

La Salle River Integrated Watershed Management Plan



October 2010

LA SALLE RIVER INTEGRATED WATERSHED MANAGEMENT PLAN

October 2010

Prepared and Published by:

La Salle River Watershed Planning Authority

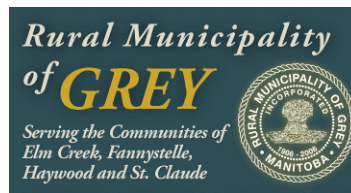
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EXECUTIVE SUMMARY

In 2006, the La Salle Redboine Conservation District (CD) started an Integrated Watershed Management Plan for the La Salle River Watershed. Based on information and input received from local stakeholders, the Watershed Planning Advisory Team developed the following vision, goals and recommendations.

VISION

To have clean, safe and abundant water that sustains our vibrant local communities and a system of co-ordinated surface water management that respects current water users, agriculture, downstream residents and aquatic ecosystems.

GOAL #1

To improve the state of surface water management in terms of alleviating downstream flooding and ensuring sufficient water is available during dry periods

To better co-ordinate drainage activities, we recommend:

- establishing a committee to review and improve surface water management policies for each of the watershed's unique water management zones

To improve the provincial waterways infrastructure maintenance schedule, we recommend:

- involving the La Salle Redboine CD in the development and review of the annual maintenance schedule and five-year work plans
- conducting an assessment of all the licensed water control structures
- developing a detailed surface water management pilot project (drainage plan) in a representative sub-watershed in the La Salle River Watershed

To improve the drainage licensing process, we recommend:

- involving the La Salle Redboine CD in the review process of water rights license applications that propose new drains and drainage upgrades

- providing all watershed residents with information on the process of applying for drainage works
- ensuring that Manitoba Water Stewardship's Water Resource Officers are available to investigate drainage works, distribute applications for review, and enforce conditions applied to approved licenses

To alleviate, and protect against, downstream flooding, we recommend:

- developing water control/retention projects
- constructing ring-dikes to flood protect residential properties
- protecting and enhancing wetlands by offering financial incentives and conservation agreements
- conducting an analysis of the flooding issues at the Elm Creek Channel to determine the most achievable and beneficial options
- developing digital maps of flood-prone and spring/summer flooding areas

GOAL #2

To protect and improve water quality

Water quality has declined significantly in the La Salle River Watershed since the early 1970s. Point and non-point nutrient loading and a relatively slow-moving river system have exacerbated the already naturally high nutrient levels.

To reduce and eliminate point and non-point source pollution to waterways, we recommend:

- providing incentive programs and technical assistance to producers to implement beneficial management practices that reduce or eliminate excess nutrients from entering waterways
- conducting scientific research to determine more sustainable methods of disposing of nutrient-rich wastewater
- providing agriculture-extension programs to help producers assess the environmental risk and impacts of their operations
- establishing permanent cover buffers along waterways to minimize the amount of nutrients that enter

waterways and reduce stream bank erosion

- continuing the long-term water quality monitoring program and additional water quality related research
- developing science-based targets for nutrient concentration reductions

To minimize or eliminate the risk of contamination to drinking water sources, we recommend:

- establishing a Source Water Protection Committee to do source water assessments at each of the public drinking water sources
- targeting source water protection programming and activities to the areas determined to be the source water protection zones
- sealing abandoned wells
- encouraging all private well owners to assess their well, implement wellhead protection measures and have their well water tested annually

GOAL #3

To improve the health of the rivers and riparian areas

In a recent riparian assessment conducted along the main stem and tributaries of the La Salle River, 119 potential rehabilitation sites were identified. This clearly indicates the need for better waterway management and riparian protection, and a new way of looking at how the land and water is managed.

To protect and enhance riparian habitat along the La Salle River, we recommend:

- using conservation agreements, and other financial and technical assistance programs, to secure existing, critical riparian areas and rehabilitate degraded riparian areas
- investigating the long-term feasibility of an ecological good and services-type program, and the provision of tax credits to landowners who protect or restore critical riparian areas
- working on the riparian rehabilitation

projects already identified in the recently completed *La Salle River Watershed Assessment Survey*

- developing municipal zoning bylaws that would restrict certain development activities in riparian areas
- providing local communities with information on how to control nuisance and invasive species

To remove excess debris and garbage from the La Salle River, we recommend:

- removing debris obstructions from the La Salle River at sites that may damage crossing infrastructure or cause overland flooding
- encouraging and supporting local communities to undertake annual river clean-up events

GOAL #4

To increase public participation in watershed stewardship activities

To provide watershed awareness, education and participation opportunities to the public, we recommend:

- offering watershed management presentations to local schools
- submitting newspaper articles and public service announcements
- building the capacity of municipal governments, organizations and residents by supporting land and water management workshops and field tours
- incorporating watershed management presentations into municipal

conferences and agriculture-extension events

- developing watershed educational/interpretive highway rest-stops at locations throughout the watershed
- maintaining the La Salle Redboine CD website as a valuable information source for watershed management activities, local stewardship opportunities and plan implementation progress

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1.0 INTRODUCTION

1.1 Watershed

A watershed is a topographically defined area of land where water flows through a network of waterways and ends at a common downstream point, such as a large river or lake. It is a diverse environment of living (i.e. plants, animals) and non-living things (i.e. air, water, soil) all connected by a common water resource.

The land and water-use activities of local watershed residents have a tremendous influence on the health of the watershed. In turn, the watershed has an influence on the health of its residents.

1.2 Integrated Watershed Management Planning

An integrated watershed management plan (IWMP) is a document developed cooperatively by government and stakeholders (watershed residents, interest groups). It states shared goals and outlines actions to manage land, water and related resources on a watershed basis.

1.3 Purpose

The purpose of the La Salle River Integrated Watershed Management Plan (IWMP) is to improve the health and sustainability of the watershed by identifying watershed issues, and recommending actions to address the issues and working together with all watershed stakeholders towards shared goals for the watershed by implementing the plan.

1.4 Watershed Management Principles

The following principles were essential in provided general direction to the Watershed Planning Advisory Team and all stakeholders throughout the planning process. They provided a basic understanding of the connections and interrelationships in a watershed, which helped with the development of management strategies for the watershed.

- Nothing happens in isolation – everything is connected by the land and water in a watershed.
- Upstream is connected to downstream.
- Water management planning should be based on watersheds.
- What happens on the land is reflected in the water.
- Clean water is critical to the sustainability of our local communities and environment.
- The watershed planning process needs to be community-based, transparent, and inclusive and respectful of all stakeholders.
- Management strategies must be adaptable to changing conditions and situations.
- Decisions must be made considering the best available science, and local knowledge and experience.
- Monitoring, research and evaluation are essential parts of watershed management.
- Nothing happens overnight - large-scale landscape improvements require long-term commitment and participation.
- Building momentum through successful implementation is critical to reaching watershed goals and long-term success.
- Opportunities for learning and participating must be easily accessible.

1.5 Planning Process

The planning process used to develop the La Salle River IWMP took place as follows:

- March 2006 – La Salle Redboine Conservation District designated Water Planning Authority for the La Salle River Watershed
- May 2006 – completed Terms of Reference
- June 2006 – January 2007 – prepared *State of the Watershed Report*
- March 2007 – held first round of public input meetings to identify priority issues and solutions
- October 2007 – completed first draft plan
- November 2007 – Watershed Planning Advisory Team reviewed draft plan
- June 2008 – held second round of public input meetings
- October 2008 – held meeting with rural municipalities re: drainage infrastructure
- February 2009 – completed second draft plan
- September 2009 – final review of second Draft Plan
- October 2009 – submitted final plan for provincial approval
- Present – implementation

1.6 Key Players

La Salle Redboine Conservation District

Established in 2002, the La Salle Redboine Conservation District (CD) is a watershed-based organization comprised of municipalities and local people in partnership with the provincial government, private industry and non-government organizations. Its mandate is to promote the sustainable use and management of the land, water and related resources in the La Salle River Watershed.

Water Planning Authority

A Water Planning Authority (WPA) is a recognized, legal entity/organization designated by the Water Protection Act to develop a watershed management plan for a

given watershed. LSRBCD is the designated WPA for the La Salle River Watershed.

The LSRBCD was responsible for ensuring all provisions of the plan were completed in accordance with *The Water Protection Act*. In preparing the plan, the WPA also considered provincial land and water policy and legislation.

Watershed Planning Advisory Team

To maximize local input and facilitate the collection of pertinent technical and scientific information, a Watershed Planning Advisory Team – stakeholders from numerous organizations and agencies – was established. This group included representatives of cities, towns, villages, municipalities, producer groups, and environmental and recreational organizations.

Appendix A lists all members of the Watershed Planning Advisory Team.

The Watershed Planning Advisory Team also included members of the provincial and federal public service who provided science-based information on aspects of the watershed. These individuals, collectively referred to as the Technical Advisory Sub-group, provided comments on all available technical information relating to their respective fields. Report submissions focused on identifying areas or criteria of concern within the watershed, the extent of current impacts, a historical review of impacts, and potential future impacts based on available data.

Project Management Team

The Project Management Team was comprised of a small group of key decision-makers, appointed by the Water Planning Authority, to represent the interests of all watershed stakeholders, and to keep the watershed planning process on schedule and moving forward. The team's main responsibilities included reporting regularly to the Water Planning Authority, organizing and compiling all data submissions, and co-

ordinating the public consultation and advisory team meetings.

Watershed Residents / Stakeholders

Residents and stakeholders of the La Salle River Watershed participated in the development of the plan through four public consultation meetings. Their input on watershed issues and concerns, and their contributions in addressing and resolving the issues, were valuable in developing this plan. In fact, their participation in land stewardship and water management related activities will be critical to the implementation and long-term success of the plan.

