Water Quality Assessment for Broughton's Creek Watershed 2002-2006

Prepared by the Little Saskatchewan River Conservation District for the Broughton's Creek Integrated Watershed Plan

Broughton's Creek IWMP Water Quality Testing Project

Goals:
To develop an understanding of the water quality within the watershed as part of the Broughton's Creek Watershed Plan.

To learn about nutrients and what role they play in water quality within the watershed.

Specific Objectives:

To understand the water quality actions across the watershed,

To understand the role of Phosphorous within the watershed,

To see, if possible, how the water quality in Broughtons Creek watershed compares to what is in the Little Saskatchewan River,

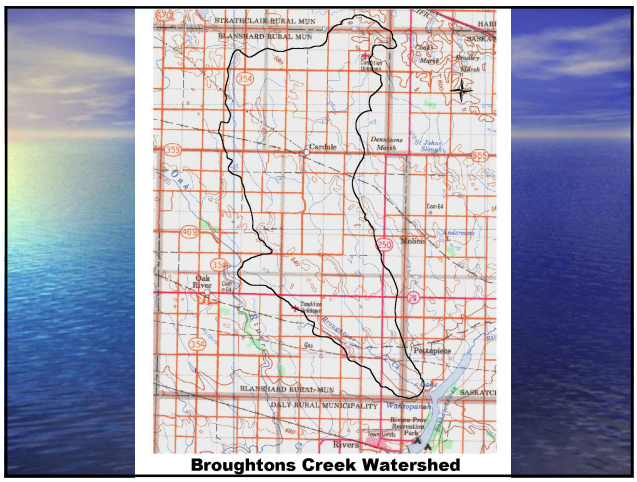
*** To see if the water quality can be put into a quantative perspective.**

Broughton's Creek IWMP Water Quality Testing Project (cont')

- This was and is not to be a finger pointing exercise
- Rather, it is opportunity to provide insight to the producers and the conservation district for future programming.

Broughtons Creek Watershed (Bio.)

- **The watershed is approximately 100 square miles in size,**
- **Watershed has a diverse agricultural & cultural background**
- **As watershed has good land practices within it: Primarily zero tillage in headwaters, sufficient riparian buffers, small amount of livestock operations toward middle and bottom of watershed.**
- **Some intensive Livestock Operations,**
- **Community of Cardale,**
- **The municipal waste facility is located in the watershed**
- **Has important role to Lake Wahtopanah and it's water quality**


STRATHCLAIR RURAL MUN
BLANSHARD RURAL MUN
Cardule
Meadow Marsh
Meadow
Oak River
Pinkerton
BLANSHARD RURAL MUN
DALY RURAL MUNICIPALITY
Rivers
Broughtons Creek Watershed

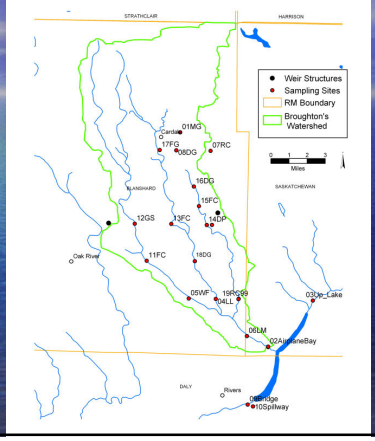
Water Quality - Surface

- Most water quality information found along Little Saskatchewan
- Not very much information collected within the watershed itself
- Have to look at:
  - Total Nitrogen
  - Total Phosphorous
  - Ammonia
  - Nitrates
- These will give an indicator to health of watershed
- Over the course of the past two years, 18 sample sites have been conducted.
- Used two test methods: Portable Kits & Enviro-Test

Water Quality – Surface (con't)

- Samples were collected under standard sampling protocols
- Sampling was targeted for the start of runoff to completion from 2002 - 2006 and attempts during rainfall events in summer
- Samples were also attempted to be collected at first part of week for Envirotest Lab analysis needs.
- All sites were marked with Global Positioning Systems (GPS) and recorded in the LSRCD Geographic Information System (GIS) Database.
- LSRCD staff collected samples and submitted to Envirotest for results. Some sites had Rivers Collegiate conducting the sampling and analysis in classroom with portable test kits.
- Some sites were reselected due to difficulty (unplowed, snow banks, wetness in spring)
- Some sites were developed to explain nutrient level fluctuations
- Some sites were included as a result of a grant request for the sampling

