



Working with agriculture and the rural community to ensure our environment is protected.

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The Monitor

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Soil Baseline Analysis to be Completed this Fall Near Big Sky Barns (Rama)

By Jim Davis, Chairperson of Soil/Manure Monitoring Sub-Committee

During April and May 2001, the Spirit Creek Watershed Monitoring Committee reviewed presentations made by Agrologists from the University of Saskatchewan and Saskatchewan Agriculture and Food (SAF) to assist in the design of a soil-sampling program. This program would establish the present nutrient values in soils that will receive manure and allow for monitoring of nutrient movement (if any) during future cropping/manure cycles.



A Soil/Manure Monitoring Subcommittee was formed to coordinate the selection of a qualified consultant to complete the required monitoring program. The subcommittee drafted a project outline to be used for the selection of a qualified Saskatchewan consultant. Letters of interest were solicited from several consultants that resulted in a short list of three for consideration. Each was interviewed and provided the committee with information on their experience relevant to soil/nutrient monitoring. Each consultant was also asked for a proposal to carry out the monitoring project.

In early June, after reviewing the responses received, the subcommittee made a recommendation to the Spirit Creek Watershed Monitoring Committee to ask Head & Associates of Nipawin, Saskatchewan, to design and carry out the project. SAF has provided the funding for this project through the TAD (Technology Adoption and Demonstration) program for research and development.

The consultant was instructed to design a monitoring strategy that would effectively meet the project's aims. This proposal was received and approved by the Soil/Manure Monitoring Subcommittee in June.

The consultant visited the barn sites in August and identified the most representative areas for effective and accurate monitoring. Farmers whose land will provide the most effective and convenient sampling will be approached to participate. Those who participate will receive a detailed nutrient analysis – an essential tool in fertilizer application management. The analysis may also provide a comparison of the effectiveness of manure versus commercial fertilizer.

The 2001 sampling program will be completed in October. Analysis of samples, as well as entering and evaluation of data, will be completed by year-end. Head and Associates will submit a 2001 project report to the committee.

Results and conclusions will be reported to the public in the Spring 2002 issue of *The Monitor*.

Water Quality Monitoring Activities and Results

By Dr. Joanne Sketchell, Director of Environmental Sciences – Saskatchewan Water Corporation

The stewardship group The Friends of Good Spirit Lake, in conjunction with Sask Water staff, continue to monitor water quality on Good Spirit Lake. This ongoing monitoring program was established in 1997 as part of a lake stewardship program and provides some of the most up-to-date information on Good Spirit Lake.

The monitoring program includes sampling in the middle of Good Spirit Lake, close to the deepest point, to provide information on the overall quality of the lake. In addition, local residents monitor three shoreline locations including Canora Beach, Government Beach and Burgis Beach, as well as two locations on Spirit Creek – the main tributary to the lake. The volunteers for this program are crucial to its success and in 2000 included Bill Anaka, Ray Riesz, Peter Wichar, Eugene Wichar, Lloyd Wilson and Willie Baron.

At the baseline location in the middle of the lake, samples are collected and analysed for nutrients, major ions, dissolved and suspended solids, bacteria and chlorophyll *a*. In addition, Sask Water staff conducts field measurements for dissolved oxygen, temperature, conductivity, pH and secchi disk transparency. The shoreline locations are sampled for bacteria and chlorophyll *a*.

Table 1 shows the 2000 and 2001 water quality results from the deep water sampling location on Good Spirit Lake.

Table 1 Water quality results from the baseline station on Good Spirit Lake (2000 – 2001)