Manitoba Water Council

The Manitoba Water Council is a group of nine individuals, appointed by the Minister of Water Stewardship to represent the regional diversity of Manitoba and local government, agricultural and environmental perspectives. One of the council's responsibilities, stated in *The Water Protection Act*, is to review final draft integrated watershed management plans, and provide the Minister of Water Stewardship with advice and comments.

1.7 Linking Watershed Planning to Land Use Planning

Land use planning is a process of developing a long-range, comprehensive strategy to guide development and outline the long-term vision and goals for a municipality. The planning process is co-ordinated by the designated planning authority for the area and involves the consideration of *The Planning Act*, *The Water Protection Act*, the Provincial Land Use Policies, and the interests of the local communities. The development plan includes policies based on the community goals and objectives for the conservation and wise use of community resources, and development practices which are sustainable and compatible with surrounding land use. Similar to integrated watershed management planning, land use planning involves collaboration between provincial departments, local governments and citizens, and is an essential part of building healthy, prosperous and sustainable communities.

2.0 CHARACTERISTICS OF THE LA SALLE RIVER WATERSHED

The following section provides an overview of the La Salle River Watershed. All of the information was referenced from the *La Salle River Watershed – State of the Watershed Report*, May 2007. The full report can be viewed online at www.lasalleredboine.com or at the La Salle Redboine Conservation District office..

2.1 Location, Size and Population

The La Salle River Watershed is approximately 2,400 km² in size and has a population of approximately 14,000.

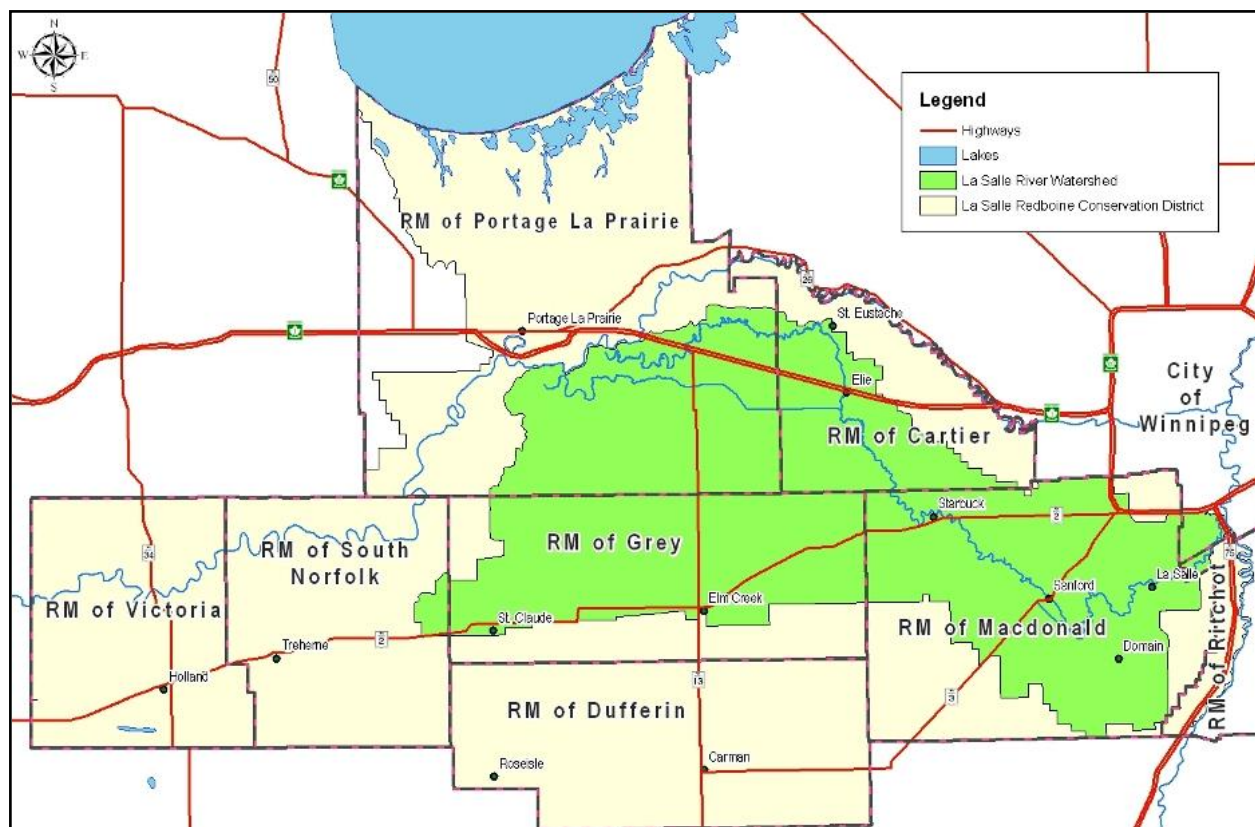


Figure 1. Rural Municipalities and the La Salle River Watershed in the La Salle Redboine Conservation District

2.2 Regions

The La Salle River Watershed is generally characterized by two unique regions based on similar land and water characteristics (as described in Table 1). The regional variation in the watershed is an important consideration when proposing policies relating to land and water management. Figures 2 and 3 illustrate some of the land and water features of the watershed. Figure 3 also illustrates the three sub-districts in the watershed.

lower, to **marginal**. Concentrations of Dicamba and MCPA (broadleaf weed herbicides), when detected, usually exceed the guidelines and greatly influence the index. During the same period, the fecal coliform guideline for the La Salle River was exceeded relatively few times.

Nutrient enrichment can result in excessive algae growth in surface waters. Algae blooms decompose and consume oxygen, which leads to anaerobic conditions. The reduced oxygen environment can kill fish, decrease biodiversity, cause taste and

Table 1. Regional Characteristics in the La Salle River Watershed

Zone / Region	Topography	Agricultural Capability	Natural Drainage	Drainage Standard	Water Retention Potential	Anticipated Cost/Benefit of Drainage
Red River Valley	Flat	Majority Class 1,2,3 "Prime Agricultural Lands"	Poor	Cereal (grain-major)/ Special crops	Poor	High
Lower Assiniboine Delta	Moderate/ Steep	Majority Classes 3,4,5,6	Good	Cereal crops (wet sands)/ Pioneer (no drainage)	Good/ Excellent	Medium

2.3 Surface Water Quality

The Canadian Council of Ministers of the Environment (CCME) have developed a Water Quality Index as a means to provide consistent procedures for Canadian jurisdictions to report water quality information to both management and the public. Rankings are provided for individual water bodies of *excellent*, *good*, *fair*, *marginal* or *poor*.

Through the CCME Water Quality Index, water quality is ranked based on a number of measured, water quality variables such as acidity, fecal coliform, dissolved oxygen and so on.

The Water Quality Index for the La Salle River Watershed, between 1990 and 2005, was calculated mostly as **fair**. However, some years saw the calculations drop even

odour problems and increase water treatment costs. It can also lead to blue-green algae toxin production, if blue-green algae are present

During the summer, dissolved oxygen concentrations in the La Salle River are generally above the Manitoba Surface Water Quality Objective for the protection of aquatic life, although complete oxygen depletion does occur occasionally. In the winter months, however, it is common for oxygen consumption to exceed oxygen production. The result is concentrations that are below the Manitoba Surface Water Quality Objective for the protection of aquatic life, which often cause anaerobic conditions.

Land features of the La Salle River Watershed

AND WHAT THESE FEATURES MEAN FOR PEOPLE LIVING IN THE WATERSHED

Natural landscape characteristics such as elevation and soil type play a major role in how the land is used by people who live in the La Salle River Watershed. The map below illustrates agriculture capability in the watershed. Considering topography / elevation and agriculture capability, the watershed can be divided into two distinct regions separated by the Lake Agassiz Beach Ridge: the Red River Valley Region and the Lower Assiniboine Delta Region.

Lower Assiniboine Delta Region

- Soil surface texture is sandy and coarse loamy
- Underlain by approximately 3 meters of medium to fine sand over clay
- Internal soil drainage is mostly imperfect with small areas of well, poor and very poor
- Suitability for irrigation is mostly good with some areas of fair and poor
- Salinity is not an issue
- Water erosion risk is negligible to low
- Wind erosion risk of bare exposed soil is high to severe

Red River Valley Region

- Soil surface texture is clayey
- Underlain by mostly clay, ranging from 50 meters depth near Portage la Prairie to less than 5 meters at the eastern edge of the watershed
- Internal soil drainage is imperfect to poor
- Suitability for irrigation is poor with some areas of fair to good in the northeast
- Soil salinity is generally not an issue
- Water erosion risk is negligible to low
- Wind erosion risk of bare exposed soil is moderate to high

Soils suitable for annual crops cover over 86% of the watershed, enabling a thriving farming community. However, all people in the watershed repeatedly struggle with soil drainage and flooding problems due to the flat topography.

