SCEI Riverwatch Handbook:

A Guide for Student Monitoring of Water Quality

Program Background

South Central Eco Institute

in
Prairie Spirit School Division
South Central Manitoba
in the
Red River Watershed

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As primary team members, we would like to acknowledge the support of our many partners; we would not be where we are with this program without them.

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Our goal was to develop a program within the schools and surrounding community which would teach students, through their involvement in Water Related Scientific Research, and working in consultation with the local Conservation Districts, the importance of being aware of our effect on our water resources.

Within months of proposing this concept to local groups, we became aware that there was more interest than we had expected. We met with the managers of the Pembina Valley, La Salle Redboine and Assiniboine Hills Conservation Districts and were pleased that they were all interested in developing this concept. We arranged for the managers to meet with the principals of the Prairie Spirit School Division to promote the partnership concept. This meeting led to the organization of a pair of Workshops, held on April 24 and 27, 2009.

Suffice it to say, twenty-five of the twenty-seven schools in this division, covering the upper Pembina River Watershed, and components of the Boyne, and Assiniboine Watersheds agreed to send teams of teachers to be trained in the use of the Ducks Unlimited Project Webfoot and the Riverwatch program to be used as vehicles for the development of this awareness. Project Webfoot, provided by Ducks Unlimited, would serve as an introductory level for use with Grade Four students.

The Riverwatch program is accessible to junior high students, as for example, the photo on the cover of this document These students were involved in a training session which took place along the Pembina River during a trial session held in the autumn of 2008.

Using our on-site weather station, we wanted to provide an opportunity for the students to study long-term trends in weather patterns and their effect on water quality and quantity.

Through discussions with the International Water Institute (Wayne Goeken) and the American Riverwatch program and with the Alberta Riverwatch, we have developed a web site which allows field representatives to enter data fathered locally into the web

site data banks. This data is reviewed by the web administrators and, after confirmation, the data is available to the public for review and analysis.

We wanted to include the students, through their collection of data, in the development of a Watershed Management Plan for the district.

The Pembina Valley, LaSalle Redboine, and Assiniboine Hills Conservation District have provided training for students in their districts. The Pembina Valley Conservation District has supported student learning through many components of their Water Management Plan and through their participation in the Envirothon program at the school. This process will be expanded to include the LaSalle Redboine and the Assiniboine Hills Conservation Distiricts, and others, as their partnerships with the schools develop.

Finally, we wanted to promote eco-environmental trades and careers through the development of an awareness of the work our partners do. Students work with these local technicians, from an early age. Students participate in internships during their senior high years through the school's Career and Technology Studies program.

We would like to thank all of the staff of Prairie Spirit School Division. This has become a much larger project than we initially believed possible. The dedication to a cause evident at the workshops held in April 2009 left us feeling rather overwhelmed. The need to expand the program has led to the necessity of dividing our school and conservation district partners into cohorts – smaller groups each working with one field kit. We appreciate the willingness to lead and the willingness to work in partnership which is implicit in this structure.

There will no doubt that the process of data collection and training is ongoing, as students grow and graduate, and as new staff and volunteers join the program. The goals of the project will be refined as we learn from experience. We have no doubt that the work will get done, though.

Please contact us if you have any questions or suggestions.

Thanks

Kent Lewarne

Lynda Matchullis

Al Thorleifson

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1. Overview

a. Riverwatch program

Oak Hammock Marsh Interpretive Center is the host organization for the Riverwatch program in Manitoba. An overview of Riverwatch (as appears on their website) follows:

River Watch

Introducing students and teachers to water quality monitoring with the help of the Interpretive Centre

River Watch, a program of the Red River Centre for Watershed Education, has teachers, students and citizens teaming up to monitor the water quality of selected rivers and streams in the Red River watershed. The program is delivered in Manitoba by the Oak Hammock Marsh Interpretive Centre.

The Red River Basin River Watch Monitoring Program, or River Watch, began in Minnesota in 1995. The watershed-wide (Minnesota, North Dakota and Manitoba) program provides hands-on, 'real world', science opportunities for participating students, teachers and citizens. With some training, participants collect, analyze, and share water samples and data.

The program provides leadership experiences for students, promotes community understanding of the importance of watersheds, and contributes to a greater understanding of baseline water quality in the Red River Basin. Water sampling is done on a regular basis; usually once a month throughout the open water season. In Manitoba, the information is also added to the Interpretive Centre's interactive GIS community mapping project.

b. Riverwatch in Prairie Spirit – Development of the South Central Eco Institute

As a rural agricultural community we are dependent on our water resources. Most members of the community are, however, not aware of the techniques used to analyze and manage these resources, nor of the importance of the technical trades people whose job it is to manage the resource.

Many of the trades people employed on eco-environmental projects are unaware of the scientific basis of the research which grounds these projects.

We need to make students aware of the relationship between eco-environmental issues and the related trades and careers, and to provide them with the opportunity to gain real-time experience with them.

We need to make students aware that they are a part of a much larger watershed. The flooding and related water-based concerns on and near Lake Winnipeg are, to some extent, due to the way we manage our water here. The water problems which we deal with cross political and community boundaries; the more we work in partnerships, the more aware students will be of their interconnectedness.

The South Central Eco-institute is an umbrella organization consisting of members of the academic community, local governmental representatives, reps from the eco-environmental trades and agencies, and interested community members.

The Institute is grounded in water resource management. There is already a strong infrastructure within the region, but the seasoned trades persons will now work alongside students and their teachers. The goal is to affirm the importance of water to our lives and to affirm the credibility of the experts who manage water resources. The students will begin to see themselves as some of these credible experts and will spread this knowledge within their own families and communities.

c. Goals of Program

Our ultimate goals are:

To improve our students' awareness of water resources, both surface water and ground, our use of it, and the quality of the supply. Students will work in conjunction with community trades persons and professionals and will become aware of the role played by resource technicians in the community.

> Nellie McClung Collegiate (NMC) annually chooses a team of senior students who are trained in the use of the River Watch equipment and in the teaching of the Project Webfoot curriculum. They will teach younger students in the Manitou community and will serve as a model team for other schools as they continue to develop this partnership model.

To develop and maintain a collection of software and applied technology tools to be used to study water quality, water resource management, and water retention.