Sampling Sites in Broughton's Creek Watershed



Challenges to Samples collection

- Spring runoff on some sites limited to 2-3 week period (length of runoff)
- Some earlier picked sites were inaccessable because of snow
- Quick Snow melt and Flood of 2005
- Envirotest sample submission limited to early part of week.
- LSRCD normal work commitments took priority
- Spring Runoff usually meant commitment outside of summer staff

Analysis of Data

- Look at it from a Temporal Context (Time)
- Look at Data from Spatial Context (location)
- Look at Data with LSR
- Look at Data and how it may apply to other provincial projects

Analysis: Looking at samples during spring runoff vs. those taken later in the year.

Table 1. Average snowmelt and summer concentrations.

	< April 15th Snowmelt Concentration	> April 15th Summer Concentration
	mg/L	
TKN	3.25	1.77
TP	1.69	0.34
NH3	0.88	0.04
NO3	2.3	0.01

(Elliot, 2007)

Table Observations from the Spring vs. Summer Comparisons

- N (NO_3 and NH_3) are very low during the summer as the productivity of the system is likely N-limited
- P in the summer samples are high enough to be classed as hyper-eutrophic (>0.1 mg/L)
- Flow data would help to draw conclusions from temporal patterns in the concentration data, if available.

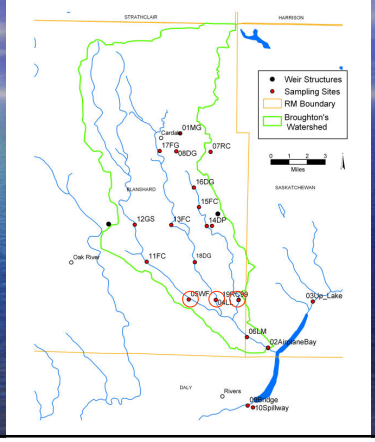
(Elliot, 2007)

Comparisons to Each of the Tributaries

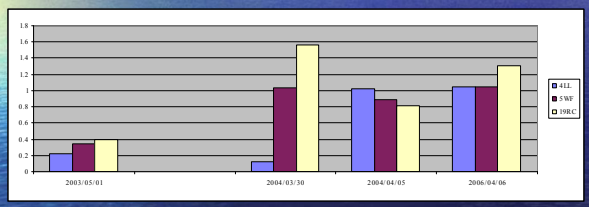
- The highest concentrations measured in the watershed are found at sites 15FC and 16DG.
- To see if the branch of creek where 15FC and 16DG were located were any different than the others, comparisons were attempted for the three branches near the confluences – sites 4LL, 5WF, and 19RC.
- Samples were taken on the same day at these sampling sites on 4 occasions (1 summer and 3 snowmelt)
- Generally, similar nutrient concentrations were measured in the three branches
- On 2 of 4 occasions P concentrations were higher on the east branch than the others but the data were variable.

(Elliot, 2007)

Sampling Sites in Broughton's Creek Watershed



Comparison of the Three Creek Channels- TP

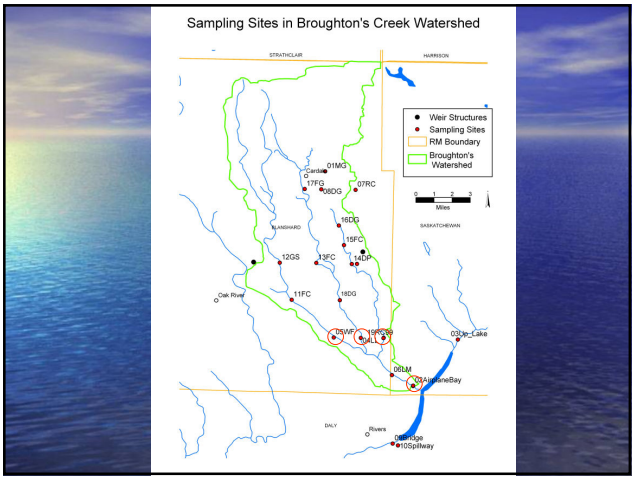


(Elliot, 2007)

