MANITOBA HYDRO

St. Vital Transmission Complex

Environmental Assessment Report

Aquatic Technical Memorandum

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1.0 INTRODUCTION

Manitoba Hydro has identified the need to provide transmission improvements in voltage supply to southern Manitoba. In order to meet this need, Manitoba Hydro is proposing the development of the St. Vital Transmission Complex ('the Project'). This Project will serve existing and new load growth to provide firm transmission and adequate voltage support to communities located in southern Manitoba.

1.1 PROJECT OVERVIEW

The Project consists of construction and operation of two new 230-kiloVolt (kV) alternating current (AC) transmission lines and modifications to the St. Vital Station, Letellier Station, and La Verendrye Stations.

The Letellier transmission line ('St-Let') consists of approximately 119 km of 230-kV transmission line originating at the St. Vital Station, traversing south-central Manitoba (via the Steinbach area) and terminating at the Lettelier Station. While the La Verendrye transmission line ('St-Lav') also originating at the St. Vital Station will extend 34 km to the La Verendrye Station via the 'southern loop.'

Upgrades to the existing St. Vital, Lettelier and La Verendrye stations will be required to accommodate this new load and will consist of the installation of 230-kV supporting major equipment (i.e., 230-kV beakers, appropriate current transformers, etc.), steel structures and foundations.

Specific information regarding the Project is located in the St. Vital to Letellier and La Verendrye Stations Environmental Assessment Report to which this document is appended.

1.2 SCOPE OF WORK

A desktop evaluation of aquatic resources within the Project Siting Study Area (PSSA) and the development area of the Southern Loop was performed (Map 1-1). Information from a number of regulatory and scientific based sources was collected and analyzed. This information was used to:

- Provide a better understanding of the aquatic environment within the PSSA and the development area of the Southern Loop.
- Identify potential adverse environmental impacts and potential mitigation to offset those impacts.
- Identify gaps in existing data which will require additional information in order to provide a confident assessment.

1.3 PURPOSE

This report has been prepared to provide preliminary baseline aquatic resource information for the Project. This report describes the aquatic conditions, characteristics and sensitive sites potentially located within the PSSA and the development area of the Southern Loop. This information will support the Environmental Assessment Report for the Project.

2.0 STUDY AREA

The study area for this aquatic environmental technical memorandum is specific to the transmission line components of the St. Lav and St. Let transmission lines. As identified and evaluated during the route selection study, a preferred route for the proposed transmission lines that considered factors, including existing land use, special land use classifications (e.g., national or provincial parks, federal Lands, floodplains, wetlands, etc.), cultural resources, and threatened and endangered species and their habitat was selected. The corresponding Project Siting Study Area (PSSA) for environmental assessment purposes was identified as an area of approximately 2,356.5 km² spanning from the south eastern limits of the City of Winnipeg near Grande Pointe southward to Defrost, westward to the Red River east of Morris, southward to Lettelier, eastward to Stuartburn, and continues northward to Prairie Grove on the west side of Steinbach.

The PSSA is contained within the Prairie and Boreal Plain ecozones (Smith et al. 1998; Map 2-1). Surface water hydrology in the Prairie Ecozone is characterized by large, turbid rivers and streams along with many smaller rivers and creeks that drain the area in a north-easterly direction through the Nelson River drainage system, ultimately draining to Hudson Bay. Many of the major watercourses in these ecozones have been modified or developed to some extent by hydro-power, irrigation, flood protection or water management (Smith et al. 1998). The Boreal Plains Ecozone is characterized as nearly level to gently rolling plains with wetlands covering between 20 and 50% of the ecozone. The principal land use activity within this ecozone is the sustainable use of forestry resources for pulpwood and sawlogs. Activities including hunting, trapping, commercial fishing operations, and tourism generated from water-oriented recreation, national and provincial parks make up the bulk of on-going land use in the ecozone (Smith et al. 1998).

Contained within the Red River Basin, the PSSA spans five sub-watersheds as delineated by Manitoba Conservation and Water Stewardship (MWS; Map 2-2):

- Rivere Salle Sub-watershed
- Seine River Sub-watershed
- Rat River Sub-watershed
- Roseau River Sub-watershed
- Aux Marais/Plum River Sub-watershed

Perennial waterbodies draining the PSSA include the Red, Seine, LaSalle, Rat, Rousseau, Aux Marias, Marsh, and Jordan rivers, Joubert, Sarto, Mosquito and Touramond creeks, Coulee des Naults, and numerous agricultural drains.

3.0 METHODS

3.1 REVIEW OF EXISTING DATA SOURCES

A desktop study to characterize Aquatic Resources in the Study Area was conducted using information gathered from publically accessible aquatic resources including the following:

- Manitoba Water Stewardship (MWS), Water Science and Management Branch long-term water quality monitoring data.
- MWS, Fisheries Branch, Fisheries Inventory and Habitat Classification System (FIHCS) database (fish, fish habitat, and water quantity assessment).
- MWS Division, Integrated Watershed Management Planning documentation.
- Manitoba Conservation Database Centre (presence of listed species).
- Fisheries and Oceans Canada (DFO), Canadian Data Report of Fisheries and Aquatic Sciences (DFO 2013) (watercourses/drainages within the Study Area).
- MWS Division, Conservation Districts documentation.
- Geographic Information System (GIS) and mapping.

3.2 ANALYSES

3.2.1 Watershed characteristics

General watershed characteristics were determined and surface water resources information was collected from documentation available through government agency internet sites including: Manitoba Water Stewardship, Environment Canada, and Agriculture and Agri-Food Canada (formerly the Prairie Farm Rehabilitation Administration) and scientifically cited peer-reviewed literature.

3.2.2 Surface Water Quality

3.2.2.1 Guideline / Objective Comparisons

Surface water quality data for the area was requested and received from the Water Quality Management Branch of MWS. Desktop analysis for conventional parameters such as major ions, nutrients, and total metals were performed from data collected on a quarterly basis between 2008 and 2013 (Appendix A). The minimum, mean, median, maximum and 75th percentile were calculated and compared against applicable provincial and federal water-quality guidelines for the protection of aquatic life (MOE 1994, MWS 2011, CCME 2012), drinking water

(Health Canada 2010) and livestock watering (CCME 2012). The most stringent guideline was used to determine a guideline exceedance.

3.2.2.2 Water Quality Index Rankings

Water Quality Index (WQI) rankings, which summarize large amounts of long-term water quality data into simple terms (e.g., good, fair, etc.) have been developed for four rivers located in the PSSA (Environment Canada 2014, Manitoba Water Stewardship Division 2009, 2011). These rankings are based on water quality variables outlined in Appendix B and are calculated by combining the percentage of parameters which exceed guidelines, the percentage of total observations exceeding guidelines and the amount by which parameters exceed guidelines.

The Water Quality Index combines three different aspects of water quality:

- 'scope,' – the percentage of water quality variables with observations exceeding guidelines)
- 'frequency' – the percentage of total observations exceeding guidelines
- 'amplitude' – the amount by which observations exceed the guidelines

In combination, these aspects of water quality provide a general overview of water quality with the basic premise that water quality is excellent when all guidelines or objectives set to protect water uses are met virtually all the time. When guidelines or objectives are not met, water quality becomes progressively poorer. Thus, the Index logically and mathematically incorporates information on water quality based on comparisons to guidelines or objectives to protect important water uses.

The Water Quality Index ranges from 0 to 100 and is used to organize waterbodies into five (5) categories as follows:

- Excellent (95-100) – Water quality never or very rarely exceeds guidelines
- Good (80-94) – Water quality rarely exceeds water quality guidelines
- Fair (60-79) – Water quality sometimes exceeds guidelines and possibly by a large margin
- Marginal (45-59) – Water quality often exceeds guidelines and/or by a considerable margin
- Poor (0-44) – Water quality usually exceeds guidelines and/or by a large margin

3.2.3 Fish and Fish Habitat

Fish habitat and community information was compiled from cited literature sources and analysis of data provided by Milani (2013) specific to the Project Siting Study Area. Habitat types and classifications were determined based on methods as outlined in Milani (2013). Utilizing fish habitat classifications of Type A, Type B and Type C, data collected by Milani (2013) in areas of stream crossings were identified and assessed for potential effects resulting from Project construction and operation and maintenance activities.

4.0 RESULTS

Analysis of the preferred transmission line routes (both St. Lev and St. Lav) indicated that a total of 70 locations will cross waterways of some type. Of these 70locations, 16 were classified as providing Type A, B or C fish habitat and are considered areas where potential Project-related effects may be experienced (Milani (2013), Table 4-1).

Table 4-1: Fish Habitat at Watercourse Crossings

Watercourse	Stream Feature	Fish Habitat Type
St Lav Transmission Line (Y36L)		
Red River	River/Stream	A
Seine River	River/Stream	A
La Salle River	River/Stream	A
St Lev Transmission Line (Y95V)		
Marais, RiviFre aux	Ditch	B
Old Prairie Grove Drain	Ditch	B
Tourond Creek	Ditch	B
Rat River	River/Stream	A
Red River	River/Stream	A
Roseau River	River/Stream	A
Seine River	River/Stream	A
Seine River Diversion	River/Stream	B
Coulee Des Nault (1)	River/Stream	A
Coulee Des Nault (2)	River/Stream	C
Joubert Creek	River/Stream	A
Unnamed (1)	Intermittent Stream	A
Unnamed (2)	Intermittent Stream	C

Notes:
Type A: Watercourse that provides direct complex fish habitat with indicator species present, i.e. potential for presence of Commercial, Sport, Aboriginal and SARA listed fish species.
Type B: Watercourse that provides direct simple fish habitat with indicator species present, i.e. potential for presence of Commercial, Sport, Aboriginal and SARA listed fish species.
Type C: Watercourse that provides direct complex fish habitat without indicator species, i.e. potential for presence of forage fish species.
Source: Milani (2013).