Parameters	2000				2001	
	May 16	June 27	Aug 15	Oct 2	May 28	Jul 10
Nutrients (mg/L)						
Dissolved Organic Carbon	27	22	27	28	NA	NA
Nitrate, as nitrogen	0.09	0.11	0.13	0.03	<0.02	<0.02
Ammonia, as nitrogen	<0.02	0.04	<0.02	<0.02	NA	<0.02
Total Kjeldahl Nitrogen (TKN)	2.1	2.4	3.0	9.2	1.5	2.8
Total Phosphorous	0.04	0.14	0.10	0.09	0.09	0.06
Ortho-phosphate as P	0.03	0.04	0.02	<0.02	<0.02	<0.02
Solids (mg/L)						
Total Dissolved Solids	725	745	737	751	709	706
Total Fixed Solids	6	17	14	13	8	11
Total Volatile Solids	21	46	38	25	22	20
Total Suspended Solids	27	63	52	38	30	31
Bacteria (organisms/100 ml)						
Fecal Coliforms	<10	<10	<10	<10	<2	<2
<i>Surface Water Quality Objectives¹</i> 200 orgs/100 ml						
Fecal Streptococci	<10	<10	10	NIL	10	<2
Total Coliforms	<10	<100	<100	8	<10	<100
<i>Surface Water Quality Objectives¹</i> 5000 orgs/100 ml						
Major Ions (mg/L)						
Alkalinity, total	222	230	232	226	220	210
Alkalinity, phenol	10	14	18	14	14	16
Bicarbonate	246	246	239	242	234	217
Calcium	44	44	42	41	44	40
Carbonate	12	16.8	21.6	16.8	16.8	19.2
Chloride	5	5	6	8	9	8
Hardness, total	489	497	492	502	497	512
Magnesium	92	94	94	97	94	100
Potassium	20	21	21	22	NA	NA
Sodium	19	20	21	20	20	21
Sulphate	287	296	292	304	291	301
Other						
Chlorophyll <i>a</i> (µg/L)	7.0	37.6	42.7	<0.2	48.9	<0.20
Conductivity (µS/cm)	922	917	934	981	968	921
Biochemical Oxygen Demand	2.9	4.8	3.8	3.6	3.6	2.9
Chemical Oxygen Demand	98.4	121	119	112	106	104
pH (pH units)	8.6	8.6	8.6	8.7	8.7	8.8
<i>Surface Water Quality Objectives¹</i> 6.5 to 8.5						
Turbidity (NTU)	7.51	25.10	26.20	18.53	8.86	16.60

¹ *Surface Water Quality Objectives*, specific for the Protection of Aquatic Life, Contact and Non-contact Recreation, August 1997

An eutrophic lake

Lakes are classified based on the amount of nutrients (nitrogen and phosphorous) in the lake and on its productivity. Lakes that have low inputs of nutrients, organic matter and sediment are called oligotrophic lakes; while lakes that are productive and have high levels of nutrients, organic matter and sediment are called eutrophic; lakes that fall between these two classifications and have a moderate level of nutrients, organic material and sediment are called mesotrophic.

To classify lakes according to their trophic status, several parameters are measured and then used as indicators. The most commonly used “trophic indicators” include nutrients, chlorophyll *a* (measure of algal biomass) and secchi disk transparency (water clarity). Based on these parameters Good Spirit Lake would be classified as an eutrophic lake.

Good Spirit Lake is also a turbid lake, in part due to the sandy nature of the lake and the fact that it is shallow and well-mixed. The secchi disk reading, which is a measure of water transparency, has ranged from 0.3 to 0.6 metres throughout 2000 and 2001. The secchi disk reading can be affected by suspended sediment, algal blooms and water colour. For contact recreation, the *Surface Water Quality Objectives* (1997) state that the secchi disk should be visible at 1.2 metres.

Like most prairie lakes, Good Spirit Lake is an alkaline lake. The lake also has a moderate level of minerals with a total dissolved solid (TDS) concentration ranging from 706 to 751 mg/L. The amount of minerals found in a water supply depends mainly on the types of rock or soil the water comes into contact with, and the amount of water lost to evaporation relative to precipitation. A high mineral concentration can restrict the use of the water, depending on the specific minerals present and their individual concentration. While a high TDS can affect the use of water for irrigation, livestock watering, municipal, and domestic uses, it generally does not have a significant impact on lake recreation activities.

Protecting aquatic life

Dissolved oxygen is essential for aquatic life. Fish, plants, invertebrates and aerobic bacteria all require oxygen for respiration. A number of factors can determine the amount of dissolved oxygen found in a lake including water temperature (dissolved oxygen increases in colder water), wind and wave action, photosynthesis, respiration and the shape and depth of a lake. For the protection of aquatic life, the Saskatchewan *Surface Water Quality Objectives* sets a minimum dissolved oxygen concentration of 5 mg/L. As Good Spirit Lake is shallow and well-mixed, the dissolved oxygen and temperature remains relatively uniform throughout the entire water column, changing very little with depth. The dissolved oxygen levels throughout the open water season in



Good Spirit Lake photo courtesy of SERM

2000 and to date in 2001 has remained above 5 mg/L for the protection of aquatic life.