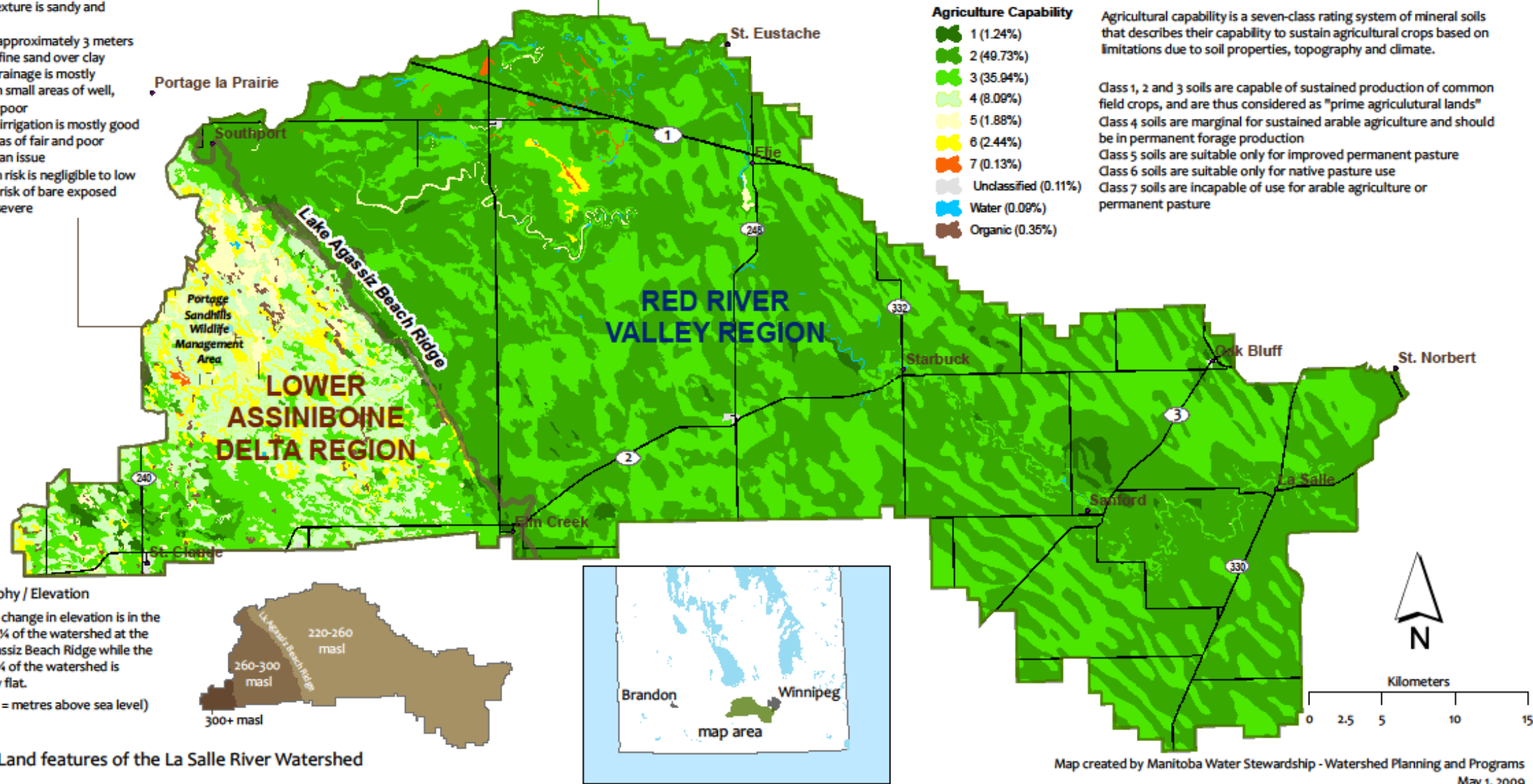


Figure 2 - Land features of the La Salle River Watershed

Water features of the La Salle River Watershed

AND WHAT THESE FEATURES MEAN FOR PEOPLE LIVING IN THE WATERSHED

The La Salle River is a tributary of the Red River and has its headwaters located about 10 km southeast of the City of Portage la Prairie. The river flows eastward along a meandering course from its source to eventually converge with the Red River in St. Norbert, at the south end of Winnipeg. The reach of the river is close to 140 km long, running through a relatively low gradient, intensively cultivated watershed over 2,400 square kilometres in size. It is one of the most extensively drained watersheds in Manitoba with over 1,946 km of constructed drains.

Water Quality in the La Salle River

Water quality in the La Salle River has declined significantly over the last 30 years. This decline has been measured through various indices and parameters, such as the water quality index (WQI).

The basic premise of the WQI is that water quality is excellent when all guidelines set to protect water uses are met virtually all the time. The WQI declines when water quality guidelines are exceeded.

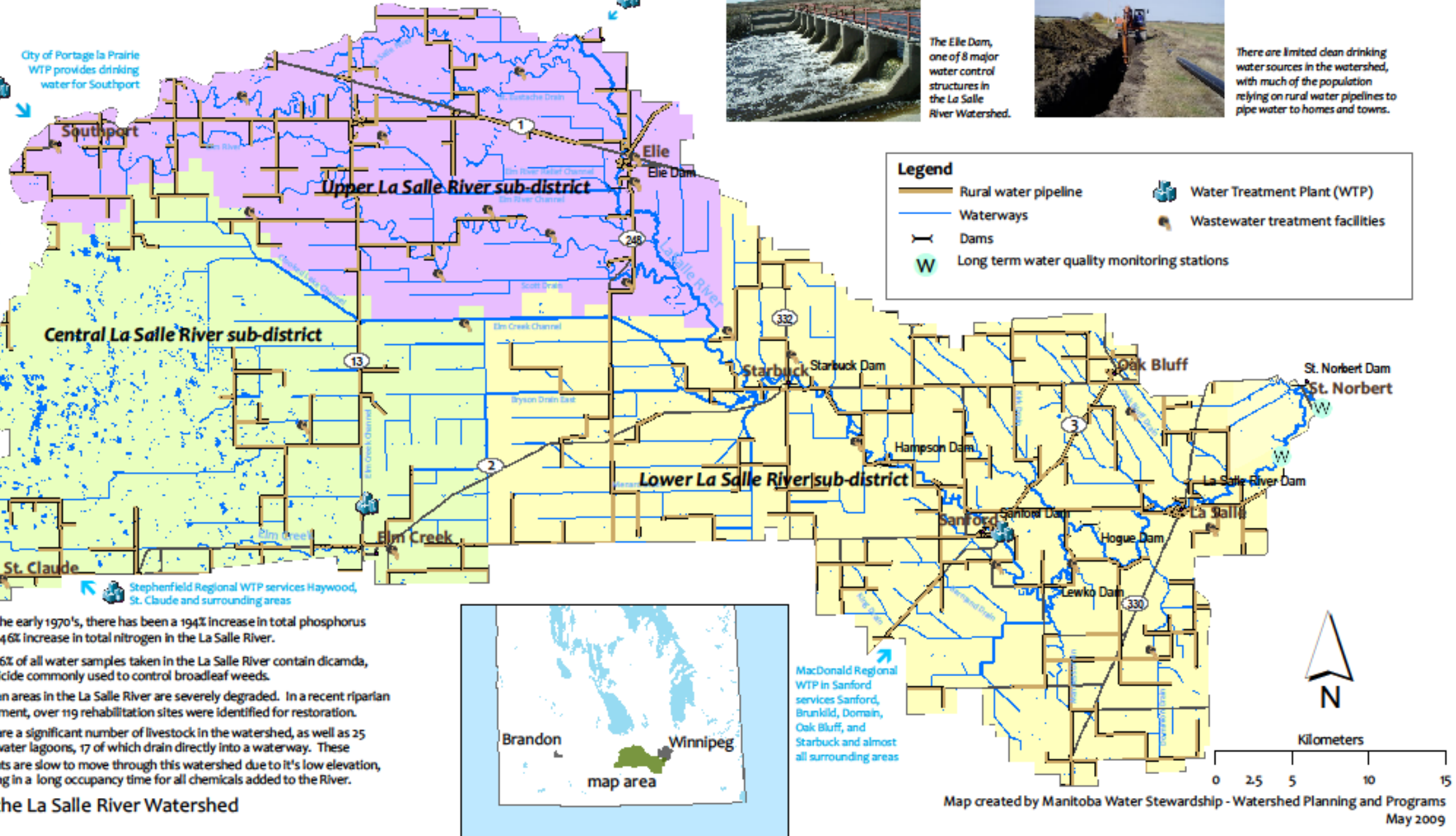
EXCELLENT
GOOD
FAIR
MARGINAL
POOR

The WQI for the LaSalle River is between fair and marginal

Why is it fair to marginal?

- Since the early 1970's, there has been a 194% increase in total phosphorus and a 146% increase in total nitrogen in the La Salle River.
- Over 36% of all water samples taken in the La Salle River contain dicamba, a herbicide commonly used to control broadleaf weeds.
- Riparian areas in the La Salle River are severely degraded. In a recent riparian assessment, over 119 rehabilitation sites were identified for restoration.
- There are a significant number of livestock in the watershed, as well as 25 wastewater lagoons, 17 of which drain directly into a waterway. These nutrients are slow to move through this watershed due to it's low elevation, resulting in a long occupancy time for all chemicals added to the River.

The Cartier Regional Water Distribution System services six rural municipalities; the RM of Cartier, RM of Portage la Prairie, RM of St. Francois Xavier, RM of Headingley, RM of Grey, and the RM of Rosser.



Hydrology and Groundwater

- On average, 70-75% of annual run off volume occurs in early March to end of May
- Over the last 41 of 50 years of recorded data, the annual peak flow occurred in April, during spring run off
- 76% of the surface water available for allocation has been allocated, of which three quarters is used for irrigation
- Aquifer sustainable yield estimates and groundwater allocation budgets have not been established for the La Salle River Watershed
- There are limited potable groundwater resources in the watershed
- The clay soils in the Red River Valley are not conducive to water infiltration to underlying aquifers



The Elie Dam, one of 8 major water control structures in the La Salle River Watershed.



There are limited clean drinking water sources in the watershed, with much of the population relying on rural water pipelines to pipe water to homes and towns.