4.1 THE LA SALLE RIVER INTEGRATED WATERSHED MANAGEMENT PLANNING UNIT

4.1.1 Watershed Characteristics

Encompassing almost 2,400 km^2 of the central plains regions of Manitoba, the La Salle River watershed is home to a large number of small communities including five rural municipalities and portions of the City of Winnipeg. In general, it is characterized by topography ranging from flat, poorly drained “prime agricultural lands” to moderate/step well drained agricultural lands with numerous natural creek tributaries and artificial provincial drains (LaSalle Redboine Conservation District 2007).

4.1.2 Surface Water Resources

The La Salle River, a tributary to the Red River, drains in an easterly direction from its headwaters east of Portage La Prairie, Manitoba to its outlet at the Red River, south of St. Norbert, Manitoba. Considered an intermittent stream due to periods of zero flow, it is the main watercourse contained within the watershed. Headwaters and tributaries to the La Salle River include the Elm River, Elm Creek Channel, Scott Coulee, Meakin Creek, King Drain, Domain Drain, Manness Drain along with additional unnamed provincial drains. Streamflow of the La Salle River varies considerably both seasonally and annually based on climatic conditions. In general, annual streamflow peaks in April during the spring runoff period with an average of 70 - 75% of the annual runoff volume occurring between March and May.

4.1.3 Surface Water Quality

Historical surface water quality data collected quarterly and analyzed from one site on the LaSalle River by MWS between 2008 and 2013 are presented in Table 4-2. Analysis of the historical data revealed that eight out of 51 water quality parameters exceeded the most stringent guidelines including total phosphorous, total aluminum, total arsenic, total chromium, total iron, total manganese, total selenium, total silver, and total thallium. Total dissolved solids were within the MWSOG irrigation guideline range. Total arsenic, manganese, selenium, silver, and thallium concentrations were only marginally non-compliant when guideline exceedences were observed. Nutrients as measured by total phosphorous and total nitrogen have been increasing in the La Salle River since the early 1970s (LaSalle Redboine Conservation District 2007) resulting in deteriorated water quality. Wastewater treatment lagoon discharge, runoff associated with fertilizer and manure application, septic fields, enhanced drainage systems and reduced riparian vegetation, erosion, and instream processes are other mechanisms that have led to the deterioration of water quality in the watershed in the past.

Table 4-2: Historical Surface Water Quality Data Collected by MWS on the LaSalle River (2008-2013)

		LaSalle River – upstream of Project Siting Study Area						LaSalle River – downstream of Project Siting Study Area					
Parameter	units	Count	Min	Mean	Max	Median	75th Percentile	Count	Min	Mean	Max	Median	75th Percentile
Physiochemical													
Temperature water (field measurements)	Deg C	27	-1	9	26	5	16	36	0	11.6	23	13	16
pH	pH units	26	7	8	9	8	8	30	6.48	8.1	9.41	8.115	8.4
Oxygen dissolved	mg/L	16	3	7	11	8	10	7	4.7	8.7	12.8	8.8	9.9
Conductivity (at 25c)	US/CM	25	164	1033	2140	764	1400	30	141	477	822	448.5	687.25
Turbidity	Ntu	16	2	22	130	13	25	7	4.03	57	148	49.2	73.25
Total dissolved solids	mg/L @180C	16	108	628	1090	592	884	7	118	317	488	370	410
Total suspended solids	mg/L	18	5	47	182	31	53	7	118	317	488	370	410
Specific conductance (lab)	uS/cm	1	1580	1580	1580	1580	1580						
Anions & Nutrients													
Chloride (Cl) - dissolved	mg/L	12	11	78.5	187	58.4	87.5	12	6.65	29.771	67.7	25.4	35.7
Phosphorus (P) - total inorganic	mg/L	21	0.181	0.455	0.968	0.436	0.542	30	0.153	0.410	0.699	0.3935	0.517
Potassium (K) - total	mg/L	21	6.8	13.1	16.4	14.6	15.3	18	9.1	12.288	20	12.05	12.9
Calcium (Ca) - total	mg/L	21	17.6	71.5	138	56.7	103	18	15.9	44.194	82.7	34.45	65.35
Sodium (Na) - total	mg/L	21	5	63.6	137	47.7	100	18	3.42	16.222	42.3	12.55	23.45
Magnesium (Mg) - total	mg/L	21	8.37	37.5	69	28.8	56.2	18	7.88	21.6844	43.9	17.4	31.025
Metals													
Aluminum (Al) - dissolved	mg/L	16	***0.001***	0.0109	0.045	0.0028	0.0148	7	0.0051	0.040	0.107	0.0219	0.05935
Aluminum (Al) - total	mg/L	21	0.035	1.40	5.82	0.56	2.13	18	0.409	4.8352	43.6	2.345	4.4775
Antimony (Sb) - total	mg/L	21	***0.0002***	0.0003	0.0006	0.00028	0.00039	18	***0.0002***	0.0002	0.00051	0.0002	0.00027
Arsenic (Ar) - total	mg/L	21	0.0022	0.0062	0.0136	0.00569	0.00779	18	0.00282	0.005	0.0113	0.00434	0.00536
Barium (Ba) - total	mg/L	21	0.032	0.084	0.157	0.0825	0.0928	18	0.0419	0.081	0.152	0.0663	0.109
Beryllium (Be) - total	mg/L	21	***0.0002***	0.00020	0.00022	0.0002	0.0002	18	***0.0002***	0.0002	0.00062	0.0002	0.0002
Bismuth (Bi) - total	mg/L	21	***0.0002***	0.0002	0.0002	0.0002	0.0002	18	***0.0002***	0.0002	0.0002	0.0002	0.0002
Boron (B) - total	mg/L	21	0.029	0.078	0.136	0.07	0.1	18	0.023	0.041	0.074	0.0385	0.0465
Cadmium (Cd) - total	mg/L	21	***0.00001***	0.000029	0.00007	0.00003	0.00004	18	***0.00001***	0.00004	0.00016	0.00002	0.00004
Calcium (Ca) - dissolved	mg/L	0	-	-	-	-	-						
Cesium (Ce) - total	mg/L	21	***0.0001***	0.00019	0.00059	0.0001	0.0002	18	***0.0001***	0.0004	0.00226	0.00023	0.0004
Chromium hexavalent dissolved	mg/L	16	***0.01***	0.01	0.02	0.01	0.02	7	***0.01***	0.01	0.01	0.01	0.01

Table 4-2: Historical Surface Water Quality Data Collected by MWS on the LaSalle River (2008-2013)

		LaSalle River – upstream of Project Siting Study Area						LaSalle River – downstream of Project Siting Study Area					
Parameter	units	Count	Min	Mean	Max	Median	75th Percentile	Count	Min	Mean	Max	Median	75th Percentile
Chromium (Cr) - total	mg/L	21	0.0002	0.0022	0.0074	0.0011	0.003	18	0.001	0.0054	0.033	0.0035	0.00528
Cobalt (Co) - total	mg/L	21	0.00026	0.0007	0.0019	0.0006	0.0008	18	0.00029	0.0012	0.00557	0.00092	0.00129
Copper (Cu) - total	mg/L	21	0.00146	0.00337	0.00724	0.00296	0.00388	18	0.0024	0.0048	0.0171	0.004	0.00513
Iron (Fe) - dissolved	mg/L	1	-	-	-	-	0.086						
Iron (Fe) - total	mg/L	20	0.104	1.34	4.82	0.81	1.535	18	0.32	3.1919	22.3	1.955	3.3125
Lead (Pb) - total	mg/L	19	0.00016	0.00073	0.00221	0.00058	0.00089	18	0.00037	0.0013	0.00662	0.00086	0.00145
Lithium (Li) - total	mg/L	21	0.0145	0.059	0.104	0.0469	0.0773	18	0.0117	0.0316	0.0521	0.03145	0.04128
Manganese (Mn) - total	mg/L	21	8.37	37.5	69	28.8	56.2	18	0.0168	0.0658	0.166	0.0572	0.07858
Mercury (Hg) - total	mg/L	3	***0.00002***	0.00002	0.00002	0.00002	0.00002						
Mercury (Hg) - total	ug/L	0	-	-	-	-	-						
Molybdenum (Mo) - total	mg/L	21	0.00097	0.00199	0.00286	0.0021	0.00232	18	0.00098	0.002	0.00235	0.00165	0.00189
Nickel (Ni) - total	mg/L	21	0.0026	0.0053	0.0089	0.0051	0.006	18	0.0038	0.0067	0.0229	0.00595	0.00678
Rubidium (Rb) - total	mg/L	21	0.00168	0.00393	0.0101	0.0028	0.0055	18	0.0022	0.007	0.0396	0.00504	0.00729
Selenium (Se) - total	mg/L	21	***0.0004***	0.0009	0.0016	0.001	0.001	18	0.001	0.0010	0.001	0.001	0.001
Silicon (Si) - total	mg/L	15	2.92	9.52	22.2	7.86	12.4	11	1.76	20.011	109	9.87	17.8
Silver (Ag) - total	mg/L	21	***0.00002***	0.00008	0.00013	0.0001	0.0001	18	0.0001	0.0001	0.00042	0.0001	0.0001
Strontium (Sr) - total	mg/L	21	0.064	0.353	0.665	0.271	0.517	18	0.0684	0.189	0.383	0.1635	0.25
Tellurium (Te) - total	mg/L	21	***0.0002***	0.0002	0.0002	0.0002	0.0002	18	***0.0002***	0.0002	0.0002	0.0002	0.0002
Thallium (Tl) - total	mg/L	21	***0.00002***	0.00008	0.0001	0.0001	0.0001	18	0.0001	0.0001	0.00027	0.0001	0.0001
Thorium (Th) - total	mg/L	21	***0.0001***	0.0003	0.00094	0.0001	0.00027	18	***0.0001***	0.0006	0.00293	0.00035	0.00077
Tin (Sn) - total	mg/L	21	***0.0002***	0.0003	0.0006	0.0002	0.0002	18	***0.0002***	0.0005	0.00152	0.00045	0.0006
Titanium (Ti) - total	mg/L	21	0.0015	0.0434	0.175	0.017	0.059	18	0.00967	0.109	0.49	0.0755	0.14775
Tungsten (W) - total	mg/L	14	0.0001	0.0006	0.001	0.001	0.001	18	0.0002	0.0006	0.001	0.0006	0.001
Uranium (U) - total	mg/L	21	0.00054	0.00223	0.00726	0.00206	0.00266	18	0.00044	0.002	0.0047	0.00137	0.00276
Vanadium (V) - total	mg/L	21	0.0021	0.0084	0.0231	0.0072	0.01	18	0.00607	0.016	0.0673	0.0112	0.01895
Zinc (Zn) - total	mg/L	21	0.002	0.007	0.0292	0.006	0.0073	18	0.005	0.013	0.0678	0.0102	0.01343
Zirconium (Zr) - total	mg/L	21	0.0004	0.0020	0.00535	0.00196	0.002	18	0.0007	0.004	0.00924	0.00266	0.00529

