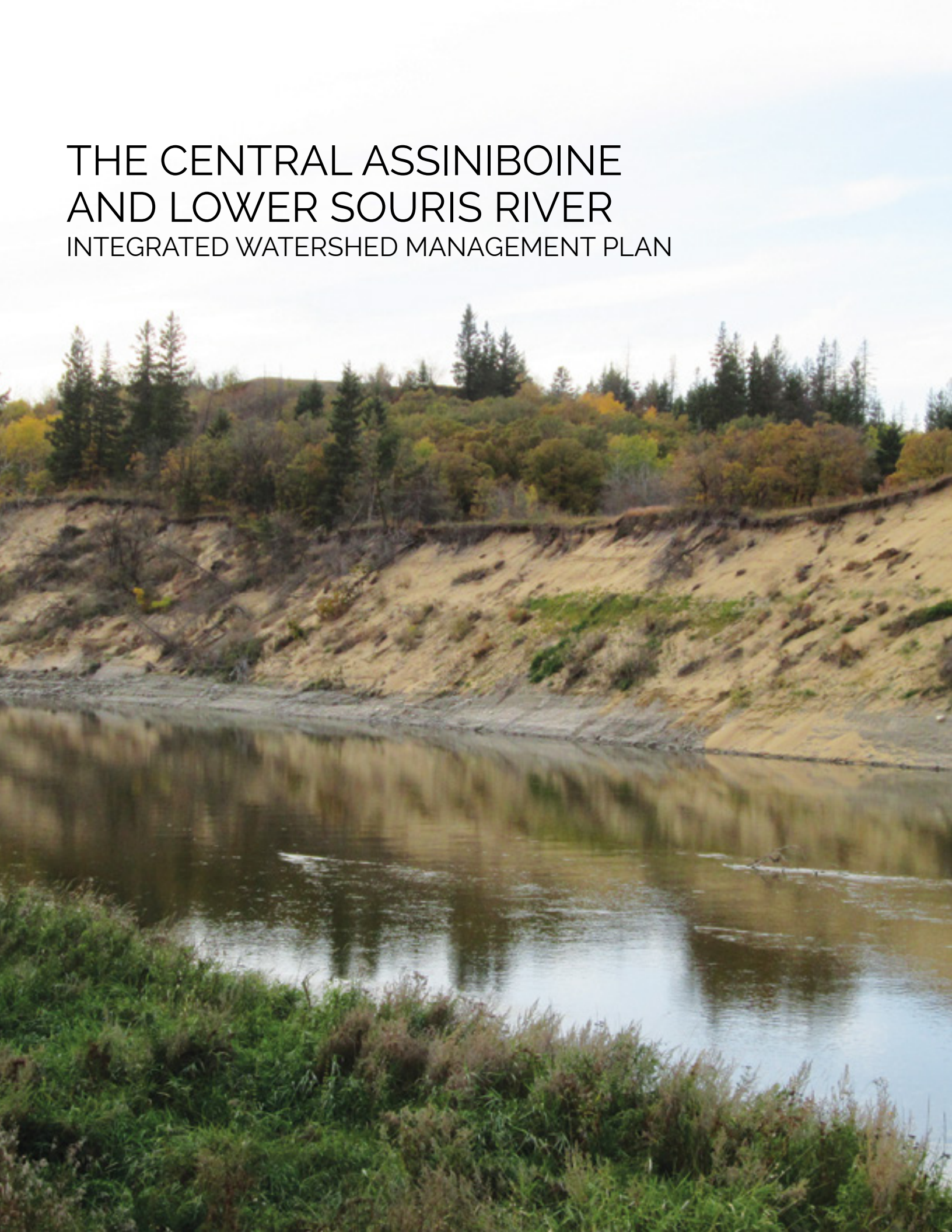
THE CENTRAL ASSINIBOINE AND LOWER SOURIS RIVER

INTEGRATED WATERSHED MANAGEMENT PLAN



EXECUTIVE SUMMARY

In Manitoba, resource managers are moving towards a watershed-based management philosophy. Watersheds are considered the most ecologically and administratively appropriate units for managing water. Working within watersheds gives people the opportunity to address water quality, quantity, community and habitat issues beyond the scope of single jurisdictions, as well as, consider cumulative impacts.

An integrated watershed management plan is a document that outlines actions to address priority land and water resource issues on a watershed basis. This plan is a tool to assist residents, stakeholders and all levels of government in making responsible decisions on how to manage water, develop land and allocate financial resources. An effective watershed plan is important for the sustainable development of thriving communities like those in the Central Assiniboine and Lower Souris River Watershed, as the implementation of its actions not only includes improvements to the environment, but also social and economic benefits.

ACKNOWLEDGEMENTS

The Assiniboine Hills Conservation District, as the water planning authority for the Central Assiniboine and Lower Souris River Watershed, would like to acknowledge and thank their watershed residents and partners for their support, input and participation in the development of the Central Assiniboine and Lower Souris River Integrated Watershed Management Plan.

A special thank you to all the members of the Project Management Team – Chairperson Heather Dalgleish, Ted Snure, Lonnie Dunlop, David Mazier, Jack Bolack, Murray Jackson, Ross Erickson, Hugh Stephenson, Gordon Beddome, Roger Lesage, Don Daniels, John Rigaux, Barb Kingdon, Jonathan Wiens and Andrea McLean. Thank you to the Province of Manitoba and the Municipalities of Argyle, Cornwallis, Elton, Glenwood, Oakland, Riverside, South Cypress, Strathcona, Whitehead and Whitewater, the Town of Souris, the Villages of Glenboro, Wawanesa, and the City of Brandon.

Many thanks to the members of the Watershed Team which included representatives from Agriculture and Agri-Food Canada, Ducks Unlimited Canada, Manitoba Habitat Heritage Corporation, Manitoba Conservation and Water Stewardship, Manitoba Infrastructure and Transportation, Manitoba Agriculture Food and Rural Development, Manitoba Municipal Government, Nature Conservancy Canada, Spruce Woods Provincial Park, local municipalities, local planning districts and residents of the watershed.

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INTEGRATED WATERSHED MANAGEMENT

Residents of the Central Assiniboine and Lower Souris River Watershed are fortunate to have bountiful supplies of clean and accessible fresh water. Water has defined the agricultural industry, society and culture of southwest Manitoba. It is the responsibility of all residents and all levels of government to ensure our water remains clean and in abundant supply for the health and prosperity of future generations. This integrated watershed management plan will be a tool used by residents, governments and other stakeholders to assist in making responsible decisions on how we manage water, develop and improve land, and allocate conservation dollars.

In Manitoba, resource managers are moving towards a watershed-based management philosophy. Watersheds are considered the most ecologically and administratively appropriate units for managing water. Water flows downstream through a watershed and any activity that happens upstream affects people and places downstream. Working within watersheds gives people the opportunity to address water quality, quantity, community and habitat issues beyond the scope of single jurisdictions like towns or municipalities, as well as to consider cumulative impacts of land use practices.

The Central Assiniboine and Lower Souris River Watershed is served by four conservation districts; the majority of which is served by the Assiniboine Hills Conservation District. The extreme western portion is covered by the Turtle Mountain

Conservation District; the central-northern edge of the watershed by the Little Saskatchewan River Conservation District; and the east by the La Salle Redboine and Pembina Valley Conservation Districts. Nineteen Rural Municipalities (RMs) are within the watershed boundary. This diverse watershed covers an area of 7,238 square kilometres (2,794 square miles) and is one of many watersheds that contribute to the larger Assiniboine River Basin.

The plan is divided into seven subwatersheds with each area having a section dedicated to source water protection, surface water management, and natural area conservation (Figure 1).

Through a series of public consultations and a review of the most up-to-date technical information the project management team determined the most achievable solutions to watershed issues. Each subwatershed section has individual goals and a list of recommended actions with a map detailing where these actions should take place.

Understanding the connection between landscape features, how we use the land, and the quality and quantity of downstream water is critical to the long-term health and prosperity of residents in the Central Assiniboine and Lower Souris River Watershed. According to the watershed residents, the successful implementation of this plan will ensure the coexistence of human and natural needs with a process of checks and balances. Partnerships will be formed between all governments and agencies, allowing for better management of our natural resources.

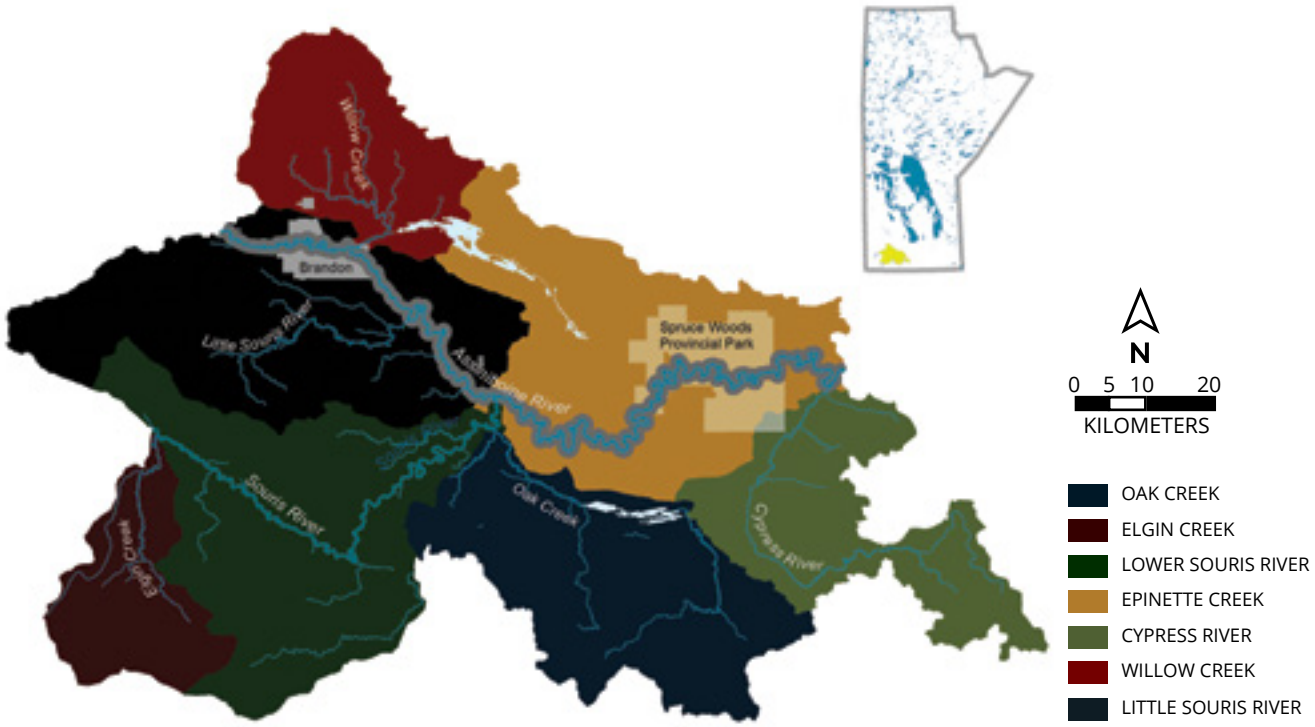


FIGURE 1: Subwatersheds of the Central Assiniboine and Lower Souris River Watershed.

OVERVIEW

The Assiniboine and Souris Rivers are major watercourses in south central Manitoba. Both rivers flow through the Central Assiniboine and Lower Souris Watershed, which is part of the larger Assiniboine River Basin. The Assiniboine River originates in eastern Saskatchewan and flows east across southern Manitoba, through major urban centres including Brandon and Portage la Prairie. The Souris River originates in south eastern Saskatchewan. The lower portion of the river stretches across the watershed from the town of Souris to Treesbank within the boundaries of this watershed. The watershed area is approximately 739,779 ha in size and comprises 5% of the Assiniboine River Basin. Seven subwatersheds (Figure 1) comprise the Central Assiniboine and Lower Souris Watershed.

A large extent of the Assiniboine and Lower Souris rivers flow through wide valley, which was formed during a period of glacial runoff after the last ice age. Following the last glacial period, alluvial deposits of rock fill created large deposits of sand and gravel. The result was the establishment of several shallow aquifers in various parts of the watershed. The Assiniboine Delta structure is the result of a very large glacial river depositing sediments into a large bay in Lake Agassiz.

There are several major communities in the watershed including Brandon, Souris, Glenboro, Kemnay, Douglas, Chater, Forrest, Mariapolis, Baldur, Belmont, Dunrea, Nesbitt, Minto, Elgin, and Swan Lake First Nation.

Climate

Average monthly precipitation ranges from 81 mm (3.2 in) in June to 18 mm (0.7 in) in February. Rainfall during the growing season is usually not more than 330 mm (13 in) with total annual precipitation averaging 460 mm (18 in). The mean effective growing season is about 155 days, with an average frost free period of about 124 days.

Topography

The elevation of the watershed ranges from 560 metres above sea level (masl) in the northern edge of the watershed, down to 255 masl in far eastern corner of the watershed. Although the watershed's topography is relatively flat to undulating, there is a general increase in elevation around the Brandon Hills, south of Brandon, and the Tiger Hills, along the southern portion of the watershed (Figure 2).

FIGURE 2: Topography of the Central Assiniboine and Lower Souris River Watershed.

SOILS AND EROSION

The Central Assiniboine and Lower Souris Watershed is characterized by productive soils that support a strong agricultural community and rural economy. Within the Central Assiniboine and Lower Souris River watershed approximately 60% of the soils are classified as Class 1-3 under the Canadian Land Inventory (Figure 3). The majority of these soils are found within the Elgin Creek, Willow Creek, and Lower Souris River subwatersheds. Approximately 38% of soils are classified as Class 4-7; the majority of which are sandy soils located over the Assiniboine Delta Aquifer. Although classified at a higher level, the combination of soil type and availability of water also make some land within this area suitable for irrigated cropland development. Less than 2% of the soils are organic; small pockets of organic soils can be found near the Douglas, Alexander-Griswold, and the Glenboro Marshes.

Soil erosion risk is calculated based on slope length, slope gradient, and soil type of unprotected soils. Large areas of the Central Assiniboine and Lower Souris River Watershed are at a high risk of water and wind erosion, although both of these normally occur in different areas of the watershed (Figure 3). Wind erosion can be a serious concern for agricultural producers growing annual crops. Approximately 37% of the land in this watershed is considered to have soil with a moderate, high, or severe wind erosion risk, based on bare, unprotected soils; the majority of which is concentrated to the sandy soils located over the Assiniboine Delta Aquifer. Many landowners have mitigated this risk by using residue management, shelterbelts, and crop rotation practices.

The Canada Land Inventory is a comprehensive multi-disciplinary land inventory that identifies land capability for agriculture, forestry, wildlife, and recreation. The land capability for dry land agriculture is based on evaluation of both internal and external soil characteristics that influence soil suitability and limitations for agricultural use. Class 1 lands have the highest, and Class 7 has the lowest capability to support agricultural land use activities.

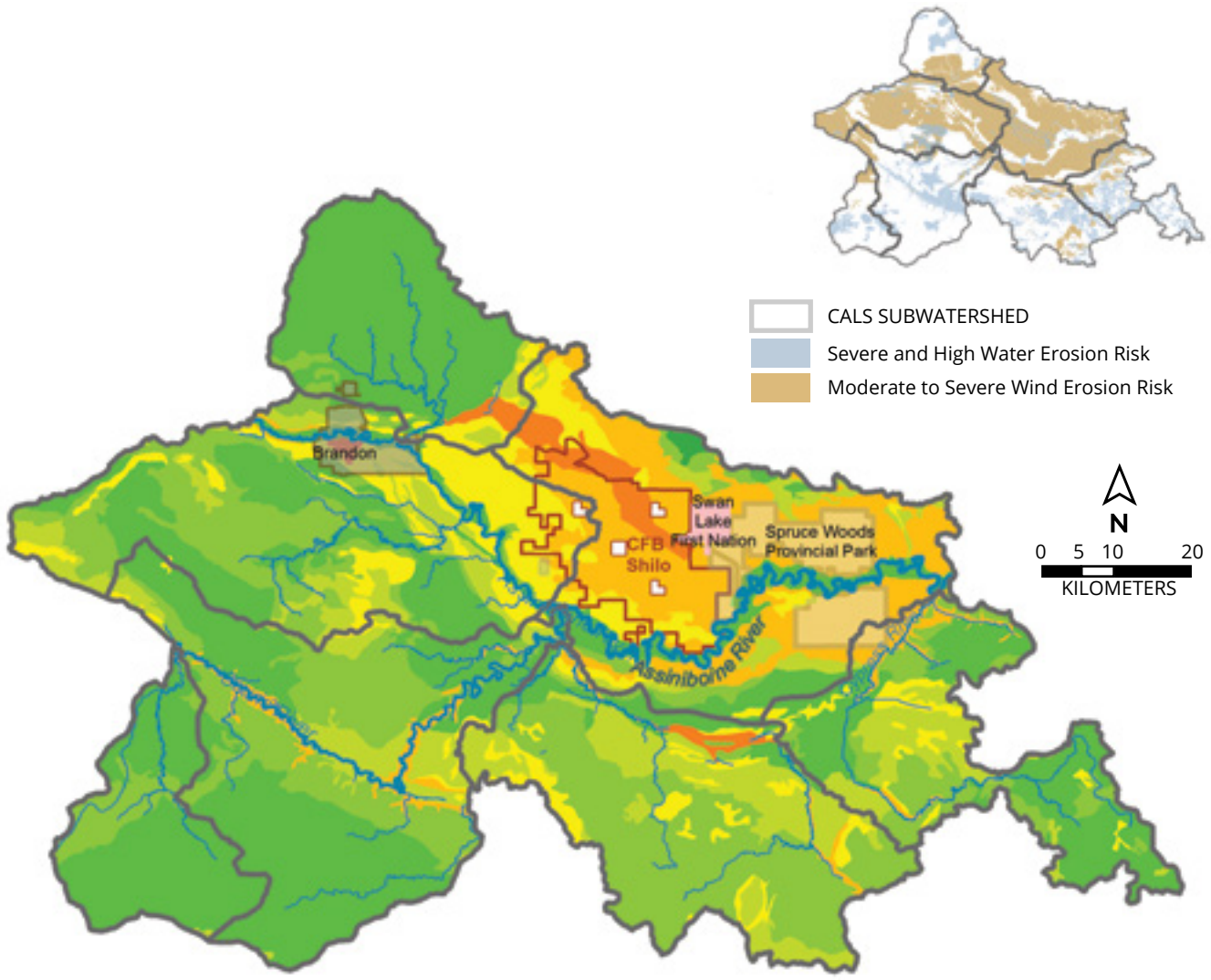


FIGURE 3: Agricultural Capability of the Central Assiniboine and Lower Souris River Watershed. Map provided by the Canada Land Inventory.

PEOPLE OF THE BASIN

Throughout the history of the Assiniboine River Basin, there has been a close connection between the river and the people that live along its banks. This relationship is especially important for First Nations. The Assiniboine River is the ancestral boundary between the Cree who hunted north of the river, and the Dakota/Assiniboine (Sioux Nation) who hunted south of the river in the prairie. As the bison heards receeded west and south, the Ojbiway people moved in from the Minnesota and Sioux St. Marie area. To this day, the Spruce Woods area holds significant cultural values to the Ojibway people. In 1881, the town site of Brandon was established in the Assiniboine River valley as a major divisional point for the Canadian Pacific Railway. Over the last 100 years a vibrant and diverse agricultural community has been sustained in the Central Assiniboine and Lower Souris River Watershed.

Land use can vary significantly across the watershed (Figure 4, Table 1). Annual cropping is common throughout the watershed, however is more prevalent in the western subwatersheds. Protected areas and areas that are owned by the Crown are more prevalent in the Epinette Creek subwatershed, and therefore have more natural cover including trees, wetlands, and grasslands.

At approximately 345 km^2, the Canadian Forces Base Shilo encompasses 5% of the Central Assiniboine and Lower Souris River Watershed and contributes considerably to the area's economy. Prior to 1855, the area that is now CFB Shilo was homesteaded, but reverted to the Crown in 1895. Military activity began in 1910 at the Range & Training Area (now called Camp Hughes) which was used for artillery practice and manoeuvre of small arms. The present Shilo base was established in 1933 and has been used year round since 1942. For over a century the training areas of CFB Shilo have been used for a variety of purposes including:

- Basic and common soldier training, anti-aircraft training, surface to surface missile training, artillery, search and rescue training, forward air controlling and observation, and much more.
- Training of mechanized troops of the Federal Republic of Germany, as well as other foreign countries such as France, Denmark, and the United States.
- Currently CFB Shilo is the home of 1Royal Canadian Horse Artillery (1RCHA), 2nd Battalion Princess Patricia Canadian Light Infantry (2PPCLI), and Land Force Western Area Training Centre detachment Shilo.

There is one large industry operating in the watershed. In the mid 1960s and early 1970s, a potato processing plant was developed just south of the town of Carberry. The plant is currently operated by McCains Food Canada, a division of McCains Foods Limited.

CHIEF YELLOWQUILL

"Chief Yellowquill was an environmentalist; he knew where all the plants and animals were that our people needed to survive. Chief Yellowquill established seven trade routes which extended west and south to what is now the United States. He would go on long trade missions some of which reached the Iowa Valley. The area is now mostly used for hunting and gathering of traditionally important plants.

Natural laws guide our practices and we all have a responsibility to look after everything. I am no more important than the plants and animals; we need them to survive. We hold this value even in today's environment." - David Scott, Swan Lake First Nation Treaty Research Specialist.

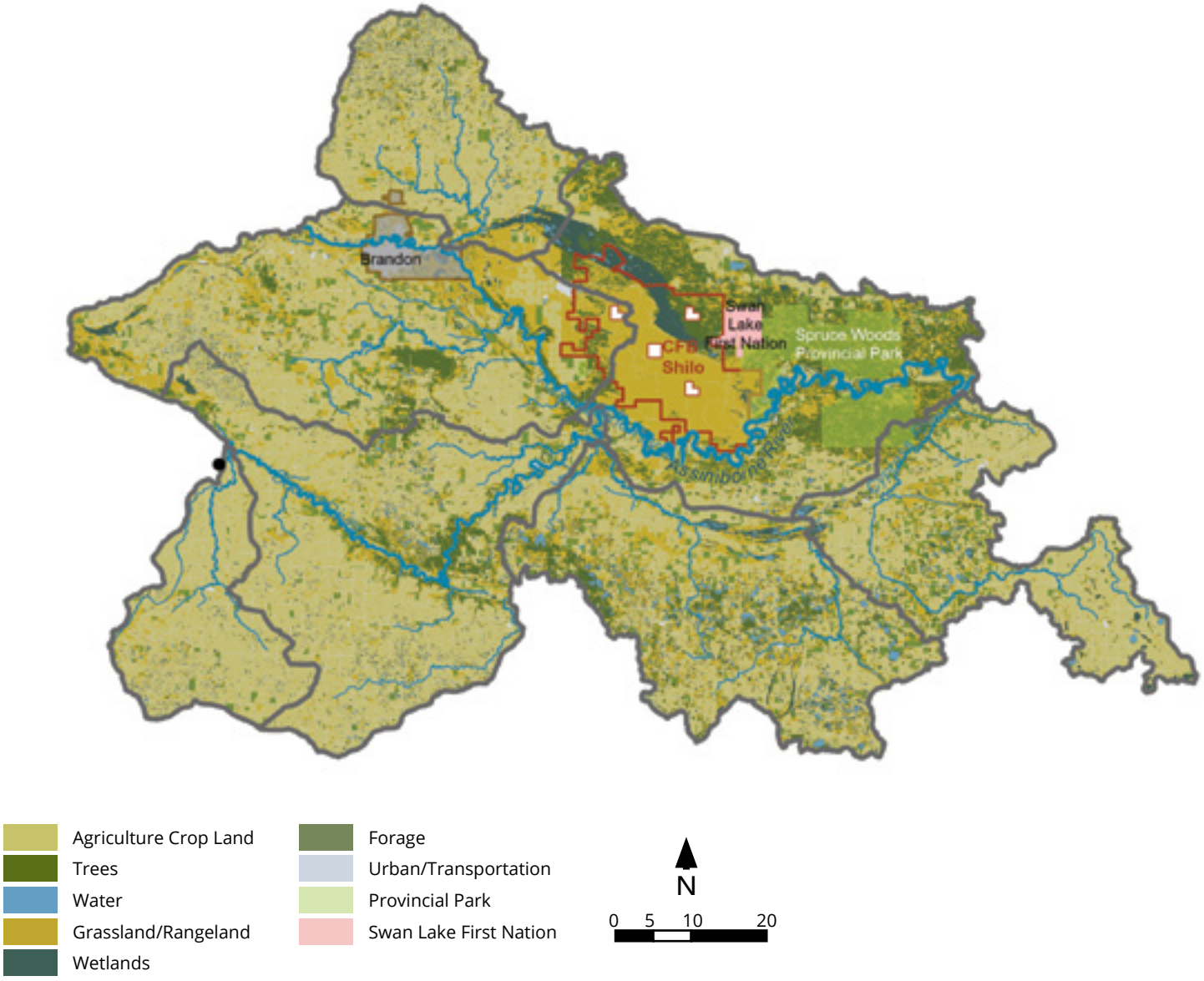


FIGURE 4: Land Cover in the Central Assiniboine and Lower Souris River Watershed (2006 LandSat Imagery).

TABLE 1: Per cent land cover within the subwatersheds of the Central Assiniboine and Lower Souris River Watershed.

	LOWER SOURIS	ELGIN	LITTLE SOURIS	WILLOW	EPINETTE	CYPRESS RIVER	OAK CREEK
Annual Cropland	67.5	80.7	46.9	68.7	13.9	59.8	45.5
Trees	7.5	0.1	8.7	3.2	36.5	8.3	8.3
Water	0.9	0.3	1.0	0.9	1.5	1.6	3.9
Grasslands	14.6	11.3	28.9	15.5	37.7	16.8	26.8
Wetlands	2.8	1.9	2.7	5.2	4.4	2.6	6.4
Forages	3.8	2.8	6.4	3.2	4.1	7.6	6.5
Urban	3.0	2.9	5.4	3.3	2.0	3.3	2.6

SURFACE WATER QUANTITY

The Assiniboine River is the main river in the Central Assiniboine and Lower Souris River Watershed. The river has a large drainage basin of 163,000 km^2 covering portions of southeast Saskatchewan, northwest North Dakota and Southwest Manitoba. The Assiniboine Basin is a relatively flat prairie that is extensively cultivated. Major tributaries of the Assiniboine River include the Qu'Appelle River and the Souris River (Table 2). It is important to note that the Central Assiniboine and Lower Souris River Watershed represents less than five per cent of the Assiniboine River Basin and is located in the lower reaches of the basin's drainage area.

MAJOR RIVERS

The main stem of the Assiniboine River spans over 120 kilometres across the Central Assiniboine and Lower Souris River Watershed. Annual flow for the Assiniboine River at Holland (station: 05MH005) is typical for prairie streams with large flow variability from year to year and the highest flow occurring in the spring from snow melt (Figure 5). The Central Assiniboine and Lower Souris River Watershed contributes an average of 12 cubic meters per second (cms) (425 cubic feet per second (cfs)) to the Assiniboine River, although the amount of flow can vary greatly from year to year. The Assiniboine Delta Aquifer (ADA) provides significant base flow to the Assiniboine River in the reach between Brandon and Holland; approximately 4 cms (140 cfs). Flows in the Assiniboine River gradually decline over summer until reaching a base flow just under 5.7 cms (200 cfs); most of which is contributed by the ADA.

The Souris River is another major river important to the Central Assiniboine and Lower Souris River Watershed. The Souris River drains an area of 61,000 km^2 spanning two Canadian provinces and two American states. Starting in southeast Saskatchewan, the headwaters of the Souris River flow in a south-easterly direction into and across North Dakota. From North Dakota, the river crosses the international border again, entering southwest Manitoba flowing northeast spilling into the Assiniboine River near Treesbank, Manitoba.

TABLE 2: Assiniboine River Flow Sources

SUB-BASIN	DRAINAGE AREA	% OF DRAINAGE AREA	% FLOW SOURCE		
			MEDIAN	DRY	DROUGHT
Qu'Appelle	58,900	36	15	10	5
Souris River	61,000	38	15	10	3
Upper Assiniboine (upstream of Shellmouth Dam)	19,000	12	23	24	27
Manitoba local tributaries - upstream Brandon	15,800	10	28	26	16
- downstream Brandon	7,900	4	9	14	24
Assiniboine Delta Aquifer	3,900	---	10	16	25

2011 FLOOD

The spring and summer of 2011 brought extensive and widespread flooding to southern Manitoba. Extensive flooding damage was sustained to municipal roads, culverts, highways, bridges, buildings, residences, and other infrastructure. Most agricultural producers in this watershed experienced delayed seeding, or no seeding at all. Hundreds of heavy equipment operators and thousands of volunteers were called to help raise dikes around the communities of Brandon, Souris, and Wawanesa, among many others. Thousands of people were evacuated from their residences in the flood zone. South-western Manitoba rivers crested more than once during the 2011 flood season due to heavy spring run-off and subsequent heavy spring rainfall events in Manitoba and eastern Saskatchewan. Despite the dire circumstances, governments and residents of the watershed worked together to ensure that no lives were lost, and property damage was kept to a minimum. In the direct aftermath of this unprecedented flooding, politicians, policy makers, and planners reaffirmed the importance of prudent land use planning, investment in flood proofing initiatives, careful water management, and thorough emergency preparation.

SUBWATERSHEDS

The Central Assiniboine and Lower Souris River Watershed is made up of a number of subwatersheds including the Lower Souris River, Elgin Creek, Little Souris River, Cypress Creek, Oak Creek, Epinette Creek, and Willow Creek (Figure 1). The runoff productivity of these subwatershed areas is fairly consistent across the watershed with the exception being the Epinette Creek subwatershed (Table 3). The Epinette Creek subwatershed overlays the Assiniboine Delta Aquifer and has sandier soils than the other areas of the watershed (mostly clay and loams). The sandy soils allow more water to infiltrate in the spring and summer, and the creek flows are higher due to discharge from the Assiniboine Delta Aquifer.

TABLE 3: Runoff Productivity of the subwatersheds in the Central Assiniboine and Lower Souris River Watershed.

SUBWATERSHED	DRAINAGE AREA KM² (SQ.MILE)	AVERAGE RUNOFF (ACRE-FEET PER SQUARE MILE)	
		March - May	June - October
Lower Souris River	1,899 (733)	45.7	3.5
Little Souris River	836 (323)	28.2	1.4
Oak Creek	1,147 (443)	30.9	5.0
Cypress River	813 (314)	45.7	3.5
Willow Creek	670	40.9	5.3
Epinette Creek	410 (158)	22.0	10.6
Elgin Creek	488 (188)	32.1	2.3
Central Assiniboine and Lower Souris River Watershed	7,400 (2,856)	40.8	31.8

The Central Assiniboine and Lower Souris River Watershed represents less than 5% of the Assiniboine River Basin and is located in the lower reaches of the Basin. Much of the water flowing through this watershed has been impacted by activities outside of the reach of this watershed.

Annual Flow for Assiniboine River near Holland

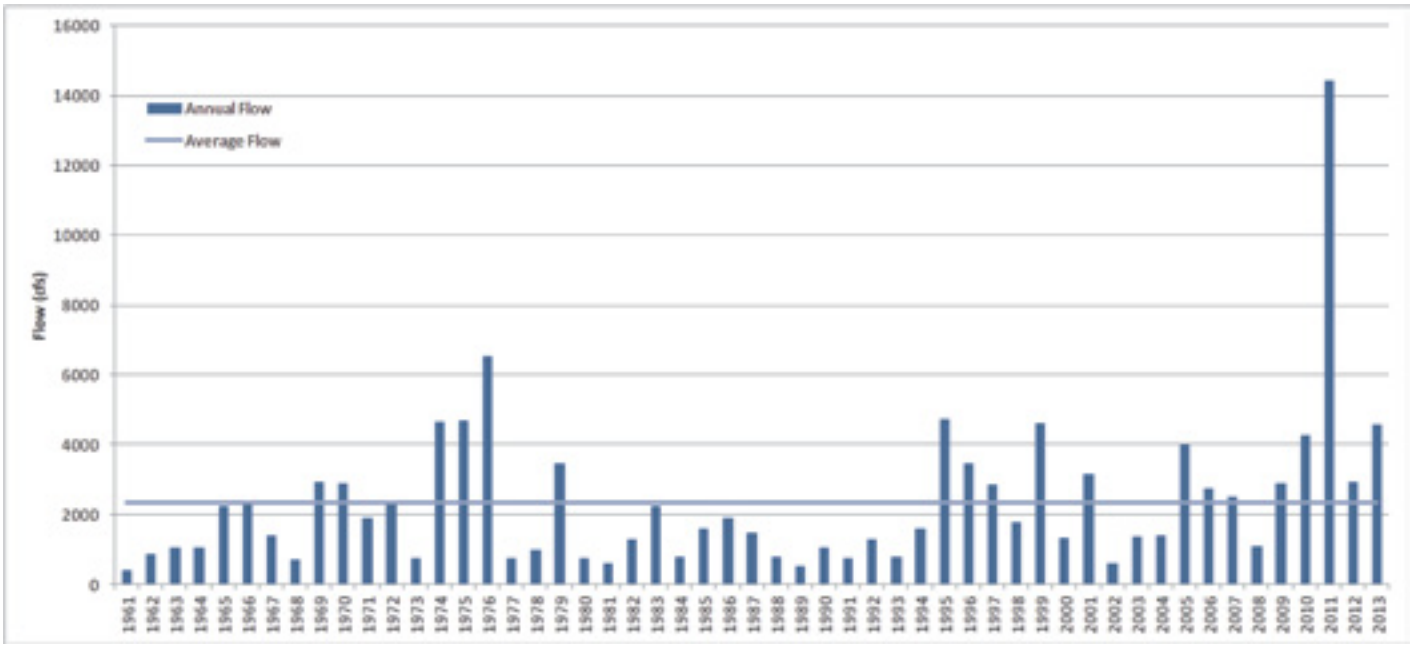


FIGURE 5: Average annual flows for the Assiniboine River near Holland (05MH005).

