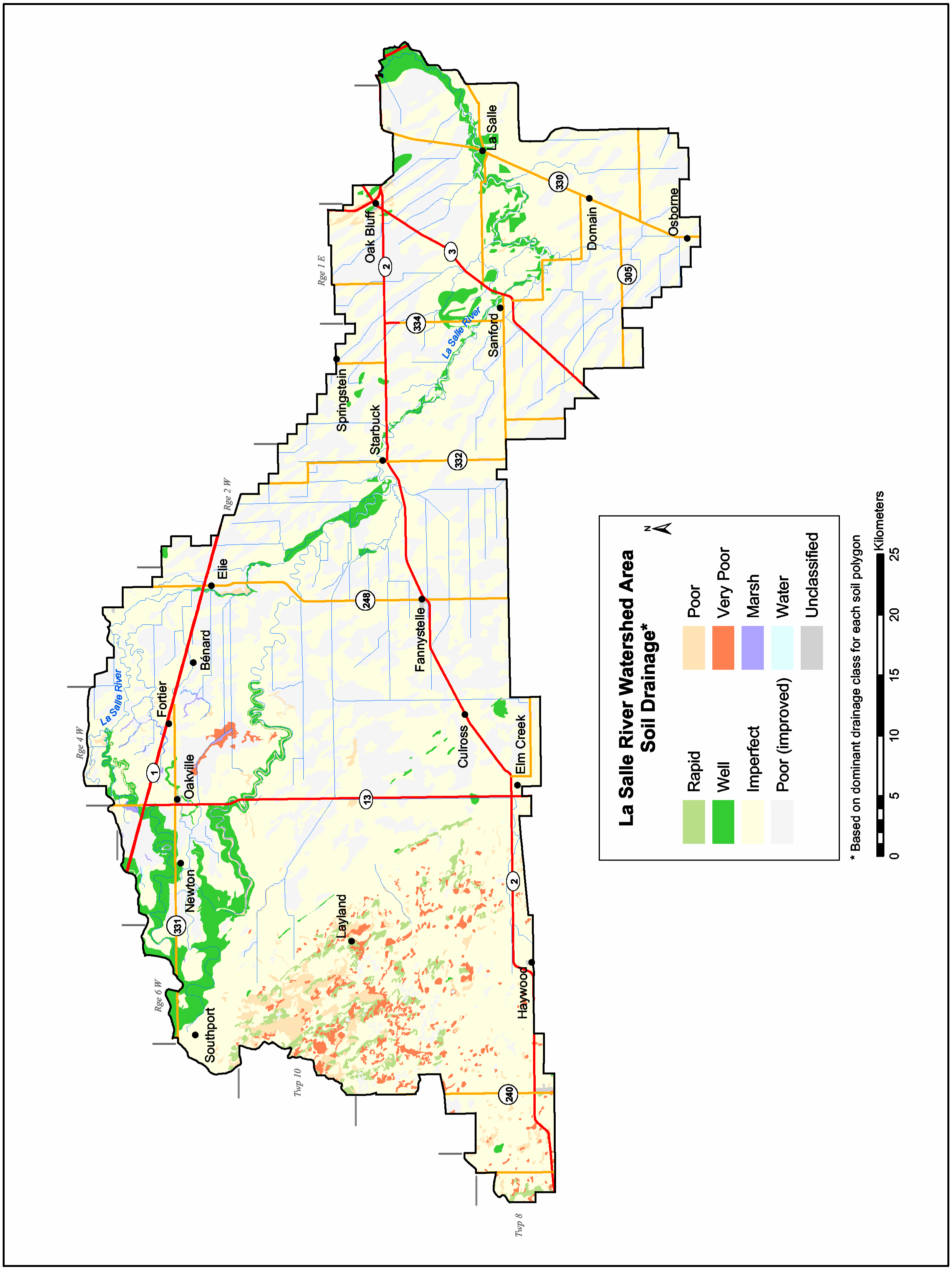

Figure 9.0 Soil drainage classes for the La Salle River Watershed Study Area

Agricultural Capability

The Canada Land Inventory System (CLI) was used to classify land based on agricultural capability. The CLI is a comprehensive survey of land capability and use designed to provide a basis for making rational land-use planning decisions. Under the CLI, lands are classified according to physical capability for agricultural use. The system uses seven classes to rate agricultural capability, with Class 1 lands having the highest capability to support agriculture, and Class 7 the lowest. Table 6.0 provides a description of each class. Subclass descriptors are also used to identify specific limiting factors within each class (Table 7.0). The classes indicate the degree of limitation for mechanized agriculture imposed by the soil. The subclasses indicate the type of limitations that individually, or in combination with others, affect agricultural land use. The CLI classification assumes good land management and is independent of location, accessibility, ownership, distance from cities or roads, and the present use of the land (Natural Resources Canada 2000).

Table 6.0 Canada Land Inventory (CLI) class descriptions

Class #	Description
1	Soils in this class have no significant limitations in use for crops.
2	Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices.
3	Soils in this class have moderate limitations that restrict the range of crops or require special conservation practices.
4	Soils in this class have severe limitations that restrict the range of crops or require special conservation practices or both.
5	Soils in this class have very severe limitations that restrict their capability to produce perennial forage crops, and improvement practices are feasible.
6	Soils in this class are capable only of producing perennial forage crops, and improvement practices are not feasible.
7	Soils in this class have no capability for arable culture or permanent pasture
O	Organic soils

Source: Natural Resources Canada 2000.

Table 7.0 Canada Land Inventory (CLI) subclass descriptions

Subclass	Description
C	Adverse climate
D	Undesirable soil structure and/or low permeability
E	Erosion
F	Low fertility
I	Inundation by streams or lakes
M	Moisture limitations
N	Salinity
P	Stoniness
R	Consolidated bedrock
T	Topography
W	Excess water
X	This subclass is comprised of soils having a limitation resulting from the cumulative effect of two or more adverse characteristics

Source: Natural Resources Canada 2000

Figure 10.0 illustrates the classes of agricultural land found within the watershed. At this generalized map scale, subclass limitations could not be displayed. As Table 8.0 indicates, the majority of the land within the watershed is productive agricultural land (Classes 1, 2 and 3), making up 87% of the area. The majority of this land is found in the Red River Valley region of the watershed. There are also Class 4 (8%), Class 5 (2%), and Class 6 (2%) soils present, most of which are found in the western area. Excess water is the main limitation for the Class 2 and 3 areas, whereas the primary limitation is lack of moisture or excess water in Class 4 to 6 soils.

Table 8.0 Agricultural capability in the La Salle River Watershed Study Area[1] and the major type of limitations within each class.

Class	Subclass	Area (ha)	Percent of Watershed
Class 1		**2984**	**1.2**
Class 2		**119,654**	**49.7**
	2D	*3,364*	*1.4*
	2DW	*9,316*	*3.9*
	2I	*5,308*	*2.2*
	2M	*2,469*	*1.0*
	2TI	*2,464*	*1.0*
	2W	*96,650*	*40.2*
Class 3		**86,481**	**35.9**
	3I	*2,612*	*1.1*
	3MI	*12,432*	*5.2*
	3W	*69,865*	*29.0*
Class 4		**19,455**	**8.1**
	4M	*18,545*	*7.7*
Class 5		**4,526**	**1.9**
	5W	*3,863*	*1.6*
Class 6		**5,863**	**2.4**
	6M	*2,817*	*1.2*
	6W	*2,774*	*1.2*
Class 7		**313**	**0.1**
Organic		**852**	**0.4**
Water		**226**	**0.1**
Unclassified		**270**	**0.1**
Total		**240,624**	**100**

1. Agricultural capacity is based on the dominant soil series and slope gradient within each soil polygon

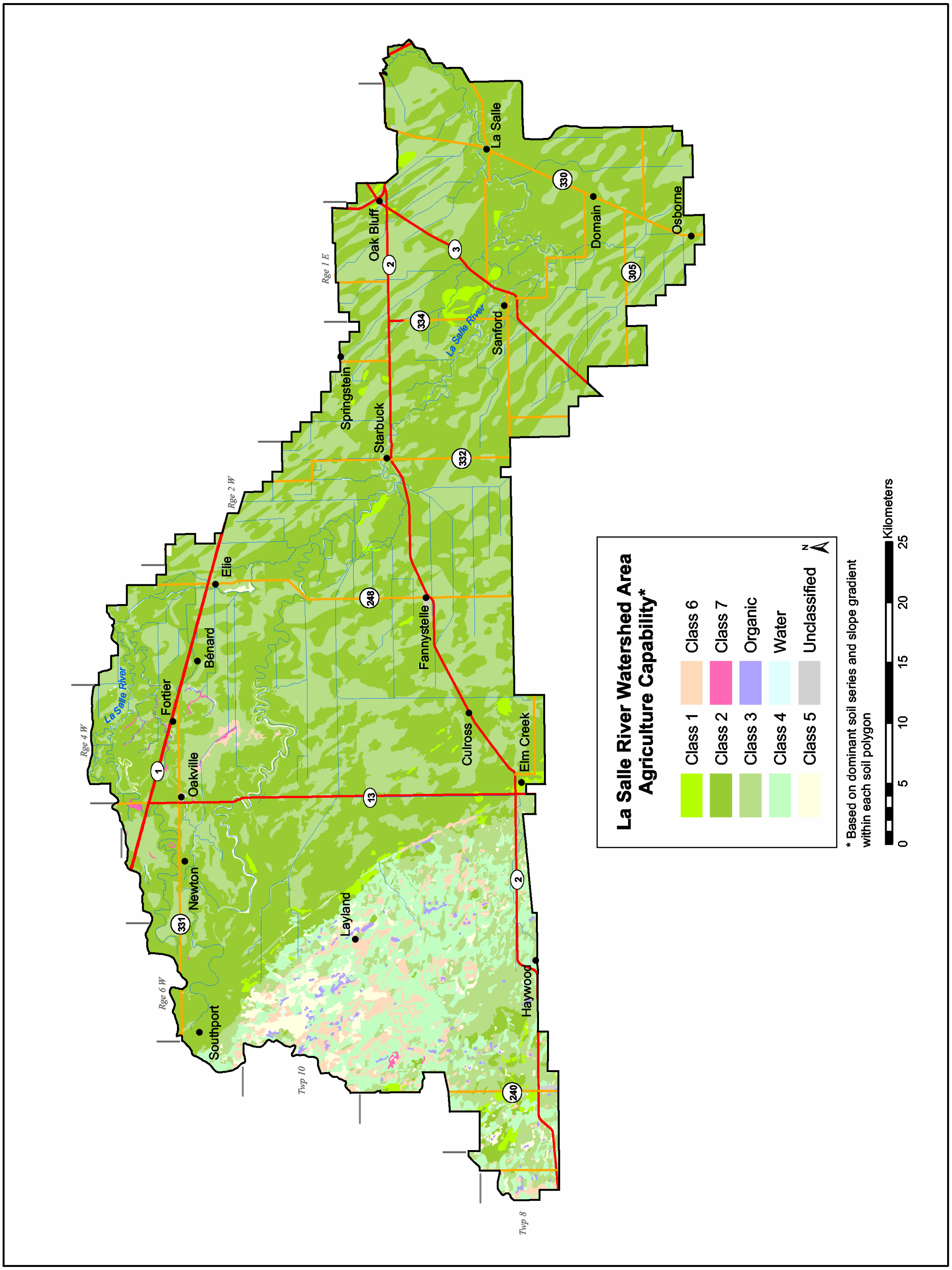

Figure 10.0 Agricultural capability class in the La Salle River Watershed Study Area

Water Erosion Risk

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 (tonnes/hectare/year) was calculated for each soil component in each soil map polygon. Water erosion risk factors used in the calculation include mean annual rainfall, slope length, slope gradient, vegetation cover, management practices, and soil erodibility (Eilers et al. 2002). Erosion risk classes were assigned based on the weighted average soil loss for each map polygon. The five classes of soil erosion risk (ranging from negligible to severe) are based on a bare, unprotected soil condition. However cropping and residue management practices can significantly reduce this risk depending on crop rotation, soil type, and landscape features. Basing the soil erosion risk on the bare soil case helps to identify areas dominated by sensitive, erosive soils which may otherwise be masked if a land use or surface vegetation cover factor was considered (Eilers et al. 2002).

