Grassmere and Netley Creek Watershed
Water Quality Report

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State of the Watershed Report
05OJ Grassmere and Netley 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 Grassmere and Netley Creek watershed (05OJ). 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 Grassmere and Netley Creek portion of this watershed represent data that were generated from both long-term water quality sites and from short-term, issue-driven studies. Additionally, water chemistry data have been collected by the Eastern Interlake Conservation District from a number of watercourses in the watershed. 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. Table 1 highlights stations in the watershed containing water chemistry data that is discussed below.

Table 1. Water quality monitoring stations within the Grassmere and Netley Creek watershed.

Station Number	Location	Period of Record	Sampling Frequency	Agency
MB05OJS074	Red River at Selkirk	1967 to 2008	quarterly	Province
MB05OJS009	Netley Creek at PTH #7	1999, 2005	Irregular	Province
MB05OJS010	Netley Creek at PTH #17	1999, 2005	Irregular	Province
MB05OJS027	Netley Creek at PTH #8	1999, 2005	irregular	Province
MB05OJS091	Wavey Creek mouth	1995	Bi-weekly	Province
MB05OJS092	Wavey Creek at PTH #9	1995	Bi-weekly	Province
MB05OJS093	Wavey Creek D/S of Bruneau Drain	1995	Bi-weekly	Province
MB05OJS094	Bruneau Drain near mouth	1995	Bi-weekly	Province
MB05OJS095	Wavey Creek U/S of Bruneau Drain	1995	Bi-weekly	Province
MB05OJS096	Municipal Drain U/S of PTH #8	1995	Bi-weekly	Province
MB05OJS097	Municipal Drain by Lac Sod	1995	Bi-weekly	Province
MB05OJS098	Wavey Creek D/S of Argyle, Lac Sod	1995	Bi-weekly	Province
MB05OJS099	Argyle Drain near mouth	1995	Bi-weekly	Province
	Grassmere Creek	2007 - 2008	quarterly	EICD
	Park Drain	2007 - 2008	quarterly	EICD
	Netley Creek	2007 - 2008	quarterly	EICD
	Wavey Creek	2007 - 2008	quarterly	EICD
MB05SBS025	Matlock Beach	1995 - 2008	Open water season	Province
MB05SBS001	Winnipeg Beach	1995 - 2008	Open water season	Province

Long-Term Trends - Surface Water Quality

There is a long history of water quality monitoring on the Red River within this watershed (05OJ in part) In 1967, routine water quality monitoring was initiated by the Province on the Red River at the bridge site in Selkirk, and quarterly monitoring continues to this day (Figure 1). While it is recognized that this site better represents water quality conditions of the upper Red River Watershed, it is included in this document since the site is on the boundary of the Grassmere – Netley Watershed. Additionally, this is the only site in the watershed that has a continuous long-term data set. Water samples collected at this site were analyzed for a wide range of water chemistry variables including pesticides, metals, nutrients, general chemistry, and bacteria.