Figure 3 - Water features of the La Salle River Watershed

Map created by Manitoba Water Stewardship - Watershed Planning and Programs
May 2009

Nutrient sources entering the La Salle River and affecting water quality include agricultural waste from commercial fertilizers and livestock manure, septic fields, wastewater treatment facilities, enhanced drainage, soil loss and erosion, and natural in-stream and watershed processes. Research determined that from 1974 to 1999, the average total nitrogen (TN) and total phosphorus (TP) concentrations increased by 146 percent and 193 percent respectively. Research also showed that in 2001, the La Salle River contributed 1.5 percent of the total nitrogen load and 1.3 percent of the total phosphorus load to the Red River.

2.4 Riparian Areas and Aquatic Ecosystems

The *La Salle River Watershed Assessment Survey* – initiated by La Salle Redboine Conservation District and completed in 2006 by North/South Consultants Inc. – determined qualitative classifications of channel morphology, bank stability and riparian zone function along approximately 262 kilometres of streams in the La Salle River Watershed. Based on these ratings, one of four aquatic habitat quality ratings was assigned to each stream reach with similar attributes.

The description of the classes used and results for the La Salle River Watershed are shown in Figure 4 below. The qualitative results of this assessment and the exceptionally high nutrient level increases seen over the last 30 years illustrate the very poor condition of the streams in the La Salle River Watershed. The survey also identified 119 potential restoration sites.

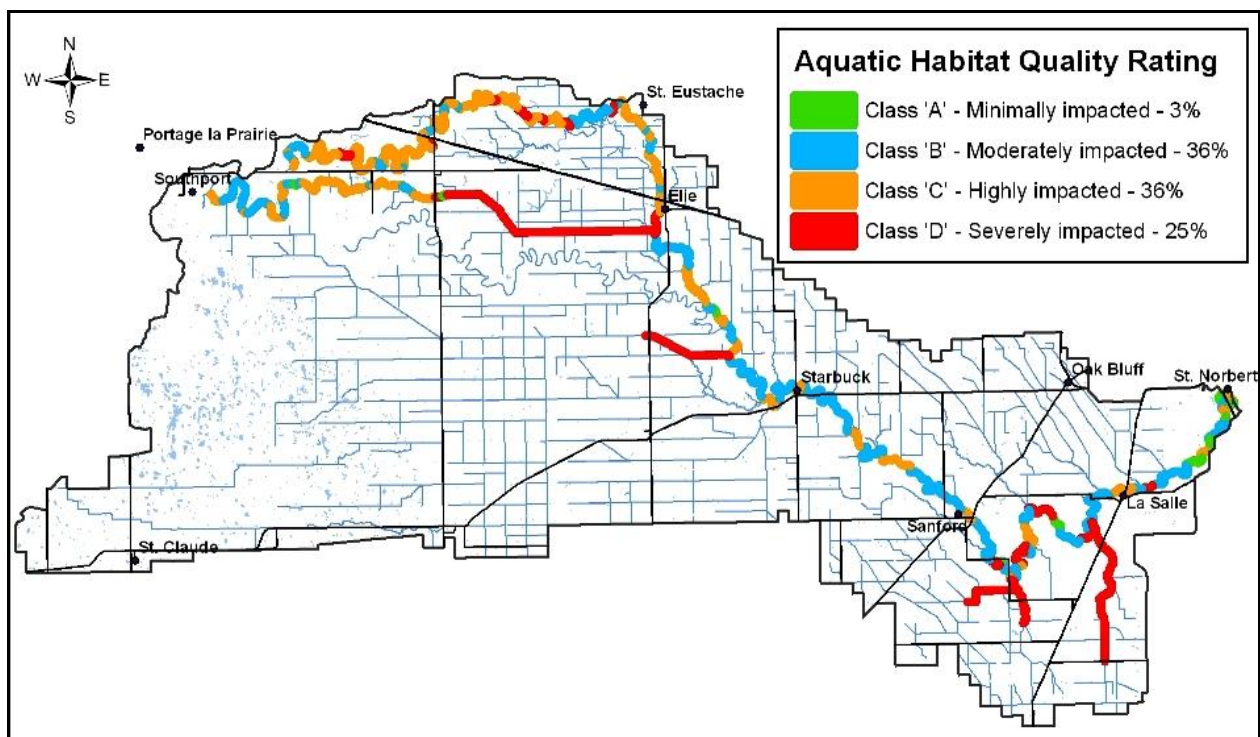


Figure 4. Aquatic Habitat Quality Ratings for the Major Streams in the La Salle River Watershed

Fish

The La Salle River is the main fish-bearing waterway in the watershed. The majority of the other waterways in this watershed are constructed drains. A recent watershed assessment focusing on fish, fish habitats and riparian areas in the La Salle River Watershed identified only 13 species currently in the La Salle river and its tributaries. The actual use of the La Salle River by fish is largely restricted due to

habitat suitability, water quality and a series of low-head dams that obstruct movement upstream from the Red River.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists three of the fish species potentially inhabiting the La Salle River Watershed as being of “special concern”: the bigmouth buffalo, the silver chub and the chestnut lamprey.



St. Norbert Dam

3.0 ISSUES

The Project Management Team held meetings involving local stakeholders and the Watershed Planning Advisory Team to identify and prioritize the issues and concerns in the watershed, and to suggest solutions that would form the basis for the goals, objectives and recommended actions.

Surface Water Management related issues:

- land clearing and drainage in headwaters of watershed
- timing and volume of flow in Elm Creek Channel
- flooding causing damages to properties, communities and cropland
- lack of foresight and co-ordination on drainage
- excess vegetation, soil erosion, blockages, slumping and slope failures in improperly maintained drains
- inadequate funding for proper maintenance of the provincial waterways infrastructure (i.e. drains, dams, crossings)
- enforcement of illegal drainage activities and license conditions
- outdated drainage standards for provincial waterways
- volume of water actually being used for irrigation
- wetland and pothole drainage/elimination - loss of natural water retention areas
- beaver dams



Water Quality Management related issues:

- water quality degradation
- overland flooding during heavy, summer rain events that carry nutrients, fertilizers, pesticides, animal manure and contaminants into waterways
- impact of livestock operations, livestock handling facilities and manure management
- municipal sewage lagoons and effluent releases
- insufficient water quality monitoring throughout watershed
- run-off from urban areas
- shallow, wide-diameter wells in the Lower Assiniboine Delta region – high vulnerability of contamination
- abandoned/improperly decommissioned wells

- observed decline in groundwater quality in RM of Grey
- number of potential threats of contamination to drinking water sources
- fall field application of manure and fertilizer – greater chance of run-off
- stagnant water in La Salle River in summer and fall (in dry years)
- suitability of water for cropland irrigation and livestock
- concentrations of Dicamba and MCPA (broadleaf herbicides) exceeding the water quality guidelines for irrigation
- incorporation of effective and sustainable water supply and wastewater management into all future developments
- provincial/federal programs (i.e. crop insurance) that are counter-productive to protecting water quality
- aging and deteriorating municipal and private wastewater treatment systems
- quality of water diverted into watershed from Assiniboine River at three pumping stations
- potential for cost increases for domestic water treatment or alternate water source
- potential threat of orphaned contaminated sites

Riparian Zone and Aquatic Ecosystem Management related issues:

- fallen trees in rivers that are restricting and blocking flow, causing further flooding and negative impacts on water quality
- river bank erosion and failure – threat to riverside properties and infrastructure
- limited river recreational opportunities (i.e. canoeing, snowmobiling) in some areas due to dead trees, debris and blockages in river

- poor aquatic habitat – recent study on aquatic habitat quality ratings for watershed showed high to severe impact on more than 60 per cent of streams
- excessive sediments restricting flow in La Salle River
- livestock operations near waterways and livestock's free access to streams
- residential development in flood-prone areas or riparian zones along the La Salle River
- loss of natural areas, wildlife habitats and wetlands
- lack of protection for habitats for endangered plant and animals
- anaerobic conditions in La Salle River in winter, which affects aquatic life

Watershed Awareness and Stewardship related issues:

- limited education available to residents to teach them more about their watershed and what they can do to protect, restore and enhance it
- limited funding opportunities for farming operations to make changes/improvements addressed in this plan, and the new legislation and regulations
- failure to compensate landowners for ecological goods and services they provide to society



4.0 VISION, GOALS AND OBJECTIVES

The vision, goals and objectives are based on the priority issues identified by the Watershed Planning Advisory Team and at public meetings throughout the planning process.

Vision

To have clean, safe and abundant water that sustains our vibrant local communities and a system of coordinated surface water management that respects current water users, agriculture, downstream residents and aquatic ecosystems

Goal 1

TO IMPROVE THE STATE OF SURFACE WATER MANAGEMENT IN TERMS OF ALLEVIATING DOWNSTREAM FLOODING AND ENSURING SUFFICIENT WATER IS AVAILABLE DURING DRY PERIODS

- a. Co-ordinate properly designed drainage works and activities by developing a surface water management plan and policies for the watershed
- b. Improve the provincial waterways infrastructure maintenance schedule
- c. Improve the drainage licensing process
- d. Develop water control and flood protection projects

Goal 2

TO PROTECT AND IMPROVE WATER QUALITY

- a. Reduce and eliminate point and non-point source pollution to waterways
- b. Minimize or eliminate the risk of contamination to drinking water sources

Goal 3

TO IMPROVE THE HEALTH OF THE RIVERS AND RIPARIAN AREAS

- a. Protect and enhance riparian habitat areas along the La Salle River
- b. Remove excess debris and garbage from the La Salle River

Goal 4

TO INCREASE PUBLIC PARTICIPATION IN WATERSHED STEWARDSHIP ACTIVITIES

- a. Provide watershed awareness, education and participation opportunities to the public

5.0 RECOMMENDED ACTIONS

Watershed stakeholders and the Watershed Planning Advisory Team recommended the following objectives and actions to meet the goals and achieve the vision for the watershed.