> South Central Eco Institute members have been in consultation with professionals in the field and have chosen a collection of tools and software which are consistent with professional standards and still accessible to students in the schools. To date, twelve footlocker kits have been assembled each containing the collection of tools and resources required to test water quality in the watersheds. These kits have been distributed throughout the region.

To provide annual in-service opportunities for teachers, conservation district staff, and community volunteers in the use of and maintenance of the testing tools, the analysis of the data, its interpretation for the general public, and the transfer of the data to the SCEI web site.

> Meeting have been held with divisional administrators. Based on these meetings, two workshop days, called the Partners' Forum, were held on April 24 and 27, 2009. At these workshops, division staff shared their own programs and experiences, met potential partners, trained in the use of the tools and software, and planned their own goals for the initial year. These workshops became the model for our annual training sessions.

To encourage student awareness of the trade careers involved in water resource management through the Career and Technology Studies program of the collegiate.

During the past years, students at Nellie McClung have received credits through eco-environmental Internships. These credits all include awareness of technical tools and their use in the field.

To define the infrastructure needed to expand this program to other schools and communities in the division.

Nellie McClung Collegiate has, over many years, worked in concert with divisional staff to promote this model of partnership. We have instigated meetings between conservation districts and the principals and teachers of regional schools.

We have encouraged the sharing of current practices and partnerships, and have begun the process of training staff in the use of the technical tools and software which we initially purchased under the auspices of the TVI Demonstration Project Grant which we received in 2008 – 2009.

We have attempted to ensure the availability of sufficient tool kits. We intend that schools will share these kits, due to the cost. However, we have tried to ensure all staff have access to the kits during the autumn and spring/summer seasons on a regular enough basis to provide a well-grounded knowledge in their purpose and use. As well, it is important to model for students the necessity to do regular, consistent testing.

We have been able to fund the kits through the support of such organizations as Manitoba Water Stewardship. We have provided schools with these starter kits, and have one full kit which currently will serve the entire division. We do not feel this is adequate and will continue to upgrade the kits as funds and tool analysis through field experience continue.

To develop a model to deal with the replacement of consumables needed for the tool kit, a regular reporting system, and a single site where these consumables will be ordered and stored, and from which they will be disbursed. This site will also arrange for ongoing maintenance and repair of tools and technology.

Although we have an initial idea of how this will be accomplished, we will need to work with divisional staff and partners to ensure the consumables are as inexpensive and as available as possible.

d. As a member of a Cohort

A cohort can be defined as “a company of companions or supporters” or those having a common characteristic. We believe that those in the Riverwatch cohorts have a common interest in making the study of water quality come alive for students through hands-on experiences.

Schools in PSSD are divided into a series of seven cohorts; others are being developed:

	Cohort	**Schools and Partners**
1	PSSD Teaching	Nellie McClung Collegiate, PVCD
2	PSSD Southwest	Pilot Mound, Thomas Greenway, Cartwright, Willow Creek, Crystal City Elementary
3	PSSD Southeast	West Valley, Manitou Elementary, Evergreen
4	PSSD Central	Somerset, Westmount, Ste. Marie
5	PSSD Northwest	Baldur, Glenboro, Holland Elementary
6	PSSD Northeast	St. Claude, Treherne Elementary, Treherne Collegiate
7	PSSD Colony Central	Windy Bay, Whistling Wind, Shamrock, Sandy Bank, Valleyview
8	PSSD Colony North	New Rosedale, Shady Lane, Fairholme, Boyne Valley, Kamsley
9	Boyne	LaSalle Redboine, Carman Collegiate
10	Red	Bob Adamson and Pembina Trails
11	tba	
12	tba	

Although all PSSD schools are listed, only schools with a teaching staff member trained in Riverwatch are considered active members. Staff will continue to be trained at later sessions and will then get access to the equipment.

Schools within the cohort will have a trained teaching member delegated as primary contact. That contact has the following duties:

a. For PSSD schools, book the footlocker kit by going to your cohort calendar in the First Class Container under Riverwatch. Those who book a footlocker have first access to it. You can only book for a week at a time. Other cohorts will need to develop a similar booking schedule.

b. Arrange for pickup of the Riverwatch footlocker (and related equipment) from another school in the cohort. Record in the Use Log at the back of the binder.

c. Go over the checklist upon receipt to confirm equipment is in good order and you have enough consumables (eg. batteries, the chemical components of the water testing kits).

d. Clean all equipment after use (i.e. wash off the river mud!) and store dry. Some equipment has specialized requirements (eg. the probes on the Sonde units).

e. Notify Kent Lewarne of any shortages or damage.

f. Record data on an SCEI Water Sampling Data Sheet and make a copy for the use log. That way, those in your cohort have ready access to your results. Keep your own copy and also enter the data in the SCEI Riverwatch Web Site. Choose the correct watershed and site; sites must be registered on the web site before the data can be entered.

g. Let the next school who has booked the equipment know that it is ready.

h. Any tools which need repair should go back to Nellie McClung at the end of January for servicing. Inform Kent Lewarne whenever there is a need to replenish consumables. PSSD technicians will assist with this.

Identified contacts as of June 2010:

	Cohort	Schools	Contact
1	Teaching	**Nellie McClung Collegiate**	**Kent Lewarne**
2	Southwest	**Pilot Mound,** **Thomas Greenway,** **Cartwright**, Willow Creek, Crystal City Elementary	**Brad Anderson** **Ken Beavis** **Dean Scheepmaker**
3	Southeast	**West Valley**, Manitou Elementary, Evergreen	**Peter Plante**
4	Central	**Somerset**, Westmount, Ste. Marie	
5	Northwest	**Baldur,** **Glenboro**, Holland Elementary	**Devin McLean** **Karen Rawlings**
6	Northeast	St. Claude, **Treherne Elementary,** **Treherne Collegiate**	 **Allison Simon** **David Matskiw**
7	Colony Central	**Windy Bay,** **Whistling Wind,**	**Al Deschambault** **Raymond Wollman**

		Shamrock, Sandy Bank, Valleyview	**Clarence Hofer**
8	Colony North	**New Rosedale**, Shady Lane, **Fairholme**, Boyne Valley, Kamsley	**Hilda Maendel** **Garry Strick** **Evelyn Maendel**
9	Boyne	**LaSalle Redboine** **Carman Collegiate**	**Justin Reid** **Rosanne Massinon**
10	Red	**Pembina Trails**	**Bob Adamson**
11	tba		
11	tba		

2. Education

a. Outcome matches – using Riverwatch to teach/learn curricula

Education for sustainable development is a priority for the Manitoba Government and, indeed, we are seen as leaders in its implementation. The intent is to embed these outcomes throughout the curricula and through a number of curricular matches. These are outlined in the *K-10 Sustainable Development Outcomes* document found in the PSSD First Class Best Practices Container under Sustainability. They are also available on the Manitoba Education, Citizenship, and Youth website along with a number of excellent resources: http://www.edu.gov.mb.ca/k12/esd/index.html

A focus on In order to facilitate integration of Riverwatch processes, we have provided below a summary of the curricular matches. This summary will allow you to focus on river and watershed research in early years, middle years, and senior years programs..