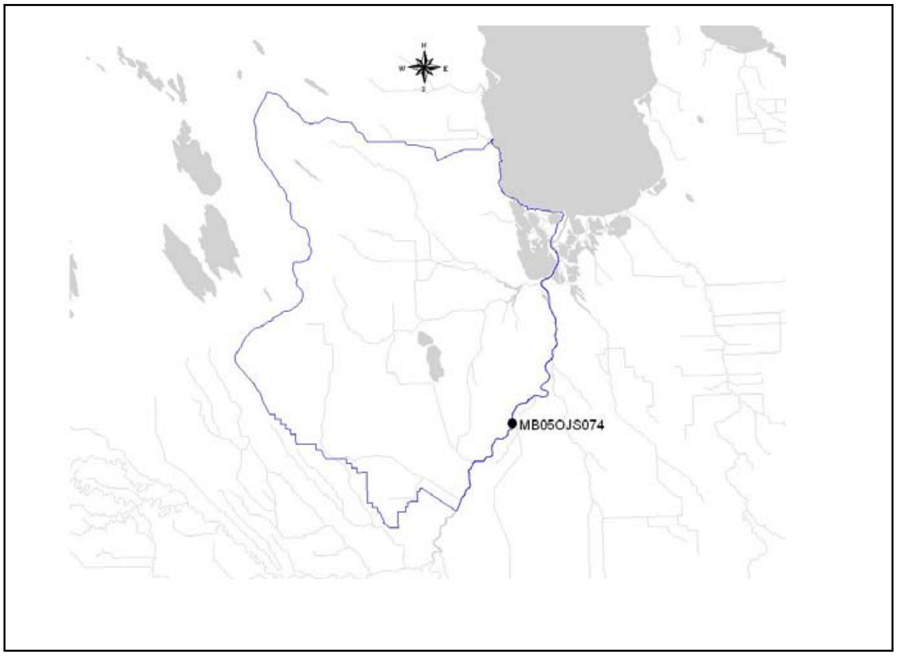

Figure 1. Map of the Grassmere-Netley Creek Watershed with the long-term water quality station (MB05OJS074)

In 2001, total phosphorus (TP) and total nitrogen (TN) from all the long-term water quality stations in the province were analyzed for trends using a relatively complex statistical model (Jones and Armstrong 2001). The model identified trends in concentrations of TP and TN after accounting for variations due to river flow. The Red River at Selkirk was included in the 2001 analysis.

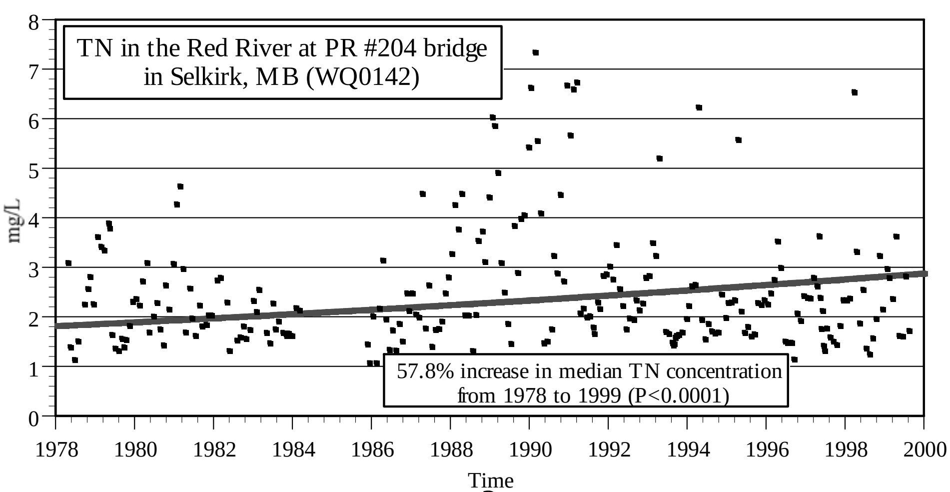

Figure 2: Total phosphorus (TP) in the Red River at Selkirk. The % change in median concentration refers to the median concentration of flow adjusted trend line.

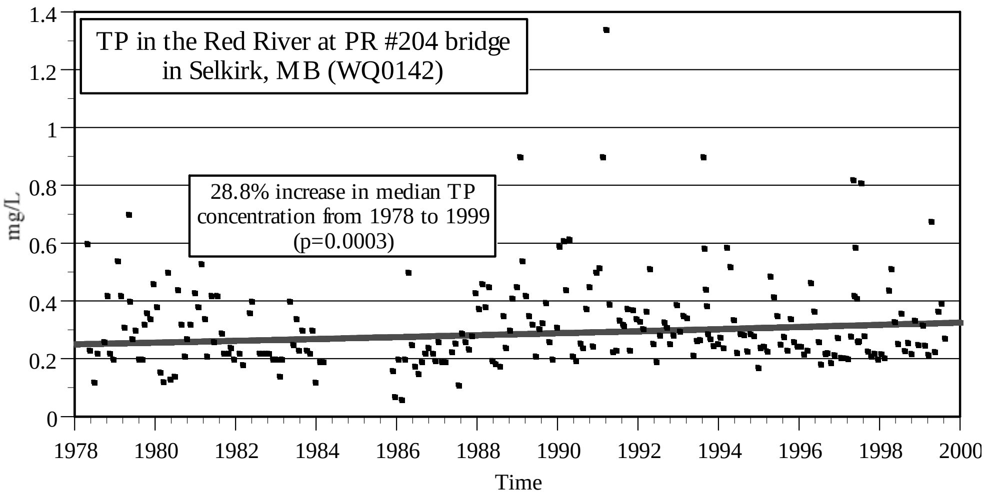

Figure 3: Total nitrogen (TN) in the Red River at Selkirk. The % change in median concentration refers to the median concentration of flow adjusted trend line.