According to the interpreted water erosion risk classification for soils, water erosion is of low to negligible concern within the majority of the watershed (96%) (refer to Table 9.0, Figure 11.0). There is some moderate to severe concern in the northwest corner and along the course of the La Salle River between the communities of Sanford and La Salle. As well, there are some small areas of high and severe risks in the west, where rougher terrain is seen.

Table 9.0 Water erosion risk classes in the La Salle River Watershed Study Area [1]

Risk (tonnes/ha/yr)	Area (ha)	Percent of Watershed
Negligible (<6)	117,051	48.6
Low (6-11)	113,343	47.1
Moderate (11-22)	8,638	3.6
High (22-33)	494	0.2
Severe (>33)	602	0.3
Water	226	0.1
Unclassified	270	0.1
Total	240,624	100

1. Water erosion risk is based on the weighted average USLE predicted soil loss within each soil polygon, assuming a bare unprotected soil.

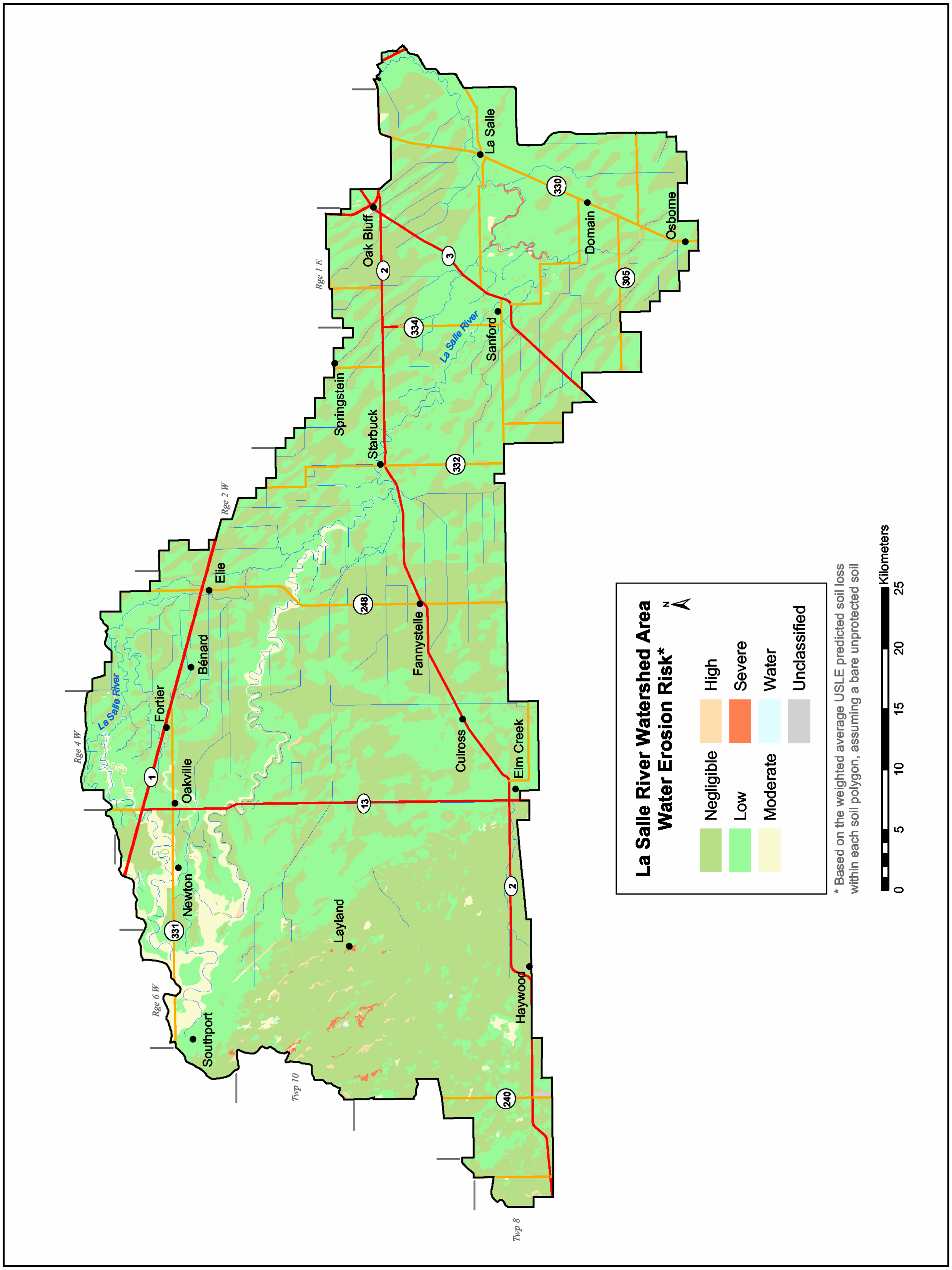

Figure 11.0 Water erosion risk in the La Salle River Watershed Study Area

Agricultural Activities

Riparian areas can be impacted by anthropogenic activities occurring within a watershed. Land use and management practices within riparian zones and on upland areas affect the health of riparian areas. Although agriculture is only one component, with other human activities such as industry, recreation and residences contributing to degraded riparian areas, this report focuses on the impacts of agriculture. By knowing the extent and type of agricultural activities within the watershed, more effective decision-making and project planning can be put into place.

Agriculture data for the watershed was obtained from the 2001 Census of Agriculture using the farm headquarters reporting method, which links census data to the land location of the farm headquarters. In the 2001 Census, the farm headquarters was defined as "the operator's residence if he/she lives on land that is part of the agricultural operation; the location of the main building or main gate of the agricultural operation; or if many parcels of land without buildings are in separate locations, the parcel with the largest land area or share of gross agricultural receipts is considered the farm headquarters" (Statistics Canada 2002). It should be noted that in cases where the farm headquarters location is different from that of the actual farmed land or the location of livestock, inaccuracies in data will be introduced. For example, the reported farm headquarters could fall within one watershed, whereas a proportion of the land/livestock associated with that operation could fall within another. Despite the inaccuracies, the Census of Agriculture provides the most comprehensive source of available agricultural data (see Appendix B for more information and definitions).

The *Statistics Act* requires that all census information be kept confidential. As a result, any data that could disclose information concerning a particular agricultural operation or individual is suppressed in the data tables reported by Statistics Canada. For example, if there are only one or two dairy operations within a watershed, the number of farms reporting dairy will be given, however the total number of dairy cows reported within that watershed will be suppressed. In instances where a geographic area has very few agricultural operations, data are not released separately but are merged with data from one or more geographically adjacent areas (Statistics Canada 2002).

The La Salle River Watershed Study Area is a productive agricultural area. According to the 2001 Census, there were a total of 644 farms utilizing 90% (217,493 ha) of the land in the watershed. For the purpose of this report, farmland includes all land that is owned, rented, leased (including government land) or crop-shared by agricultural operations. Of this land, 5,431 ha (3%) is leased government land. Of the farmland, 172,751 ha (79%) were prepared for seeding in the fall of 2000 or spring 2001.

Land use and management practices of upland areas are important considerations in watershed planning. Crop type (permanent vs. annual, high residue vs. low residue), tillage practices, nutrient management, and conservation practices on the landscape are all activities that can affect water quality within the watershed.

Table 10.0 summarizes the major crops grown in the watershed, including crops cut for hay, silage, green feed, etc. According to the 2001 Census data, the majority of farmers within the watershed had grown some type of cereal crop; comprising 50% of the farmland. Oilseeds were grown on 23% of the farmland and pulse crops on 2%. There were also a small number of hectares seeded to potatoes.

Table 10.0 Summary of cultivated crops, including crops cut for hay, silage, green feed, etc, grown in the La Salle River Watershed Study Area (2001 Census)

Crop Type	Hectares[1]	Percent of Farm Land[1]	Percent of Watershed[1]
Cereals (wheat, barley, oats, buckwheat[2], canary seed)	107,693	49.5%	44.7%
Forages (corn for silage, alfalfa, forage for seed, other tame hay and fodder crops[3])	17,745	8.2%	7.4%
Oilseeds (canola, flaxseed, soybeans, sunflowers)	50,493	23.2%	21.0%
Potatoes[3]	986	0.5%	0.4%
Pulse Crops (dry field peas[2], dry beans[2])	5,035	2.3%	2.1%

1 - Numbers do not include suppressed data
2 - Data is suppressed for one farm reporting
3 - Data is suppressed for two farms reporting

Tillage practices on upland fields can affect the amount of erosion and run-off occurring. As the amount of tillage on a field increases, the chance of run-off (containing sediment and nutrients) entering waterways also increases. Table 11.0 provides a breakdown of tillage practices within the watershed. According to the 2001 Census of Agriculture, 75% of the land prepared for seeding in 2001 was tilled to incorporate most of the crop residue, whereas 25% of the fields had little or no tillage for seedbed preparation, retaining most of the residue on the surface of the fields.

Table 11.0 Summary of tillage practices in the La Salle River Watershed Study Area (2001 Census)

Tillage Practices	Hectares	Proportion of Seeded Area	Proportion of Watershed
Tillage incorporating most crop residue	129,907	75.2%	54.0%
Tillage retaining most crop residue on surface (conservation tillage)	37,622	21.8%	15.6%
No till or zero till	5,222	3.0%	2.2%
Total seeding area prepared	172,751	100%	71.8%

In addition to minimum or no tillage, other conservation practices also reduce water erosion, thereby decreasing the amount of contaminated run-off entering waterways. Other conservation practices reported within the watershed included crop rotation (alternating low residue crops with high residue crops to maintain a good residue cover), permanent grass cover, winter cover crops, contour cultivation, strip cropping, grassed waterways and shelterbelts or windbreaks. Table 12.0 provides a breakdown of the percentage of farms using these conservation practices within the watershed.

Table 12.0 Summary of the conservation practices carried out in the La Salle River Watershed Study Area (2001 Census)

Conservation Practices	Percentage of Farms Using Conservation Practice
Crop rotation	74.2
Permanent grass cover	18.3
Winter cover crops	2.3
Contour cultivation	4.5
Strip cropping	0.8
Grassed waterways	7.3
Windbreaks or shelterbelts	19.7

A number of farms within the watershed reported having livestock. As a result, manure production and the utilization of riparian areas by grazing animals are two areas where appropriate management practices should be implemented to reduce nutrient loading into rivers and streams and maintain healthy riparian areas. Table 13.0 provides a breakdown of the livestock distribution within the watershed. Approximately 34% of farms within the watershed have cattle, the majority of which are beef operations. There are also 47 hogs operations and 39 chicken farms in the study area.

Total Animal Units (AU) produced in the watershed (based on annual nitrogen production) has been calculated using Manitoba's Animal Unit coefficients and by making several assumptions (refer to Appendix C). As represented in Table 13.0, pigs and beef cattle are almost equal in their contribution to the total AU produced in the watershed (39% and 36% respectively). Dairy contributed to 15% to the total AU.