Early Years:

Although most of the Riverwatch tools were not intended to be used by Early Years students, it is important to introduce the philosophy of Riverwatch at this stage. Students should learn that they are part of a larger environment that has both physical and living

components. They should recognize that the environment is constantly changing, through both natural and man-made influences.

- Teach students to value the environment through stories from various cultures.

- Take them out into an outdoor classroom to inquire about their surroundings through tree rubbings, dipnetting, and examining rotting logs.

- Grade 2 Science has the closest matches regarding water systems but other science outcomes that refer to habitat, soils, and plants can be taught with a focus on the riparian area. Riparian refers simply to the place where the land and stream meet.

- On your outdoor excursions, play nature games by the water's edge.

Finally, have students realize that they are someone else's upstream neighbour and have a responsibility to take care of the environment. Indeed, the Grade 4 Social Studies curriculum calls upon students to recognize the unique relationship that aboriginal peoples have with the environment, and that we are all called upon to be environmental stewards.

K-4 Social Studies Outcome Matches:

K	KL-012 Describe characteristics of the local physical environment. Include: natural and constructed elements VL-003 Appreciate the beauty and importance of the natural environment. VG-005 Demonstrate interest in the larger world beyond their immediate environment.
1	KL-012 Recognize that people depend on the environment for survival. KH-019 Describe how the repeating patterns of the seasons influence their lives. VL-007 Appreciate the beauty and benefits that the natural environment brings to their lives. VL-007A Value the special relationships Aboriginal people have with the natural environment. KG-020 Recognize that people all over the world have similar concerns, needs, and relationships. KG-021 Identify relationships or connections they have with people in other places in the world. VC-001 Respect the rights and need of others.
2	S-103 Make decisions that reflect care, concern, and responsibility for the environment. KL-017 Give examples of ways in which the natural environment influences their communities. KL-022 Explain the importance of conserving or restoring natural resources.
3	KC-005 Recognize that people around the world have basic human rights. *Examples: access to food, water, shelter, a secure environment, education, fair and equal treatment…* KG-031 Give examples of personal decisions and actions that may positively affect people locally or globally. *Examples: charitable donations and projects, recycling…* KE-036 Give examples of how the natural environment influences work, goods, technologies, and trade in communities studied. VL-005 Appreciate the diversity of the global natural environment.
4	KL-023 Identify issues related to environmental stewardship and sustainability in Manitoba. KL-024 Give examples of Aboriginal peoples' traditional relationships with the land. VL-006 Appreciate Manitoba's natural environment. VL-006A Respect their spiritual connections to the natural environment (land, water, sky).

K-4 Science Outcome Matches:

K	Focus on trees
1	1-1-10 Describe how humans and other living things depend on their environment to meet their needs. *Examples: the environment provides humans and other living things with food …*
2	2-2-16 Describe ways humans dispose of solids and liquids to maintain a clean and healthy environment. *Examples: take used car oil and old paints to collection sites, recycle newspapers…* Cluster 4: Air and Water in the Environment 2-4-11 Explain and appreciate the importance of clean air and water for humans, plants, and animals. 2-4-12 Identify substances that pollute air and water, and describe ways of reducing such pollution. *Examples: car exhaust, smoke, carbon monoxide, oil, house paints, and sewage…* 2-4-13 Recognize that clean water is an increasingly scarce resource in many parts of the world, and describe consequences of a shortage of clean water.
3	If you consider plants and soils in a riparian area: 3-1-16 Identify how humans from various cultures use plant parts for food and medicine. *Examples: use of roots for food (carrots) and medicine (ginseng) …* 3-1-17 Investigate to determine how humans from various cultures make useful products from plant materials. *Examples: lumber milling, paper making, rope making, fabric making …* 3-1-18 Explain how humans replenish the plants they use and the consequences if plants are not replenished. Examples: after loggers harvest trees, new ones should be planted to ensure a future lumber supply… 3-4-08 Explain the importance of understanding the characteristics of different soils. *Examples: enables farmers to determine which crops can be grown in a particular area, enables gardeners to improve plant growth, enables engineers to know what types of foundations to set for structures…* Sci 3-4-10 Describe ways to return organic matter to the soil. *Examples: composting, spreading manure on fields…*
4	If you consider the riparian area: 4-1-13 Predict, based on their investigations, how the removal of a plant or animal population may affect the rest of the community. *Examples: if the wolves were removed from a community, the deer population may increase rapidly…* 4-1-14 Investigate natural and human-caused changes to habitats, and identify resulting effects on plant and animal populations. Include: endangerment, extinction. 4-1-15 Describe how their actions can help conserve plant and animal populations and their habitats. *Examples: clean up a local stream to improve fish and bird habitat…* 4-1-17 Recognize and appreciate how traditional knowledge contributes to our understanding of plant and animal populations and interactions. 4-4-12 Investigate and describe ways in which soil erosion is controlled or minimized in their community and in communities around the world. *Examples: windbreaks, retaining walls, terracing, cover crops, reforestation…* 4-4-13 Use the design process to determine an appropriate system for controlling soil erosion in a given situation. 4-4-15 Identify natural phenomena and human activities that cause significant changes in the landscape. Examples: floods, avalanches, mud slides, hydroelectric dams, clearing land for agriculture, clear-cut forestry, forest fires…

K-4 Physical Education/Health Education Outcome Matches:

K	A.1.6 Appreciate and respect the natural environment while participating in physical activity.
1	A.1.6 Appreciate and respect the natural environment while participating in physical activity.
2	A.1.6 Appreciate and respect the natural environment while participating in physical activity. K.3.2.B.2 **Identify ways to avoid potentially dangerous situations related to water** (e.g., floods, bathtubs, ice conditions, big waves, lightening…) **and unsupervised situations** (e.g., waterfront…) **for self and/or others**.
3	A.1.6 Appreciate and respect the natural environment while participating in physical activity.
4	A.1.6 Appreciate and respect the natural environment while participating in physical activity. K.5.4.A.2 Identify ways (e.g., avoid loud sound, don't drink or swim in contaminated water, avoid second-hand smoke, avoid plants and food that causes allergic reactions, wear a hat, wear sunscreen…) **to prevent reactions to various environmental conditions** (e.g., noise, water, sun, air, plants…).