SURFACE WATER QUALITY

There are six long term water quality monitoring stations (1956-2013) within the Central Assiniboine and Lower Souris River Watershed. Three of these stations are located on the Assiniboine River, two on the Souris River, and one on the Cypress River. In general, the Water Quality Index (WQI) for the Assiniboine and Souris Rivers was within categories of 'Fair' and 'Good', with total phosphorous typically responsible for driving down the WQI.

Total phosphorous and nitrogen concentrations increased at most of the Assiniboine and Souris River sampling sites between 1970 and 2012. There was no significant difference between nutrient levels between sampling sites within the Central Assiniboine and Lower Souris River Watershed. Because of the size of the Assiniboine River and Souris River Basins upstream of these sampling sites, information from these stations better represents water quality conditions of upstream portions of the basins and may not accurately represent the water quality conditions in the Central Assiniboine and Lower Souris River Watershed.

Provincial data collected from 1970 to 2012 indicated on average, the Assiniboine River had lower total phosphorous concentrations than the Souris and Cypress Rivers. Furthermore from 1970 to 2012, total phosphorous and nitrogen concentrations have increased; likely caused by human activities on the landscape. Total phosphorous and nitrogen concentrations also show significant seasonal variation, with typically greater concentrations during the spring and early summer months than the rest of the year.

There are no water quality monitoring stations in the Epinette Creek, Elgin Creek, Little Souris River, and Willow subwatershed. Local observations of water quality indicate concerns of poor water quality in the waterways within the Elgin Creek, Little Souris River and the Willow Creek subwatershed. Most residents indicate the development of the upstream drainage network over the last 50 years as the major influence in the decline of water quality.

The Water Quality Index (WQI) is used for reporting technical information in a consistent, easy to understand manner. The index ranges from 0 to 100, and summarizes data into simple categories like excellent, good, fair, marginal and poor.

PUBLIC DRINKING WATER

There are 18 public water systems in the Central Assiniboine and Lower Souris River Watershed that provide drinking water to over 65,000 residents (Figure 6). Seventeen of these public water systems obtain water from groundwater sources. The City of Brandon obtains the majority of its drinking water from the Assiniboine River and supplements that supply with groundwater. Residents who are not connected to a public water system obtain their drinking water from private or semi-public sources (usually a groundwater supply). Drinking water assessments for each public water system are in respective subwatershed portions of this plan.

GROUNDWATER

Groundwater is a major source of water for private domestic use as well as for municipal, industrial, commercial and agricultural purposes within the Central Assiniboine and Lower Souris River Watershed. Groundwater discharge also provides base flow to rivers and streams, and contributes water to marshes and wetlands. The principal aquifers in this watershed are sand and gravel including:

- Assiniboine Delta Aquifer – located in the central/northeast part of the watershed
- Oak Lake Aquifer – a small portion of this aquifer is located in the western part of the watershed
- Buried sand and gravel aquifer located east of Souris
- Brandon Channel Aquifer Complex – located in the Brandon area
- Spiritwood Aquifer System – located in the southwestern portion of the watershed
- Spillway Aquifer – a small portion of this aquifer is located in the eastern part of the watershed
- Small or isolated lenses of sand and gravel occur throughout parts of the watershed, which form local aquifers.

There is also one shale bedrock aquifer in the watershed:

- The Odanah Shale Aquifer also forms a regionally important bedrock aquifer in the watershed.

Aside from the City of Brandon, groundwater is the primary water source for most residents in the watershed. The quality and quantity of available groundwater in this subwatershed is largely controlled by the supplying aquifer.

The yield of water derived from the Oak Lake, Assiniboine Delta and Souris area aquifers range from low to abundant, with generally good to excellent water quality. Little information is available on the yield and quality of groundwater from the Spiritwood Aquifer system. A recent study of this aquifer system suggests it may have the potential to be a locally significant groundwater supply. In the areas containing lenses of sand and gravel, well yields can range significantly, from low to abundant, and water quality can range from very poor to excellent. In the Odanah Shale Aquifer, water is generally abundant but the quality can be quite variable, ranging from poor to good with some areas containing slightly saline groundwater.

According to provincial groundwater specialists, bacteria and nitrate are the most common types of well water contamination found in private wells. The occurrence of bacteria and nitrate is more common in shallow wells located in unconfined aquifers or in aquifers located close to ground surface rather than in wells located in confined and/or deep aquifers.

ASSINIBOINE DELTA AQUIFER

The Assiniboine Delta Aquifer (ADA) is a mostly unconfined sand and gravel deposit that covers about 3,900 km^2 (1,500 mi^2) and is the main aquifer in the watershed. Two-thirds of the ADA is located within the Central Assiniboine and Lower Souris Watershed. The Epinette Creek subwatershed is totally encompassed by the ADA and represents about 10% of the entire aquifer. It is estimated that the ADA contains about 12 million acre-feet of water. Recharge of the aquifer is from local rainfall and snowmelt.

The Assiniboine Delta structure is the result of a very large glacial river depositing sediments into a large bay in Lake Agassiz. The aquifer body is comprised mostly of sand and gravel. The thickness of the ADA varies, from about five feet along the extremities of the aquifer to greater than 100 feet in the central parts where sand beds are generally thicker. The unsaturated zone of the ADA extends from zero feet at the Devil's Punchbowl in Spruce Woods Provincial Park and Douglas Marsh near the town of Douglas to a maximum of about 70 feet in the Glenboro area.

Local groundwater availability, allocation and usage vary throughout 13 sub-basins of the Assiniboine Delta Aquifer. Six of these sub-basins are primarily located in the Central Assiniboine and Lower Souris River Watershed (Figure 6); three of which are almost fully allocated (Table 2). However, a fully allocated sub-basin does not preclude domestic use.

The quality of groundwater derived from the Assiniboine Delta Aquifer is generally excellent to good. Concentrations of naturally occurring arsenic and barium have been found above the drinking water quality standard in some wells, with arsenic more common in deeper parts of the aquifer. Hardness, iron, and manganese are common aesthetic water quality problems.

In 2005, the Assiniboine Delta Aquifer Management Plan was completed outlining actions for monitoring water quality, addressing issues related to irrigation accountability and co-management, and promoting awareness and education. Community-based action teams have met annually since completion of the aquifer plan. McCains of Canada, a member of the ADA Advisory Board, pursued their own water management improvements to significantly reduce water usage and improve waste water treatment processes. The Canada-Manitoba Crop Diversification Centre at Carberry has also supported increased water use efficiency and beneficial management practices for nutrient management for potato production.

FIGURE 6: Public drinking water sources, major aquifers, and major sand and gravel aquifers within the Central Assiniboine and Lower Souris River Watershed.

WATER LICENSING AND ALLOCATION

Water licenses are provided under *The Water Rights Act* in Manitoba with the intention of protecting the interests of the licensees, domestic users, the general public and the environment. Provincial allocation limits are developed by Conservation and Water Stewardship to set allocation limits for major streams and aquifers. Common practice is to calculate and conservatively estimate annual recharge rates. This is the quantity of water that the aquifer can discharge each year and while maintaining the current water level regime. One half of this discharge is reserved to maintain surface environment as stream flows, lake and wetland water levels, water supply for vegetation that can access the water table, and for domestic use. The balance of the discharge is the allocation limit available for licensing.

TABLE 4: Available yield and allocation limit and status (acre-feet/year) of the sub-basins of the Assiniboine Delta Aquifer in the Central Assiniboine and Lower Souris River Watershed.

SUB-BASIN	AVAILABLE YIELD	ALLOCATION LIMIT	ANNUAL ALLOCATION	AVAILABLE ALLOCATION
Epinette Creek North	18,000	9,000	8,959	**41**
Epinette Creek South	335	168	232	**0**
Assiniboine East	15,900	7,950	245	**7,706**
Assiniboine South	17,754	8,877	5,136	**3,741**
Assiniboine West	8,256	4,128	4,153	**0**
Assiniboine Souris	2,886	1,433	530	**0**
Subtotal	**63,111**	**31,556**	**19,255**	**12,391**

Assiniboine River Monitoring Study

In 2002, consultants were hired to conduct an aquatic water resource inventory on behalf of the Mid-Assiniboine River Conservation District. Water chemistry data were collected from both the Little Souris River and the Willow Creek where each confluences with the Assiniboine River. Concentrations of nutrients were relatively high in the Little Souris River compared to other similar tributaries off of the Assiniboine River. Total phosphorous concentrations within the Little Souris River (0.331 mg/L) and the Willow Creek (0.348 mg/L) in July were higher than in three other Assiniboine River tributaries (Five-mile Creek – 0.088mg/L, Epinette Creek – 0.044mg/L, and the Cypress River 0.087mg/L) and the Assiniboine River (0.151 mg/L). Conditions were similar however, to conditions measured in the Willow Creek (0.348mg/L). The concentrations of chlorophyll A measured in July for the Little Souris River was an order of magnitude higher than in other tributary streams and considerably higher than that measured in the Assiniboine River at the same time, and was indicative of the occurrence of an algal bloom. Collectively, the data indicated that nutrient enrichment may be a significant stressor in the Little Souris River and the Willow Creek subwatersheds.

Waste Water Treatment Lagoons

Wastewater treatment is the process of removing contaminants from wastewater and sewage. In Manitoba, the Environmental Approvals Branch of Manitoba Conservation and Water Stewardship administers the portion of *The Environment Act* in relation to wastewater collection systems. In the watershed, there are 21 municipal wastewater treatment lagoons and one wastewater treatment plant. Historically, wastewater treatment lagoons and plants were required to meet guidelines for biological oxygen demand (BOD), total and fecal coliforms. More recently, wastewater treatment plants are also required to meet guidelines for nutrients including nitrogen and phosphorous. Although nutrient limits have recently been required for large municipal and industrial facilities, nutrient limits are not routinely specified for smaller systems. Typical secondary lagoons have effluent quality of about 5 mg/L for total phosphorus. Very few of these facilities have nutrient limits imposed in their licences.

Spruce Woods Provincial Park

Spruce Woods Provincial Park was established in 1964 in response to requests by local communities to create a provincial park to protect the Carberry Sand Hills. After several years of construction the park was officially opened in 1970. It was expanded in 1975 to include what is now known as the Spirit Sands to its current size of 269 square kilometres. Under the authority of *The Provincial Parks Act* (1993) Spruce Woods is classified as a Natural Park and, as such, is intended to both preserve areas of the Assiniboine Delta Natural Region and accommodate a diversity of recreational opportunities and resource uses.

Yellow Quill Prairie Preserve

The Nature Conservancy of Canada (NCC) established the Yellow Quill Prairie Preserve south of Brandon, Manitoba in 1998 to give the few remaining species at risk in this area a better chance for survival, and to maintain the last intact remnants of their natural habitats. This preserve straddles the Little Souris and Epinette Creek Subwatershed and is located 20 kilometres southeast of the city of Brandon and two kilometres north of the junction of the Souris and Assiniboine Rivers. It abuts the western boundary of the Canadian Forces Base Shilo training grounds. This area is currently managed with grazing to maintain grassland biodiversity.

ECOLOGICAL CHARACTERISTICS

The Central Assiniboine and Lower Souris River Watershed lies within the Prairie Ecozone, the Aspen Parkland Ecoregion and Southwest Manitoba Uplands Ecoregion. Aspen bluffs are usually associated with the wetter sites, oak and grasses are usually associated with drier sites. Some of the grassland species found in the watershed include Junegrass, Kentucky Bluegrass, junipers, and a variety of fescue and wheatgrasses. Undisturbed, numerous areas also support American elm, basswood, Manitoba maple, green ash, white birch, balsam poplar, and willow tree species. Common ground cover species include vetches, sarsaparilla, and wood strawberry. Willow is a common shrub in wetter areas and along small waterways, along with Manitoba maple, dogwood, and green ash. Wet sites and riparian areas in this watershed support slough grass, marsh reed grass, sedge, cattail, and willow.

Manitoba's mixed grass prairie ecosystem is composed of shorter species of grass which thrive in more arid conditions, and tall grass species which are more dominant to the east. These temperate grassland communities occur on well-drained, sandy or gravelly soils. The mixed-grass prairies support increasingly threatened species designated under Manitoba's *Endangered Species Act (ESA)* and the federal *Species at Risk Act (SARA)*. The mixed grass prairie is a meadowland rich in plant diversity which covers rich soils underlying the parklands, making it suitable for agricultural development. In Canada, more than 70% of mixed-grass prairie has been converted to annual or forage crop, or human infrastructure.

Spruce Woods Provincial Park lies in the Assiniboine Delta Natural Region. This ecoregion supports some of the last remaining intact habitats found in southwest Manitoba including mixed-grass prairie, river bottom forests, wetlands, and sand hill habitats. These lands have high ecological significance as they provide habitat for a high concentration of federally and provincially listed threatened and endangered species.

CONSERVATION AREAS

The Central Assiniboine and Lower Souris River Watershed contains a number of ecologically important sites, some of which are legally protected areas. Spruce Woods Provincial Park and the Spruce Woods Provincial Forest Reserve offer excellent mixed grass prairie habitat, and are home to endangered and threatened species including the northern prairie skink, hognose snake, and burrowing owl. The Brandon Hills Wildlife Management Area is a large hilly region situated upon a large glacial moraine. The well drained soils support a diverse range of prairie wildlife. The Souris River Bend Wildlife Management Area was originally established as a whitetail deer haven, but also serves to conserve valuable riparian habitat along the lower Souris River. The Alexander - Griswold Marsh and Douglas Marsh are two nationally renowned wetland complexes that serve as important staging and nesting habitat for migratory birds. Both marshes are designated as Important Bird Areas, and Douglas Marsh Protected Area is protected through provincial legislation.

INVASIVE SPECIES

Leafy spurge is a long-lived, hardy plant introduced to North America from Europe and Asia and is declared noxious weed in Manitoba. It will readily establish itself in a variety of environments, and is quick to take advantage of disturbed sites. Leafy spurge can be found in pastures, agricultural lands, roadsides, ditches, and riparian areas. In Manitoba, it does best in sandy soils of moderate moisture. Leafy spurge's aggressive growth habits and lack of natural predators allow it to easily displace native vegetation. The result is reduced habitat value from reductions in species diversity. As leafy spurge expands in pastures, normal herbage production is reduced. Cattle and horses will totally or partially avoid grazing in these infested sites, thus increasing the grazing pressure on surrounding vegetation.

In 2010, the Rural Development Institute of Brandon University conducted an impact assessment on leafy spurge in the area - *Economic Impact Assessment of Leafy Spurge in Southern Manitoba*. Of the 17 rural municipalities in the Central Assiniboine and Lower Souris River Watershed, six municipalities were considered as having a high level of spurge density (61-100%), three were considered moderate (31-60%), and 4 were considered to have low spurge density (11-30%).

AQUATIC ECOSYSTEMS

WETLANDS

Wetlands naturally function to collect and store rain or snowmelt from surround uplands. Wetlands also have many other beneficial functions including their ability to filter sediments and nutrients from the water, protect against flooding and drought, increase groundwater recharge potential, and improve biological diversity. The Oak Creek subwatershed is considered to be one of the most significant breeding areas for ducks and geese in the Central Assiniboine and Lower Souris River Watershed. Much of remaining wetlands within this subwatershed are privately owned. Marginal agricultural land capability and salinity in this subwatershed has likely limited agricultural land development within this area thus leaving it in a more natural state.

RIPARIAN AREAS

Riparian areas are the transitional areas between land and water and serve many important functions. These areas are densely vegetated and retain sediment, filter water, store flood water and energy, recharge groundwater, and increase biodiversity. Riparian areas along the Assiniboine River support slough grass, marsh reed grass, sedge, cattail, and willow (Smith et al. 1998, AAFC - PFRA 2004). Healthy riparian areas contribute to healthy aquatic ecosystems.

FISHERIES

The Assiniboine River is home to a wide array of aquatic species and ecosystems. Fish species found within the Assiniboine River include lake sturgeon, walleye, yellow perch, northern pike, mooneye, burbot, channel catfish, brown bullhead, rock bass, white sucker and common carp. The main stem of the Souris River contains a high diversity of fish species and is the most popular fishing spot for local fishermen. Tributaries of the Assiniboine River and the Souris River include white suckers, fathead minnows, darters, sticklebacks, shiners, yellow perch, walleye and northern pike. Those provide a large biomass of forage fish upon which the predacious fish within the Assiniboine River depend.

Fisheries habitat assessments were conducted in 2002 along the Willow Creek and the Little Souris River to investigate the quality of fish habitat, water quality, channel morphology, bank vegetation, and fish migration barriers. These studies examined 129 km and 182 km of the Willow Creek and the Little Souris River respectively. Over half of the examined stretches of Willow Creek were considered moderately impacted. Thirty per cent was considered highly impacted, and 5% was considered severely impacted. For the Little Souris River, 34% was considered moderately impacted, over 50% was highly impacted, and 6% was considered to be severely impacted. The studies noted that degraded riparian zones, sedimentation, erosion, barriers to fish passage, and unmanaged livestock access were the main factors impairing habitat quality.

FISHERIES MANAGEMENT OBJECTIVES

Under the amended Federal Fisheries Act (2012) fisheries management objectives (FMOs) are the stated socio-economic, biological, and ecological goals for a fishery that are typically established by provincial or territorial fishery managers. Where they exist, these objectives guide regulators on decisions related to fisheries protection provisions. Proponents should consider and use any guidelines set out in fisheries management objectives for required avoidance, mitigation and offsetting measures. The federal goverment ins obliged under the 2012 Act to consider these FMOs when licensing changes to the environment that may affect fish stocks.

Manitoba has high level FMOs for the province. At the time of printing this report, the Souris River is the only system in the Central Assiniboine and Lower Souris Watershed where fisheries management objectives have been developed. The Souris River provides important socio-cultural, economic and ecological fisheries benefits to southwestern Manitoba and is the primary river ecosystem in the southwest portion of the province. Fisheries management objectives for the Souris River are listed within the Lower Souris River subwatershed portion of this plan.

LAKE STURGEON

Lake sturgeon are an evolutionary ancient fish historically found in North America's large lakes and rivers within the Hudson Bay, the Great Lakes, the Mississippi and the St. Lawrence drainage basins. Among freshwater fish, they have a unique life history which has made them culturally important to almost any First Nation located on lake sturgeon bearing waters. Their long life, large size, slow growth, and late onset of sexual maturity combined with an intermittent reproductive cycle make them vulnerable to many human influences including overharvesting, pollution, and loss of habitat. In most jurisdictions, commercial fisheries in the late 19th and early 20th centuries depleted lake sturgeon stocks to the point where many have not recovered.

The outlook for lake sturgeon has improved significantly since the first Manitoba lake sturgeon strategy was launched in 1992 and there continues to be progress towards achieving the goals identified in the Province's 1997, and 2012 strategies. Possibly one of the most successful management measures put in place was the closure of the Manitoba commercial lake sturgeon fishery in 1999. The closure demonstrated limiting mortality is the single most effective means of sustaining lake sturgeon stocks. There is evidence that most of the major rivers in Manitoba have lake sturgeon stocks that are no longer considered to be declining which may be related to the elimination of harvest by recreational and commercial fisheries province-wide.

WHAT WE VALUE IN OUR WATERSHED

Water

We value water for its ability to provide for human, wildlife and plant survival in the watershed. High quality water is essential for drinking and recreational purposes for humans, and is also an essential element of natural habitats for plants and animals. Flows in rivers and streams need to be properly managed for the benefit of all life in the watershed.

Natural Environment

Indicators for the natural environment of our watershed need to include water quality and quantity and also the health of the wildlife population. The preservation of healthy natural habitats is critical.

Economy

The coexistence of the natural environment complemented by a strong urban and rural economy needs to be recognized and enhanced without significant impact by either upon the other.

WHAT WE ARE CONCERNED ABOUT IN OUR WATERSHED

EXCESSIVE AND UNLICENSED DRAINAGE

While a system of licensing drainage works is in place, public perception is it is not a practical instrument. An alternate system should be developed to include incentives for those who comply with land drainage policies and penalties for those who do not comply. One land owner should not have an economic advantage over another land owner by simply sending their land drainage issue further downstream.

"Many of the top watershed issues and threats identified in the (consultation process) are profoundly impacted by the loss or degradation of wetlands"
– Ducks Unlimited Canada

EROSION

While erosion has not shown to be a widespread issue in the watershed (see figure 3, pg. 9), localized soil erosion issues do exist and efforts are needed to address them. Erosion of river and stream banks needs to be evaluated to determine where and when erosion prevention measures are needed.

CLEARING OF NATURAL COVER AND SHELTERBELTS

As farming practices have changed over the years (larger equipment, volatile crop prices, larger farm operations, and climatic changes) the watershed has also changed. Clearing of natural cover and shelterbelts have caused overland water flows to change. Plant and wildlife have been impacted to the detriment of the natural environments. Management practices/policies and incentives need to be developed to provide greater balance.

LARGE SCALE IRRIGATION

Balancing irrigation farming with the ability of aquifers and rivers to sustainably supply water for a driver of the rural economy (ability to grow a variety of crops) needs to be further explored. Licensing of aquifer users needs to be more than a permit. It needs an education component to connect farming with sustainable water use practices with higher fees to reflect the value of the resource.

WELL WATER CONTAMINATION

Abandoned wells can act as a pathway for surface contaminants to enter an aquifer if they are not properly sealed. To reduce the risk of groundwater contamination, an inventory of abandoned wells needs to be developed and a process established to properly seal these wells.

RIVERBANK EROSION AND DESTRUCTION

There will always be loss of riverbank due to the natural processes of spring floods, and ice thaws, summer drought, and sudden surging of river channels due to wet climates. Riverbank stabilization is needed both for urban centres and rural areas for economic development reasons as well as improving surface water quality. Methods of stabilization need to be tested and acceptable best practices established for future river bank stabilization.

RECOMMENDATIONS & ACTIONS

THE ASSINIBOINE RIVER MAIN STEM

- The main stem of the Assiniboine River is 120 km in the Central Assiniboine and Lower Souris River Watershed.
- The watershed contributes an average of 12 cms (425 cfs) to the Assiniboine River.
- The Assiniboine Delta Aquifer provides significant base flow to the river between Brandon and Holland.
- It is estimated that the ADA provides approximately 4 cms (140 cfs) to the River.
- Fertile soils characteristic of flood plains (Class 2) are found alongside the river.
- The combination of sandy soil types and availability of water make this area suitable for irrigation.
- There are many areas susceptible to water erosion along the larger meanders of the river.
- Spruce Woods Provincial Park and Provincial Forest Reserve offer excellent mixed grass prairie habitat, and are home to endangered and threatened species including the northern prairie skink, hognose snake, and burrowing owl.
- The Assiniboine River is a major tributary of the Lake Winnipeg Basin, and as such has been listed as a vulnerable water body under the Nutrient Management Regulations under *The Water Protection Act*.
- There are two public water systems in this subwatershed: the Spruce Woods Provincial Park Campground for seasonal use (groundwater), and The City of Brandon (draws surface water from the Assiniboine River and supplements with groundwater).
- Lake sturgeon were known to occur throughout the Assiniboine River but were extirpated by historical fishing and barriers to fish movement. Since 1996, a total of 16,683 lake sturgeon have been stocked near the City of Brandon. Reports from anglers throughout the Assiniboine River Basin provide evidence that stocking can be effective for re-introducing lake sturgeon populations in areas where they have been extirpated.

Historically, the stretch of the Assiniboine River within the City of Brandon and adjoining parts of the RM of Cornwallis was one of the most significantly flood-prone areas in Manitoba. Prior to construction of the Shellmouth Dam located near Russell, Manitoba, the Assiniboine River Valley in Brandon had suffered severe flooding in 1922, 1923, 1927 and 1955. In the 1960s, two major structures were constructed to regulate flows within this area, the Shellmouth Dam (1969) and to a lesser extent the Rivers Dam (1960). Operation of Shellmouth Reservoir began in 1972, and since that time, two severe floods have occurred. In 1976, dikes were constructed around flat areas near the Assiniboine River in the City of Brandon. In 2011, the flooding was extensive throughout the Assiniboine River Basin. Earthen dikes were enhanced in the City of Brandon to 2011 flood of record levels plus two feet freeboard.

Disinfection by-products and drinking water

As part of the drinking water treatment process, chlorine is added as a disinfectant to protect drinking water from disease. As a result of an interaction between the disinfectant and the source water, disinfection by-products can occur – some of which may have negative affects with prolonged consumption. In 2009 and 2010 approximately 70 % of all surface water sourced public water systems in Manitoba (124 of 176 surface water systems) exceeded the tri-halomethane (THM) guidelines on at least one occasion. The City of Brandon was one of the public water systems where disinfection by-products in treated drinking water exceeded provincial guidelines. Primary water quality precursors to the formation of these disinfection by-products are elevated concentrations of total organic carbon (TOC) as well as total inorganic carbon (TIC).

There are several ways to reduce the THMs in the drinking water including:

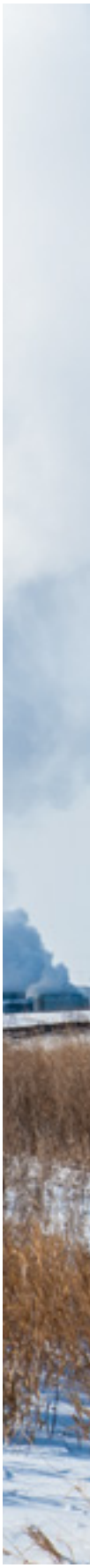
- Change source to groundwater
- Blend surface water with ground water
- Optimize treatment to remove particulate mater
- Add powder activated carbon or a granulated active carbon filter to remove dissolved organic compounds
- Install a specialized media such as MIEX to remove dissolved organic compounds
- Change the treatment process, or add to the treatment process membrane technology that can remove dissolved organic compounds
- Incorporate an alternative disinfectant such as ozone or UV light to reduce the amount of chlorine added
- Change the secondary disinfectant to monochloramine instead of free chlorine to reduce the formation of THMs

It should be noted that any method used to control THM levels must not diminish the effectiveness of the disinfection process. The City of Brandon is currently exploring a number of these options.

Wastewater Treatment in Brandon

Treatment of domestic wastewater from the City of Brandon commenced in 1963 with construction of a new wastewater interceptor sewer, a main pumping station and 5 facultative treatment lagoon cells. In 1971, an aeration treatment plant was installed up stream of the lagoons with further treatment plant enhancements completed in 1994. With the addition of a major industry into the City in the late 1990's a new industrial wastewater treatment plant was constructed to handle the industrial wastewater. In 2003 it was recognized that new effluent discharge requirements were on the horizon thus resulting in a collaborative effort of the City of Brandon and two of its major industries toward the development of a single wastewater treatment facility which would meet the new effluent discharge requirements.

In October 2013 the new water reclamation facility using membrane technology was commissioned. The new facility puts Brandon at the forefront of wastewater treatment with the effluent discharged meeting all federal and provincial requirements. The effluent being discharged is being considered for future industrial and potential domestic usage.



GOAL

Reduce the impacts of flooding and erosion along the main stem of the Assiniboine River by controlling the upstream flows and local land use.

MEASURES OF SUCCESS

- Surface water management decisions will be made on a basin wide basis with consideration of downstream impacts.
- Peak flows will be reduced through upstream natural cover restoration.
- Infrastructure will meet historic flow characteristics of the Assiniboine River Basin.
- Water storage capacity upstream of the City of Brandon will be increased.
- 25% of natural cover on private lands along the main stem of the Assiniboine River will be protected through land protection agreements.

SURFACE WATER MANAGEMENT

ISSUES

- The combination of wetland loss and expanded agricultural drainage development in the Assiniboine River Basin contribute to spring and summer flood events that damage infrastructure, cause significant erosion, and frustrate landowners along the Assiniboine River.
- Participants in public consultations noted development encroaching the Assiniboine River flood plain has increased the frequency and extent of flooding in recent years.
- There are four wastewater treatment facilities along the Assiniboine River within the watershed.
- Continual removal of natural vegetation, grading land surfaces, and increased drainage has caused an increase in runoff volumes and shortened runoff time into streams from rainfall and snowmelt.
- Many of the impacts and issues in the watershed are a result of activities occurring in the upstream portion of the Assiniboine River Basin.

SOLUTIONS

- Develop and maintain flood mitigation measures and protect natural water retention areas to help reduce the impact of flood events and decrease erosion.
- Increase the adoption of land use practices that are better suited to the environment and the hydrological regime.
- Improve communication and cooperation between the local conservation districts, municipalities, and provincial government to better coordinate surface water management activities.
- Residents and landowners in the Assiniboine River floodplain need to understand the limitation to development in a floodplain and ensure that all development and land use practices are appropriate and able to withstand periodic flooding.

HOW WE PLAN TO REACH OUR GOAL

When planning for surface water management it is important to consider the entire watershed. In this chapter the main stem of the Assiniboine River is the area where the Project Management Team (PMT) would like to see improvements. Concerns associated with flooding and flow velocities are a result of upstream surface water management. Land management practices upstream of the Central Assiniboine and Lower Souris River Watershed affect surface water within the watershed. Similarly, land management practices within the watershed affect surface water in watersheds downstream. Therefore the PMT has made the following recommendations to improve surface water management in the Assiniboine Basin as well as along the main stem of the Assiniboine River.

RECOMMENDATIONS	ORGANIZATION
Use commonalities between infrastructure, basin, and watershed plans as a basis for continuing cross boundary communications and developing relationships with watershed managers across the Assiniboine River Basin.	*MIT, MCWS – Water Science and Management*, Water Control Works and Drainage Licensing, Municipalities, Planning Districts
Review the effectiveness and maintenance responsibility of upstream water retention structures on the Souris River.	*AAFC, MIT*, MCWS – Water Science and Management
Maintain existing drainage infrastructure to current standard in the Assiniboine River Basin.	*Municipalities*
Reconstruct if necessary without increasing peak water flows. Develop upstream managed reservoirs along the Assiniboine, Souris, and Qu'Appelle Rivers to slow runoff and reduce peak flows in the lower Assiniboine River Basin.	*Province of Manitoba, Province of Saskatchewan*, AAFC
Create a designated flood zone along the main stem of the Assiniboine River in Manitoba.	*MIT*, MCWS – Water Science and Management
Secure flooded and eroded areas along the Assiniboine River through conservation agreements or land purchases.	*Conservation Districts, Conservation Agencies*, Municipalities
Promote agricultural beneficial management practices that encourage riparian and natural cover restoration and conservation through incentives, education, and technical assistance.	*Conservation Districts*, *MAFRD*, Conservation Agencies
Provide education and incentives to agricultural producers on beneficial management practices for water erosion control and stream bank stabilization.	*Conservation Districts, MAFRD*

* lead organizations have been italized.

** Conservation Agencies are any non governmental agency with a mandate to conserve, restore or enhance natural areas

- A list of acronyms used can be found on page 135.

GOAL

Conserve and restore the quality and integrity of natural areas.

MEASURES OF SUCCESS

- Degraded riparian habitat along the Assiniboine River will be restored. The Assiniboine Hills Conservation District will undertake a riparian habitat assessment in 2014-15. By 2020, all high priority projects will be completed.
- Development will be limited along the Assiniboine River. 25% of natural cover on private lands along the main stem of the Assiniboine River will be protected through land protection agreements.

