Section 5.0 – Water Resources

Section 5.3 - Surface Water Quality of the La Salle River (Source: Manitoba Water Stewardship)

The La Salle River Watershed from a Water Quality Perspective.

A number of reports/studies have been conducted over the last 25 years examining the surface water quality within the La Salle River watershed. These can be summarized as follows:

- A CONDUCTIVITY STUDY ON THE LA SALLE RIVER, 1980-81. Williamson D. A. Winnipeg: Department of Environment. 1982
- A PRELIMINARY INVESTIGATIONINTO THE PRESENCE OF AGRICULTURAL PESTICIDES IN THE LA SALLE AND ASSINIBOINE RIVERS, MANITOBA, CANADA. Williamson, D. A. Winnipeg, Manitoba Environment. 1984
- CONTAMINATION BY PESTICIDES OF THE LA SALLE AND ASSINIBOINE RIVERS, MANITOBA, CANADA Therrien-Richards, S and D. A. Williamson. Ottawa, Environment Canada and Manitoba Environment and Workplace Safety and Health. 1987.
- AN ASSESSMENT OF PESTICIDE RESIDUES IN SURFACE WATERS OF MANITOBA, CANADA. Curry R. S. and D. A. Williamson. Winnipeg, Manitoba Environment. 1995.
- A POST-HOC ASSESSMENT OF THE ASSINIBOINE-LA SALLE RIVER DIVERSION PROJECT. Lowman, Lisa. Winnipeg. Man. University of Manitoba. 2001
- LONG – TERM TRENDS IN TOTAL NITROGEN AND TOTAL PHOSPHORUS CONCENTRATIONS IN MANITOBA STREAMS. Jones G and N. Armstrong Winnipeg, Manitoba Conservation. 2001.
- A PRELIMINARY ESTIMATE OF TOTAL NITROGEN AND TOTAL PHOSPHORUS LOADING TO STREAMS IN MANITOBA, CANADA. Bourne A., N. Armstrong, and G. Jones. Winnipeg, Manitoba Conservation. 2002.

The Water Quality Management Section maintains a province-wide monitoring program that provides information on long term trends in surface water quality. There is currently one long-term monitoring station within the La Salle River watershed as well as other monitoring stations established for short term projects (Table 1).

Table 1: Water quality monitoring stations within the watershed area.

EMS Station Number	Location for La Salle River Stations	Period	Frequency

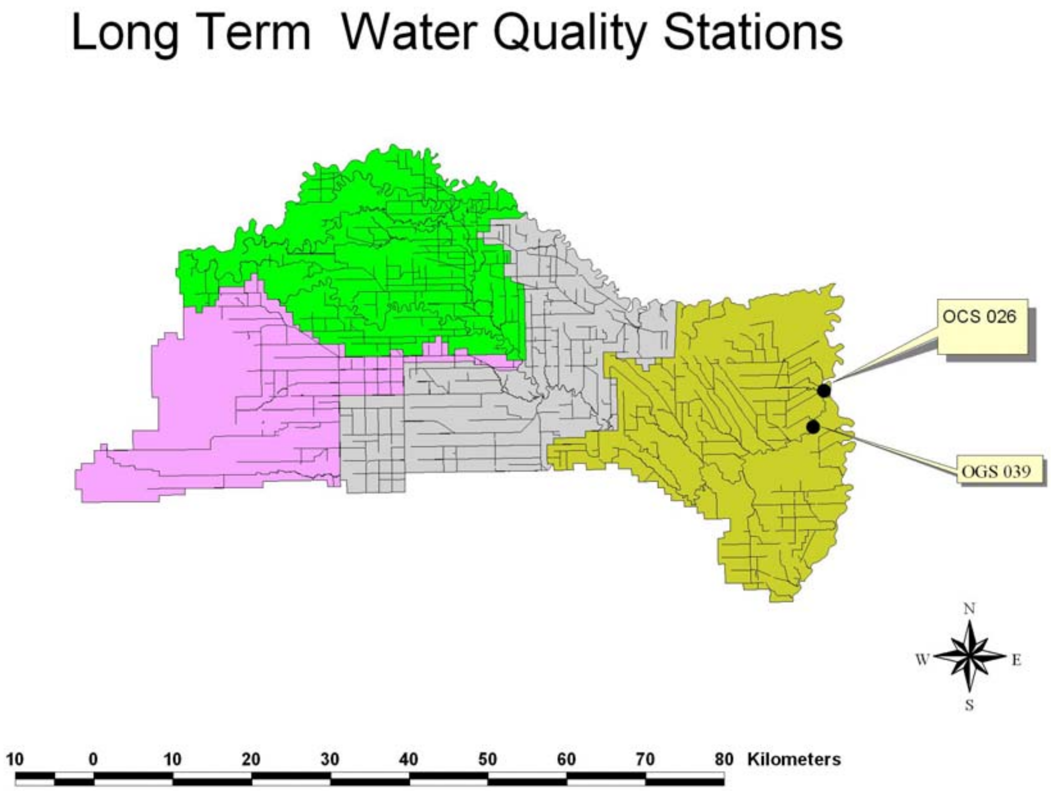
Section 5.0 – Water Resources

Long Term Water Quality Stations			
MB05OCS026	Upstream of Hwy 75 Bridge	Apr-Nov 1973-77 July-Oct 1988 Jan-Oct-1989-94 Jan-Oct 1995 Jan-Oct 1996 Jan-Oct 1997 Jan-Oct 1998 Apr-Sept 1999	3-4 samples/yr 2 samples/yr 4 samples/yr 12 samples/yr 17 samples/yr 8 samples/yr 11 samples/yr 3 samples/yr
MB05OGS039	Downstream of LaBarriere Dam	Aug-Dec 1984 Jan-June 1985 Jan-Oct 2000-05	6 samples/yr 7 samples/yr 4 samples/yr