Middle Years:

In Middle Years, students continue developing an appreciation for natural environments and how to sustain them. Those could be on river ecosystems. Different perspectives are considered, in particular those of First Nations. The science becomes more specific by Middle Years.

Exploring where we are in the world and what creates our sense of community – these are issues which can be developed in Middle Years. By participating in the Watershed Legacy Project through Oak Hammock, students identify key locations in their communities, mark them with GPS, and then have the data and pictures loaded onto the Oak Hammock Website.

Grade 6 students can learn about the five kingdoms using river organisms as examples. The curriculum actually suggests field trips out into the environment and the collection of pond organisms for identification - with a particular emphasis on invertebrates.

By Grade 7, students begin to look at relationships. Their energy pyramids can reflect river food chains and webs. They should also be introduced to practices and events which might impact the sustainability of river systems. In particular, once students have looked at turbidity levels, they can examine what factors lead to greater erosion on riverbanks and increased silt levels. The impacts of this on particular organisms would follow (i.e. affecting water temperature or spawning for fish). An examination of pH and initial discussion of water chemistry is suitable when considering the issue of river pollution and bioaccumulation in river organisms.

Grade 8 Science is all about water systems. This is a perfect point to talk about watersheds and downstream neighbours. Contact your local water conservation district to see if you can tour where they have water quality/quantity projects. Find out how your local water is treated – just how safe is it? Use what you learn in this unit to help determine suitable Riverwatch sites.

Finally, when working in the natural environment, consider the opportunities for physical activity by planning for a hike or outdoor games.

5-8 Social Studies Outcomes:

5	S-103 Make decisions that reflect care, concern, and responsibility for the environment. S-207A Use traditional knowledge to read the land. KL-017 Describe practices and beliefs that reflect First Peoples' connections with the land and the natural environment. KE-051 Compare First Peoples' and European approaches to natural resource use in early Canada. *Examples: hunting and fishing, agriculture, trade, landholding and ownership…* VE-015 Be willing to consider diverse approaches to resource and land use. VL-007 Appreciate the significance of the land and natural resources in the development of Canada. (think about the role of rivers …)
6	KL-024 Give examples of the influence of the natural environment on daily life for various groups

	during the Depression. (think about water tables and river levels) KL-026 Describe the influence of the natural environment on life in Canada. KL-026A Describe the influence of the land on their First Nation, Inuit, Métis identity. *Examples; values, beliefs, traditions, customs, art, clothing… (think about the role of rivers)* VL-011 Value the natural environment.
7	S-103 Make decisions that reflect the principles of sustainable development. KL-018 Locate on a world map the major population clusters and explain the relationship between population distribution and the natural environment. (think about watersheds) KC-002 Describe the impact of various factors on quality of life in Canada and elsewhere in the world. Examples: access to shelter, food, water, health care, and education; globalization … (think about Canada's surface water reserves)
8	S-103 Make decisions that reflect the principles of sustainable development. KL-022 Give examples of the influence of the natural environment on the development of societies. (think about settlement along rivers) VL-008 Appreciate the importance of sustaining the natural environment for future societies.

5-8 Science Outcomes:

5	5-4-18 Recognize that climates around the world are ever changing, and identify possible explanations. (Think about rivers – what are weather influences, what are climate influences?) *Examples: volcanic eruptions, ozone depletion, greenhouse effect, El Niño, deforestation…*
6	**6-1-04** Identify living things using an existing classification key, and explain the rationale used. *Examples: identification of birds, butterflies, animal tracks, winter twigs...* **6-1-07** Recognize that many living things are difficult to see with the unaided eye, and observe and describe some examples. **6-0-5a** Make observations that are relevant to a specific question. GLO: A1, A2, C2 **6-0-5c** Select and use tools and instruments to observe, measure, and construct. *Examples: hand lens, telescope, binoculars…* GLO: C2, C3,C5 **6-0-5f** Record and organize observations in a variety of ways. *Examples: point-form notes, sentences, labelled diagrams, charts, ordered lists of data, frequency diagrams, spread sheets…* GLO: C2, C6 (ELA Grade 6, 3.3.1; Math: SP-III.2.6) **6-0-9e** Be sensitive to and develop a sense of responsibility for the welfare of other humans, other living things, and the environment. **6-1-08** Observe and describe the diversity of living things within the local environment. Include: fungi, plants, animals. **6-1-09** Recognize that the animal kingdom is divided into two groups, vertebrates and invertebrates, and differentiate between the two. Include: vertebrates have backbones, invertebrates do not. **6-1-10** Provide examples of a variety of invertebrates to illustrate their diversity. Include: sponges, worms, molluscs, arthropods. **6-1-11** Compare and contrast adaptations of common arthropods, and describe how these adaptations enable them to live in particular habitats. GLO: D1, D2, E1
7	Do the Interactions within Ecosystems Unit in the context of the River 7-1-05 Identify and describe positive and negative examples of human interventions that have an impact on ecological succession or the makeup of ecosystems. *Examples: positive protecting habitats, reintroducing species; negative-preventing natural fires, introducing non-indigenous species, draining wetland for agriculture or housing…* 7-1-06 Identify environmental, social, and economic factors that should be considered in the management and preservation of ecosystems. *Examples: habitat preservation, recreation, employment, industrial growth, resource*