CONSERVATION OF NATURAL AREAS

ISSUES

- Treed riparian areas have been converted to annual cropland, rangelands, and urban centres which has caused changes to overland flow and has impacted local wildlife.
- Increased development has resulted in an associated increase in flood damages and riverbank erosion problems.
- The Water Quality Index (WQI) for the Assiniboine River fell within "Fair" to "Good" categories. Total phosphorous is typically responsible for driving down the WQI.
- The area surrounding the Assiniboine River is primarily agricultural production, which, if not managed appropriately, can be a source of nutrient and bacteria loading.
- The Assiniboine River is a major tributary of the Lake Winnipeg Basin, and as such has been listed as a vulnerable water body under the *Nutrient Management Regulations* under *The Water Protection Act*.
- Barriers to fish movement prevent the migration of native fish species which can have severe impacts on populations. Along the Assiniboine River, there are three major water control structures only one of which falls within the boundaries of the Central Assiniboine and Lower Souris River Watershed – the Brandon 3rd Street Dam – however all three structures impact fish movement within the watershed. In 2012, this Dam was replaced with a rock ramp to allow for fish passage in average to high flow years.

SOLUTIONS

- Implement strategies to reduce nutrient loading and increase protection of natural habitat in the Assiniboine River Basin.

Nutrient enrichment is one of the most important water quality issues in Manitoba. Excessive levels of phosphorus and nitrogen fuel the growth production of algae and aquatic plants. Extensive algal blooms can cause changes to aquatic life habitat and reduce essential levels of oxygen. In addition, some forms of blue-green algae can produce highly potent toxins.

In the spring of 2008, the Brandon 3rd Street Dam failed. In 2012, the City of Brandon received authorization to replace the failed dam with a sloping rock weir, ramp and fishway with a center channel boulder garden. Due to extremely high water flows, the 3rd Street Weir and Fishway has not been evaluated for efficacy. Although it has not been evaluated formally, its role as a barrier to fish movement is still possible in low flow years, but the site is more passable than it was.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Promote agricultural beneficial management practices that limit livestock access to waterways through, incentives, education, and technical assistance.	*Conservation Districts, Conservation Agencies, MAFRD*
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and/or financial incentives.	*Conservation District, Rural Municipalities, Conservation Agencies*
Work to conserve mixed grass prairie habitat through legal provincial designations, conservation agreements, payments or other land conservation programs.	*Conservation District, Rural Municipalities, Conservation Agencies, MCWS - Protected Areas Initiative*
Support government efforts to protect ecologically important habitats on Crown lands surrounding Spruce Woods Provincial Park and Provincial Forest.	Conservation District, Municipalities
Explore options to minimize nutrient discharge for new wastewater treatment facilities. Ensure new or renewed wastewater treatment facilities licenses require a reduction of nutrient discharge rates lower than current standards.	*MCWS – Environmental Compliance and Enforcement*
Consider a periodic inspection program for private residential wastewater systems to ensure water quality is protected.	*MCWS – Environmental Compliance and Enforcement*
Evaluate options to reduce nutrient discharge from municipal wastewater treatment systems. Consider options such as effluent irrigation, trickle discharge, constructed wetland treatment, or chemical treatment to reduce nutrient load to the Assiniboine River	Conservation Districts, *Rural Municipalities, MCWS – Environmental Compliance and Enforcement,* University of Brandon, ACC
Provide education and incentives to upgrade existing private septic systems.	*Conservation District*
Provide education on methods to reduce water pollution from urban water run-off including phosphorus based fertilizers on lawns and gardens.	*Conservation District*, MCWS - Water Science and Management, *City of Brandon – Environment Committee*
Conduct a fisheries and riparian area survey along the Assiniboine River and its tributaries to determine sites of barriers to fish movement. Work toward implementing 50% of priority projects identified in the survey.	*Assiniboine Hills Conservation District*, MCWS – Fisheries, City of Brandon – Environment Committee
Develop Fisheries Management Objectives for the Assiniboine River and its tributaries within the watershed.	*MCWS - Fisheries*

* lead organizations have been italized.

GOAL

Maintain source water quality and quantity throughout the main stem of the Assiniboine River

MEASURES OF SUCCESS

- The percentage of private wells exceeding the drinking water guidelines for bacterial contamination will be reduced.
- Recommendations for public water system source protection will be completed by 2016.
- The conservation districts will seal all abandoned wells brought forward over the next 10 years.

SOURCE WATER PROTECTION

ISSUES

- The City of Brandon's water treatment facility sources water from the Assiniboine River and provides potable water to over 60,000 residents. Continual removal of natural vegetation, grading land surfaces, and increased drainage in the Assiniboine River Basin has contributed toward a decrease in raw water quality of the Assiniboine River over the last 20 years. As a result, greater levels of treatment are needed for the City of Brandon.
- Key raw water variables include total suspended and dissolved solids, and total organic and inorganic carbon; all of which are directly or indirectly related to sediment loading in the Assiniboine River. When combined with chlorine in the drinking water process, these variables can cause the formation of disinfection by-products such as TriHaloMethanes.
- Approximately 57% of the Assiniboine drainage basin is located upstream of the City of Brandon's intake.
- Groundwater is the source of drinking water for most towns and private residences. Wells that are not properly located, constructed or maintained can lead to potential well water contamination problems especially within in flood prone areas.

SOLUTIONS

- Clean, potable drinking water is critical for human life. Protecting water at its source, or before it arrives at treatment facilities, is a preventative approach to water management. Source water protection also provides benefits to aquatic ecosystems, supports recreational and wildlife values, and ensures sustainability for future generations.

There are three steps to protecting well water:

- Protect the well water at the ground surface by avoiding, eliminating, or reducing contaminants;
- Inspect the well regularly and keep it in good running order; and
- Test the well water regularly and respond to contamination problems.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Ensure that nutrient discharge reduction measures are required when new wastewater treatment facilities are licensed, or when existing waste water treatment facilities are renewed.	*MCWS – Environmental Services Compliance and Enforcement*
Identify and stabilize locations of significant bank erosion upstream of the City of Brandon water intake.	*Conservation Districts,* City of Brandon
Evaluate options for to reduce nutrient discharge from municipal wastewater treatment systems. Consider options such as effluent irrigation, trickle discharge, constructed wetland treatment, or chemical treatment to reduce nutrient load to the Assiniboine River.	Conservation Districts, Municipalities, MCWS – *Environmental Compliance and Enforcement, University of Brandon,* Assiniboine Community College
Conduct a riparian health assessment to identify degraded habitat upstream of the City of Brandon source water intake site. Complete riparian habitat improvements projects identified as high priority from the assessment.	*Conservation Districts*, City of Brandon
Provide education on proper well head management.	*Conservation Districts*
Locate groundwater wells at a safe distance from potential sources of contamination and in an area away from surface water runoff.	*Landowners, certified well drillers*
Protect wells within any designated flood area from flood waters. Ensure flood water do not enter the well directly.	Conservation Districts, *Landowners*, certified well drillers
Ensure abandoned wells are properly sealed to provincial requirements.	*Conservation Districts*, MCWS – Groundwater Management Section

* lead organizations have been italized.

RECOMMENDATIONS FOR PUBLIC WATER SYSTEMS

In Manitoba, the Office of Drinking Water defines a public water system (PWS) as a potable supply of drinking water with 15 or more connections. The Assiniboine River main stem buffer contains two public drinking water systems including the City of Brandon, and Spruce Woods Provincial Park Campground.

RECOMMENDATIONS	ORGANIZATION
The **City of Brandon** public water systems supplies 60,000 residents of Brandon with treated water drawn from the Assiniboine River on the west side of the city and supplemented with a groundwater source on the northwest corner of the city. The water treatment process combines a conventional treatment regime with a multi-barrier treatment process.	
Promote agricultural beneficial management practices that encourage limiting livestock access to waterways through, incentives, education, and technical assistance.	*Conservation Districts, MAFRD*
Ensure that nutrient discharge reductions measures are required when new or renewing wastewater treatment facilities are licensed or relicensed.	*MCWS – Environmental Compliance and Enforcement*
Identify and stabilize locations of significant bank erosion upstream of the City of Brandon water intake.	*MIT, Municipalities, Conservation Districts*
Enhance inspection programs of wastewater systems on residential properties to ensure water quality is being protected.	*MCWS – Environmental Compliance and Enforcement*
Provide education and incentives to upgrade existing private septic systems.	*Conservation Districts*, MCWS - Environmental Compliance and Enforcement
Develop managed reservoirs along the Assiniboine River Basin, to slow runoff and reduce peak flows in the Assiniboine River.	*Province of Manitoba, Province of Saskatchewan*
Promote agricultural beneficial management practices that encourage natural cover restoration/conservation, reduce water erosion control or slow the water flows along small tributaries through incentives, education, and technical assistance.	*Conservation Districts, MAFRD*
Seal abandoned wells within 1.5 km surrounding the City of Brandon groundwater wells.	*City of Brandon*, Conservation District
Ensure an emergency response plan is in place for The City of Brandon public water system.	*City of Brandon, MCWS – Office of Drinking Water*
Spruce Woods Provincial Park has four wells to provide water to the seasonal campgrounds. Two wells supply water to Bays 1-7, while the other two supply Bays 8-11. The southwest well head only extends out of the ground 12 inches. Spruce Woods Provincial Park is looking into developing a new waste water lagoon within the source water protection area. The wells and the treatment facility are managed by the Spruce Woods Provincial Park staff.	
Ensure new lagoon development does not impact local groundwater quality.	*MCWS – Parks*, MCWS – Water Science and Management, MCWS - Environmental Compliance and Enforcement
Ensure there is an earthen mound around the well head.	*MCWS – Parks*, MCWS – Office of Drinking Water
Fence well heads and install collision barriers.	*MCWS – Parks*, MCWS – Office of Drinking Water
Ensure an emergency response plan is developed for the public water system.	*MCWS – Parks*, MCWS – Office of Drinking Water

LINKING TO DEVELOPMENT PLANNING

Proposed for adoption **in the development plan** for the Brandon & Area, Cypress, and South Central Planning Districts:

- Water Quality Management Zone: The first regulation under *The Water Protection Act* — the *Nutrient Management Regulation* defines five Water Quality Management Zones for Nutrients to protect water from excess nutrients that may arise from the over-application of fertilizer, manure, and municipal waste sludge on land beyond the amounts reasonably required for crops and other plants during the growing season. The Assiniboine River has been listed as one of these vulnerable water bodies in the *Nutrient Management Regulations*. Development plans should consider the regulations within the outlined Nutrient Buffer Zone as it applies to the Assiniboine River.

- The development of permanent structures upon lands immediately adjacent to the Assiniboine River should be confined to lands which are in excess of the corresponding 100 year flood level or the corresponding flood of record level. Lands subject to flooding, erosion or bank instability should be left in their natural state or only developed for low intensity uses such as open space recreation, grazing, cropping, forestry and wildlife habitat. Permanent structures which are proposed for construction upon flood prone lands must be constructed upon building sites raised with clean, impervious fill to an elevation above the 100 year flood elevation or the flood of record elevation, whichever is greater, plus two feet of free board.

- Intensive and high-pollution risk development activities, (land uses and structures that have a high risk of causing pollution and include, but are not limited to chemical/ fertilizer storage facilities, disposal fields, fuel tanks, waste disposal grounds, wastewater treatment facilities) should be restricted in public drinking water source zones. Where restriction is not possible, development may be considered in public drinking water source zones provided:

    - The proponent can prove by adequate engineering or hydro-geological investigation that the proposed activity will not cause pollution of the public drinking water supply,

    - Appropriate precautionary measures have been taken to sufficiently mitigate the risk of endangering the quality of the water supply for public drinking water supply purposes.

- Seal abandoned wells and repair or seal poorly constructed wells that are located within a source water protection zones for all public drinking water.

- To prevent significant surface water quality and drinking water quality deterioration, developments in or near surface waters and riparian areas will be restricted, or limited, if they:

    - lead to the contribution of nutrients, pathogenic organisms, deleterious chemicals or materials to these waters;
    - accelerate erosion and bank instability;
    - cause the removal of natural vegetative cover; and/or
    - may have an impact on in-stream flows needed to maintain healthy aquatic ecosystems.

THE LOWER SOURIS RIVER SUBWATERSHED

OVERVIEW

- The Lower Souris River subwatershed is a small part of a much bigger picture: the Souris River, which drains 61,000 km^2 of land and spans two Canadian provinces and one American State.

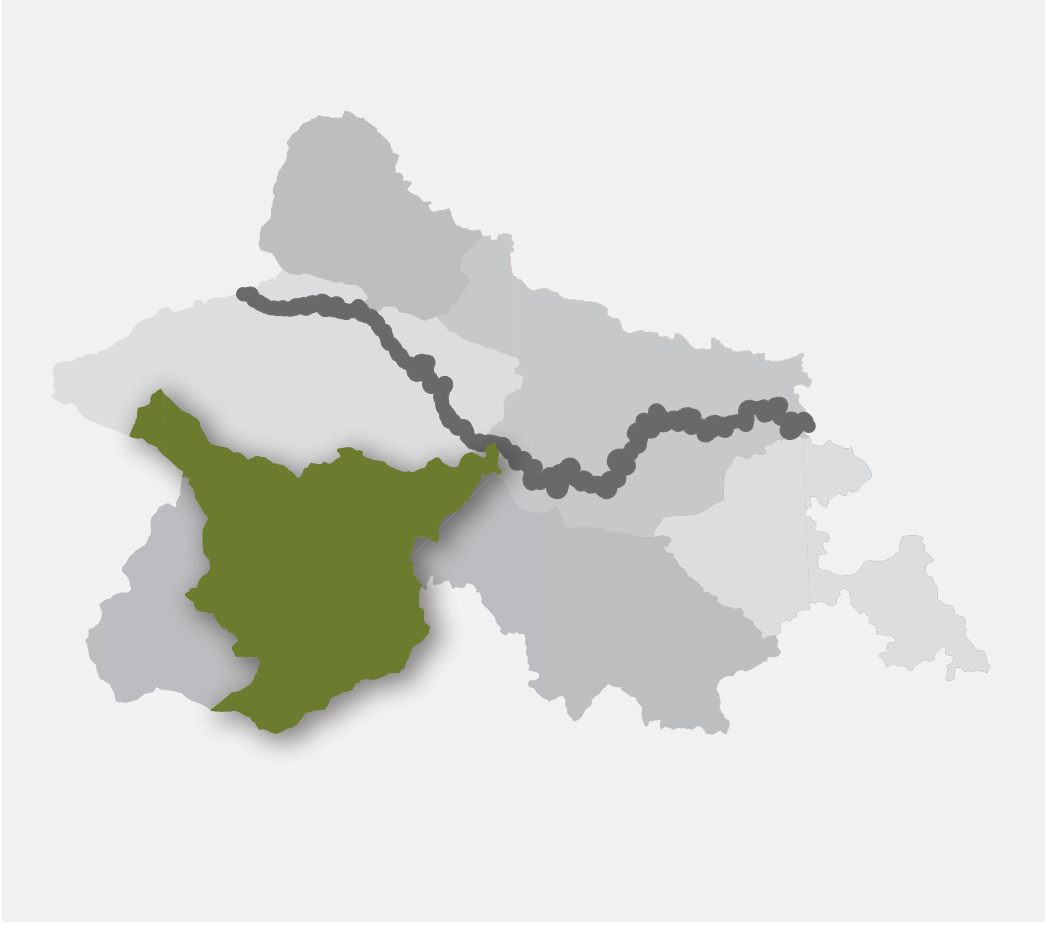
- The Lower Souris River subwatershed drains 1,900 km^2 (733 mi^2) of land into the Souris River and is the largest subwatershed in the Central Assiniboine and Lower Souris River Watershed.

- The Lower Souris River subwatershed is characterized by fertile soils. Most of the soils have an agricultural capability of Class 2 and 3; there are no Class 1 soils in this subwatershed. Class 4 to 6 soils are generally concentrated around the Souris River Valley.

- Agriculture is the main industry in the Lower Souris River subwatershed. In 2006, agricultural land uses like annual croplands, pasture and grasslands, and forage cover represented 86% of the land area within the subwatershed. Although pasture and forage lands are located throughout the area, they are more common along the Souris River.

- The Lower Souris River subwatershed was once dominated by the mixed grass prairie ecosystem. These temperate grassland communities occur on well-drained, sandy or gravelly soils. The mixed-grass prairie ecosystem supports increasingly threatened species designated under *Manitoba's Endangered Species Act* (ESA) and the federal *Species at Risk Act* (SARA), such as baird's sparrow, burrowing owl and small white lady slipper.

- The main stem of the Souris River supports many different fish species and is a popular fishing spot for local fishermen. Lake sturgeon, northern pike and walleye are among three species of interest in the Central Assiniboine and Lower Souris River Watershed. Manitoba has been the lead agency engaged in the re-introduction of Lake Sturgeon into the Assiniboine River since 1996. Manitoba sees the use of the lower reach of the Souris River as an important element in the re-introduction of the species.



- There are four groundwater sourced public water systems in the subwatershed that provide drinking water for over 2,000 residents.
- There are three wastewater treatment lagoons in the subwatershed.

- The Lower Souris River subwatershed has six main aquifers; the quality and quantity of which is largely dependent on the aquifer. These aquifers include:
  - Odanah Shale Aquifer (shale bedrock aquifer)
  - Oak Lake Aquifer (a small portion of this unconfined sand and gravel aquifer is in the northwest portion of the subwatershed)
  - Assiniboine Delta Aquifer (a small portion of this unconfined sand and gravel aquifer is in the northeast portion of the subwatershed)
  - Buried sand and gravel aquifer located east of Souris
  - Spiritwood Aquifer System (a small portion of this deep buried sand and gravel aquifer is in the southwest portion of the subwatershed)

GOAL

Reduce peak flows to reduce flooding and waterway erosion of tributaries of the Souris River.

MEASURES OF SUCCESS

- Surface water management decisions will be made on a watershed basis with consideration of downstream impacts.
- Peak flows will be maintained or reduced on smaller tributaries entering the Souris River.
- Municipal surface water management infrastructure will be maintained at the current capacity.
- Water storage capacity of smaller tributaries of the Souris River will be increased by 5,778 acre-feet.

SURFACE WATER MANAGEMENT

ISSUES

- Water related activities upstream in Saskatchewan, North Dakota, and Manitoba have potential to significantly affect flow regime in the Souris River.
- A number of structures have been built to help mitigate the annual and seasonal variation in water flows. Many of these are structures outside of the watershed and regulate flows into the Lower Souris River subwatershed; affecting drought and flood events and the hydrological regime.
- The combination of wetland loss and expanded agricultural drainage development in the subwatershed contribute to spring and summer flood events that damage infrastructure, cause significant erosion, and frustrate landowners in downstream tributaries of the Souris River. Public consultations noted increased frequency and extent of flooding in recent years.
- Many of the impacts and issues along the Souris River are a result of activities occurring in the upstream portion of the Souris River Basin.

SOLUTIONS

- Develop and maintain flood mitigation measures and protect natural water retention areas in the Lower Souris River subwatershed and upstream watersheds to help reduce the impact of flood events and decrease erosion.
- Increase the adoption of land use practices that are better suited to the environment and the hydrological regime.
- Improve communication and cooperation between the local conservation districts, municipalities, and provincial government to better coordinate surface water management activities in the Lower Souris River subwatershed and the Souris River Basin.

THE SOURIS RIVER DAM

The Souris River Dam is located just east of the Town of Souris on the main stem of the Souris River. The dam was built in 1952 by PFRA as a fixed crest structure including a 68 metre wide reservoir and a 55 metre spillway. The dam creates a 48 km long reservoir with 65,432 dam (53,046 acre-feet) of storage. Wawanesa Dam was also constructed by PFRA to provide a small reservoir for agricultural purposes on the eastern edge of the meander.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Maintain existing infrastructure	*Municipalities*
Complete a culvert size and location inventory, and create a drainage standard for the subwatershed with a goal to reduce flow velocities and enhance retention capabilities of the system by 10%.	*Municipalities, Assiniboine Hills Conservation District, Turtle Mountain Conservation District*
Review the effectiveness and maintenance responsibility of upstream regulation structures on the Souris River. Upgrade structures as required with considerations to fisheries management ojectives.	*Agriculture Canada, MIT*, MCWS – Water Science and Management, MCWS - Fisheries
Develop retention areas, dry dams, riffle structures or other beneficial management practices along small tributaries to slow runoff and reduce peak flows while not impeding fish passage.	*Assiniboine Hills Conservation District, Turtle Mountain Conservation District*, Conservation Agencies
Provide conservation easements and payments for water retention, wetland or natural cover restoration or conservation.	*Assiniboine Hills Conservation District, Turtle Mountain Conservation District, Conservation Agencies*
Promote agricultural beneficial management practices that encourage water retention, wetland and natural cover restoration and conservation through incentives, education, and technical assistance.	*Assiniboine Hills Conservation District, Turtle Mountain Conservation District, MAFRD*, Conservation Agencies
Establish best management practices for river bank stabilization along the Souris River.	*MIT*, MCWS – Water Science and Management, Fisheries
Prevent downstream flash floods caused by beaver dam washouts through promotion of beaver pond levellers.	*Assiniboine Hills Conservation District*

* lead organizations have been italized.

PEAK FLOW REDUCTIONS

Lowering the peak flow of water, spreading it over a larger period, and temporarily storing water until peak flows have passed, allows for needed drainage activities while reducing the costs associated with replacing valuable infrastructure or causing downstream flooding impacts. The amount of upstream storage needed to reduce peak flows by 10% has been calculated at one point within the Lower Souris River subwatershed (see table below). Stakeholders within the Lower Souris River subwatershed should work toward this goal to help mitigate the severity of flooding in a 1 in 10 year event. The amount of upstream water storage needed to reduce peak flow by 10% has been estimated at 5,778 ac. ft.

STATION NAME	DRAINAGE AREA	1:10 YEAR FLOW		10% REDUCTIONS OF PEAK DISCHARGE	ASSOCIATED STORAGE NEEDED
	(sq.km)	Annual Peak Discharge (cfs)	Hydrograph Volume (ac-ft)	(cfs)	(ac-ft)
Lower Souris River (05NG001)	1,410	2,658	48,965	266	5,778

Analysis results for Lower Souris River subwatershed hydrology upstream of index station 05NG001.

LEGEND	ISSUE	RECOMMENDATIONS
Black Creek	The majority of the Black Creek area has been cleared of natural cover and water retention capabilities causing downstream erosion and damage to infrastructure	• Landowners should be encouraged to re-vegetate riparian areas and the conservation districts should promote the use of bufferstrips along 1st and 2nd order streams. • Black Creek is a locally important fisheries area. Small dams, check dams, or other water retention structures should be designed with fish habitat in mind. • The Assiniboine Hills Conservation District should promote wetland conservation and restoration through incentives, education, and demonstration. • The Province of Manitoba should explore wetland consolidation versus drainage within this area through regulation or policy.
Flooding and Erosion	Water flows from spring melt and heavy rainstorms water flows cause significant in stream erosion.	• The Assiniboine Hills Conservation District should encourage the adoption of check dams and small dams to slow water flowing off 1st and 2nd order streams. • Promote wetland conservation and restoration through incentives, education, and demonstration.
Treesbank Bridge	During the 2011 flood the Treesbank Bridge washed out. The remaining materials are causing significant erosion due to backwashing effects.	• Province of Manitoba should rebuild the Treesbank Bridge over the Souris River. • Assiniboine Hills Conservation District should work with local landowner to prevent further erosion of lands adjacent to former bridge area.
Infrastructure Washouts	Heavy spring melt and summer rain fall events cause flooding and washout problems to downstream infrastructure	• Municipalities should look towards upgrading water retention capabilities of the drainage system including drop inlet structures, dry dams, and riffle structures to slow water moving through the system.

2011 FLOOD

During the spring and summer of 2011, extensive flooding occurred in southwest Manitoba. Damage was sustained to roads, bridges, culverts, highways, buildings, residences, and other critical infrastructure. Most agricultural producers in this watershed experienced delayed seeding or no seeding at all. Hundreds of heavy equipment operators and thousands of volunteers were called upon to raise dikes around the communities of Souris and Wawanesa. Thousands of people were evacuated from residences within the flood area. Southwestern Manitoba rivers crested more than once during the 2011 flood season due to a heavy spring runoff and a subsequent heavy spring rainfall in eastern Saskatchewan and western Manitoba. The Souris River peaked three times, April 23rd (1359.86 feet asl), June 15th (1361.13 feet asl), and July 5th (1364.68 feet asl), the highest in recorded history.

LINKING TO THE WATER CONTROL WORKS AND DRAINAGE LICENSING SYSTEM

The following are recommendations for conservation districts, municipalities, and other organizations to consider when reviewing or developing water control works and/or drainage projects within the watershed. Responsibility to administer *The Water Rights Act* is held by Manitoba Conservation and Water Stewardship.

- Any new land improvements that involve the alteration of a water body require approval from the Province and will be subject to periodic inspections for continued compliance.

- The project management team has set out targeted water storage goals for the subwatershed. Drainage activities that contribute to peak flows should pass through temporary water storage sites to mitigate additions to peak flows.

- Water Resource Officers, Conservation Districts and Municipalities should be reviewed on drain license applications. These organizations should consider the following when reviewing these applications:

    - **Do not recommend** approval for works such as:

        - Add water at times of peak flow.

        - Disturb natural streams. If natural streams are disturbed, mitigate impacts by completing a riparian improvement project within the subwatershed. Consider incorporating this consideration into The *Water Rights Act*.

    - **Recommend** approval for works that include:

        - General maintenance of existing drains and culverts.

        - Water retention, specifically during spring runoff periods.

GOAL

Conserve and restore the quality and integrity of natural areas.

MEASURES OF SUCCESS

- Existing natural areas will be retained including forests, riparian areas, wetlands, mixed-grass prairie and other sensitive ecosystems.
- Degraded riparian habitat along the Souris River will be restored. The Assiniboine Hills Conservation District will undertake a riparian habitat assessment in 2014-15. By 2020, all high priority projects will be completed.
- Remaining Crown lands will be retained. Crown lands with mixed-grass prairie habitat will be managed to conserve ecosystem diversity.

CONSERVATION OF NATURAL AREAS

ISSUES

- Clearing of natural cover and shelterbelts have caused overland water flow patterns to change, impacting plant and wildlife communities.
- Livestock with unlimited access to waterways have impacted riparian areas. Historically these waterways have been used to water livestock and to remove manure during the spring runoff. Overgrazing within these areas can lead to bacterial contamination of the surface water as well as increased erosion, sedimentation, and disturbances of the streambed.
- Provincial water quality data collected from 1970 to 2009 indicate that the total phosphorous and nitrogen concentrations have increased in the Souris River. Researchers suggest that this increase in nutrients is caused by human activities on the landscape - most impact is likely occurring outside of this subwatershed. Water quality results for the Souris River indicate no difference in nutrient levels between upstream and sites for nutrient levels in the Lower Souris River.

SOLUTIONS

- Residents and landowners in the Souris River floodplain need to understand the limitations to development and ensure that all development and land use practices are appropriate and able to withstand periodic flooding.

BARRIERS TO FISH PASSAGE

Native fish require unimpeded access along waterways in order to survive and reproduce. Barriers to fish movement prevent the migration of fish species which can have severe impacts on watershed populations. Along the Souris River, there are six water control structures two of which are within the Central Assiniboine and Lower Souris River Watershed at Souris and Wawanesa. The Wawanesa Dam was purposely constructed as a fish barrier to prevent Common Carp (an invasive species) from moving upstream. There are no carp upstream of the Wawanesa Dam. There has been some discussion regarding establishing a fishway at the Souris Dam, however nothing has been finalized to date.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Promote agricultural beneficial management practices that restrict limiting livestock access to waterways through, incentives, education, and technical assistance.	*Assiniboine Hill Conservation District, MAFRD, Conservation Agencies*
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and/or financial incentives.	*Assiniboine Hills Conservation District*, Rural Municipalities, *Conservation Agencies*
Work to conserve mixed-grass prairie habitat through legal provincial designations, conservation agreements, financial incentives or other land conservation programs.	Assiniboine Hills Conservation District, Rural Municipalities, *Conservation Agencies, MCWS-Protected Areas Initiative*
Complete a riparian health assessment along waterways within the subwatershed.	*Assiniboine Hills Conservation District*
Work to control invasive species (such as leafy spurge) on pastures.	*Weed Control District, MAFRD*, Municipalities, MCWS - Biodiversity Habitat & Endangered Species Branch
Conduct a fisheries and riparian area survey along the Souris River and its tributaries to determine sites of barriers to fish movement. Work toward implementing 50% of priority projects identified in the survey.	Assiniboine Hills Conservation District, *MCWS – Fisheries*, City of Brandon – Environment Committee
Develop Fisheries Management Objectives for the Souris River downstream of the Wawanesa Dam.	*MCWS - Fisheries*
Conduct an instream flow needs investigation on the Souris River.	*MCWS - Fisheries*

* lead organizations have been italized.

LINKING TO FISHERIES MANAGEMENT OBJECTIVES IN THE LOWER SOURIS RIVER SUBWATERSHED

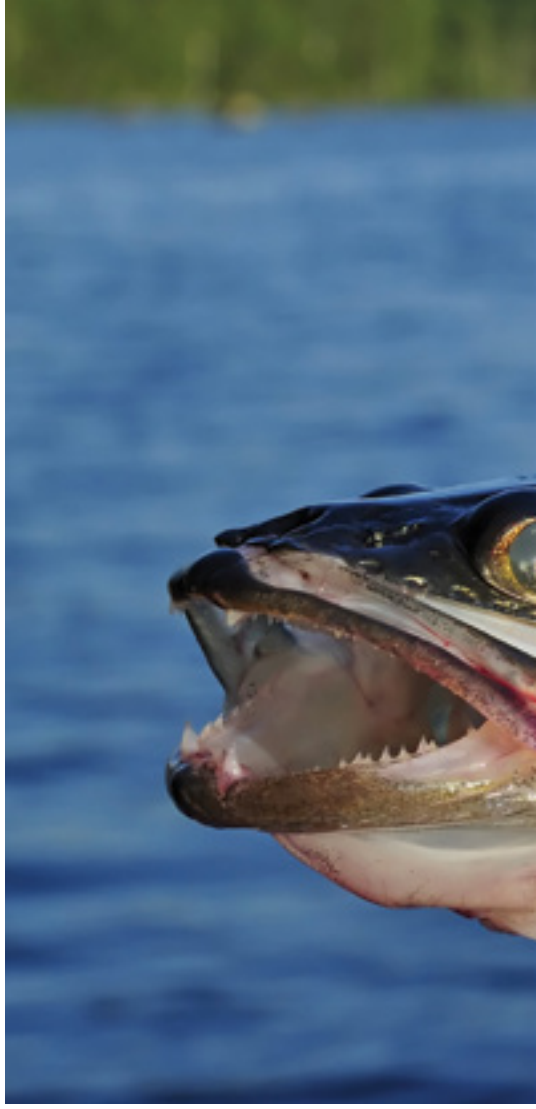
Fisheries management objectives (FMOs) are the stated socio-economic, biological, and ecological goals for a fishery that are typically established by provincial or territorial fishery managers. Where they exist, these objectives guide regulators on decisions related to the fisheries protection provisions. Proponents should consider and use the following guidelines set out in fisheries management objectives for required avoidance, mitigation and offsetting measures for the Souris River system:

Objectives

- Protect and maintain a viable and self-sustaining mixed fishery with emphasis on Walleye and Northern Pike.
- Protect and maintain the existing biodiversity of fish species (including small-bodied, non-sport and large bodied sport fishes) within the ecosystem.
- Maintain, enhance and / or restore the ecological integrity of the tributaries of the Souris River.
- Prevent the spread of Aquatic Invasive Species (AIS) – especially Common Carp - within the watershed.
- Achieve the instream flow needs (IFN) requirement of longitudinal riverine connectivity - measured as fish passage - for the reach upstream of Wawanesa to the US border.
- Facilitate the reintroduction of Lake Sturgeon to the Lower Souris River system – especially with respect to its connectivity to the Assiniboine River population.

Mechanisms that support FMOs

- Consider the addition of riffle structures within the river system to inject dissolved oxygen (DO) into the water column to support aquatic life.
- Plant / restore riparian vegetation along the banks / shorelines of tributaries to: minimise thermal change; provide upslope bank stability; mitigate local floods, and improve the health of the terrestrial / aquatic interface.
- Add bi-directional fish passage to all control structures on the main stem and tributaries upstream of Wawanesa by i) utilising rock ramps on the upstream and downstream side of fixed weir sites with embedded habitat heterogeneity, including the Souris Dam (main stem), or ii) removing or modifying all control structures and rock ramps (tributaries).



GOAL

Maintain source water quality and quantity throughout the Lower Souris River subwatershed.

MEASURES OF SUCCESS

- The percentage of private wells exceeding the drinking water guidelines for bacterial contamination will be reduced.
- Recommendations for public water system source protection will be completed by 2016.
- All abandoned wells identified over the next 10 years will be sealed by conservation districts.

SOURCE WATER PROTECTION

ISSUES

- Groundwater is the source of drinking water for most towns and private residences. Wells that are not properly located, constructed or maintained can lead to potential well water contamination problems.

SOLUTIONS

- Clean, potable drinking water is critical for human life. Protecting water at its source, or before it arrives at treatment facilities, is a preventative approach to water management. Source water protection also provides benefits to aquatic ecosystems, supports recreational and wildlife values, and ensures sustainability for future generations.

