Birdtail River Watershed
Water Quality Report

August, 2007

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State of the Watershed Report
05ME Birdtail Creek Watershed - Water Quality Component

Surface water quality data have been collected by the Water Quality Management Section, Manitoba Water Stewardship, to address various issues within the Birdtail Creek watershed (05ME). Surface water quality data are collected primarily to: 1) assess long-term, ambient water quality trends at routinely monitored sites, and 2) assess ambient water quality through short-term, intensive studies and activities. Results of water chemistry collected from the Birdtail River watershed represent data that were generated from both long-term water quality sites and from short-term, issue-driven studies. While water quality samples have been collected fairly consistently from some sites, other data collections in the watershed are not as continuous or consistent in either date range or chemistry.

Long-Term Trends - Surface Water Quality

There is a long history of water quality monitoring on the Assiniboine River within the Birdtail Creek watershed. In 1965, routine water quality monitoring was initiated on the Assiniboine River just south of Miniota at the Highway #83 bridge. In 1973, another long-term station was established upstream near Russell. Routine monitoring occurred at these stations until 1984 when sampling was discontinued. Sampling was re-initiated at these stations in 2001 as part of the Assiniboine River Water Quality Modelling Study (Armstrong 2002, Armstrong 2005) but was discontinued when the study was completed in 2003. In 2006, the Upper Assiniboine River Conservation District, the Lake of the Prairies Conservation District, and the Water Quality Management Section collaborated to re-establish long-term water quality monitoring at these sites near Russell and Miniota.

In contrast, routine water quality monitoring on Birdtail Creek did not occur until 2001 when the station was monitored in Birtle as part of the Assiniboine River Water Quality Modelling Study (Armstrong 2002, Armstrong 2005). While this work was completed in 2003, the station was re-established in 2006 as part of the collaboration between the Upper Assiniboine River Conservation District and the Water Quality Management Section.

Water samples collected at the three long-term stations in the watershed are analyzed for a wide range of water chemistry variables including pesticides, metals, nutrients, general chemistry and bacteria.

Water Quality Index:

Water quality at long-term water quality monitoring stations can be assessed with the Canadian Council of Ministers of the Environment (CCME) Water Quality Index. The 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 1) and are compared with water quality objectives and guidelines contained in the Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson 2002 and Table 1).

Table 1. 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 Greenhouse
Specific Conductivity	uS/cm	1000	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 Aluminium	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 where detectable	Irrigation
Bromoxynil	ug/L	0.33	Irrigation
Simazine	ug/L	0.5	Irrigation
2,4 D	ug/L	4	Aquatic Life
Lindane	ug/L	0.01	Aquatic Life
Atrazine	ug/L	1.8	Aquatic Life
MCPA	ug/L	0.025 where detectable	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

While water chemistry has been monitored at the long-term monitoring stations for several periods between 1965 and 2007, certain pesticides that are required to calculate the WQI were not monitored prior to 1991. In addition, water quality monitoring done as part of the Assiniboine River Water Quality Modelling study did not always include the full suite of variables required to calculate the Water Quality Index. Therefore, the WQI has been calculated for the Assiniboine River at Miniota and Birdtail Creek at Birtle with available data from 2001 to 2007. In contrast, relatively less water quality data are available for the Assiniboine River at Russell in the upstream portion of the 05ME Birdtail Creek watershed. Therefore, the WQI was calculated for the Assiniboine River at Russell with data collected from 2006 to 2007. As more data are collected for these three long-term monitoring stations, it will be possible to calculate and compare the Water Quality Index across individual years.

The Water Quality Index was rated as 80 for the Assiniboine River at Miniota and 81 for Birdtail Creek at Birtle. Water quality was rated even higher in the upstream portion of the watershed with a WQI rating of 88 for the Assiniboine River at Russell. The WQI ratings for all three stations suggest that water quality is "good"; is protected with only a minor degree of threat or impairment; and that conditions rarely depart from natural or desirable levels.

Objectives exceeded at the Assiniboine River at Miniota and Birdtail Creek at Birtle were similar. Both stations occasionally exceeded the water quality objective for protection of use for irrigation for conductivity. Specific conductance or conductivity in water is a measure of the amount of dissolved salts and minerals such as chloride, nitrate, sulphate, sodium, calcium, iron, etc. Conductivity is mostly influenced by soil characteristics of the watershed. Rivers and streams that run through primarily clay soils tend to have higher conductivity because of the presence of materials that ionize when washed into the water. Discharges to rivers and streams, such as municipal discharge, can change the conductivity due to higher levels of sulphate, chloride, and nitrate.