	development… 7-1-07 Propose a course of action to protect the habitat of a particular organism within an ecosystem. *Examples; protect the nesting habitat of a given bird in a local wetland…* 7-1-10 Analyze, using ecological pyramids, the implications of the loss of producers and consumers to the transfer of energy within an ecosystem. 7-1-11 Explain, using ecological pyramids, the potential for bioaccumulation within an ecosystem. 7-4-10 Describe methods used to control soil erosion, and recognize the importance of soil conservation. *Examples: economically important to the agri-food industry, important for controlling the flow of water, necessary for plant growth…* 7-4-11 Identify environmental, social, and economic factors that should be considered in making informed decisions about land use.
8	Cluster 4: Water Systems (Riverwatch is a perfect fit!) 8-4-05 Describe how the heat capacity of large bodies of water and the movement of ocean currents influence regional climates. *Examples: Gulf Stream effects, El Niño, lake effect…* 8-4-11 Describe examples of human interventions to prevent riverbank or coastal erosion. *Examples: vegetation, reinforcement (concrete, boulders), piers, breakwaters…* 8-4-12 Identify factors that can cause flooding either individually or in combination. *Examples: heavy snow pack, quick thaw, rain in spring, lack of vegetation to remove water through transpiration, frozen ground preventing absorption, agricultural systems, dams, diversions…* 8-4-13 Provide examples of the way in which technology is used to contain or prevent damage due to flooding, and discuss related positive and negative impacts. *Examples: floodway, diversion, dike, levee …* 8-4-14 Identify sources of drinking water and describe methods for obtaining water in areas where supply is limited. *Examples: desalination, melting of ice, condensation…* 8-4-15 Explain how and why water may need to be treated for use by humans. Include: filtration, settling, chlorination, fluoridation. 8-4-16 Compare the waste-water disposal system within their communities to one used elsewhere. Include: process involved, environmental impact, cost. 8-4-17 Identify substances that may pollute water, related environmental and societal impacts of pollution, and ways to reduce or eliminate effects of pollution. 8-4-18 Identify environmental, social, and economic factors that should be considered in the management of water resources. *Examples: ecosystem preservation, employment, recreation, industrial growth, water quality…* 8-4-19 Use the design process to develop a system to solve a water-related problem.

5-8 Physical Education/Health Education Outcomes:

5	A.1.6 Appreciate and respect the natural environment while participating in physical activity. K.3.5.B.2 **Describe ways to respond appropriately to potentially dangerous situations related to environmental conditions** (e.g., floods, fires, extreme weather conditions, icy conditions, lightning…) **relevant to self and others**.
6	A.1.6 Appreciate and respect the natural environment while participating in physical activity. K.3.6.A.2 **Determine how environmental conditions can influence safety while exercising outdoors** (e.g., effects of ultraviolet rays, hot sunny weather can lead to heat exhaustion and sunburn, cold weather and high wind-chill factors increase risk of hypothermia and frost-bite…). K.3.6.A.3 **Recognize reasons** (e.g., safety, personal hygiene, comport, ease of movement…) **for appropriate dress for physical activities in different weather and environmental conditions** (e.g., sunny, cold, windy, wet …). K.3.6.A.5a **Show an understanding of potential safety risks related**

7	A.1.6 Appreciate and respect the natural environment while participating in physical activity. K.3.7.A.5b **Outline the emergency steps** (e.g., seeking help, first aid…) **related to water incidents or accidents** (e.g., hypothermia, drowning…).
8	A.1.6 Appreciate and respect the natural environment while participating in physical activity. K.5.8.B.2 **Investigate different ways to increase physical activity in daily living as it relates to sustainable development** (e.g., using stairs, cycling/walking to school to help the environment and to contribute to the health of society…).

Senior Years:

By Grade 9, students are focused on local and global citizenship issues. The focus for this program should be on sustainability of river systems and the politics/ethics of water use. Students must begin to see that they have a responsibility to take action on water quality. They can begin to use a decision-making process to examine water issues.

Grade 10 Science has a nice fit for the Riverwatch program as students start to examine how nutrients cycle through living and non-living systems.

- How do carbon, nitrogen, and phosphorus cycle through our local rivers?

- What local agricultural and industrial practices impact their levels (positively and negatively)?

- What is our impact on our downstream neighbour – Lake Winnipeg?

- What does climate change mean for our water landscape? Again, get out and sample those rivers.

- This is the perfect opportunity to look at long-term data from your sites on our SCEI Web Site as you examine the local ecosystem.

- Is the health of your local river changing? Why?

- Determine how you might take action to clean up a local riverbank (contributing to sustainability through physical activity).

9-10 Social Studies Outcomes:

9	S-103 Promote actions that reflect the principles of sustainable development. S-107 Make decisions that reflect social responsibility. KL-028 Evaluate Canadian concerns and commitments regarding environmental stewardship and sustainability. VL-007 Be willing to make personal choices to sustain the environment.
10	S-103 Promote actions that reflect principles of sustainable development. S-107 Make decisions that reflect social responsibility. KL-018 Explain the importance of stewardship in the preservation of the Earth's complex environment. VL-005 Respect the Earth as a complex environment in which humans have important responsibilities. KC-002 Describe sustainability issues related to natural resource extraction and consumption. KI-004 Identify Aboriginal perspectives and rights regarding natural resources and their use. E*xamples: perspectives-sacred, caretaking; resources-land claims, fishing and hunting rights, mineral rights...* KH-033 Identify factors that influence the changing use of natural resources over time.