There are three steps to protecting well water:

- Protect the well water at the ground surface by avoiding, eliminating, or reducing contaminants;
- Inspect the well regularly and keep it in good running order; and
- Test the well water regularly and respond to contamination problems.

RECOMMENDATIONS FOR PUBLIC WATER SYSTEMS

In Manitoba, the Office of Drinking Water defines a public water system as a potable supply of drinking water with 15 or more connections. The Lower Souris River subwatershed contains four public drinking water systems in the towns of Dunrea, Minto, Souris, and Wawanesa.

RECOMMENDATIONS	ORGANIZATION
The **Dunrea** public water system (PWS) supplies 60 residents of Dunrea with treated water drawn from one well located on the southwest side of the town. The well is located in a confined sand and gravel aquifer. It was constructed in 1988 with a well depth of 24.0 m, and the depth to groundwater at 12.8 m below the surface of the ground. The water in Dunrea's PWS is treated by slow sand filtration.	
Consider a well house around the well, complete with concrete floor/apron sealed to the casing; alternatively build fencing around the well to keep people, and vehicles away from the well head.	Municipality
Ensure an emergency response plan is in place for the system.	Municipalities, MCWS – Office of Drinking Water
Seal unused, abandoned and poorly constructed wells that are located within the source water protection zone.	Assiniboine Hills Conservation District, Municipality
The **Minto** public water system supplies 100 residents of the Town of Minto with treated water drawn from two wells located on the southwest side of town. Both wells are located in a confined sand and gravel aquifer. Well No. 1 was completed in 2005 with a depth of 42.9 m, and the depth to groundwater at 2.9 m below the surface of the ground. Well No. 2 was completed in 2005, with a depth of 49 m and a depth to groundwater at 3.3 m.	
Ensure an emergency response plan is in place for the Minto PWS.	Municipalities, MCWS – Office of Drinking Water
Seal unused, abandoned and poorly constructed wells that are located within the 1.5 km source water protection zone around both Minto PWS wells.	Assiniboine Hills Conservation District, Municipality
The **Souris** public water system supplies 1,700 residents of the Town of Souris with treated water drawn from two wells located ten kilometres east of town. Both wells are located in a confined sand and gravel aquifer. The south well, which is used as the main source of water for the public system, was completed in 2001 with a well depth of 40.8 m, and the depth to groundwater at 3.4 m below the surface of the ground. The north well was completed in 2004, with a well depth of 39.6 m and a depth to groundwater of 4.7 m. The wells are shock chlorinated every three months to treat for iron bacteria which can damage treatment membranes.	
Ensure an emergency response plan is developed for the public water system.	Municipalities, MCWS – Office of Drinking Water
Seal unused, abandoned and poorly constructed wells that are located within the 1.5 km source water protection zone around the Souris PWS.	Assiniboine Hills Conservation District, Municipality
There are three wells with depths to groundwater ranging between 6.3 m and 7.4 m which provide water to the **Wawanesa** public water system. These wells are constructed along the dykes built to prevent flood damage from the Souris River during extreme flood events. As a result of their proximity to the river, the wells were at risk of flooding in 2011. The Town of Wawanesa raised the casing of the wells to accommodate the increased height of the dykes and a boil water advisory was placed on drinking water during this time.	
Fence well heads and install collision barriers.	Municipality
Ensure an emergency response plan is in place for the Wawanesa PWS.	Municipality, MCWS – Office of Drinking Water
Seal unused, abandoned and poorly constructed wells that are located within the 1.5 km source water protection zone around the Wawanesa PWS.	Assiniboine Hills Conservation District, Municipality

LINKING TO DEVELOPMENT PLANNING

Proposed for adoption in the development plans with land within the Lower Souris River subwatershed:

- Provincial Planning Regulation 5.1.3 under the Water Policy: To ensure protection, retention and, where required, rehabilitation of riparian areas, the following setbacks should be applied in respect to development: a) a minimum setback of 15 m upslope from the normal high water mark of first and second order drains and retention ponds; and b) a minimum setback of 30 m upslope from the normal high water mark for all other natural water bodies and waterways.

- Intensive and high-pollution risk development activities (land uses and structures that have a high risk of causing pollution and include, but are not limited to chemical/ fertilizer storage facilities, disposal fields, fuel tanks, waste disposal grounds, wastewater treatment facilities) will be restricted in public drinking water source zones. Where restriction is not possible, development may be considered in public drinking water source zones provided:

  - The proponent can prove by adequate engineering or hydro-geological investigation that the proposed activity will not cause pollution of the public drinking water supply or;

  - Appropriate precautionary measures have been taken to sufficiently mitigate the risk of endangering the quality of the water supply for public drinking water supply purposes.

- To prevent significant surface water quality and drinking water quality deterioration, developments in or near surface waters and riparian areas will be restricted, or limited, if they:

  - lead to the contribution of nutrients, pathogenic organisms, deleterious chemicals or materials to these waters;

  - accelerate erosion and bank instability;

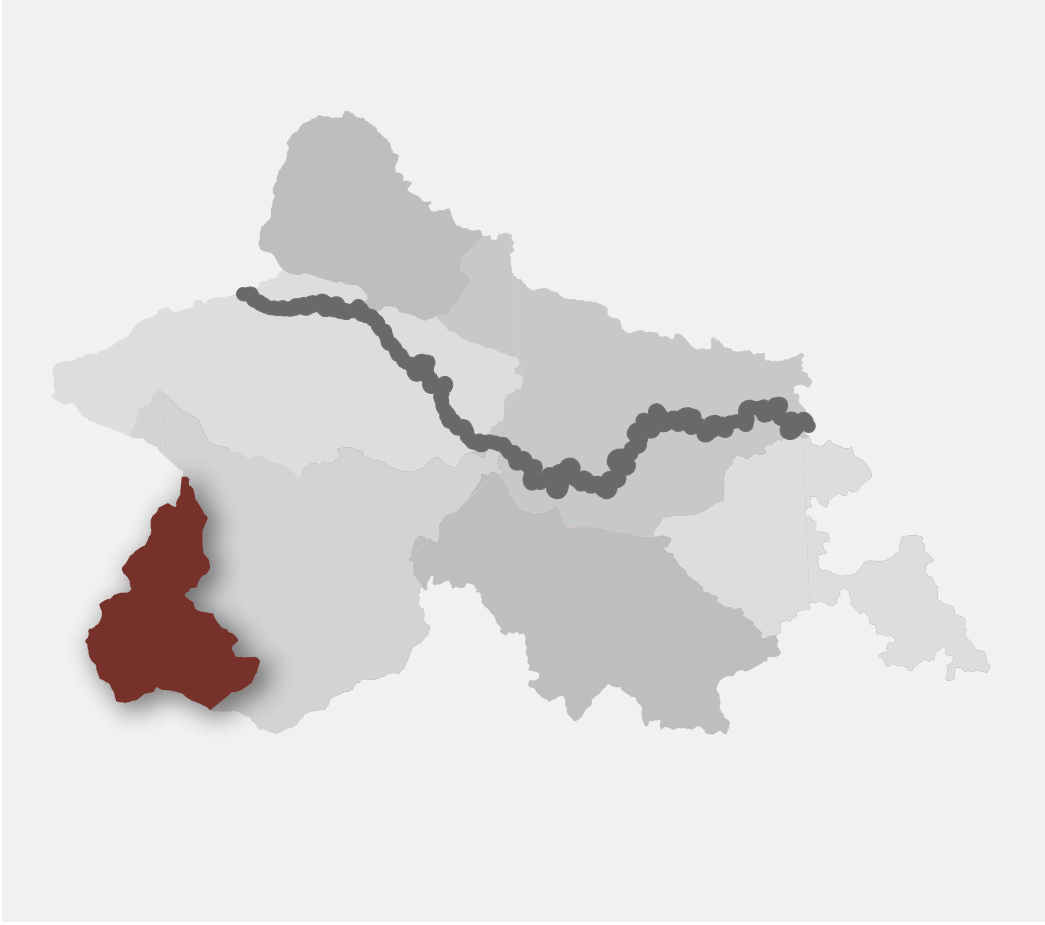
  - cause the removal of natural vegetative cover; and/or

  - may have an impact on in-stream flows needed to maintain healthy aquatic ecosystems.

ELGIN CREEK SUBWATERSHED

OVERVIEW

- Elgin Creek subwatershed is the second smallest subwatershed in the Central Assiniboine and Lower Souris River Watershed with an area of 499 km^2 (194 mi^2).
- Elevation in the Elgin Creek subwatershed descends 90 m from 503 m (1,650 ft) in the south to 413 m (1,355 ft) where the Elgin Creek confluences with the Souris River.
- High or severe water erosion risk areas follow a band from west to east in the southern portion of the subwatershed. This is an area with steep and deep ravines coupled with annual cropping to the edge of these ravines. The land outside the ravines is fairly flat.
- The majority of runoff occurs in April and May with rain triggering minor flood events between June and September. The majority of the tributaries of the Elgin Creek are shallow seasonal streams that only run during the spring. The seasonal nature of these tributaries makes them accessible for agricultural purposes in drier months.
- There are no water quality monitoring stations in the Elgin Creek subwatershed. Local observations of water quality indicate concerns of poor water quality in the waterways within the Elgin Creek subwatershed due to turbidity.
- The vast majority of soil is classified as Class 2, and 3; there are no Class 1 soils.
- Annual cropland dominates the use of land within this subwatershed (80 %). Grasslands/pasture areas cover 11% and forage land covers another 2% of the subwatershed. Water, urban, treed and wetland areas, compose the remaining landuse in the subwatershed
- The Elgin Creek subwatershed was once dominated by the mixed-grass prairie ecosystem. These temperate grassland communities support increasingly threatened species designated under Manitoba's *Endangered Species Act* (ESA) and the federal *Species at Risk Act* (SARA). The mixed-grass prairie is rich in plant diversity supports rich soils that make it suitable for agricultural development.
- Waterways within the Elgin Creek subwatershed support smaller fish species. White suckers and fathead minnows are the most common fish found in the subwatershed, which provides a large biomass of forage fish for the predacious fish of the Souris River.
- There is one public drinking water system in the Elgin Creek subwatershed.
- There is one wastewater treatment lagoon in the subwatershed in Elgin.



- Residents who are not connected to a public water system obtain their drinking water from private or semi-public sources (usually groundwater).
- The Elgin Creek subwatershed has two main aquifers;
  - Odanah Shale Aquifer (shale bedrock aquifer) – relatively abundant, slightly saline.
  - Lenses of sand and gravel (which typically occur in glacial till and other surficial deposits) – well yields can range significantly, water quality ranges from very poor to excellent.
- Groundwater is the primary water source for most residents in the Elgin Creek subwatershed.

GOAL

Ensure there is a balance between flood and erosion protection for agriculture and infrastructure, and the natural processes needed to maintain a healthy natural waterway.

MEASURES OF SUCCESS

- Surface water management decisions will be made on a watershed basis with consideration of downstream impacts.
- Existing peak flows on the Elgin Creek will be maintained or reduced.
- Municipal surface water management infrastructure capacity will be maintained.
- Water storage capacity of the subwatershed will be increased by 1,917 acre-feet.
- The Elgin Dam will be used to regulate downstream flows.

SURFACE WATER MANAGEMENT

ISSUES

- Most residents indicate the development of the upstream drainage network over the last 50 years as the major influence to spring and summer flooding events that damage municipal infrastructure, cause significant erosion, and frustrate landowners.
- During public consultations it was noted that the frequency and extent of infrastructure damage has increased over the last 10 years due to a combination of wetland drainage and wetter conditions. Widespread illegal drainage and removal of natural areas occurs throughout the subwatershed, but is concentrated in the southern portion. Removal of natural vegetation has shortened runoff time into streams, creating problems for downstream landowners specifically along the stretches downstream of the Elgin Dam to the outlet to the Souris River.
- Few wetlands remain intact in the Elgin Creek subwatershed; the majority have been drained for agricultural production.
- Public feedback was generally divided between those who want flood waters off the land as quickly as possible, and those that expressed concern with the impacts of drainage activities - demonstrating disconnected opinions on how water should be managed.

SOLUTIONS

- Develop and maintain flood mitigation measures and protect natural water retention areas to help reduce the impact of flood events and decrease erosion.
- Increase the adoption of land use practices that are better suited to the environment and the hydrological regime.
- Improve communication and cooperation between the local conservation districts, municipalities, and provincial government to better coordinate surface water management activities.

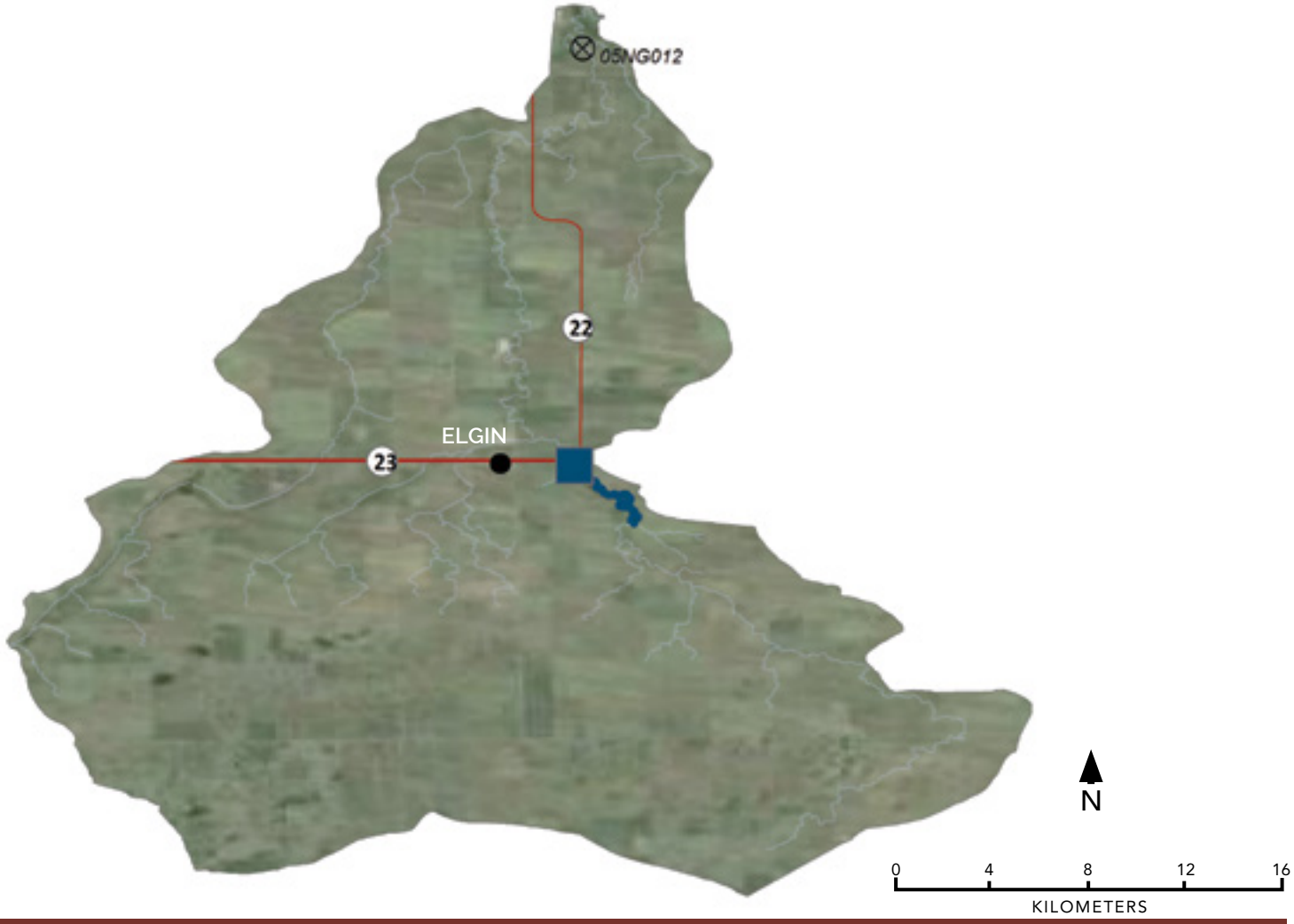
THE ELGIN CREEK DAM

The Elgin Creek Dam is located in section NE 33-5-21W on Elgin Creek, about 457 m upstream of PTH 23. The dam was constructed in 1966 by PFRA to provide a source of water for stock watering, irrigation, and conservation purposes. The 396 m long dam consists of an earth fill of 9 m high across Elgin Creek creating the Elgin Reservoir with approximately 640 dam^3 (520 acre-feet) storage capacity. The project was turned over to the Province in 1968 and is currently used as a water storage site where water levels are not regulated.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Municipalities should complete a culvert size and location inventory, and create a drainage standard for the subwatershed with a goal to reduce flow velocities and enhance retention capabilities of the system by 10%.	*Municipalities*, Assiniboine Hills Conservation District, Turtle Mountain Conservation District
Maintain existing drainage infrastructure to original design standard, reconstruct if necessary	*Municipalities*
Develop retention areas, dry dams, riffle structures or other beneficial management practices along smaller tributaries to slow runoff and reduce peak flows.	*Assiniboine Hills Conservation District, Turtle Mountain Conservation District, MAFRD,* Conservation Agencies
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and/or financial incentives.	*Assiniboine Hills Conservation District, Turtle Mountain Conservation District*, Rural Municipalities, *Conservation Agencies*
Explore the potential of regulating natural cover removal through a provincial licensing system.	*MCWS*

* lead organizations have been italized.



PEAK FLOW REDUCTIONS

One of the goals in the subwatershed is to reduce peak flows. The main issue seems to be additional contributions to the system through on farm drainage practices that result in frequent damages to infrastructure. Lowering the peak flow of water, spreading it over a larger period, and temporarily storing water until peak flows have passed, allows for needed drainage activities while reducing the costs associated with replacing critical infrastructure or causing downstream flooding impacts.

The amount of upstream water storage needed to reduce peak flows by 10% for the Elgin Creek subwatershed have has been estimated at 1,917 acre-feet (see table below). Stakeholders within the Elgin Creek subwatershed should work towards increasing current water storage capacities of the system to help mitigate the severity of flooding in a 1 in 10 year event.

Station Name	Drainage Area	1:10 Year Flow		10% Reductions of Peak Discharge	Associated Storage Needed
	(sq.km)	Annual Peak Discharge (cfs)	Hydrograph Volume (ac-ft)	(cfs)	(ac-ft)
Elgin Creek (05NG012)	488	1,313	16,928	131	1,917

Analysis results for Elgin Creek subwatershed hydrology upstream of index station 05NG012.

LEGEND	ISSUE	RECOMMENDATIONS
Flooding/ Drainage	Increased drainage, spring melt and heavy rainstorm water flows cause significant damage to municipal infrastructure.	• Assiniboine Hills and Turtle Mountain Conservation Districts will encourage the adoption of check dams and/or small dams, to slow water flowing off 1st and 2nd order streams. • Conservation agencies and districts will promote wetland conservation and restoration through incentives, education, and demonstration. • The Province of Manitoba should explore wetland consolidation versus drainage within this area as well as requirements for tile drainage areas to store water coming off the fields through regulation and/or policy development. • Assiniboine Hills and Turtle Mountain Conservation District will lead in development of small water storage options to stagger flow timing and broaden the peak flows through this area.

LINKING TO THE WATER CONTROL WORKS AND DRAINING LICENSING SYSTEM

The following are recommendations for conservation districts, municipalities, and other organizations to consider when reviewing or developing water control works and/or drainage projects within the watershed. Responsibility to administer *The Water Rights Act* is held by Manitoba Conservation and Water Stewardship.

- Any new land improvements that involve the alteration of a water body require approval from the Province and will be subject to periodic inspections for continued compliance.

- The project management team has set out targeted water storage goals for the subwatershed. Drainage activities that contribute to peak flows need to pass through temporary water storage sites to mitigate additions to peak flows.

- Maintain no loss policy for seasonal, semi-permanent or permanent wetlands, sloughs, potholes, or other similar bodies of water in the subwatershed. If one acre of wetland is to be compromised, then another acre should be restored somewhere in the subwatershed. Legislation should reinforce the maintenance of wetlands and associated upland cover for the sole purpose of maintaining and increasing water quality and flood protection.

- Water Resource Officers, Conservation Districts and Municipalities should be reviewed on drain license applications. These organizations should consider the following when reviewing these applications:

  - **Do not recommend** approval for works such as:
    - Add water at times of peak flow.
    - Increase capacity in upstream tributaries.
    - Disturb natural streams. If natural streams are disturbed, mitigate impacts by completing a riparian improvement project within the subwatershed.

  - **Recommend** approval for works that include:
    - General maintenance of existing drains and culverts.
    - Flow retention within the Elgin Creek and smaller tributaries.
    - Storing water during spring runoff periods.

GOAL

Restore a balance between industry and natural areas; conserve all remaining natural areas.

MEASURES OF SUCCESS

- Existing natural areas including forests, riparian areas,wetlands, mixed grass prairie and other sensitive ecosystems will be maintained.

CONSERVATION OF NATURAL AREAS

ISSUES

- Agricultural intensification has resulted in the loss of natural areas within the Elgin Creek subwatershed. Clearing of natural cover and shelterbelts has impacted wildlife by destroying critical habitat for many species.

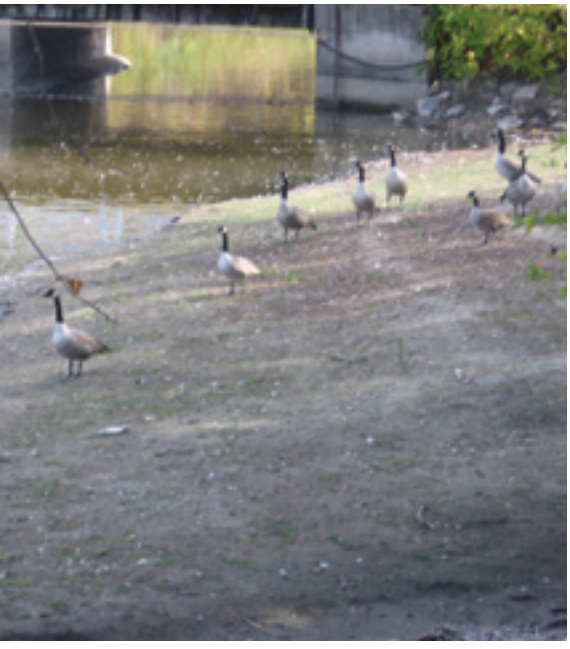
- Agricultural practices have undergone a significant change causing many natural areas to be converted to continuous cropping. As more water moves to local streams, waterways of the Elgin Creek have increased erosion problems.

- The majority of the threatened or endangered species designated under Manitoba's *Endangered Species Act* (ESA) and the federal *Species at Risk Act* (SARA) rely on mixed- grass prairie habitat; most of which has been converted to annual cropland.

SOLUTIONS

- Better drainage eforcement, coordination and planning is needed.

- Management practices, policies and incentives need to be developed to provide a greater balance between agriculture, invasive species control and the environmental needs of the subwatershed.



HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Promote agricultural beneficial management practices that encourage continued health levels of wetland, riparian, and woodland habitat through, incentives, education, and technical assistance.	*Assiniboine Hills Conservation District, Turtle Mountain Conservation District, MAFRD, Conservation Agencies*
Encourage private landowners to maintain or restore wetlands and riparian areas through conservation agreements and/or financial incentives.	*Assiniboine Hills Conservation District, Turtle Mountain Conservation District*, Rural Municipalities, *Conservation Agencies*
Promote the conservation of habitats that support endangered or threatened species as designated under the Manitoba *Endangered Species Act* and the federal *Species at Risk Act* (SARA).	Assiniboine Hills Conservation District, Turtle Mountain Conservation District, Rural Municipalities, *Conservation Agencies, MCWS - Biodiversity Habitat and Endangered Species Branch*
Complete a Riparian Health Assessment along waterways of the Elgin Creek.	*Conservation District*

* lead organizations have been italized.

NATURAL AREAS MANAGEMENT

Natural areas require management. It is not sufficient to idle these lands and anticipate that habitat will be suitable for the desired outcome. Widespread presence of leafy spurge found in Wildlife Management Areas and local pastures in the watershed is an example. Without control of this invasive species, the potentially rich habitats become unsuitable for wildlife and grazing.

GOAL

Maintain source water quality and quantity throughout the Elgin Creek subwatershed

MEASURES OF SUCCESS

- The percentage of private wells exceeding the drinking water guidelines for bacterial contamination will be reduced.
- Recommendations for public water system source protection will be completed by 2016.
- All abandoned wells identified over the next 10 years will be sealed by the conservation districts.

SOURCE WATER PROTECTION

ISSUES

- Groundwater is the source of drinking water for most towns and private residences. Wells that are not properly located, constructed or maintained can lead to potential well water contamination problems.
- According to provincial groundwater specialists, bacteria and nitrate are the most common types of contamination found in private wells.
- Abandoned wells can also lead to well water contamination if wells are not properly sealed.

SOLUTIONS

- Clean drinking water is critical for human life. Protecting water at its source, or before it arrives at treatment facilities, is a preventative approach to water management. Source water protection also provides benefits to aquatic ecosystems, supports recreational and wildlife values, and ensures sustainability for future generations.

There are three steps to protecting well water:

- Protect the well water at the ground surface by avoiding, eliminating, or reducing contaminants;
- Inspect the well regularly and keep it in good running order; and
- Test the well water regularly and respond to contamination problems.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Provide education on well head management to local residents.	*Assiniboine Hills Conservation District, Turtle Mountain Conservation District, MCWS - Office of Drinking Water*
Locate wells at a safe distance from potential sources of contamination and in an area away from surface water runoff.	*Landowners, certified well drillers*
Wells within any designated flood area should have adequate well head protection to ensure flood waters do not enter the well directly.	Assiniboine Hills Conservation District, Turtle Mountain Conservation District, *landowners*, certified well drillers
Ensure abandoned wells are properly sealed to provincial requirements.	*Assiniboine Hills Conservation District, Turtle Mountain Conservation District*, MCWS – Groundwater Management Section

* lead organizations have been italized.

RECOMMENDATIONS FOR PUBLIC WATER SYSTEMS

In Manitoba, the Office of Drinking Water defines a public water system as a potable supply of water with 15 or more connections. The Elgin Creek subwatershed contains one public water system in the town of Elgin.

RECOMMENDATIONS	ORGANIZATION
The Elgin public water system (PWS) supplies 125 residents of Elgin with treated water drawn from one well located on the southwest side of the town. The well is located in a confined sand and gravel aquifer. It was constructed in 2012 with a well depth of 6.1 meters, and the depth to groundwater at 2.1 meters below the surface of the ground. Because of its shallow depth and proximity to a local waterway, the Elgin PWS is designated as GUDI (Groundwater Under the Direct Influence of surface water) meaning it is vulnerable to contamination by surface waters and potential sources of contamination in the area. A Hutterite colony well is located approximately seven meters from the Elgin well.	
Inform local EMO/fire department to contact Elgin water utility to stop well use if any spills which may contaminate the source water occur within 1.5 km of the well.	*Municipality*
Work with local Colony to ensure safety precautions are also applied to the adjacent colony well.	*Municipality, MCWS – Office of Drinking Water*
Ensure an emergency response plan is developed for the system.	*Municipalities, MCWS – Office of Drinking Water*
Seal unused, abandoned and poorly constructed wells that are located within the source water protection zone.	*Assiniboine Conservation District*, Municipality
Ensure an emergency response plan is developed for the public water system.	*MCWS – Parks*, MCWS – Office of Drinking Water

* lead organizations have been italized.

LINKING TO DEVELOPMENT PLANNING

Proposed for adoption in the development plan for lands within the Elgin Creek subwatershed:

- Prior to further upgrades to existing infrastructure, municipalities should see assistance to develop options to help achieve a 10% peak flow reduction on 1 in 10 year events (water, roads). Existing infrastructure will be maintained when necessary.

- Adopt policies for a minimum setback distance of 50 m for new development or buildings along streambanks of Class 3 and higher waterways.

- Value and maintain wetlands. Ensure wetlands are considered in all land management decisions. If an acre of wetland is to be compromised, then another acre should be restored somewhere in the subwatershed. Policy should reinforce the maintenance of wetlands and associated upland cover for the purposes of maintaining and increasing water quality as well as reducing downstream flood impacts.

- Adopt policies for a minimum set back distance of for annual cropping and forage operations along tributaries for the purposes of maintaining and improving water quality, and reducing erosion risk and impact of stream flooding on agricultural lands and erosion risk. Recommend 10m setback distance for Class 1 and 2 waterways, 20m for class 3 or higher.

- To maintain and/or improve water quality, reduce erosion risk and impact flooding, adopt policies for a minimum set-back distance for annual cropping and forages along tributaries. Recommend 10 m setback for Class 1 and 2 waterways, 20 m set-back for Class 3 or higher.
- Intensive and high-pollution risk development activities, (land uses and structures that have a high risk of causing pollution and include, but are not limited to chemical/ fertilizer storage facilities, disposal fields, fuel tanks, waste disposal grounds, wastewater treatment facilities) will be restricted in public drinking water source zones. Where restriction is not possible, development may be considered in public drinking water source zones provided:

  - The proponent can prove by adequate engineering or hydro-geological investigation that the proposed activity will not cause pollution of the public drinking water supply or;

  - Appropriate precautionary measures have been taken to sufficiently mitigate the risk of endangering the quality of the water supply for public drinking water supply purposes.

- To prevent significant surface water quality and drinking water quality deterioration, developments in or near surface waters and riparian areas will be restricted, or limited, if they:

  - lead to the contribution of nutrients, pathogenic organisms, deleterious chemicals or materials to these waters;

  - accelerate erosion and bank instability;

  - cause the removal of natural vegetative cover; and/or

  - may have an impact on in-stream flows needed to maintain healthy aquatic ecosystems.

LITTLE SOURIS RIVER SUBWATERSHED

OVERVIEW

- Third largest subwatershed in the Central Assiniboine and Lower Souris River Watershed – area is 836 km^2 (323 mi^2).
- Elevation in the Little Souris River subwatershed descends 137 m. The overall slope of the land from west to east is generally gentle; water erosion risks to soils are minimal. Severe erosion risk areas that do exist tend to follow areas with higher elevation changes like those within the Brandon Hills.
- There are no Class1 soils, , and Class 2 and 3 lands soils comprise most of the the subwatershed. Class 4-6 soils are confined to major watershed features including the Brandon Hills, the Alexander-Griswold Marsh, and the Assiniboine Delta Aquifer.
- Agriculture is the main industry; almost 60% of the subwatershed was under annual crop production in 2006. Both pasture and forage lands are located throughout the area, but are more prevalent along the Assiniboine River and above the Assiniboine Delta Aquifer.
- Brandon is the second largest city and service centre in Manitoba after Winnipeg, with a city population of 56,219 people and is a major hub for the surrounding agricultural area. Brandon's industry reflects its agricultural history; its major industries are related to agriculture and include fertilizer and hog processing plants, as well as retail and government services for the surrounding area of Westman.
- There are two public drinking water systems in the Little Souris River subwatershed that provide drinking water for over 700 residents from groundwater sources including: Whitehead Elton Regional and Brandon Hills Estates. The City of Brandon falls within both the Assiniboine River Main Stem and the Little Souris River subwatershed.
- There is one wastewater treatment lagoon in the subwatershed.
- The Little Souris River subwatershed has five main aquifers;
    - Odanah Shale Aquifer (a small portion of this shale bedrock aquifer occurs in the south central portion of the subwatershed)
    - Assiniboine Delta Aquifer (a small portion of this unconfined sand and gravel aquifer is found in the western portion of the subwatershed)
    - Oak Lake Aquifer (only a small portion of this unconfined sand and gravel aquifer is found in the western portion of the subwatershed)
    - Brandon Channel Aquifer Complex (sand and gravel)
    - Lenses of sand and gravel (which typically occur in glacial till and other surficial deposits)
- The quality and quantity of available groundwater in this subwatershed is largely controlled by the supplying aquifer.

GOAL

Ensure there is a balance between natural waterways and protection of annual croplands and infrastructure from flooding and downstream erosion.

MEASURES OF SUCCESS

- Surface water management decisions will be made on a watershed basis with consideration of downstream impacts.
- Water storage capacity will be increased by 2,785 and 5,515 acre-feet upstream and downstream of hydrometric station.
- Current capacity of municipal surface water management infrastructure will be maintained.

SURFACE WATER MANAGEMENT

ISSUES

- Flooding of agricultural lands and infrastructure was identified as a concern in the northern portion of the Little Souris River subwatershed. Agricultural drainage concerns were primarily noted upstream of frequently washed out infrastructure and flooded areas.
- Significant agricultural flooding was noted southeast of Alexander, an area with a high density of terminal basins and topography that limits the movement of water. This area was highly affected by the 2011 flood.
- Erosion and loss of natural areas were a concern in the southern portions of the subwatershed.
- Public feedback was generally divided between those who want flood waters off the land as quickly as possible, and those that expressed concern with the impacts of drainage activities - demonstrating disconnected views on how water should be managed.