The long term monitoring station (MB05OCS026) is located close to the La Salle River outlet to the Red River in Saint Norbert (Figure 1). This site was located as far as possible downstream to capture the cumulative upstream inputs affecting water quality within the watershed. The location was moved slightly upstream to the LaBarriere Dam (MB05OGS039) in 2000 because of backwater impacts at the original site during high flows on the Red River. Water samples are collected and analysed for a wide range of variables at the long-term monitoring station and the water quality status is summarized with the Water Quality Index.

Section 5.0 – Water Resources

Figure 1: Location of long term monitoring stations in the La Salle River Watershed.-



The Canadian Council of Ministers of the Environment (CCME) Water Quality Index is used to summarize large amounts of water quality data into simple terms (e.g., good) for reporting in a consistent manner. Twenty-five variables are included in the Water Quality Index (Table 2) and are compared with water quality objectives and guidelines contained in the Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson 2002 and Table 2).

Table 2. Water quality variables and objectives or guidelines (Williamson 2000, Williamson 1988) used to calculate Water Quality Index (CCME 2000).

Variables	Units	Objective Value	Objective Use
Fecal Coliform MF	**Bacteria/100mL**	**200**	**Recreation**
Ph	**Ph Units**	**6.5-9.0**	**Aquatic Life**
Specific Conductivity	**uS/cm**	**1000**	**Greenhouse Irrigation**
Total Suspended Solids	**mg/L**	**25 (mid range)**	**Aquatic Life**

Dissolved Oxygen	**mg/L**	**5 (mid range)**	**Aquatic Life**
Total or Extractable Cadmium*	**mg/L**	**Calculation based on Hardness (7Q10)**	**Aquatic Life**
Total or Extractable Copper*	**mg/L**	**Calculation based on Hardness (7Q10)**	**Aquatic Life**
Total Arsenic	**mg/L**	**0.025**	**Drinking Water, Health**
Total or Extractable Lead*	**mg/L**	**Calculation based on Hardness (7Q10)**	**Aquatic Life**
Dissolved Aluminum	**mg/L**	**0.1 for pH >6.5**	**Aquatic Life**
Total or Extractable Nickel*	**mg/L**	**Calculation based on Hardness (7Q10)**	**Aquatic Life**
Total or Extractable Zinc*	**mg/L**	**Calculation based on Hardness (7Q10)**	**Aquatic Life**
Total or Extractable Manganese	**mg/L**	**0.05**	**Drinking Water, Aesthetic**
Total or Extractable Iron	**mg/L**	**0.3**	**Drinking Water, Aesthetic**
Total Ammonia as N	**mg/L**	**Calculation based pH**	**Aquatic Life**
Soluble or Dissolved Nitrate-Nitrite	**mg/L**	**10**	**Drinking Water, Health**
Total Phosphorus	**mg/L**	**0.05 in Rivers or 0.025 in Lakes**	**Nuisance Plant Growth**
Dicamba	**ug/L**	**0.006 ug/L where irrigation is a use of the waterbody, otherwise 10 ug/L for the protection of Aquatic Life within the waterbody**	**Irrigation**
Bromoxynil	**ug/L**	**0.33**	**Irrigation**
Simazine	**ug/L**	**0.5**	**Irrigation**
2,4 D	**ug/L**	**4**	**Aquatic Life**
Lindane	**ug/L**	**0.08**	**Aquatic Life**
Atrazine	**ug/L**	**1.8**	**Aquatic Life**
MCPA	**ug/L**	**0.025 ug/L where irrigation is a use of the waterbody, otherwise 2.6 ug/L for the protection of Aquatic Life within the waterbody**	**Irrigation**
Trifluralin	**ug/L**	**0.2**	**Aquatic Life**

