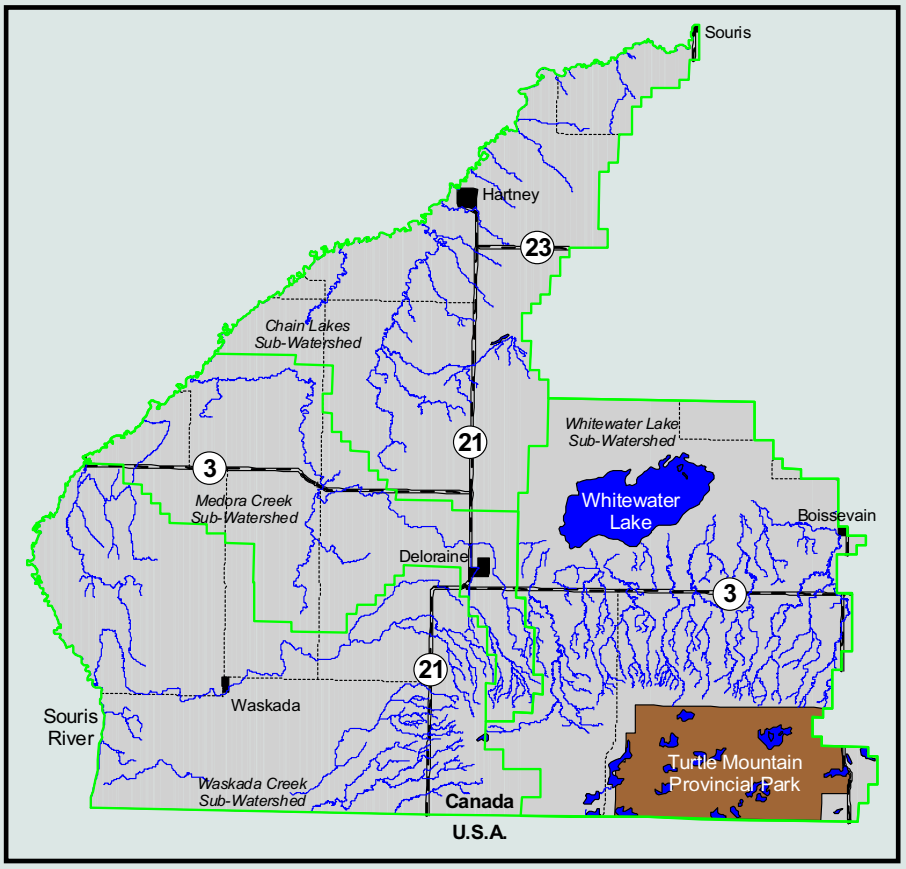
Taking Care of Our Watershed

A Watershed Plan for the East Souris River Watershed, Manitoba, Canada

January, 2006



Deloraine, Manitoba
January, 2006

Turtle Mountain Conservation District

Our watershed community, lead by the Turtle Mountain Conservation District and the Watershed Planning Advisory Team, has prepared the East Souris River Watershed Management Plan.

The Actions in the plan must be implemented and monitored if we want to see improvements to our watershed. We have approval from member municipalities to proceed with the implementation of the plan.

Successful implementation will require long-term dedication and commitment of money and staff from many organizations. On behalf of the Turtle Mountain Conservation District and the Watershed Planning Advisory Team, we are prepared to implement the plan to the best of our ability and spirit.

Richard Sexton
TMCD Chair

Our Vision

A healthy, sustainable, diverse landscape capable of providing economic, social and environmental benefits for current and future generations.

Minister of Water Stewardship
Room 314 - 450 Broadway Avenue
Legislative Building
Winnipeg, MB R3C 0V8

Mr. Richard Sexton, Chairperson
Turtle Mountain Conservation District
Box 508, Deloraine, MB R0M 0M0

Dear Mr. Sexton:

I would like to congratulate the staff and board of the Turtle Mountain Conservation District for developing the East Souris River Watershed Management Plan. I applaud the leadership of the Turtle Mountain Conservation District in recognizing that integrated watershed planning is critical to the protection, conservation and management of Manitoba's water resources and aquatic ecosystems.

The East Souris River Watershed Management Plan is an important step in addressing local risks to water resources and aquatic ecosystems in your watershed and will assist in evaluating priority of the actions needed to protect land and water. This plan is a positive step in realizing the vision you have articulated for your watershed.

This management plan will forge a strong and continued partnership with the Province of Manitoba. I am pleased to provide the services of Manitoba Water Stewardship to help support the implementation of your plan, with respect to the inclusion of source water protection and surface water management strategies.

Once again, congratulations on the plan and best wishes to the board and staff as you move towards implementation of the East Souris River Watershed Management Plan.

Sincerely,

Steve Ashton
Minister

"Vision without action is merely a dream. Action without vision just passes the time. Vision with action can change the world." **- Joel Barker**

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for the East Souris River Watershed,
Manitoba, Canada
January, 2006

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Acknowledgments

Preparation of the watershed plan was coordinated by the Turtle Mountain Conservation District with financial support from Manitoba Water Stewardship and member municipalities and in-kind contributions provided by numerous other organizations and agencies.

A steering committee of Sheldon Kowalchuk – Turtle Mountain Conservation District, Phil Weiss – Manitoba Water Stewardship and Dave Dobson – Ducks Unlimited Canada provided professional advice, direction and overall management of the plan preparation.

The development of this plan was only made possible through the hard work and dedication of various individuals, volunteers and organizations who committed a great deal of time and resources to prepare the East Souris River Watershed Management Plan. Many hours were put into the Resource Summary for the East Souris River Watershed and a core group of committed individuals faithfully attended numerous meetings required to prepare the watershed plan. This watershed plan is a reflection of the cooperative effort of the watershed community.

Turtle Mountain Conservation District

Manitoba

Introduction

Purpose of the plan

The plan is a roadmap for the community to help plan and practice good, common sense programs.

What is a Watershed?

A watershed is a defined land area that captures rainfall and other precipitation and funnels it to a river, lake or stream.

A watershed just makes sense as a way to define the place where we live. It is the people, government, businesses, institutions, animals, plants and more. This rich, diverse community lives in the watershed. The community influences the watershed and the watershed influences the community…what a coincidence!!

Since any watershed is a complex system, everyone with a stake in the watershed has to make trade-offs, compromises, and maybe some sacrifices to keep it healthy…it's only common sense.

What is a Watershed Plan?

A watershed plan is a document prepared by the watershed community that describes needed actions in the watershed over time to achieve a sustainable healthy watershed.

The East Souris River Watershed Management Plan is simply an organized way of spending money and living in the watershed. It is your way of stepping back from the table and looking at the bigger picture while setting short and long term priorities.

The plan is a common sense way to balance both the pressing issues of today with special care for future generations too.

Why is a Watershed Plan important?

There are pressures on the watershed due to a growing economy. The plan ensures the resources in the watershed are managed in a sustainable fashion.

The plan is a roadmap for the community to help plan and practice good common sense programs. The plan helps define what is important to the community.

The plan sets local priorities between need to-do's and nice to-do's. The plan helps communicate to the public where the work will be done.

The plan demonstrates to senior governments that local people are in charge of managing their own resources.

The plan sets a way to measure future progress on meeting resource goals and objectives. The plan helps groups like the Turtle Mountain Conservation District (TMCD) acquire external money for community projects.

Watershed Plan Helps Land Use Planning

Information included in the watershed plan will be used by area planning districts in their development plans to avoid potential conflicts with existing or future development in the watershed. An example would be valuable information about riparian protection or drinking water source protection included in the watershed plan used by the planning districts when land use policy statements are being prepared.

Planning districts have had input into the preparation of this watershed plan and will continue to be asked for input into future revisions or proposed updates. Tying good land use planning decisions into improving the health of the watershed is only common sense and everyone wins.

25 Years From Now - 2031

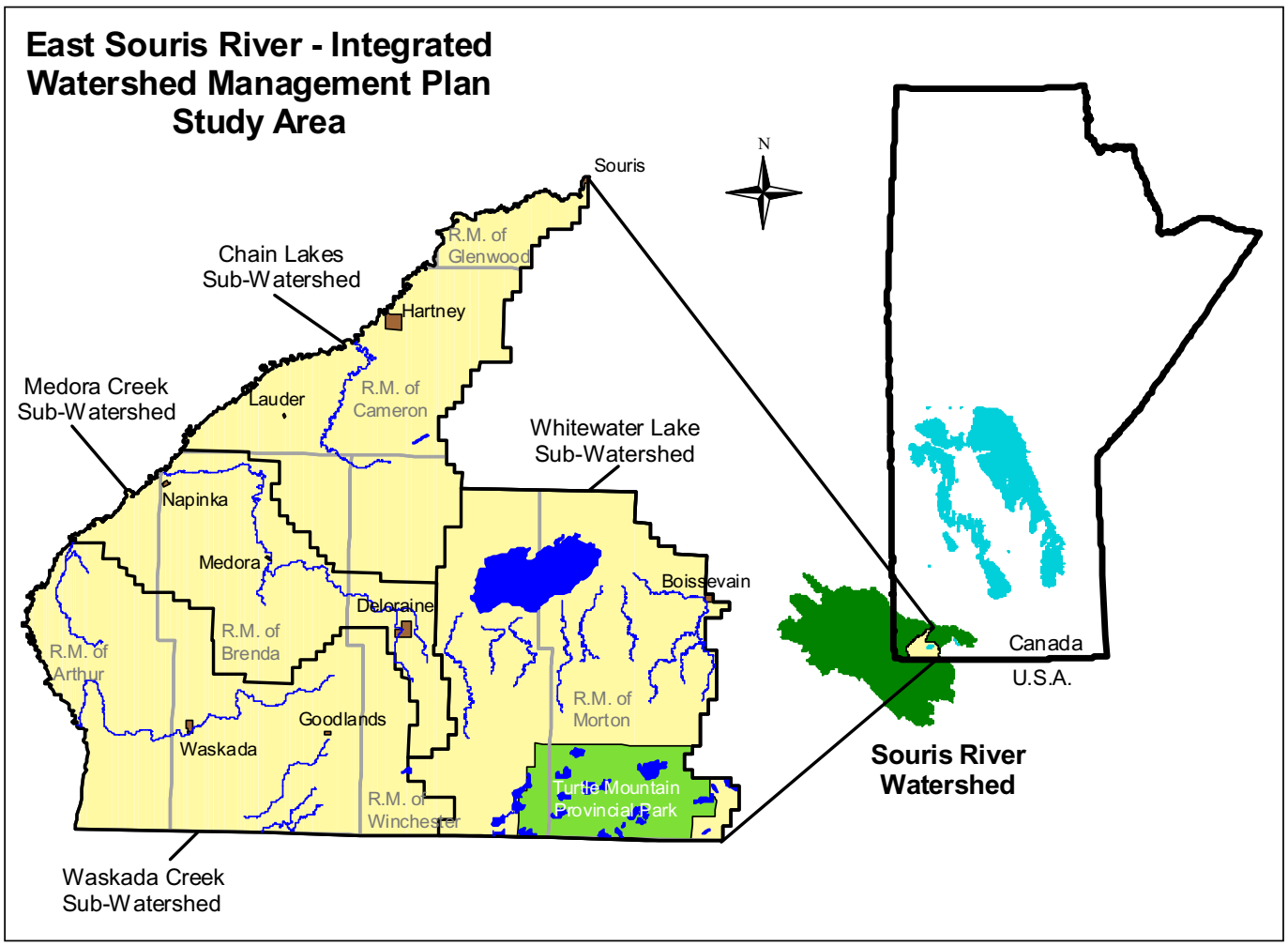
What would we see if we flew over our watershed 25 years from now and looked out the window?

Would we see a watershed that supports a strong agricultural community with healthy ecological functions?

Would we see a watershed that can buffer harmful water level fluctuations?

Would we see a watershed with manageable sediment and nutrient movement?

What do you want your watershed to look like?



Our Principles Behind the Plan

COOPERATION	Everyone in the watershed will cooperate and work together.
RESPECT	Neighbourly respect is a must. There is always someone downstream.
SHARING	The Turtle Mountain Conservation District and their member municipalities can't succeed without a fair and reasonable provincial and federal government commitment to help our watershed.
VALUE FOR MONEY	Our collective investments in this watershed will demonstrate good value.
PARTNERSHIPS	A team approach in working with other collective agencies and citizens will be encouraged. No one group can do it all.
LEADERSHIP	This community will be a leader in watershed management.
PRO CHANGE	This community is not afraid of trying new things.
ACTIVISM	Everyone with a stake in this watershed will be encouraged to participate in making the watershed a healthy place to live.