Both stations consistently exceeded the water quality guideline for manganese for drinking water. Manganese is strongly associated with iron in water and is also naturally found in water from weathering of minerals. High concentrations of manganese can impart an unpleasant taste and as such the water quality guideline for manganese is an aesthetic guideline. Exceedences can be mitigated through treatment of the water for drinking.

Water quality objectives for the protection of aquatic life for total suspended solids were also exceeded occasionally in the Assiniboine River at Miniota and Birdtail Creek. Total suspended sediments increase after spring runoff and summer precipitation events. Overland runoff carries soil, silt, and organic debris - all of which will increase the concentration of suspended sediments in water. Bank erosion will also contribute to increased suspended sediments. Poor land-use practices such as removing vegetated buffer strips from along rivers and smaller tributaries will also increase the overland movement of soil and other debris into the river.

Total phosphorus often exceeded the narrative guideline of 0.05 mg/L in the Assiniboine River at Miniota and in Birdtail Creek. The province-wide narrative phosphorus guideline of 0.05 mg/L provides general guidance on phosphorus concentrations but will need to be replaced with more ecologically-relevant objectives (See below in Nutrient Section). Other nutrients (ammonia and nitrate/nitrite nitrogen) were within guidelines for the entire period of record. While some water bodies contain naturally elevated concentrations of nutrients due to watershed characteristics, many human alterations impact nutrient loading to the Assiniboine River and Birdtail Creek.

Once during the time period of analysis, the water quality objective for the protection of aquatic life for dissolved oxygen was exceeded on the Assiniboine River at Miniota. Low dissolved oxygen concentration can result from the decomposition of organic material such as algae and plants and is exacerbated by ice cover, a time when dissolved oxygen concentrations are less likely to be replenished. Critically low concentrations of dissolved oxygen can result in fish kills and foul smelling water. Armstrong (2005) also observed that dissolved oxygen occasionally dropped below the water quality objectives for aquatic life in the Assiniboine River, primarily during the open water season in 2001. Exceedences of the dissolved oxygen objectives were attributed to relative warm air and water temperatures during the summer of 2001. According to the climate information collected by Environment Canada at Shoal Lake, Manitoba (Environment Canada 2007), max and mean air temperatures in 2006 were even warmer than those observed in 2001. In fact, 2006 was the warmest year so far since 2000 and the second warmest year was 2001.

In contrast, water quality in the Assiniboine River at Russell exceeded only two guidelines - the narrative guideline for total phosphorus and the drinking water guideline for manganese. In addition, exceedences of these two guidelines were smaller in amplitude than those observed at the two downstream stations resulting in a relatively higher WQI rating.

Since routine water quality monitoring is now underway at three stations within the watershed, the Water Quality Management Section will be able to update the Water Quality Index values each year and provide an ongoing assessment.

Nutrients

Nutrient enrichment or eutrophication is one of the most important water quality issues in Manitoba. 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, clog fisher's commercial nets, 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.

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 (Jones and Armstrong 2001, Bourne *et al.* 2002). A similar phenomenon has also occurred in many other Manitoba streams, rivers, and lakes.

Manitobans, including those in the Birdtail Creek watershed, contribute about 47 % of the phosphorus and 44 % of the nitrogen to Lake Winnipeg (Bourne *et al.* 2002, updated in 2006). About 15 % of the phosphorus and 6 % of the nitrogen entering Lake Winnipeg is contributed by agricultural activities within Manitoba. In contrast, about 9 % of the phosphorus and 6 % 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 Birdtail Creek.

Nutrient reduction targets under the Lake Winnipeg Action Plan are interim targets that reflect the need to take immediate action to reduce nutrient loads to Lake Winnipeg. Manitoba Water Stewardship is working to develop long-term, ecologically -relevant objectives for nutrients in Lake Winnipeg and its contributing basins such as the Birdtail Creek watershed. Long-term, ecologically -relevant objectives will also replace narrative guidelines that are currently applied across Manitoba. However, reducing nutrients across Manitoba, the Birdtail Creek watershed, and the Lake Winnipeg watershed is a challenge that will require the participation and co-operation of all Manitobans and will involve:

- Implementing expensive controls on nutrients in municipal and industrial wastewater treatment facilities.
- Developing scientifically -based measures to control the application of inorganic fertilizers, animal manure, and municipal sludge to agricultural lands.
- Reducing nutrient contributions from individual cottagers and homeowners.
- Working with our upstream neighbours.