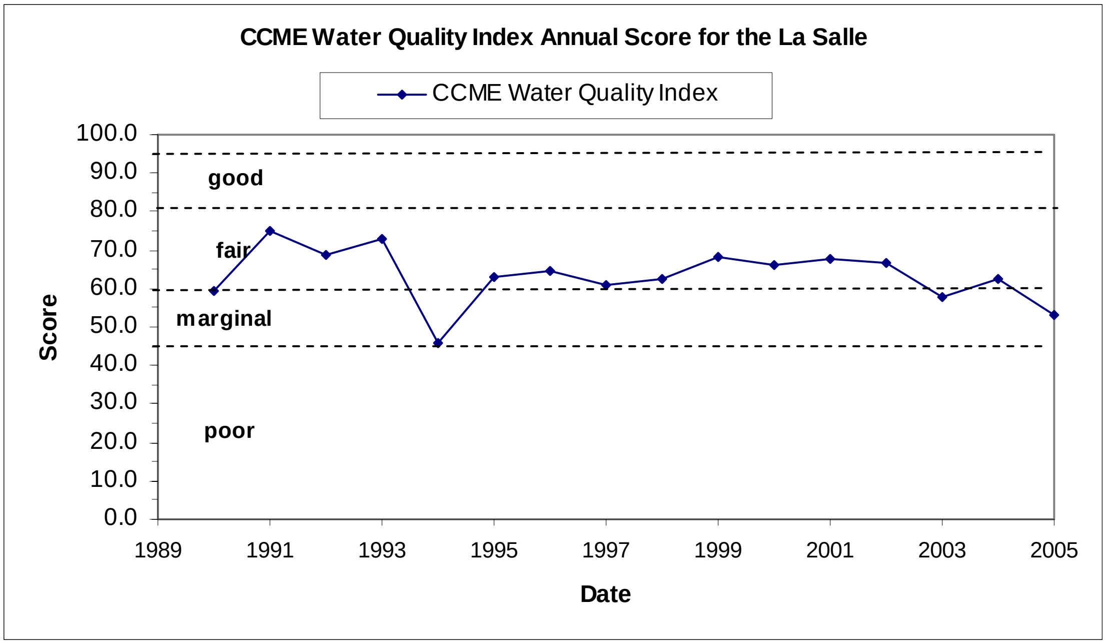
The Water Quality Index combines three different aspects of water quality: the 'scope,' which is the percentage of water quality variables with observations exceeding guidelines; the 'frequency,' which is the percentage of total observations exceeding guidelines; and the 'amplitude,' which is the amount by which observations exceed the guidelines. The basic premise of the Water Quality Index is that water quality is excellent when all guidelines or objectives set to protect water uses are met virtually all the time. When guidelines or objectives are not met, water quality becomes progressively poorer. Thus, the Index logically and mathematically incorporates information on water quality based on comparisons to guidelines or objectives to protect important water uses. The Water Quality Index ranges from 0 to 100 and is used to rank water quality in categories ranging from poor to excellent.

- Excellent (95-100) - Water quality never or very rarely exceeds guidelines
- Good (80-94) - Water quality rarely exceeds water quality guidelines
- Fair (60-79) - Water quality sometimes exceeds guidelines and possibly by a large margin
- Marginal (45-59) - Water quality often exceeds guidelines and/or by a considerable margin
- Poor (0-44) - Water quality usually exceeds guidelines and/or by a large margin

An annual water quality index was calculated for the La Salle Rive from 1990 to 2005 based on water quality data from the long term station. In instances where more than one objective or guideline is available for a specific variable, the most restrictive has been used in the Index. As an example, for the herbicide Dicamba, the guideline for irrigation (.006 mg/L) is much lower than the guideline for the protection of aquatic life (10 mg/L) and would be used in the Index. Results shown in Figure 2 indicate that over the 16 year time frame, water quality is generally fair with some years with marginal water quality.

Section 5.0 – Water Resources

Figure 2: CCME Water Quality Index for the La Salle River.



Concentrations of Dicamba and MCPA (Figures 3 and 4) generally exceed the guidelines when detected and greatly influence the index. Both Dicamba and MCPA are herbicides commonly used to control broadleaf weeds on agricultural land or road and utility right of ways. Dicamba can enter surface waters through spills, aerial drift, improper disposal methods, and direct overspray of water bodies during application. Dicamba is very soluble in water and run-off from adjacent cropland is another pathway into the aquatic environment. Dicamba was detected in 36 % of samples taken (139) while MCPA was only detected in 16 % of samples taken (94). MCPA and Dicamba are often marketed together as multi mixed product but can also be distributed separately.

Figure 3: Historical Dicamba Concentrations Detected in the La Salle Watershed from 1984 – 2006.