	Examples: technology, culture… KP-041 Identify ways in which competing interests and needs influence control and use of the land and natural resources in Canada. *Examples: mining, forestry, water...* VI-003 Be willing to consider diverse views regarding the use of natural resources. KL-023 Describe the impact of various agricultural practices on the physical environment. *Examples: soil erosion, water quality, soil fertility...* KH-034 Give examples of ways in which food production has changed over time. *Examples: soil conservation strategies, technological change...* KG-036 C3 Describe issues related to freshwater and saltwater food resources. KE-048 Use examples to describe the advantages and disadvantages of locating a manufacturing industry in a particular area. (think near a river)

9-10 Science Outcomes:

9	When thinking about river issues … 9-0-3e Determine criteria for evaluation of an STSE decision. *Examples: scientific merit; social cultural, economic, and political factors: safety; cost; sustainability...* 9-0-4b Demonstrate work habits that ensure personal safety, the safety of others, as well as consideration for the environment. Include: knowledge and use of relevant safety precautions, WHMIS regulations, emergency equipment. 9-0-5d Evaluate, using predetermined criteria, different STSE options leading to a possible decision. Include: scientific merit; technological feasibility; social, cultural, economic, and political factors; safety; cost; sustainability. 9-0-7b Select the best option and determine a course of action to implement the STSE decision. 9-0-7c Implement an STSE decision and evaluate its effects. 9-0-9e Be sensitive and responsive in maintaining a balance between the needs of humans and a sustainable environment. 9-0-9f Demonstrate personal involvement and be proactive with respect to STSE issues.
10	Think about the river system 10-1-01 Illustrate and explain how carbon, nitrogen, and oxygen are cycled through an ecosystem. 10-1-02 Discuss factors that may disturb biogeochemical cycles. Include natural events, human activities 10-1-03 Describe bioaccumulation and explain its potential impact on consumers. *Examples: DDT, lead, dioxin, PCBs, mercury...* 10-1-07 Discuss the potential consequences of introducing new species and of species extinction to an ecosystem. 10-1-10 Investigate how human activities affect an ecosystem and use the decision-making model to propose a course of action to enhance its sustainability. Include: impact on biogeochemical cycling, population dynamics, and biodiversity 10-4-06 Investigate the social, economic and environmental impact of a recent severe weather event. Include related consequences on personal and societal decision-making 10-4-07 Investigate and evaluate evidence that climatic change occurs naturally and can be influenced by human activities. Include: the use of technology in gathering and interpreting data 10-4-08 Discuss potential consequences of climate change. *Examples: changes in ocean temperature may effect aquatic populations, higher frequency of severe weather events influencing social and economic activities, scientific debate over nature and degree of change...*

9-10 Physical Education/Health Education Outcomes:

9	A.1.6 Appreciate and respect the natural environment while participating in physical activity.
10	A.1.6 Appreciate and respect the natural environment while participating in physical activity. K.3.10.B.4 **Investigate the contributions self and/or others can make to community/global health and sustainable development** (*i.e., maintaining safe and healthy lifestyle practices, volunteering, reducing, reusing, recycling). (think about water quality)i*

Other Senior Courses with a Water Emphasis:

Some other non-compulsory courses can benefit from the use of Riverwatch in the classroom:

- Current Topics in Science 30S – do a Watershed unit using Riverwatch
- Grade 12 Biology – in the Conservation of Biodiversity Unit, focus on Riparian Areas using Riverwatch and another program called Managing the Water's Edge
- Grade 11 Chemistry – when studying solutions, look at suspended and dissolved materials in river systems, as wells as solubility of dissolved oxygen.
- Grade 12 Chemistry – when studying acids and bases, look at water pH.

b. Working with students – Riverwatch for Middle and Senior Years for cross-grade teams

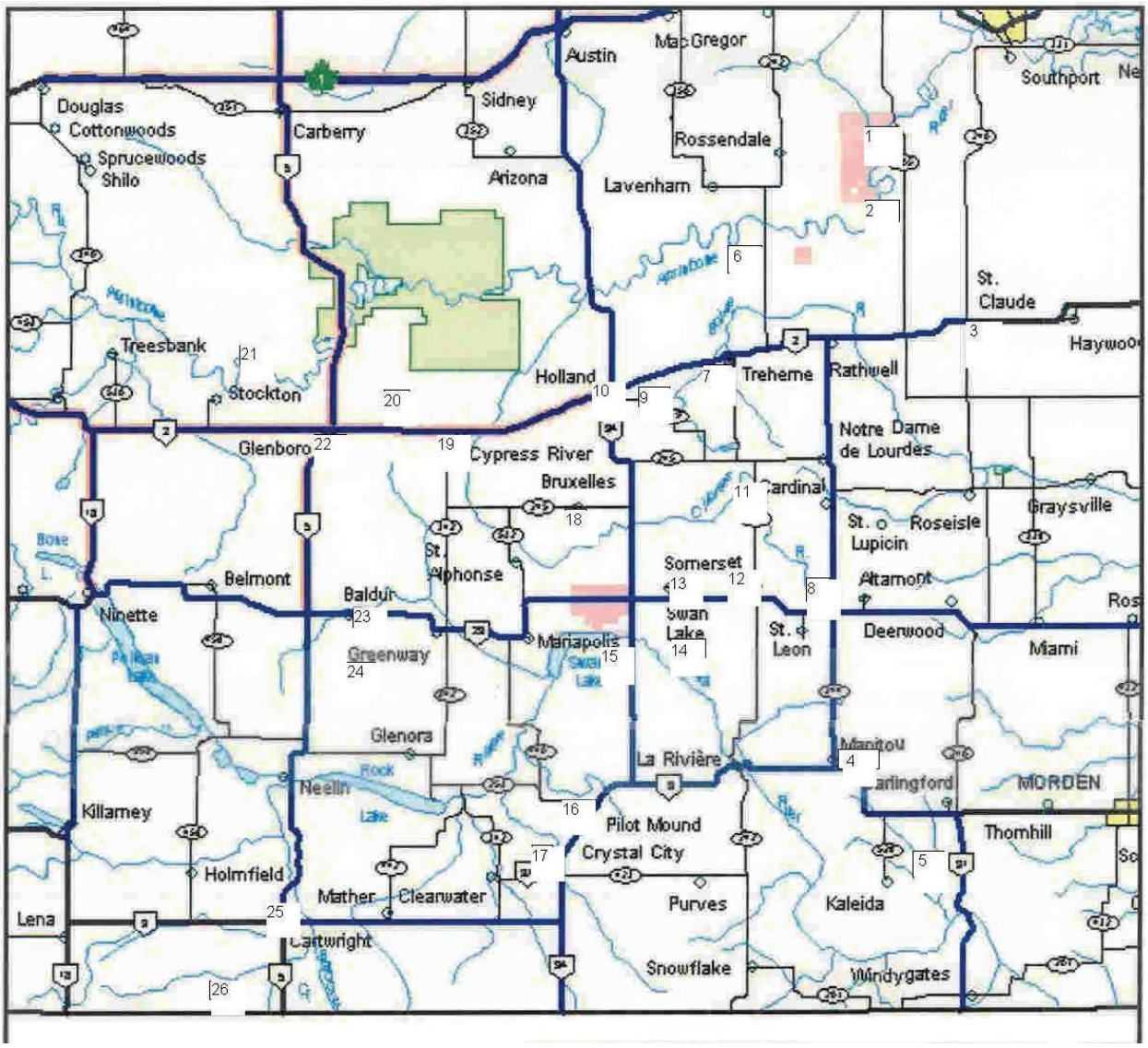
We are someone else's upstream neighbour – the watershed perspective.
We tend to think only about our local area, and as water passes beyond the horizon, it passes out of our consideration. We must change this myopic point of view, recognizing we influence other peoples' water quality by what we do in our small community.