Table 13.0 Livestock distribution in the La Salle River Watershed Study Area (2001 Census)

Livestock	Total Number of Farms[1]	Number of Animals[2]	AU Coefficient[3]	Total AU[2]
Total cattle and calves	219	27,965	--	
Total dairy cows	37	2,862	2	5,724
Total beef cows	175	9,330	1.25	11,663
Total heifers & steers for slaughter and feeding (1 yr and older)	--	3,596	0.631	2,269
Total pigs	47	124,014	--	
Total sows	25	17,216	0.313	5,389
Total nursing and weaner pigs	21	37,439	--	
Total grower and finisher pigs	39	69,006	0.143	9,868
Boars	21	353	0.2	71
Total hens and chickens	39	307,071	--	
Broilers and Roasters	13(4)	48,918	0.005	245
Layers (19 weeks and older)	30	162,103	0.0083	1,345
Pullets (under 19 weeks)	10(4)	34,700	0.0033	115
Turkeys	6(3)	23,440	0.014	328
Total sheep and lambs	10(3)	244	--	
Ewes	10(3)	140	0.2	28
Lambs	6(6)	0	--	0
Total horses and ponies	66	1,989	1	1,989
Bison	0	0	0.8875	0
Elk	2(2)	0	0.52	0
Goats	6(3)	95	0.143	14
				39,046

1 - Numbers in parentheses indicate the number of farms for which data is suppressed for that livestock category
2 - Numbers do not include suppressed data
3 - Refer to Appendix C for the definition of Animal Unit and assumptions used to derive Animal Unit coefficients

Manure is a valuable source of nutrients for crop production. With the prevalence of livestock production in the study area, manure management becomes important. Table 14.0 provides a summary of the method of manure application on the land in the watershed. Although more farms reported spreading solid manure in the study area in 2000, liquid manure was applied to a larger area. Liquid manure was applied using three different methods in the study area with 32 farms spreading it on the surface, 23 farms injecting it and a small number (2 farms) applying it through irrigation. In order to achieve efficient use of the nutrients while ensuring no adverse effects to riparian health and water quality, management practices should include incorporation of manure as soon as possible after field application, determination of application rates based on crop nutrient requirements, and timing of field applications to nutrient utilization by crops.

Table 14.0 Summary of manure application in the Whitemud River Watershed in 2000 (from 2001 Census of Agriculture)

Method of Manure Application	Number of Farms Reporting[1]	Area (ha) [2]
Solid Spreader	119	3245
Liquid Spreader (on surface)	32	2219
Liquid Spreader (injected)	23	3224
Irrigation System	2 (2)	--

1. Number in parentheses indicate the number of farms for which data is suppressed in that category
2. Numbers do not include suppressed data

Watershed Considerations

The La Salle River Watershed Study Area is made up of numerous streams, creeks, potholes and sloughs. This large amount of riparian area must be properly managed to protect surface water quality for users both within the watershed and downstream. Land management decisions in upland areas will also influence riparian health.

Manitoba Conservation has been monitoring Total Nitrogen (TN) and Total Phosphorous (TP) levels on the La Salle River from 1974 to 1999 near St. Norbert. Analysis shows a trend of increasing TN and TP concentrations on the La Salle River over this time period (Jones and Armstrong 2001). Changes in nutrient concentrations may be attributed to land-use practices.

Soils and Land Cover

The characteristics of soil and landscape affect land use. The majority of the soils within the watershed are rated as Class 1, 2 or 3 (87% of the watershed) and are productive agricultural lands. The main limiting factor to production is excess water. Class 4 to 6 soils occur on about 12% of the land in this watershed, mainly in the western region, and are affected by excess water as well as lack of moisture. Most of the watershed (96%) has a low to negligible risk of water erosion. Areas of concern for water erosion (high to severe risk, assuming bare soil) are minimal, and are located along parts of the La Salle River and in the west.

To overcome the excess water limitations in some areas of the watershed, a network of drainage systems has been established. These drains are effective at moving water off fields quickly and decreasing the amounts of standing water on fields, allowing for agricultural operations to take place. However, these advantages to agricultural production also cause some concern. The drains move water off fields quicker than normal, loading the river channel to high water levels in response to heavy precipitation events. This could place the river into a flood or near-flood stage, thereby increasing the risk for water erosion. In addition, man-made drains seldom have riparian areas around them, unlike most natural watercourses. With small or non-existent riparian zones, there is increased risk of nutrient and sediment loading into watercourses. Riparian areas and permanent vegetation on adjacent lands are able to trap and store sediment and nutrients found in field runoff, reducing the risk of contamination of surface water.

Land cover provides a glimpse into agricultural practices in the watershed. In 2001 the dominant land cover was annual crop land, making up 75% of the watershed. Although forages made up a small part of the watershed (4%) in 2001, the area had increased 1.4 times since 1994. Forage fields were likely converted from annual crop land, since this category experienced a decrease in area over the seven year period. The increase in forages reflects the expansion of the livestock industry in Manitoba over the last several years. Because grassland hectares also increased, there was an overall increase in permanent cover (grassland and forages) over the same period.

Riparian Areas

In order to provide an indication of the amount of riparian areas present in the study area, a shoreline density was calculated using the length of shoreline around watercourses and waterbodies. This shoreline density can provide a glimpse into how much upland is in contact with surface waterbodies and watercourses (riparian areas). A higher shoreline density could mean there is a greater potential for interaction between upland activities and surface water. For this analysis, length of shoreline of both permanent and intermittent waterbodies and watercourses was determined from the 1:50,000 NTS datasheets (note that densities will be underestimated since numerous small wetlands and potholes as well as some small constructed water courses (first, second and third order drains) are not captured by the NTS sheets). Table 15.0 provides a summary of the length and density of shoreline in the La Salle River Watershed Study Area. In the La Salle River Watershed Study Area, Sub-watershed #230 has the highest concentration of riparian areas with 19.5 m of shoreline/ha. Watercourses (rivers, creeks, streams, etc) make up the majority of shoreline in the sub-watersheds, with very little waterbodies found in the three eastern sub-watersheds. In Sub-watershed #229, intermittent waterbodies (wetlands and sloughs) become more common, making up 40% of the shoreline (refer to Figure 12.0). A higher shoreline density will indicate a greater concentration of riparian areas. Since riparian areas provide a buffer between upland areas and surface water, management practices (including riparian pasture management, buffer strips, and grassed waterways) become important to maintain this vegetated buffer area surrounding waterbodies and watercourses.

Table 15.0 Summary of shoreline density in the La Salle River Watershed Study Area (includes permanent and intermittent streams and waterbodies).

Sub-watershed ID	Length of Shoreline[1] (m)	Percent Watercourse Shoreline	Percent Waterbody Shoreline	Shoreline Density[2] (m/ha)
229	506,625	59.9	40.1	7.8
230	1,188,340	92.0	8.0	19.5
231	517,565	99.3	0.7	10.3
232	861,425	98.8	1.2	13.5

1. Length of shoreline is determined from the 1:50,000 NTS data sheets and will be underestimated due to the fact that many wetlands as well as some small constructed water courses (first, second and third order drains) are not captured in the data sheets
2. Area is calculated as the entire area of the sub-watershed (minus area of waterbodies from the 1:50,000 NTS data sheets)

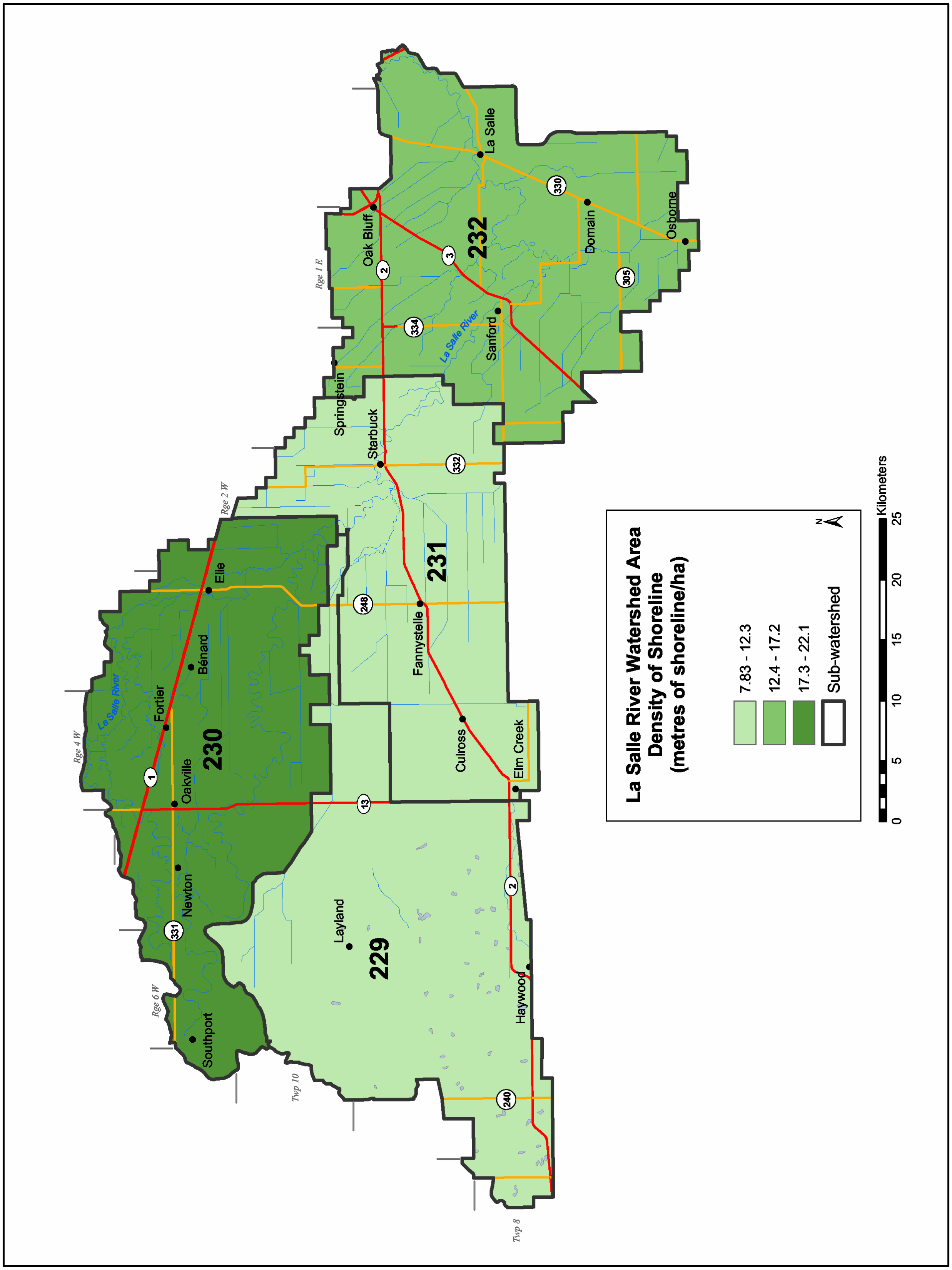

Figure 12.0 Density of shoreline in the La Salle River Watershed Study Area, as determined by the 1:50,000 NTS data sheets

Riparian areas play a very important role in reducing the impact of agriculture on surface water quality. Riparian areas reduce the amount of contaminants, nutrients, and pathogens reaching surface waters by trapping and filtering sediments and by absorbing excess nutrients. The health of a riparian area determines the extent to which the riparian area can perform its functions. Riparian health is generally determined by on-site assessment and evaluation, however this was not feasible for this project. Instead, land cover in a 50 m buffer around waterbodies and water courses (both permanent and intermittent) within the watershed was analyzed, since these areas will have a greater likelihood of influencing water quality. Although this method cannot determine management practices occurring in the riparian areas (ie. livestock use of riparian areas, nutrient and pesticide management practices, etc), percentage of trees and annual crops within the buffered area could give an indication of possible health of riparian areas as well as potential agricultural impacts to water quality. Trees are an important part of the riparian area. Tree roots help to stabilize banks and hold the soil in place while canopy cover provides protection from rain drops. Their sparse presence could be an indication of declining riparian health. Another indicator of potential decline in riparian health is the presence of annual crop land in the buffer area. Annual crop land can potentially impact water quality by allowing contaminated run-off to enter surface water.