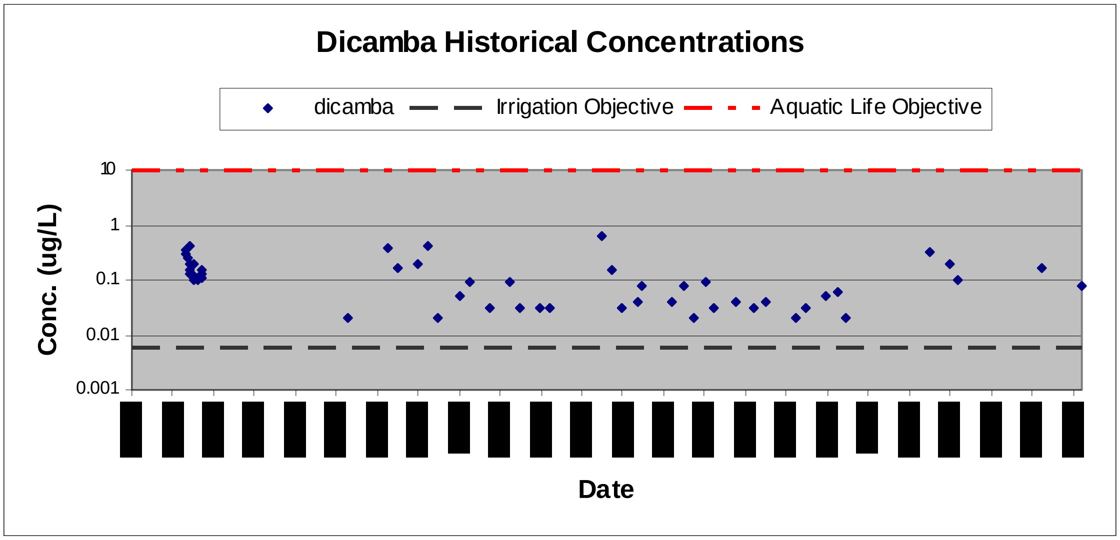


Figure 4: Historical MCPA Concentrations Detected in the La Salle Watershed from 1984 – 2006.

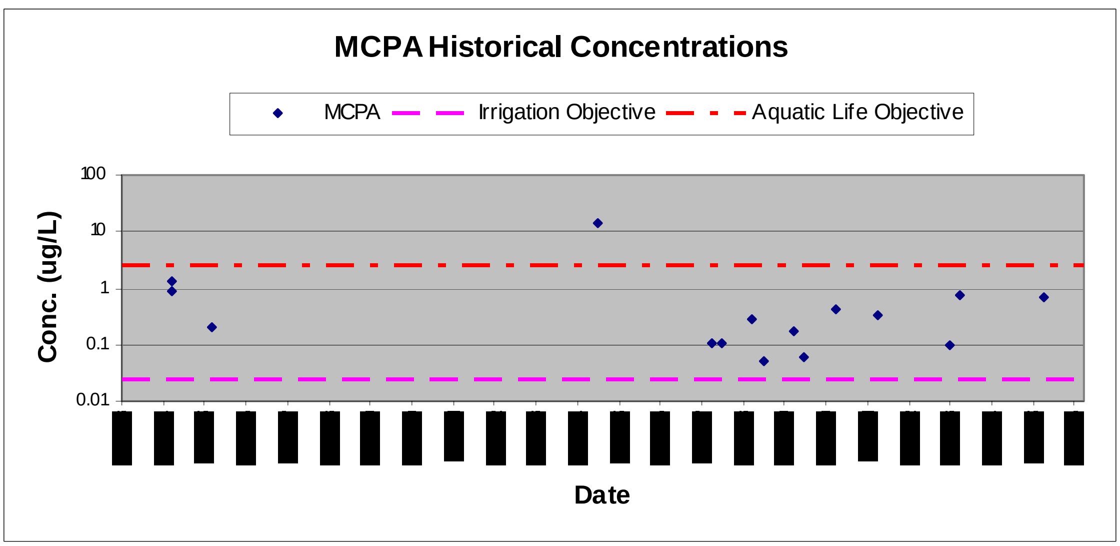
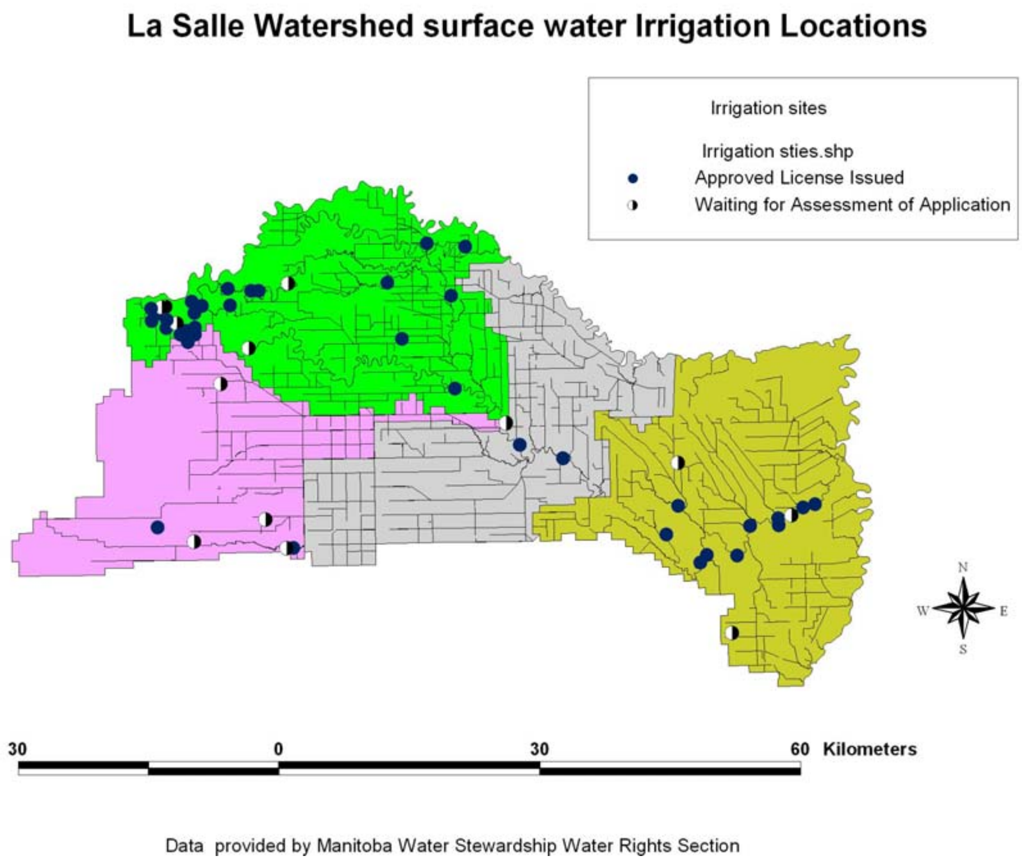