Process and Players

TMCD members

R.M. of Arthur
R.M. of Brenda
R.M. of Cameron
R.M. of Morton
R.M. of Turtle Mountain
R.M. of Winchester
Town of Boissevain
Town of Deloraine
Town of Killarney
Village of Waskada

The Turtle Mountain Conservation District has been a conservation leader in the community for over 30 years. Representing its member municipalities and ratepayers, the TMCD Board, in partnership with the provincial government, has delivered many excellent programs and projects to area residents. The Board has had lots of help along the way with its programs, but is always striving for improvement.

In 2002, well before the provincial government launched a new water management strategy and legislation, the TMCD Board decided it was time to step back and set revised watershed goals, objectives and new actions in an integrated watershed plan. The Board agreed that their role was to facilitate the preparation of the plan in partnership with others in the watershed.

The watershed plan would only be a success if it was prepared with input from everyone in the watershed, not just the Board and its sub-district committees. The Board sees the plan as a valuable tool for many organizations in their watershed to use in making decisions.

The Birth of WPAT

The invitation soon went out in 2002 for representatives from the watershed community to participate on a Watershed Planning Advisory Team (WPAT). The agencies, organizations and interest groups that received the invitation are listed in Appendix A and Appendix B.

Professionals from key government and private agencies came together as WPAT with TMCD, municipal and other agencies and ratepayers to:

1. **oversee the planning process,**
2. **get community input to the plan,**
3. **keep the community updated, and**
4. **troubleshoot along the way.**

WPAT met 12 times during the process and was key to keeping the process going without sacrificing quality.

WPAT meeting
Photo credit: Dave Dobson

The Planning Process

Step 1
Got Organized
Fall 2002

Step 2
Talked to RMs
2003

Step 3
Formed WPAT
2003

Step 4
Resource Summary Prepared

Step 5
Public Open Houses
2004
(Issues and Actions)

Step 6
Draft Plan
2005

Step 7
Public Open Houses
2005

Step 8
Final Plan
January 2006

Step 9
Implementation

The goal is to ensure the plan be truly prepared by and for the residents of the East Souris River Watershed.

East Souris River Resource Summary

Study Area

The East Souris River (ESR) watershed is 2,922 km^2 and consists of four sub-watersheds: Waskada Creek (812 km^2), Medora Creek (481 km^2), Chain Lakes (658 km^2), and Whitewater Lake (971 km^2). The ESR watershed is part of the Souris River watershed which drains parts of southeast Saskatchewan and northwest North Dakota. It terminates where it enters the Assiniboine River in southwest Manitoba. The Souris River is approximately 720 kilometres long and has a drainage area of approximately 45,500 km^2.

Human History, Population and Income

The first settlers arrived in the ESR watershed in the late 1870s and the first railway was constructed by 1886.

Farming is a major industry in the watershed. The number of farms in Manitoba has decreased by 28.4% since 1981 with 13.6% of the decline occurring over the five-year period after 1996. Between 1981 and 2001, the number of farms in Manitoba declined from 29,442 to 21,071. Manitoba's share of the nation's farms in 2001 remained virtually stable at just under 9%. Since 1981, the average Manitoba farm has increased in size (i.e. the amount of land farmed, herd size, and gross farm receipts) by 39.4%. In general, agriculture in the ESR watershed has followed these provincial trends.

The estimated population within the ESR watershed is 4,267 with 43% living in the rural municipalities while the remaining 57% live in the towns and villages. The watershed population has declined by about 14% over the past 15 years with the urban population declining at a slower rate than in the surrounding farming areas.

The average individual earnings for persons living in towns within the ESR watershed in 2001 was $22,742 while rural residents earned $18,111.

Climate

The ESR watershed has a continental semi-humid climate characterized by significant variations in seasonal and annual temperatures and precipitation. Extensive temperature variations may occur on a day-to-day basis as well as between day and night. It is warm and relatively humid in the summer, and very cold and dry in the winter. The mean annual precipitation decreases in a northwesterly direction from 550 mm in the Turtle Mountain Provincial Park to 500 mm at the Souris River. Approximately three-quarters of this precipitation falls as rain, the rest falls as snow. Less than 10% of the average annual total precipitation results in streamflow. The potential mean annual evapotranspiration loss is about 850 mm. As potential gross evaporation losses are greater than the annual precipitation, the area is generally considered 'water deficient'. The southwest corner is normally the driest corner of the province.

Weather data from Deloraine indicates that the mean annual temperature is 3.3^{0}C with a mean daily maximum temperature of 9.3^{0}C and a mean daily minimum temperature of -2.7^{0}C. The annual amount of precipitation averages approximately 478 mm with rainfall accounting for roughly 366 mm and snowfall about 112 mm. The average frost-free period for Deloraine is 111 days. The calculated seasonal moisture deficit for the period between May and September ranges from 250 mm to slightly less than 200 mm for the R.M. of Winchester to slightly in excess of 300 mm for the R.M. of Brenda.

This section presents a brief discussion of the Resource Summary of the East Souris River watershed which was prepared for the East Souris River Watershed Planning Advisory Team (WPAT) in 2005. The detailed report is available on the TMCD website (www.tmcd.ca).

The estimated population within the East Souris River watershed is 4,267. The population has declined by about 14% over the past 15 years.

Farming is a major industry in the watershed.

Waterways and Riparian Areas

The ESR watershed contains a total of 1,804 km of surface channels including 161 km of the Souris River. (Table 1)

There are 9,942 hectares of riparian area (based on a 30-metre buffer along the watercourses). (Table 2)

Table 1: Waterways

Waterway Class	Length (km)	% of total
0	324	18.0
1	413	22.9
2	494	27.4
3	267	14.8
4	145	8.1
7	161	8.9
Totals	1804	100

Table 2: Riparian areas
(Based on a 30-metre buffer)

Riparian Type	Area (hectares)	% of total
Native (grass, trees, shrubs)	6,700	66.2
Cultivated	2,868	30.1
Permanent cover	145	1.4
Other (Roads, etc)	229	2.3
Totals	9,942	100

Souris River near Hartney.

Wildlife and Wetlands

The watershed provides a diversity of wildlife habitat. Some of the main features include the wooded Turtle Mountain, riparian areas surrounding the Turtle Mountain, Whitewater Lake and the pothole areas surrounding the lake, the wooded and grassland riparian habitat adjacent to the Souris River and in the Blind Souris region, as well as a mix of intensively farmed area interspersed with remnant native habitat areas. Undeveloped rights-of-way provide important habitat for wildlife as well as wind and water erosion reduction.

The area known as the Blind Souris supports both flora and fauna listed as rare, threatened or endangered. This region is home to buffalograss, a species that is listed as threatened under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). This is the only location of current buffalograss records in Manitoba, and one of only two locations of this species in Canada. An inventory was conducted on 39 grassland sites in the Blind Souris region, totalling 5,465 acres. Approximately 78% of the grassland sites were graded as "C-minus" or better, which is considered good quality native prairie.

Based on information provided by the Manitoba Conservation Data Centre, 55 different species at risk have been identified within the ESR watershed.

Wetland Inventory

There are at least three data sets for the wetlands in this watershed. Ducks Unlimited Canada habitat inventory based on 1986 Landsat data indicates 77,144 acres of wetlands comprised of 19,641 basins. Prairie Farm Rehabilitation Administration (PFRA) landcover data, based on 2000 Landsat indicates 45,764 acres, comprised of 8,302 wetlands, 1:20,000 topographic map data set indicates 30,571 acres, comprised of 7,703 wetlands. The discrepancies between the data sets are due to differences in classification, classification error and differences in water conditions at the time of photography.

There has been a 5.6% net decrease in the amount of wetlands from 1985 to 2003 based on data collected by the Canadian Wildlife Service at monitoring transects located near Boissevain and Hartney, and two near Melita.

Fisheries

Native fish species of the Souris River are northern pike, bullhead, walleye, shorthead redhorse sucker and white sucker, in addition to numerous species of minnow. Non-native species in the ESR watershed include small and large mouth bass, brown trout and rainbow trout. Waterbodies that support sportfishing throughout the study area are: Lake Metigoshe, Deloraine Reservoir, Waskada Reservoir, Derksen-Heide Reservoir, lakes in the Turtle Mountain Provincial Park such as Lake Max, Bower Lake and Lake Adam and the Souris River and its tributaries. All habitats are "key habitat" to different fish species at different times of year. Habitat areas change from spawning areas, nursery areas, migration routes and critical overwintering habitat areas. Some areas are intermittent, however they can still provide a source of food for fish.

Water Resource Features and Concerns

There are 1,748 dugouts, 129 man-made dams and 110 beaver dams within the ESR watershed (source: provincial 1:20,000 topographical layer). As of January 2005, there were 46 Water Rights Licenses issued and a total of 10 licenses were ongoing. There are also nine municipal sewage lagoons, 10 active garbage dumps and one inactive garbage dump within the ESR watershed. There are also two agricultural lagoons within the R.M. of Morton, one within the R.M. of Arthur and seven agricultural/ household lagoons within the R.M. of Cameron.

Surface Water: Hydrology

The ESR watershed has four main watercourses which all flow into the Souris River: Waskada, Medora and Chain Lakes creeks and the Blind Souris River. In addition, the headwaters of the Boundary and Willow creeks originate on the southern slopes of the Turtle Mountain and flow into North Dakota. Whitewater Lake is considered a closed basin.

Hydrometric Data

Streamflow and lake level data has been collected at 11 hydrometric gauging stations within the ESR watershed for varying time periods since the mid-1960s. Historic streamflow data is available on Waskada, Medora and Turtlehead Creeks. However, Medora Creek is the only gauging station still operating.

Streamflow Characteristics

Waskada Creek had an average runoff during the 1965 to 2002 period of 1,900 dam^3 or 18 mm over the entire watershed. The annual runoff depths for Waskada Creek from 1966 to 1994 ranged from no runoff in 1977 to a maximum of 80 mm in 1976.

The majority of runoff for Waskada Creek (85%) occurs as a result of snowmelt and early spring rains when the watershed is still saturated. Stream flow records reveal that in 20 of the 29 years of record, the annual peak flow occurred during the spring runoff, and in nine out of the 29 years, the peak flow occurred during the summer growing period.

Medora Creek near Napinka had an average runoff during the 1966 to 2003 period of 4,600 dam^3 or 14.7 mm over the entire watershed. The annual runoff depths for Medora Creek from 1966 to 1994 range from no runoff in 1977 to a maximum of 77 mm in 1976. The majority of runoff (90%) occurs in the March to May period.

Records indicate that in 26 of the 29 years, the annual peak flow on Medora Creek occurred during the spring runoff, and in three out of the 29 years the peak flow occurred during the summer growing period.

Based on available data from 1964 to 1996, Turtlehead Creek above Deloraine Reservoir had an average runoff of 2,350 dam^3 or 31 mm over the entire watershed. The annual runoff depths for Turtlehead Creek from 1966 to 1994 range from no runoff in 1977 to a maximum of 121 mm in 1975. The majority of runoff (88%) occurs in the March to May period.

Data indicates that in 26 of the 33 years the annual peak flow on Turtlehead Creek occurred during the spring runoff, and in seven out of the 33 years the peak flow occurred during the summer growing period.

The Whitewater Lake watershed has a drainage area of 732.6 km^2. Its main feature is Whitewater Lake which can dry up in times of extreme drought or expand to cover as much as 130 square kilometres in very wet years. The watershed is considered a closed basin, which means it has no outlet except under extremely wet, high water conditions. The natural outlet is into Medora Creek to the west, with spillage occurring at the approximate elevation of 498.65 metres (1,636 ft) above sea level (asl).

Derksen-Heide Dam

Streamflow and lake level data has been collected within the ESR watershed for varying time periods since the mid-1960s.

Hydrometric gauging station along Medora Creek.

The highest recorded water level on Whitewater Lake was from May 5 to 11, 1976.

Mean monthly reconstructed and recorded levels for Whitewater Lake for the period 1921 to 2003 are available. The lake was virtually dry from the fall of 1934 until the spring of 1941. Levels were below average during most of the 1960s and the early 1980s to mid-1990s. The highest recorded level of 497.55 m (1,632.4 feet) asl was from May 5 to 11, 1976, after a series of wet years. The lake is very shallow, having an average depth of 0.76 m (two and a half feet) at elevation 495.9 m (1,627 ft) asl and is therefore greatly influenced by wind.

Lake Metigoshe covers an area of approximately 615 ha of which only 24.4 ha are in Canada. However, the drainage area of Lake Metigoshe is 165.6 km^2, which is almost entirely in Canada. The lake is controlled, with free overflow occurring at the full supply level of 651.65 m (2,138.0 ft) asl into Oak Creek, a tributary of Willow Creek. Dromore Lake upstream is connected to Lake Metigoshe.

Deloraine Reservoir was constructed on Turtlehead Creek in 1962 to provide a water supply for the town of Deloraine and water for stock during drought periods. The dam is operated to maintain a full supply level of 540.1 m (1,772 ft) asl. At this level, the reservoir has a maximum depth of 12 m, covers an area of 31 ha, and contains 1,730 dam^3 of water. The firm annual yield is estimated at 271 dam^3 or about one-sixth of its storage capacity. The drainage area of the reservoir is 76.7 km^2.