Summer Observations comparing Specific Sites with Common Sampling Dates across the Watershed

- Examination of the sites over the summer (2AB has 5 samplings in common with 11FC and 4LL has 5 samplings in common with 19RC).
- The comparison between is between a mid-stream site (11FC) and a site near the outflow (2AB) indicated:
  - TKN concentrations were greater upstream (11FC than 2AB)
  - NH3 concentrations were also generally low
  - no consistent trend in TP

(Elliot, 2007)



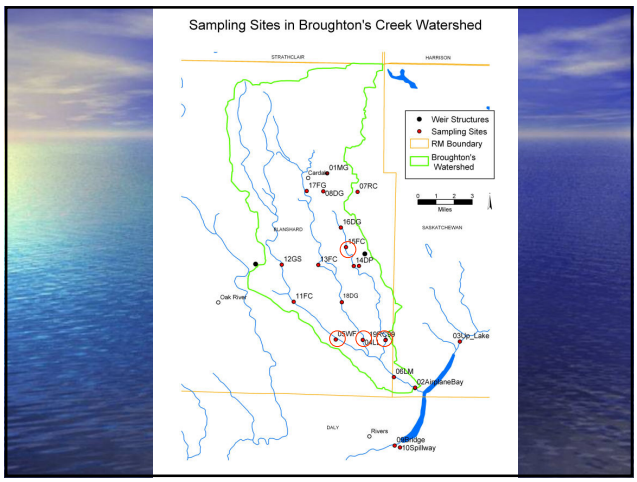
Summer Observations (cont')

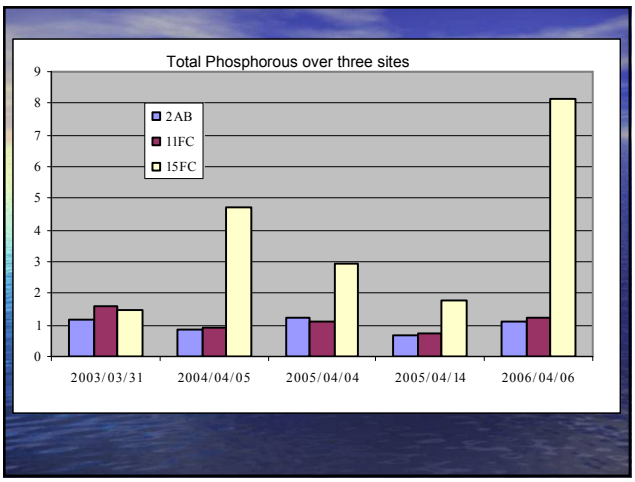
- The comparison between 4LL and 19RC is an extension of the analysis done earlier for the 3 branches of the stream but now only considers the central and eastern branches.
- NO3 and NH3 are low but tend to be slightly higher on 4LL than 19RC,
- TP concentrations are significant and generally higher on 19RC than on 4LL.

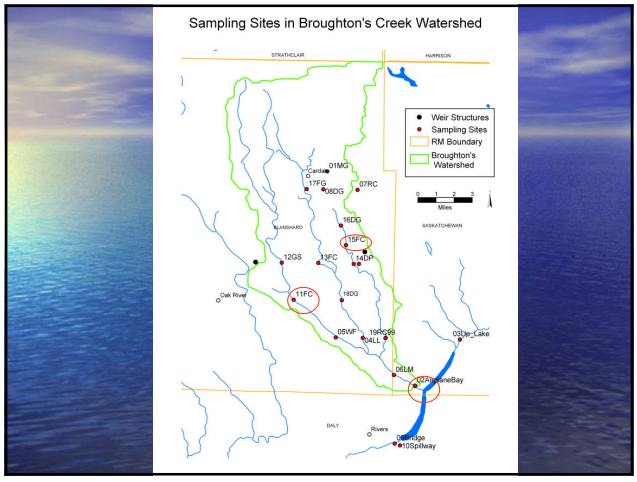
Snowmelt Observations comparing Specific Sites with Common Sampling Dates across the Watershed