Both total phosphorus (TP), and total nitrogen (TN) showed statistically significant increases from 1978 to 2001 of 28.8 % and 57.8 %, respectively (Figures 2 and 3).

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 2002, 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 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 station in Selkirk for several periods between 1967 and 2007, certain pesticides that are required to calculate the WQI were not monitored prior to 1993. Therefore, the graph highlighting the WQI is represented from 1993 to 2007.

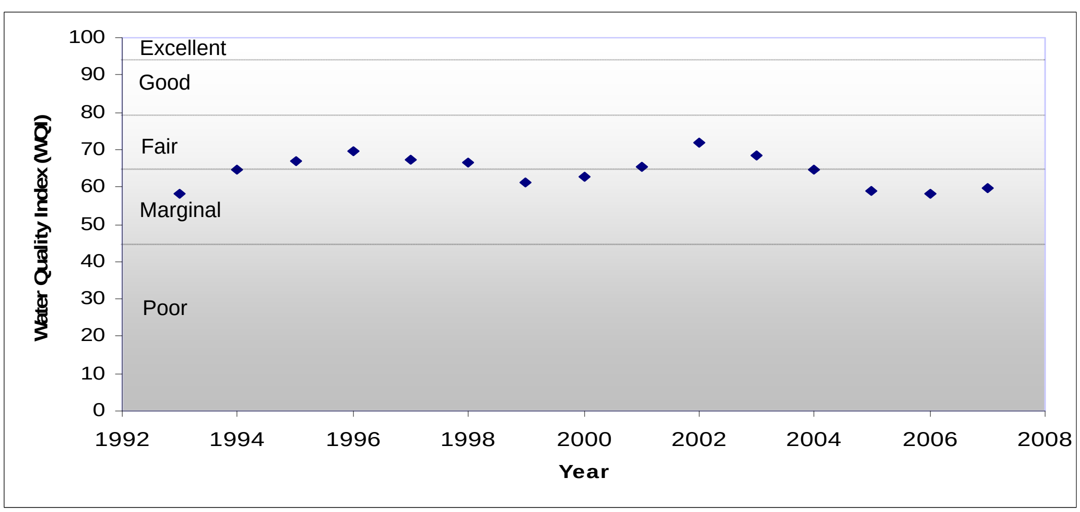

Figure 4. Water Quality Index calculated from 1993 to 2007 for the Red River at Selkirk.

The Water Quality Index from 1993 to 2007 ranged from marginal to fair. During 2005 to 2007, the WQI was marginal largely due to water quality exceedences of *E. coli*, conductivity, suspended solids, manganese, total phosphorus, and occasionally in 2007, exceedences of the pesticides, Dicamba and MCPA. Management of these issues is truly one of upstream contributions. Government continues to support and develop numerous initiatives to reduce nutrient contributions within the Lake Winnipeg drainage basin. For a detailed discussion concerning Government's actions and initiatives on reducing nutrient contributions to Lake Winnipeg, please visit:

http://www.gov.mb.ca/waterstewardship/water_quality/lake_winnipeg/index.html .

Water Quality Data

Other data-sets collected with some consistency from the Netley-Grassmere Watershed include:
Wavey Creek 1995
Netley Creek 2005
Grassmere Drain, Wavey Creek, Netley Creek, and Park Creek 2007 to 2009
Wavey Creek 1995

Wavey Creek Water Quality

In 1995 a water quality project in the Wavey Creek was undertaken by the South Interlake Land Management Association (SILMA) with funding from the Canada-Manitoba Agreement on Agricultural Sustainability (CMAAS) to determine impacts to water quality in a largely agricultural area. Ten locations along Wavey Creek were sampled for ten sampling periods between March and October 2005 (SILMA 1996). Samples were collected from agricultural drains as well as from the main stem of Wavey Creek including the most downstream location near the confluence with Muckle Creek. The groundwater monitoring well as also monitored as a control.