Water Allocation

Presently, licensed water allocation in the ESR watershed is seven dam^3.

In total, within the ESR watershed approximately 287 dam^3 could be allocated at the 80% risk level and 1,194 dam^3 at the 70% risk level in the spring. Presently, licensed allocation in the ESR watershed is seven dam^3.

Surface Water: Quality

Manitoba Water Stewardship's Water Quality Management Section examined trends in concentrations of total nitrogen and phosphorus in streams across Manitoba with the United States Geological Survey's *QWTrend* program. Data from the water quality sampling station on the Souris River at the town of Souris (WQ0371) in the ESR watershed indicated that there was a 25.9% increase in flow-adjusted Total Nitrogen (TN) concentration from 1978 to 1997. Over that same time period, some relatively high Total Phosphorus (TP) concentrations were recorded in the latter half of the reporting period. However, these were highly positively correlated with flow and no significant trend was found once the influence of flow had been taken into account.

Flow-adjusted TP concentrations showed no significant trend between 1973 and 1999 at the water quality monitoring station near Coulter, Manitoba and Westhope, North Dakota. TN data could not be analysed because of problems with Environment Canada's nitrogen analysis.

Manitobans, including those in the Souris River watershed, contribute about 41% of the phosphorus and 36% of the nitrogen to Lake Winnipeg. About 14% of the phosphorus and 5% of the nitrogen entering Lake Winnipeg is contributed by agricultural activities within Manitoba. In contrast, about 11% of the phosphorus and 7% of the nitrogen entering Lake Winnipeg from Manitoba is contributed by wastewater treatment facilities such as lagoons and sewage treatments plants.

The Souris River watershed contributes about 2% of the nitrogen and 5% of the phosphorus to Lake Winnipeg.

Groundwater Resources

Aquifer Information

Groundwater is available from a number of sand and gravel and deeper bedrock aquifers located throughout the ESR watershed. The quantity and quality, however, varies considerably from location to location.

Provincial Observation Wells

The province currently maintains a network of six active observation wells within the ESR watershed. The observation wells are used to monitor groundwater levels and collect groundwater chemistry data from various sand and gravel aquifers located throughout the study area.

The Turtle Mountain Conservation District has sealed 74 abandoned wells within the ESR watershed since it commenced well sealing activities in 1999.

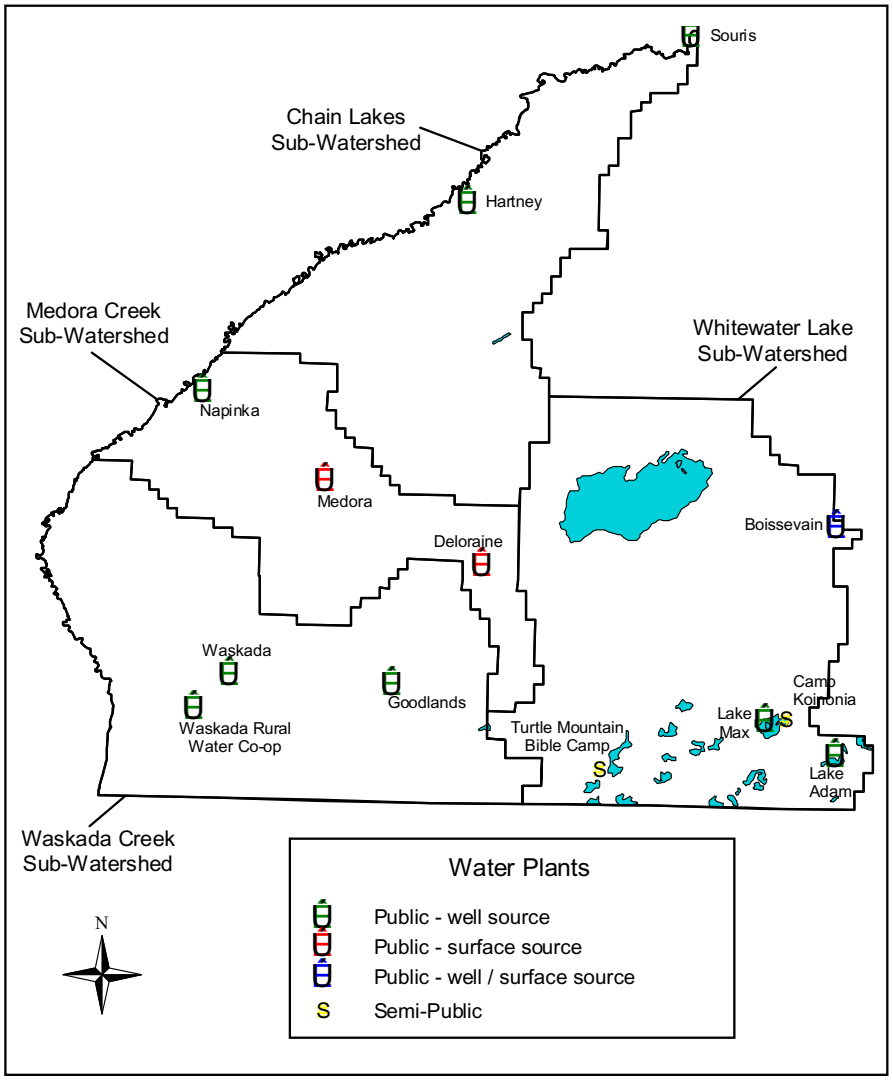
Water Systems

There are 11 public water plants located within the ESR watershed. Eight are classified as well-source water systems, and service Napinka, Waskada, the Waskada Rural Water Co-op (which services the rural area south and west of Waskada), Goodlands, Hartney, Souris, Lake Max and Lake Adam. At present, the village of Waskada and Waskada Rural Water Co-op pipeline are sourced from the Waskada-Medora channel aquifer. Of the remaining three public water systems, two are surface sources located in Deloraine and Medora and the other is a well/surface source located in the town of Boissevain. These are indicated on the map adjacent.

There are two semi-public water plants located within the watershed. One is a well-source located at the Turtle Mountain Bible Camp. The other is a surface water source located at Camp Koinonia. There are also 30 community wells within the ESR watershed.

For private water systems, the responsibility lies with the owner of a private water system to ensure it is properly constructed and provides water that is safe for drinking.

The Turtle Mountain Conservation District has sealed 74 abandoned wells within the ESR watershed since 1999.



Six of Manitoba's 13 oilfields are in the East Souris River watershed.

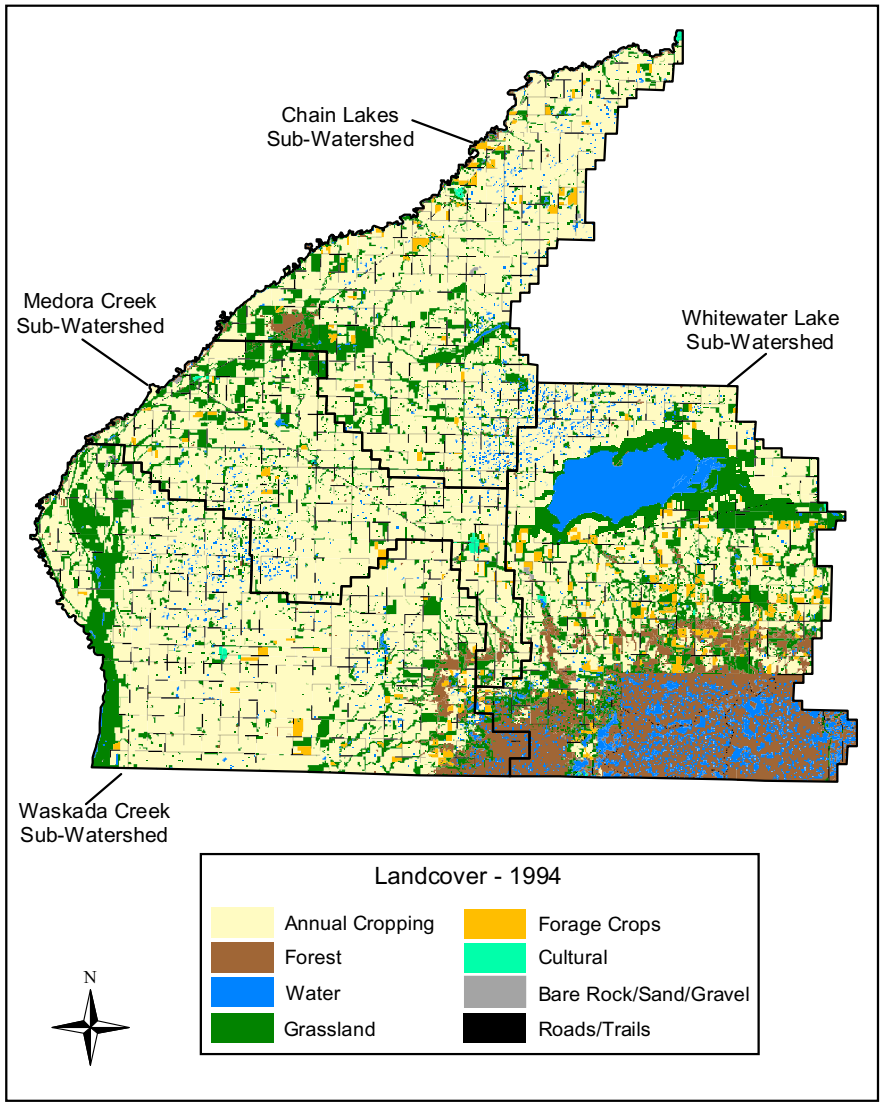
Geology

The geology of the ESR watershed consists of bedrock formed by Cretaceous and Tertiary sediments (approximately 55-80 million years before present) overlain by unconsolidated deposits laid down prior to, during and following Pleistocene glaciation.

Slope and Topography

The highest elevation within the watershed is within the Whitewater Lake sub-watershed, at 762 metres asl. The lowest point is within the Chain Lakes sub-watershed, at 406 metres asl.

In the ESR watershed 166,030 ha (56.9%) of the area is classified as having a slope of 0-2% and 66,253 ha (22.7%) falls in the 2-5% slope class.



Petroleum Resources

Six of the 13 oilfields in Manitoba are found within the boundaries of the ESR watershed. The six oilfields are Lulu Lake, Mountainside, Regent, Souris-Hartney, Waskada and Whitewater. In 2003, the combined oil production from the six fields totalled 157,017 m^3, accounting for 24.8% of Manitoba's total oil production. The Waskada field was discovered in 1952 and is the largest field in the ESR watershed and was the third highest producing oilfield in Manitoba in 2003.

As of 2003 in the six oilfield areas within the watershed, there were 475 active wells. Of these active wells, 370 are active oil production wells while 105 are active wells for other purposes (water injection, salt water disposal, water supply, gas injection and various others).

Landcover

Landcover in the ESR watershed is displayed in Table 3 and on the adjacent map. The landcover data are from Landsat imagery collected in 1994.

Table 3: Landcover

Cover type	Area (hectares)	% of total
Annual cropping	182,523	62.5
Forest	27,364	9.4
Water	17,511	6.0
Grassland	50,409	17.2
Forage crops	6,444	2.2
Cultural	430	0.1
Bare rock/ sand/ gravel	162	0.1
Roads/ trails	7,406	2.3
Totals	292,249	100

Soils

Surface Texture

The majority of the soil in the ESR watershed has been classified as a type of loam with some small pockets of sand. The loam soil texture is an even composition of sand, silt, clay and organic matter particles of varying sizes. The total area of soil in the loam category (coarse loamy, loamy and clayey) is approximately 234,725 ha (85.3%), the amount of sandy textured soil (sands and coarse sands) is roughly 18,039 ha (6.6%) and there are approximately 7,527 ha (2.7%) classified as eroded slopes.

Salinity

In the ESR watershed (excluding the R.M. of Glenwood), the following is a breakdown of the amount of land within the various salinity classes: non-saline 225,480 ha (83.4%), weakly saline 19,477 ha (7.2%) and moderately saline 3,667 ha (1.4%).

Manitoba Crop Insurance Corporation (MCIC) Soil Classes

Within the ESR watershed, 53.7% (143,638 ha) of the soil is MCIC soil class E. The distribution of MCIC soil classes within the watershed is displayed on the accompanying map.