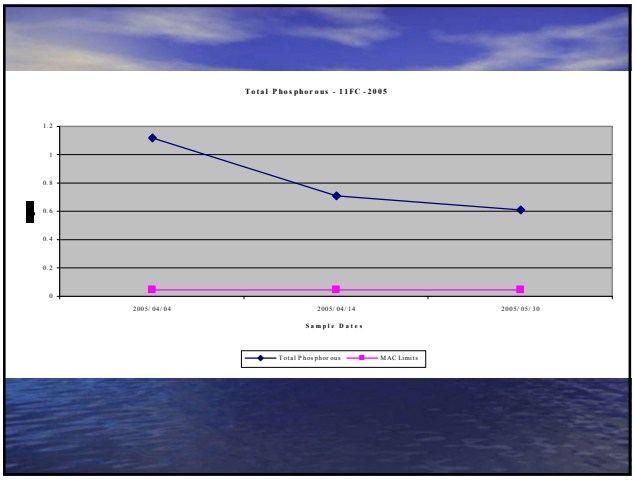
- Comparisons for the snowmelt data were made between 2AB, 11FC and 15FC, which represent downstream, mid-stream and upstream sites, respectively.
- 8 common dates for 2AB and 11FC and 6 common dates when 15FC is included.
- Concentrations at site 15FC are within the range of the other sites on 4 of 6 sampling occasions.
- Concentrations of NH3 are similar in a majority of the samples.
- TP concentrations at 15FC are considerably greater than those at 2AB or 11FC on 4 of 5 occasions.
- 15FC has higher NO3 and TKN concentrations on 5 of 6 sampling occasions.

(Elliot, 2007)

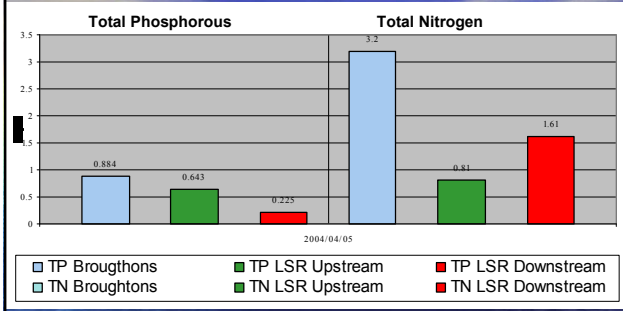

Sampling Sites in Broughton's Creek Watershed
STRATHCLAIR
HARRISON
Weir Structures
Sampling Sites
RM Boundary
Broughton's Watershed
Miles
SASKATCHEWAN
MANSHARD
Oak River
DALY
Rivers
01MG
17FG
08DG
07RC
16DG
15FC
14DP
12GS
13FC
11FC
18DG
05WF
19RC99
04LL
03Up_Lake
06LM
02AllaneBay
09Bridge
10Spillway


Total Phosphorous over three sites
2AB
11FC
15FC
0
1
2
3
4
5
6
7
8
9
2003/03/31
2004/04/05
2005/04/04
2005/04/14
2006/04/06


Sampling Sites in Broughton's Creek Watershed
STRATHCLAIR
HARRISON
Weir Structures
Sampling Sites
RM Boundary
Broughton's Watershed
Miles
SASKATCHEWAN
MANSHARD
Oak River
DALY
Rivers
01MG
17FG
08DG
07RC
16DG
15FC
14DP
12GS
13FC
11FC
18DG
05WF
19RC99
04LL
03Up_Lake
06LM
02AllaneBay
09Bridge
10Spillway


Total Phosphorous - 11FC - 2005
1.2
1
0.8
0.6
0.4
0.2
0
2005/04/04
2005/04/14
2005/05/30
Sample Dates
Total Phosphorous
MAC Limits

Broughtons and LSR Comparisons on April 4th, 2004



Total Nitrogen calculated using Total Kjendal Nitrogen +Nitrates-Nitrites

Broughton's Water Quality results compared to other Provincial Trials

- Comparisons were made choosing one point (11FC) from Broughtons Creek Watershed that would provide an estimated similar drainage basin to Deerwood Model.
- Concentrations of TN and NO3 were generally higher at Miami than in Broughton's Creek in both spring and summer
- Total P and NH3 were lower at Miami than in Broughton's Creek during snowmelt but in the remainder of the year, concentrations were lower in Broughton's Creek