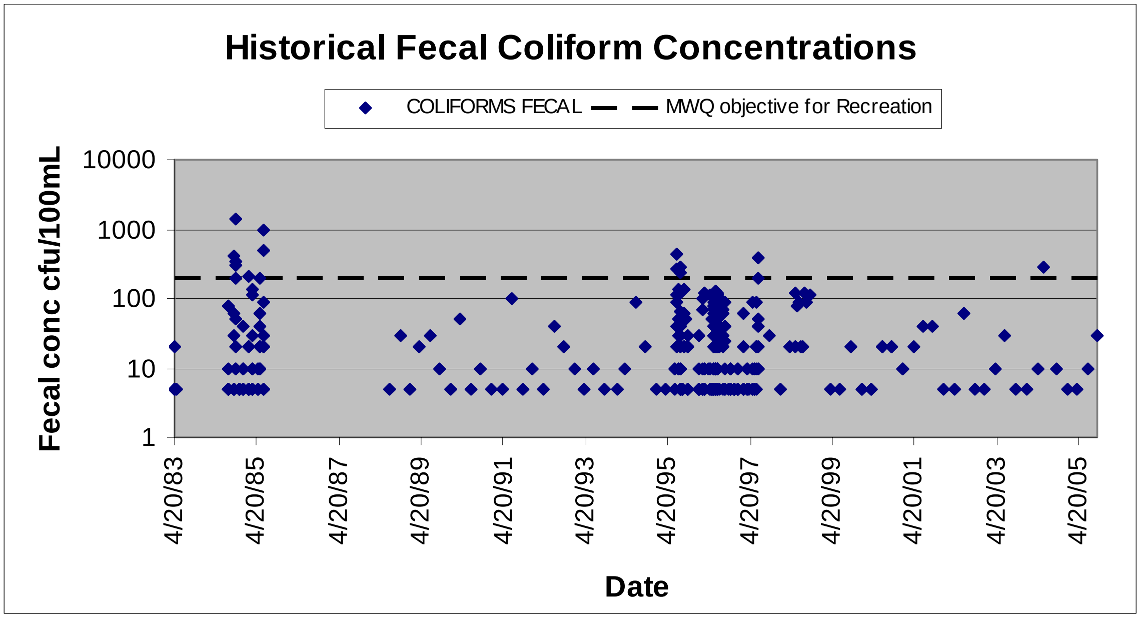
Figure 5: Locations of Surface Water Irrigation Licensed sites within the La Salle River Watershed



Licenses for irrigation are concentrated in the upper western corner of the watershed as well as in the lower reaches of the watershed where some of the higher water demand users are located such as the golf courses and water treatment plant (Figure 5). The upper reaches of the Elm Creek Channel are also starting to be developed based on pending applications. To improve water quality as indicated by the Water Quality Index, consideration should be given to best management practices that could reduce the transport of Dicamba and MCPA to surface water while still maintaining their beneficial use in controlling broadleaf weeds within the watershed.

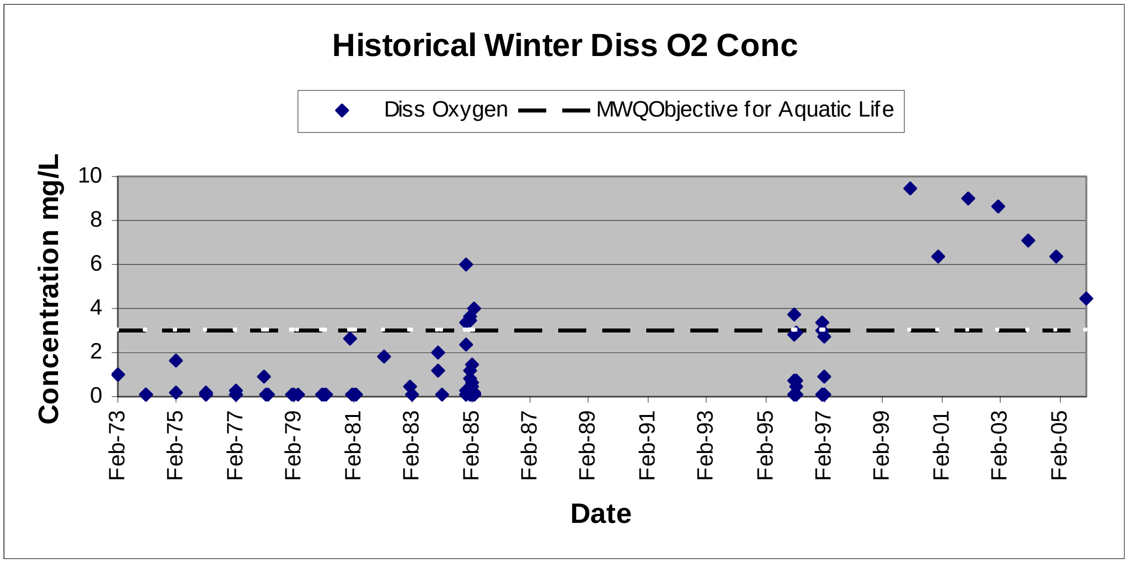
Fecal coliform bacteria are found in the intestinal tracts of birds and mammals and are used as indicators of other waterborne illness and viruses. Fecal coliforms are often introduced into the waterway as feces from humans, livestock or wildlife. The Manitoba Water Quality Guideline for fecal coliforms for the protection of recreational uses is 200 colony forming units per 100mL. Relatively few exceedences of the fecal coliform guideline were observed on the La Salle River between 1983 to 2005 (Figure 6).