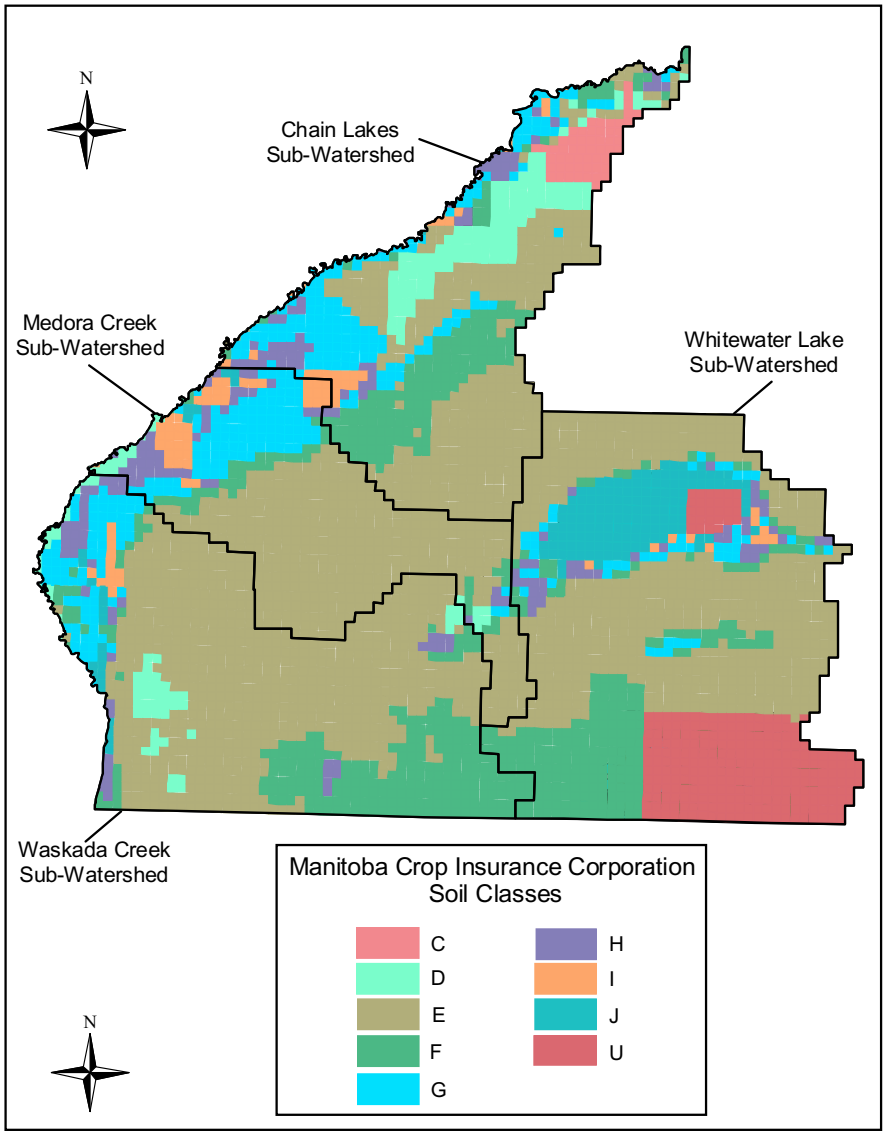
Water Erosion Risk

The water erosion risk under bare soil conditions within the ESR watershed (excludes the R.M. of Glenwood due to a lack of data) is displayed in Table 4.

Table 4: Water erosion risk

Risk level	Area (hectares)	% of total
Negligible	58,112	21.5
Low	83,233	30.1
Moderate	74,526	27.6
High	14,615	5.4
Severe	25,821	9.6

Soil salinity is an issue in certain localities.



Fifty-seven per cent of the land area within the ESR watershed is classified as Class 2 for agriculture.

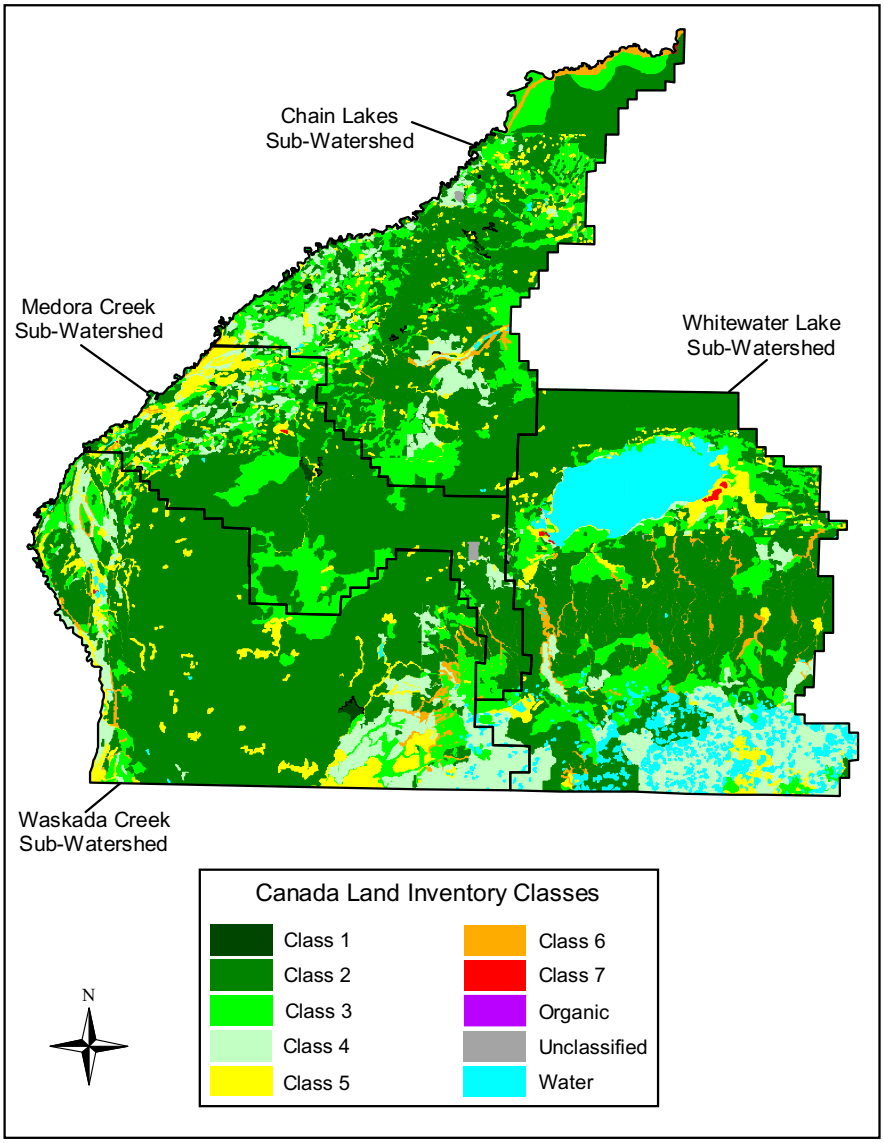
Agricultural Capability

Agricultural capability can best be described as the ability of the land to support the appropriate type of crops and agriculture management techniques. Not all land can be used in the same manner and it varies according to soil type, topography, stoniness, soil moisture deficiency and low fertility, to name only a few of the limitations.

Agricultural land capability based on Canada Land Inventory (CLI) data is displayed in Table 5 and on the map below.

Table 5: Agricultural capability

CLI Class	Area (hectares)	% of total
1	741	0.3
2	166,120	57.0
3	52,288	17.9
4	31,668	10.9
5	16,864	5.8
6	8,543	2.9
7	615	0.2



Agricultural Use in the Study Area

Information from Statistics Canada in 2001 for the R.M.s of Arthur, Brenda, Cameron, Glenwood, Morton and Winchester was compiled to provide an overview of the agriculture industry in southwest Manitoba. Due to the fact that information is summarized on a municipal basis, details could not be refined to provide details specifically for the ESR watershed.

In 2001, there were 905 farms within the six R.M.s with an average farm size of 1,179 acres. There were 846 cropland farms and 346 farms practicing conventional tillage, 291 using conservation tillage practices and 233 are zero-tillage farms. There were 76,431 cattle, 23,984 hogs and 4,463 horses in this area in 2001. Spring wheat, canola and barley were the three most common crops grown in 2001.

Issues and Public Consultation

Background

The rich diversity and natural resources in the watershed have supported a strong and vibrant agricultural based economy for almost a century. A community commitment to improved soil and water management emerged in the 1950s with the formation of the Turtle Mountain Conservation District (TMCD) in the late 1960s. Since then, rapid changes to the agricultural industry have occurred while the watershed has endured flood and drought cycles. In the past, TMCD has offered many watershed programs in response to local resource issues. Today, the TMCD continues to monitor the pulse of the watershed by constantly reviewing programs to determine what programs are most needed.

Although still productive and healthy, the watershed is showing wear and tear. Chronic flooding, erosion and water quality problems have emerged that require priority attention. The TMCD Board and area residents have made a commitment in this plan to invest in watershed protection now, or pay a heavy price later. There is a realization that the time to act is now on serious drainage and flooding issues to prevent future generations from bearing huge consequences.

Community Consultation

The TMCD Board set out in 2002 to invite watershed residents to identify, assess and evaluate a wide variety of new and old issues that needed to be considered. The TMCD Board met with area municipalities and sub-watershed committees listening to discussion on more than 100 issues. The Watershed Planning Advisory Team (WPAT) was formed with representation from many local agencies and watershed professionals, to be in charge of the planning process in partnership with the TMCD Board. WPAT hosted seven public open houses in Deloraine, Boissevain, Waskada, Hartney, Souris, Melita and Medora.

From these meetings came about 60 proposed actions aimed at dealing with the resource issues. The actions were separated into two phases. Phase One lists high priority actions that require immediate response. Other important proposed actions are identified in Phase Two, and will be addressed as time and resources permit.

The proposed Actions are grouped into six categories:

1. **Surface Water Management**
2. **Water Quality**
3. **Water Supply**
4. **Ecosystems**
5. **Soils**
6. **Education and Communications**

The proposed actions are described on the following pages including details on how each action will be implemented.

The Draft Watershed Plan was prepared and presented to the community through a second series of seven community meetings for feedback in the fall of 2005. Comments were incorporated into the plan and the final plan was completed in January 2006.

Challenges

The overall challenge expressed during public consultation was how to invest limited resources into the highest priority programs that return the most watershed health payback.

The plan is intended to be a simple collection of actions to be taken to help achieve the goal of sustained watershed health. The plan will be evaluated by the actions that come out of the plan and the way the community follows many of the guidelines in the plan leading to good sound resource decisions.

Wildlife habitat protection.

In 2003, the TMCD Board met with area municipalities and sub-watershed committees listening to discussion on more than 100 issues.

WPAT hosted seven public open houses in Deloraine, Boissevain, Waskada, Hartney, Souris, Melita, and Medora.

Actions

A Summary of Phase 1 Actions

ACTIONS REQUIRING FIRST RESPONSE

Category	Name (Objective)	Start Date
SURFACE WATER MANAGEMENT **Goal: Efficient and Effective Surface Water Management.**	- Develop a surface water management plan. - Improve drainage licensing system. - Improve enforcement of drainage infractions. - Develop drainage Beneficial Management Practices (BMPs) and mitigative measures.	Jan '06 March '06 March '06 Feb '06
WATER QUALITY **Goal:To Preserve and Enhance Surface and Groundwater Quality.**	- Design a monitoring program with indicators to benchmark water quality and identify trends. - Promote drinking water source protection. - Design and implement a Wetland Rehabilitation Incentive Program (WRIP).	Apr '07 Apr '06 Apr '06
WATER SUPPLY **Goal: Sustainable Water Supplies.**	- Design and administer a water supply use and needs inventory. - Assess new groundwater sources.	Dec '06 On-going
ECOSYSTEMS **Goal: Maintain Ecological Functions of the Watershed.**	- Promote the conservation of natural cover in highly erosive areas. - Promote the restoration of natural upland areas. - Conduct wetland and riparian education workshops. - Provide incentives for the conservation of wetlands. - Design and implement a riparian management strategy for the watershed. - Promote the concept of ecological goods and services payments.	On-going 2006 Sep '06 Jun '06 Apr '07 2007
SOILS **Goal: Maintain the Productive Capability of Soils.**	- Implement a salinity management program. - Increase/maintain grassed waterways and forage bufferstrips. - Identify and ground-truth high erosion risk areas.	On-going Sep '06 Jun '06
EDUCATION AND COMMUNICATIONS **Goal: Educate and Engage the Watershed Community.**	- Increase awareness of community benefits of improved watershed management.	2006

Details concerning the action items listed above are presented on pages 19 to 34.
A map displaying the locations of some of these actions appears on page 18.