4.1.4 Fish Habitat

Fish habitat in the watershed is limited to the LaSalle River and some provincial drains in the region. Actual fish utilization of the La Salle River is restricted due to habitat suitability, water quantity and a series of low head dams that restrict movement up from the Red River (LaSalle Redboine Conservation District 2007). Fish habitat in the LaSalle River watershed is greatly impacted by nutrient loading from agricultural, municipal, and residential sources. Continued degradation of riparian buffer zones along natural waterways and associated drainage networks reduces the buffering of nutrient and sediment loading into watershed watercourses from upslope sources degrading the amount, quality and availability of suitable fish habitat.

Recent studies in the area have indicated the presence of some fish species that can tolerate relatively poor aquatic habitat conditions, however, migration blockages (resulting from a series of low head dams) in combination with low oxygen levels have resulted in winter kill conditions (LaSalle Redboine Conservation District 2007). In general, the lower reaches of the LaSalle River in proximity to the Red River appear to provide the most suitable year-round fish habitat in the watershed while other watercourses only provide suitable fish habitat during the spring freshette.

4.1.5 Fish Community

The La Salle River is the main fish barring water course found in the LaSalle River watershed. As a tributary of the Red River, the La Salle River has the potential for numerous Red River fish species to inhabit the river in particularly lower reaches near the mouth of the river.

Thirty-three fish species have been identified in the in the La Salle River (Table 4-3). During high spring freshet years, fish runs from the Red River are able to pass over a number of dams along the river (for a short period of time) and access upper reaches of the system. During low or normal spring flow years fish passage over the dams is restricted.

Actual fish utilization of the La Salle River during the summer months in mid and upper reaches of the river appears to be limited to mostly fish species that can survive in poor habitat conditions (bullheads, sticklebacks, suckers, fathead minnows, central mudminnows, carp, etc.). In contrast, fish species diversification is much greater in lower reaches of the river in proximity to the Red River. Recent fishery inventories (Milani 2013) on other waterways and drains in the watershed (Elm Creek, Morris River, Meakin Creek, King, Barnland, Boundary, Coder, Domain, Franzman, Kelvin, Kirk, Manness, Oak Bluff, 11-A drains and Scott Coulee) indicate the presence of a few tolerant fish species (brook stickleback, fathead minnow, central mudminnow, bullheads, sucker, carp). The vast majority of these waterways would be unsuitable for fish species beyond the summer months due to lack of water to sustain fish presence (LaSalle Redboine Conservation District 2007).

Table 4-3: Fish Species Potentially Occuring in the Project Study Area

Fish		Red River	Red River Floodway	Old Prairie Grove Drain	La Salle River	Seine River	Seine River Diversion	St. Adolphe Coulee	Manning Canal	Youville Drain	Prefontaine Drain	Rat River	Joubert Creek	Rat River Swamp	Mosquito Creek	Roseau River	Riviere aux Marais	Marsh River	St. Malo Lake	St. Malo Canal	Arnaud Drain	Ste. Elizabeth Drain	Tourond Creek	Vita Drain
Common Name	**Species Name**																							
Banded Killifish	*Fundulus diaphanus*	X																						
Bigmouth Buffalo	*Ictiobus cyprinellus*	*X*			*X*																			
Bigmouth Shiner	*Notropis dorsalis*	*X*														*X*								
Black Bullhead	*Ameiurus melas*	X			X	X						X	X			X	X							
Black Crappie	*Pomoxis nigromaculatus*	X			X	X										X	X							
Blackchin Shiner	*Notropis heterodon*	X																						
Blacknose Dace	*Rhinichthys atratulus*	X			X											X								
Blacknose Shiner	*Notropis heterolepis*																X							
Blackside Darter	*Percina maculata*	X	X			X						X	X			X								
Bluegill	*Lepomis macrochirus*	X			X							X												
Bluntnose Minnow	*Pinephales notatus*	X																						
Brassy Minnow	*Hybognathus hankinsoni*	X																						
Brook Stickleback	*Culaea inconstans*	X		X	X	X		X	X		X	X	X			X							X	
Brook Trout	*Salvelinus fonyinalis*	X										X												
Brown Bullhead	*Ameiurus nebulosus*	X			X	X						X	X				X							
Brown Trout	*Salmo trutta*	X										X				X								
Burbot	*Lota lota*	X			X	X						X	X			X								
Central Mudminnow	*Umbra limi*	X			X	X			X			X	X			X							X	
Channel Catfish	*Ictalurus punctatus*	X			X							X				X								
Chestnut Lamprey	*Ichthyomyzon castaneus*	*X*										*X*				*X*								
Cisco	*Coregonus artedi*	*X*																						
Common Carp	*Cyprinus carpio*	X			X	X						X				X								
Common Shiner	*Luxilus comutus*	X			X	X						X				X								
Creek Chub	*Semotilus atromaculatus*	X			X											X								
Emerald Shiner	*Notropis atherinoides*	X			X	X						X				X								
Fathead Minnow	*Pimephales promelas*	X	X	X	X	X			X		X	X	X			X	X							
Finescale dace	*Phoxinus neogaeus*	X										X				X								
Flathead Chub	*Platygobio gracilis*	X														X								
Freshwater Drum	*Aplodinotus grunniens*	X			X	X																		

Table 4-3: Fish Species Potentially Occuring in the Project Study Area

Fish		Red River	Red River Floodway	Old Prairie Grove Drain	La Salle River	Seine River	Seine River Diversion	St. Adolphe Coulee	Manning Canal	Youville Drain	Prefontaine Drain	Rat River	Joubert Creek	Rat River Swamp	Mosquito Creek	Roseau River	Riviere aux Marais	Marsh River	St. Malo Lake	St. Malo Canal	Arnaud Drain	Ste. Elizabeth Drain	Tourond Creek	Vita Drain
Common Name	**Species Name**																							
Golden Redhorse	*Moxostoma erythrurum*	X										X												
Golden Shiner	*Notemigonus crysoleucas*	X																						
Goldeye	*Hiodon alosoides*	X			X	X						X				X								
Goldfish	*Carassius auratus*	X				X																		
Hornyhead Chub	*Nocomis biguttatus*	X																						
Iowa Darter	*Etheostoma exile*	X																						
Johnny Darter	*Etheostoma nigrum*	X	X		X	X						X	X			X								
Lake Chub	*Couesius plumbeus*	X																						
Lake Sturgeon	*Acipenser fulvescens*	*X*																						
Lake Whitefish	*Coregonus Clupeaformis*	X																						
Largemouth Bass	*Micropterus salmoides*	X																						
Logperch	*Percina caprodes*	X																						
Longnose Dace	*Rhinichthys cataractae*	X				X						X				X								
Longnose Sucker	*Catostomus catostomus*	X																						
Mimic Shiner	*Notropis volucellus*	X																						
Mooneye	*Hiodon tergisus*	X														X								
Ninespine Stickleback	*Pungitius pungitius*	X																						
Northern Pike	*Esox lucius*	X	X		X						X	X	X			X	X						X	
Northern Redbelly Dace	*Phoxinus eos*	X										X				X								
Pearl Dace	*Margariscus margarita*	X				X			X			X												
Pumpkinseed	*Lepomis gibbosus*	X																						
Quillback	*Carpiodes cyprinus*	X			X							X				X								
Rainbow Smelt	*Osmerus mordax*	X																						
Rainbow Trout	*Oncorhynchus mykiss*	X										X				X								
River Darter	*Percina shumardi*	X			X											X	X							
River Shiner	*Notropis blennius*	X			X							X				X								
Rock Bass	*Ambloplites rupestris*	X			X	X						X	X			X								
Rosyface Shiner	*Notropis rubellus*	X																						
Sand Shiner	*Notropis stramineus*	X										X	X			X	X							