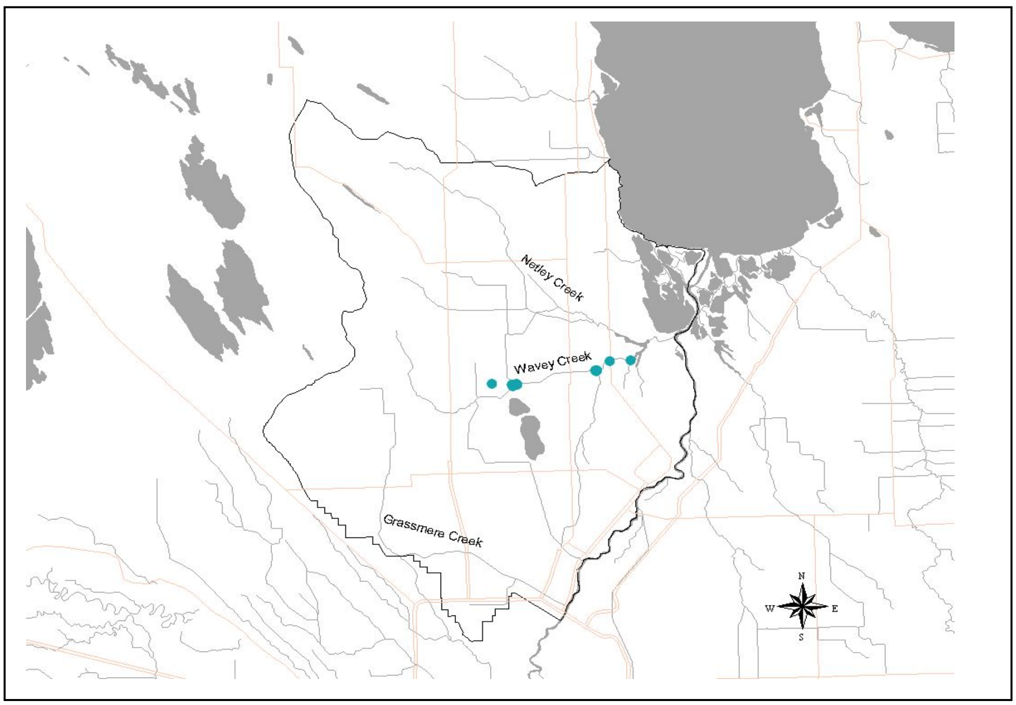

Figure 5. Sampling locations along the Wavey Creek and agricultural drains during 1995.

Mean values of all nutrients (total and dissolved phosphorus, ammonia, total kjeldahl nitrogen, and dissolved nitrogen) had highest concentrations from the agricultural drain upstream of site #8 near the Argyle Drain. Concentrations were also elevated at the most downstream site on the Wavey Creek. While not statistically valid (due to too few data points), there appears to be accumulative impacts along the main stem of Wavey Creek. Figure 5 indicates the concentration of total phosphorus (mg/L) found in the Wavey Creek sites (dark blue) and the contributing agricultural drains (light blue). The control site (groundwater) is Site 10.