Actions

A Summary of Phase 2 Actions

OTHER ACTIONS TO BE ADDRESSED

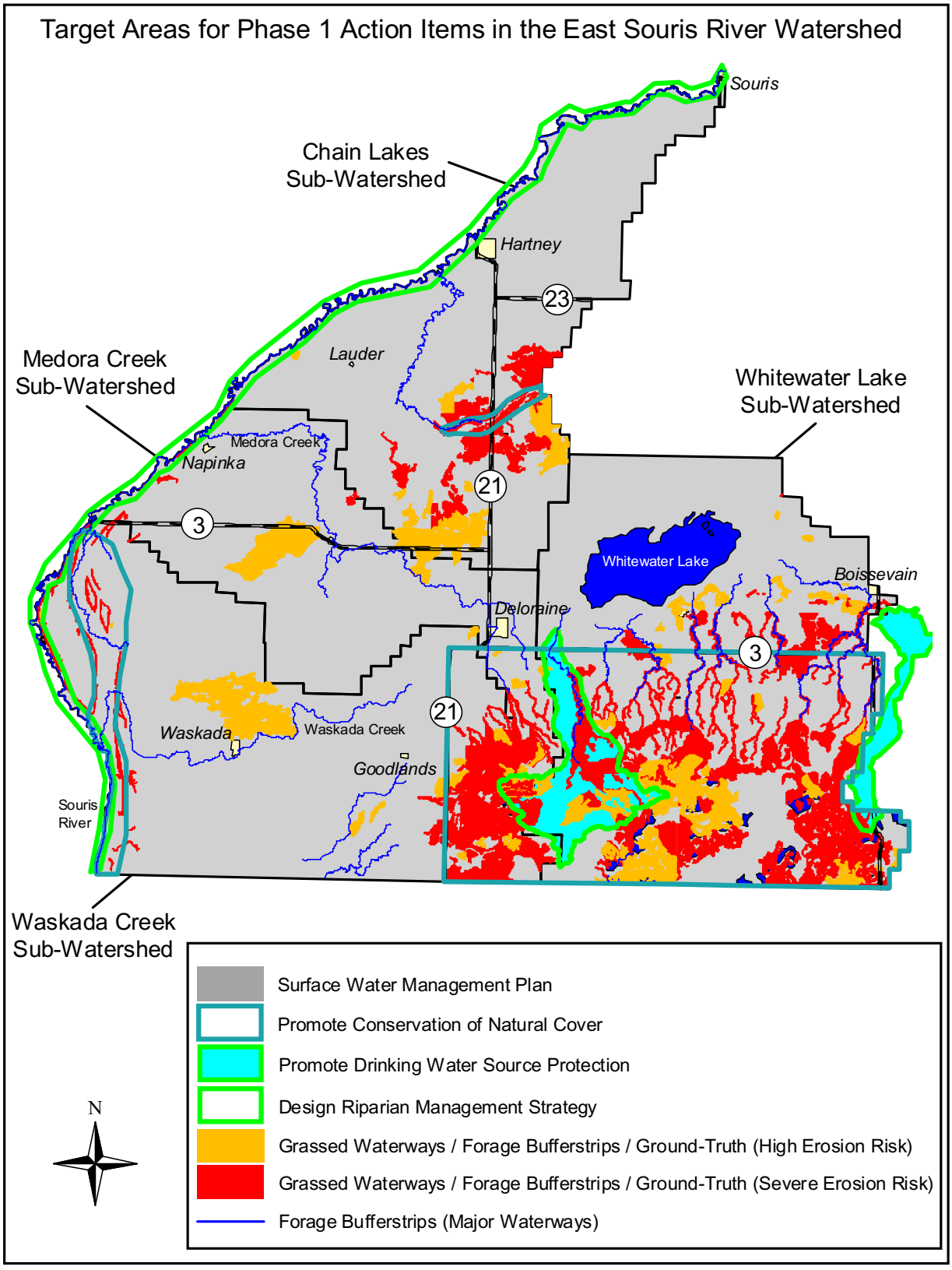
Category	Name (Objective)
SURFACE WATER MANAGEMENT	- Fee for drainage. - Whitewater Lake - summarize previous report findings. - Whitewater Lake - determine acceptable high water level. - Moratorium on drainage until a surface water management plan is completed. - Provide link to land assessment.
WATER QUALITY	- Ensure municipal lagoon effluent meets standards. - Monitor runoff and sediment levels.
WATER SUPPLY	- Inventory private active and abandoned wells. - Encourage landowners to adopt EFPs/BMPs. - Re-evaluate the Oak Lake aquifer pipeline. - Promote wise efficient water use for all residents. - Lake Metigoshe - water conservation at Lake Metigoshe/ Dromore Lake/Lake Hasselfield.
ECOSYSTEMS	- Compensation for holding water on land. - Develop provincial policy for all wetland classes. - Identify important wetland areas. - Provide link to land assessment. - Develop deforestation by-law. - Preserve existing native cover. - Encourage good landuse practices via tax credits. - Souris River - reduce the amount of dead trees along the river.
SOILS	- Evaluate the effectiveness of the grassed waterways. - Develop zoning/legislation/enforcement. - Promote and maintain a permanent cover program. - Identify severity of soil salinity problem. - Implement a salinity education and awareness program. - Implement a salinity seed program. - Ensure proper crop rotations for poor soil fertility.
EDUCATION AND COMMUNICATIONS	- Promote clean stream team. - Education - function and value of wetlands. - Education - endangered species/biodiversity. - Educate landowners - proper well maintenance. - Educate public - weed problems and control options. - Lake Metigoshe - educate landowners re: drainage area, recharge and water levels.

Some of the action items listed above may be addressed in Phase 1 implementation.

Phase 1 Actions

Target Areas

Note: Not all Phase 1 action items are included on the map below at this time. Some action items will be delivered across the entire watershed and for some action items, target areas will be defined once the implementation phase commences.



Phase 1 Actions

Surface Water Management

Develop a surface water management plan

Goal

Develop a watershed-wide surface water management plan, at the subwatershed level, that will coordinate the watershed's need for drainage, water control, water storage, waterway maintenance and municipal infrastructure needs, as well as address concerns associated with flooding, surface water and groundwater quality and quantity, riparian and wetland function and in-stream and in-field soil erosion. The plan will provide a water management strategy that will target actions to each of the subwatershed's specific needs as identified by the watershed's stakeholder group.

Why

Currently, drainage is unplanned, lacks guidelines, licensing and enforcement which results in flooding of land downstream, washing out of infrastructure, in-stream and in-field soil erosion, water quality degradation, lowering of the groundwater table, and loss of wildlife habitat and ecological and hydrological function throughout the watershed. A surface water management plan is required to provide drainage policy and guidelines that would allow landowners to drain water in certain situations, while ensuring adverse affects caused by drainage are minimized throughout the watershed.

What/How/When

Step 1 – Form management plan development team- *January 2006*

TMCD to assemble and coordinate technical and local input into plan.

Step 2 – Study Team Review Principles of Water Management – *January 2006*

- Water management begins when precipitation hits the ground.
- Requires a comprehensive approach that includes both on-farm (land management) and off-farm (structural) approaches.
- Must consider both flood and drought events.
- Water connects all resources and stakeholders in a watershed. A balanced approach must be taken to ensure development within watershed is sustainable.
- Drainage activities should not result in negative impacts to downstream landowners, otherwise mitigation measures must be implemented.
- Future water management goals for discharge rate and volumes must be established - determined at a watershed scale. Examples include maintaining the *status quo*, increasing volumes and reducing peak rates, reducing peak rates and volumes and other options.

Step 3 -- Review Watershed Physical Characteristics – Hydrology, Topography, Soils, Land Use, Waterway Capacity Information – *February 2006*

- Review watershed topography and characteristics of runoff rates - for example, areas of swift moving, erosive water, or areas of slow moving, flood waters.
- Review soil characteristics in the watershed such as porosity and infiltration rates and agricultural capability.
- Review watershed land use and land cover characteristics and its impact on water runoff such as areas of bush, grassland and pastureland and cropland.
- Review hydrology - spring and summer peak flows, duration and volumes.
- Review existing waterway layout and capacity information.
- Review small dam network.

Step 4 – Identify Watershed Concerns/Needs – *March 2006*

a) Drainage Infrastructure Related Concerns/System Needs

- Identify areas of concern - system bottlenecks, limiting factors in waterway system, roads frequently flooded/washed out, farmland that is frequently flooded, potential small dam sites and potential wetland restoration sites.
- Identify the existing drainage network and determine the effect on effective drainage areas (in terms of additional area, peak flows and volumes coming into the system now as compared to pre-drainage).

Phase 1 Actions

Surface Water Management

- In areas of concern, determine waterway and infrastructure capacity (consult WPAT for all relevant information to be collected), both in terms of flow rate and event frequency. Determine the system's ability to handle spring and summer peak flows and ability to handle additional water.
- Determine the drainage standard throughout the watershed (what event can the system safely remove water from agricultural lands, and how long will it take?).
- Determine water management system needs.

b) Watershed Impact Drainage-Based Concerns

- Identify historic farmlands that are frequently flooded – area, frequency and duration of flooding.
- Identify areas that are water short and/or in need of surface water storage, and wetlands that can be restored.
- Identify groundwater areas of concern.
- Identify areas prone to in-stream and in-field soil erosion.
- Identify habitat that has been lost. This may be accomplished by reviewing past drainage records and unlicensed drainage works and CWS habitat transect records.
- Identify habitat that should not be drained in the future.
- Determine and maintain cumulative watershed impacts of drainage in terms of additional area drained, water volumes added to the system and acres of wetlands lost from the system.
- Develop mitigative measures and BMPs to address watershed concerns.
- Identify conditions that should be placed on drainage works in various areas within each subwatershed.

Step 5 – Determine Water Management Strategies for Subwatersheds – *September 2006*

- In areas of concern, identify and evaluate the feasibility of proposed water management strategies such as increased municipal infrastructure and waterway maintenance, in-field and riparian vegetation to slow water down, small dams and backfloods to reduce peak flows, riparian restoration, wetland restoration, purchase of frequently flooded areas, control structures on drainage works, control structures on municipal culverts/temporary storage, close drains, or do nothing.
- Determine budget and delivery timelines for proposed strategies.

Step 6 – Surface Water Management Plan Submitted to WPAT for Approval – *October 2006*

- Present water management strategies, BMPs and mitigative measures that should be implemented for future drainage activity in each subwatershed to MWS.

Step 7 – Surface Water Management Plan Submitted to Minister of Water Stewardship for Approval/Use in Future Drainage Licensing – *December 2006*

- Present water management strategies, BMPs and mitigative measures that should be implemented for future drainage activity in each subwatershed to WPAT.

Where
In areas of concern within each of the four subwatersheds.

Who
TMCD – in-kind GIS, plan coordination support.
WPAT members, landowners – in kind technical and anecdotal support.
MWS – in-kind support to develop plan, engineering support.
ACC – survey support for culvert and waterway information.

Budget*: **$ 1000** – meeting costs; **$ 5000** – cost to obtain survey information on culverts and waterways.
* Costs are per subwatershed.

Waterway in the Chain Lakes subwatershed

Phase 1 Actions

Surface Water Management

Monitoring and Evaluation
The following criteria can be used by the watershed group to measure the progress and level of success of this initiative.

Step 1 – Surface water management study team is formed, with adequate technical and local support.
Step 2 – Study team reviews water management principles.
Step 3 – Study team reviews physical characteristics of subwatersheds.
Step 4 – Watershed drainage and associated impacts have been identified.
Step 5 – Water management strategies have been identified and evaluated.
-- Overall water management strategy for subwatershed has been determined.
Step 6 – WPAT approves surface water management plan.
Step 7 – Minister approves surface water management plan.
-- MWS staff follow plan when licensing future drainage works.

Deloraine flood, 2005.
Photo credit: Ken McGregor

Post Plan Development
Step 8 – Track annually the number of licenses granted, number of illegal works reported, actions taken, additional area contributing to system, area and class of wetland drained, volumes of water introduced to system and impacts on peak flow.

Improve the drainage licensing system

Goal
Clarify and communicate drainage licensing requirements and process to follow, streamline time required to obtain a license, as well as provide for WPAT input into drainage licensing applications.

Why
Landowners are either unaware of drainage licensing requirements or frustrated with the time required to review and approve license applications. Hence, substantial un-licensed drainage is occurring throughout the watershed, which often results in adverse affects to the watershed and its residents. Allowing WPAT input into licensing applications will ensure watershed-related concerns are addressed before and after the development of the various subwatershed surface water management plans.

What/ How/When
i) Prepare and Communicate Licensing Requirements Fact Sheet - *March 2006*
- MWS to prepare a fact sheet outlining what drainage activities require licensing.
- MWS to communicate licensing approval criteria to WPAT.
- WPAT to communicate these requirements and approval criteria to watershed community.

ii) Improve Communication, Input and Feedback from Watershed Community in Licensing Process – *October 2006*
- MWS to circulate drainage applications to WPAT for review and input.
- MWS to provide a summary of licensing and enforcement issues to WPAT as part of annual review process.
- WPAT to provide MWS with surface water management plans, which will be used to assist in licensing process.

Budget
In-kind costs provided by MWS.

Phase 1 Actions

Surface Water Management

Monitoring and Evaluation
The following criteria can be used by the watershed group to measure the progress and level of success of this initiative.