Broughton's Summary

- Sample results are only to be used as guidelines
- Some degree of consistency (Year to Year) and longterm sampling to provide accurate analysis
- Most of the Phosphorous in the watershed is in the dissolved form
- Nitrogen appears to be low and in a limiting amount.
- Overall, nutrient concentrations at the downstream site were not consistently different from those at the midstream site in either spring or summer
- When east arm upstream sample sites of watershed are considered, there are generally greater nutrient levels than those downstream

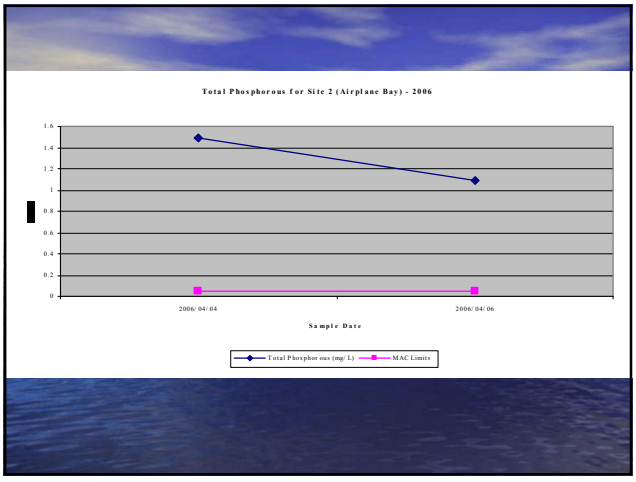
Broughton's Summary (cont')

- Some explanation for higher results upstream then changing:

1. Nutrient concentrations at edge-of-field sites frequently exceed those found in stream
2. measured concentrations usually decrease as the catchment area increases
3. include in-stream processes (physical, chemical and biological),
4. smaller proportion of the catchment that contributes water to the stream
5. The dilution effect (wetlands, DU structures, groundwater)

Lessons Learned

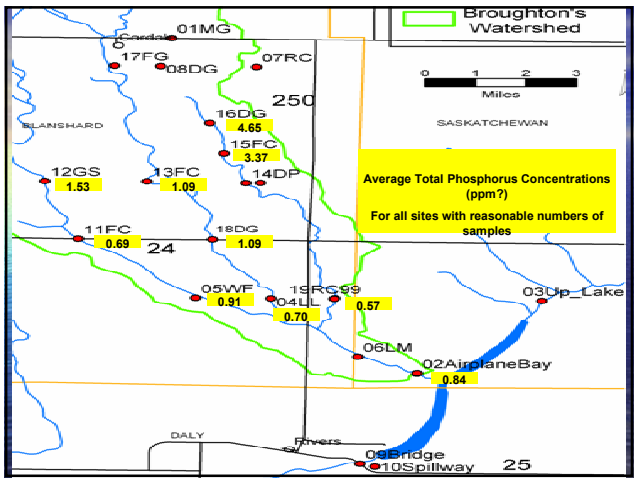
- Sample results are only to be used as guidelines
- Conducting water quality testing is costly and big commitment for labour/ money
- Sampling could be considered if Gov't picks up sampling costs – analysis and labour (WSRCD)
- Analysis on a small watershed can provide some insight, but only toward program opportunities (what can be expected from larger testing area?)

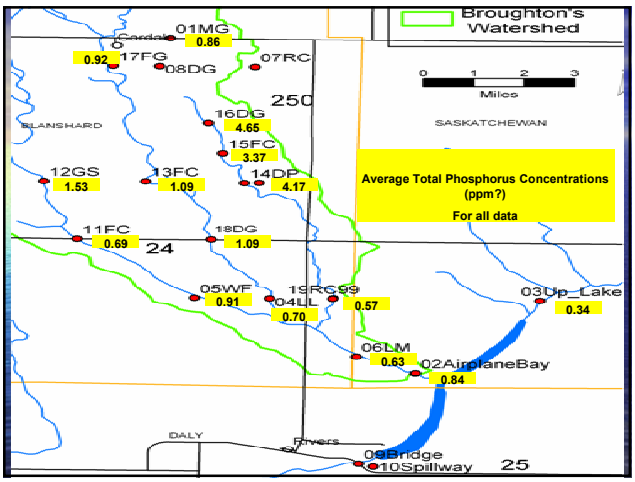


For more information:

LSRCD
Box 209
Oak River, Mb.
Phone: (204) 566-2270
Fax: (204) 566-2299
E-mail: lsrcd@mts.net

Goodbye!