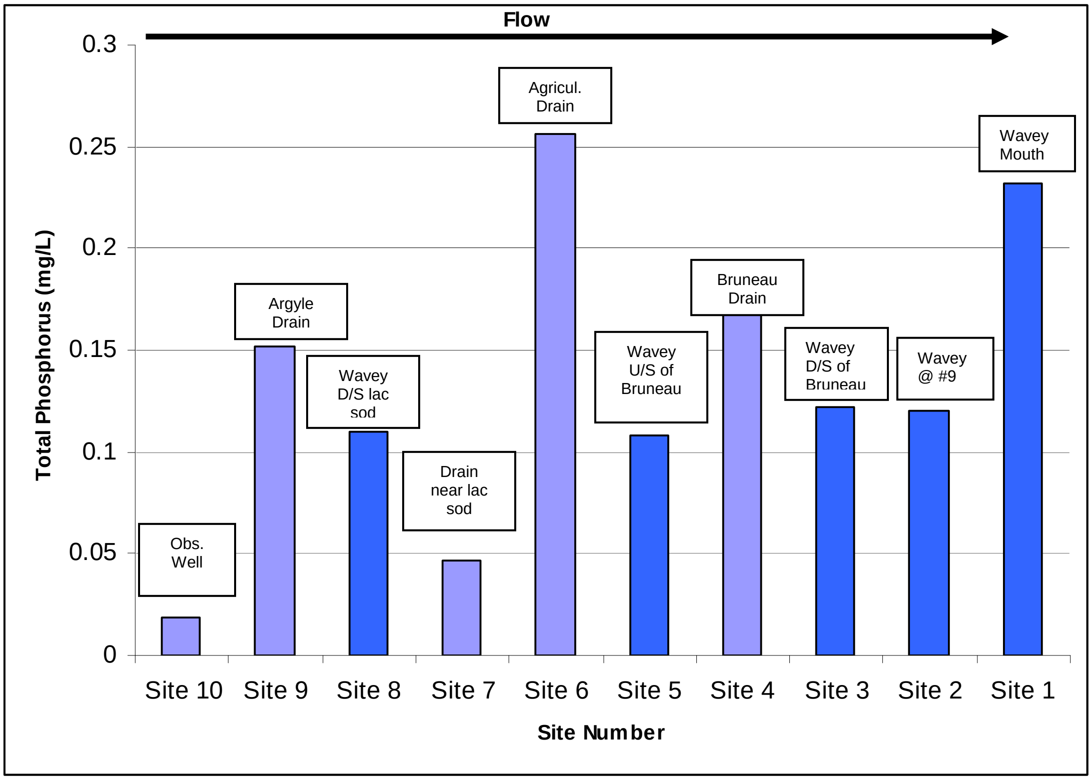

Figure 6. Mean Total Phosphorus (TP) collected on Wavey Creek in 1995.

Netley Creek Water Quality

Netley Creek was monitored with some consistency in 2005. The area experienced significant and continuous rainfall throughout July and the beginning of August 2005. This caused concern about runoff from agricultural land in both the context of *E. coli* and nutrients. *Escherichia coli* were mostly at or below the detection limit (10 E. coli/100 ml). However nutrients differed significantly from the 2 sites on Netley Creek that were monitored. Netley Creek at Hwy #8 was significantly higher compared to Netley Creek at Hwy #7. There was approximately four times the concentration of total phosphorus in the downstream site (Hwy #8 crossing) compared to concentrations in the upstream site (Hwy #7) (Figure 7). Significant differences were also observed for concentrations of ammonia with higher levels found in the downstream site. The greatest differences were observed in July 2005, whereas concentrations in August samples were similar between the two sites.

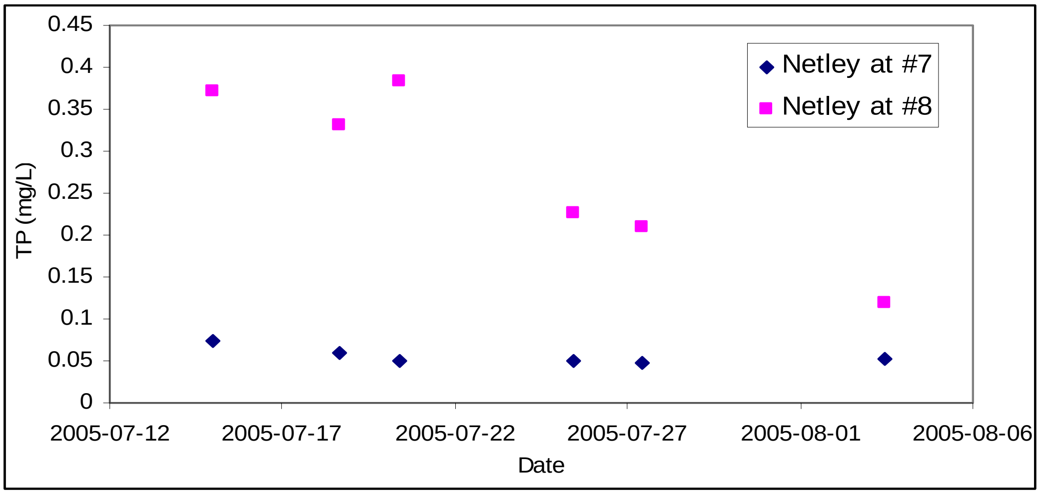

Figure 7. Total Phosphorus (TP) in Netley Creek at Hwy # 7 and Hwy #8.