SOLUTIONS

- Develop and maintain flood mitigation measures and protect natural water retention areas to help reduce the impact of flood events and decrease erosion.
- Increase the adoption of land use practices that are better suited to the environment and the hydrological regime.
- Improve communication and cooperation between the local conservation districts, municipalities, and provincial government to better coordinate surface water management activities.

FLASH FLOODS

During public consultations, a number of comments were made in regard to the subwatershed experiencing more “flash floods” in recent years. Data from the Little Souris River was analyzed to determine notable trends. For every year from 1961 to 2009 the date of peak flow due to snowmelt was identified. The time of rise in the hydrograph was determined by counting how many days it took to reach the peak once flow started. The average time of rise for each of the five decades of data was calculated and examined for any trend. If the characteristics of the watershed or climate conditions were changing to increase flash floods, the time of rise should be trending to faster rises in the hydrograph. Although there is variability from year to year, overall there was no decreasing trend in the time of rise for spring floods in the Little Souris River. Time of rise as short as two to three days was common in the 1960s and 1970s. The average time of rise in the Little Souris River subwatershed has stayed consistently between 4.5 to 5.5 days for the past 50 years.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Municipalities should complete a culvert size and location inventory, and create a drainage standard for the subwatershed with a goal to reduce flow velocities and enhance retention capabilities of the system by 10%.	*Municipalities*, Conservation Districts
Maintain existing drainage infrastructure to original design standard, reconstruct if necessary.	*Municipalities, MIT*
Develop retention areas, dry dams, riffle structures or other beneficial management practices along smaller tributaries to slow runoff and reduce peak flows.	*Conservation Districts*, MAFRD
Encourage water retention, wetland or natural cover restoration and conservation through conservation agreements and /or financial incentives. Consider addressing through the tax system.	*Conservation Districts, Conservation Agencies*, Municipalities
Promote agricultural beneficial management practices that encourage water retention, wetland and natural cover restoration and conservation through incentives, education, and technical assistance.	*Conservation Districts, MAFRD, Conservation Agencies*
Provide payments or secure conservation agreements with private landowners to maintain or restore wetlands and riparian areas.	*Conservation District*, Rural Municipalities, *Conservation Agencies*

* lead organizations have been italized.

PEAK FLOW REDUCTIONS

One of the goals in the subwatershed is to reduce peak flows. The main issue seems to be additional contributions to the system through on farm drainage practices that result in more frequent damages to infrastructure. Lowering the peak flow of water, spreading it over a larger period, and temporarily storing water until peak flows have passed will allow for needed drainage activities while reducing the costs associated with replacing valuable infrastructure or causing downstream flooding impacts. The amount of upstream water storage needed to reduce peak flows by 10% in the Little Souris River subwatershed has been estimated at 4, 810 acre-feet in additional storage (see table below). Stakeholders within the Little Souris River subwatershed should work towards this target to reduce frequency and severity of flooding in a 1 in 10 year event.

Station Name	**Drainage Area**	**1:10 YEAR FLOW**		**10% Reductions of Peak Discharge**	**Associated Storage Needed**
	(sq.km)	Annual Peak Discharge (cfs)	Hydrograph Volume (ac-ft)	(cfs)	(ac-ft)
Little Souris River (05MH006)	837	2,113	25,848	211	4,810

Analysis results for Little Souris River subwatershed hydrology upstream of index station 05MH006.

LEGEND	ISSUE	RECOMMENDATIONS
Flooding/ Drainage	Increased drainage, spring melt and heavy rainstorm water flows cause significant damage to municipal infrastructure as well as flooding of agricultural lands	• Assiniboine Hills Conservation District and other Conservation Agencies should promote wetland conservation and restoration through incentives, education, and demonstration • Assiniboine Hills Conservation District and municipalities should encourage the adoption of check dams and small dams, to slow water flowing off 1st and 2nd order streams. • Assiniboine Hills Conservation District to lead in development of smallscale water storage options to stagger flow timing and broaden the peak flows through this area.
Assiniboine River Riparian Area	Assiniboine River riparian habitat is degraded by human activities including urban encroachment	• Promote urban riparian area conservation and restoration through incentives, education, and demonstration along the Assiniboine River in the City of Brandon, RM of Cornwallis. • Permanently protect the river bottom forest along the Assiniboine River. • Promote development of recreational and educational opportunities within the area.
Low Moderate Severe Little Souris River Watershed Aquatic Resource Inventory	Aquatic ecosystem habitat is impaired at 117 locations within this subwatershed. The range of impairment is from: minor problems like sloughing stream banks (low) to major fish passage barriers (severe).	• Assiniboine Hills Conservation District is to lead or facilitate the completion of these 117 projects in order recommended by the habitat assessment.
Alexander - Griswold Marsh	The Alexander-Griswold Marsh is a locally important wetland that runs into the Little Souris River. Increased upstream drainage has caused land to flood surrounding the marsh.	• Conservation Agencies should work to conserve Alexander Marsh and its uplands through provincial designation, conservation agreements, payments and/or other land conservation programs.
Assiniboine Delta Aquifer	Sandy soils of the Assiniboine Delta Aquifer area contributes to high risk of wind erosion. The drier the conditions, the greater the soil loss risk.	• Assiniboine Hills Conservation District and MAFRD should encourage the adoption of beneficial management practices that help reduce wind erosion (e.g. shelterbelts, permanent cover establishments) through incentives, demonstration, and education.

LINKING TO THE WATER CONTROL WORKS AND DRAINAGE LICENSING SYSTEM

The following are recommendations for conservation districts, municipalities, and other organizations to consider when reviewing or developing water control works and/or drainage projects within the watershed. Responsibility to administer *The Water Rights Act* is held by Manitoba Conservation and Water Stewardship.

- Any new land improvements that involve the alteration of a water body require approval from the Province and will be subject to periodic inspections for continued compliance.

- Maintain no loss policy for seasonal, semi-permanent or permanent wetlands, sloughs, potholes, or other similar bodies of water in the subwatershed. If one acre of wetland is to be compromised, then another acre should be restored somewhere in the subwatershed. Legislation should reinforce the maintenance of wetlands and associated upland cover for the sole purpose of maintaining and increasing water quality and flood protection.

- The project management team has set out targeted water storage goals for the subwatershed. Drainage activities that contribute to peak flows should pass through temporary water storage sites to mitigate additions to peak flows.

- Water Resource Officers, Conservation Districts and Municipalities should be consulted on drain license applications. These organizations should consider the following when reviewing these applications:

  - **Do not recommend** approval for works such as:
    - Add water at times of peak flow.
    - Increase capacity in upstream tributaries.
    - Disturb natural streams. If natural streams are disturbed, mitigate impacts by completing a riparian improvement project within the subwatershed.

  - **Recommend** approval for works that include:
    - General maintenance of existing drains and culverts.
    - Flow retention within the Little Souris River tributaries.
    - Storing water or slowing flows during spring runoff periods.
    - Nutrient loading reductions in the Little Souris tributaries

GOAL

Restore a balance between industry and natural areas; conserve and restore natural areas.

MEASURES OF SUCCESS

- Existing natural areas will be maintained including wetlands, mixed grass prairie, riparian areas and other sensitive ecosystems.
- 30% of the total natural cover on private land in the Alexander Marsh region and the Assiniboine Delta Aquifer region will be protected.
- 50% of the potential rehabilitation sites identified in the Little Souris River Watershed Aquatic Resource Inventory will be implemented.

CONSERVATION OF NATURAL AREAS

ISSUES

- In 2005, an aquatic water resource inventory was conducted on the Little Souris River and Five-Mile Creek. Total phosphorous (0.331 mg/L) concentrations within the Little Souris River in July were higher than in three other Assiniboine River tributaries (Five-mile Creek – 0.087mg/L, Epinette Creek – 0.044mg/L, and the Cypress River 0.087mg/L) and the Assiniboine River (0.151mg/L). These results suggest nutrient enrichment may be a significant stressor for this subwatershed..
- In 2005, North/South Consultants Inc. conducted the Little Souris River Watershed Aquatic Resource Inventory. Approximately 182 km of the Little Souris River was rated according to aquatic habitat quality: 50% of the reach was considered highly degraded, 34% was considered moderately degraded, 11% was considered to be minimally degraded, and 6% was considered to be severely degraded.
- The Little Souris River subwatershed was once dominated by the mixed grass prairie ecosystem. These temperate grassland communities occur on well-drained, sandy or gravelly soils. The mixed-grass prairie supports increasingly threatened species designated under Manitoba's *Endangered Species Act* (ESA) and the federal *Species at Risk Act* (SARA).
- Wetlands are more common in the eastern part of the subwatershed. In larger depressions, permanent lakes or ponds of water remain like the Alexander-Griswold Marsh. Alexander-Griswold Marsh is a permanent marsh found on the northern side of the subwatershed and runs east into the Little Souris River.
- The Assiniboine Delta begins on the east side of the Assiniboine River where little surface runoff occurs due to coarse textured soils that allow most of the precipitation that reaches the ground to infiltrate. The sandy soils found on the east side of the subwatershed also provide significant niche habitats to many endangered or threatened species in Manitoba. The majority of species rely on sandy well-drained soils similar to those found in the Assiniboine Delta Aquifer region.
- The conversion of mixed-grass prairie or pastures to irrigated crop production and habitat loss from invasive speices such as leafy spruge has greatly impacted the ability for threatened or endangered species to thrive in this area.

SOLUTIONS

- Management practices, policies and incentives need to be developed to provide a greater balance between agriculture, invasive species control and the environmental needs of the subwatershed.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Promote agricultural beneficial management practices that encourage healthy levels of wetland, riparian, and woodland habitat through, incentives, education, and technical assistance.	*Assiniboine Hills Conservation District, MAFRD*, Conservation Agencies
Provide payments or secure conservation agreements with private landowners to maintain or restore wetlands and riparian areas focusing on upstream areas as a priority (northern portion of the watershed).	*Assiniboine Hills Conservation District*, Rural Municipalities, *Conservation Agencies*
Work to conserve the Assiniboine River riparian area through conservation agreements, protected areas initiatives, provincial designations and/or other land conservation programs.	*Assiniboine Hills Conservation District*, Rural Municipalities, *Conservation Agencies*
Work to conserve Alexander-Griswold Marsh and its uplands through provincial legislation, conservation agreements, landowner payments and/or other land conservation programs.	*Assiniboine Hills Conservation District*, Rural Municipalities, *Conservation Agencies*
Complete projects on rehabilitation sites identified in the **Little Souris River Watershed Aquatic Resource Inventory.**	*Assiniboine Hills Conservation District*
Promote the conservation of habitats that support endangered or threatened species as designated under the Manitoba *Endangered Species Act* and the federal *Species at Risk Act* (SARA).	Assiniboine Hills Conservation District, Rural Municipalities, *Conservation Agencies*

* lead organizations have been italized.

LITTLE SOURIS RIVER WATERSHED AQUATIC RESOURCE INVENTORY

The Little Souris River system is home to an array of aquatic species and ecosystems. Fisheries habitat assessments were conducted in 2005 to investigate the quality of fish habitat, water quality, channel morphology, bank vegetation, and fish migration barriers. This study revealed 117 potential rehabilitation sites in the subwatershed, and noted that degraded riparian zone sedimentation, and unmanaged livestock access were the main factors impairing habitat quality. Approximately 80% of the 117 identified sites were degraded due to anthropogenic influences.

GOAL

Maintain source water quality and quantity throughout the Little Souris River subwatershed.

MEASURES OF SUCCESS

- The percentage of private wells exceeding the drinking water guidelines for bacterial contamination will be reduced.
- Recommendations for public water system source protection will be completed by 2016.
- All abandoned wells brought forward over the next 10 years will be sealed by the Assiniboine Hills Conservation District.

SOURCE WATER PROTECTION

ISSUES

- In the Little Souris River subwatershed the majority of urban watershed residents, rely on surface water from the Assiniboine River for drinking water (City of Brandon). Source water protection for the Assiniboine River is discussed in the Assiniboine River Main Stem section of the plan.
- Groundwater is the source of drinking water for most rural residences. Wells that are not properly located, constructed or maintained can result in well water contamination problems.
- Increasing water demands on the aquifers while maintaining and protecting the ability of the aquifers to support human and environmental needs in a sustainable manner is a concern for watershed residents.
- The porous nature of the soils over the aquifers like the Oak Lake, Assiniboine Delta Aquifer and the Brandon Channel Aquifer Complex makes them highly susceptible to contamination from sources such as sewage, petroleum products, fertilizers, manure, and pesticides.

SOLUTIONS

- Clean, potable drinking water is critical for human life. Protecting water at its source, or before it arrives at treatment facilities, is a preventative approach to water management. Source water protection also provides benefits to aquatic ecosystems, supports recreational and wildlife values, and ensures sustainability for future generations.

There are three steps to protecting well water:

- Protect the well water at the ground surface by avoiding, eliminating, or reducing contaminants;
- Inspect the well regularly and keep it in good running order; and
- Test the well water regularly and respond to contamination problems.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Provide education on well head management to well owners.	*Assiniboine Hills Conservation District,* MCWS - Office of Drinking Water, Groundwater Management Section
Locate the well at a safe distance from potential sources of contamination and in an area away from surface water runoff.	*Landowners, certified well drillers*
Ensure wells within any designated flood area have adequate well head protection to ensure flood waters do not enter the well directly.	*Assiniboine Hills Conservation District,* MCWS – Groundwater Management Section
Ensure abandoned wells are properly sealed to provincial requirements. Focus on areas within the Source Water Protection Zones (1.5 km area around a wellhead).	*Assiniboine Hills Conservation District,* MCWS – Groundwater Management Section
Promote the development of rural water pipelines in areas designated for residential development.	*Municipalities, Manitoba Water Services Board*
Require fuel storage and dispensing sites to be protected from leaks and spills using containment areas.	*MCWS – Environmental Compliance & Enforcement*

* lead organizations have been italized.

RECOMMENDATIONS FOR PUBLIC WATER SYSTEMS

In Manitoba, the Office of Drinking Water defines a public water system (PWS) as a potable supply of water with 15 or more connections. The Little Souris River subwatershed contains two public drinking water systems including the Whitehead Elton Regional System and the Brandon Hills Estates System.

RECOMMENDATIONS	ORGANIZATION
The Whitehead Elton Regional System provides drinking water to approximately 700 residents of the municipality of Whitehead and Elton. A pipeline extends from the Alexander treatment plant to Forest within the Little Souris River Subwatershed. There may be a potential for this source to be extended further to provide a better source of drinking water within the RM of Elton. Recommended actions and policies for all potential pollutant sources within 1.5km of the Whitehead Elton Regional well head include:	
Ensure septic systems are well managed and maintained.	*MCWS - Environment Compliance and Enforcement*
Ensure permanent 5 m grass buffer surrounding well head.	*Municipalities*, Assiniboine Hills Conservation District
Install bollards.	*Municipalities*
Ensure an emergency response plan is developed for the system.	*Municipalities, MCWS – Office of Drinking Water*
Seal unused, abandoned and poorly constructed wells that are located within the 1.5 km source water protection zone around the well.	*Conservation District*, Municipality
The Brandon Hills Estates System provides drinking water to approximately 80 residents. The treated water from the Brandon Hills Estate system exceeds the Canadian Drinking Water Health Guidelines for arsenic, and as a result the treated water is under Water Quality Advisory. There is an abandoned unsealed well 2 m adjacent to the source well. Recommended actions and policies for all potential pollutants sources within 1.5 km of the Brandon Hills Estates well head include:	
Seal abandoned well next to source well.	*Conservation District*
Upgrade the existing well and extend well casing to a height of 16 inches above ground level, or properly seal existing well and install new water well.	*Owner/Operator*
Ensure septic systems are well managed and maintained.	*MCWS - Environmental Compliance and Enforcement*
Ensure new well casing is sealed securely.	*Owner/Operator*
Rodent proof the well house around the well.	*Owner/Operator*
Ensure an emergency response plan is developed for the system.	*Owner/Operator, MCWS – Office of Drinking Water*
Seal unused, abandoned and poorly constructed wells that are located within the 1.5 km source water protection zone around the well.	*Conservation District*

* lead organizations have been italized.

LINKING TO DEVELOPMENT PLANNING

Proposed for adoption in the development plans with lands within the Little Souris River subwatershed:

- Prior to further upgrades to existing infrastructure,municipalities should seek technical assistance to develop options to help achieve a 10% peak flow reduction on 1 in 10 year events. Existing infrastructure will be maintained when necessary.

- Adopt policies for a minimum setback distance of 50 m for new development or buildings along streambanks of Class 3 and higher waterways. Adopt policies for a minimum setback distance of 100 m for new development or buildings along the Assiniboine River.

- Development along the Assiniboine River within the elevation of the flood of record should be designed to withstand frequent flooding. Commercial and residential development should be prohibited and phased out.

- Value and maintain wetlands. Ensure wetlands are considered in all land management decisions.

- Intensive and high-pollution risk development activities, (land uses and structures that have a high risk of causing pollution and include, but are not limited to chemical/ fertilizer storage facilities, disposal fields, fuel tanks, waste disposal grounds, wastewater treatment facilities) will be restricted in public drinking water source zones. Where restriction is not possible, development may be considered in public drinking water source zones provided:

  - The proponent can prove by adequate engineering or hydro-geological investigation that the proposed activity will not cause pollution of the public drinking water supply or;

  - appropriate precautionary measures have been taken to sufficiently mitigate the risk of endangering the quality of the water supply for public drinking water supply purposes.

- To prevent significant surface water quality and drinking water quality deterioration, developments in or near surface waters and riparian areas will be restricted, or limited, if they:

  - lead to the contribution of nutrients, pathogenic organisms, deleterious chemicals or materials to these waters;

  - accelerate erosion and bank instability;

  - cause the removal of natural vegetative cover; and/or

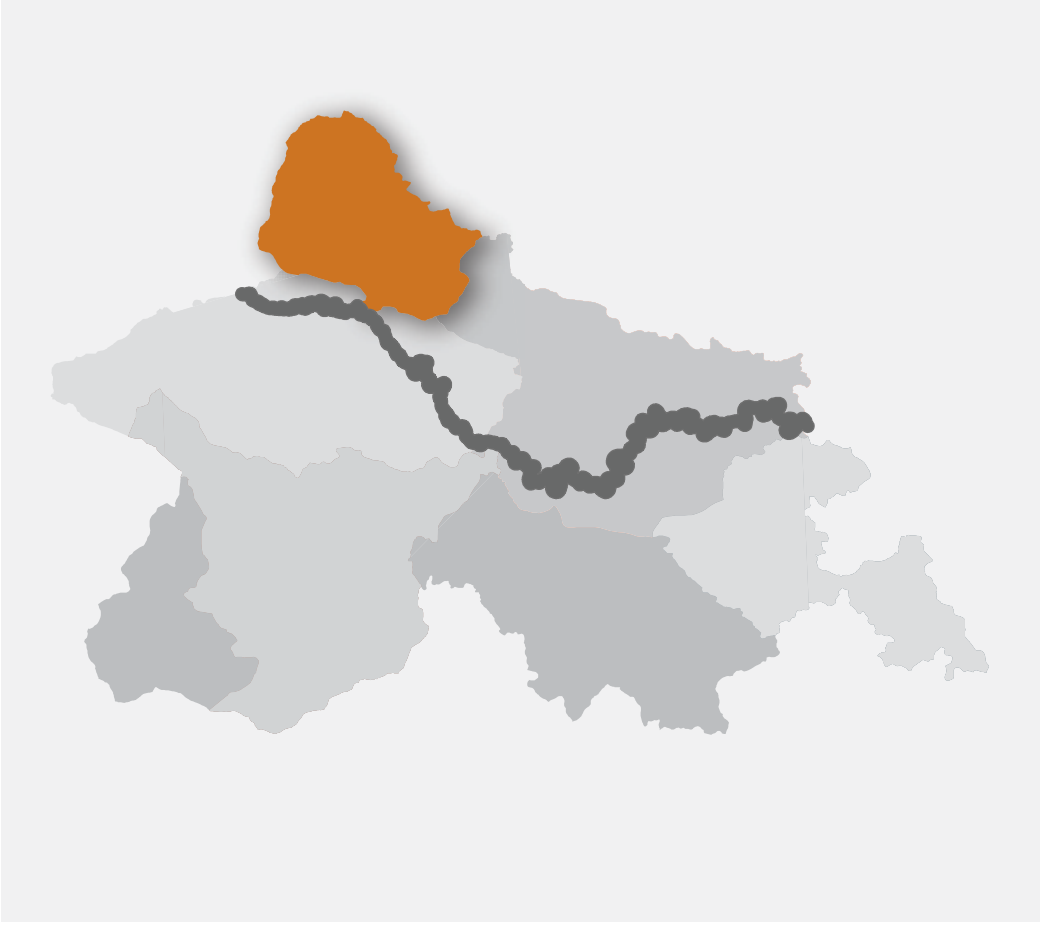
  - may have an impact on in-stream flows needed to maintain healthy aquatic ecosystems.

WILLOW CREEK SUBWATERSHED

OVERVIEW

- With an elevation change of 203 m, the Willow Creek subwatershed drains 670 km^2 (259 mi^2) and is the third smallest subwatershed in the Central Assiniboine and Lower Souris River Watershed.
- Average runoff for the Willow Creek is similar to those in the Lower Souris River subwatershed which has more than three times the drainage area.
- The northern portion of the Willow Creek Subwatershed is considered to have high or severe water erosion risk. Severe erosion risk areas tend to follow tributaries and the main arm of the Willow Creek from Chater to Douglas.
- Soils within the Willow Creek subwatershed are characteristically fertile; the majority of soils are classified as Class 2, and 3. Class 4 to 6 soils are concentrated in the southeast. Near the Douglas Marsh, soil capability is classified as Class 7.
- In 2006, agricultural land use (croplands, pasture and grasslands and forage) represented 87% (58,500 ha) of the land use by area within the subwatershed.
- Waterways within the Willow Creek subwatershed support spawning habitat for Northern Pike and White Suckers, and year round habitat for smaller fish species.
- There are five wastewater treatment lagoons in the Willow Creek subwatershed.
- There are two public water systems located in the subwatershed: Chater and Campbell's Mobile Home Park systems. Public drinking water for the community of Forrest is obtained from the Whitehead Elton Regional Public Water System in the Little Souris River subwatershed.
- Residents who are not connected to a public water system obtain their drinking water from private or semi-public sources (usually groundwater).
- The Willow Creek subwatershed has three aquifers;
  - Odanah Shale Aquifer (a small portion of this shale bedrock aquifer occurs in the northern portion of the subwatershed)
  - Assiniboine Delta Aquifer (a small portion of this unconfined sand and gravel aquifer occurs in the western portion of the subwatershed)
  - Lenses of sand and gravel (which typically occur in glacial till and other surficial deposits).

  The quality and quantity of available groundwater in this subwatershed is largely controlled by the supplying aquifer. Outside of the Assiniboine Delta Aquifer, groundwater quality is generally of poor quality. Many residences north of the aquifer have their potable water hauled in.



GOAL

Waterways will be maintained to protect annual croplands and infrastructure from flooding and reduce downstream waterway erosion.

MEASURES OF SUCCESS

- Surface water management decisions will be made on a watershed basis with consideration of downstream impacts.
- Existing peak flows on the Willow Creek will be maintained or reduced.
- Current capacity of municipal surface water management infrastructure will be maintained.
- Water storage capacity will be increased by 3,652 acre-feet.
- All municipalities within this subwatershed will be a member of a conservation district.

SURFACE WATER MANAGEMENT

ISSUES

- During public consultations it was noted that the frequency and extent of flooding has increased in recent years due to a combination of wetland drainage, farming too close to tributaries of Willow Creek and wetter conditions over the last 10 years. Expanding agricultural operations into tributary creek beds puts increased pressure to get the water off of the land as quickly as possible.
- Water seems to move through the system faster than historical memory. Increased removal of natural vegetation, grading of land surfaces, and construction of improved drainage has caused increased runoff volumes, and more importantly, shortened runoff time into streams. As a result, the frequency of flooding and erosion sites has increased in Willow Creek subwatershed.

SOLUTIONS

- Develop and maintain flood mitigation measures and protect natural water retention areas to help reduce the impact of flood events and decrease erosion.
- Increase the adoption of land use practices that are better suited to the environment and the hydrological regime.
- Improve communication and cooperation between the local conservation districts, municipalities, and provincial government to better coordinate surface water management activities.

THE DOUGLAS MARSH

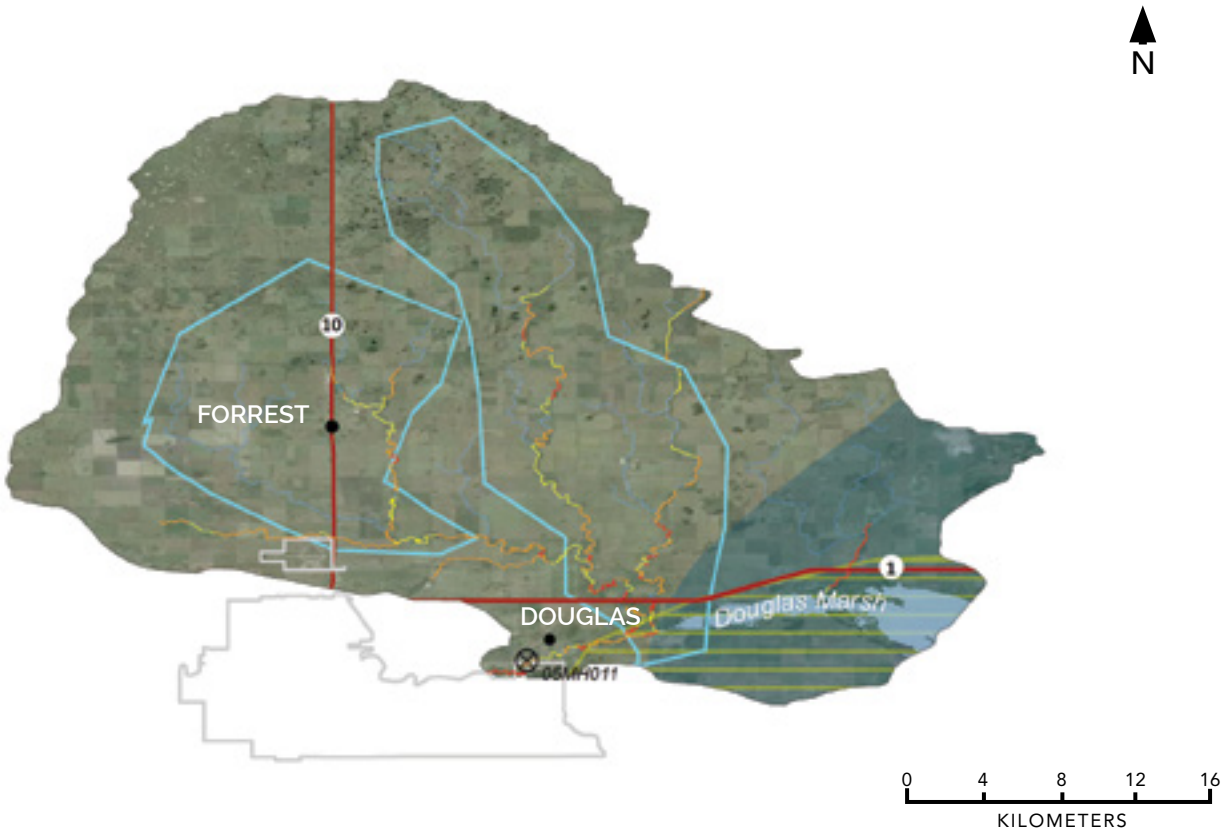
The Assiniboine Delta Aquifer accounts for the presence of many wetland areas in the southern portion of the subwatershed. The Douglas Marsh is a boggy wetland that straddles the subwatershed boundaries between this and the Epinette Creek subwatershed. The Douglas Marsh has the largest concentrations of breeding Yellow Rails in southern Manitoba, and perhaps all of the Canadian Prairie Provinces. It is internationally recognized for its Yellow Rail populations and is designated as an Important Bird Area.

"What used to take one week, now takes one day"
– R.M. of Elton Councillor, commenting on surface water flows of the Willow Creek subwatershed.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Maintain existing drainage infrastructure to original design standard, reconstruct if necessary.	*Municipalities, MIT*
Complete a culvert size and location inventory, and create a drainage standard for the subwatershed with a goal to reduce flow velocities and enhance retention capabilities of the system by 10%.	*Municipalities*, Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District
Develop retention areas, dry dams, riffle structures or other beneficial management practices along smaller tributaries to slow runoff and reduce peak flows	*MAFRD, Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District*
Promote agricultural beneficial management practices that encourage water retention, wetland and natural cover restoration and conservation through incentives, education, and technical assistance.	*Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District*, MAFRD, Conservation Agencies
Adopt erosion control management practices along waterways and drains, where practicable.	*Municipalities*, MCWS - Water Control Works and Drainage Licensing
Provide payments or secure conservation agreements with private landowners to maintain or restore wetlands and riparian areas.	*Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District*, Municipalities, *Conservation Agencies*

* lead organizations have been italized.



PEAK FLOW REDUCTIONS

One of the goals in the subwatershed is to reduce peak flows. The main issue seems to be additional contributions to the system through on farm drainage practices that result in more frequent damages to infrastructure. Lowering the peak flow of water, spreading it over a larger period, and temporarily storing water until peak flows have past, allows for needed drainage activities while reducing the costs associated with replacing valuable infrastructure or causing downstream flooding impacts. Estimations of the amount of upstream water storage needed to reduce peak flows by 10% in the Willow Creek subwatershed has been estimated at 3,652 acre-feet (see table below). Stakeholders within the Willow Creek subwatershed should work towards increasing this target to help mitigate the severity of flooding in a 1 in 10 year event.

STATION NAME	DRAINAGE AREA	1:10 YEAR FLOW		10% REDUCTIONS OF PEAK DISCHARGE	ASSOCIATED STORAGE NEEDED
	(sq.km)	Annual Peak Discharge (cfs)	Hydrograph Volume (ac-ft)	(cfs)	(ac-ft)
Willow Creek (05MH011)	670	2,266	26,063	227	3,652

Analysis results for Willow Creek subwatershed hydrology upstream of index station 05MH011.

LEGEND	ISSUE	RECOMMENDATIONS
Flooding/ Drainage	Increases in upstream drainage network have caused significant water and ice blockages in the spring. Increased drainage, spring melt and heavy rainstorm water flows cause significant damage to municipal infrastructure.	• Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District should encourage the adoption of check dams and small dams to slow water flowing off 1st and 2nd order streams. • Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District and other Conservation Agencies should promote wetland conservation and restoration through incentives,education, and demonstration. • MCWS - Water Control Works and Drainage Licensing should explore implementing policies for wetland consolidation versus drainage within this area as well as a requirement for tile drainage projects to store drained water temporarily until peak flows have passed. • Assiniboine Hills Conservation District will lead in development of small water storage options to stagger flow timing and broaden the peak flows through this area.
Low Moderate Severe Willow Creek Watershed Aquatic Resource Inventory	With increased value for land, livestock operations are confined to riparian areas. Aquatic ecosystem habitat is impaired at 106 locations within this subwatershed. Impariments range from: minor problems like sloughing stream banks (low) to major fish passage barriers (severe).	• Promote and provide technical and financial assistance to producers to implement beneficial management practices that reduce nutrient loading and stream bank erosion such as, rotational grazing, riparian area management, and manure testing. Assiniboine Hills Conservation District will lead or facilitate the completion of these projects in the order recommended by the habitat assessment.
Soil Erosion	Wind erosion problem areas as a result of sandy soils. The drier the conditions, the greater the soil loss risk.	• Encourage the adoption of beneficial management practices to mitigate wind erosion through incentives, demonstration, and education.
Assiniboine Delta Aquifer	Assiniboine Delta Aquifer is a good source of water for many residents. Protection of this natural resource is essential.	• Provide education and awareness on the proper management of private septic systems and the hazards resulting from the releases of nitrates, E-coli, and nutrients. • Provide more education on nutrient management options for crop and livestock producers. Encourage managed livestock grazing, off-site watering, manure management, winter livestock management, and chemical fertilizer management. • Promote the proper removal and disposal of fuel tanks in the Assiniboine Delta Aquifer region.

LINKING TO THE WATER CONTROL WORKS AND DRAINAGE LICENSING SYSTEM

The following are recommendations for conservation districts, municipalities, and other organizations to consider when reviewing or developing water control works and/or drainage projects within the watershed. Responsibility to administer *The Water Rights Act* is held by Manitoba Conservation and Water Stewardship..