Water Quality – Groundwater

- There hasn't been very much information collected regarding groundwater quality.
- There are a limited number of driller logs for the area.
- Availability of suitable groundwater is limited
- Examined water quality two ways:
  1) Looked at water quality tests from RM wells
  2) Results from LSRCD Coordinated Well Testing Program

Groundwater (cont')

	Unit	Well 1		Well 3		CCME Guideline
ph		8.2		7.9		6.5-8.5*
Electrical Conductivity	uS/cm	3400		1700		
Calcium	mg/L	43.8		202		
Magnesium	mg/L	12.6		90.1		
Sodium	mg/L	686		79.8		200*
Potassium	mg/L	9.1		8.4		
Iron	mg/L	0.17		0.32		0.3*
Manganese	mg/L	0.296		1.19		0.05*
Hardness	mg/L	161		875		200*
Total Dissolved Solids	mg/L	2180		1090		500*
Nitrite-Nitrate-N	mg/L	0.68		0.07		1**
Sulphate	mg/L	426		528		500*
Chloride	mg/L	575		22.7		250*

* Asthetic Guidelines (Guideline for Canadian Drinking Water Quality)

- Wells showed high levels of sodium, iron, hardness, Total Dissolved Solids, Sulphates, and Chlorides
- High levels of electric conductivity = High Dissolved Salts
- High Calcium +Magnesium = Hardness

2004 Testing Results

Sampling was conducted over the spring and early summer – Starting on March 30/04 – May 05/04

There seems to consistencies with previous years data.

Two of the sites (15&16) are showing continued signs of high phosphorous, Ammonia, and Nitrates-Nitrites.

Site 15

Site 16

Water Quality-Surface

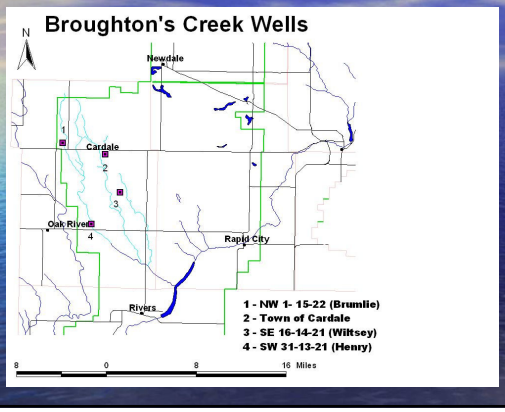
Sample Collection at Broughton's Creek Watershed			
2002 Sample Results		Human Health Allowable	Aquatic Life Allowable
Parameter	**Sample Sites Ranges**	**Limits**	**Limits**
Total Phosphorous (mg/L)	.223-.576	.025-.05**	.025-.05**
Phosphates (mg/L)(1)	.39-1.45	.025-.05**	.025-.05**
Nitrates (mg/L)	.01-.03	0.10	0.20
Ammonia (mg/L)	.03-.15		1.37 - 2.2
pH	7.8-9.0	6.5-9.0	
Dissolved Oxygen			5.0-9.5
2003 Spring Sample Results			
Parameter	**Sample Sites Ranges**		
Total Phosphorous (mg/L)	.90-4.17	.025-.05**	.025-.05**
Phosphates (mg/L)(1)	.89-3.89	.025-.05**	.025-.05**
Nitrates (mg/L)	1.4-3.54	0.10	0.20
Ammonia (mg/L)	.65-1.82		1.37 - 2.2
pH	-	6.5-9.0	
Dissolved Oxygen	-		5.0-9.5

Water Quality-Surface

What we have seen:

- *Some of the higher tributary sites showing signs of high nutrient readings in first flush (Total Phosphourous =4.17 mg/l, Phosphates = 3.89 mg/l, Nitrates = 3.54 mg/l)*
- *Ph 5- 7:*
- *Nitrogen is limiting factor in the watershed*
- *This would seem to indicate that flows do play a part in the nutrient development within the watershed and lake itself.*
- *Elevated Ecoli readings in the LSR and Lake (Coliform Total MPNQT >200 MPNU/100mL entering and 53 MPNU/100mL at spillway end of lake – Classrooms & Creeks (Rivers) 2003.*