Table 16.0 provides a summary of the 2001 land cover in a 50 m buffer area around all water courses and waterbodies in the La Salle River Watershed Study Area (from the 1:50,000 NTS data sheets). Approximately 6% of the study area is located within 50 m of a watercourse or waterbody (including intermittent streams and wetlands). In this buffered area, over half was in annual crops while about 11% was treed.

Potential impacts of crop production to riparian areas may be greater in areas where annual crop land is predominant within a 50 m area from a watercourse or waterbody. In most areas of the La Salle River Watershed Study Area, annual crop land occupied over 50% of the buffered areas (refer to Table 16.0). Impacts will be slightly reduced due to the fact that 25% of the crop land was prepared using minimum or zero tillage. These areas have a significant amount of man-made drains which generally have very small riparian or buffer areas.

The presence of trees within the 50 m buffer may give an indication of the potential for a riparian area to be healthy. Trees occupy a small part of the buffered areas throughout the watershed, with the greatest occurrence found in Sub-watershed #230 at only 13% of its buffered area (Table 16.0). Absence of trees can be a result of several factors; trees have been removed due to overgrazing, cultivation, straightening of creeks, or hydrological conditions have changed.

Table 16.0 Summary of land cover in a 50 m buffer around all waterbodies and on either side of watercourses in the La Salle River Watershed Study Area (using 2000/2001 satellite imagery and 1:50,000 NTS water layers)[1]

Sub-watershed ID	Buffered area (percent of sub-watershed)	Percent of Buffered Area						
		annual crop land	trees	water	grassland	wetland	forages	roads, urban
229	4.1	35.7	10.7	0.0	40.3	1.1	2.5	9.7
230	9.7	57.3	12.7	1.0	17.4	0.2	3.1	8.1
231	5.2	57.9	7.7	1.9	14.3	0.1	1.8	16.4
232	6.6	52.2	9.6	4.2	22.9	0.0	2.4	8.6
Total	6.4	52.3	10.7	1.9	22.4	0.3	2.6	9.9

1. Due to the nature of clipping raster data (land cover layer) with vector data (1:50,000 NTS water layer) and the various scales of the data, areas are estimate.

Farm Management Practices

The 2001 Census of Agriculture had 644 farm headquarters reporting within the study area (note that census data is attached to farm headquarter and reports on activities on farmland associated with that farm headquarter, therefore whether or not the farmland is located within the watershed cannot be differentiated). In 2001, agriculture in the watershed consisted mainly of livestock and grain production with about 90% of the land utilized by farmers. This includes land that is owned, rented, leased (including government land) or crop-shared. Land management practices will have an effect on the health of the riparian areas. Upland management practices such as crop selection and rotation, tillage practices, nutrient management and grassed waterways can have impacts on riparian areas. According to the census data, 79% of the farmland was prepared for the 2001 growing season, of which 25% was prepared using minimum or zero tillage, resulting in a reduction of the risk of soil erosion. In addition, the majority of the farmers practice crop rotation which, along with minimum and zero tillage, will assist in providing extra soil protection by carrying residues over from one year to the next. In 2001, the area seeded to cereals was twice as much as that seeded to oilseeds, potatoes and pulse crops. Grassed waterways are another effective practice and, when located along natural drainage paths in fields, can help to reduce water erosion and filter out sediments from run-off before it enters the watercourse or waterbody. In the La Salle River Watershed Study Area, 7% of the farms reported using grassed waterways. Efforts should continue to promote reduced tillage, crop rotation, grassed waterways and other practices which will help reduce soil erosion.

Livestock grazing management is important to the health of riparian areas. Although grazing livestock in the watershed include cattle, sheep and horses, beef production is predominant with approximately 27% of the farms having cow/calf operations. Pastures and forages are necessary for summer grazing and winter feed, and land cover trends show an increase in area dedicated to forages to meet the demand for feed. In order to maximize forage productivity and promote healthy riparian vegetation, ranchers must ensure that they avoid grazing riparian areas during vulnerable times, such as when streambanks and shorelines are saturated and are more vulnerable to trampling.

Ranchers should also ensure that they allow the vegetation a proper rest period after grazing during the growing season. Vegetation requires adequate rest in order to rebuild roots (energy supply), and restore vigour. During grazing periods, ranchers should utilize management tools to distribute livestock evenly over the grazing area. This not only reduces streambank damage due to trampling and overuse, but it also helps to distribute manure evenly across the grazing area. Manure is a valuable source of nutrients for plants, and when evenly distributed can be fully utilized with minimal risk of contamination to nearby waterbodies.

In contrast to grazing systems, confined livestock operations often result in an accumulation of manure that will require mechanical removal and subsequent land application. In the La Salle River Watershed Study Area, there were 37 dairy operations, 47 hog operations and 39 poultry operations in 2001. The majority of these will have confined livestock facilities with associated manure storage facilities. Accumulated manure is a valuable source of plant nutrients and organic matter, which can be used to improve soil quality and crop production. Although riparian areas can trap nutrients found in run-off from fields and reduce the risk of contamination of water sources, manure management practices should include incorporation as soon as possible after application to the field and maintenance of buffer zones around riparian areas to minimize the risk of contaminated run-off entering water sources. Other manure management practices include soil and manure testing to assist in applying nutrients to crop requirements.

Agriculture Production Intensity

Riparian areas can be affected by all aspects of activities within a watershed, including agriculture, urban areas, recreation activities, etc. For this report, an attempt was made to determine the level of agriculture production intensity within each sub-watershed to determine which areas of the watershed may have a greater potential to riparian health. The level of livestock and crop production was determined on a per hectare basis. Because information is not available to indicate at what point the livestock density or crop production intensity becomes critical with respect to potential impacts on riparian health, the values calculated were compared to the highest value calculated in a sub-watershed in all of Manitoba.

Livestock density was calculated for each sub-watershed. Densities of different types of livestock were standardized by calculating Animal Units per hectare (AU/ha). In Manitoba, an Animal Unit (AU) is defined as the number of livestock required to excrete 73 kg (160 lbs) of nitrogen in a 12-month period. Refer to Appendix C for assumptions used to derive AU coefficients. Suppression of livestock numbers in the census data will affect total AU to varying degrees, depending on the amount of suppression (refer to Table 13.0). Area used in the calculation consisted of hay and crop land, summerfallow, tame pasture and native land used for pasture (as reported in the 2001 Census of Agriculture). In Manitoba, the sub-watershed in which the City of Steinbach is located (in the Seine River Watershed Study Area, refer to Appendix D), had the highest livestock density (0.98 AU/ha). All other livestock densities were compared to this one.

Table 17.0 and Figure 13.0 illustrate the different livestock densities within the sub-watersheds of the La Salle River Watershed Study Area. Pigs produced the majority of AU in all sub-watersheds with the exception of Sub-watershed #229 where beef cattle dominate. Sub-watershed #229 also had the greatest livestock density of 0.32 AU/ha. This is still only 33% of the province's highest value. With the higher number of beef cattle present, riparian pastures are likely common and riparian pasture management will be important to maintain or improve riparian health. Sub-watershed #231 had the lowest livestock production density in the study area. Livestock production at any density requires attention to manure management, nutrient management and riparian pasture management. Any area with a higher livestock density may have a greater potential to impact riparian areas.

Table 17.0 Comparison of livestock density in the La Salle River Watershed Study Area using 2001 Census livestock numbers converted to Animal Units[1]

Sub-watershed ID	Area[2] (ha)	Livestock Density	
		AU/ha[1]	As a percentage of 0.981 AU/ha[3]
229	45,983	0.32	32.6
230	59,278	0.21	21.2
231	53,596	0.07	6.6
232	50,338	0.16	16.6

1. Refer to Appendix C for assumptions used in calculating Animal Units. Some suppression of data occurs (see Table 13.0)
2. Area is calculated as the amount of land planted to annual and hay crops, summerfallow, tame pasture and native land used for pasture, as reported in the 2001 Census of Agriculture
3. Value is calculated as a percentage of the highest AU/ha value determined in Manitoba (using 2001 Census of Agriculture data)

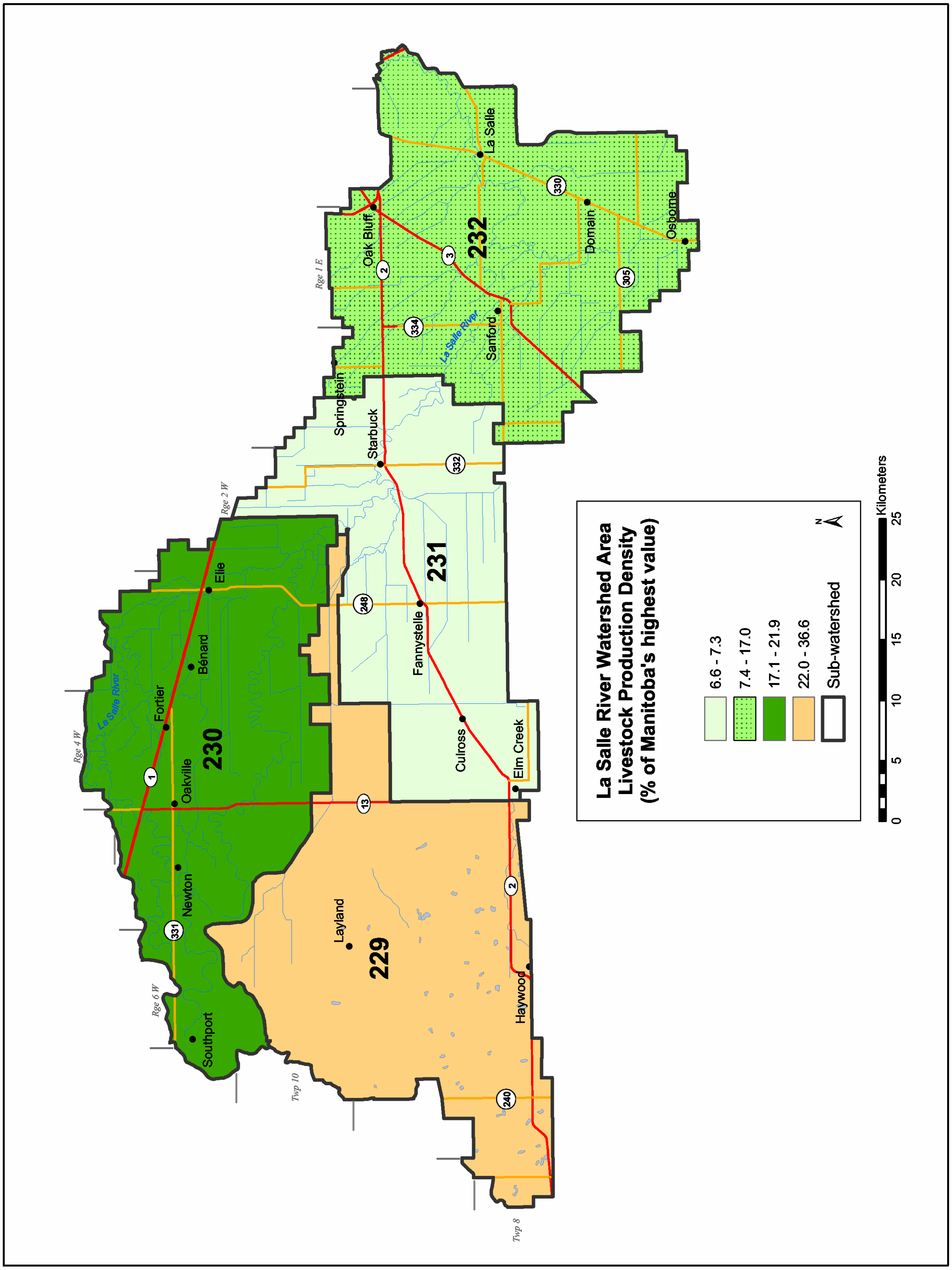

Figure 13.0 Livestock density in the La Salle River Watershed Study Area, as a percentage of the highest value in Manitoba of 0.98 AU/ha)as reported in the 2001 Census of Agriculture)