- Any new land improvements that involve the alteration of a water body require approval from the Province and will be subject to periodic inspections for continued compliance.
- Maintain no loss policy for seasonal, semi-permanent or permanent wetlands, sloughs, potholes, or other similar bodies of water in the subwatershed. If one acre of wetland is to be compromised, then another acre should be restored somewhere in the subwatershed. Legislation should reinforce the maintenance of wetlands and associated upland cover for the sole purpose of maintaining and increasing water quality and flood protection.
- The project management team has set out targeted water storage goals for the subwatershed. Drainage activities that contribute to peak flows need to pass through temporary water storage sites to mitigate additions to peak flows.
- Water Resource Officers, Conservation Districts and Municipalities should be consulted on drain license applications. These organizations should consider the following when reviewing these applications:

  - **Do not recommend** approval for works such as:
    - Add water at times of peak flow.
    - Increase capacity in upstream tributaries.
    - Disturb natural streams. If natural streams are disturbed, mitigate impacts by completing a riparian improvement project within the subwatershed.

  - **Recommend** approval for works that include:
    - General maintenance of existing drains and culverts.
    - Retain water flows within the Willow Creek system.
    - Store water during spring runoff periods.
    - Reduce erosion within the Willow Creek tributary system.

GOAL

Restore a balance between agriculture and natural areas; conserve all remaining natural areas.

MEASURES OF SUCCESS

- Existing natural areas including forests, riparian areas, wetlands, mixed grass prairie and other sensitive ecosystems will be maintained.
- Degraded riparian habitat along the Willow Creek will be restored. The Assiniboine Hills Conservation District will implement 60% of all high priority projects outlined in the *Willow Creek Watershed Riparian Health Assessment* (2005).
- 25% of private land surrounding the Douglas Marsh will be protected from development.

CONSERVATION OF NATURAL AREAS

ISSUES

- Agricultural intensification has resulted in the loss of natural areas within the Willow Creek subwatershed. Clearing of natural cover and shelterbelts has negatively impacted wildlife and water quality. Agricultural practices have undergone a significant change causing many natural areas to be converted to continuous cropping. As more water moves to local streams rather than being utilized on the landscape, waterways of the Willow Creek are experiencing increased erosion problems.
- Increases in land prices have resulted in pastures being concentrated in riparian areas of the Willow Creek. Wetland drainage has been accelerated by the increased capability of new agricultural equipment and pressures to harvest higher yields.
- In 2002, the *Willow Creek Watershed Aquatic Resource Inventory* found total average phosphorous concentrations within the Willow Creek (0.348 mg/L) were higher than in three other Assiniboine River tributaries (Five-mile Creek – 0.088mg/L, Epinette Creek 0.044mg/L, and the Cypress River 0.087mg/L) and the Assiniboine River (0.151 mg/L). This suggests nutrient enrichment may be a significant stressor in the Willow Creek subwatershed.
- In 2005, North/South Consultant Inc. conducted the *Willow Creek Watershed Aquatic Resource Inventory*. Approximately 129 km of Willow Creek was rated according to aquatic habitat quality. Over half of the reach was considered moderately impacted, 30% was high, 15% was low and 5% was considered severely impacted.
- The Willow Creek subwatershed was once dominated by the mixed-grass prairie ecosystem. Manitoba's mixed-grass prairie ecosystem is composed of shorter species of grass which thrive in more arid conditions, and tall grass species (which are more dominant to the east). These temperate grassland communities occur on well drained, sandy or gravelly soils.
- The majority of the threatened or endangered species in the Willow Creek subwatershed rely on sandy well-drained soils similar to those found within the Assiniboine Delta Aquifer region. The conversion of mixed-grass prairie or pastures to irrigated crop production has posed the most significant challenge to these species.

SOLUTIONS

- Strategies need to be implemented to reduce nutrient loading and increase protection of natural habitat within the subwatershed.
- Management practices, policies and incentives need to be developed to provide a greater balance between agriculture and the environmental needs of the subwatershed.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Promote agricultural beneficial management practices that encourage conservation and restoration of wetland, riparian, and woodland habitat through incentives, education, and technical assistance.	*Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District, MAFRD, Conservation Agencies.*
Provide conservation payments to private landowners to maintain or restore wetlands and riparian areas focusing on upstream areas as a priority (northern portion of the watershed).	Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District, Rural Municipalities, *Conservation Agencies*
Work to conserve Douglas Marsh and its uplands through conservation agreements, conservation payments and/or other land conservation programs.	*Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District,* Rural Municipalities, Conservation Agencies
Complete rehabilitation sites identified in the **Willow Creek Watershed Aquatic Resource Inventory.**	*Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District*
Promote the conservation of habitats that support endangered or threatened species as designated under the *Manitoba Endangered Species Act* and the federal *Species at Risk Act (SARA).*	*Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District,* Rural Municipalities, *Conservation Agencies, MCWS - Biodiversity Habitat and Endangered Species*

* lead organizations have been italized.

WILLOW CREEK WATERSHED AQUATIC RESOURCE INVENTORY

The Willow Creek system is home to an array of aquatic species and ecosystems. Fisheries habitat assessments were conducted in 2005 to investigate the quality of fish habitat, water quality, channel morphology, bank vegetation and barriers to fish migration. This study revealed 106 potential rehabilitation sites in the watershed, and noted that degraded riparian zones due to sedimentation, and unmanaged livestock access to be the main sources impairing habitat quality. Approximately 60% of the issues were anthropogenic in origin.

GOAL

Protect the Assiniboine Delta Aquifer and improve drinking water quality.

MEASURES OF SUCCESS

- The percentage of private wells exceeding the drinking water guidelines for bacterial contamination will be reduced.
- Recommendations for public water system source protection will be completed by 2016.
- All abandoned wells brought forward over the next 10 years will be sealed by conservation districts.

SOURCE WATER PROTECTION

ISSUES

- Groundwater is the source of drinking water for most towns and private residences. Wells that are not properly located, constructed or maintained can lead to potential well water contamination problems.
- Groundwater sources include shallow, sand and gravel aquifers and confined shale bedrock aquifers. Groundwater within this area is generally plentiful but poor quality. This has lead to municipalities seeking other sources (e.g. water pipelines) to provide good quality drinking water.
- Accommodating increasing water demands on the Assiniboine Delta Aquifer while maintaining and protecting the ability of the aquifer to support human and environmental needs is a main concern for residents. The porous nature of the soils over the aquifer and proximity of the water table to land surface in some areas make the aquifer highly susceptible to contamination from sources such as: sewage, petroleum products, fertilizers, manure, and pesticides.

SOLUTIONS

- Clean, potable drinking water is critical for human life. Protecting water at its source, or before it arrives at treatment facilities, is a preventative approach to water management. Source water protection also provides benefits to aquatic ecosystems, supports recreational and wildlife values, and ensures sustainability for future generations.

There are three steps to protecting well water:

- Protect the well water at the ground surface by avoiding, eliminating, or reducing contaminants;
- Inspect the well regularly and keep it in good running order; and
- Test the well water regularly and respond to contamination problems.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Provide education on well head management.	*Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District*, MCWS - Groundwater Mangement Section, Office of Drinking Water
Locate the well at a safe distance from potential sources of contamination and in an area away from surface water runoff.	*Landowners, certified well drillers*
Ensure wells within any designated flood area have adequate well head protection to protect flood waters from entering the well directly.	*Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District*, MCWS - Groundwater Management Section
Ensure abandoned wells are properly sealed to provincial requirements.	Assiniboine Hills Conservation District, Little Saskatchewan River Conservation District, MCWS – Groundwater Management Section
Promote the development of rural water pipelines in areas designated for new and existing residential development. Require water soft paths planning and water conservation methods in development of water expansion process and prior to water hook-up.	*Manitoba Water Services Board*, Municipalities

* lead organizations have been italized.

RECOMMENDATIONS FOR PUBLIC WATER SYSTEMS

In Manitoba, the Office of Drinking Water defines a public water system as a potable supply of drinking water with 15 or more connections. The Willow Creek subwatershed contains two public water systems: the community of Chater and Campbell's Mobile Home Park. Public drinking water for much of this subwatershed is also obtained from the Whitehead Elton Regional Public Water System. This public water system sources drinking water from two wells near Alexander to supply the community of Forrest and surrounding area.

RECOMMENDATIONS	ORGANIZATION
The Campbell's Mobile Home Park public water system supplies 300 residents with treated water drawn from one well located southwest of the mobile home park. The groundwater source for Chater well is located within 0.5 km of Campbell's Mobile Home Park well. Because of its shallow depth, the Chater PWS is designated as a GUDI system (Groundwater Under the Direct Influence of surface water) meaning it is vulnerable to contamination by surface waters. There may be a potential for this source to be hooked up with the Chater system once it is upgraded. Recommended actions and policies for the area within 1.5 km of the Campbell's Mobile Home Park well head include:	
Repair fence around well head and pump house. Ensure sanitary seal is secure and in good condition.	*Public water system owner*
Decommission mines. Prohibit any further gravel extraction. If gravel extraction cannot be prohibited, ensure extraction is done with consideration of local water system.	*Municipality, Manitoba Mineral Resources*
Ensure a proper manure storage plans are in place and septic systems are well managed.	*MCWS – Environmental Compliance & Enforcement*
Ensure an emergency response plan is developed for the system.	*Public water system owner, MCWS – Office of Drinking Water*
Seal unused, abandoned and poorly constructed wells that are located within the source water protection zone (1.5 km buffer around wellhead).	*Assiniboine Hills Conservation District*
The Chater public water system supplies 100 residents with treated water drawn from one well located on the east side of the town. The well was completed in 1989 with a well depth of 7.9 m, and the depth to groundwater at 3 m below the surface of the ground. Because of its shallow depth, the Chater well is designated as a GUDI system (Groundwater Under the Direct Influence of surface water) meaning it is vulnerable to contamination by surface waters. A tank loader system also provides water from the source well, making the well vulnerable to potential back-siphoning contamination. Recommended actions and policies for the source water protection zone within 1.5 km of the Chater well head include:	
If available develop a new well that is not directly under the influence of surface water. Develop a separate well for tank load use including installation of backflow prevention device to prevent groundwater contamination.	*Public water system owner*
Maintain hay land 100 meters around well head.	*Landowner*
Decommission mines. Prohibit any further gravel extraction. If gravel extraction cannot be prohibited, ensure extraction is in compliance with Environment Act.	*Municipality, Manitoba Mineral Resources*, MCWS - Environmental Compliance & Enforcement
Ensure a proper manure storage plans are in place and septic systems are well managed.	*MCWS – Environmental Compliance & Enforcement*
Ensure an emergency response plan is developed for the system.	*Public water system owner*, *MCWS – Office of Drinking Water*
Seal unused, abandoned and poorly constructed wells that are located within the source water protection zone (1.5 km buffer around wellhead).	*Assiniboine Hills Conservation District*

* lead organizations have been italized.

LINKING TO DEVELOPMENT PLANNING

Proposed for adoption in the Cypress, South Central, and 23 West development plans or incorporation into local municipal policies:

- Adopt policies for a minimum setback distance of 50 m for new development or buildings along streambanks of Class 3 and higher waterways.

- Value and maintain wetlands. Ensure wetlands are considered in all land management decisions. If an acre of wetland is to be compromised, then another acre should be restored somewhere in the subwatershed. Policy should reinforce the maintenance of wetlands and associated upland cover for the purposes of maintaining and increasing water quality as well as reducing downstream flood impacts.

- New land development including mining and agricultural operations surrounding Douglas Marsh should be prohibited to prevent contamination of the Assiniboine Delta Aquifer.

- Promote the development of rural water pipelines in areas designated for residential development.

- Municipalities should seek technical assistance to develop options to stay within the recommended 1 in 4 year drainage standard, prior to upgrading existing infrastructure. Existing infrastructure will be maintained when necessary.

- Intensive and high-pollution risk development activities - (land uses and structures that have a high risk of causing pollution and include, but are not limited to chemical/ fertilizer storage facilities, disposal fields, fuel tanks, waste disposal grounds, wastewater treatment facilities) will be restricted in public drinking water source zones and Douglas Marsh. Where restriction is not possible, development may be considered in public drinking water source zones provided:

    - The proponent can prove by adequate engineering or hydro-geological investigation that the proposed activity will not cause pollution of the public drinking water supply or;

    - Appropriate precautionary measures have been taken to sufficiently mitigate the risk of endangering the quality of the water supply for public drinking water supply purposes.

- To prevent significant surface water quality and drinking water quality deterioration, developments in or near surface waters and riparian areas will be restricted, or limited, if they:

    - lead to the contribution of nutrients, pathogenic organisms, deleterious chemicals or materials to these waters;

    - accelerate erosion and bank instability;

    - cause the removal of natural vegetative cover; and/or

    - may have an impact on in-stream flows needed to maintain healthy aquatic ecosystems.

EPINETTE CREEK SUBWATERSHED

OVERVIEW

- The Epinette Creek has the smallest drainage area of any subwatershed in the Central Assiniboine and Lower Souris River watershed (410 km^2 or 158 mi^2). Other than the Epinette Creek and the Assiniboine River, there is little surface runoff in this subwatershed and consequently a minimal waterway network as most rainfall and snow melt infiltrate.
- The Epinette Creek subwatershed is characterized by relatively flat topography.
- Annual runoff volume for the Epinette Creek is mainly fed by the Assiniboine Delta Aquifer via springs. Groundwater springs throughout the creek bed provide significant flow and thus have a much more consistent flow throughout the summer months than other waterways within the watershed.
- As a result of a minimal waterway network in the subwatershed, there were not any public issues or concern related to surface water management.
- Water erosion risk is minimal in the Epinette Creek subwatershed. Coarse textured soils and minimal gradients allow most of the rainfall that reaches the ground and most snow melt to infiltrate, rather than running along the surface.
- The majority land within the Epinette Creek subwatershed has marginal to poor agricultural capabilities at Class 4 or higher. These soils can be managed and productive with irrigation. Class 1, 2 and 3 soils are concentrated along the Assiniboine River riparian area as well as the southern and northern portions of the subwatershed around Glenboro and Carberry.
- On private land, dry land agriculture and livestock operations are extensive. Irrigated land makes up around one per cent of the total farmland in the entire Central Assiniboine and Lower Souris River Watershed - the majority of which falls in the Epinette Creek subwatershed.
- The Epinette Creek subwatershed represents 10% of the area of the Assiniboine Delta Aquifer and is entirely underlain by the aquifer. The unsaturated thickness ranges from zero at the Devils Punchbowl and Douglas Marsh to a maximum of about 70 feet. The Assiniboine Delta Aquifer is the main groundwater supply in the subwatershed. In addition to domestic use, groundwater discharge from the ADA provides significant base flow to rivers and streams and contributes water to marshes and wetlands. Groundwater flow within the portion of the aquifer located in the subwatershed is generally towards the Assiniboine River.
- There is one public water system in the subwatershed that provides drinking water for approximately 50 residents sourced from groundwater aquifers.
- Flora and fauna within both the Douglas Marsh and the Devils Punch Bowl are particularly dependent on the aquifer's water table

which is exposed at the surface. The Douglas Marsh is a boggy wetland that straddles the subwatershed boundaries between this and the Willow Creek subwatershed. The Douglas Marsh has the largest concentrations of breeding Yellow Rails in southern Manitoba and as such is recognized internationally an Important Bird Area.

- Swan Lake First Nation maintains an Indian Reserve of 6,514 acres of land situated between Canadian Forces Based Shilo and Spruce Woods Provincial Park. Significant historical and ecological work has been done in the area to map out important cultural and environmental sites to the Swan Lake First Nation.
- Few water bodies within this subwatershed have an adequate capability to support fish habitat. Canadian Forces Base Shilo conducted fish species studies on Sewell Lake and Epinette Creek respectively. Sewell Lake species included central mudminnows, Iowa darters, and northern pike. Northern pike was also found in Epinette Creek along with Brook Sticklebacks. Those species provide forage fish upon which the predacious fish of the Assiniboine River depend.
- There are eight wastewater treatment lagoons in the Epinette Creek subwatershed.

Coarse-textured soils and minimal gradients allow most of the snow melt and rainfall to infiltrate. Surface water management is not a concern for this subwatershed.

GOAL

Natural areas should be protected and restored to maintain habitat for at-risk-species.

MEASURES OF SUCCESS

- Existing natural areas including forests, riparian areas, wetlands, mixed grass prairie and other sensitive ecosystems will be maintained.
- Hectares of designated conserved natural areas will be increased.
- 30% of private lands will be protected from development.

The Assiniboine Delta Natural Region supports some of the last remaining intact habitats found in southwest Manitoba including mixed grass prairie, river bottom forests, wetlands, and sand hill habitats. These lands have high ecological significance as they provide habitat for a high concentration of federally and provincially listed threatened and endangered species.

CONSERVATION OF NATURAL AREAS

ISSUES

- The Epinette Creek subwatershed is characterized by sandy soils which are susceptible to wind erosion. Wind erosion can be a serious concern for producers growing annual crops, as it removes topsoil and nutrients, thus reducing the soil's ability to produce crops.
- In some instances, such as the Spruce Woods Provincial Park Spirit Sands area, sand dunes are moved along by the prevailing northwesterly winds and cover everything in their paths. Since this is a natural process and this part of the park is designated as a Protected Area, this is accepted. The concern now is that the area is being stabilized by brush encroachment leading to a shift away from desert habitat.
- The sandy soils found within this subwatershed also provide significant niche habitats to many endangered or threatened species in Manitoba which are unique to this area. The majority of the threatened or endangered species in the Epinette Creek subwatershed rely on sandy well drained soils similar to those found within the Assiniboine Delta Aquifer region.
- Soil type and proximity to a good source of water within the area provides ideal conditions for irrigated crop production. The conversion of natural cover to irrigated cropland has posed the most significant challenge to native species within the area because they are adapted to live in these desert-like conditions - an ecosystem that is not found elsewhere in the province.
- Leafy spurge can be found in pastures, fields, roadsides, ditches, native prairie and riparian areas. It thrives in sandy soils of moderate moisture, like those characteristic of the Epinette Creek subwatershed. Leafy spurge's aggressive growth habits and lack of natural predators allow it to easily displace native vegetation. The result is reduced species diversity and habitat value.
- The Assiniboine Delta Aquifer is a natural asset to the Central Assiniboine and Lower Souris River Watershed. The land area within the Epinette Creek subwatershed is important for recharge potential of the aquifer. Due to the porous nature of the soils over the aquifer, susceptibility to contamination is high. Protecting the aquifer supply and quality requires protecting the natural cover on the surface above the aquifer.

SOLUTIONS

- Management practices, policies and incentives need to be developed to provide a greater balance between agriculture and the environmental needs of the subwatershed; - specifically due to the specialized niche habitats, susceptibility to wind erosion, and susceptibility of the Assiniboine Delta Aquifer to contamination.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	LEAD ORGANIZATION
Promote agricultural beneficial management practices that encourage continued healthy levels of wetland, riparian, woodland, and grassland habitat through, incentives, education, and technical assistance.	*MAFRD, Assiniboine Hills Conservation District*, Conservation Agencies
Provide payments or secure conservation agreements with private landowners to maintain or restore riparian, wetland, woodland, and grassland areas.	*Assiniboine Hills Conservation District*, Rural Municipalities, *Conservation Agencies*
Promote the conservation of habitats that support endangered or threatened species as designated under the *Manitoba Endangered Species Act* and the federal *Species at Risk Act* (SARA).	*Assiniboine Hills Conservation District*, Rural Municipalities, *Conservation Agencies, Swan Lake First Nation, MCWS - Biodiversity, Habitat and Endangered Species*
Complete a riparian health assessment along the Assiniboine River. Implement recommendations through incentive, education, and technical assistance programs.	*Assiniboine Hills Conservation District*, Conservation Agencies
Support government efforts to protect ecologically important habitats on Crown lands. Identify natural areas for inclusion in the Province's protected areas network.	MCWS - Protected Areas Initiative, Wildlife Branch, Provincial Parks. *Assiniboine Hills Conservation District*
Continue with support from local area residents for park improvement and planning.	*MCWS – Spruce Woods Provincial Park*
Promote agricultural beneficial management practices that encourage continued healthy levels of vegetative cover on highly erodible soils through, incentives, education, and technical assistance	*Assiniboine Hills Conservation District, MAFRD*
Promote the establishment and maintenance of shelterbelts on highly erodible soils through incentives and technical assistance.	*Assiniboine Hills Donservation District, MAFRD*
Explore new environmentally responsible ways to control invasive species threatening natural areas such as leafy spurge.	Local Weed District, Assiniboine Hills *Conservation District, Municipalities, Swan Lake First Nation*, Conservation Agencies
Development of waste water systems and disposal of effluent needs to recognize the special soil conditions and aquifer recharge capabilities characteristic of this subwatershed.	*Municipalities, Swan Lake First Nation*, MCWS

* lead organizations have been italized.

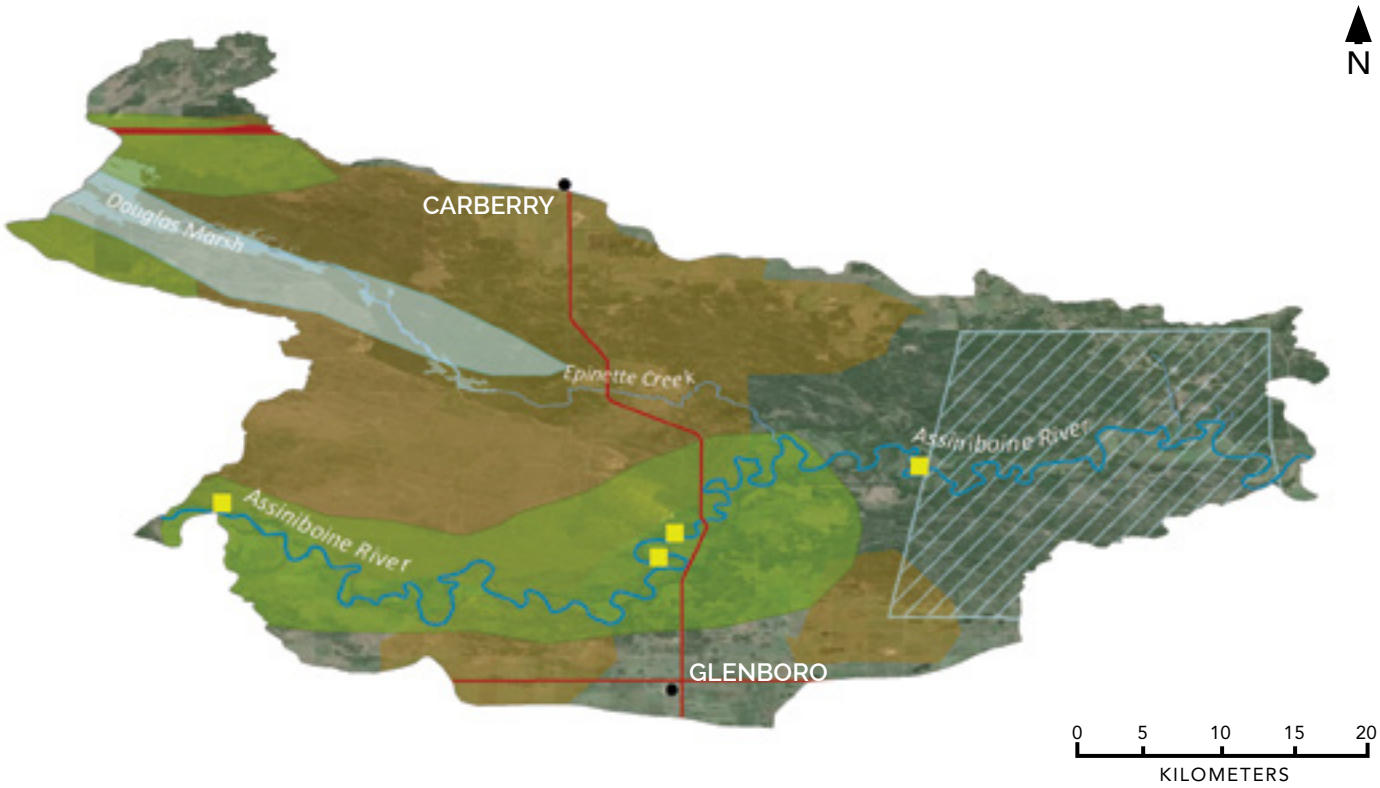
THE DOUGLAS MARSH

The Assiniboine Delta Aquifer accounts for the presence of many wetland areas in the southern portion of the subwatershed. The Douglas Marsh is a boggy wetland that straddles the subwatershed boundaries between this and the Willow Creek subwatershed. The Douglas Marsh has the largest concentrations of breeding Yellow Rails in southern Manitoba, and perhaps all the Canadian Prairie Provinces. It is internationally recognized for its Yellow Rail populations and is designated as an Important Bird Area.

SWAN LAKE FIRST NATION

Swan Lake First Nation maintains an Indian Reserve of 6,514 acres of land situated between Canadian Forces Base Shilo and Spruce Woods Provincial Park. The land was originally purchase in 1995 for a potato operation and the preservation and conservation of the natural habitat and cultural values including the Yellowquill Trail. In 2005, the land was established as an Indian Reserve, and in 2010, received land code designation in 2010 under the *First Nations Land Management Act*. The Swan Lake First Nation no longer runs the potato operation, however manages a bison ranch and hayland in the area. Significant historical and ecological work is being done in the area to map out important cultural and environmental sites important to the Swan Lake First Nation.and Resources.

CONSERVATION OF NATURAL AREAS IN ACTION



LEGEND	ISSUE	RECOMMENDATIONS
Soil Erosion	Sandy soils make this area prone to wind erosion. The drier the conditions, the greater the risk of soil loss.	• Encourage the adoption of wind erosion mitigation beneficial management practices that mitigate wind erosion through incentives,, demonstration and education.
Erosion/Flooding	During heavy rainstorms water flows can cause beaver dam washouts which result in significant erosion and flooding.	• Encourage the adoption of beaver dam stabilizers to limit water levels and wash outs on beaver dams in the area.
Douglas Marsh	Douglas Marsh is an exposed area of the Assiniboine Delta Aquifer. It is also designated as an Important Bird Area.	• Provide payments or secure conservation agreements with private landowners surrounding Douglas Marsh to preserve native cover and protect water quality of the aquifer.
Critical Habitat	Critical habitat sites identified by stakeholders as high priority for conservation.	• Promote habitat conservation and restoration through incentives, education, and demonstration. • Ensure Crown lands continue to be managed in an environmentally sustainable manner to minimize potential impacts on critical habitats.
Erosion	Erosion sites identified by watershed stakeholders as high priority for reclamation.	• Tools to fix these sites will include reclamation of permanent cover (trees, forage), installation of rip-rap or stream bank stabilization, and sloping existing stream banks.

GOAL

Maintain source water quality and quantity throughout the Epinette Creek subwatershed.

MEASURES OF SUCCESS

- The percentage of private wells exceeding the drinking water guidelines for bacterial contamination will be reduced.
- Recommendations for public water system source protection will be completed by 2016.
- The conservation districts will seal all abandoned wells brought forward over the next 10 years.

SOURCE WATER PROTECTION

ISSUES

- In the Epinette Creek subwatershed, groundwater is the source of drinking water for all towns and private residences. The groundwater is generally drawn from the sand and gravel deposits of the Assiniboine Delta Aquifer. Accommodating increasing water demands on the Assiniboine Delta Aquifer while maintaining and protecting the ability of the aquifer to support human and environmental needs in a sustainable manner was a main concern for residents.
- The porous nature of the soils over the aquifer and the proximity of the water table to land surface in some areas make the aquifer highly susceptible to contamination from sources such as: sewage, petroleum products, fertilizers, manure, and pesticides. Wells that are not properly located, constructed or maintained can lead to potential well water contamination problems.
- Increasing water demands on the aquifer is a concern for subwatershed residents. Recently, the number of requests for water use licenses have increased. Available allocations for the Assiniboine Delta Aquifer are almost completely allocated in 3 of the 5 sub-basins occurring in this subwatershed.

SOLUTIONS

- Maintain and protect the ability of the Assiniboine Delta Aquifer to support human and environmental needs in a sustainable manner.
- Clean, potable drinking water is critical for human life. Protecting water at its source, or before it arrives at treatment facilities, is a preventative approach to water management. Source water protection also provides benefits to aquatic ecosystems, supports recreational and wildlife values, and ensures sustainability for future generations.

ASSINIBOINE DELTA AQUIFER WATER ALLOCATION

Local groundwater availability and usage of the ADA is based on aquifer sub-basins, five of which are located in the Epinette Creek subwatershed: Epinette Creek North, Epinette Creek South, Assiniboine West, Assiniboine South and Assiniboine East. The allocation limit for groundwater use in each sub-basin is based on the aquifer's available yield. Licensing is based on 50% of the available yield (Table 1). The remaining 50% is reserved for the environment and domestic users. This approach of aquifer management has provided sustainable development for domestic, municipal, industrial, commercial, and agricultural use within the watershed.

SUB-BASIN	AVAILABLE YIELD	ALLOCATION LIMIT	ANNUAL ALLOCATION	AVAILABLE ALLOCATION
Epinette Creek North	18,000	18,000	8,953	47
Epinette Creek South	335	167	128	39
Assiniboine West	8,256	4,128	4,148	0
Assiniboine South	2,866	1,433	21	1,412
Assiniboine East	15,900	7,950	256	7,694

Allocation status (acre-feet/year).

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Provide education on well head management. Provide incentives to upgrade existing private wells and improve well head protection (caps, grass seed, pit replacement, slope contours).	*Assiniboine Hills Conservation District*, MCWS - Office of Drinking Water
Locate the well at a safe distance from potential sources of contamination and in an area away from surface water runoff.	*Landowners, certified well drillers*
Ensure abandoned wells are properly sealed to provincial requirements.	*Assiniboine Hills Conservation District*, MCWS – Groundwater Management Section
Promote agricultural beneficial management practices that encourage continued healthy levels of natural habitat on private land above the ADA through, incentives, education, and technical assistance.	*Assiniboine Hills Conservation District, MAFRD,* Conservation Agencies
Promote appropriate tillage practices, managed grazing systems, sowing of permanent cover, remote watering systems, fencing off exposed groundwater from cattle and other appropriate beneficial management practices that encourage groundwater quality protection on private land above the Assiniboine Delta Aquifer through, incentives, education, and technical assistance.	*MAFRD, Canada-Manitoba Crop Diversification Centre, Assiniboine Hills Conservation District,* Conservation Agencies
Provide payments or secure conservation agreements with private landowners to maintain natural areas.	*Assiniboine Hills Conservation District, Conservation Agencies*
Promote the proper removal and disposal of fuel tanks on the Assiniboine Delta Aquifer. Ensure petroleum pipelines have appropriate emergency measures plans to protect the aquifer from potential contamination.	*Green Manitoba, Assiniboine Hills Conservation District, Agriculture and Irrigation, Oil and Gas Industry*
Promote and provide workshops for the development of water soft path plans for municipalities exploring connections to rural water pipelines.	*Assiniboine Hills Conservation District*, Municipalities
Promote agriculture beneficial management practices that increase water efficiency for irrigation through, incentive, education, and technical assistance.	*Irrigation Industry, McCains Ltd., MAFRD*
Maintain current practices of regulating water use from the Assiniboine Delta Aquifer based on 50% of available yields.	*MCWS - Water Use and Licensing*

* lead organizations have been italized.

RECOMMENDATIONS FOR PUBLIC WATER SYSTEMS

In Manitoba, the Office of Drinking Water defines a public water system as a potable supply of drinking water with 15 or more connections. The Epinette Creek subwatershed contains one public water system: Spruce Woods Mobile Home Park.

RECOMMENDATIONS	ORGANIZATION
The Spruce Woods Mobile Home Park Public Drinking Water System provides 50 residents with drinking water. Currently there are 17 water hook ups to this system. Once this system reaches below 15 hook ups it will change classification to a semi-public water system. Recommended actions and policies for the source water protection area within 1.5 km of the well head include:	
Properly seal the two abandoned sandpoint wells located in the floor of the treatment plant	Conservation District
Distribute publications that educate landowners on proper septic system maintenance throughout the source water protection area.	Conservation District
Ensure an emergency response plan is in place for the Spruce Woods Mobile Home Park Public Water System.	MCWS – Office of Drinking Water
Seal unused, abandoned and poorly constructed wells that are located within the source water protection zone.	Conservation District, Municipality

* lead organizations have been italized.

LINKING TO DEVELOPMENT PLANNING

Proposed for adoption in the local development plans:

- Wells within a designated flood area should have adequate well head protection to ensure flood waters do not enter the well directly.