Individual Manitobans can help by taking the following steps:

- Maintain a natural, riparian buffer along waterways such as the Assiniboine River, Birdtail Creek and their tributaries. 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.

Water Quality Monitoring at Silver Beach and Rossman Lakes

A considerable amount of water quality monitoring has been undertaken at two lakes in the 05ME Birdtail Creek watershed - Rossman Lake and Silver Beach Lake.

Beaches at Rossman and Silver Beach lakes are monitored as part of Manitoba Water Stewardship's Clean Beaches Program. Beaches are monitored about 4 times each summer for densities of *Escherichia coli*. Recreational water quality is excellent at both beaches with geomeans well below the recreational water quality objective of 200 colony forming units per 100 mL. Between 1997 and 2006, even maximum densities of *E. coli* at Rossman Lake and Silver Beach Lake were well below the recreational objective at 40 and 39 colony forming units per 100 mL, respectively.

In addition to sampling for *E. coli* since 1979, 141 water samples have been collected and analyzed from Rossman Lake. Over the same time period, 261 water samples were collected and analyzed from Silver Beach Lake. During the summers of 1979 and 1980, samples were collected for chlorophyll *a* and secchi depth was recorded about once per week throughout the summer. Chlorophyll *a* is a measure of the amount of algae in the lake and secchi depth represents the transparency or clarity of the water. Samples for a wide range of variables including nutrients, chlorophyll *a*, and metals were collected in 1994-1995 in Rossman Lake. At Silver Beach Lake, more routine sampling for a wide range of variables was undertaken in 1992 and 1993, and samples were also collected periodically in 1994 and in 1998 to 2001. Several reports were produced by the Water Quality Management Section on these data including Hughes (1982) and Ralley (1994).

One of the few variables that was collected fairly consistently throughout these water quality studies on Rossman and Silver Beach lakes was chlorophyll *a* (Figure 1). As seen in other lakes across Manitoba, concentrations of chlorophyll *a* and therefore the density of algae in the water varied from year to year and there do not seem to be any clear trends over time. The relatively high concentration observed in 2001 can likely be attributed to the relatively warm temperatures observed that summer. The frequency and severity of algae blooms is closely linked to climate with relatively more blooms occurring in warm and hot summers with lots of sunshine and relatively less blooms in cool and cloudy summers. In general, for the few years with comparative data, concentrations of chlorophyll *a* appear to be higher in Silver Beach as compared to Rossman Lake.

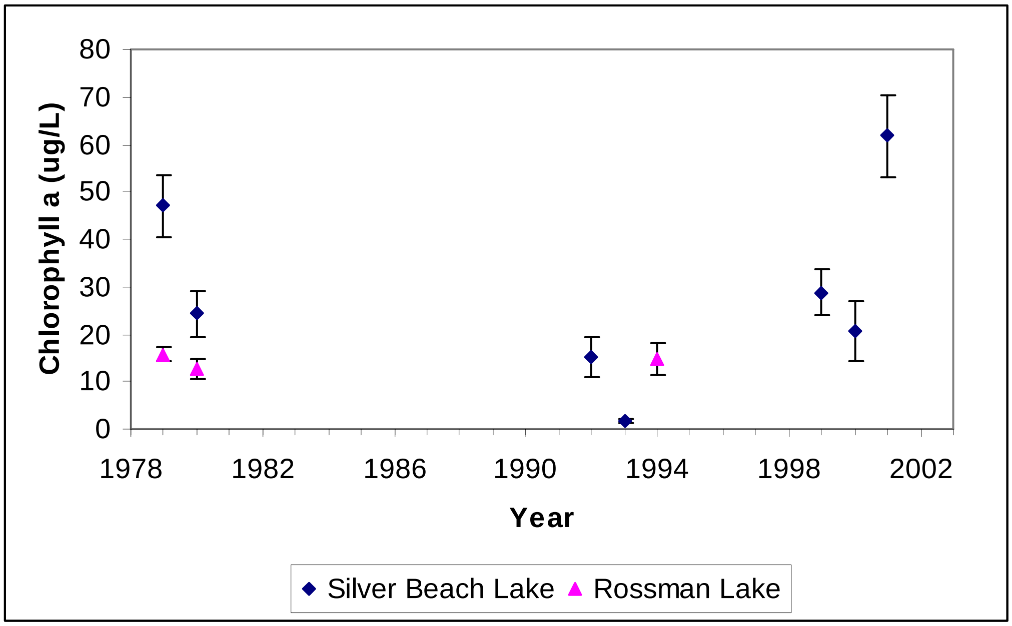

Figure 1. Mean annual chlorophyll *a* concentrations (with standard error bars) in Silver Beach and Rossman Lakes.