Step 1 – A drainage licensing requirement fact sheet is prepared and circulated throughout the community. WPAT is aware of the drainage license evaluation criteria, and communicates this to the watershed community.

Step 2 – WPAT is involved in the licensing review process.
- Applications are processed in a timely manner.
- Surface water management plans are submitted to MWS and are adhered to in the licensing process.
- Less illegal drainage is being done.

Improve enforcement of drainage infractions

Goal
Unlicensed drainage works are either licensed, modified or closed, and licensed drainage works that do not comply with drainage license conditions are either modified to comply, or closed.

Why
Unplanned, unlicensed drainage - or drainage that has been licensed but license conditions have not been followed - often result in adverse impacts to the watershed. Compliance to the drainage license conditions and drainage licensing process is vital to ensuring adverse impacts associated with drainage are minimized.

What/How/When
i) Develop Unlicensed/Non-Compliance Drainage Reporting System - March 2006
- MWS will develop a one-page form that can be filled out and submitted to MWS through WPAT for enforcement action on drainage works that are either unlicensed, or licensed but not following the conditions stated on license.
- Licensed drainage works are to be posted to ensure licensed works are not reported on.

ii) Lobby the Province for Enforcement on Illegal Drainage Activity.
- Legislation is needed that has actual consequences for illegal drainage.
- Municipal participation is required.
- An ensurance that license conditions are being followed is required.

Budget*
In-kind support from MWS, R.M.'s, WPAT.

Monitoring and Evaluation
The following criteria can be used by the watershed group to measure the progress and level of success of this initiative.
- The number of complaints reported are recorded and actions taken.
- There are actions being taken to stop illegal drainage activities - less illegal drainage is being done.

Phase 1 Actions

Surface Water Management

Develop drainage Beneficial Management Practices and mitigative measures

Goal
To develop Beneficial Management Practices (BMPs) and mitigative measures that should be taken to ensure drainage does not adversely affect the watershed.

Why
Surface water drainage has the potential to affect the watershed in a variety of negative ways. These include increased flooding downstream, washing out of municipal infrastructure downstream, in-stream and in-field soil erosion, degradation to water quality, lowering of groundwater table and loss of wildlife habitat. Developing drainage BMPs will ensure the watershed remains in a healthy state.

What/How/When
i) Develop Drainage BMPs/Mitigative Measures - February 2006

- WPAT will identify various concerns associated with drainage throughout the watershed, and develop BMPs and mitigative measures to address these concerns.

ii) BMPs/Mitigative Measures Incorporated into Surface Water Management Plans – March 2006

- BMPs and mitigative measures developed by WPAT will be incorporated into respective subwatershed surface water management plans. WPAT will assist in the drainage licensing process.

Budget
In-kind support from WPAT.

Monitoring and Evaluation
The following criteria can be used by the watershed group to measure the progress and level of success of this initiative.

- BMPs and mitigative measures are developed for watershed.
- BMPs and mitigative measures are incorporated into surface water management plans and are used in future drainage licensing process.

Waskada Creek, spring 2005.

Spring runoff near Medora, 2005.

Phase 1 Actions

Water Quality

Design a monitoring program with indicators to benchmark water quality and identify trends

Goal
To preserve and enhance surface and groundwater quality.

Why
There is insufficient knowledge of surface and groundwater quality in the watershed.

What/How
Water quality monitoring involves the collection and measurement of the physical, chemical and biological properties of water relative to its intended use such as domestic, municipal, agriculture, fish and wildlife, recreation and other uses. Monitoring data is used to help determine the baseline quality of surface water and groundwater, track water quality trends, identify water quality problems as they arise and develop response plans to address specific water quality problems.

Components

1. Strategy
2. Set Indicators
3. Locate stations
4. Collect samples
5. Analyze water samples
6. Establish database
7. Reporting, communications, extension.

Some surface and groundwater indicators being considered include:

1. Total Phosphorus (P)
2. Nitrogen (N)
3. Bacteria
4. Suspended Solids
5. Dissolved Oxygen
6. pH
7. Temperature
8. Nitrates
9. Chloride
10. Benthic Invertebrates

Phosphorus and Nitrogen Loading Assessments
As the results of the monitoring program are gathered, they will help identify point and non-point source inputs of P and N to the four subwatersheds including recreational, industrial, municipal, agricultural and natural sources. Assessment goals are to quantify P and N loading in the watershed, estimate P and N export from the watershed and recommend specific remedial actions to address areas where excessive loading is causing major water quality impairment.

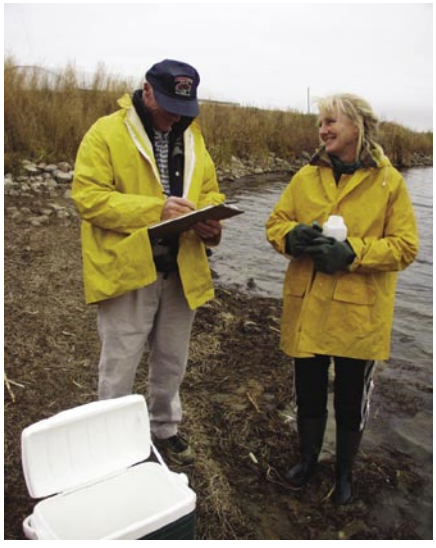
Sampling stations will be selected in each of the four subwatersheds. Water samples will be collected every two weeks during ice-free seasons and sent for analysis according to the indicators. As part of the analysis, total nitrogen and phosphorus loading will be calculated for each station.

When
April 2007

Where
All four subwatersheds.

Who
TMCD and MWS water quality professionals will prepare a detailed action plan including budget to be in place and operational by April, 2007.

Monitoring and Evaluation
Results from the monitoring program will be presented in an Annual Watershed Report Card and 5 Year State of the Watershed Report Card.



Water quality sampling.

Phase 1 Actions

Water Quality

Promote drinking water source protection

Goal
To ensure adequate protection of drinking water sources.

Why
To minimize the risk of surface water and groundwater-sourced drinking water contamination.

What/How
The key to ensuring clean, safe and secure drinking water is to implement multiple barriers throughout the drinking water system, from source to tap. These barriers act to block or control microbiological, chemical and physical contaminants that may enter the water supply system.

A multi-barrier approach is an integrated system of procedures, processes and tools that collectively prevent or reduce the contamination of drinking water from source to tap in order to reduce risks to public health.

The multi-barrier approach aims to reduce the risk of drinking water contamination and to increase the feasibility and effectiveness of remedial controls or preventative options. The ultimate goal of the multi-barrier approach is to protect public health. A multi-barrier approach to safe drinking water contains three main elements. These elements are managed in an integrated manner.

1. Source water (watershed/aquifer),
2. drinking water treatment plant, and
3. distribution system.

Components
This plan will only address the source water protection component. The treatment plants and public distribution systems are municipal responsibilities. The source water component includes three parts.

1. Source water protection plans (SPPs) for public surface water systems in Boissevain and Deloraine will be prepared by focusing on the contributing watersheds. Protection programs for surface water and groundwater-sourced private systems are on-going and targeted by TMCD and the APF.

   A SPP is a management strategy designed to minimize the impact that human and natural activities have on the quality and supply of drinking water. The SPPs will include physical information about the watersheds, identify sensitive areas where water quality is threatened, provide scientific data about the current quality and supply of water and present recommendations about how to manage the impacts of harmful activities.

   Some information has already been collected in the East Souris River Watershed Resource Summary, but much more detailed information is required in the subwatersheds in order to prepare a high quality SPP. Medora has a Boil Water Advisory and alternate supply and treatment options are being discussed and will be included in the Deloraine SPP.

2. Education and advice on location, construction, maintenance and protection procedures will be given to residents with private wells in partnership with MWS and the TMCD.

3. Cost-shared water quality BMP incentive programs will be offered to residents with private surface water systems.

Phase 1 Actions

Water Quality

Who
MWS and the TMCD will cooperate in the preparation of the Boissevain and Deloraine SPPs, including public consultation and provide assistance to residents with private water supplies.

When
The two SPPs will be completed by 2008.

Monitoring and Evaluation
The surface water quality monitoring program will include monitoring in the two subwatersheds that will be included in the two SPPs. The Annual Watershed Report Card will give updates on the preparation of the SPPs.

Design and implement a Wetland Rehabilitation Incentive Program (WRIP)

Goal
To restore wetlands in key areas of the watershed to mitigate flooding, reduce infrastructure costs, improve biodiversity and improve water quality.

Why
There is consensus that the overall management of surface water is unplanned and lacks guidelines, licensing and enforcement. As a result, reports are quite common on flooding, damage to municipal infrastructure, in-stream and in-field soil erosion, water quality degradation, lowering of the groundwater table and loss of wildlife habitat and ecological function throughout the watershed.

The Surface Water Management section of this plan describes proposed actions to address these problems. Included in these was the recommendation that a wetland rehabilitation program be part of proposed surface water management solutions.

What/How
The WRIP program would offer financial compensation and technical help to landowners interested in rehabilitating previously drained wetlands. A wide variety of incentives and instruments (some already used) will be investigated as fair and reasonable tools to permanently restore wetlands. Depending on landowner interest and the level of incentive and compensation offered, it is realistic to expect that about 20 wetlands in the watershed could be rehabilitated each year.

Where
The program will be introduced as a pilot to any interested landowners in the watershed, with the longer term goal to target into limited areas depending on program success.

Who
A WRIP planning team will be formed with membership from the TMCD, Ducks Unlimited Canada, Manitoba Water Stewardship, Manitoba Conservation and the Canadian Wildlife Service. The team would be responsible for designing how the program would work, including a budget and who would be responsible for designing and building the rehabilitation projects.

When
The goal is to have the first rehabilitation project ready to build in 2006.

Monitoring and Evaluation
The program will be monitored according to the number of farmers enrolled and the location of the projects, acres and volume of water stored and habitat types. Results will be included in the Annual Watershed Report Card.

Phase 1 Actions

Water Supply

Design and administer a water supply use and needs inventory

Goal
To determine the current and future water supply needs for watershed residents.

Why
The supply and demand for water within the watershed is not well understood. No detailed inventory exists on the amount of water available from surface and groundwater sources, the amount of water currently being used for domestic, agricultural, commercial or industrial uses or the future water supply needs of the watershed.

What/How
A questionnaire will be designed and mailed to residents and municipalities to collect information such as the type, age, condition, source and quality and quantity of current private and municipal water supplies. Current water use and future water supply needs will also be determined. Information collected will be stored in a TMCD database and used for planning.

Where
All watershed residents will be invited to participate.

Monitoring and Evaluation
Survey results will be included in the State of the Watershed Report.

Who
Assiniboine Community College, PFRA , TMCD and Water Licensing Branch of MWS will be asked to help with the survey.

When
The survey is expected to be administered in the winter of 2006/2007.

Tank loader.
Photo credit: Richard Pasquill

Assess new groundwater sources

Goal
To assess the potential for developing new groundwater sources for domestic, agricultural, commercial and industrial uses.

Why
The quality and quantity of groundwater varies considerably throughout the watershed. Most groundwater comes from sand and gravel and bedrock aquifers with potential new sources in deep, buried channels. Previous test drilling results on the channels were promising but incomplete and general support exists to try and continue test drilling.

What/How
The definition of buried valley aquifers within Maniotba was initially undertaken in the 1960s and 1970s. Various test drilling programs have since been carried out, the most recent in 2003 by the West Souris River Conservation District (WSRCD) and PFRA. A new compilation of information on buried valley aquifers in south-western and west-central Manitoba has recently been prepared by Groundwater Management Section of MWS. The idea had been discussed to expand the deep buried aquifer test drilling that was started in 2003 by WSRCD and PFRA.

Where
Exploration may include parts of the ESR watershed, WSRCD and south-east Saskatchewan.

Who
WSRCD, PFRA and Groundwater Managment Section of MWS.

When
Discussions are expected to begin in 2006.

Monitoring and Evaluation
2003 Phase 1 results and any future results will be included in the Annual Watershed Report Card and on conservation district web sites.

Phase 1 Actions

Ecosystems

Promote the conservation of natural cover in highly erosive areas

Goal
To secure 25% of the natural cover on private land in the Turtle Mountains, Chain Lakes Valley and Blind Souris River Valley.

Why
Natural areas are important for a variety of environmental, economic and recreational reasons. These include soil erosion prevention, increased infiltration of water, reduced peak flows and the provision of wildlife habitat. Protecting these areas will result in long-term cost savings if these areas can be preserved. In recent years, commercial logging has occurred in the Turtle Mountains and there is some uncertainty as to how the land will be used in the future. Permanent protection of natural cover in the ESR watershed has been conducted on a limited scale in the past and it was not until 2004 that the first conservation agreement was signed in the Turtle Mountains. Conservation organizations have also used conservation agreements to secure native grassland habitat along the western boundary of the ESR watershed.