Figure 6: Historical Fecal Coliform Concentrations within the La Salle River Watershed



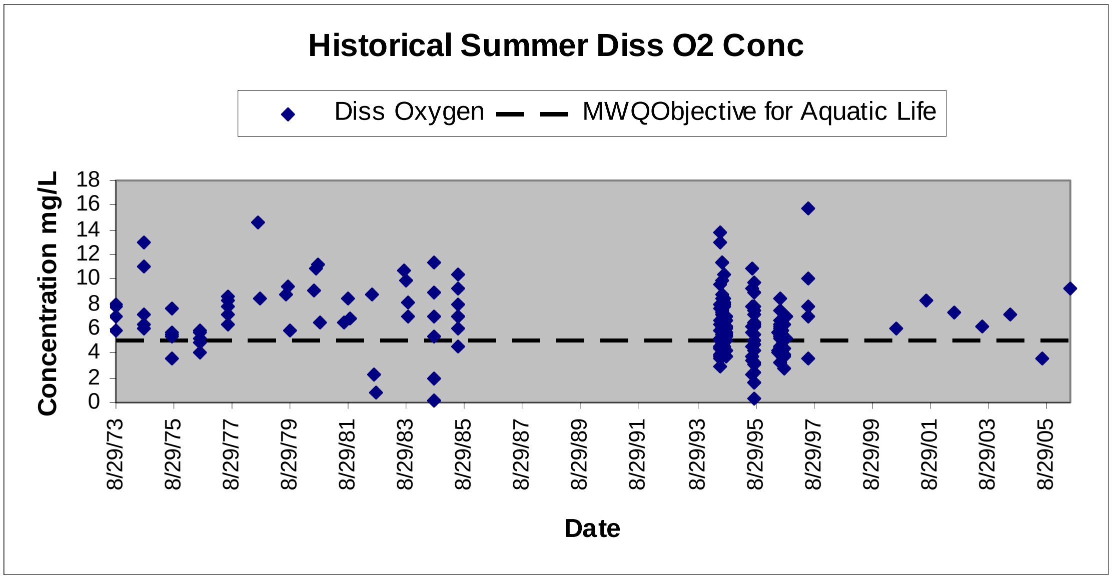
Adequate instream dissolved oxygen concentrations are essential to the overall health of the aquatic community. Oxygen is introduced into water systems via atmospheric exchange and plant photosynthesis. Oxygen is moderately soluble in water and its solubility is effected by temperature, elevation, salinity and mixing. Oxygen can be lost from water systems via bacterial decomposition of organic material and via plant and animal respiration. When oxygen consumption exceeds production then oxygen depletion (anaerobic conditions) can occur thereby impacting aquatic life. Oxygen concentrations can be depleted during winter when ice cover limits atmospheric exchange and reduces photosynthesis capability within the stream leading to greater consumption than production. In the La Salle River, oxygen consumption during the winter greatly exceeds production and anaerobic conditions can occur (Figure 7). Dissolved oxygen concentrations are generally higher in the 2000's but this may reflect the change in location and mixing that is occurring at the dam at LaBarriere Park.

Figure 7: Historic Winter Dissolved Oxygen Concentration within the La Salle River Watershed



Warmer water temperatures during the summer months generally increase biological activity and overall productivity. Warmer temperatures also enhance bacteria activity and consumption of oxygen. Solubility of oxygen also decreases with warmer temperatures. Therefore, stream oxygen concentrations may also drop below water quality objectives in summer. While summer dissolved oxygen concentrations throughout the La Salle River are generally above the Manitoba Surface Water Quality Objective for the protection of aquatic life, oxygen depletion occurs occasionally (Figure 8).