Table 4-3: Fish Species Potentially Occuring in the Project Study Area

Fish		Red River	Red River Floodway	Old Prairie Grove Drain	La Salle River	Seine River	Seine River Diversion	St. Adolphe Coulee	Manning Canal	Youville Drain	Prefontaine Drain	Rat River	Joubert Creek	Rat River Swamp	Mosquito Creek	Roseau River	Riviere aux Marais	Marsh River	St. Malo Lake	St. Malo Canal	Arnaud Drain	Ste. Elizabeth Drain	Tourond Creek	Vita Drain
Common Name	**Species Name**																							
Sauger	*Stizostedion canadense*	X			X							X				X	X							
Shorthead Redhorse	*Moxostoma macrolepidotum*	X			X	X						X				X								
Shortjaw Cisco	*Coregonus zenithicus*	*X*																						
Silver Chub	*Macrhybopsis storeriana*	*X*			*X*							*X*				*X*								
Silver Lamprey	*Ichthyomyzon unicuspis*	X										X				X								
Silver Redhorse	*Moxostoma anisurum*	X			X							X	X											
Smallmouth Bass	*Micropterus dolomieu*	X																						
Spotfin Shiner	*Cyprinella spiloptera*	X			X							X				X								
Spottail Shiner	*Notropis hudsonius*	X				X																		
Stonecat	*Noturus flavus*	X										X				X								
Tadpole Madtom	*Noturus gyrinus*	X			X	X						X				X								
Trout-perch	*Percopsis omiscomaycus*	X	X			X										X								
Walleye	*Stizostedion vitreum*	X			X	X						X				X								
Western Blacknose Dace	*Rhinichthys obtusus*	X										X												
White Bass	*Morone chrysops*	X			X											X								
White Crappie	*Pomoxis annnularis*	X																						
White Sucker	*Catostomus commersoni*	X	X		X	X			X	X		X	X			X	X						X	
Yellow Perch	*Perca flavescens*	X			X							X												

Italicized – provincially or federally protected fish species

4.2 THE SEINE RIVER INTEGRATED WATERSHED MANAGEMENT PLANNING UNIT

4.2.1 Watershed Characteristics

The Seine River Integrated Wateshed Management Planning Unit is located in the most northern section of the Project Study Area (Map 2-2). The Seine River Watershed is approximately 2,509 km^2 in size. Several tributaries and drains flow into the Seine River, including the Intermunicipal Drain, within the northern portion of the preliminary corridor. Nine rural municipalities (RMs) are located, either in whole or in part within the watershed including: Hanover, La Broquerie, Ste. Anne, Tache, Ritchot, Reynolds, Piney, Springfield, and De Salaberry. The City of Steinbach and a portion of the City of Winnipeg, along with the towns of Ste. Anne and Niverville and several smaller communities are located within the watershed contributing to the estimated 44,000+ residents within the watershed boundaries (SRRCD 2009).

There are about 600 kms of Provincial drains in the watershed supplemented by a network of municipal drains. Some of these drains provide flood protection, such as the Seine River Diversion, in addition to providing agricultural land drainage. Provincial drains and ditches paralleling Provincial Trunk Highways and Provincial Roads are the responsibility of Manitoba Infrastructure and Transportation while municipal drainage infrastructure is the responsibility of individual RMs.

4.2.2 Surface Water Resources

The Seine River meanders in a northwest direction from its headwaters in the Sandilands Provincial Forest in the southeast of Manitoba. It passes under the Red River Floodway and through the Seine River Siphon to where it joins the Red River within the City of Winnipeg.

The flow of the Seine River is highly variable within and between years, and frequently floods in the spring. To protect Ste. Anne and communities downstream, including the City of Winnipeg, from flooding, the Seine River Diversion was constructed in the mid-1960's (Seine-Rat River Conservation District 2009, Dillon Consulting Limited 2001). The Diversion is a uniform, engineered channel that begins at St. Anne and stretches approximately 36 km east to its outflow into the Red River, north of Ste. Adolphe. The Seine River Diversion receives water from many local drains from the south. Within the Project Siting Study Area the larger drains include the Manning Canal and the Youville Drain (Dillon Consulting Limited 2001). The volume of water entering the Seine River has been reduced to riparian flow and that from smaller drains north of the Diversion. Water flows from both the Seine River and the Seine River Diversion can fluctuate widely on a monthly basis; from flood levels in the spring to reaching almost zero by the end of the summer (Seine-Rat River Conservation District 2009).

4.2.3 Surface Water Quality

Surface water quality data recorded from two locations on a quarterly basis on the Seine River (but outside of the PSSA) were compiled and analyzed and are reported in Table 4-4.

In general, results have indicated that:

- Six out of 51 water quality parameters exceeded the most stringent guidelines including total phosphorous, total aluminum, total chromium, total iron, total manganese, and total silver.
- Total manganese concentrations exceeded the guidelines only marginally.

Utilizing water chemistry data collected from the Seine River between 1990 and 2005 indicated WQI rankings between “fair” and “good” indicating water quality during that time period sometimes exceeded water quality guidelines for some variables.

In general, phosphorus consistently exceeded the narrative guideline of 0.05 mg/L while other nutrients including ammonia and nitrate/nitrite nitrogen concentrations were within guidelines throughout the entire period of record. As seen in other watercourses within the PSSA, a consistent pattern of low dissolved oxygen concentrations during ice-covered months has been observed indicating the potential for incidents when aquatic life and wildlife may be impacted (MWS undated).

The accumulated impacts of land-use practices, municipal discharges, decreases in vegetated buffer strips along the Seine River and contributions from major provincial drains has seemingly resulted in an increase in nutrients, suspended sediments and turbidity as water flows from upstream sites to downstream sites (MWS undated).

4.2.4 Fish Habitat

Milani (2013) has classified aquatic habitat of the Seine River as Complex, with Indicator fish species present. Downstream sections of the Seine Diversion contain many areas with abundant macrophytes, overhanging vegetation and woody debris (DCL 2001). Backwater areas contain emergent vegetation, while submerged vegetation is common throughout the river. Pools have been reported throughout the area, but not all are sufficiently deep to be overwintering habitat. Bottom substrates are predominantly soft and muddy, with limited cobble and gravel areas containing appropriate nest-building and spawning habitat for bullhead species (Scott and Crossman 1973). Limited spawning habitat exists for fish species such as walleye and white sucker requiring cobble type substrate or riffles (DCL 2001 and 2005, Scott and Crossman 1973). Most areas throughout the system offer suitable habitat for northern pike spawning and nursery habitat for a variety of species through the presence of emergent macrophtes and terrestrial vegetation that floods in the spring (DCL 2001, Scott and Crossman 1973).

Table 4-4: Historical Surface Water Quality Data Collected by MWS on the Seine River (2008-2013)

Parameter	units	Seine River – Upstream Project Siting Study Area						Seine River –Downstream of the Project Siting Study Area					
		Count	Min	Mean	Max	Median	75th Percent-ile	Count	Min	Mean	Max	Median	75th Percent-ile
Physiochemical													
Temperature water (field measurements)	Deg C	52	-0.9	10.8	25.3	10.6	17.7	22	-0.8	10.7	27.3	8.5	17.7
pH	pH units	51	7.3	8.2	8.6	8.2	8.4	21	7.2	8.2	8.6	8.2	8.4
Oxygen dissolved	mg/L	26	1.7	6.8	12.4	7.3	8.6	21	3.5	8.2	13.2	8.4	10.0
Conductivity (at 25c)	US/CM	50	267	496	709	511	574	20	232	431	592	432	495
Turbidity	Ntu	25	12	35	90	25	46	21	2	15	50	12	17
Total dissolved solids	mg/L @180C	25	168	320	528	324	361	21	134	277	362	292	310
Total suspended solids	mg/L	51	5	44	148	40	60	16	7	29	70	23	38
Specific conductance (lab)	uS/cm	1	852	852	852	852	852	1	623	623	623	623	623
Anions & Nutrients													
Chloride (Cl) - dissolved	mg/L	27	6.770	21.368	58.900	18.400	26.950	10	2.360	6.910	10.100	7.425	8.643
Phosphorus (P) - total inorganic	mg/L	46	0.040	0.198	0.506	0.175	0.280	17	0.018	0.124	0.438	0.096	0.155
Potassium (K) - total	mg/L	40	1.560	5.880	11.600	5.490	7.493	21	0.940	3.474	10.600	2.620	4.670
Calcium (Ca) - total	mg/L	40	27.000	59.203	125.000	59.150	67.025	21	34.800	64.310	88.000	66.200	73.000
Sodium (Na) - total	mg/L	40	5.970	14.116	37.200	12.200	16.925	21	2.810	7.353	19.700	6.050	8.970
Magnesium (Mg) - total	mg/L	40	13.0000	27.0650	49.3000	26.3000	33.5750	21	10.4000	19.8619	27.8000	19.3000	23.7000
Metals													
Aluminum (Al) - dissolved	mg/L	25	0.001	0.044	0.936	0.006	0.012	21	0.001	0.009	0.100	0.003	0.005
Aluminum (Al) - total	mg/L	40	0.3300	1.7415	4.9500	1.1950	2.5825	21	0.0414	0.4606	2.4400	0.2460	0.4920

Table 4-4: Historical Surface Water Quality Data Collected by MWS on the Seine River (2008-2013)