- Intensive and high-pollution risk developments (developments, activities, land uses, and structures that have a high risk of causing contamination and include, but are not limited to chemical and fertilizer storage facilities, septic fields and tanks, fuel tanks, waste disposal grounds and sewage treatment facilities) should be restricted in source water protection areas for the Epinette subwatershed. Where restriction is not possible, or where development is not within a public drinking water source area, development may be subject to:

    - Demonstration by the proponent that no significant negative effect on water is likely to occur;

    - The implementation of mitigation measures and alternative approaches that protect, improve or restore these areas; and,

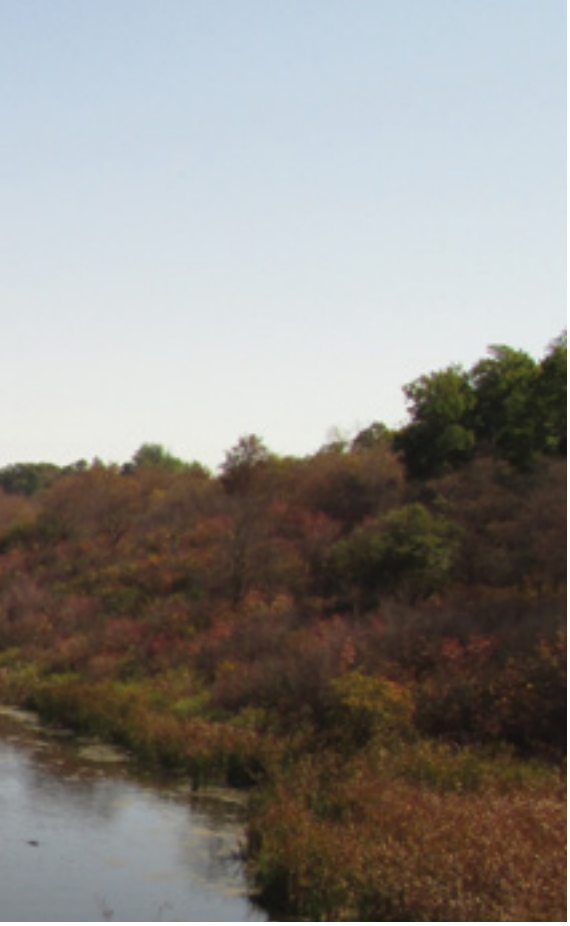
    - The preparation of a strategy for mitigation in the event that negative impacts do occur.

- Adopt policies for the mandatory sealing of wells in areas that become serviced by public water systems.

CYPRESS RIVER SUBWATERSHED

OVERVIEW

- The Cypress River subwatershed drains 810 km^2 (313 mi^2) of land into the Assiniboine River. The Cypress River is known for its winding and bending characteristics and elevation drops of 3.2 m per kilometre of stream. Elevation in the Cypress River subwatershed descends from 500 m (1,640 ft) in the south of the watershed to 305 m (1,000ft) where the Cypress River meets the Assiniboine River.
- The majority of the subwatershed south of PTH 2 is considered a high or severe water erosion risk area.
- Pockets with marginal to poor agricultural capabilities are focused in the Bruxelles area and the northern part of the subwatershed around Spruce Woods Provincial Park.
- In 2006, agriculture was the dominant land use at (68,900 ha) of the subwatershed - annual croplands at 60% (48,940 ha), grasslands/pasture 16% (13,720 ha), and forage land cover 8%. Urban cover was 4% while trees, water, and wetlands compose the remaining 12%.
- Waterways within the Cypress River subwatershed support smaller fish species. White suckers and fathead minnows are the most common fish within the subwatershed and provide a large biomass of forage fish for the predacious fish of the Assiniboine River.
- The Cypress River subwatershed was once dominated by the mixed grass prairie ecosystem. These temperate grassland communities occur on well-drained, sandy or gravelly soils. The mixed grass prairies support increasingly threatened species designated under Manitoba's *Endangered Species Act* (ESA) and the federal *Species at Risk Act* (SARA).
- There are three public water systems in the subwatershed that provide drinking water for approximately 2,300 residents. All three systems get their source water from groundwater aquifers.
- There are four wastewater treatment lagoons in the Cypress River subwatershed.
- Residents not currently connected to a public water system get their drinking water from private or semi-public sources (groundwater sourced).
- The Cypress River subwatershed has three main aquifers;
    - Odanah Shale Aquifer (shale bedrock aquifer) – generally good availability but slightly saline
    - Assiniboine Delta Aquifer (a small portion of this unconfined sand and gravel aquifer occurs in the north western portion of the subwatershed) - good quality
    - Lenses of sand and gravel (which typically occur in glacial till and other surficial deposits)



GOAL

Reduce peak flows to reduce downstream erosion.

MEASURES OF SUCCESS

- Surface water management decisions will be made on a watershed basis with consideration of downstream impacts.
- Existing peak flows on all tributaries entering the Cypress River will be maintained or reduced.
- Current capacity of municipal surface water management infrastructure will be maintained while water retention capacity will be increased in key areas.
- Water storage capacity will be increased by 2,785 acre-feet upstream and 5,515 acre-feet downstream of hydrometric station 05MH008 (Cyress River).

SURFACE WATER MANAGEMENT

ISSUES

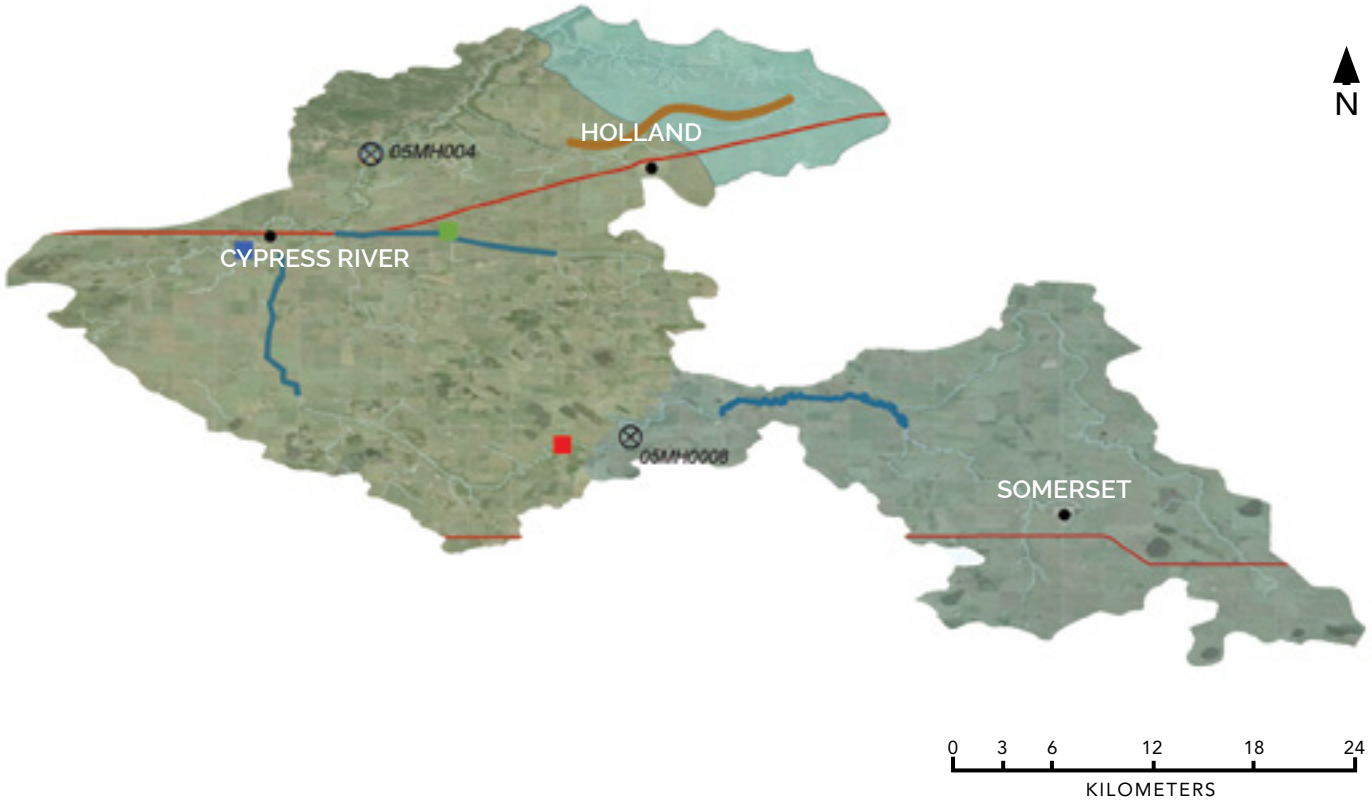
- During public consultations it was noted that the frequency and extent of flooding has increased due to a combination of wetland drainage, farming too close to the Cypress River and wetter conditions over the last 10 years. Expanded agricultural drainage development in upstream portions of the Cypress River subwatershed contribute to spring and summer flood events that damage municipal infrastructure, cause significant erosion and frustrate landowners in the downstream portions of the subwatershed. Agricultural operations are expanding into the Cypress River flood plain, putting increased pressure on farmers to get the water off of the land as quickly as possible.
- Increased removal of natural vegetation, grading of land surfaces, and drainage improvements has increased runoff volumes, and shortened runoff time into streams from rainfall and snowmelt. The peak discharge, volume and frequency of flooding and erosion have increased in and along the Cypress River.

SOLUTIONS

- Protecting natural water retention areas and creating management policies that allow for natural stream processes and broaden the timing of runoff will help to reduce the impacts of flood events and erosion.
- Encourage the adoption of land use practices that better suit the environment and the hydrological regime.
- Management practices, policies and incentives need to be developed to provide a greater balance between agriculture and the environmental needs of the subwatershed.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Maintain existing drainage infrastructure to original design standard, reconstruct if necessary.	*Municipalities, Manitoba Infrastructure and Transportation*
Municipalities should complete a culvert size and location inventory, and create a drainage standard for the subwatershed with a goal to reduce flow velocities and enhance retention capabilities of the system by 10%.	*Municipalities*, Assiniboine Hills Conservation District, LaSalle Redboine Conservation District, Pembina Valley Conservation District
Develop retention areas, dry dams, riffle structures or other beneficial management practices along small tributaries to slow runoff and reduce peak flows.	*Assiniboine Hills Conservation District, LaSalle Redboine Conservation District, Pembina Valley Conservation District*, Conservation Agencies
Provide conservation agreements and payments for water retention, wetland or natural cover restoration or conservation. Consider addressing through the tax system.	*Assiniboine Hills Conservation District, LaSalle Redboine Conservation District, Pembina Valley Conservation District, Conservation Agencies*, Municipalities
Promote agricultural beneficial management practices that encourage water retention, wetland and natural cover restoration and conservation through incentives, education, and technical assistance.	*Assiniboine Hills Conservation District, LaSalle Redboine Conservation District, Pembina Valley Conservation District*, Conservation Agencies, *MAFRD*
Adopt erosion control management practices along waterways and drains.	*Municipalities*



PEAK FLOW REDUCTIONS AND SOLUTIONS

One of the goals in the subwatershed is to reduce peak flows. The main issue seems to be additional contributions to the system through on farm drainage practices that result in more frequent damages to infrastructure. Lowering the peak flow of water, spreading it over a larger period, and temporarily storing water until peak flows have passed, allows for needed drainage activities while reducing the costs associated with replacing valuable infrastructure or causing downstream flooding impacts. The amount of upstream water storage needed to reduce peak flows by 10% has been calculated at two points within the Cypress River subwatershed (see table below). Stakeholders within the Cypress River subwatershed should work towards these water storage goals to help reduce the frequency and severity of flooding in a 1-in-10 year event.

STATION NAME	DRAINAGE AREA	1:10 YEAR FLOW		10% REDUCTIONS OF PEAK DISCHARGE	ASSOCIATED STORAGE NEEDED
	(sq.km)	Annual Peak Discharge (cfs)	Hydrograph Volume (ac-ft)	(cfs)	(ac-ft)
Cypress River upstream 05MH008	274	1,641	24,575	164	2,785
Cypress River upstream 05MH004	540	2,061	48,494	260	5,515

Analysis results for Cypress River subwatershed hydrology upstream of index station 05MH008 and 05MH004.

LEGEND	ISSUE	RECOMMENDATIONS
Salinity	Saline areas exist as a result of water sitting close to PTH 2. The wetter the conditions, the greater the salinity issue.	• LaSalle Redboine Conservation District and MAFRD will encourage the adoption of salinity beneficial management practices to manage saline areas. • LaSalle Redboine Conservation District and MAFRD will encourage test plots to determine most suitable type of vegetation to minimize salinity issues. • LaSalle Redboine Conservation District will encourage the implementation of upstream water storage projects.
Flooding and erosiion	Spring melt and heavy rainstorm water flows cause significant erosion and flooding.	Water storage goals upstream of 05MH008 have been calculated. Working toward gaining the additional outlined water storage in area through temporary or permanent measures will help to slow the flow of water movement and generate extra time for run-off downstream. Efforts should be made by the Assiniboine Hills, LaSalle Redboine and Pembina Valley Conservation Districts, as well as MAFRD, and MWCS - Water Control Works and Drainage Licensing to: • Encourage the adoption of check dams and small dams to slow water flowing off 1st and 2nd order streams. • Promote wetland conservation and restoration through incentives, education, and demonstration. • Explore wetland consolidation versus wetland drainage within this area. Requirements for tile drained areas to store water coming off the fields.
Tiger Creek Drain	Land surrounding the Tiger Creek Drain commonly floods. Flooding causes significant weed problems for local farmers.	• MIT should restore the Tiger Creek Drain to its original design standard. Culvert replacements are needed.
Bridges	Bridges are commonly flooded by spring runoff events.	• RM of Lorne to replace bridge infrastructure.
Bear Paw Gulch	Spring melt and heavy rainstorm water flows cause significant erosion and flooding in the Bear Paw Gulch area.	• LaSalle Redboine Conservation District, MAFRD, and MCWS should encourage the adoption of check dams and small dams to slow water flowing off 1st and 2nd order streams. • LaSalle Redboine Conservation District, MAFRD, and Conservation Agencies should promote wetland conservation and restoration through incentives, education and demonstration. • MCWS - Water Control Works and Drainage Licensing should explore wetland consolidation versus wetland drainage within this area. Requirements for tile drained areas to store water coming off the fields should also be explored.
Flooding/ Drainage	During spring melt and heavy summer rains agricultural lands commonly flood in this area due to topography and increased upstream drainage.	Water storage goals upstream of 05MH008 have been calculated. Working towards gaining the additional outlined water storage in area through temporary or permanent measures will help to slow the flow of water movement and generate extra time for run-off downstream. Efforts should be made to: • Pembina Valley Conservation District to lead in development of small water storage options to stagger flow timing and broaden the peak flows through this area.

LINKING TO THE WATER CONTROL WORKS AND DRAINAGE LICENSING SYSTEM

The following are recommendations for conservation districts, municipalities, and other organizations to consider when reviewing or developing water control works and/or drainage projects within the watershed. Responsibility to administer *The Water Rights Act* is held by Manitoba Conservation and Water Stewardship.

- Any new land improvements that involve the alteration of a water body require approval from the Province and will be subject to periodic inspections for continued compliance.

- The project management team has set out targeted water storage goals for the subwatershed. Drainage activities that contribute to peak flows need to pass through temporary water storage sites to mitigate additions to peak flows.

- Water Resource Officers, Conservation Districts and Municipalities should be consulted on drain license applications. These organizations should consider the following when reviewing these applications:

- **Do not recommend** approval for works such as:
  - Add water at times of peak flow.
  - Increase capacity in upstream tributaries.
  - Disturb natural streams. If natural streams are disturbed, mitigate impacts by completing a riparian improvement project within the subwatershed.

- **Recommend** approval for works that include:
  - General maintenance of existing drains and culverts.
  - Retain water on the land for a period of time specifically during spring runoff periods. An indicator like the amount of flow or water elevation at a downstream culvert should be selected to set when the control can be released upstream. This should be written into a license so that all parties can understand the timing of the release.

GOAL

Conserve and restore the quality and integrity of natural areas.

MEASURES OF SUCCESS

- Existing natural areas including forests, riparian areas, wetlands, mixed-grass prairie and other sensitive ecosystems will be maintained.
- Degraded riparian habitat along the Cypress River will be restored. The Assiniboine Hills, Pembina Valley, and LaSalle Redboine Conservation Districts will undertake a riparian habitat assessment by 2017. By 2020, all high priority projects will be completed.
- Crown lands will be maintained. Crown lands with mixed-grass prairie habitat will be managed to conserve ecosystem diversity.

CONSERVATION OF NATURAL AREAS

ISSUES

- From 1970 to 2012, total phosphorous and nitrogen concentrations have increased in the Cypress River and on average concentrations were much higher compared to the Assiniboine River in Brandon. Total phosphorous and nitrogen concentrations also show significant seasonal variation, with typically greater concentrations during the spring and early summer months than the rest of the year; seasonal variations are likely caused by human activities on the landscape.
- Increases in crop prices and lower cattle prices have shifted pasture areas to land less suitable for crop production, including to riparian areas of the Cypress River. Treed areas are relatively nonexistent other than areas where natural cover is protected like Spruce Woods Provincial Park and Forest.
- The Cypress River subwatershed was once dominated by the mixed-grass prairie ecosystem. These temperate grassland communities occur on well-drained, sandy or gravelly soils. The mixed-grass prairies support increasingly threatened species designated under Manitoba's *Endangered Species Act* (ESA) and the federal *Species at Risk Act* (SARA).
- Leafy spurge can be found in pastures, agricultural lands, roadsides, ditches, native prairie and riparian areas. It thrives in sandy soils of moderate moisture, like those characteristic of the northern portion of the Cypress River subwatershed. Leafy spurge's aggressive growth habits and lack of natural predators allow it to easily displace native vegetation; the result is reduced habitat value from reductions in species diversity.

SOLUTIONS

- Management practices, policies and incentives need to be developed to provide a greater balance between agriculture, natural area conservation, invasive species control and the environmental needs of the subwatershed.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Promote agricultural beneficial management practices that encourage limiting livestock access to riparian areas and waterways through incentives, education, demonstration, and technical assistance.	*Assiniboine Hills Conservation District, LaSalle Redboine Conservation District, Pembina Valley Conservation District, MAFRD,* Conservation Agencies
Provide payments and secure conservation agreements with private landowners to maintain or restore forest, wetlands and riparian areas.	*Assiniboine Hills Conservation District, LaSalle Redboine Conservation District, Pembina Valley Conservation District, Conservation Agencies,* Rural Municipalities
Work to conserve mixed grass prairie habitat through provincial designations, conservation agreements, incentive payments or other land conservation programs.	*Assiniboine Hills Conservation District, LaSalle Redboine Conservation District, Pembina Valley Conservation District, Rural Municipalities, Conservation Agencies, MCWS*
Promote storage and reuse of field runoff to limit contributions of phosphorous to the Cypress River.	*Assiniboine Hills Conservation District, LaSalle Redboine Conservation District, Pembina Valley Conservation District, MAFRD, MCWS-Water Control Works and Drainage Licensing Section*
Support government efforts to protect ecologically important habitat on Crown lands surrounding Spruce Woods Provincial Park.	Assiniboine Hills Conservation District, LaSalle Redboine Conservation District, Pembina Valley Conservation District, Protected Areas Initiative
Work to control invasive species such as leafy spurge on pastures.	MAFRD, *Weed Control District, Municipalities, MCWS - Biodiversity, Habitat and Endangered Species (WMAs)*

* lead organizations have been italized.

GOAL

Maintain source water quality and quantity throughout the Cypress River subwatershed.

MEASURES OF SUCCESS

- The percentage of private wells exceeding the drinking water guidelines for bacterial contamination will be reduced.
- Recommendations for public water system source protection will be completed by 2016.
- All abandoned wells brought forward over the next 10 years will be sealed by conservation districts.

SOURCE WATER PROTECTION

ISSUES

- In the Cypress River subwatershed the majority of watershed residents rely on groundwater for drinking water. Wells that are not properly located, constructed or maintained can lead to potential well water contamination problems.
- The porous nature of the soils over the Assiniboine Delta Aquifer make it highly susceptible to contamination from sources such as sewage, petroleum products, fertilizers, manure and pesticides.

SOLUTIONS

- Clean, potable drinking water is critical for human life. Protecting water at its source, or before it arrives at treatment facilities, is a preventative approach to water management. Source water protection also provides benefits to aquatic ecosystems, supports recreational and wildlife values, and ensures sustainability for future generations.

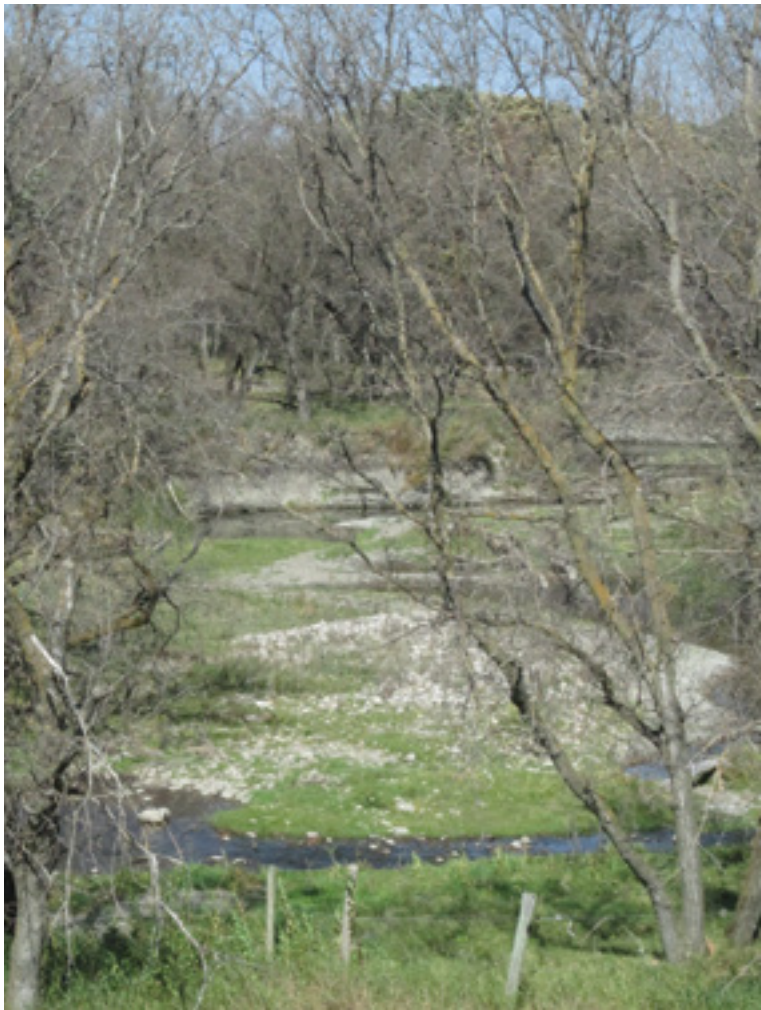
There are three key steps to protecting well water:

1. Protect the well water at the ground surface by avoiding, eliminating, or reducing contaminants;
2. Inspect the well regularly and keep it in good running order; and
3. Test the well water regularly and respond to contamination problems.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Provide education on well head management	*LaSalle Redboine Conservation District, Assiniboine Hills Conservation District, Pembina Valley Conservation District,* MCWS – Groundwater Management Section
Locate the well at a safe distance from potential sources of contamination and in an area away from surface runoff from potential sources.	*Landowners, certified well drillers*
Wells within any designated flood area should have adequate well head protection to ensure flood waters do not enter the well directly	LaSalle Redboine Conservation District, Assiniboine Hills Conservation District, Pembina Valley Conservation District, *Landowners, certified well drillers*
Ensure abandoned wells are properly sealed to provincial requirements	*LaSalle Redboine Conservation District, Assiniboine Hills Conservation District, Pembina Valley Conservation District,* MCWS – Groundwater Management Section

* lead organizations have been italized.



RECOMMENDATIONS FOR PUBLIC WATER SYSTEMS

In Manitoba, the Office of Drinking Water defines a public water system (PWS) as a potable supply of water with 15 or more connections. The Cypress River subwatershed contains three public drinking water systems including Cypress River, Holland, and Somerset Systems.

RECOMMENDATIONS	ORGANIZATION
The Cypress River Public Water System supplies 450 residents of Cypress River with treated water drawn from one well located on the west side of the town. The well is located in a sand and gravel aquifer. It was constructed in 1988 with a well depth of 22 m, and the depth to groundwater at 4 m below the surface of the ground. The water is treated by green sand filtration. Recommended actions and policies for the source water protection zone within 1.5 km of the Cypress River well head include:	
Ensure manure management plans are in place for local manure storage areas.	*MCWS - Environmental Compliance and Enforcement*
Ensure permanent 5 m grass buffer is established surrounding well.	*Municipality*, Conservation District
Fence well and install collision bollards.	*Municipality*
Ensure an emergency response plan is in place for the system.	*Municipalities, MCWS – Office of Drinking Water*
Seal unused, abandoned and poorly constructed wells that are located within the source water protection zone.	*Conservation District*, Municipality
The Holland Public Water System supplies 500 residents of the Town of Holland with treated water drawn from two wells located on the south side of town. Both wells are located in a confined sand and gravel aquifer. Well No. 1 was completed in 1962 with a well depth of 29.4 meters and Well No. 2 was completed in 1986, with a depth of 31 meters. Recommended actions and policies for the source water protection zone potential contamination sources within 1.5 km of the Holland well head include:	
Ensure manure management plans are in place for local manure storage areas.	*MCWS - Environmental Compliance and Enforcement*
Seal unused, abandoned and poorly constructed wells that are located within the source water protection zone.	*Conservation District*, Municipality
Ensure an emergency response plan is developed for the system.	*Municipalities, MCWS – Office of Drinking Water*
The Somerset Public Water System supplies 450 residents of Somerset with treated water drawn from two wells located on the south side of the town. Both wells are located in a confined sand and gravel aquifer. Well No.1 was completed in 1969 with a well depth of 31 m, and the depth to groundwater at 2.7 m below the surface of the ground. Well No.2 was completed in 1990 with a well depth of 15 m and the depth to groundwater at 4.3 m below the surface of the ground. The water is treated by green sand filtration. Recommended actions and policies for the source water protection zone within 1.5 km of the Somerset well head include:	
Ensure manure management plans are in place for local manure storage areas.	*MCWS - Environmental Compliance and Enforcement*
Ensure permanent 5 m grass buffer surrounding well head.	*Municipality*, Conservation District
Fence wellhead and install collision bollards.	*Municipality*
Ensure an emergency response plan is in place for the system.	*Municipalities, MCWS – Office of Drinking Water*
Seal unused, abandoned and poorly constructed wells that are located within the source water protection zone.	*Conservation District*, Municipality

* lead organizations have been italized.

LINKING TO DEVELOPMENT PLANNING

Proposed for adoption in local development plans:

- Provincial Planning Regulation 5.1.3 under the Water Policy. To ensure protection, retention and, where required, rehabilitation of riparian areas, the following setbacks should be applied in respect to development: a) a minimum setback of 15 m upslope from the normal high water mark of first and second order drains and retention ponds; and b) a minimum setback of 30 m upslope from the normal high water mark for all other natural water bodies and waterways. These areas should be identified by appropriate zoning.

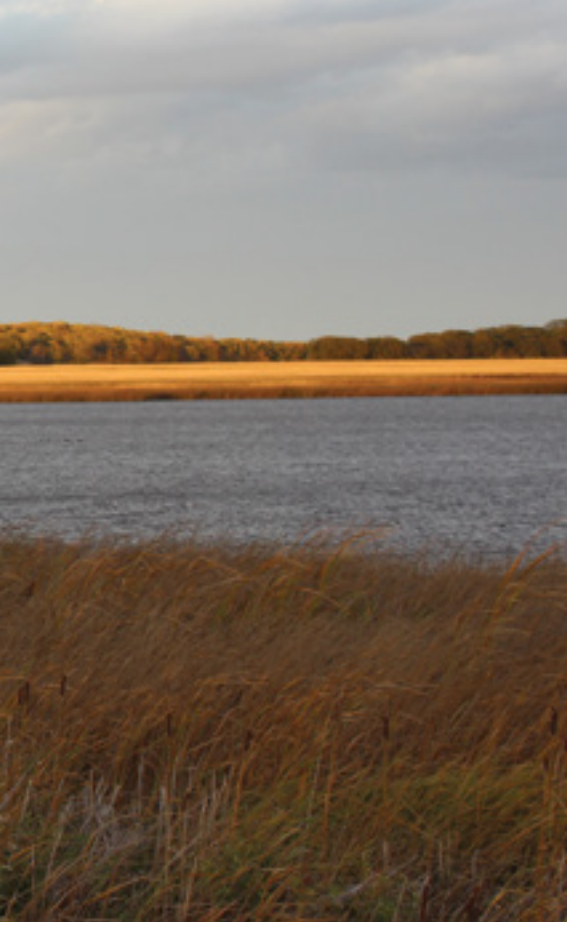
Intensive and high-pollution risk development activities, (land uses and structures that have a high risk of causing pollution and include, but are not limited to chemical/ fertilizer storage facilities, disposal fields, fuel tanks, waste disposal grounds, wastewater treatment facilities) will be restricted in public drinking water source zones. Where restriction is not possible, development may be considered in public drinking water source zones provided:

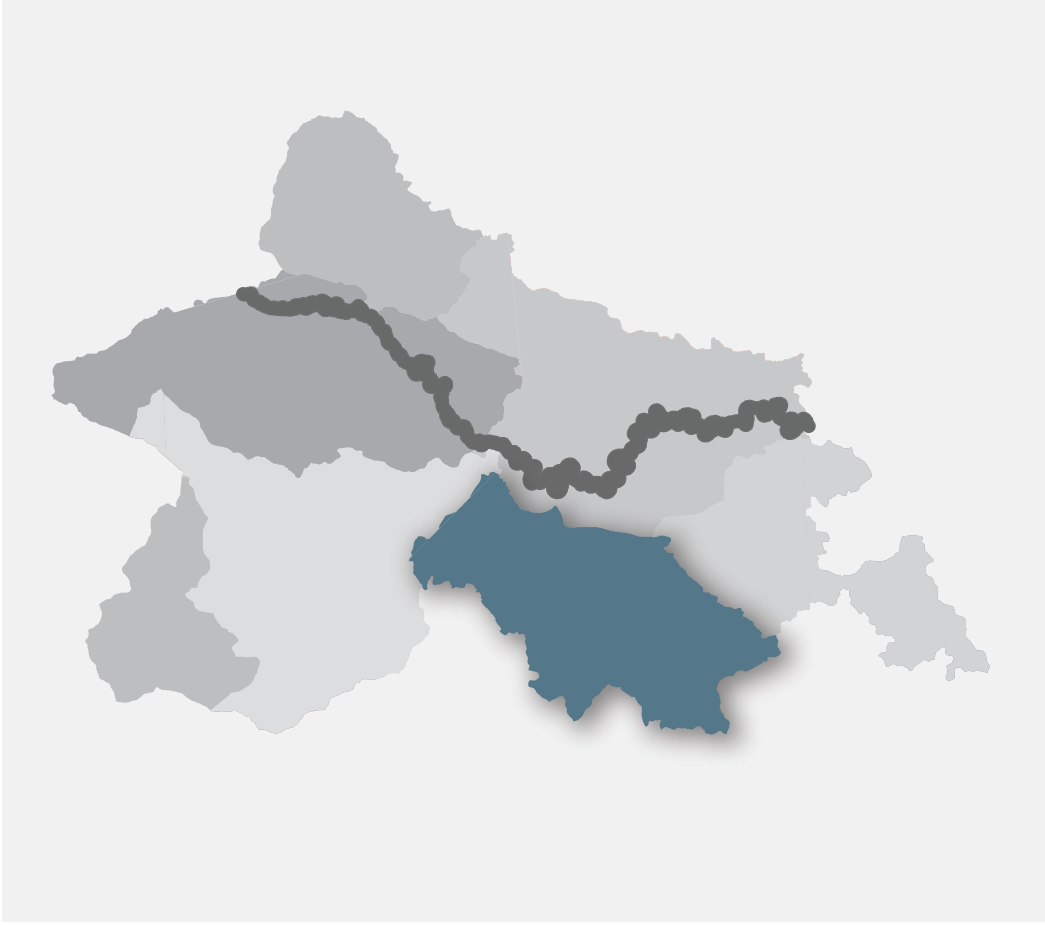
- The proponent can prove by adequate engineering or hydro-geological investigation that the proposed activity will not cause pollution of the public drinking water supply or;
- Appropriate precautionary measures have been taken to sufficiently mitigate the risk of endangering the quality of the water supply for public drinking water supply purposes.
- Seal unused, abandoned and poorly constructed wells that are located within a source water protection zones for all public drinking water.
- To prevent significant surface water quality and drinking water quality deterioration, developments in or near surface waters and riparian areas will be restricted, or limited, if they:
    - Lead to the contribution of nutrients, pathogenic organisms, deleterious chemicals or materials to these waters;
    - Accelerate erosion and bank instability;
    - Cause the removal of natural vegetative cover; and/or
    - May have an impact on in-stream flows needed to maintain healthy aquatic ecosystems.