Acronyms:

- AAFC/AESB – Agriculture and Agri-Food Canada/Agri-Environment Services Branch
- CD – Conservation District
- MAFRI – Manitoba Agriculture, Food and Rural Initiatives
- MHHC – Manitoba Habitat Heritage Corporation
- MWS – Manitoba Water Stewardship
- MIT – Manitoba Infrastructure and Transportation

GOAL 1: TO IMPROVE THE STATE OF SURFACE WATER MANAGEMENT IN TERMS OF ALLEVIATING DOWNSTREAM FLOODING AND ENSURING THERE IS SUFFICIENT WATER AVAILABLE DURING DRY PERIODS

Objective 1A: Coordinate properly designed drainage works and activities by developing a surface water management plan and policies for the watershed

RECOMMENDED ACTION(S)	LEAD ORGANIZATION and PARTNERS	TIME FRAME
Establish a committee to develop the La Salle River Watershed's <i>Surface Water Management Plan</i> and policies to manage the issues outlined in Figure 5.	La Salle Redboine CD MWS – Water Control Systems Management MWS – Water Science and Management Branch MIT Planning Districts Municipalities MAFRI	2009-11

MEASURE OF SUCCESS

- The Surface Water Management Committee for the La Salle River Watershed is established.
- The Surface Water Management Plan for the La Salle River Watershed is completed.

ADDITIONAL TOOLS

Manitoba Water Stewardship's Water Science and Management Branch is developing an environmentally-friendly drainage manual that will be used as a guide in all future surface water management decisions. This manual is due for release in 2010.

Surface Water Management Plan and Policies in the La Salle River Watershed

LINKING LAND AND WATER

In November 2008, representatives from municipalities, Manitoba Water Stewardship and the LSRBCD met to identify issues and solutions related to surface water management. Admittedly not an inclusive list, the group identified 26 problem areas in the watershed as shown on the map.

In 2006, the LSRBCD completed the La Salle River Watershed Assessment Survey which identified 119 riparian rehabilitation project sites in the watershed. In addition, 26 problem areas were identified. The LSRBCD will continue to work with BPC and other stakeholders to address all of the identified projects.

Surface water management policies for the two distinct regions of the La Salle River Watershed were developed with consideration for the agricultural capability, soil characteristics, drainage limitations, land use and topography. The two regions are the Red River Valley and Lower Assiniboine Delta.

Red River Valley Region

This region is characterized by soils with high agricultural capability, little change in topography, and poor natural drainage. Surface water management policies in this region include:

- Drainage projects shall be planned and executed so that projects in one area do not adversely affect another area
- Drainage projects which service more land area will receive higher priority over projects providing benefit to a small area
- Drainage projects will be planned and executed with consideration for wetland areas, fish habitat and downstream water quality
- Wetland areas shall be protected and managed as such
- Landowners shall be provided with incentives to protect and restore riparian areas along the La Salle River
- Debris, rocks and garbage shall be removed from the La Salle River

Lower Assiniboine Delta Region

This region is characterized by greater topographic changes and more limitations to agriculture.

Surface water management policies in this region include:

- Water retention, and control and timing of runoff, shall be promoted as part of watershed management
- Protection of wetlands shall be a consideration in planning and developing drainage projects
- Maintenance of existing drainage systems shall be of higher priority than reconstruction
- No new or upgrade drainage projects

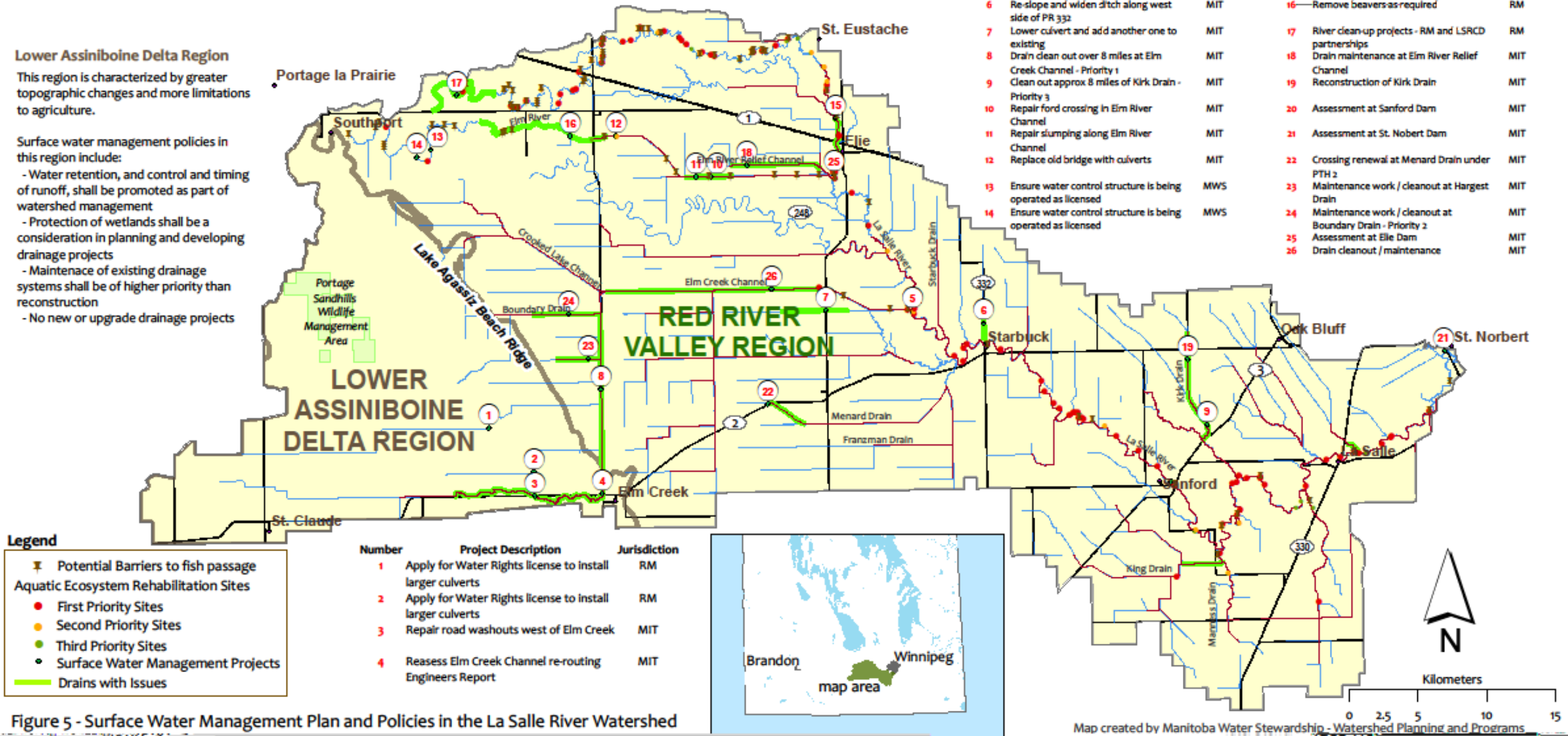


Figure 5 - Surface Water Management Plan and Policies in the La Salle River Watershed

May 2009

Objective 1B: Improve the provincial waterways infrastructure maintenance schedule.

RECOMMENDED ACTION(S)	LEAD ORGANIZATION and PARTNERS	TIME FRAME
Involve the La Salle Redboine CD in the development and review of the annual works and maintenance schedule for the provincial waterways infrastructure.	MWS - Water Control Systems Management MIT La Salle Redboine CD	2009-16
Conduct an assessment report of all the licensed water control structures in the La Salle River Watershed.	Manitoba Infrastructure and Transportation MWS - Water Control Systems Management	2009-12
Develop a detailed surface water management pilot project (drainage plan) in a representative sub-watershed in the La Salle River Watershed.	MWS - Water Control Systems Management MIT La Salle Redboine CD	2009-12

MEASURE OF SUCCESS

- La Salle Redboine CD is consulted in the development of the provincial waterways infrastructure maintenance schedule.
- The number of kilometers of provincial waterways maintained per year (based on a recent five-year average) has not decreased.
- The number of provincial and municipal crossings maintained and replaced per year (based on a recent five-year average) has not decreased.
- An assessment report of all the water control structures in the La Salle River Watershed is completed.
- The sub-watershed drainage plan is completed.
- Funding for the provincial waterways infrastructure has not decreased.

Objective 1C: Improve the drainage licensing process.

RECOMMENDED ACTION(S)	LEAD ORGANIZATION and PARTNERS	TIME FRAME
Involve the La Salle Redboine CD in the review process of water rights license applications that propose new drains or drainage upgrades in the watershed.	MWS - Water Control Systems Management La Salle Redboine CD	2009-16
Ensure Manitoba Water Stewardship's Water Resource Officers are available to distribute drainage work applications for review and assessment; investigate drainage works; follow up on and enforce conditions applied to approved licenses; and make water rights license application forms and contact numbers easy to obtain.	MWS - Water Control Works and Drainage Licensing Municipalities La Salle Redboine CD MIT	2009-16
MEASURE OF SUCCESS		

- La Salle Redboine CD is providing input and comments on water rights license applications that have proposed new drains and drainage upgrades in the watershed.
- Water Resource Officers are investigating drainage works and enforcing conditions applied to water rights licenses.
- There have been fewer complaints about the drainage licensing process, based on observations from Water Resource Officers and local municipalities.