Figure 8: Historic Summer Dissolved Oxygen Concentration within the La Salle River Watershed



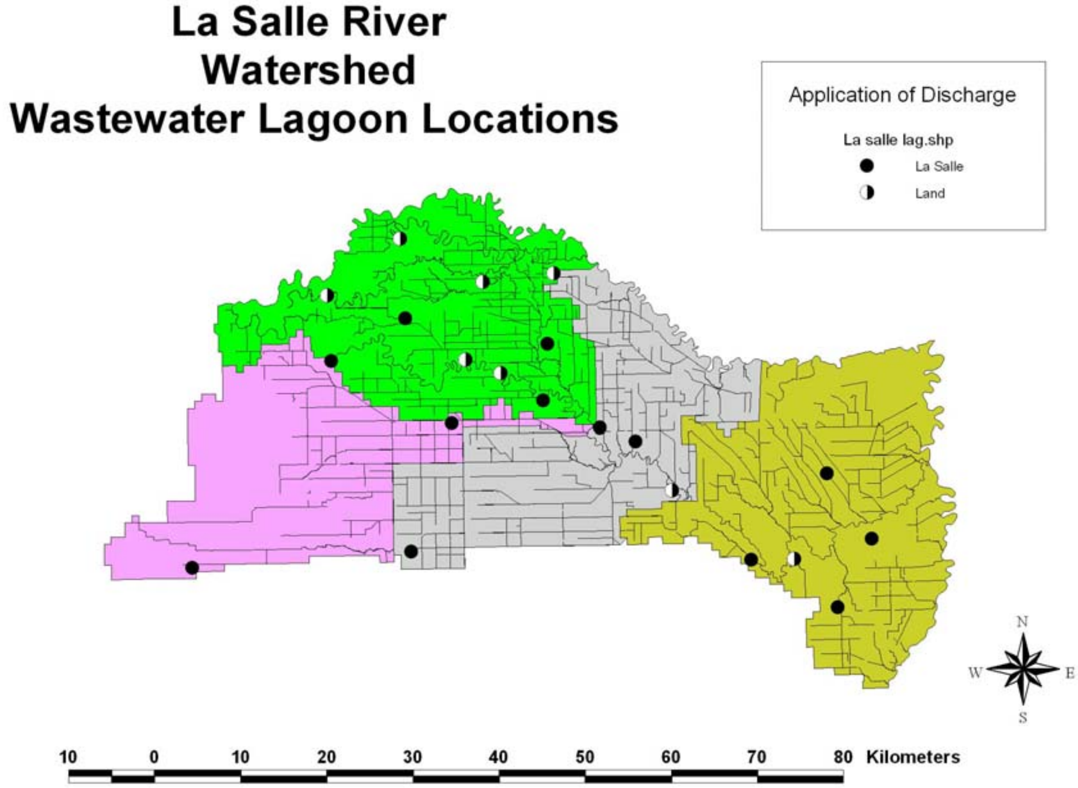
Nutrients play an important role in the stream ecosystem and are essential to overall biological productivity. However, excessive levels of phosphorus and nitrogen fuel the production of algae and aquatic plants. Extensive algal blooms can cause changes to aquatic life habitat, reduce essential levels of oxygen, interfere with drinking water treatment facilities, and cause taste and odour problems in drinking water. In addition, some forms of blue-green algae can produce highly potent toxins. Limiting and managing nutrient inputs in the La Salle River may assist in mitigating conditions associated with eutrophication such as dissolved oxygen depletion.

Nutrients as measured by total phosphorous and total nitrogen have been increasing in the La Salle River since the early 1970's. Jones and Armstrong (2001) demonstrated that total phosphorous concentrations have increased by over 194 % while total nitrogen concentrations have increased by 146 % over the time period from 1973 to 2000. This corresponds to an approximate increase in phosphorus and nitrogen loads of 29 tonnes and 118 tonnes, respectively. For comparison, studies have shown that since the early 1970s, phosphorus loading has increased by about 10 per cent to Lake Winnipeg and nitrogen loading has increased by about 13 per cent. Increased nutrient concentrations have resulted in the deterioration of water quality and development of more frequent and more widely distributed algal blooms in Lake Winnipeg.

Manitobans, including those in the La Salle River watershed, contribute about 47 % of the phosphorus and 49 % of the nitrogen to Lake Winnipeg (Bourne *et al.* 2002, updated in 2006). About 15 % of the phosphorus and 5 % of the nitrogen entering Lake Winnipeg is contributed by agricultural activities within Manitoba. In contrast, about 9 % of the phosphorus and 5 % of the nitrogen entering Lake Winnipeg from Manitoba is contributed by wastewater treatment facilities such as lagoons and sewage treatments plants.

As part of Lake Winnipeg Action Plan, the Province of Manitoba is committed to reducing nutrient loading to Lake Winnipeg to those levels that existed prior to the 1970s. The Lake Winnipeg Action Plan recognizes that nutrients are contributed by most activities occurring within the drainage basin and that reductions will need to occur across all sectors. Reductions in nutrient loads across the Lake Winnipeg watershed will benefit not only Lake Winnipeg but also improve water quality in the many rivers and streams that are part of the watershed including the La Salle River. In particular, issues related to excessive plant growth and reduced dissolved oxygen concentrations in the La Salle River can be mitigated by reducing nutrient loads to surface waters.

Figure 9: Location of all wastewater lagoons within the La Salle Watershed.