The potential for crop production to impact riparian health is present in all the sub-watersheds but may be greater in those with higher fertilizer and pesticide crop inputs. Run-off containing nutrients from manure and commercial fertilizers, pesticides, and pathogens can affect riparian vegetation and biodiversity. The value of commercial crop inputs can be used as an indication of crop production intensity. Crop production intensity within a watershed was determined as dollars spent on fertilizers and pesticides (herbicides, insecticides and fungicides) per hectare in the year 2000, as reported by farms in the 2001 Census. Land area was calculated as the number of hectares used for crop and hay production and summerfallow (as reported by farms within the study area). These numbers ($ fertilizer/ha, $ pesticides/ha) were then compared to the highest respective value calculated in all the sub-watersheds with census data in Manitoba. Fertilizer dollars spent per hectare were compared with the highest value of $101.23/ha, found in the sub-watershed containing the community of Bagot (in the Whitmud River Watershed Study Area). Pesticide dollars were compared with the highest value of $81.65/ha, found in the sub-watershed containing the communities of Poplar Point and High Bluff, north of the Assiniboine River (in the Lower Assiniboine River Watershed Area, refer to Appendix D).

Table 18.0 and Figures 14.0 and 15.0 illustrate the different levels of fertilizer and pesticide use in 2000 within the sub-watersheds of the La Salle River Watershed Study Area. Although crop production intensities were similar throughout the study area, fertilizer inputs were highest in Sub-watershed #232, while pesticide inputs were highest in Sub-watershed #230. Along with the high pesticide and fertilizer inputs, these areas also have a high shoreline density, which increases the potential for contaminants to enter surface water. Sub-watershed #229 had the lowest fertilizer and pesticide inputs in the watershed but, as seen in Table 17.0, this area has one of the higher livestock densities in the study area. Though areas with higher crop production intensities may have a greater potential to impact riparian areas and water quality, best management practices with regards to pesticide and fertilizer use are important in all areas.

Table 18.0 – Comparison of crop production intensity in the La Salle River Watershed Study Area using dollars spent on pesticides and fertilizers in 2000, (as reported in the 2001 Census of Agriculture)

Sub-watershed ID	Area[1] (ha)	Fertilizer[2] (as a percentage of $101.23/ha)	Pesticides[2] (as a percentage of $81.65/ha)
229	34,185	64.4	68.2
230	53,692	75.9	88.1
231	52,656	75.6	75.3
232	48,173	77.8	70.7

1. Area is calculated as the land planted to annual and hay crops, and summerfallow, as reported in the 2001 Census of Agriculture
2. Value is calculated as a percentage of the highest fertilizer (or pesticide) dollars/ha value determined in Manitoba (using 2001 Census of Agriculture data)

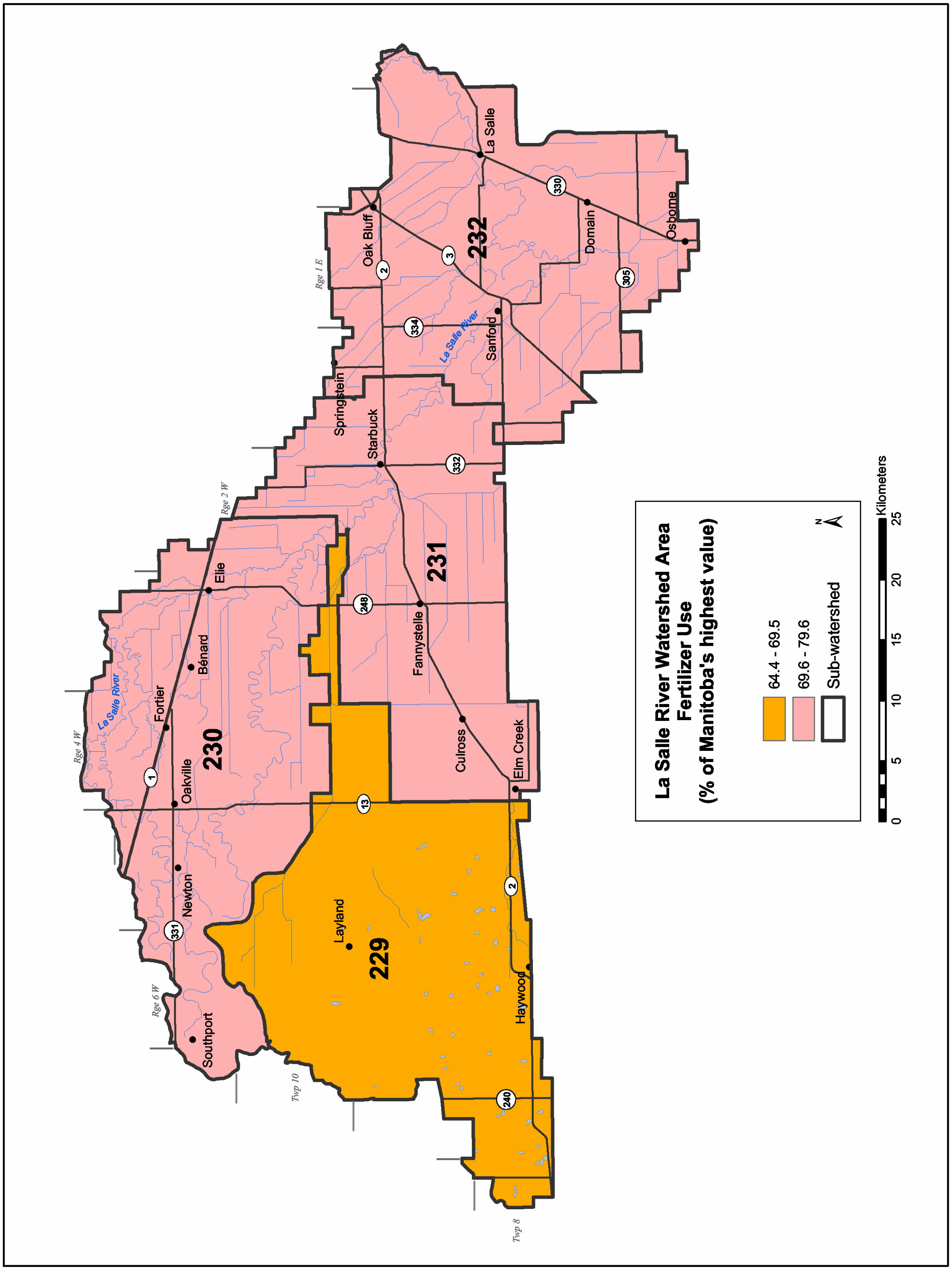

Figure 14.0 Level of fertilizer use in the La Salle River Watershed Study Area in 2000, as a percentage of the highest value in Manitoba of $101.23/ha (as reported in the 2001 Census of Agriculture)

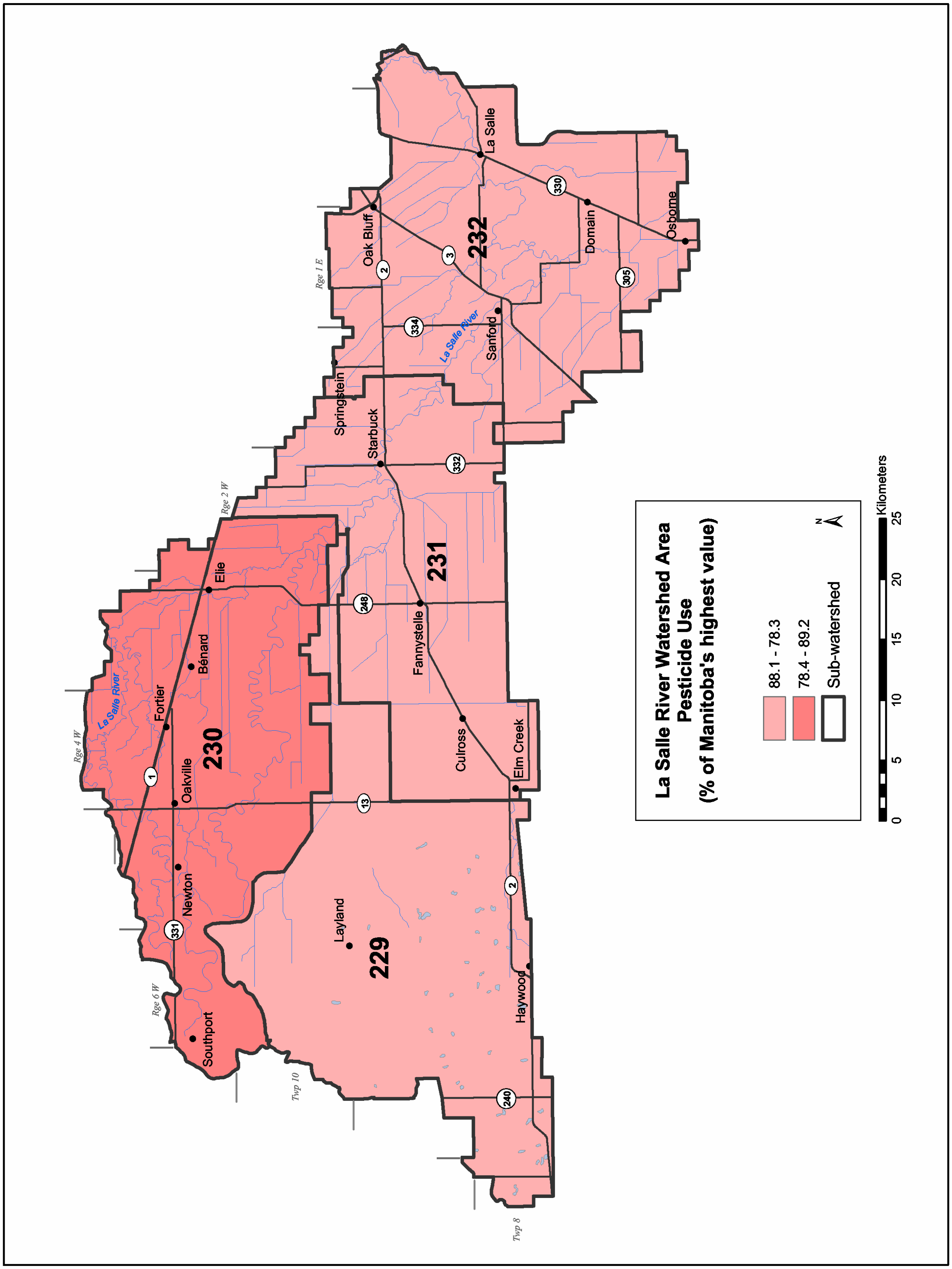

Figure 15.0 Level of pesticide use the La Salle River Watershed Study Area in 2000, as a percentage of the highest value in Manitoba of $81.65/ha (as reported in the 2001 Census of Agriculture)

Summary

Although riparian areas are affected by all activities in a watershed, this report concentrates on the potential impacts from agricultural activities. The La Salle River Watershed Study Area contains a variety of soils and landscapes and, as a result, supports a diverse agricultural landscape. Appropriate management of agricultural activities is very important to protect riparian areas in the watershed.