Using Prairie Spirit School Division as an example, the school division decreases in elevation from west to east, with the primary watershed being the Pembina in the south, the Boyne in the middle, and the Assiniboine in the north.

What is the watershed address for Prairie Spirit School Division? Looking at the big picture, we are part of the Hudson's Bay Watershed, eventually draining into Hudson's Bay through the Nelson River. By the same token, we are part of the Lake Winnipeg Watershed. How our waters get to Lake Winnipeg depend on where you are in the division.

Three main rivers drain our area:

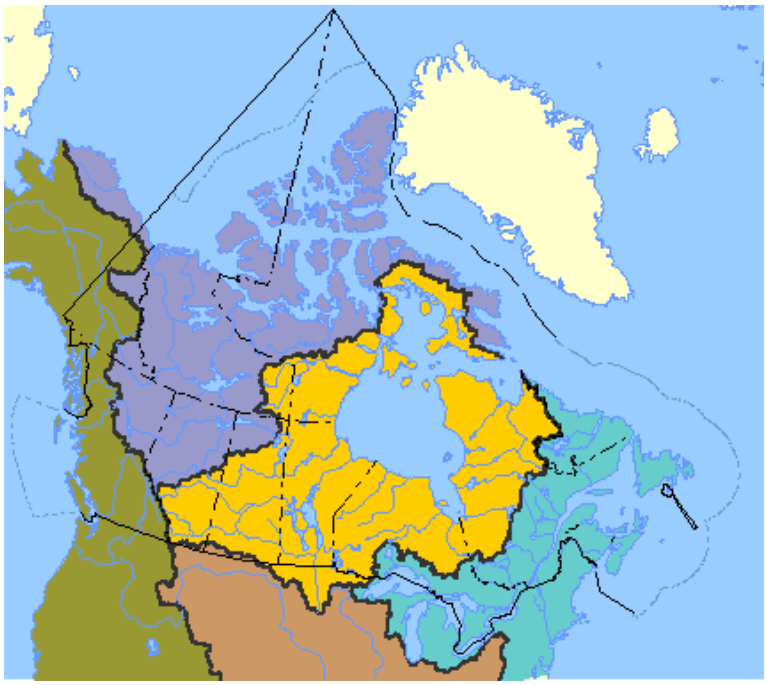
a. The Assiniboine River in the north end of the division drains into the Red River and eventually to Lake Winnipeg.
b. We also have Pelican Lake draining through Lake Lorne and Lake Louise to Rock Lake, and via the Pembina River and Swan Lake through to the east of our region.
c. The Pembina River in the south of the division drainsvia the USA into the Red River south of Emerson, MB.
d. The Boyne River Watershed also runs through the centre of the school division, then travels via a series of canals and emties into the Red.



MAP OF PSSD SCHOOL LOCATIONS

1) New Rosedale School
2) Fairholme School
3) St-Claude School Complex
4) Manitou Elementary/Nellie McClung Collegiate
5) West Valley School
6) Shady Lane School
7) Treherne Elementary/Treherne Collegiate
8) Evergreen School
9) Boyne Valley School
10) Holland School
11) Kamsley School
12) Somerset School
13) Westmount School Complex
14) Valleyview School
15) Windy Bay School
16) Pilot Mound Collegiate
17) Crystal City Early Years/Thomas Greenway Middle Years
18) Ste. Marie School
19) Cypress River School
20) Sandy Bank School
21) Whistling Wind School
22) Glenboro School
23) Baldur School
24) Shamrock School
25) Cartwright School
26) Willow Creek School