One of the sources of nutrients to the La Salle River is wastewater treatment lagoon discharge. There are a total of 25 lagoons in the La Salle River watershed of which 8 discharge via land application (Figure 9). The remaining 17 lagoons discharge directly or indirectly via the drainage network to the La Salle River. Calculations indicate that contributions from these discharges contribute 7.3 % of the total phosphorus and 12.3 % of the total nitrogen load to the La Salle River. Remaining sources of nutrients to the La Salle River include runoff associated with fertilizer and manure application, septic fields, enhanced drainage and reduced riparian vegetation, erosion, and instream processes. These many activities each contribute a relatively small proportion of the overall nutrient load to the La Salle River. However, the sum of these many small nutrient loads impacts the La Salle River and downstream waterways such as Lake Winnipeg. It is evident that reducing nutrients across the La Salle River watershed is a challenge that will require the participation and co-operation of all residents and will involve:

- Implementing controls on nutrients in municipal and industrial wastewater treatment facilities and considering the cumulative impact of multiple lagoon discharges along the La Salle River.
- Developing scientifically-based measures to control the application of inorganic fertilizers, animal manure, and municipal sludge to agricultural lands.

- Reducing nutrient contributions from individual homeowners.

Individual residents can help by taking the following steps:

- Maintain a natural, riparian buffer along waterways. Natural vegetation slows erosion and helps reduce the amount of nitrogen and phosphorus entering lakes, rivers and streams.
- Value and maintain wetlands. Similar to riparian buffers along waterways, wetlands slow erosion and help reduce nutrient inputs to lakes, rivers, and streams. Wetlands also provide flood protection by trapping and slowly releasing excess water while providing valuable habitat for animals and plants.
- Don't use fertilizer close to waterways. Heavy rains or over-watering your lawn can wash nutrients off the land and into the water.
- Use phosphate-free soaps and detergents. Phosphates have been prohibited from laundry detergents but many common household cleaners including dishwasher detergent, soaps, and other cleaning supplies still contain large amounts of phosphorus. Look for phosphate-free products when you are shopping.
- Ensure that your septic system is operating properly and is serviced on a regular basis. It's important that your septic system is pumped out regularly and that your disposal field is checked on a regular basis to ensure that it is not leaking or showing signs of saturation.

One of the short term studies undertaken on the La Salle River examined ammonia concentrations in wastewater lagoon discharges. In 1996, several lagoon discharges were sampled and monitoring occurred upstream and downstream of the wastewater discharge into the La Salle River. Organic matter in a lagoon breaks down naturally to ammonia and then in the presence of sufficient oxygen to nitrite/nitrate as part of the treatment process. Ammonia, while an essential and readily used nutrient for plant growth, can in its un-ionized state be toxic to aquatic life. The toxicity of ammonia in surface waters is related to the total amount of ammonia present, and in particular the ratio of un-ionized to total ammonia. This ratio is affected by the pH and to a lesser extent the temperature of the water. Results of the study indicated that for all of the lagoon discharges monitored in 1996, there were no exceedences of the Manitoba Water Quality Objectives for ammonia for the protection of aquatic life.

Drainage

Although it is recognized that drainage in Manitoba is necessary to support sustainable agriculture, it is also recognized that drainage works can impact water quality and fish habitat. Types of drainage include the placement of new culverts or larger culverts to move more water, the construction of a new drainage channels to drain low lying areas, the draining of potholes or sloughs to increase land availability for cultivation and the installation of tile drainage. Artificial drainage can sometimes result in increased nutrient (nitrogen and phosphorus), sediment and pesticide load to receiving drains, creeks and rivers. All types of drainage should be constructed so that there is no net increase in nutrients (nitrogen and phosphorus) to waterways. To ensure that drainage maintenance, construction, and re-construction occurs in an environmentally friendly manner, the following best available technologies, and best management practices aimed at reducing impacts to water quality and fish habitat are recommended.

- Surface drainage should be constructed as shallow depressions and minimal removal of vegetation and soil should be observed during their construction.
- Based on Canada Land Inventory Soil Capability Classification for Agriculture (1965) Class 6 and 7 soils should not be drained.
- When sloughs or potholes are drained then an additional holding pond or wetland should be constructed as a collection point for the water prior to entering the municipal drain, creek or river. This will help filter nutrients from runoff from the land as well as compensate for the loss of wetlands that support wildlife.
- Erosion control methodologies according to the guidelines outlined in *Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat* should be used where the surface drain intersects with another water body.
- A strip of vegetation of at least 1 metre should be maintained along the surface drainage channel as a buffer. This will reduce erosion of the channel and aid in nutrient removal.
- When necessary the proponent must revegetate exposed areas along the bank of the surface drainage channel.
- Discharge from tile drainage should enter a holding pond or wetland prior to discharging into a drain, creek or river.
- Nutrient application needs to be established for most efficient uptake by the crop and should occur just prior to seeding. Fall application of manure or fertilizer should not be permitted on drained land.

Summary

- Water quality is an important issue within the watershed. The water quality index is an excellent method of evaluating water quality and assessing changes/improvements over time.
- Nutrient enrichment or eutrophication is one of the most important water quality issues in Manitoba. It is evident that reducing nutrients across the La Salle River watershed is a challenge that will require the participation and co-operation of all residents and will involve many actions.
- To improve water quality, consideration should be given to best management practices that could reduce the transport of Dicamba and MCPA to surface water while still maintaining their beneficial use in controlling broadleaf weeds within the watershed.
- Best management practices for reducing nutrient contributions and managing drainage in an environmentally friendly manner should also be implemented on a watershed basis.