What/How
Through the promotion and signing of conservation agreements, 25% of the natural cover on private land within the Turtle Mountains, Chain Lakes Valley and Blind Souris River Valley will be permanently secured. Other incentives such as tax credits will be promoted with external funding.

Where
Turtle Mountains Uplands, Chain Lakes Valley and Blind Souris River Valley.

Who
TMCD, MHHC, Manitoba Finance.

When
Start: 2006; Completion: on-going.

Budget
Turtle Mountains = $605,500, Chain Lakes Valley= $20,000 , Blind Souris River Valley: $150,000

Monitoring and Evaluation
The total number of acres secured will be evaluated to determine if goals are achieved.

Promote the restoration of natural upland areas

Goal
Encourage landowners to restore natural upland areas.

Why
The existence of natural upland areas in the ESR watershed adjacent to waterways and in the headwaters area provide many watershed benefits. Over time the amount of natural vegetation in upland areas of the watershed has decreased. In order to restore ecological functions in the watershed, WPAT is proposing to restore these areas in conjunction with private landowners.

What/How
Provide voluntary cost-shared incentives such as tax credits to encourage landowners to restore upland areas and extend funding opportunities for native habitat.

Where
ESR watershed headwaters.

Who
Manitoba Finance, external partners.

When
Start: 2006; Completion: 2011.

Monitoring and Evaluation
The amount of acres restored would be used to measure success.

Phase 1 Actions

Ecosystems

Conduct wetland and riparian education workshops.

Goal
Increase the awareness and importance of wetlands and riparian areas in maintaining watershed health.

Why
Healthy riparian areas and wetlands perform key ecological functions. Raising awareness about the importance of riparian areas and wetlands is critical if these areas are going to be managed and protected to provide benefits for current and future generations of the ESR watershed.

What/How
Personnel involved with the Managing the Waters Edge program will be requested to conduct presentations on riparian function, riparian health assessments, grazing management, importance of wetlands and other relevant topics. The TMCD will host workshops and promote the workshops in conjunction with partners within the ESR watershed.

Where
ESR watershed.

Monitoring and Evaluation
Number of landowners, and TMCD Board and Sub-District members that attend a riparian workshop, public feedback from workshop questionnaires.

Who
Managing the Waters Edge, TMCD, schools, Project WET.

When
Start: 2006; Completion: 2009

Budget
$5,000

Riparian health workshop.
Photo credit: Wes Pankrantz

Provide incentives for the conservation of wetlands.

Goal
Maintain ecological and hydrological functions of the watershed.

Why
Wetlands provide society with a variety of ecological benefits (i.e. recharge groundwater, purify water, reduce floods, etc.) and their presence is linked to watershed health. The number of wetlands in the ESR watershed has decreased over time and landowners need to be given a financially viable alternative to draining wetlands.

What/How
MHHC and DUC currently have wetland conservation programs where conservation agreements are used to protect wetlands. The WPAT and TMCD will work in conjunction with various partners to develop criteria and priorities for wetland conservation based on results of the surface water management plan. Conservation agreements, leases and tax credits are options that can be used to compensate landowners to protect wetlands.

Where
Currently, wetland conservation projects within the ESR watershed are targeted at highly productive waterfowl areas. However, criteria needs to be developed to secure wetlands to ensure watershed health is maintained.

Did You Know?
There are almost 20,000 wetlands covering 77,000 acres in the watershed.

Phase 1 Actions

Ecosystems

Who
MHHC, DUC, TMCD, and other partners.

When
Start: 2006; Completion: 2011.

Budget
Total budget of $500,000 is based on a goal of securing 1,000 acres of wetlands per year.

Monitoring and Evaluation
The number of acres of wetlands secured and the number of acre-feet of water stored, and habitat type conserved will be used to measure success.

Wetland.
Photo credit: Ducks Unlimited Canada

Design and implement a riparian management strategy for the watershed

Goal 1
To assess the relative health of existing riparian areas.

Goal 2
To protect and restore riparian areas by targeting voluntary BMPs.

Why
Healthy riparian areas perform valuable ecological functions. Managing and protecting riparian areas is a cost-effective way of addressing many environmental issues. They are a first line of defense in filtering nutrients and trapping sediments before they enter our waterways, and they provide valuable wildlife habitat.

What/How
Assessment will be conducted through an aerial video evaluation to locate both the intact and impacted riparian areas. Detailed assessments will be conducted using the Managing the Waters Edge guide encouraging producers to participate in the process.

Targeted programs such as remote watering systems, riparian fencing, rotational grazing, forage buffers and grassed waterways will be promoted to improve the health of riparian areas. Landowners can access help through the completion of an Environmental Farm Plan.

Where
Although the general assessment will be undertaken in the entire watershed, the Souris River from the U.S. border to the town of Souris and the contributing watersheds upstream of Boissevain and Deloraine will be priorities.

Who
The TMCD, MWS and the Manitoba Riparian Health Council and their members will lead in the development of the overall riparian management strategy.

When
Start in April 2007 and complete in 2011.

Did you know?
There are over 1,760 kilometres of riparian areas in the watershed?

Monitoring and Evaluation
The number of projects implemented, length of waterways and riparian areas protected and/or restored will be recorded in the watershed report cards to be prepared as part of the communication strategy.

Phase 1 Actions

Ecosystems

Promote the concept of ecological goods and services payments.

Goal
Provide incentives to landowners for ecological goods and services provided to the public.

Why
Ecological goods and services (clean water, wildlife, clean air, etc.) are provided to the public through ecologically-friendly land management practices. If the public is going to receive benefits as a result of wise land management, the public must compensate landowners financially for those services. The payment for ecological goods and services is not a new concept, however given the current economic reality in agriculture, the only way to ensure that public benefits will be provided by private landowners is to fairly compensate them for those ecological goods and services.

What/How
Details of this program need to be developed and finalized and the WPAT will be paying close attention to a pilot project that is being implemented in the R.M. of Blanshard. Some of the recommendations are to have demonstration projects, pilot projects, tax credits, conservation agreements and riparian management programs so that landowners can be compensated for the benefits they provide to society. Areas will be prioritized, focusing on existing natural habitat within the ESR watershed.

Where
ESR watershed.

Who
TMCD, KAP, municipal, provincial and federal governments, and conservation and agricultural organizations.

When
Start: 2007; Completion: on-going.

Budget
To be determined once the program is developed.

Monitoring and Evaluation
Interest by landowners in an ecological goods and services program, and the number of acres signed up as part of the program will be used to evaluate the program.


Riparian area.


Wetland and wooded habitat.

Phase 1 Actions

Soils

Implement a salinity management program.

Goal
Target 5,000 acres of saline land in order to manage saline soils from increasing.

Why
Salinity seems to be expanding in the ESR watershed in recent years, reducing the productive capability of the soil. If land is either naturally saline, or becomes more saline over time due to weather, cropping practices, road construction or other factors, it is difficult to reverse the trend. Prevention is the most cost-effective method of addressing this problem.

What/How
The TMCD currently has a salinity seed program aimed at establishing forage in saline areas. The guidelines for the current programs will be reviewed in order to encourage participation and they will be promoted in order to address the problem. Other salinity seed programs are offered by DUC, and through the APF, landowners can access funds through the Land Management for Soils at Risk (BMP). Increased education and awareness activities are also required in order to inform landowners about management options to address saline problems.

Monitoring and Evaluation
The number of seeded acres will be monitored, landowner surveys will be conducted to obtain feedback on the program and soil testing on a number of monitoring sites will be completed to determine if soil salinity reduces over time.

Where
ESR watershed.

Who
TMCD, DUC, APF partners.

When
Start: 2006;
Completion: 2010.


Salinity barrier.

Budget
$125,000 for forage seed plus $25,000 in-kind costs to advertise and deliver the program.

Did you know?
There are 9,100 acres of moderately saline land, and 50,000 acres of weakly saline land in the watershed.

Increase/maintain grassed waterways and forage bufferstrips.

Goal
To minimize in-stream soil erosion and improve water quality.

Why
Soil erosion causes sedimentation of waterways. Also, nutrients such as phosphorus attached to eroded soil particles can impact downstream water quality. The amount of water being drained in the watershed has increased over time and if the soil resource is going to be protected, it is important that soil erosion along waterways is minimized through the establishment of forages.


Grassed waterway.

Phase 1 Actions

Soils

What/How
Three hundred forty miles of riparian areas in cropland will be targeted for the establishment of grassed waterways. Land adjacent to waterways will be prioritized to establish and/or increase forage bufferstrips. Projects need to be protected through conservation agreements or caveats to ensure they remain in place for the long-term.

Where
Along main waterways in the watershed and waterways designated as having severe and high risk for water erosion.

Who
TMCD, MWS, APF partners.

When
Start: 2006; Completion: 2011.

Budget
Costs will be determined once riparian health along target waterways is determined and the length of grassed waterways and forage bufferstrips in need of establishment are defined.

Monitoring and Evaluation
The total length of grassed waterways and forage bufferstrips will be used to model a reduction in soil erosion.

Identify and ground-truth high erosion risk areas.

Goal
To reduce soil erosion in the watershed through mapping and targeting in-stream and in-field areas subject to severe and high erosion risk.

Why
Present erosion risk maps were developed at a reconnaissance scale, assuming the ground cover was bare soil. Given the recent increase in the use of zero and conservation tillage in cropland areas and constant land cover changes, these areas need to be redefined to assist in future targeting of erosion control programs.

What/How
A technical review of severe and high risk erosion areas on existing maps will be conducted. A review of riparian areas that have been identified as cropland will also be included.

Where
Areas identified as having a severe and high risk of erosion, with priority given to source water areas.

Monitoring and Evaluation
Local acceptance of the soil erosion risk maps will be used to evaluate this initiative.

Who
RM councilors, PFRA and MAFRI.

When
Start: 2006; Completion: 2008.

Budget
$20,000 to cover wages and travel expenses.

Wind erosion.

Phase 1 Actions

Education and Communications

Increase awareness of community benefits of improved watershed management.

Goal 1
To educate and engage the watershed community of the need for, and benefits of, improved watershed management.
Goal 2
To increase youth participation in watershed programs.
Goal 3
To promote a sense of watershed community.
Goal 4
To encourage and support farmer participation in beneficial management practices programs and environmental farm planning throughout the watershed.

What / How
Awareness of the benefits of improved watershed management will be achieved by a number of methods including the following:

- Sponsor survey/public focus groups.
- Distribute a newsletter.
- Write a regular watershed newspaper article.
- Produce a State of the Watershed Report every five years.
- Produce an Annual Watershed Report Card.
- Sponsor an annual water festival.
- Create an elementary school watershed club.
- Better signage about the watershed.
- Build a 3-D model of the watershed.
- Promote EFP farmer focus groups.
- Invertebrate sampling / community-based water sampling (linked to water quality).

Who
An education sub-committee will be formed with area school teachers, TMCD, 4-H, Assiniboine Community College, Brandon University and Ag in the Classroom.

When
The sub-committee will prepare a communications plan ready for implementation in September, 2006 to build on the valuable education efforts currently underway. The plan will include a budget and a monitoring and evaluation strategy.


Winter watering system.


Students "pond-dipping" at Whitewater Lake.

Measuring our Progress

Background

The watershed plan lays out a framework of actions linked to goals and objectives set out by the community. The recommended actions have been designed to be practical, common sense solutions to improve the overall health of the East Souris River watershed.

The programs and projects that will be undertaken need to be evaluated and monitored wherever possible in order for the watershed residents to know if there are real overall benefits to the health of the watershed.

Measuring our collective progress in the watershed is the goal of a monitoring and evaluation program….something that is new and never put in place before in the watershed. It is a challenge that we are up to!!

What is watershed health?

Watersheds are not simple. A healthy watershed is defined as the conditions necessary to support various uses like drinking water, aquatic life and swimming, as examples.

To assess the health of our watersheds, then, we must assess the health of its living communities in a range of conditions that reflect human impacts, from minimal to severe.

How do we measure watershed health?

To truly monitor and assess the health of our watersheds, we would need to monitor all their physical, chemical and biological features – everywhere and all the time! Obviously, we can't do that. So, we need to make choices about the *indicators* (measureable features) that we will track and how, where and how often we will track them.

Simple indicators are being developed to help measure our progress in areas including:

1. water,
2. soil,
3. habitat (plants and animals), and
4. community.

The assessment and results of applying the indicators to the watershed will be written in a Watershed Report Card to be produced and distributed at regular intervals.

The Report Card is a score card prepared by the community on relative watershed health to:

1. help measure progress on programs and projects,
2. target programs where most needed,
3. communicate watershed news to the public, and
4. help the TMCD Board in decision-making.

What is the current condition of our watershed today?

Will it get better or worse in relative terms over the years as we try to improve local economic conditions in the watershed but do it in a sustainable way?