The majority of the area in the La Salle River Watershed Study Area is productive agricultural land. In 2001, annual crop production occurred on 75% of the land. Although forages only made up 4% of the area, hectares had increased 1.4 times since 1994, reflecting the expansion of the livestock industry. Beef cattle and pigs make up the majority of the livestock, representing almost 75% of the Animal Units produced in the watershed (beef – 36%, pigs – 49%). Efforts should continue on education and awareness of the importance of nutrient management, manure management, residue management and crop rotation.

By looking at land cover in an area within a 50 metre distance from all waterbodies and watercourses, an attempt was made to determine areas which might have the potential for healthier riparian areas and areas which may be impacted by agricultural activities. Overall, over half of the buffered area was annually cropped and only 11% was occupied by trees. With annual crop land in close proximity to surface water, there may be greater opportunity for contaminated run-off or chemical drift to affect riparian areas and water quality. Trees were more common in the buffered areas in the western part of the watershed, along the escarpment. Trees are an important part of the riparian area and their presence can indicate a certain level of riparian health. More detailed on-site analysis will be required to determine actual riparian health.

Calculation of shoreline densities provides information on areas where riparian areas are more concentrated. In the La Salle River Watershed Study Area, rivers and creeks, including intermittent streams make up the majority of shoreline, although an area with a large amount of wetland shoreline is found in the western part. The ‘Oakville’ sub-watershed has the highest shoreline density. A higher shoreline density will indicate a greater concentration of riparian areas. Since riparian areas provide a buffer between upland areas and surface water, management practices (including riparian pasture management, buffer strips, and grassed waterways) become important to maintain this vegetated buffer area surrounding waterbodies and watercourses.

An attempt was made to determine an overall level of agricultural intensity with respect to livestock production and crop production. Because thresholds are not known, determinations of high, medium and low were not made. Instead, values were compared to the highest value calculated in Manitoba. In the La Salle River Watershed Study Area, the southwestern sub-watershed had the highest livestock density, which was still only 33% of the highest livestock density in Manitoba. Crop production intensity was generally found to be high throughout the watershed, though slightly less in the southwestern part. Areas with higher levels of livestock density or crop production intensity, or both, should be targeted for programs which promote the use of management practices that improve riparian health and reduce impacts to water quality.

This report has been presented to provide a central source of riparian-related information to assist in strategic planning for riparian areas in Manitoba. Riparian areas play an important role in surface water quality and their ability to carry out this function can be affected by anthropogenic activities on the landscape. Agriculture is only one component, with other human activities such as industry, recreation and residences contributing to degraded riparian areas. The intent of this report is to be a first step towards addressing the issue of riparian health, with respect to agriculture, in the watershed study area. By providing information on the land resources and the agricultural activities in the study area, a better understanding of the issue can be obtained which will assist towards better planning and priority setting by local decision makers, land use planners and policy decision-makers. While this reports studies the agricultural aspect of the watershed study area, in a true watershed study, all factors of activities of all sectors must be considered. Due to scale and accuracy limitations, this report does not replace the need for site-specific analysis; rather, it serves as a guide for general planning purposes in the La Salle River Watershed Study Area.

Future Steps

Agriculture is a significant land use found within many watersheds across the southern portions of Manitoba. The way in which individual producers manage their land can have positive and negative impacts on the environment. The understanding of the relationship between management choices available to agricultural producers in Manitoba and the type and extent of their impact on riparian and water quality issues is not well understood. It is crucial that a better understanding of these relationships be developed. This, in combination with more information about the agricultural activities within a watershed, will provide a solid foundation of science and information upon which programs, policies and beneficial management practices can be developed and evaluated.

However, agriculture is only one component of the anthropogenic activities that occur within any given watershed. Other human activities, such as industry, residences and recreation can also significantly contribute to degraded riparian areas and reduced water quality within a watershed. As with agriculture, the relationship between these activities and the type and extent of their impact is typically not well known. If issues related to riparian areas and water quality within watersheds are to be understood there needs to be significant work done to collect information on these other activities and relate them to watershed issues. This will require all sectors, public and private, to jointly focus on these issues and work together to reaching their resolution.

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Glossary

Animal Unit - the number of livestock required to excrete 73 kg (160 lbs) of nitrogen in a 12-month period in Manitoba

Erosion – The wearing away of the land surface by detachment and transportation of soil and rock material through the action of moving water, wind or other geological processes.

Field Capacity – The amount of water remaining in a soil after free water has been allowed to drain away after the root zone had been previously saturated

Lacustrine – Mineral deposits that either have settled from suspension in bodies of standing fresh water or have accumulated at their margins through wave action. The sediments generally consist of either stratified are varved (layered annual deposits) fine sand, silt and clay deposited on the lake bed; or moderately well sorted and stratified sand and coarser materials that are beach and other near-shore sediments transported and deposited by wave action.

Mean Annual Growing Degree Days - accumulation of days that the daily average temperature [average of maximum and minimum temperature] is greater than 5 C multiplied by the number of 5 C the daily average exceeds 5 C for each day).

Moisture Deficit – Precipitation [P] – Potential Evapotranspiration [PE] = Moisture Deficit accumulated over the growing season by August 13 or September 30.

Permeability – The ease with which water and air pass through the soil to all parts of the profile

Appendix A

Classification Scheme: Land Cover Mapping of Manitoba	
1. Annual crop land:	Land that is normally cultivated on an annual basis.
2. Forage:	Perennial forages, generally alfalfa or clover with blends of tame grasses.
3. Grassland:	Areas of native or tame grasses, may contain scattered stands of trees
4. Trees:	Lands that are primarily in tree cover
5. Wetlands:	Areas that are wet, often with sedges, cattails, and rushes
6. Water	Open water – lakes, rivers, streams, ponds, and lagoons
7. Urban and Transportation:	Towns, roads, railways, quarries

Appendix B

The Census of Agriculture is conducted concurrently with the Census of Population by Statistics Canada, every five years. The 2001 Census of Agriculture is the most recent Census to date. The Census of Agriculture collects information from operations that meet the definition of a census farm.

In 1996 and 2001, a census farm was defined as "an agricultural operation that produces at least one of the following products intended for sale: crops (hay, field crops, tree fruits or nuts, berries or grapes, vegetables, seed); livestock (cattle, pigs, sheep, horses, game animals, other livestock); poultry (hens, chickens, turkeys, chicks, game birds, other poultry); animal products (milk or cream, eggs, wool, furs, meat); or other agricultural products (Christmas trees, greenhouse or nursery products, mushrooms, sod, honey, maple syrup products)" (Statistics Canada 2002).

The *Statistics Act* requires that all census information be kept confidential. As a result, any data that could disclose information concerning a particular agricultural operation or individual is suppressed in the data tables reported by Statistics Canada. Suppressed data are, however, included in the aggregate subtotals and totals within each data table. In instances where a geographic area has very few agricultural operations, data are not released separately, but are merged with data from one or more geographically adjacent areas (Statistics Canada 2002).

2001 Census of Agriculture Terms and Definitions (*Source: Statistics Canada 2002)*

Agricultural operation: a farm, ranch or other agricultural operation producing agricultural products for sale. Other agricultural operations include, for example: feedlots, greenhouses, mushroom houses, nurseries, Christmas tree farms, fur farms, hobby farms, game farms, beekeeping, sod, fruit and berry, maple syrup and poultry hatchery operations. Sales in the past 12 months are not necessary but there **must** be the intent of sales.

Summerfallow land: a term used to describe land on which no crop will be grown in order to conserve moisture but which will be sprayed or cultivated for weed control.

Tame or seeded pasture: grazeable land that has been improved from its natural state by seeding, draining, irrigating, fertilizing or weed control.

Natural land for pasture: grazeable land that has not been recently improved.

Tillage: the practice of working the soil for the purpose of bringing about the more favourable conditions for plant growth. Clean-till (conventional tillage) incorporates most of the crop residue into the soil, while minimum-till (conservation tillage) retains most of the crop residue on the surface. No-till includes direct seeding into stubble or sod.

Crop rotation: a practice where crops are alternated each year, or in a multi-year cycle, for soil conservation or disease control purposes.

Permanent grass cover: a practice where a field or land is kept in grass cover indefinitely to keep the soil from being eroded away.

Winter cover crops: crops such as oats or fall rye seeded in the fall to protect the soil from water and wind erosion during the winter and from heavy rains and run-off in the spring.

Green manure crops for plough down: the practice of incorporating young green plants into the soil for fertility purposes. These plants are usually grown with the single purpose of being used as a soil improver. Common examples are buckwheat and red clover.

Contour cultivation: the practice of cultivating the field across the slope to reduce soil erosion from rapid water run-off.

Grassed waterways: either natural or constructed, to control soil erosion. The waterway is permanently grassed and consists of a shallow channel, which is designed to slow down run-off water. The grass stabilizes the soil and prevents it from being washed away. They are usually shaped to allow easy crossings by farm machinery.

Strip-cropping: (or strip farming, field strip-cropping or wind strip-cropping) a method of controlling soil erosion by dividing the farm into narrow fields having different crops, with or without fallow. For example, the narrow fields may be alternately cropped–uncropped (e.g., wheat–fallow–wheat–fallow) or they may be strips of different crops (cereals, corn, soybeans). The widths of the cropped strips are usually multiples of a tillage implement or spray boom, etc.

Windbreaks or shelterbelts: trees, either planted or naturally present. This practice is used more predominantly in western Canada where farmland is more susceptible to wind action and where trapping snow for moisture is important.

Appendix C

Summary of Animal Unit coefficients used in Manitoba as compared to those used for calculations in this report[1]. Assumptions are given in the following Table.

Livestock	Animal Units produced by one animal (MAFRI)	Animal Unit coefficient used in report
Dairy		
Milking Cows (including associated livestock)	2.000	2.000
Beef		
Beef Cows, incl. associated livestock	1.250	1.250
Backgrounder	0.500	\
Summer pasture	0.625	} 0.631
Feedlot	0.769	/
Hogs		
Sows, farrow-to-finish	1.250	--
Sows, farrow-to-weanling	0.313	0.313
Sows, farrow-to-nursery	0.250	--
Weanlings	0.033	--
Grower/finishers	0.143	0.143
Boars (artificial insemination operations)	0.200	0.200
Chickens		
Broilers	0.0050	0.0050
Roasters	0.0100	--
Layers	0.0083	0.0083
Pullets	0.0033	0.0033
Turkeys		
Broilers	0.010	\
Heavy Toms	0.020	} 0.014
Heavy Hens	0.010	/
Horses (PMU)		
Mares, including associated livestock	1.333	1.00
Sheep		
Ewes, including associated livestock	0.200	0.200
Feeder Lambs	0.063	--
Goats	0.143	0.143
Bison		
Cow	1.00	\
Bull	1.00	} 0.8875
Calf	0.25	/
Elk		
Cow	0.53	\
Bull	0.77	} 0.520
Calf	0.05	/

1. An Animal Unit is defined as the number of livestock required to excrete 73 kg (160 lbs) of nitrogen in a 12-month period (as defined in the Farm Practices Guidelines for Poultry Producers in Manitoba)