Parameter	units	Seine River – Upstream Project Siting Study Area						Seine River –Downstream of the Project Siting Study Area					
		Count	Min	Mean	Max	Median	75th Percent-ile	Count	Min	Mean	Max	Median	75th Percent-ile
Antimony (Sb) - total	mg/L	40	0.0002	0.0002	0.0004	0.0002	0.0002	21	0.0002	0.0002	0.0005	0.0002	0.0002
Arsenic (Ar) - total	mg/L	40	0.001	0.003	0.005	0.003	0.003	21	0.001	0.001	0.004	0.001	0.002
Barium (Ba) - total	mg/L	40	0.040	0.076	0.138	0.072	0.079	21	0.042	0.076	0.130	0.078	0.081
Beryllium (Be) - total	mg/L	40	0.0002	0.0002	0.0002	0.0002	0.0002	21	0.0002	0.0002	0.0002	0.0002	0.0002
Bismuth (Bi) - total	mg/L	40	0.0002	0.0002	0.0002	0.0002	0.0002	21	0.0002	0.0002	0.0002	0.0002	0.0002
Boron (B) - total	mg/L	40	0.020	0.038	0.068	0.036	0.043	21	0.019	0.032	0.061	0.030	0.032
Cadmium (Cd) - total	mg/L	40	0.00001	0.00003	0.00009	0.00003	0.00004	21	0.00001	0.00002	0.00004	0.00001	0.00003
Calcium (Ca) - dissolved	mg/L	0	-	-	-	-	-	0	-	-	-	-	-
Cesium (Ce) - total	mg/L	40	0.0001	0.0002	0.0006	0.0001	0.0003	21	0.0001	0.0001	0.0003	0.0001	0.0001
Chromium hexavalent dissolved	mg/L	25	0.01	0.01	0.02	0.01	0.01	21	0.01	0.01	0.02	0.01	0.01
Chromium (Cr) - total	mg/L	40	0.0007	0.0027	0.0078	0.0020	0.0033	21	0.0003	0.0012	0.0035	0.0010	0.0010
Cobalt (Co) - total	mg/L	40	0.0002	0.0008	0.0018	0.0006	0.0010	21	0.0002	0.0004	0.0009	0.0003	0.0005
Copper (Cu) - total	mg/L	40	0.0016	0.0036	0.0058	0.0033	0.0045	20	0.0007	0.0019	0.0100	0.0016	0.0018
Iron (Fe) - dissolved	mg/L	0	-	-	-	-	-	0	-	-	-	-	-
Iron (Fe) - total	mg/L	40	0.5010	1.5360	4.0900	1.1000	2.0100	21	0.2230	0.7652	2.4400	0.5700	0.9900
Lead (Pb) - total	mg/L	40	0.0003	0.0009	0.0022	0.0007	0.0012	21	0.0001	0.0005	0.0014	0.0004	0.0005
Lithium (Li) - total	mg/L	40	0.0073	0.0195	0.0433	0.0174	0.0225	21	0.0038	0.0071	0.0119	0.0068	0.0086
Manganese (Mn) - total	mg/L	40	0.0160	0.0655	0.2130	0.0505	0.0682	21	0.0106	0.0576	0.1800	0.0547	0.0689
Mercury (Hg) - total	mg/L	3	0.00002	0.00002	0.00002	0.00002	0.00002	3	0.00002	0.00002	0.00002	0.00002	0.00002
Mercury (Hg) - total	ug/L	0	-	-	-	-	-	0	-	-	-	-	-
Molybdenum (Mo) - total	mg/L	40	0.0006	0.001	0.002	0.001	0.001	21	0.0004	0.001	0.002	0.001	0.001

Table 4-4: Historical Surface Water Quality Data Collected by MWS on the Seine River (2008-2013)

Parameter	units	Seine River – Upstream Project Siting Study Area						Seine River –Downstream of the Project Siting Study Area					
		Count	Min	Mean	Max	Median	75th Percent-ile	Count	Min	Mean	Max	Median	75th Percent-ile
Nickel (Ni) - total	mg/L	40	0.0016	0.0040	0.0070	0.0037	0.0051	21	0.0010	0.0020	0.0031	0.0020	0.0020
Rubidium (Rb) - total	mg/L	40	0.002	0.004	0.010	0.004	0.006	21	0.002	0.003	0.006	0.002	0.004
Selenium (Se) - total	mg/L	40	0.0004	0.0009	0.0010	0.0010	0.0010	21	0.0004	0.0009	0.0010	0.0010	0.0010
Silicon (Si) - total	mg/L	25	5.150	9.547	19.900	9.030	11.600	9	3.940	6.939	11.100	6.170	8.570
Silver (Ag) - total	mg/L	40	0.00002	0.0001	0.0002	0.0001	0.0001	21	0.00002	0.0002	0.0015	0.0001	0.0001
Strontium (Sr) - total	mg/L	40	0.077	0.152	0.254	0.153	0.170	21	0.056	0.120	0.166	0.124	0.136
Tellurium (Te) - total	mg/L	40	0.0002	0.0002	0.0002	0.0002	0.0002	21	0.0002	0.0002	0.0006	0.0002	0.0002
Thallium (Tl) - total	mg/L	40	0.0000	0.0001	0.0001	0.0001	0.0001	21	0.0000	0.0001	0.0001	0.0001	0.0001
Thorium (Th) - total	mg/L	40	0.0001	0.0004	0.0012	0.0003	0.0005	21	0.0001	0.0001	0.0005	0.0001	0.0001
Tin (Sn) - total	mg/L	40	0.0002	0.0004	0.0015	0.0002	0.0006	21	0.0002	0.0003	0.0009	0.0002	0.0002
Titanium (Ti) - total	mg/L	40	0.011	0.067	0.251	0.049	0.114	21	0.002	0.018	0.093	0.010	0.017
Tungsten (W) - total	mg/L	33	0.0001	0.0006	0.0010	0.0010	0.0010	15	0.0001	0.0006	0.0010	0.0010	0.0010
Uranium (U) - total	mg/L	40	0.000	0.002	0.006	0.001	0.002	21	0.000	0.000	0.001	0.000	0.000
Vanadium (V) - total	mg/L	40	0.002	0.008	0.021	0.007	0.011	21	0.001	0.002	0.007	0.002	0.002
Zinc (Zn) - total	mg/L	40	0.003	0.008	0.019	0.008	0.011	21	0.001	0.006	0.016	0.005	0.007
Zirconium (Zr) - total	mg/L	40	0.001	0.003	0.007	0.002	0.003	21	0.000	0.001	0.002	0.001	0.002

The Seine River Diversion, together with the two primary drains in the PSSA (Youville Drain and Manning Canal), have been classified as Type B Habitat; simple with indicator species present. Smaller drains discharging into these three channels are predominantly Type E; ephemeral flows with indirect fish habitat (Milani 2013). The Diversion channel bottom is considered good bullhead spawning habitat as it is composed primarily of soft clay and mud. While limited in-stream protection from sunlight, predation and heavy currents are limiting factors for bullhead species, the presence of emergent aquatic macrophytes lining the margins of the stream provide suitable northern pike spawning habitat. The potential for walleye and white sucker spawning habitat is created by numerous gradient control structures made from boulders. These pool and riffle habitats occur over steep gradients ranging from ~10 to 20 m in length but by their very nature may also pose a barrier for fish passage, particularly during times of low water flow (DCL 2001).

4.2.5 Fish Community

Up to 32 different species of fish (Table 4-3) have been reported in the Seine River (MWS 2007, Biggin pers. comm. 2013) of which none are provincially or federally protected. This high number of species likely occurred in years where high water flows allowed fish from the Red River to enter the Seine River via the Seine River Diversion. Under typical rainfall years, the Seine River fishery is largely dependent on resident fish stocks (DCL 2005). Gaudet (1997) reported that the most common species found were white sucker, pearl dace, black bullhead, emerald shiner, fathead minnow, common shiner, and longnose dace. Limited numbers of walleye and northern pike were also collected. While the bigmouth buffalo has been observed in the Seine River in the past, the most recent survey by AEC in 2005 did not find any of these fish in the system (DCL 2005). The bigmouth buffalo is currently listed as '*special concern*' under the federal *Species at Risk Act* (2002).

A limited number of fish species have been collected in the Seine River Diversion; however it is likely that several species spend at least part of their lifecycle there. Although the habitat is poor and classified as which could limit fish productivity, it could provide good spawning grounds for bullhead and pike, and nursery habitat for several species (Dillon Consulting 2001). The gradient control structures could also potentially serve as spawning areas for white suckers, and walleye (MWS 2007).

The smaller drains entering the Seine River and the Diversion contain primarily forage fishes. These typically include brook stickleback, central mudminnow, fathead minnow and pearl dace. White suckers and northern pike have also been collected in the Manning Canal and the Prefontaine Drain (Seine-Rat River Conservation District 2005a).

The Seine River survey and restoration project (SSRCD 2005a) reported six orders of benthos found throughout the system; Oligochaeta, Trichoptera, Ephemeroptera, Odonata, Diptera, and Bivalvia. Of the 10 families represented, 5 were considered to be common Naididae (formerly Tubificidae - tubificid worms), Hydropsychidae (caddisflies), Ephemeridae (mayflies),

Gomphidae (clubtail dragonflies), and Chironomidae (chironomids or non-biting midges). Bethos that fell into the categories uncommon or rare were Caenidae (squaregill mayfly), Heptageniidae (flatheaded mayflies), Empididae (daggerflies or balloon flies), Simuliidae (blackflies) and Sphaeriidae (pea clams or fingernail clams) (DCL 2005). As the benthic community provides an important food source for resident fish species, particularly for forage fish, the lack of complex habitat in the Seine River Diversion and other drains of this system could limit this essential resource (Dillon Consulting 2001).

4.3 THE RAT-MARSH RIVER WATERSHED

4.3.1 Watershed Characteristics

The Rat-Marsh River Integrated Watershed Management Planning Unit (Map 2-2) is located in the central portion of the PSSA. Land use in this area is primarily agriculture, including both crop and livestock practices. Only Joubert Creek and the headwaters of the Marsh River are within the PSSA. The headwaters of the Marsh River are located near Letellier, and it flows north to where it meets the Rat River in Ste. Agathe. Five designated drains were constructed in 1980/81 to improve drainage in the Marsh River. Four of these are within the project area; Angle drain, Ste. Elizabeth drain, Lafond drain and Arnaud drain (MWS 2012).

The Rat River has an expansive natural floodplain which frequently floods in the spring. Water retention in the watershed is accomplished with wetlands, and the construction of dams and Ducks unlimited retention projects (MWS 2012). The St. Malo dam and St. Malo reservoir were constructed in 1959 to supply municipal water to the Village of St. Malo, and for agricultural practices and recreation (Graveline et al. 2006, MWS 2012, Agriculture and Agri-Food Canada - Prairie Farm Rehabilitation Administration, Prairies East Region 2004, Manitoba Conservation and Water Stewardship 2012). The north shore of the reservoir was designated St. Malo Provincial Park in 1961 (Graveline et al. 2006, MWS 2012, Manitoba Conservation and Water Stewardship 2012). The reservoir is approximately 2.4 km long and an average of 305 m wide. The park itself is roughly 148 hectares in size (Manitoba Conservation and Water Stewardship 2012).