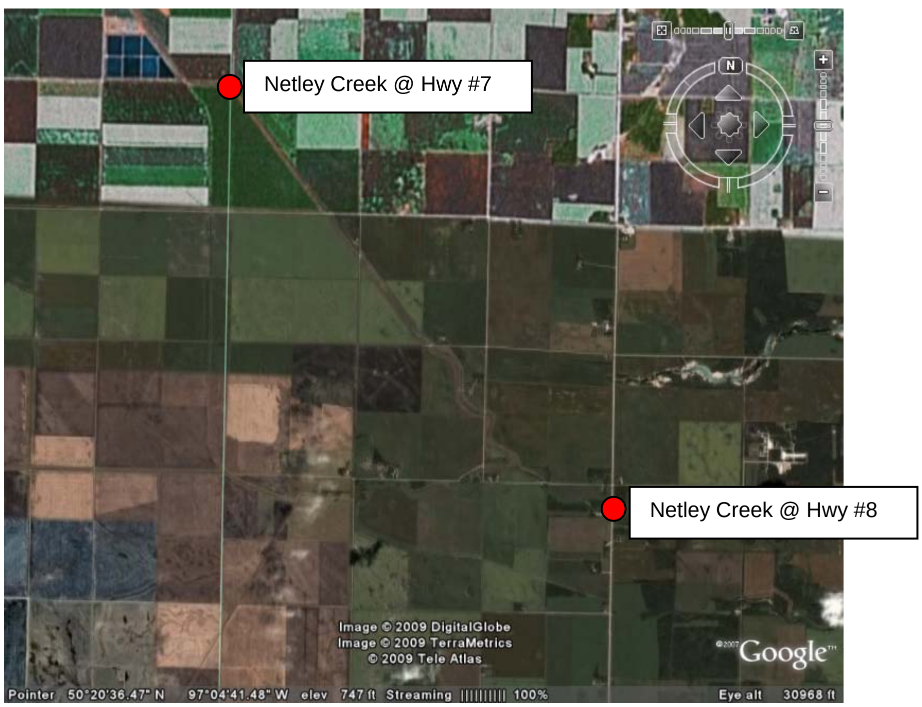

Figure 8. Map of locations on Netley Creek where samples were collected during 2005.

Grassmere, Wavey, Netley, Park creeks Water Quality

The Eastern Interlake Conservation District (EICD) has been collecting detailed water chemistry from four sites in the watershed from 2007, 2008, and continued throughout 2009. Samples were analyzed for general chemistry, nutrients, metals, dissolved salts and minerals, and *E. coli*.

Figure 9 indicates total phosphorus levels collected by the EICD from April 2007 – April 2008 at the Grassmere drain. In general, the Grassmere Drain appears to have higher concentrations of total phosphorus than those found in Netley and Wavey creeks and in the

Park Drain. The TP concentration during January 2008 spiked in the Grassmere Drain to nearly 4.0 mg/L, where no similar spike was found in the other three water courses. However, as indicated, sample results from the Wavey Creek (1995) and Netley Creek (2005) also show high concentrations of TP (ranges 0.124 to 0.244 mg/L in Wavey Creek ; 0.127 to 0.395 mg/L of TP in Netley Creek). The cause of the elevated spike in TP from January 2008 is unknown, but generally a point source could cause such a spike, particularly given the time of year and that no similar result was found in other nearby water courses.