OAK CREEK SUBWATERSHED

OVERVIEW

- The Oak Creek subwatershed is the second largest subwatershed in the Central Assiniboine and Lower Souris River watershed with an area of 1,147 km^2 (443 mi^2).
- Elevation in the Oak Creek subwatershed descends 154 metres above sea level (masl) starting with a highpoint of 495 masl (1,624 feet above sea level) in the south along Huntly's Ridge, dropping to 341 masl where the Oak Creek flows confluences with the Souris River.
- The majority of runoff occurs in April and May, with rain triggering minor flood events between June and September. The majority of the tributaries off of the Oak Creek are shallow seasonal streams that only run during the spring and major rain events in the summer. The seasonal nature of these tributaries makes them accessible for agricultural purposes in drier months.
- There are two areas prone to erosion - Huntly's Ridge which stretches from the western portion of the subwatershed, and the Tiger Hills, a band of hills north of Baldur and Belmont.
- There are no water quality stations in the Oak Creek subwatershed. Local observations of water quality indicate water in the main stem of Oak Creek hasn't changed noticeably over the last 30 years.
- 60% of soils in the subwatershed are classified as Class 2 or 3. The majority of the remaining soils are considered Class 4 – 6. In the northeastern corner of the subwatershed, near the Glenboro Marsh, soil capability is classified as Class 7, accounting for only 2% of the subwatershed.
- Annual cropping is the main land use within this subwatershed (52,000 ha). Grasslands/pasture areas cover 26% (31,000 ha) and forage the remaining 6% of the subwatershed.
- Considering most land within the Oak Creek subwatershed is privately owned, this subwatershed has a large amount of natural areas including trees and wetlands.
- The subwatershed supports a diverse wildlife population and is situated in the North American nesting and breeding habitat for ducks and geese. Habitat within the Tiger Hills pothole region is particularly good for waterfowl.
- Wetlands are common in this subwatershed. In larger depressions, permanent lakes or ponds of water remain, many of which are saline or alkaline.





- Waterways within the Oak Creek subwatershed support smaller fish species. White suckers and fathead minnows are probably the most common fish within the subwatershed. Those species provide a large biomass of forage fish for predacious fish in the Souris River.
- There are two public drinking water systems and two wastewater treatment lagoons in the Oak Creek subwatershed, located in Baldur and Belmont.
- Residents who are not connected to a public water system obtain their drinking water from private or semi-public sources (usually groundwater wells).
- The Oak Creek subwatershed has three main aquifers;
    - Assiniboine Delta Aquifer (a small portion of this unconfined sand and gravel aquifer occurs in the northern portion of the subwatershed)
    - Odanah Shale Aquifer (shale bedrock aquifer)
    - Lenses of sand and gravel (which typically occur in glacial till and other surficial deposits)

GOAL

Waterways in this subwatershed will be managed to reduce peak flows by 10% to reduce flood damages to infrastructure and agricultural lands.

MEASURES OF SUCCESS

- Surface water management decisions will be made on a watershed basis with consideration of downstream impacts.
- Oak Creek peak flows will be reduced by 10%.
- Current capacity of municipal surface water management infrastructure will be maintained.
- Water storage capacity will be increased.

SURFACE WATER MANAGEMENT

ISSUES

- Land use changes have occurred as a result of commercial fertilizer usage and the emergence of large-scale agro-business, creating larger farms, and consequently fewer farmers.
- From 1994 to 2006, there was a reduction in wetlands from 7,650 ha to 7,350 ha. Wetland drainage has been accelerated by increased capability of new agricultural equipment, increased land prices and pressures to harvest higher yields.
- During public consultations it was noted that the frequency and extent of flooding has increased due to a combination of wetland drainage and wetter conditions over the last 10 years. Expanded agricultural drainage networks in upstream portions of the Oak Creek subwatershed contribute to spring and summer flood events that damage municipal infrastructure, cause significant erosion issues and frustrate landowners in the downstream portions of the subwatershed.
- Landowners are frustrated with the repeated flooding of agricultural lands, specifically surrounding the Glenboro Marsh.

SOLUTIONS

- Protecting natural water retention areas and creating management policies that allow for natural stream processes and broaden the timing of runoff will help to reduce the impacts of flood events and erosion.
- Encourage the adoption of land use practices that better suit the environment and the hydrological regime.
- Management practices, policies and incentives need to be developed to provide a greater balance between agriculture and the environmental needs of the subwatershed.

THE GLENBORO MARSH

The Glenboro Marsh is connected to Oak Creek and acts as a natural retention area. The marsh is several miles long with a significant capacity to store water. The Oak Creek flows through the marsh in a north-westerly direction. Once Oak Creek runs into the Glenboro Marsh flows are attenuated before entering the portion of the creek located downstream of the marsh. As with many marshes, the Glenboro Marsh can become overgrown with cattails and other water plants, resulting in slower flows of water through the marsh. In some cases, water within the Glenboro Marsh has backed up along the Oak Creek, spilling into Andersons Marsh (within the Cypress River subwatershed). In 2010, the Province conducted a preliminary analysis on crossings for the purpose of addressing drainage and flooding issues around Glenboro Marsh.

Local observations indicate a trend of agricultural encroachment on lands surrounding the Glenboro Marsh. During the very dry ‘80s, when the marsh was probably at its lowest level, farmers surrounding the marsh were able to increase their productive acres. Glenboro Marsh is subject to climatic conditions with water levels that vary causing the marsh to shrink or expand in size. Water levels in Glenboro Marsh are influenced by climatic conditions - this variation causes the marsh to shrink or expand in size.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Complete a culvert size and location inventory, and create a drainage standard for the subwatershed with a goal to reduce flow velocities and enhance retention capabilities of the system by 10%.	*Assiniboine Hills Conservation District* *Pembina Valley Conservation District*
Maintain existing drainage infrastructure to original design standard, reconstruct if necessary.	*Municipalities*
Develop retention areas, dry dams, riffle structures or other beneficial management practices along smaller tributaries to slow runoff and reduce peak flows.	*Assiniboine Hills Conservation District* *Pembina Valley Conservation District,* *MAFRD,* Conservation Agencies
Provide payments or secure conservation agreements with private landowners to maintain or restore forest, grasslands, wetlands and riparian areas.	*Assiniboine Hills Conservation District* *Pembina Valley Conservation District,* *Conservation Agencies*, Municipalities

* lead organizations have been italized.

LINKING TO THE WATER CONTROL WORKS AND DRAINAGE LICENSING SYSTEM

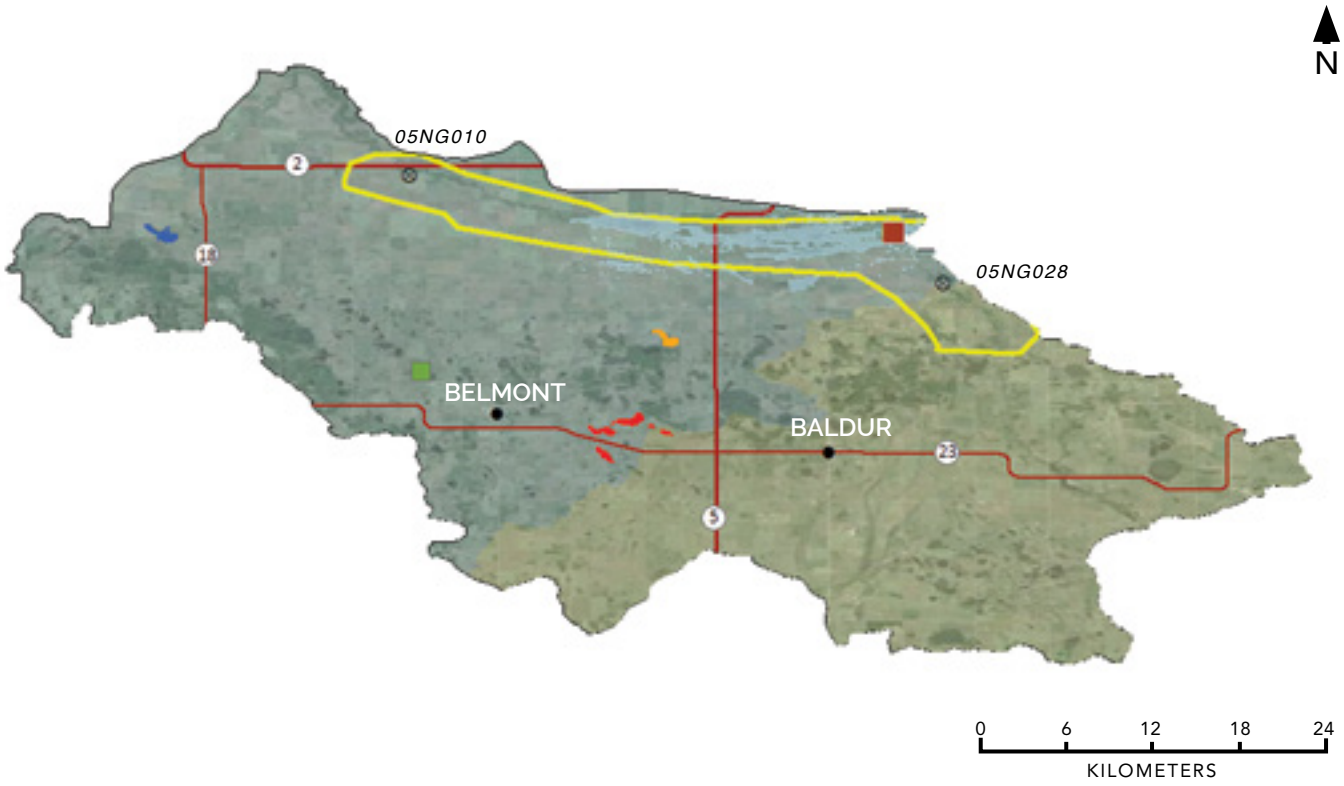
The following are recommendations for conservation districts, municipalities, and other organizations to consider when reviewing or developing water control works and/or drainage projects within the watershed. Responsibility to administer *The Water Rights Act* is held by Manitoba Conservation and Water Stewardship.

- Any new land improvements that involve the alteration of a water body require approval from the Province and will be subject to periodic inspections for continued compliance.

- Maintain no loss policy for seasonal, semi-permanent or permanent wetlands, sloughs, potholes, or other similar bodies of water in the subwatershed. If one acre of wetland is to be compromised, then another acre should be restored somewhere in the subwatershed. Legislation should reinforce the maintenance of wetlands and associated upland cover for the sole purpose of maintaining and increasing water quality and flood protection.

- The project management team has set out targeted water storage goals for the subwatershed. Drainage activities that contribute to peak flows need to pass through temporary water storage sites to mitigate additions to peak flows.
- Water Resource Officers, Conservation Districts and Municipalities should be reviewed on drain license applications. These organizations should consider the following when reviewing these applications:

    - **Do not recommend** approval for works such as:
        - Add water at times of peak flow that are not compensated for through temporary water storage.
        - Increase capacity in upstream tributaries.
        - Disturb natural streams. If natural streams are disturbed, mitigate impacts by completing a riparian improvement project within the subwatershed.
    - **Recommend** approval for works that include:
        - General maintenance of existing drains and culverts.
        - Retain water flows within Oak Creek and its tributaries.
        - Store water during spring runoff periods.



PEAK FLOW REDUCTIONS

One of the goals in the subwatershed is to reduce peak flows. The main issue seems to be additional contributions to the system through on farm drainage practices that result in more frequent damages to infrastructure. Lowering the peak flow of water, spreading it over a larger period, and temporarily storing water until peak flows have passed, allows for needed drainage activities while reducing the costs associated with replacing valuable infrastructure or causing downstream flooding impacts. The amount of upstream water storage needed to reduce peak flows by 10% at two points within the Oak Creek subwatershed has been calculated (see table below). Stakeholders within the Oak Creek subwatershed should work towards these goals to help mitigate the frequency and severity of flooding in a 1 in 10 year event.

STATION NAME	DRAINAGE AREA	1:10 YEAR FLOW		10% REDUCTIONS OF PEAK DISCHARGE	ASSOCIATED STORAGE NEEDED
	(sq.km)	Annual Peak Discharge (cfs)	Hydrograph Volume (ac-ft)	(cfs)	(ac-ft)
Oak Creek Upstream 05NG028	429.4	756	16,190	680	2,654
Oak Creek Upstream 05NG010	1,025.5	1,010	33,670	909	3,765

Analysis results for Oak Creek subwatershed hydrology upstream of index station 05NG028 and 05NG010.

LEGEND	ISSUE	RECOMMENDATIONS
Bennony's Lake Project	Ducks Unlimited Project constructed in 1984. Basin divided into three cells through 3 variable drop stop-log structures; total storage is 556 acre-feet. Considered a perched basin, significant headwater storage.	• Protecting and maintaining water storage aspect of this site is highly recommended.
Kerbis Project	A marsh was divided into the two cell project by a long dyke. Elevation changes at the outlet moving down the ridge to the north.	• Is currently in good condition. Protecting and maintaining the water storage aspect of this site is highly recommended.
Waldon Project	Ducks Unlimited Project constructed in 1983. Basin is divided into two cells with total storage of 510 acre-feet. Half round outlet needs removal to allow free flow between cells. Semi saline marsh; land surrounding cells is idle and remains in natural state.	• Protecting and maintaining water storage aspect of this site is highly recommended.
McLeod Project	Project spans approximately 4 miles of wetlands with 4 control points. Project fills most years with a total storage of approximately 909 acre-feet.	• Protecting and maintaining water storage aspect of this site is recommended.
Anderson's Marsh	During spring melt and heavy summer rainstorms, the Glenboro Marsh can back flow into Anderson's Marsh across the subwatershed boundary into the Cypress River subwatershed.	• Conservation Districts, MAFRD, and MCWS should implement temporary water storage upstream of hydrometric station 05MH008 to slow the flow of water movement from Baldur to Glenboro Marsh and generate extra time for spring run-off downstream. Associated water storage goals have been calculated. • Payment schemes and partnerships between landowners, Assiniboine Hills Conservation District, MAFRD and MCWS for flooded acres surrounding the marsh should be explored.
Flooding/ Drainage	Historical infrastructure washouts and flood related problem sites. Historical agricultural flood related problem sites.	• Water storage goals upstream of hydrometric stations 05NG028 and 05NG010 have been calculated. Working toward gaining the additional outlined water storage in these two target areas through temporary or permanent measures will help to slow the flow of water movement and generate extra time for run-off downstream.
Glenboro Marsh/ Oak Creek Flooding	Affects approximately 30 km of waterways within the Oak Creek subwatershed and can cause backflows into the Cypress River subwatershed during extreme events.	• Conservation Districts, MAFRD, and MCWS should implement temporary water storage in upstream areas (riffle structures, dry dams) to slow the flow of water movement from Baldur to Glenboro Marsh and generate extra time for spring run-off downstream. • Payment schemes and partnerships between landowners, Assiniboine Hills Conservation District, MAFRD and MCWS for flooded acres surrounding the marsh should be explored. • Review findings of crossing feasibility study.

GOAL

Maintain a balance between industry and natural areas; conserve remaining natural areas.

MEASURES OF SUCCESS

- Existing natural areas including forests, riparian areas, wetlands, mixed-grass prairie and other sensitive ecosystems will be maintained.
- Degraded riparian habitat along the Oak Creek will be restored. The Assiniboine Hills Conservation District will undertake a riparian habitat assessment in 2017-18. By 2020, all high priority projects will be completed.
- 50% of private land surrounding the Glenboro Marsh will be protected.

CONSERVATION OF NATURAL AREAS

ISSUES

- Clearing of natural cover and shelterbelts have caused overland water flow patterns to change and has impacted plants and wildlife.
- Most land within the Oak Creek subwatershed is privately owned. Historical agricultural practices have been slower to change in this subwatershed than other subwatersheds within the plan. Land here has remained in a much more natural state. The preservation of these natural areas is likely due to land capability and salinity.
- Although conversion of land is occurring at a slower rate than other subwatersheds, many of the top issues and threats identified in the public and municipal consultations were profoundly impacted by the loss or degradation of natural areas in the upstream portions of the Oak Creek subwatershed.
- Leafy spurge can be found in pastures, fields, roadsides, ditches, native prairie and riparian areas. It thrives in sandy soils of moderate moisture, like those characteristic of the northern portion of the Oak Creek subwatershed. Leafy spurge's aggressive growth habits and lack of natural predators allow it to easily displace native vegetation, resulting in reduced habitat value from reductions in species diversity.

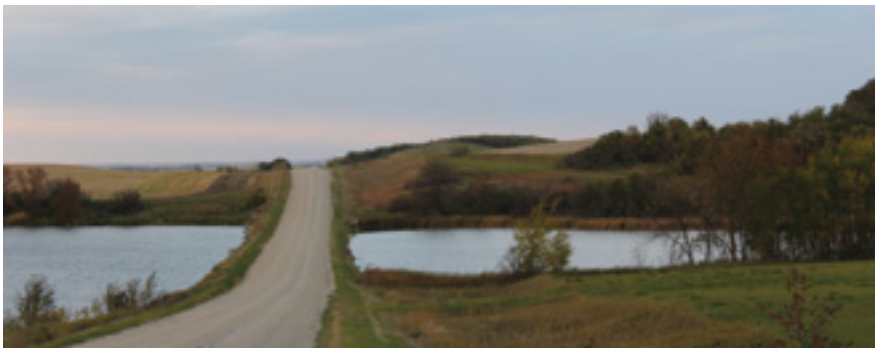
SOLUTIONS

- Management practices, policies and incentives need to be developed to maintain a greater balance between agriculture and the environmental needs of the subwatershed.

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Promote agricultural beneficial management practices that encourage limited livestock access to riparian areas and waterways through incentives, education, demonstration, and technical assistance.	*Assiniboine Hills Conservation District, Pembina Valley Conservation District, MAFRD,* Conservation Agencies
Provide payments and secure conservation agreements with private landowners to maintain or restore forested, wetlands and riparian areas.	*Assiniboine Hills Conservation District, Pembina Valley Conservation District, Conservation Agencies,* Municipalities
Work to conserve Glenboro Marsh through conservation agreements,	*Assiniboine Hills Conservation District, Pembina Valley*
Devise and implement a leafy spurge control strategy	*Weed Control District, Municipalities, MCWS - Biodiversity, Habitat and Endangered Species (WMAs), Conservation Agencies,* MAFRD

* lead organizations have been italized.



GOAL

Maintain source water quality and quantity throughout the Oak Creek subwatershed.

MEASURES OF SUCCESS

- The percentage of private wells exceeding human health guidelines for bacteria in drinking water will be reduced.
- Recommendations for public water system source protection will be completed by 2016.
- The conservation districts will seal all abandoned wells brought forward over the next 10 years.

SOURCE WATER PROTECTION

ISSUES

- In the Oak Creek subwatershed, groundwater is the source of drinking water for all towns and private residences. The groundwater used for these purposes varies between shallow, sand and gravel aquifers and confined shale bedrock aquifers.
- Accommodating increasing water demands on the Assiniboine Delta Aquifer while maintaining and protecting the ability of the aquifer to support human and environmental needs in a sustainable manner was a main concern for residents. The porous nature of the soils over the aquifer and proximity of the water table to the surface in some areas make the aquifer highly susceptible to contamination from sources such as sewage, petroleum products, fertilizers, manure and pesticides.
- Many residents identified well head management as the top issue or threat to drinking water in the subwatershed. Bacteria and nitrate are the most common types of well water contamination found in private wells. The occurrence of bacteria and nitrate is more common in shallow wells located in unconfined aquifers or in aquifers located close to ground surface.

SOLUTIONS

- Clean, potable drinking water is critical for human life. Protecting water at its source, or before it arrives at treatment facilities, is a preventative approach to water management. Source water protection also provides benefits to aquatic ecosystems, supports recreational and wildlife values, and ensures sustainability for future generations.

ASSINIBOINE DELTA AQUIFER WATER ALLOCATION

Local groundwater availability and usage of the ADA is based on aquifer sub-basins, one of which is located in the Oak Creek subwatershed: Assiniboine Souris. The allocation limit for groundwater use in each sub-basin is based on the aquifer's available yield. Licensing is based on 50% of the available yield (Table 1). The remaining 50% is reserved for the environment and domestic users. This approach of aquifer management has provided sustainable development for domestic, municipal, industrial, commercial, and agricultural use within the watershed.

SUB-BASIN	AVAILABLE YIELD	ALLOCATION LIMIT	ANNUAL ALLOCATION	AVAILABLE ALLOCATION
Assiniboine Souris	2,886	1,433	530	903

Allocation status (acre-feet/year).

HOW WE PLAN TO REACH OUR GOAL

RECOMMENDATIONS	ORGANIZATION
Provide education on well head management.	*Assiniboine Hills Conservation District, Pembina Valley Conservation District*, MCWS – Groundwater Management Section
Locate the well at a safe distance from potential sources of contamination and in an area away from surface water runoff.	*Landowners, certified well drillers*
Wells within any designated flood area should have adequate well head protection to ensure flood waters do not enter the well directly.	*Assiniboine Hills Conservation District, Pembina Valley Conservation District,* Landowners, Municipalities, certified well drillers,
Ensure abandoned wells are properly sealed to provincial requirements.	Assiniboine Hills Conservation District, Pembina Valley Conservation District, MCWS – Groundwater Management Section
Promote the development of rural water pipelines in areas designated for residential development. Require water soft paths planning and water conservation methods in development of water expansion process and prior to water hook-up.	Assiniboine Hills Conservation District, Pembina Valley Conservation District, *Municipalities, Manitoba Water Services Board*
Promote the proper removal and disposal of fuel tanks located on the Assiniboine Delta Aquifer.	Green Manitoba, Assiniboine Hills Conservation District, Pembina Valley Conservation District
Promote agriculture beneficial management practices that increase water efficiency for irrigation through, incentive, education, and technical assistance.	*Irrigation Industry, McCains Ltd., MAFRD*
Maintain current practices of regulating water use from the Assiniboine Delta Aquifer based on 50% of available yields.	*MCWS - Water Use and Licensing*

* lead organizations have been italized.

There are three steps to protecting well water:

- Protect the well water at the ground surface by avoiding, eliminating, or reducing contaminants;
- Inspect the well regularly and keep it in good running order; and
- Test the well water regularly and respond to contamination problems.

RECOMMENDATIONS FOR PUBLIC WATER SYSTEMS

In Manitoba, the Office of Drinking Water defines a public water system (PWS) as a potable supply of water with 15 or more connections. The Oak Creek subwatershed contains two public drinking water systems including Belmont and Baldur Systems.

RECOMMENDATIONS	ORGANIZATION
The Belmont Public Water System supplies 250 residents of Belmont with treated water from two wells south of town. Well No. 1 was constructed in 1966 with a depth to groundwater of 0.6 m. Well No. 2 was constructed in 1985 and has a depth to groundwater of 7 m. The wells and the treatment facility are managed by the R.M. of Strathcona. Recommended actions and policies for the source water protection zone of 1.5 km of the Belmont wellhead include:	
Install a black flow prevention device on tank loader well adjacent to well No. 2.	*Municipality*
Create a minimum 5 meter grass buffer around both the tank load well head and well No. 2 well head.	*Municipality*, Assiniboine Hills Conservation District
Ensure an emergency response plan is developed for the Belmont public water system.	*Municipality, MCWS - Office of Drinking Water*
Promote the Environmental Farm Plan Program within the source water protection area.	*MAFRD*, Assiniboine Hills Conservation District
Seal unused, abandoned and poorly constructed wells that are located within the source water protection zone.	*Assiniboine Hills Conservation District*
The Baldur Public Water System supplies 350 residents of Baldur with treated water from three wells south of town. Well No. 1 and 2 were constructed in 1988 with a depth to groundwater of 3.4 m and 3.7 m respectively. Well No. 3 was constructed in 2008 and has a depth to groundwater of 1.4 m. The wells and the treatment facility are managed by the R.M. of Argyle. Recommended actions and policies for the source water protection zone of 1.5 km of the Baldur well head include:	
Install collision barriers to prevent damage from agricultural equipment	*Municipality*
Create a minimum 5 meter grass buffer around both well heads.	*Municipality*, Assiniboine Hills Conservation District
Ensure manure management plans are in place.	*MCWS - Environmental Compliance and Enforcement*
Consider purchasing land adjacent to the well to ensure buffer stays intact.	*Municipality*
Seal unused, abandoned and poorly constructed wells that are located within the source water protection zone.	*Assiniboine Hills Conservation District*
Ensure an emergency response plan is developed for the system.	*Municipalities, MCWS – Office of Drinking Water*

* lead organizations have been italized.

LINKING TO DEVELOPMENT PLANNING

Proposed for adoption in the development plans of municipalities with land in the Oak Creek subwatershed:

- Adopt policies for a minimum setback distance of 50 m for new development or buildings along streambanks of Class 3 and higher waterways.

- Value and maintain wetlands. Ensure wetlands are considered in all land management decisions. If an acre of wetland is to be compromised, then another acre should be restored somewhere in the subwatershed. Policy should reinforce the maintenance of wetlands and associated upland cover for the purposes of maintaining and increasing water quality as well as reducing downstream flood impacts.

- Intensive and high-pollution risk development activities, (land uses and structures that have a high risk of causing pollution and include, but are not limited to chemical/ fertilizer storage facilities, disposal fields, fuel tanks, waste disposal grounds, wastewater treatment facilities) will be restricted in public drinking water source zones. Where restriction is not possible, development may be considered in public drinking water source zones provided:

    - The proponent can prove by adequate engineering or hydro-geological investigation that the proposed activity will not cause pollution of the public drinking water supply or;

    - Appropriate precautionary measures have been taken to sufficiently mitigate the risk of endangering the quality of the water supply for public drinking water supply purposes.

    - To prevent significant surface water quality and drinking water quality deterioration, developments in or near surface waters and riparian areas will be restricted, or limited, if they:

        - lead to the contribution of nutrients, pathogenic organisms, deleterious chemicals or materials to these waters;

        - accelerate erosion and bank instability;

        - cause the removal of natural vegetative cover; and/or

        - may have an impact on in-stream flows needed to maintain healthy aquatic ecosystems.

GLOSSARY & ACRONYMS

Aquatic Ecosystem: The components of the earth related to, living in or located in or on water or the beds or shores of a water body, including but not limited to:

- All organic and inorganic matter, and
- All living organisms and their habitat, and their interacting natural systems.

Beneficial Management Practices (BMP): a practical solution used to deal with soil and water conservation concerns, including techniques to manage agricultural and urban runoff and modify agricultural waste management.

Conservation Easement/Agreement: A legal agreement between a landowner and a conservation organization that ensures the protection of the property's conservation values by limiting future use or development.

Conservation Agency: Any organization with the mandate to conserve or restore natural habitat. Examples include: Ducks Unlimited Canada, Manitoba Habitat Heritage Corporation, Nature Conservancy Canada, etc...

Development Plan: A document that outlines the general objectives and policies that will guide the overall use, planning and development of land in a planning district or individual municipality.

Drinking Water Source: The raw, untreated water in the environment that is used to supply a drinking water system as defined in The Drinking Water Safety Act.

Natural Areas: Land which remains undeveloped and supports a healthy ecosystem that provides ecological goods and services, including wildlife habitat.

Riparian Area: The transition zone which acts as the interface between the upland ecosystem and water courses.

Public Water Source: A surface or groundwater source that provides water to a system with 15 or more service connections.

Water Quality Index (WQI): A means of summarizing large amounts of data into simple terms for reporting to management and the public in a consistent manner. It is calculated using twenty-five water quality variables and combines the scope, frequency and amplitude that variables exceed the water quality objectives and guidelines. The Water Quality Index ranges from 0-100 and is used to rank water quality into categories ranging from poor to excellent. Similar to the UV index or an air quality index, it can tell us whether the overall quality of water bodies poses a potential threat to various uses of water, such as habitat for aquatic life, irrigation for agriculture and livestock, recreation and aesthetics, and drinking water supplies.

Waterway: A landscape feature (natural or artificial) that continuously or intermittently transports water on the earth's surface, including headwater, rivers, creeks, channels, streams, and drains.

ACRONYMS

ADA: Assiniboine Delta Aquifer

CALS: Central Assiniboine and Lower Souris River Watershed

CD: Conservation district

CFB: Canadian Forces Base

DUC: Ducks Unlimited Canada

IWMP: integrated Watershed Management Plan

MAFRD: Manitoba Agriculture Food and Rural Development

MBWSB: Manitoba Water Services Board

MHHC: Manitoba Habitat Heritage Council

MWS: MCWS: Manitoba Conservation and Water Stewardship

MIT: Manitoba Infrastructure and Transportation

NCC: Nature Conservancy Canada

PMT: Project Management Team

OLA: Oak Lake Aquifer

RM: Rural Municipality

WPA: Water Planning Authority

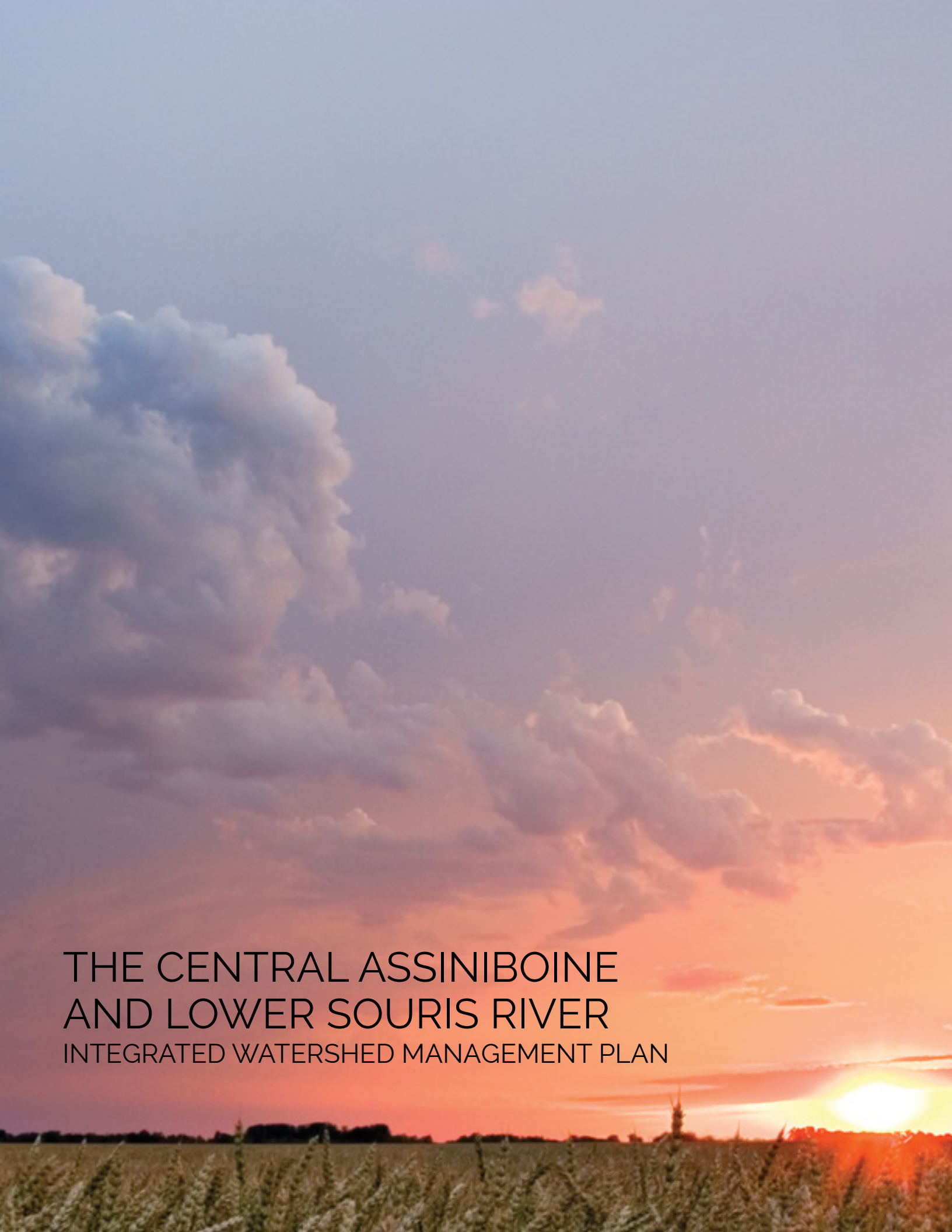
REFERENCES

Agriculture and Agri-Food Canada – Agri-Environment Services Branch (AESB) and Manitoba Food and Rural Inititatives (MAFRI) 2009. Agricultural Land Use and Management in the Central Assiniboine and Lower Souris River Watershed.

Graveline, P.G., Western, W.J., MacDonell, D.S. 2005. Little Souris River Watershed Aquatic Resource Inventory. A report prepared for Mid Assiniboine River Conservation District.

Graveline, P.G., Western, W.J., MacDonell, D.S. 2005. Willow Creek Watershed Aquatic Resource Inventory. A report prepared for Mid Assiniboine River Conservation District.

Williamson, D.A. 2002. Manitoba Water Quality Standards, Objectives, and Guidelines. Manitoba Conservation. Report 2002-11.



THE CENTRAL ASSINIBOINE AND LOWER SOURIS RIVER

INTEGRATED WATERSHED MANAGEMENT PLAN