Objective 1D: Develop water control and flood protection projects

RECOMMENDED ACTION(S)	LEAD ORGANIZATION and PARTNERS	TIME FRAME
Identify and develop water control/retention projects in the Central La Salle River sub-district.	La Salle Redboine CD MWS - Water Control Systems Management MIT Municipalities	2009-16
Construct ring dikes at specific locations in the Central La Salle River sub-district to protect rural residences from flooding.	Municipalities La Salle Redboine CD MWS – Water Control Systems Management	2009-12
Protect and enhance wetlands in the Central La Salle River sub-district with financial incentives and conservation agreements.	La Salle Redboine CD MHHC Ducks Unlimited Canada MWS – Planning and Coordination	2009-16
Conduct an analysis of the flooding issues at the Elm Creek Channel and determine the most achievable and beneficial options to deal with the concerns.	MIT MWS - Water Control Systems Management La Salle Redboine CD Municipalities	2009-12
Develop digital maps of flood-prone and spring/summer flooding areas in the watershed.	La Salle Redboine CD MWS - Water Control Systems Management	2009-12

MEASURE OF SUCCESS

- Losses from flooding will decrease based on current and historical loss benchmarks.
- Water is held back in water control/retention projects throughout the watershed.
- Agriculture and Agri-Food Canada's census data from 2006 shows no net loss of wetlands.

GOAL 2. TO PROTECT AND IMPROVE WATER QUALITY

Objective 2A: Reduce and eliminate point and non-point source pollution to waterways

RECOMMENDED ACTION(S)	LEAD ORGANIZATION and PARTNERS	TIME FRAME
Provide incentive programs for producers to implement beneficial management practices that reduce or eliminate excess nutrients from entering waterways.	La Salle Redboine CD MAFRI AAFC/AESB MHHC Ducks Unlimited Canada	2009-16
Conduct scientific research on the options for the disposal of nutrient-rich, municipal lagoon wastewater	MWS - Water Science and Management	2009-10
Provide agriculture-extension programs to help producers assess the environmental risk of their operations and encourage soil testing.	MAFRI AAFC/AESB	2009-16
Encourage the establishment and maintenance of permanent cover along waterways to minimize soil loss and stream bank erosion.	La Salle Redboine CD MAFRI MHHC Municipalities	2009-16
Continue the long-term, water quality monitoring programs and support additional water quality related research.	MWS - Water Science and Management La Salle Redboine CD Municipalities	2009-10
Develop feasible science-based targets for nutrient concentration reductions necessary for the La Salle River.	MWS - Water Science and Management La Salle Redboine CD	2009-12

MEASURE OF SUCCESS

- Nutrient loading to the La Salle River has decreased (nitrogen by 13 per cent; phosphorus, by 10 per cent).
- The Water Quality Index has not decreased.
- The number of beneficial management practices implemented throughout the watershed.
- Alternate practices for disposing of nutrient-rich, municipal lagoon wastewater are being implemented, based on recommendations from Manitoba Water Stewardship.
- Livestock manure is not applied to areas prone to spring/summer flooding.
- The long-term water quality monitoring program is continuing.

Objective 2B: Minimize or eliminate the risk of contamination to drinking water sources

RECOMMENDED ACTION(S)	LEAD ORGANIZATION and PARTNERS	TIME FRAME
Establish a Source Water Protection Committee to identify threats and assess the risk of contamination to the two public drinking water sources in the watershed.	La Salle Redboine CD MWS - Office of Drinking Water MWS – Groundwater Management MWS – Watershed Planning and Programs Municipalities	2009-16
Target source water protection programming and activities to the areas around, and upstream of, the two drinking water source intakes at Sanford and Elm Creek (see Figures 6 and 7).	La Salle Redboine CD Municipalities MWS - Watershed Planning and Programs MHHC MAFRI AAFC/AESB	2009-10
Seal abandoned wells.	Well Owners La Salle Redboine CD	2009-16
Encourage all owners of private wells to perform well assessments, implement wellhead protection measures and have well water tested annually.	La Salle Redboine CD MWS - Office of Drinking Water MWS - Groundwater Management Municipalities	2009-16

MEASURE OF SUCCESS

- A Source Water Protection Committee has been established.
- Source water protection programming is being implemented in the target areas of each drinking water source in the watershed.
- Municipalities realize the important role and influence they have in managing land use and development activities in source water protection areas, and are making the necessary additions to their development plans and zoning bylaws.
- The source water quality at Sanford and Elm Creek water treatment plants has not decreased.
- The number of abandoned wells sealed.
- Owners of private wells are making wellhead protection improvements and having their well water tested annually.

Source Water Protection in the La Salle River Watershed

Source Water Protection

Clean, potable drinking water is critical for human life and, therefore, a necessity for prosperous sustainable communities. Protecting water at its source, or before it arrives at our treatment facilities, is a preventative approach to water management. It is more ecologically responsible and may be less expensive and to prevent contamination to our source waters, than to try and remediate water quality in treatment facilities.

Source water protection provides benefits to watersheds beyond those realized at the water treatment plant. Clean water benefits aquatic ecosystems, supports recreational and wildlife values, and ensures sustainability for future generations. Source water protection fits well within the integrated watershed management framework as it pulls from a wide knowledge base spanning hydrogeology, land use planning, water quality, municipal infrastructure and industry as well as relying heavily on local knowledge for describing area conditions and implementing actions.

The approach to source water protection planning varies widely across Canada. Manitoba has adopted a 'grassroots' approach to source water protection. A source water assessment is conducted with a group of local, technical and non-technical representatives and their recommendations are placed within an integrated watershed management plan. This locally-led approach to protecting drinking water sources is inline with the shared governance model adopted for soil and water management across municipal Manitoba through the Conservation Districts program. The process is quick, easy to follow and relies primarily on the common sense of a small group of people.

Public Drinking Water Sources

In Manitoba, the Office of Drinking Water defines a public water system as a potable supply of drinking water with 15 or more connections. The La Salle River watershed contains two public drinking water systems, one which withdraws water from a groundwater source, and one that obtains water from the La Salle River.

Source Water Assessments

Source water assessments were conducted around the two public drinking water sources in the La Salle River watershed. This process includes creating maps that display potential source water threats, land cover and local infrastructure. This is done within the source water protection zone; a 1.5 kilometer buffer around the public water system well, or sub watershed of a surface water source. Information to create these maps is drawn from provincial databases that may not be updated with current information. Potential pollutant sources examined in this assessment include:

- Roadways
- Wastewater treatment plants
- Manure storage areas
- Railways
- Oil Wells
- Contaminated sites
- Chemical, fuel, petro-chemical storage locations
- Industry
- Mining operations
- Waste disposal sites
- Agricultural drains
- Population centres

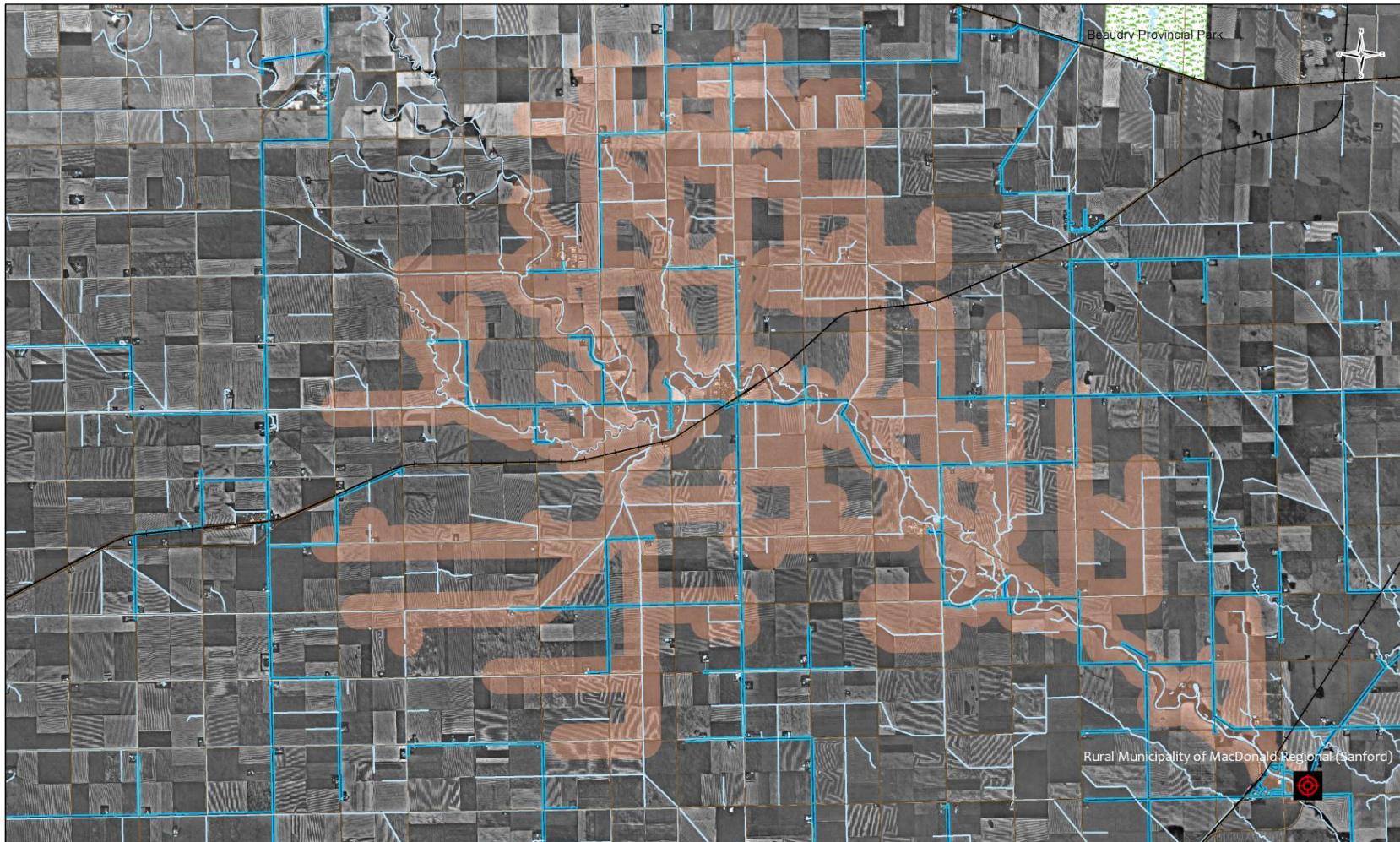
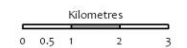
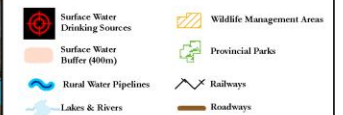
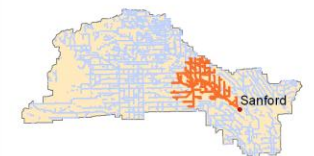