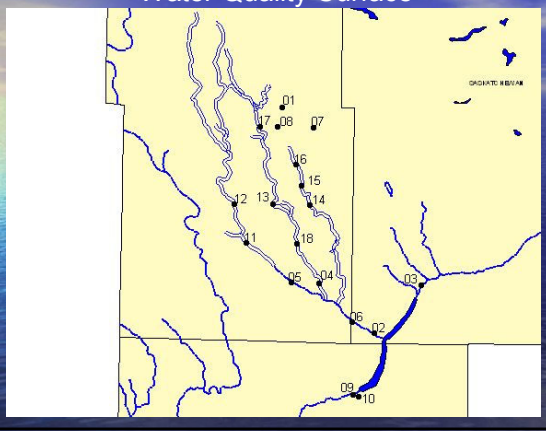
Groundwater (cont')

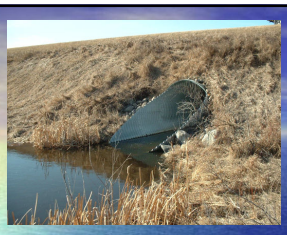


Groundwater Quality (cont')

- Nine Residents participated in the LSRCD Coordinated Well Testing Program from the watershed (2002).
- Of the nine, six failed the E-coli and Coliform Bacteria Test.
- Nitrates ranged from less than 0.01- 9.2 (Two of Seven were higher than CCME Guidelines).

Water Quality-Surface





Sample Site #4

Highway # 24 and 2nd Westerly Arm of Broughton's Creek Watershed

Site # 4

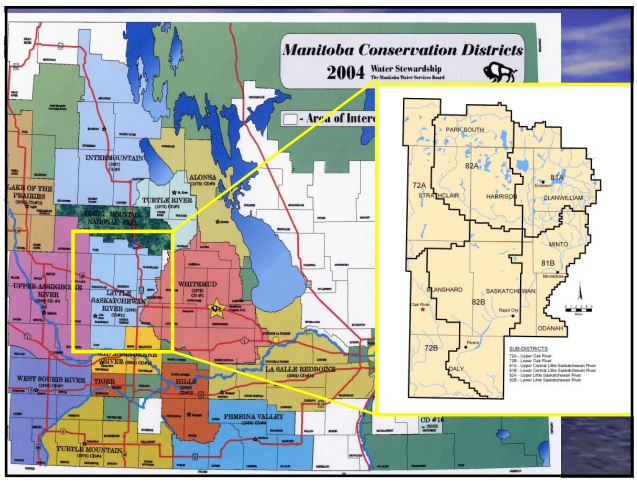
Date	Phosphates	Phosphates	Total Phosphorus	Total Phosphorus	Nitrates	Nitrates	Total Kendal Nitrogen	Total Kendal Nitrogen	Ammonia	Ammonia	Dissolved Oxygen	Dissolved Oxygen
25-Mar-03	>1		1.92	1.88	>>	3.21		4.3	0.84	0.57	9.3	
10-Apr-03			0.93				2.8		0.52			
10-Apr-03				0.273		0.01		1.7		0.04		
1-May-01				0.225		0.02		1.4		0.02		
1-May-06	0.53				0.41				>>			
14-May-03	0.48		0.29	0.198	0.11	<0.01		1.7	0.01	0.02	12.5	8.8

2002 Data

Water Quality-Surface (con't)

Comparison to Other Testing

- Broughtons Creek 2002 results comparable to what was found on the LSR in previous tests: ph that shows slightly basic and higher phosphorous and nitrogen levels, indicating high presence of aquatic plant development.
- Higher trends in spring of 2003 are result of no plant uptake of nutrients in first runoff.
- 2003 spring results showed a decline – lower numbers.
- Comparable to what would be found around the province (Mb Water Stewardship).
- This would seem to indicate that flows do play a part in the nutrient development within the watershed and lake itself.



Background: Broughton's Creek

- The LSRCD was looking to opportunity to develop program initiatives for producer
- Wanted to look at a watershed to understand what the real initiatives were on the landscape
- Wanted to develop programs that met the needs of the watershed
- Look at starting a process in a place that could serve as an example for the rest of the conservation district.