The Report Card will be put on local web sites, and in newspapers and newsletters.

Reviewing the watershed plan.

As a commitment to monitoring our progress, WPAT will be reviewing the plan annually with the community and conducting a major review after five years.

Field of sunflowers.

Off-stream watering system.

Funding the Plan

Preparing This Plan

The funds required to prepare this watershed plan were provided by Manitoba Water Stewardship, member municipalities of the TMCD, Environment Canada's EcoAction Program and in-kind contributions from partner organizations.

Investment With Payback

Through the plan, the watershed community has identified an ambitious multi-year work plan targeted at investing resources into programs aimed at improving the overall health of the watershed.

It is a priority of the plan to be able to demonstrate tangible environmental improvements to the watershed over time. This is critical to agencies and organizations that may want to invest their program and project money through partnerships to help implement the plan.

These agencies want to see a positive return on their investment. Therefore, the value of this plan becomes even more important as a business-like way for the watershed as a unified community to attract new investors.

Current Income

Unfortunately, current income received by community groups for environmental programs in the watershed is not enough to implement all the priority actions and meet the enormous community expectations and demands for solutions to serious problems.

The Turtle Mountain Conservation District helps bring in some of the program money through municipal levies, provincial grants, landowner contributions and other funds received from other government and conservation sources.

New Funding Partnerships

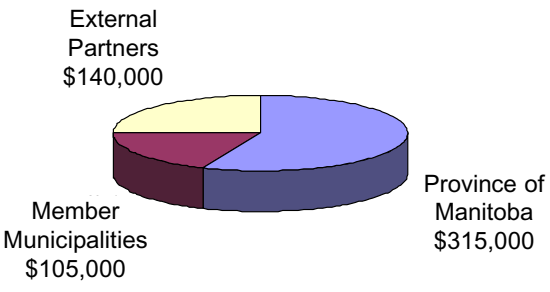
Priority will be given to soliciting external funding partnerships from many of the agencies named in the implementation section of this plan. **WPAT believes this plan will attract money.** The TMCD Board will play a lead role in applying for the external money.

It is difficult to estimate how much money is needed to implement the plan over the next 10 years. Many of the proposed actions are in the preliminary planning stages and budgets are incomplete. Specific proposals will be prepared to acquire money for action items as they become ready to implement.

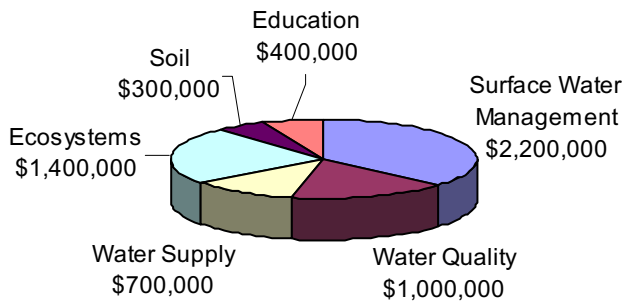
Preliminary estimates call for about $6 million required over the next five years to fund the recommended actions in the plan.

Revenue raised by the community will represent a **new money for new work** philosophy.

Current Annual Income
Turtle Mountain Conservation District



New Funding Partnerships
Projected over five years



Appendix A

East Souris River WPAT Participants List

The following is a list of agencies, organizations, and interest groups that chose to participate in the development of this watershed managment plan. While some were able to dedicate more time than others, all contributions are appreciated.

Turtle Mountain Wildlife Association - Rick Pearce
Goodlands Winter Sports Club - Russ Adams, Randy Nestibo
Deloraine/Winchester Planning District - Derek Weidenhamer, Brian Franklin
Dennis County Planning District - Murray Phillips
Southwest Planning District - Duncan Stewart
Rural Municipality of Arthur - Jim Trewin
Rural Municipality of Brenda - Duncan Stewart
Rural Municipality of Cameron - Murray Phillips
Rural Municipality of Glenwood - Phil Dornian
Rural Municipality of Morton - Brian Hammond
Rural Municipality of Winchester - Jack Edwards, Dennis Crowe
Town of Boissevain - Rob Adams
Town of Deloraine - Roy Hathaway, Brian Franklin
Village of Waskada - Keith Hannah
Tiger Hills Conservation District - Phil Dornian
Turtle Mountain Conservation District (TMCD) - Chairman - Richard Sexton
TMCD - Chain Lakes Sub-District - Murray Dillabough
TMCD - Medora Creek Sub-District - Wayne Tilbury
TMCD - Waskada Creek Sub-District - Keith Hannah
TMCD - Whitewater Lake Sub-District - Greg More
TMCD - Provincial Appointee - Murray Combs
Chain Lakes Sub-District Non-Affiliated Landowners - Neil Hathaway
Medora Creek Sub-District Non-Affiliated Landowners - Bob Brigden
Waskada Creek Sub-District Non-Affiliated Landowners - Don Temple
Wheatbelt Community Futures/Deloraine/Winchester EDO - Tyler King
Keystone Agricultural Producers - David Day, Lance Vanbeselaere, Glen Franklin
Manitoba Pork Council - Clifford McCallum
Ducks Unlimited Canada - Dave Dobson, Rick Andrews
Manitoba Habitat Heritage Corporation - Kevin Teneycke
Souris River Water Commission - Wayne Drummond
Agriculture and Agri-Food Canada/PFRA - Patsy Michiels, Tim Rollheiser, Stella Fedeniuk
Fisheries and Oceans Canada/DFO - Darryl Chudobiak
Environment Canada/CWS - Pat Rakowski
Manitoba Intergovernmental Affairs and Trade - Terry Brown
Manitoba Agriculture, Food and Rural Initiatives - Scott Day, David Hay, Lionel Kaskiw
Manitoba Conservation/Wildlife - Tom Moran
Manitoba Crop Insurance Corporation - Janos Boda
Manitoba Industry, Economic Development and Mines - Christine Winter
Manitoba Transportation and Government Services - Ron Boulet, Denise Jubenvill
Manitoba Water Stewardship/Conservation Districts Program - Phil Weiss
Manitoba Water Stewardship/Fisheries - Bruno Bruederlin
Manitoba Water Stewardship/Groundwater - Laurie Frost
Manitoba Water Stewardship/Hydrology - Bob Harrison
Manitoba Water Stewardship/Licensing - Jackie Dixon, Perry Stonehouse
Manitoba Water Stewardship/Manitoba Water Services Board - Richard Pasquill
Manitoba Water Stewardship/Water Quality - Nicole Armstrong
James Ritchie (Human History)

Appendix B

East Souris River WPAT Invitation List

The following is a list of agencies, organizations and interest groups that, in addition to the participants listed in Appendix A, were extended an invitation to contribute to the development of this watershed managment plan.

Assiniboine Community College
Southwest Horizon School Division
Deloraine Game and Fish
Hartney Game and Fish
Souris Game and Fish
Southwest Snow-trackers
Lake Metigoshe Improvement Association
Morton/Boissevain Planning District
Souris/Glenwood Planning District
Town of Hartney
Town of Souris
Boissevain Chamber of Commerce
Deloraine Chamber of Commerce
Hartney Chamber of Commerce
Souris Chamber of Commerce
Turtle Mountain Sustainable Ventures
Turtle Mountain Economic Development Corporation
Souris / Glenwood Community Development Corporation
South West Manitoba Water Development Team
Turtle Mountain Métis Local
Nature Conservancy of Canada
Boundary Trail Heritage Region
Southwest Trails Association for Regional Tourism
Deloraine/Turtle Mountain Historical Society
Western Agriculture Diversification Organization
Manitoba Cattle Producers Association

Appendix C

Abbreviations

ACC	Assiniboine Community College
APF	Agricultural Policy Framework
BMP	Beneficial Management Practice
CWS	Canadian Wildlife Service
DFO	Department of Fisheries and Oceans
DUC	Ducks Unlimited Canada
EFP	Environmental Farm Plan
ESR	East Souris River
IWMP	Integrated Watershed Management Plan
KAP	Keystone Agricultural Producers
MAFRI	Manitoba Agriculture, Food and Rural Initiatives
MWS	Manitoba Water Stewardship
MWSB	Manitoba Water Services Board
MHHC	Manitoba Habitat Heritage Corporation
PFRA	Prairie Farm Rehabilitation Administration
R.M.	Rural Municipality
SPP	Source Protection Plan
TMCD	Turtle Mountain Conservation District
WPAT	Watershed Planning Advisory Team
WRIP	Wetland Rehabilitation Incentive Program
WSRCD	West Souris River Conservation District

Appendix D

Imperial/Metric Conversions

Capacity

1 gallon (Can.)	=	4.5461 litres
1 litre	=	0.2200 gallons (Can.)

Volume

1 metre^3	=	1.30795 yards^3
1 dam^3	=	1,000,000 litres
1 acre-foot	=	1.23448 dam^3

Length

1 metre	=	3.28 feet
1 kilometre	=	0.6214 mile
1 mile	=	1.6093 kilometres
1 inch	=	25.4 millimetres
1 foot	=	0.3048 metres

Area

1 kilometre^2	=	100 hectares
1 hectare	=	2.47 acres
1 acre	=	0.404686 hectares
1 mile^2	=	2.5899 kilometres^2
1 kilometre^2	=	0.386102 miles^2

Appendix E

Glossary

Aquatic: Growing or living in, or frequenting water.

Aquifer: A saturated permeable geologic unit that can transmit significant quantities of water under ordinary hydraulic gradients.

Biodiversity: The variety of life-forms – the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form. It is usually considered at three levels – genetic, species and ecosystem diversity.

Beneficial Management Practices: Practical solutions used to deal with soil and water conservation concerns, including techniques used to manage agricultural and urban runoff and modify agricultural waste management.

Benthic Invertebrates: Organisms without an internal skeletal structure that live on or in a body of water, e.g. water insects.

Climate: The average weather conditions of a place or region throughout the seasons.

Discharge area: An area where water leaves the saturated zone across the water table surface.

E. (Escherichia) coli: Bacteria found in human and animal waste (manure). Their presence in water indicates fecal contamination.

Ecosystem: An interactive community of animals, plants and micro-organisms and the physical and chemical environment in which they live.

Elevation: The height of a portion of the earth's surface in relation to its surroundings.

Erosion: The wearing away of the land surface by running water, wind, ice or other natural agents.

Floodplain: A plain bordering a river which has been formed from deposits of sediment carried down the river. When a river rises and overflows its banks, the water spreads over the floodplain.

Gradient: The rate of regular or graded ascent or descent.

Groundwater: Water that has infiltrated below the earth's surface and moves in response to gravity, but can be restricted by impermeable rock or clay layers.

Groundwater table: The meeting point between the groundwater and the unsaturated layer above it.

Habitat: The place where an animal or plant lives; its living or non-living surroundings.

Hydrology: The scientific study of surface water.

Infiltration: The movement of water from the land surface into the soil and water table.

Intermittent stream: A watercourse that does not flow permanently year round.

Invertebrates: Animals lacking a spinal column.

Non-point source pollution: Pollution whose source cannot be linked to a specific location.

Nutrient: Something that nourishes and promotes growth, such as nitrogen and phosphorus. It is possible to have too many nutrients in an ecosystem, which can result in an unhealthy balance or overgrowth of certain species.

Permeability: The quality of having pores or openings that allow liquids to pass through.

Precipitation: The deposits of water in either liquid or solid form which reach the earth from the atmosphere. It includes rain, sleet, snow and hail.

Point source pollution: Pollution from a single source, such as an industrial smokestack.

Recharge area: An area where the soil conditions allow rain and melted snow to seep into the ground to replenish the groundwater system.

Riparian: Relating to, living on, or located on the bank of a watercourse or a body of water.

Riparian area: Areas adjacent to a waterbody or watercourse that are saturated by groundwater or intermittently inundated by surface water at a frequency and duration sufficient to support the prevalence of vegetation typically adapted for life in saturated soil.

Runoff: The portion of rainfall, melted snow or irrigation water that flows across the surface or through underground zones and eventually runs into streams.

Saturated soil: Soil that is full of moisture.

Sediment: Material deposited by water, wind or glaciers.

Slope: Ground that forms a natural or artificial incline.

Stream: A body of running water flowing on the surface of the earth.

Sub-watershed: A region or area bounded peripherally by a water parting and draining ultimately to a tributary of a larger watercourse or body of water.

Surface water: Water that sits or flows above the earth, including lakes, oceans, rivers and streams

Topography: A detailed description or representation of the features, both natural and artificial, of an area. Also the physical and natural features of an area, and their structural relationships.

Watershed: The land area that drains into a given body of water.

Wetland: Lands that are seasonally or permanently flooded by shallow water, as well as lands where the water table is close to the surface (e.g. swamps, marshes, bogs and fens).

Watershed Planning Advisory Team: Consists of various individuals who have an interest in the watershed and who have been invited to participate in the development of the East Souris River Watershed Management Plan

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