Figure 6. Public drinking water supply for the town of Sanford

The orthophoto illustrates land use within 40 km with a 400m buffer of the surface sources. There are many land use activities within the source water protection zone that impact the quality of the source water received at Sanford.



La Salle River Watershed



Date: 2009/07/13
Projection: UTM, NAD83, Zone 14



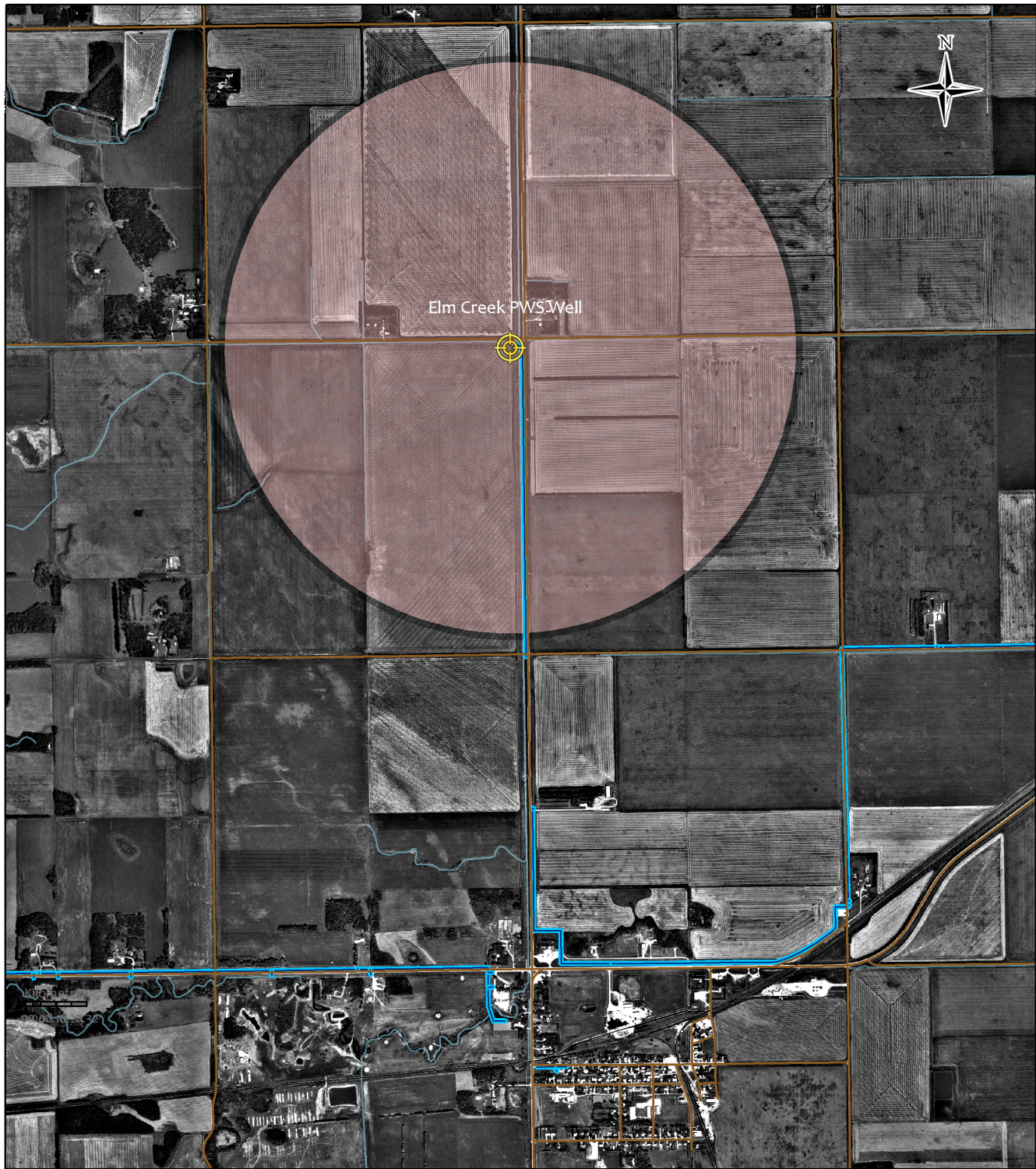

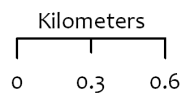


Figure 7. Public drinking water supply for the town of Elm Creek

- | | | | |
|---|--------------------------|---|--|
|  | Public Water System Well |  | Source Water Protection Area (1.5 km buffer) |
|  | Rural Water Pipelines |  | Roadways |
|  | Lakes & Rivers |  | Railways |



La Salle River Watershed



Date: 20090617

Projection: UTM, NAD83, Zone 14



GOAL 3. TO IMPROVE THE HEALTH OF THE RIVERS AND RIPARIAN AREAS

Objective 3A: Protect and enhance riparian habitat areas along the La Salle River

RECOMMENDED ACTION(S)	LEAD ORGANIZATION and PARTNERS	TIME FRAME
Use Conservation Agreements, and other financial and technical assistance programs, to secure existing, critical riparian areas and rehabilitate degraded riparian areas along the La Salle River.	La Salle Redboine CD MHHC MAFRI MWS – Watershed Planning and Programs AAFC/AESB	2009-16
Investigate the feasibility of an ecological goods and services-type program, and the provision of tax credits to landowners who protect or restore critical riparian areas.	La Salle Redboine CD MHHC MWS Municipalities MAFRI Ducks Unlimited Canada	2009-11
Undertake riparian rehabilitation projects identified in the La Salle River Watershed Assessment Survey – 2006 (see Figure 5).	La Salle Redboine CD MHHC Municipalities	2009-16
Develop municipal zoning bylaws that would restrict certain development activities in riparian areas.	Municipalities La Salle Redboine CD Manitoba Local Government – Community Planning Services	2009-12
Provide local communities with information on nuisance and invasive species, and how to control them and stop them from spreading into other areas.	La Salle Redboine CD MAFRI Invasive Species Council of MB MWS - Water Science and Management Ducks Unlimited Canada	2009-11

MEASURE OF SUCCESS

- There has been an increase in the area of critical riparian habitat secured along the La Salle River.
- An ecological goods and services-type program is being provided to landowners to protect and restore critical riparian areas.
- At least five riparian rehabilitation projects from the La Salle River Watershed Assessment Survey are completed each year.
- Municipalities realize the benefits of protecting and restoring riparian areas and are making the necessary additions to their municipal development plans and zoning bylaws.
- Based on observations from the municipal works foreman and local Weed District Officers, the presence of nuisance and invasive species has decreased.

Objective 3B: Remove excess debris and garbage from the La Salle River

RECOMMENDED ACTION(S)	LEAD ORGANIZATION and PARTNERS	TIME FRAME
Remove debris obstructions from the La Salle River at sites that may damage crossing infrastructure or cause overland flooding.	La Salle Redboine CD MIT Municipalities Department of Fisheries and Oceans	2009-16
Encourage and support local communities in undertaking La Salle River clean-up events.	La Salle Redboine CD Municipalities MHHC MWS	2009-10
MEASURE OF SUCCESS		

- The majority of the debris obstructions in the La Salle River have been cleaned up.
- Local communities have adopted annual river clean-up events throughout the watershed.

All organizations working in waterways must contact Fisheries and Oceans Canada to inform them of proposed in-stream work, to ensure aquatic communities that rely on woody debris habitat are maintained.



GOAL 4. TO INCREASE PUBLIC PARTICIPATION IN WATERSHED STEWARDSHIP ACTIVITIES

Objective 4a. Provide watershed awareness, education and participation opportunities to the public

RECOMMENDED ACTION(S)	LEAD ORGANIZATION and PARTNERS	TIME FRAME
Provide watershed management education to local communities and schools through presentations, fact sheets, literature, newspaper articles and public service announcements.	La Salle Redboine CD Schools MHHC Ducks Unlimited Canada	2009-16
Build the capacity of municipal governments, organizations and residents by sponsoring land and water management related workshops and field tours, and incorporating watershed management presentations into municipal conferences and agriculture-extension events.	La Salle Redboine CD MAFRI MWS MHHC Ducks Unlimited Canada AAFC/AESB	2009-16
Develop watershed educational/ interpretive highway rest-stops at locations throughout the watershed.	La Salle Redboine CD MIT MWS Ducks Unlimited Municipalities	2009-16
Maintain the La Salle Redboine CD website as a valuable information source for watershed management activities, local stewardship opportunities and plan implementation progress.	La Salle Redboine CD Municipalities	2009-16

MEASURE OF SUCCESS

- Watershed residents are aware of existing opportunities to improve their watershed and are participating in watershed stewardship activities.
- La Salle Redboine CD is a well respected and valued organization and is seen as the “steward” of the La Salle River.
- Three new watershed educational/interpretive highway rest-stop sites have been developed.
- La Salle Redboine CD is operating a very useful and informative website (www.lasalleredboine.com).