The Watershed Maps of Manitoba



Watersheds of Canada

Ocean Watersheds

- Arctic Ocean
- Atlantic Ocean
- Gulf of Mexico
- Hudson Bay
- Pacific Ocean

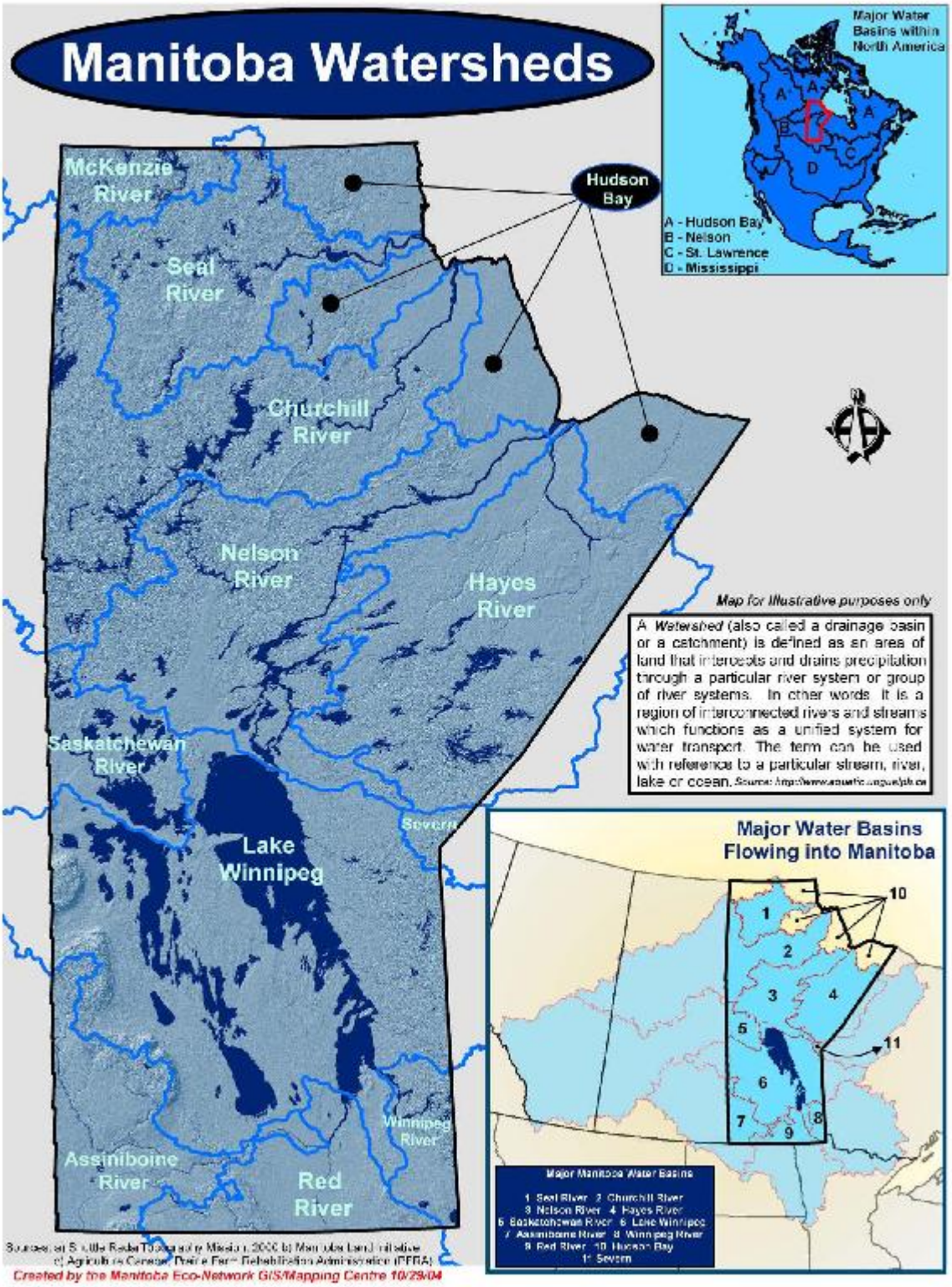
Watershed Boundary

- Ocean Watershed Boundary

Boundaries

- International
- Provincial / Territorial
- EEZ (200 mile)
- Canada / Kalaallit Nunaat dividing line

Source: http://atlas.nrcan.gc.ca/site/english/maps/environment/hydrology/watershed



Taken from the Manitoba Eco-Network Atlas at http://www.mbeconetwork.org/gis/watershed.php
Oak Hammock Legacy project

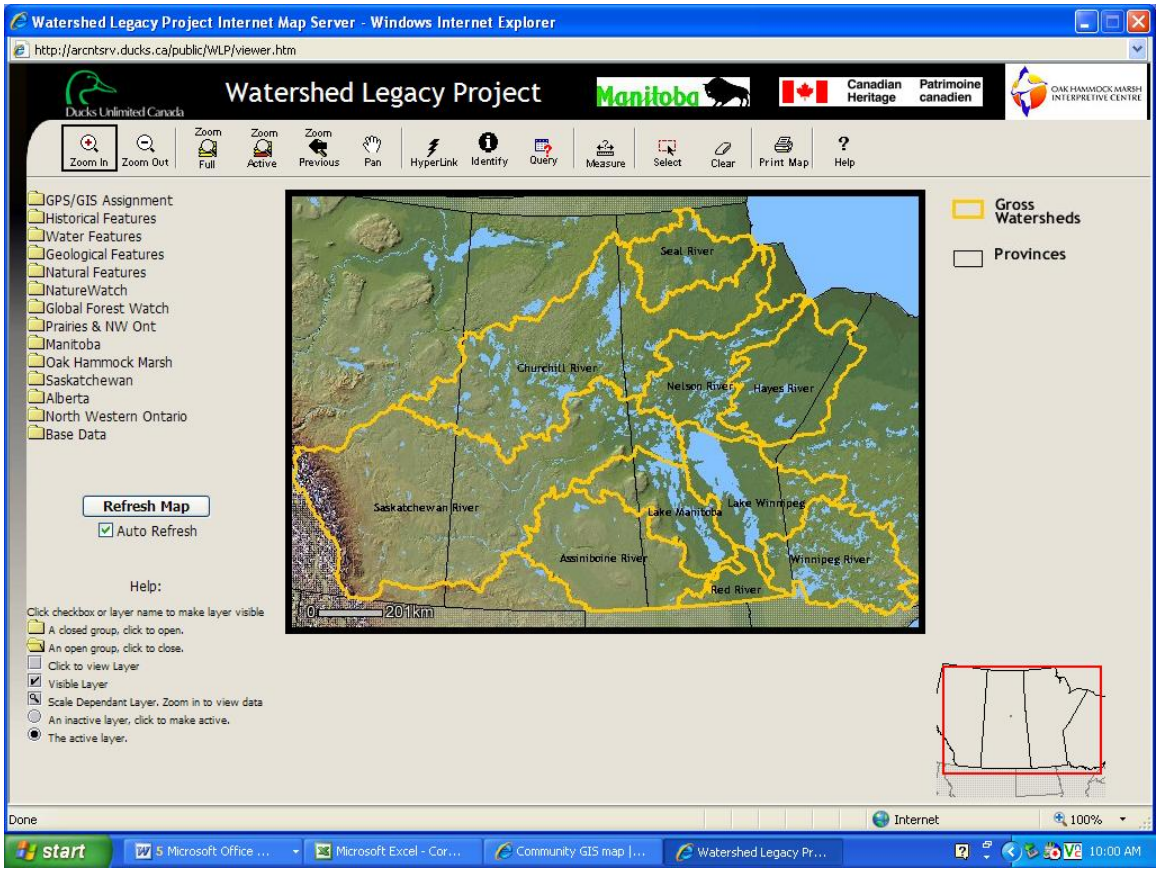
Interactive GIS community mapping

Put your community on the map with Oak Hammock Marsh Interpretive Centre!

Help Oak Hammock Marsh Interpretive Centre identify, gather and map the natural, cultural and historic features that make your watershed unique. Learn about your own community and then use GPS and GIS for exploring and mapping.

As a part of the Watershed Legacy Project, your data will be included in our GIS web-based interactive watershed map to display the story of your community.

Contact us today to learn more about this program.



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