Caliento Bog, Carrick Bog, Rat River Swamp are the largest wetlands in this project area and function as water retention areas, particularly during the spring runoff period. The Caliento Bog is located east of the Village of Sundown. As it is situated between the Rat and Roseau Rivers, the Caliento Bog contributes to runoff water flow for both rivers (MWS 2012). The Rat River Swamp was constructed in 1994 by Duck's Unlimited to retain excess spring flows and develop waterfowl production. In 2002, the Nature Conservancy and The Nature Conservancy (US) identified the Rat River Swamp as a high-priority conservation site by through the Superior Mixed Forest ecoregional planning process (Nature Conservancy Canada. 2012).

4.3.2 Surface Water Resources

The Rat River originates north east of Piney in the Sandilands Provincial Forest where it meanders west over approximately 130 km through several wetland complexes from Carrick Bog on the east, to Caliento Bog, to Rat River Swamp to join the Red River. Fed by three primary tributaries, the Marsh River, Joubert Creek and the Sand River, and many smaller creeks and ditches, the Rat River has an expansive natural floodplain which frequently floods in the spring (MWS 2011). Joubert Creek is located on the north-east side of the Rat River, beginning with the Joubert Creek extension near Zhoda. The natural portion of the river begins just south of Pansey and flows in north-west until it joins the Rat River near St. Pierre (MWS 2012).

4.3.3 Surface Water Quality

Surface water quality data recorded from 1 locations on a quarterly basis on the Rat River within PSSA, were compiled and analyzed and are reported in Table 4-5.

Table 4-5: Historical Surface Water Quality Data Collected by MWS on the Rat River (2008-2013)

Parameter	units	Rat River – Located Downstream of the Project Siting Study Area					
		Count	Min	Mean	Max	Median	75th Percent-ile
Physiochemical							
Temperature water (field measurements)	Deg C	50	-0.8	10.6	30.0	10.2	17.7
pH	pH units	51	7.5	8.2	8.6	8.2	8.4
Oxygen dissolved	mg/L	25	2.5	7.7	10.2	8.3	8.6
Conductivity (at 25c)	uS/cm	50	275	444	774	426	574
Turbidity	Ntu	25	4	14	39	9	46
Total dissolved solids	mg/L @180C	25	179	314	476	305	361
Total suspended solids	mg/L	47	5	28	129	19	60
Specific conductance (lab)	uS/cm	1	708	708	708	708	852
Anions and Nutrients							
Chloride (Cl) - dissolved	mg/L	21	6.060	12.992	24.300	11.200	26.950
Phosphorus (P) - total inorganic	mg/L	45	0.044	0.303	2.160	0.165	0.280
Potassium (K) - total	mg/L	41	1.280	4.932	17.100	4.170	7.493

Table 4-5: Historical Surface Water Quality Data Collected by MWS on the Rat River (2008-2013)

Parameter	units	Rat River – Located Downstream of the Project Siting Study Area					
		Count	Min	Mean	Max	Median	75th Percent-ile
Calcium (Ca) - total	mg/L	41	32.100	61.893	103.000	60.900	67.025
Sodium (Na) - total	mg/L	41	3.660	11.098	37.200	8.180	16.925
Magnesium (Mg) - total	mg/L	41	12.0000	22.3195	41.4000	21.4000	33.5750
Metals							
Aluminum (Al) - dissolved	mg/L	25	***0.001***	0.010	0.084	0.004	0.012
Aluminum (Al) - total	mg/L	41	0.0666	0.8444	5.6200	0.5110	2.5825
Antimony (Sb) - total	mg/L	41	***0.0002***	0.0002	0.0005	0.0002	0.0002
Arsenic (Ar) - total	mg/L	41	0.000	0.002	0.004	0.001	0.003
Barium (Ba) - total	mg/L	41	0.041	0.066	0.117	0.061	0.079
Beryllium (Be) - total	mg/L	41	***0.0002***	0.0002	0.0002	0.0002	0.0002
Bismuth (Bi) - total	mg/L	41	***0.0002***	0.0002	0.0002	0.0002	0.0002
Boron (B) - total	mg/L	41	0.018	0.039	0.105	0.030	0.043
Cadmium (Cd) - total	mg/L	41	***0.00001***	0.00004	0.00068	0.00002	0.00004
Calcium (Ca) - dissolved	mg/L	0	-	-	-	-	-
Cesium (Ce) - total	mg/L	41	***0.0001***	0.0001	0.0005	0.0001	0.0003
Chromium hexavalent dissolved	mg/L	25	***0.01***	0.01	0.02	0.01	0.01
Chromium (Cr) - total	mg/L	41	***0.0004***	0.0016	0.0071	0.0010	0.0033
Cobalt (Co) - total	mg/L	41	***0.0002***	0.0005	0.0017	0.0005	0.0010
Copper (Cu) - total	mg/L	41	0.0010	0.0023	0.0090	0.0019	0.0045
Iron (Fe) - dissolved	mg/L	0	-	-	-	-	-
Iron (Fe) - total	mg/L	41	0.2200	0.8310	4.2000	0.6120	2.0100
Lead (Pb) - total	mg/L	41	0.0002	0.0006	0.0020	0.0005	0.0012
Lithium (Li) - total	mg/L	41	0.0042	0.0100	0.0231	0.0088	0.0225
Manganese (Mn) - total	mg/L	41	0.0102	0.0485	0.1230	0.0444	0.0682
Mercury (Hg) - total	mg/L	3	***0.00002***	0.00002	0.00002	0.00002	0.00002
Molybdenum (Mo) - total	mg/L	41	***0.0004***	0.001	0.002	0.001	0.001
Nickel (Ni) - total	mg/L	41	0.0009	0.0024	0.0068	0.0020	0.0051
Rubidium (Rb) - total	mg/L	41	0.002	0.005	0.012	0.004	0.006
Selenium (Se) - total	mg/L	41	***0.0004***	0.0009	0.0010	0.0010	0.0010
Silicon (Si) - total	mg/L	27	3.920	7.771	21.200	6.420	11.600
Silver (Ag) - total	mg/L	41	***0.00002***	0.0001	0.0003	0.0001	0.0001

Table 4-5: Historical Surface Water Quality Data Collected by MWS on the Rat River (2008-2013)

Parameter	units	Rat River – Located Downstream of the Project Siting Study Area					
		Count	Min	Mean	Max	Median	75th Percent-ile
Strontium (Sr) - total	mg/L	41	0.069	0.148	0.406	0.137	0.170
Tellurium (Te) - total	mg/L	41	***0.0002***	0.0002	0.0003	0.0002	0.0002
Thallium (Tl) - total	mg/L	41	0.0000	0.0001	0.0001	0.0001	0.0001
Thorium (Th) - total	mg/L	41	***0.0001***	0.0002	0.0007	0.0001	0.0005
Tin (Sn) - total	mg/L	41	***0.0002***	0.0004	0.0020	0.0002	0.0006
Titanium (Ti) - total	mg/L	41	0.003	0.033	0.191	0.019	0.114
Tungsten (W) - total	mg/L	33	***0.0001***	0.0006	0.0010	0.0010	0.0010
Uranium (U) - total	mg/L	41	0.000	0.001	0.002	0.001	0.002
Vanadium (V) - total	mg/L	41	0.001	0.004	0.017	0.003	0.011
Zinc (Zn) - total	mg/L	41	0.002	0.006	0.017	0.005	0.011
Zirconium (Zr) - total	mg/L	41	0.000	0.001	0.006	0.001	0.003

4.3.4 Fish Habitat

The full length of both the Rat River and Joubert Creek have been designated Habitat Class A; Complex habitat with indicator species present (Milani 2013). The aquatic habitat of the Rat River can be variable and complex ranging from with gravel and cobble bottoms in some areas and sand/silt in others. Towards the banks the river bottom can be hard and irregular, but then slope into a soft, uniform composition mid-channel. There are areas with sloping banks and others that are sleep and under-cut. Aquatic vegetation ranges from sparse to abundant, providing spawning and nursery habitat for many species. Areas of the river also contain sandbars and woody debris (Graveline et al. 2006). There are several small rockfill-type weirs and dams constructed downstream of the St. Malo Dam for water retention. Joubert Creek also has at least two rock dams for summer water retention.

4.3.5 Fish Community

There are potentially 42 fish species inhabiting the Rat River (Table 4-3), 13 of of which have been observed in Joubert Creek (Biggins pers. comm. 2013). The high number of wiers and dams in place along these watercourses suggest that fish populations are resident and are not migratory in nature. The complexity and variety of habitat within these watercourses including

the presence of suitable spawning, nursery, and overwintering habitat suggests adequate fish habitat exists in the watershed to support sustaining fish species populations.

It should be noted that two (2) species designated 'Special Concern' under Schedule 1 of SARA (2002), chestnut lamprey (*Ichthyomyzon castaneus*) and silver chub (*Macrhybopsis storeriana*), have been captured in the Rat River (Biggin pers. comm. 2013).

4.4 THE ROSEAU RIVER WATERSHED

4.4.1 Watershed Characteristics

The Roseau River Watershed is located in the southern-most portion of the PSSA and encompasses portions of the Rural Municipalities of Piney, Stuartburn, and Franklin (Map 2-2). Located in southeastern Manitoba and northwestern Minnesota and encompasses a drainage area of approximately 5,818 square kilometers (2,246 square miles). The total drainage area for the Canadian portion of the Roseau River Watershed is approximately 2,584 km^2.