6.0 WATERSHED POLICIES

The Water Planning Authority will promote and encourage the following watershed policies for the La Salle River Watershed:

1. Technical assistance and financial incentive programs should be available to encourage beneficial management practices that conserve wildlife and riparian habitat, and protect and enhance water quality and aquatic ecosystems.
2. Water quality protection programming and activities should be given the highest priority in designated, source water protection zones.
3. Water storage/retention projects, including wetland conservation, should be incorporated into water management planning as a way of slowing down runoff, reducing flooding and erosion, improving water quality, providing wildlife habitat and recharging groundwater.
4. Maintenance of existing drains will receive priority over reconstruction upgrades or new drains, and maintenance will be conducted in a way that minimizes any impact on water quality and aquatic habitat.
5. Land subject to serious flooding or not flood-protected, should be left in a natural state, enhanced as a water storage/retention site or developed for recreational purposes.

7.0 IMPLEMENTATION

Implementing the plan for the La Salle River Watershed involves a co-ordinated and co-operative effort by a large group of watershed stakeholders.

These stakeholders include:

- landowners
- municipal governments
- La Salle Redboine Conservation District
- community groups and local associations
- local businesses
- planning districts
- provincial government
- federal government

Watershed stakeholders must work together to achieve these shared goals for the watershed, and endeavor to report back to the Water Planning Authority on their progress.

The La Salle Redboine CD is expected to play a significant role in the implementation of this plan. The district currently receives an annual grant from Manitoba Water Stewardship and its municipal partners. La Salle Redboine CD is a non-profit, charitable organization, and is able to acquire additional money from other available funding programs.

The Water Planning Authority will do an annual review of the plan to ensure its successful implementation and relevance in meeting the goals for the watershed. The Water Planning Authority will also celebrate implementation successes, and recognize landowners and organizations that participate in improving the health and sustainability of the watershed.

Appendix B lists some general activities that watershed residents can adopt to protect, conserve and restore the health of the La Salle River Watershed.

APPENDIX A: WATERSHED PLANNING ADVISORY TEAM – MEMBERSHIP LIST

Community groups and local associations

Assiniboine Community College
Bon Homme Colony
Community of Sanford
Club Snow - Portage la Prairie
Community of Elm Creek
Community of Fannystelle
Community of Haywood
Community of La Salle
Community of Oakville
Dairy Farmers of Manitoba
Domain Recreation Club
Elm River Colony
Grand Colony
James Valley Colony
Keystone Agricultural Producers
La Salle District Chamber of Commerce
Manitoba Canola Growers Association
Milltown Colony
Nature Conservancy of Canada
Organic Producers Association
Portage Economic & Community Dev.
Prairie Spirit School Division
Rivers West
RM of Cartier
RM of Ritchot
Rosedale Colony
Sanford Collegiate
Snoflies - Carman & Area
Vermillion Colony
White Plains Recreation District
White Plains Crop Improvement Assoc.
Central Manitoba Resource Management

Brant Wood Colony
Cross Country Snow Drifters, RM
Macdonald
Central Plains/White Plains Regional Dev.
Community of Springstein
Community of St. Claude
Community of St. Eustache
Community of St. Norbert
Community of Starbuck
Homewood Colony
Huron Colony
Iberville Colony
International Erosion Control Assoc - NPC
Manitoba Cattle Producers Association
Manitoba Pork Council
Manitoba Pulse Growers Association
Manitoba Zero Tillage Research Assoc.
Portage la Prairie School Division
Portage Planning District
Prairie Fruit Growers Association
Prairie Rose School Division
RM of Grey
RM of Macdonald
RM of Portage
St. Claude Game & Fish
Starlite Colony
Sunnyside Colony
Vegetable Growers Association of Manitoba
Waldhiem Colony
White Plains Crop Improvement Association
Winnipeg Naturalist Services Branch

Science and technical support agencies

Agriculture and Agri-Food Canada – Agri-
Environment Services Branch
Conservation Data Centre
Delta Marsh Field Station
Ducks Unlimited Canada
Manitoba Conservation – Geomatics &
Remote Sensing / Environmental
Operations, Wildlife & Ecosystem Protection
Manitoba Local Government
Manitoba Infrastructure and Transportation

Manitoba Agriculture, Food and Rural
Initiatives (MAFRI)
Environment Canada
Fisheries and Oceans Canada
Manitoba Habitat Heritage Corporation
(MHHC)
Manitoba Water Stewardship – Ecological
Services / Regulatory & Operational
Services
Manitoba Innovation, Energy & Mines
Manitoba Water Services Board

APPENDIX B: LOCAL PARTICIPATION TO PROTECT AND IMPROVE THE HEALTH OF THE LA SALLE RIVER WATERSHED

All watershed residents can play a role in ensuring the long-term health and sustainability of the La Salle River Watershed.

Here are some suggestions on how you can help:

At Home:

Use low phosphorus or phosphate-free detergents, soaps and household cleaners.

- Protect natural riparian vegetation.
- Remove garbage and debris from the river and river banks.
- Initiate and organize an annual river clean-up or tree planting day within your community.
- Ensure that your septic system is functioning properly and is serviced on a regular basis.
- Don't apply fertilizers or grass clippings/yard debris next to waterways.
- Seal your abandoned well(s).
- If your water comes from a well, have it tested annually.
- Use energy and water-efficient fixtures/appliances to reduce water consumption.
- Find out where your drinking water comes from.

On the Farm:

- Ensure farm drainage is licensed and constructed following proper design principles of 'no net increase of nutrients to waterways' and 'no destruction of aquatic habitat.'
- Control drainage from your property to eliminate any potential flooding threat to downstream neighbours.
- Value and maintain wetlands as essential parts of the landscape puzzle.
- Don't apply fertilizers or livestock manure next to waterways.
- Keep livestock and manure storage sites away from waterways and out of flood-prone areas.
- Consider applying fertilizer in the spring, rather than the fall, to reduce losses from flooding and runoff.
- Incorporate Phytase into your swine and poultry feed.
- Consider building a short-term water retention project on your property.
- Base your application of fertilizer/manure on soil test results and on the needs of your crops.
- Establish and maintain some grass cover along waterways to help reduce erosion, catch sediment and provide wildlife habitats.

APPENDIX C: GLOSSARY

Aquatic ecosystem – the components of the earth related to, living in or located in or on water or the beds or shores of a water body, including but not limited to:

- a) all organic and inorganic matter
- b) all living organisms and their habitat, and their interacting natural systems

Beneficial Management Practice (BMP) – a practical solution used to deal with soil and water conservation concerns, including techniques used to manage agricultural and urban runoff and modify agricultural waste management

Drinking water source – raw, untreated water in the environment that is used to supply a drinking-water system as defined in *The Drinking Water Safety Act*

Ecological goods and services – natural services that healthy ecosystems provide to society such as the purification of air and water, water supply, raw materials (timber), recreation, habitat, scenery, waste treatment, climate stabilization, erosion control and sediment retention, regeneration of soil fertility, soil formation, carbon storage, biological control and pollination

Non-point source pollution – pollution that cannot be traced to a single site or source (It is often characterized by garbage, trash, fertilizers, oils, pesticides and other waste and debris.)

Point source pollution – pollution from a single identifiable source, such as a wastewater effluent pipe discharging into a river

Provincial Land Use Policies (PLUPs) – a set of policies describing the provincial interest in sustainable land use and development (Local planning authorities use them as a guide when preparing their development plans.)

Riparian area – an area of land adjacent to a waterbody or watercourse that is saturated by groundwater or intermittently inundated by surface water at a frequency or duration sufficient to support the prevalence of vegetation typically adapted for life in saturated soil

Stakeholder – a person (or group) who is responsible for making or implementing a management action, who will be affected by the action, or who can aid or prevent its implementation

Water control works – any dike, dam, surface or sub-surface drain, drainage, improved natural waterway, canal, tunnel, bridge, culvert borehole or contrivance for carrying or conducting water, that:

- a) temporarily or permanently alters or may alter the flow or level of water, including water in a waterway or waterbody, by any means, including drainage
- b) changes or may change the location or direction of flow of water, including water in a waterway or waterbody, by any means, including drainage

Waterway – any landscape feature (natural or artificial) that continuously or intermittently transports water on the earth's surface, including headwater, rivers, creeks, channels, streams and drains

Water Quality Index (WQI) – a means of summarizing large amounts of data into simple terms for reporting to management and the public in a consistent manner.

It is calculated using 25 water quality variables and combines the scope, frequency and amplitude that variables exceed the water quality objectives and guidelines. The Water Quality Index ranges from 0 to 100 and is used to rank water quality into categories ranging from poor to excellent. Similar to the UV index or an air quality index, it can tell us whether the overall quality of water bodies poses a potential threat to various uses of water, such as habitat for aquatic life, irrigation water for agriculture and livestock, recreation and aesthetics, and drinking water supplies.

Zoning Bylaw – a detailed document (text and maps) used by a planning authority (municipality or planning district) to implement development plan policies (A zoning bylaw works by regulating land use and development to ensure that it is consistent with the objectives and policies of the development plan.)