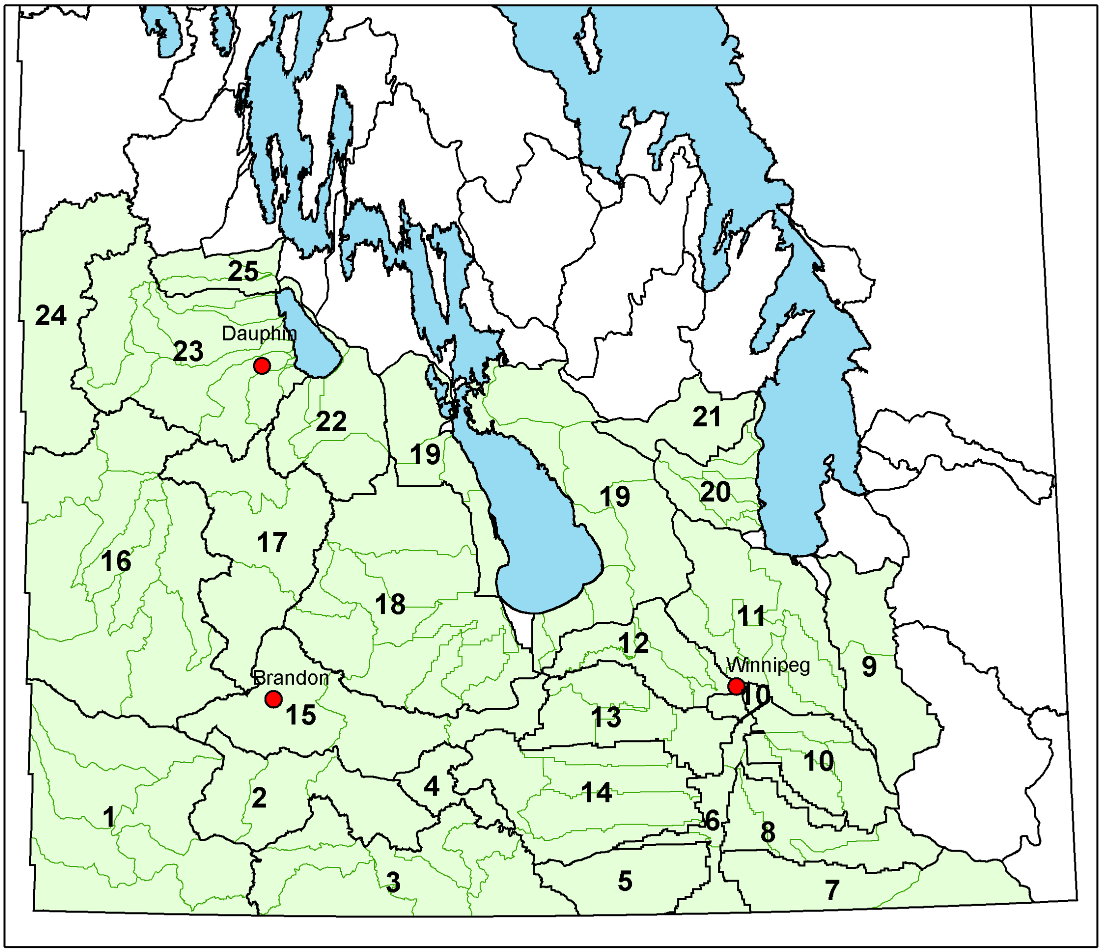
Summary of assumptions made in calculating Animal Units[1] from 2001 Agricultural Census Data.

Livestock	**Manitoba Animal Unit Category**	**Census Category**	**Assumptions Used for Animal Unit Calculations with census data**
Dairy	Milking cows (including associated livestock)	Dairy cows	Assumed categories are equal.
Beef	Beef cows	Beef cows	Assumed number of beef cows reported in 2001 Census equal cow/calf pairs
	Backgrounder Summer pasture Feedlot cattle	Heifers and steers for slaughter or feeding 1 yr and older (combined categories)	Assumed steers and heifers reported in these census categories are split into the three categories (communication with MAFRI). Animal unit coefficient determined using this ratio.
Pigs	Sows, farrow–to-weanling	Sows	Assumed there are no farrow-to-finish operations and no weanling operations in Manitoba – only farrow-to-weanling and grower/finisher operations.
	Grower/finishers	Grower and finisher pigs	
	Boars (artificial insemination operations)	Boars	Assumed all boars reported in the 2001Census are from artificial inseminations.
Chickens	Broilers	Broilers and roasters	Assumed all birds reported in the census category are broilers (communication with MAFRI).
	Layers	Laying hens (19 weeks and older)	Assumed categories are equal.
	Pullets	Pullets (under 19 weeks)	Assumed categories are equal.
	Broiler breeding hens	Laying hens in hatcheries	Assumed all laying hens in hatchery supply flocks reported in Manitoba are broiler breeder hens.
Turkeys	Broiler, Heavy Toms, Heavy Hens	Turkeys	Assumed "turkeys" represents 20% boilers, 40% heavy toms, 40% heavy hens (communication with MAFRI). Animal unit coefficient is determined using this ratio.
Sheep	Ewes, including associated livestock	Ewes	Assumed ewe/lamb pairs (communication with MAFRI).
	Feeder lambs	Lambs	Assumed no feeder lambs in province since numbers are very small and cannot be determined from census data (communication with MAFRI).
Horses	Horses	Total horses and ponies	Assumed each animal produces 1 Animal Unit – PMU farms not identified in Census (communication with MAFRI).

Livestock	Manitoba Animal Unit Category	Census Category	Assumptions Used for Animal Unit Calculations with census data
Bison	Bison	Bison	Assumed adults represent 85% and calves represent 15% of bison population in Manitoba (communication with MAFRI). Animal unit coefficient is determined using this ratio.
Elk	Elk	Elk	Number of calves and sex of animals not identified in Census – assumed 45% cows, 35% bulls and 20% calves (communication with MAFRI). Animal unit coefficient is determined using this ratio.
Goats	Goats	Goats	Number of kids and sex of animals not identified in Census – assumed 7 goats make up one Animal Unit, irregardless of age and sex.

1. One Animal Unit is defined as the number of livestock required to excrete 73 kg (160 lbs) of nitrogen in a 12-month period (as defined in the Farm Practices Guidelines for Poultry Producers in Manitoba)

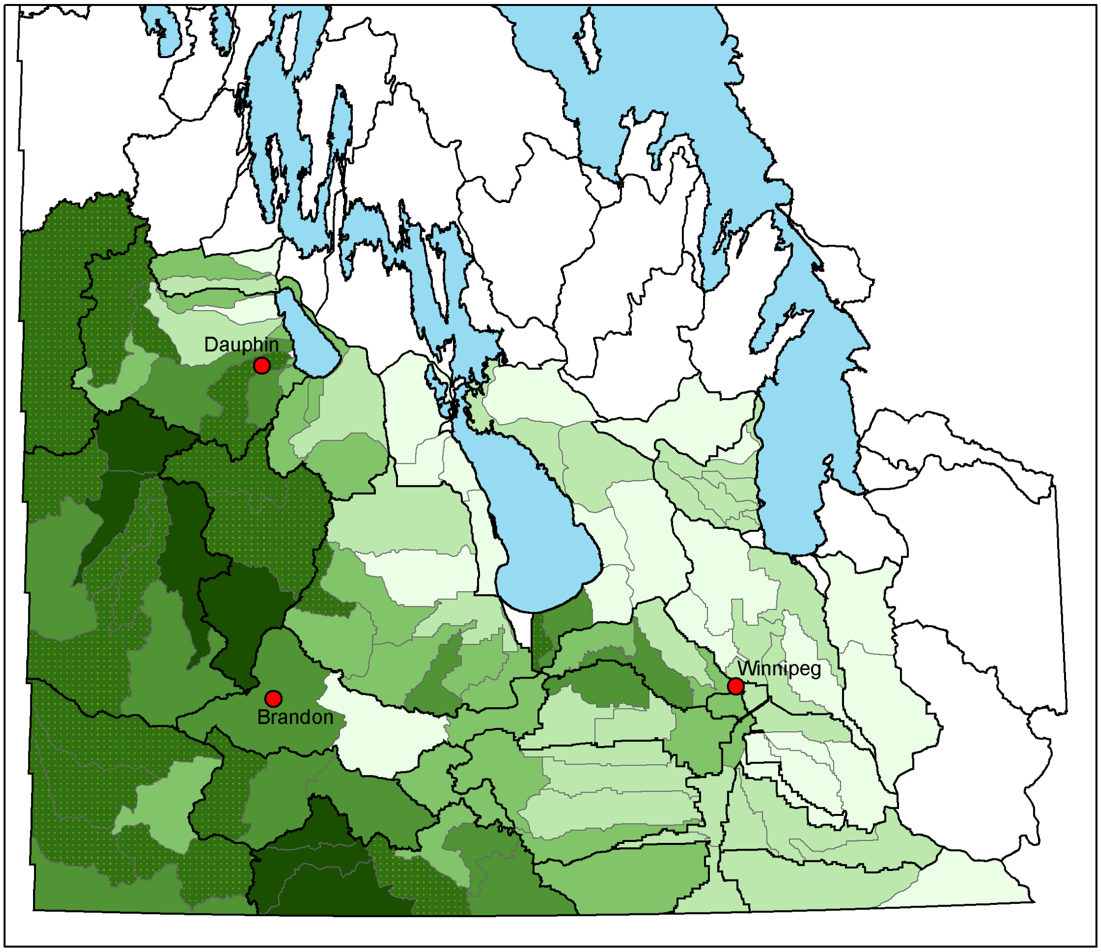
Appendix D



Watershed Study Area Summary Reports in Manitoba (black outline) and the sub-watershed areas (green outlines) used for the custom tabulation of the 2001 Census data.

Watershed Study Areas   Sub-watershed areas

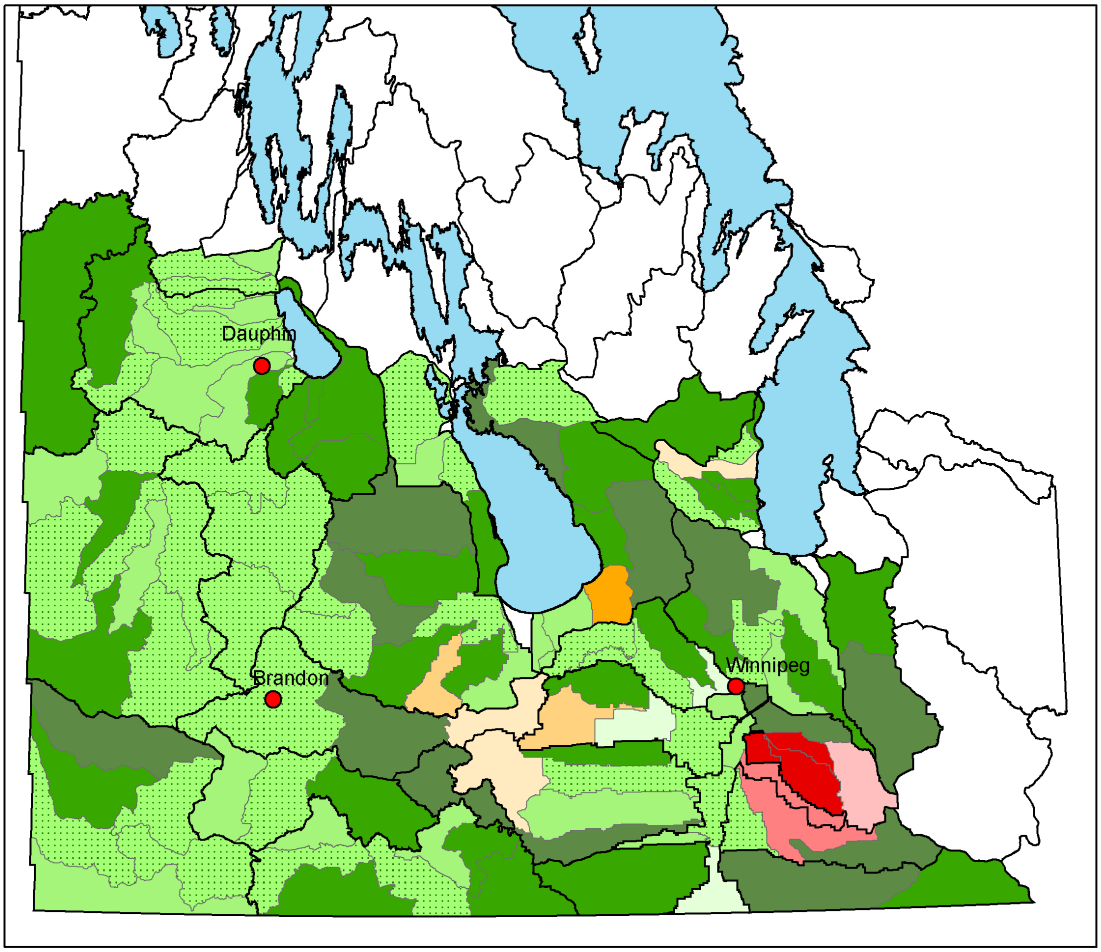
ID	Report	ID	Report
1	Upper Souris River Watershed Study Area	14	Boyne-Morris River Watershed Study Area
2	Lower Souris River Watershed Study Area	15	Middle Assiniboine River Watershed Study Area
3	Pembina River Watershed Study Area	16	Upper Assiniboine River Watershed Study Area
4	Cypress River Watershed Study Area	17	Little Saskatchewan River Watershed Study Area
5	Plum River Watershed Study Area	18	Whitemud River Watershed Study Area
6	Upper Red River Watershed Study Area	19	Lake Mantitoba Watershed Study Area
7	Roseau River Watershed Study Area	20	Lower West Lake Winnipeg Watershed Study Area
8	Rat-Marsh River Watershed Study Area	21	Icelandic River Watershed Study Area
9	Brokenhead River Watershed Study Area	22	South Dauphin Lake Watershed Study Area
10	Seine River Watershed Study Area	23	West Dauphin Lake Watershed Study Area
11	Lower Red River Watershed Study Area	24	Shell River Watershed Study Area
12	Lower Assiniboine River Watershed Study Area	25	Mossy River Watershed Study Area
13	La Salle River Watershed Study Area		