4.4.2 Surface Water Resources

The Roseau River, the main watercourse within the watershed, traverses the southern section of the PSSA flowing from east near Stuartburn to the west to Dominion City and on to its confluence with the Red River near Letellier, Manitoba. The flow of the Roseau River is variable but in recent years, the river frequently floods in the spring, and even in off season periods such as November (Roseau River International Watershed 2007). The headwaters of the Roseau River are in northwestern Minnesota and it flows approximately 344 km to the northwest to join the Red River near the village of Letellier. A number of changes have altered the natural course of the Roseau River (i.e., diversions, channelization, blockages, etc.).

4.4.3 Surface Water Quality

Surface water quality data recorded from 1 locations on a quarterly basis on the Roseau River upstream of the PSSA, were compiled and analyzed and are reported in Table 4-6.

Table 4-6: Historical Surface Water Quality Data Collected by MWS on the Roseau River (2008-2013)

Parameter	units	Roseau River – Located Downstream of the Project Siting Study Area					
		Count	Min	Mean	Max	Median	75th Percent-ile
Physical							
Temperature water (field measurements)	Deg C	60	-0.9	11.4	28.7	12.0	17.4
pH	pH units	51	7.4	8.1	8.6	8.2	8.3
Oxygen dissolved	mg/L	24	3.5	7.7	10.5	8.1	9.6
Conductivity (at 25c)	US/CM	50	196	348	770	317	383
Turbidity	Ntu	24	3	24	94	17	39
Total dissolved solids	mg/L @180C	24	125	269	492	269	294
Total suspended solids	mg/L	49	2	48	198	29	67
Specific conductance (lab)	uS/cm	1	629	629	629	629	629
Anions and Nutrients							
Chloride (Cl) - dissolved	mg/L	19	2.510	7.439	14.200	6.850	9.365
Phosphorus (P) - total inorganic	mg/L	46	0.018	0.122	0.620	0.079	0.151
Potassium (K) - total	mg/L	41	1.500	3.795	9.890	3.240	4.500
Calcium (Ca) - total	mg/L	41	23.500	49.961	98.900	49.100	56.000
Sodium (Na) - total	mg/L	41	2.430	6.297	15.500	5.230	8.300
Magnesium (Mg) - total	mg/L	41	9.8700	20.9139	49.7000	20.1000	23.9000
Metals							
Aluminum (Al) - dissolved	mg/L	24	0.002	0.020	0.205	0.006	0.012
Aluminum (Al) - total	mg/L	41	0.1010	1.4921	11.6000	0.8820	1.9600
Antimony (Sb) - total	mg/L	41	***0.0002***	0.0002	0.0005	0.0002	0.0002
Arsenic (Ar) - total	mg/L	41	0.001	0.002	0.006	0.002	0.002
Barium (Ba) - total	mg/L	41	0.030	0.050	0.090	0.048	0.054
Beryllium (Be) - total	mg/L	41	***0.0002***	0.0002	0.0003	0.0002	0.0002
Bismuth (Bi) - total	mg/L	41	***0.0002***	0.0002	0.0002	0.0002	0.0002
Boron (B) - total	mg/L	41	0.010	0.024	0.043	0.022	0.030
Cadmium (Cd) - total	mg/L	41	***0.00001***	0.00003	0.00009	0.00002	0.00004
Calcium (Ca) - dissolved	mg/L	0	-	-	-	-	-
Cesium (Ce) - total	mg/L	41	***0.0001***	0.0002	0.0009	0.0001	0.0003

Table 4-6: Historical Surface Water Quality Data Collected by MWS on the Roseau River (2008-2013)

Parameter	units	Roseau River – Located Downstream of the Project Siting Study Area					
		Count	Min	Mean	Max	Median	75th Percent-ile
Chromium hexavalent dissolved	mg/L	24	***0.01***	0.01	0.02	0.01	0.01
Chromium (Cr) - total	mg/L	41	***0.0004***	0.0024	0.0117	0.0017	0.0032
Cobalt (Co) - total	mg/L	41	***0.0002***	0.0008	0.0025	0.0006	0.0011
Copper (Cu) - total	mg/L	41	0.0011	0.0028	0.0078	0.0022	0.0036
Iron (Fe) - dissolved	mg/L	0	-	-	-	-	-
Iron (Fe) - total	mg/L	41	0.2400	1.4241	7.4000	1.0000	1.8700
Lead (Pb) - total	mg/L	41	0.0001	0.0009	0.0028	0.0007	0.0013
Lithium (Li) - total	mg/L	41	0.0038	0.0090	0.0162	0.0082	0.0107
Manganese (Mn) - total	mg/L	41	0.0162	0.0700	0.1940	0.0629	0.0980
Mercury (Hg) - total	mg/L	3	***0.00002***	0.00002	0.00003	0.00002	0.00003
Mercury (Hg) - total	ug/L	0	-	-	-	-	-
Molybdenum (Mo) - total	mg/L	41	***0.0004***	0.001	0.002	0.001	0.001
Nickel (Ni) - total	mg/L	41	0.0011	0.0030	0.0091	0.0026	0.0038
Rubidium (Rb) - total	mg/L	41	0.002	0.006	0.017	0.005	0.007
Selenium (Se) - total	mg/L	41	***0.0004***	0.0009	0.0010	0.0010	0.0010
Silicon (Si) - total	mg/L	27	3.700	9.711	37.600	8.060	10.650
Silver (Ag) - total	mg/L	41	***0.00002***	0.0001	0.0001	0.0001	0.0001
Strontium (Sr) - total	mg/L	41	0.056	0.110	0.247	0.107	0.125
Tellurium (Te) - total	mg/L	41	***0.0002***	0.0002	0.0002	0.0002	0.0002
Thallium (Tl) - total	mg/L	41	0.0000	0.0001	0.0001	0.0001	0.0001
Thorium (Th) - total	mg/L	41	***0.0001***	0.0004	0.0013	0.0003	0.0005
Tin (Sn) - total	mg/L	41	***0.0002***	0.0004	0.0022	0.0002	0.0006
Titanium (Ti) - total	mg/L	41	0.005	0.055	0.303	0.039	0.076
Tungsten (W) - total	mg/L	34	***0.0001***	0.0006	0.0010	0.0006	0.0010
Uranium (U) - total	mg/L	41	0.000	0.001	0.004	0.001	0.001
Vanadium (V) - total	mg/L	41	0.001	0.005	0.026	0.005	0.007
Zinc (Zn) - total	mg/L	41	0.002	0.007	0.023	0.006	0.009
Zirconium (Zr) - total	mg/L	41	0.000	0.002	0.007	0.002	0.003

4.4.4 Fish Habitat

In Roseau River International Watershed (2007), several key fish habitat issues were identified including the frequency of flooding, degraded water quality arising from land use practices, and the perceived need for increased flow management options (e.g., diversions or floodways to manage high flow events). Within the project boundary area, the Roseau River Anishinabe First Nation (RRAFN) has two settlements: one just east of Letellier on PR 201 and a smaller population approximately 30 km east (Roseau River International Watershed 2007). The Sewage lagoon and garbage dump proximity to the main channel of the Roseau River has raised concerns regarding potential effects during high flow events (Roseau River International Watershed 2007).

4.4.5 Fish Community

Several changes to the natural flow regime of the Roseau River are evident including channel diversions, channelized sections and local blockages (Roseau River International Watershed 2007). While there is a dam downstream of Dominion City it does not likely present an obstruction to fish passage, in part because of the placement of rock riffles downstream of the dam in 1992. These riffles act to raise water levels and provide for fish passage even under low flow conditions (Janusz pers. comm. 2013). Fish species richness is known to decline in the Roseau River with distance from the confluence with the Red River (Biggin pers. comm. 2013). A drain near the town of Vita has been identified as contributing to increased sediment in the Roseau River as a result of erosional problems (Roseau River International Watershed 2007). This is of concern because the area of the drain may be an important spawning area for walleye (Biggin pers. comm. 2013).

4.5 DATA GAPS

- No Aboriginal Traditional Knowledge (ATK) on Aboriginal Fisheries information available.
- No mammal and aquatic macrophyte information available.
- Benthic invertebrate information is limited.
- More data gaps may be identified after analysis of water quality and fish and fish habitat databases received from Manitoba Conservation and Water Stewardship.

5.0 KEY CONSIDERATIONS AND FINDINGS

Preliminary desktop assessment revealed the following:

- Riparian buffer zones along the Seine River and its tributaries have been altered by agricultural activities and construction of residences.
- Bigmouth shiner (*Notropis dorsalis*) is a potential Species of Conservation Concern (SOCC).
- Silver chub (*Macrhybopsis storeriana*), pearl dace (*Margariscus margarita*) and chestnut lamprey ( ) are recognized as rare under the Manitoba Endangered Species Act in the Interlake Plain Ecoregion.
- Mapleleaf Mussel (*Quadrula quadrula*) is an endangered bivalve listed under SARA and MESA has been recorded historically in Rat and Seine rivers.
- Data gaps, including Aboriginal Traditional Knowledge (ATK) on Aboriginal Fisheries, mammal and aquatic macrophyte data, and limited benthic invertebrate information.
- More data gaps may be identified after analysis of water quality and fish and fish habitat databases received from Manitoba Conservation and Water Stewardship.

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APPENDIX A – WATER-QUALITY PARAMETERS USED FOR CALCULATING THE FRESHWATER QUALITY INDEX

The table shows the water quality guidelines used in calculating freshwater quality scores for monitoring stations in the province of Manitoba listed by parameter, the form of the parameter (for example total or dissolved), the associated guideline value and the source of the guideline.