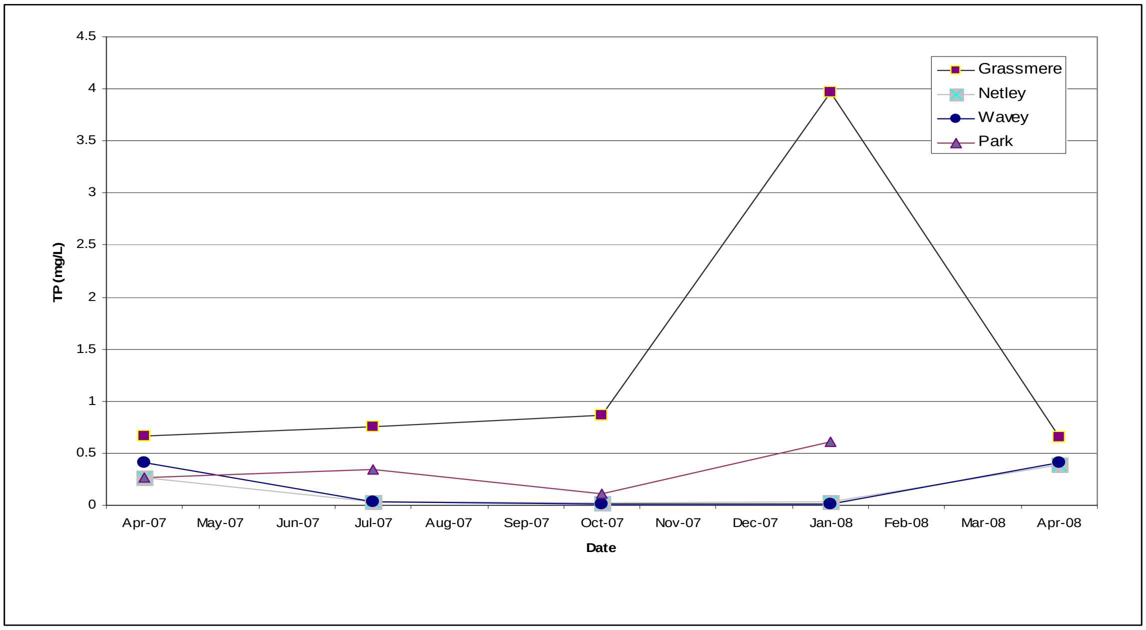

Figure 9. Concentration of total phosphorus (TP) collected by the EICD at the Grassmere drain.

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 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 Netley Creek, Wavey Creek and their tributaries and drains. 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. Refer to the *Nutrient Management Regulation* for set-back distances and nutrient application restrictions.
- 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 Winnipeg Beach and Matlock Beach, Lake Winnipeg

A considerable amount of water quality monitoring has taken place at Winnipeg Beach and at Matlock Beach on the shores of Lake Winnipeg. These beaches are monitored for densities of *Escherichia coli* (*E. coli*) as part of Manitoba Water Stewardship's Clean Beaches Program. Historically, monitoring frequency was every two weeks, however since 2004, the beaches on Lake Winnipeg have been monitored every week. Manitoba has adopted Health Canada's *Guidelines for Canadian Recreational Water Quality* of 200 *E. coli* per 100 mL for the protection of public health.

Generally, recreational water quality is excellent at both beaches with geometric means well below the recreational guideline. Occasionally, densities are above the recreational guideline but return within acceptable levels within 24 hours. On Lake Winnipeg, weather and lake level information appear to be good predictors of *E. coli* levels. Bacteria counts tend to increase when strong northerly winds cause water levels to temporarily increase and large waves wash bacteria out of beach sand. When calmer weather returns, *E. coli* bacteria levels typically fall quickly to below guideline levels.

Nutrient Management Regulation

The Nutrient Management Regulation under *The Water Protection Act* became law on March 18, 2008. The purpose of this 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 retention pond) not designated as vulnerable o a river, creek or stream designated as vulnerable	15 m	20 m
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.

Culverts

- 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.

Surface Drainage

- 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 ranges from marginal to fair at the long-term water quality monitoring stations in the Red River at Selkirk.
2. While water chemistry data was sporadically collected from the watershed, projects with consistently collected water chemistry data indicate that certain reaches or areas

contribute significant amounts of nutrients (phosphorus and nitrogen) to surface water.

Contact Information

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

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