Bacterial water quality

All surface waters are open to the environment and will contain a variety of bacterial species. These organisms play an important role in the decomposition of organic material and recycling of nutrients within the lake. While bacteria are present in surface waters, in recreational lakes where the water is used for contact recreation, it is the sanitary quality of the lake that is of concern.

In Saskatchewan, the bacteriological quality of the water is assessed using traditional bacterial indicators such as fecal and total coliforms or fecal streptococci. The province sets water quality objectives for contact and non-contact recreation using fecal and coliform bacteria as an indicator of microbial water quality. During the open water season in 2000 and 2001, the bacterial quality of the water at the deep-water location on Good Spirit Lake was good. Fecal coliform bacteria were not detected in the middle of the lake, and total coliform bacteria were only detected once, in October 2000, with eight organisms per 100 ml.

For the shoreline water samples collected from the three beach locations, the total and fecal coliform counts were higher than those reported for the middle of the lake. While some spikes in bacteria levels were observed in 2000, particularly at Burgis Beach, these levels have declined in 2001. Monitoring will continue throughout the open water season in 2001.

A more detailed report is being prepared by Sask Water and will be provided to the Friends of Good Spirit Lake board. A few copies will also be available from Sask Water's office in Yorkton for anyone who is interested. If individuals or organizations have any areas in the Good Spirit Lake Basin they are concerned about and would like to be considered for monitoring or would like to get involved in the monitoring program, you may contact Ray Riesz at (306) 783-0128.

Report of Spring 2001 Water Sampling

By Ray Riesz, Chairperson of Water Sampling Sub-Committee



Spring water sampling this year began in mid-April and was completed at the end of May. Runoff samples were collected at 15 sites located both upstream and downstream of three Big Sky barns in the RM of Invermay. The three barns were a farrowing, nursery and feeder/finishing site. All the sampling locations were at or near full capacity flow when sampled.

As the runoff water flows downstream, the water fills dugouts, sloughs and wetlands that may serve as recharge zones for groundwater in the area. As a result, water quality of the spring runoff water can be very important to the groundwater quality.

The analysis reports show that most of the parameters tested fall within Surface Water Quality Objectives. Nutrient values were high – as an example, the average for phosphorous (ortho) was 0.31mg/L. Ortho-phosphates are the most reactive (biologically accessible) form of phosphorous. Thus, the higher the level of ortho-phosphates in the stream, the more food is readily available for immediate use by algae plants. This can cause excessive weed and algal growth as can now be seen along Spirit Creek.

Phosphorus can occur naturally through the decomposition of organic matter and is also applied as a fertilizer for agriculture. The ortho phosphorous attaches to soil particles and is moved into waterways by erosion. It is easy to understand why the use of buffer zones and protecting riparian areas is so important.

A total of 21 wells, 58 dugouts and two reservoirs were sampled. This is an increase of 10 wells and 21 more dugouts than were sampled last fall. We wish to thank everyone for their participation and courtesy when we arrived to sample either the surface water or groundwater on their property. By request of landowners, two dugouts that were sampled last fall were not sampled again this spring.

Every participant in the sampling objectives program receives a copy of the Municipal Drinking Water Quality Objectives along with a copy of their water analysis. The objectives are meant for treated water, and we urge the participants to compare their analysis with the guidelines to help determine the required treatment for their water. With proper treatment, most of the water quality in the area would meet the Municipal Drinking Water Quality Objectives. The public can also contact Sask Water (786-1490) or the local Public Health Inspector (786-0618) for further advice.

The Provincial Water Laboratory at Regina preformed the analysis for all wells, dugouts, and runoff. Additionally, some duplicate samples were sent to Saskatchewan Research Council for comparison. Some of the parameters tested include the major ions, bacteria, suspended and dissolved solids, bacteria and ferrous and non-ferrous metals. A summary of the results is available from the Committee to anyone who is interested.

Another sampling of the wells and dugouts will be conducted this fall. The results of this sampling, along with those already taken in fall 2000, will help establish a baseline to which results of further sampling can be compared.



Example of high flow during runoff within Spirit Creek Watershed.

Next Steps

September/October - Fall water sampling

October - Baseline soil sampling

Winter 2002 - First soil monitoring report

March 2002 - Spring newsletter

April 2002 - Spring runoff monitoring