Nutrient Management Regulation

Manitoba is proposing a Nutrient Management Regulation under *The Water Protection Act*. The purpose of the proposed regulation is to protect water quality by encouraging responsible nutrient planning, regulating the application of materials containing nutrients and restricting the development of certain types of facilities in environmentally sensitive areas. When nitrogen and phosphorus are applied to land surfaces in greater amounts than can be used by growing plants, excess nutrients can leach into ground water or run-off into surface water with heavy rainfall, floods, and melting snow.

Manitoba's landscape has been separated into five zones. Zones N1, N2, and N3 consist of land that ranges in agricultural productivity while Zone N4 is generally unproductive land that represents a significant risk of nutrient loss to surface and groundwater. Zone N4 land consists of Canada Land Inventory soil classification 6 or 7 or unimproved organics. Zone N5 consists of urban and rural residential areas.

The proposed regulation also describes a Nutrient Buffer Zone with widths outlined below:

Water Body	A (1)	B (1)
o a lake or reservoir designated as vulnerable	30 m	35 m
o a lake or reservoir (not including a constructed stormwater	15 m	20 m

retention pond) not designated as vulnerable o a river, creek or stream designated as vulnerable		
o a river, creek or stream not designated as vulnerable o an order 3, 4, 5, or 6 drain or higher o a major wetland, bog, swamp or marsh o a constructed stormwater retention pond	3 m	8 m

(1) Use column A if the applicable area is covered in permanent vegetation. Otherwise, use column B.

Under the proposed regulation, no nitrogen or phosphorus can be applied within Zone N4 or the Nutrient Buffer Zone.

More information on the proposed *Nutrient Management Regulation* is available at http://www.gov.mb.ca/waterstewardship/wqmz/index.html.

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.

The following recommendations are being made to all drainage works proposals during the approval process under *The Water Rights Act*:

- There must be no net increase in nutrients (nitrogen and phosphorus) to waterways as a result of drainage activities. Placement of culverts, artificial drainage and construction and operation of tile drains can sometimes result in increased nutrient (nitrogen and phosphorus), sediment and pesticide loads to receiving drains, creeks and rivers.
- Synthetic fertilizer, animal manure, and municipal wastewater sludge must not be applied within drains.

<u>Culverts</u>

- Removal of vegetation and soil should be kept to a minimum during the construction and the placement of culverts.
- Erosion control methodologies should be used on both sides of culverts according to the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat.
- A strip of vegetation 1 to 3 metres wide should be maintained along drainage channels as a buffer. This will reduce erosion of channels and aid in nutrient removal.
- The proponent should revegetate exposed areas along drainage channels.

<u>Surface Drainage</u>

- Surface drainage should be constructed as shallow depressions and removal of vegetation and soil should be minimized during construction.

- Based on Canada Land Inventory Soil Capability Classification for Agriculture (1965), Class 6 and 7 soils should not be drained.
- There should be no net loss of semi-permanent or permanent sloughs, wetlands, potholes or other similar bodies of water in the sub-watershed within which drainage is occurring.
- Erosion control methodologies 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 1 to 3 metres wide should be maintained along surface drainage channels as buffers. These will reduce erosion of channels and aid in nutrient removal.
- The proponent should revegetate exposed areas along banks of surface drainage channels.

Tile Drainage

- Discharge from tile drainage should enter a holding pond or wetland prior to discharging into a drain, creek or river.

Manitoba Water Stewardship is working towards the development of an environmentally friendly drainage manual that will provide additional guidance regarding best management practices for drainage in Manitoba.

Summary

1. The Water Quality Index indicates that water quality is "good" at the three long-term water quality monitoring stations in the 05ME Birdtail Creek Watershed - the Assiniboine River at Russell and Miniota and Birdtail Creek at Birtle.
2. While most water quality variables were well below the water quality standard, objectives, and guidelines, concentrations of total suspended solids, dissolved oxygen, manganese, total phosphorus and conductivity occasionally exceeded objectives.
3. Recreational water quality at Rossman Lake and Silver Beach Lake is excellent.

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And visit the Department's web site: http://www.gov.mb.ca/waterstewardship

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