Comparison of Shoreline Densities in Manitoba calculated as metres of shoreline/ha in each sub-watershed*

2.6 - 7.5	17.3 - 22.1
7.6 - 12.3	22.2 - 27.0
12.4 - 17.2	27.1 - 31.8

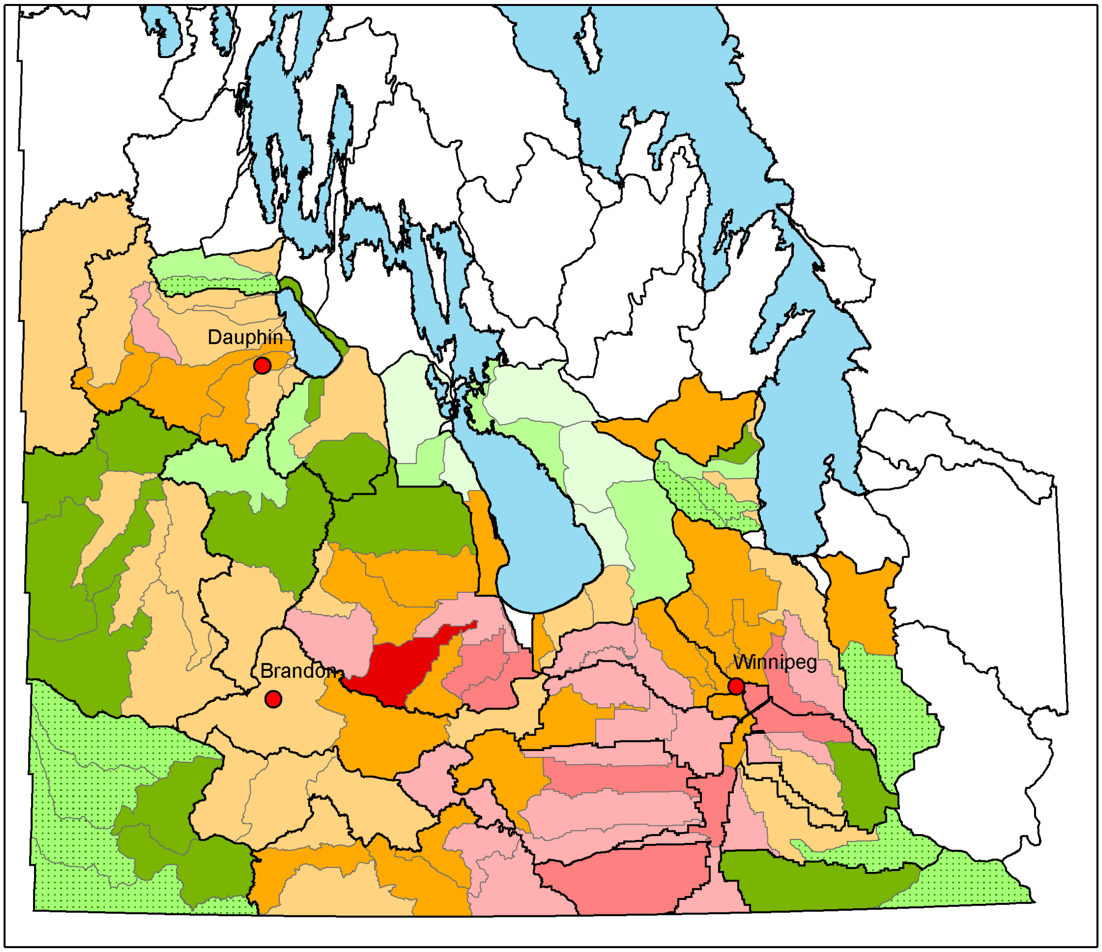
* Length of shoreline of both permanent and intermittent waterbodies and watercourses was determined from the 1:50,000 NTS datasheets (note that densities will be slightly underestimated since numerous small wetlands and potholes as well as some small constructed water courses (first, second and third order drains) are not captured by the NTS sheets).



Comparison of livestock production densities in Manitoba as a percentage of the highest value calculated in a sub-watershed using 2001 Census livestock numbers converted to Animal Units*

2.4% - 7.3%
7.4% - 12.2%
12.3% - 17.0%
17.1% - 21.9%
22.0% - 26.8%
26.9% - 31.7%
31.8% - 36.6%
41.4% - 46.3%
70.7% - 75.6%
75.7% - 80.5%
95.1% - 100%

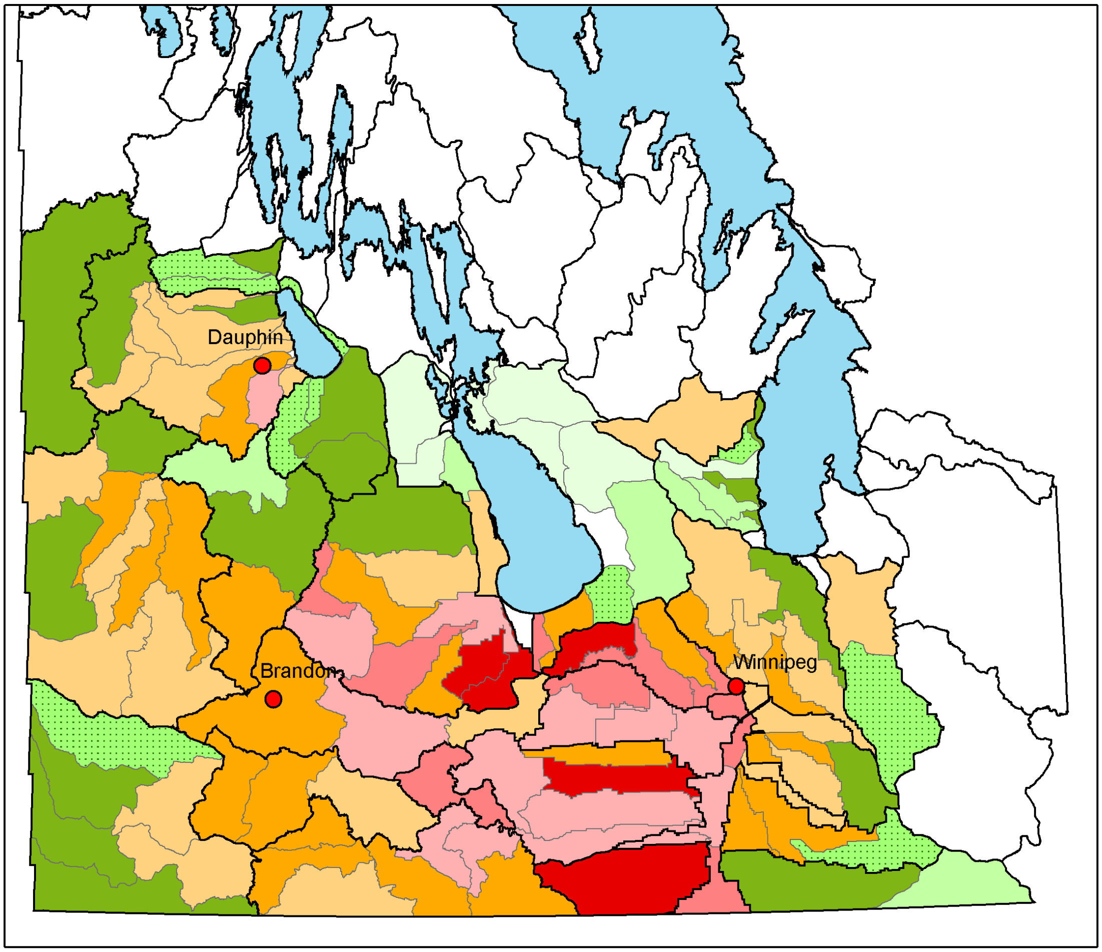
* Densities of different types of livestock were standardized by calculating Animal Units per hectare (AU/ha). In Manitoba, an Animal Unit is defined as the number of livestock required to excrete 73 kg (160 lbs) of nitrogen in a 12-month period (refer to Appendix C for assumptions used to derive AU coeffiecients). Suppression of livestock numbers in the census data will affect total AU to varying degrees, depending on the amount of suppression. Area used in calculation consisted of hay and crop land, summerfallow, tame pasture and native land used for pasture (as reported in the 2001 Census of Agriculture).



Comparison of commercial fertilizer use in sub-watersheds in Manitoba, calculated as a percentage of the highest value in a sub-watershed (as reported in the 2001 Census of Agriculture).*

8.4% - 18.6%	39.0% - 49.1%	69.6% - 79.6%
18.7% - 28.8%	49.2% - 59.3%	79.7% - 89.8%
28.9% - 38.9%	59.4% - 69.5%	89.9% - 100%

* Level of fertilizer use is calculated as dollars spent on fertilizers per hectare in the year 2000, as reported by farms in the 2001 Census of Agriculture. Land area was calculated as the number of hectares used for crop and hay production and summerfallow (as reported by farms for the 2001 Census).



Comparison of pesticide use in sub-watersheds in Manitoba, calculated as a percentage of the highest value in a sub-watershed (as reported in the 2001 Census of Agriculture).*

2.4% - 13.2%	35.0% - 45.8%	67.6% - 78.3%
13.3% - 24.1%	45.9% - 56.6%	78.4% - 89.2%
24.2% - 34.9%	56.7% - 67.5%	89.3% - 100%

* Level of pesticide use (herbicides, insecticides and fungicides) is calculated as dollars spent on fertilizers per hectare in the year 2000, as reported by farms in the 2001 Census of Agriculture. Land area was calculated as the number of hectares used for crop and hay production and summerfallow (as reported by farms for the 2001 Census).