Table A-1: Water-quality Guidelines used for Manitoba Waterbodies to Calculate the Freshwater Quality Index

Parameter	Form	Guideline	Guideline Source
2,4-D		4 µg/L	a
Ammonia1	total as N	Calculation based on pH and temperature	b, c
Ammonia2	un-ionized	19 µg/L	d
Arsenic1	extractable, total	150 µg/L	e
Arsenic2	total	5 µg/L	a
Cadmium1	extractable, total	$[e^{0.7409ln[hardness]-4.719}]$ x [1.101672 – {ln(hardness)(0.041838)}] µg/L where hardness as mg $[CaCO_3]/L$]	f
Chloride2	dissolved	120 mg/L	a
Copper1	extractable, total	[e0.8545ln[hardness]-1.702] x (0.96) µg/L where hardness as mg $[CaCO_3]/L$	b
Copper2	total	2 µg/L for hardness < 90 mg [CaCO3]/L $[e^{0.8545ln[hardness]-1.465}]$ x (0.2) µg/L for hardness > 90 mg $[CaCO_3]/L$ where hardness as mg $[CaCO_3]/L$]	d
Iron1	total	0.3 mg/L	d
Lead	extractable, total	$[e^{1.273ln[hardness]-4.705}]$ x [1.46203 – {ln(hardness)(0.145712}] µg/L where hardness as mg $[CaCO_3]/L$	d
MCPA		2.6 µg/L	a
Nickel1	extractable, total	$[e^{0.8460ln[hardness]+0.0584}]$ x [0.997]µg/L where hardness as mg $[CaCO_3]/L$	e
Nitrate1	total dissolved	2.9 mg N/L	d
Nickel2	total	< $e^{0.76[ln(hardness)]}$+1.06 µg/L where hardness as mg $[CaCO_3]/L$	d
Nitrogen2	total	1 mg N/L	h

Table A-1: Water-quality Guidelines used for Manitoba Waterbodies to Calculate the Freshwater Quality Index

Parameter	Form	Guideline	Guideline Source
Oxygen1	dissolved	5 mg/L	e
Oxygen[2]	dissolved	6.5 mg/L	a
pH		between 6.5 and 9	a
Phosphorus	total	0.05 mg/L	b, g
Suspended sediments1	total	Maximum increase of 25 mg/L for high flow and turbid waters above background levels	d
Zinc1	total	$[e^{\{0.8473\ln[\text{hardness}]+0.884\}}]$ x [0.986] µg/L where hardness as mg $[CaCO_3]$/L	b, f
Zinc2	total	7.5 µg/L for hardness ≤ 90 mg [CaCO3]/L 7.5 + 0.75*(hardness-90) for hardness > 90 mg $[CaCO_3]$/L where hardness as mg [CaCO3]/L	D

[1] Applies to stations monitored under provincial monitoring programs.

[2] Applies to stations monitored under federal monitoring programs (Prairie Provinces Water Board).

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Appendix B, Table B-1: Surface-water Quality Data and Applicable Guidelines

Parameter	Units	CCME, Freshwater Aquatic Life		MWQSOG, Freshwater Aquatic Life						
					Tier II		Tier III			
								Numerical		
		Long Term	Short Term	Tier I	Chronic	Acute	Narrative	Freshwater Aquatic Life	Irrigation	Livestock
Physicochemical										
Conductivity (at 25 ^{0}C)	uS/cm	-	-	-	-	-	-	-	1500	-
Oxygen, Dissolved	mg/L	Variable, See notes	-	-	Variable, See notes	Variable, See notes	-	-	-	-
pH	pH units	6.5-9.0	-	6.5-9.0	-	-	-	-	-	-
Temperature (Field)	Deg C	Narrative, See notes	-	-	Variable, See notes	Variable, See notes	-	-	-	-
Total Dissolved Solids (TDS)	mg/L	-	-	-	-	-	-	-	500-3500	-
Total Suspended Solids (TSS)	mg/L	-	-	-	-	-	-	-	-	-
Turbidity	NTU	Narrative, See notes	Narrative, See notes	-	Correlation, See notes	Correlation, See notes	-	-	-	-
Specific conductance (Lab)	uS/cm	-	-	-	-	-	-	-	-	-
Anions and Nutrients										
Alkalinity (PP as CaCO3)	mg/L	-	-	-	-	-	-	-	-	-
Alkalinity (Total as CaCO3)	mg/L	-	-	-	-	-	-	-	-	-
Bicarbonate (HCO3)	mg/L	-	-	-	-	-	-	-	-	-
Carbonate (CO3)	mg/L	-	-	-	-	-	-	-	-	-
Hydroxide (OH)	mg/L	-	-	-	-	-	-	-	-	-
Sulphate (SO4), Dissolved	mg/L	-	-	-	-	-	-	-	-	-
Chloride (Cl), Dissolved	mg/L	120	640	-	-	-	-	-	-	-

Appendix B, Table B-1: Surface-water Quality Data and Applicable Guidelines

Parameter	Units	CCME, Freshwater Aquatic Life		MWQSOG, Freshwater Aquatic Life						
		Long Term	Short Term	Tier I	Tier II		Tier III			
					Chronic	Acute	Narrative	Numerical		
								Freshwater Aquatic Life	Irrigation	Livestock
Nitrate (N), Dissolved	mg/L	13	550	-	-	-	-	-	-	-
Nitrite (N), Dissolved	mg/L	0.197	-	-	-	-	-	-	-	-
Phosphorus (P), Total	mg/L	Guidance Framework, See notes	-	-	-	-	0.05	-	-	-
Potassium (K), Dissolved	mg/L	-	-	-	-	-	-	-	-	-
Potassium (K), Total	mg/L	-	-	-	-	-	-	-	-	-
Sulphur (S), Total	mg/L	-	-	-	-	-	-	-	-	-
Metals, Dissolved										
Aluminum (Al)	mg/L	-	-	-	-	-	-	-	-	-
Antimony (Sb)	mg/L	-	-	-	-	-	-	-	-	-
Arsenic (Ar)	mg/L	-	-	-	0.15	0.34	-	-	0.1	0.025
Barium (Ba)	mg/L	-	-	-	-	-	-	-	-	-
Beryllium (Be)	mg/L	-	-	-	-	-	-	-	-	-
Bismuth (Bi)	mg/L	-	-	-	-	-	-	-	-	-
Boron (B)	mg/L	-	-	-	-	-	-	-	-	-
Cadmium (Cd)	mg/L	-	-	-			-	-	-	-
Calcium (Ca)	mg/L	-	-	-			-	-	-	-
Cesium (Ce)	mg/L	-	-	-			-	-	-	-
Chromium Trivalent (Cr III)	mg/L	-	-	-			-	-	-	-
Chromium Hexavalent (Cr VI)	mg/L	-	-	-	0.011	0.016	-	-	-	-

Appendix B, Table B-1: Surface-water Quality Data and Applicable Guidelines

Parameter	Units	CCME, Freshwater Aquatic Life		MWQSOG, Freshwater Aquatic Life						
		Long Term	Short Term	Tier I	Tier II		Tier III			
					Chronic	Acute	Narrative	Numerical		
								Freshwater Aquatic Life	Irrigation	Livestock
Cobalt (Co)	mg/L	-	-	-	-	-	-	-	-	-
Copper (Cu)	mg/L	-	-	-	-	-	-	-	-	-
Iron (Fe)	mg/L	-	-	-	-	-	-	-	-	-
Lead (Pb)	mg/L	-	-	-	-	-	-	-	-	-
Lithium (Li)	mg/L	-	-	-	-	-	-	-	-	-
Magnesium (Mg)	mg/L	-	-	-	-	-	-	-	-	-
Manganese (Mn)	mg/L	-	-	-	-	-	-	-	-	-
Mercury (Hg)	mg/L	-	-	-	-	-	-	-	-	-
Molybdenum (Mo)	mg/L	-	-	-	-	-	-	-	-	-
Nickel (Ni)	mg/L	-	-	-			-	-	-	-
Potassium (K)	mg/L	-	-	-	-	-	-	-	-	-
Rubidium (Rb)	mg/L	-	-	-	-	-	-	-	-	-
Selenium (Se)	mg/L	-	-	-	-	-	-	-	-	-
Silicon (Si)	mg/L	-	-	-	-	-	-	-	-	-
Silver (Ag)	mg/L	-	-	-	-	-	-	-	-	-
Sodium (Na)	mg/L	-	-	-	-	-	-	-	-	-
Strontium (Sr)	mg/L	-	-	-	-	-	-	-	-	-
Tellurium (Te)	mg/L	-	-	-	-	-	-	-	-	-
Thallium (Tl)	mg/L	-	-	-	-	-	-	-	-	-
Thorium (Th)	mg/L	-	-	-	-	-	-	-	-	-
Tin (Sn)	mg/L	-	-	-	-	-	-	-	-	-

Appendix B, Table B-1: Surface-water Quality Data and Applicable Guidelines

Parameter	Units	CCME, Freshwater Aquatic Life		MWQSOG, Freshwater Aquatic Life						
		Long Term	Short Term	Tier I	Tier II		Tier III			
					Chronic	Acute	Narrative	Numerical		
								Freshwater Aquatic Life	Irrigation	Livestock
Titanium (Ti)	mg/L	-	-	-	-	-	-	-	-	-
Tungsten (W)	mg/L	-	-	-	-	-	-	-	-	-
Uranium (U)	mg/L	-	-	-	-	-	-	-	-	-
Vanadium (V)	mg/L	-	-	-	-	-	-	-	-	-
Zinc (Zn)	mg/L	-	-	-			-	-	-	-
Zirconium (Zr)	mg/L	-	-	-	-	-	-	-	-	-
Metals, Total										
Aluminum (Al)	mg/L	-	-	-	-	-	-	0.005 if pH < 6.5 or 0.1 if pH ≥ 6.5	5	5
Antimony (Sb)	mg/L	-	-	-	-	-	-	-	-	-
Arsenic (Ar)	mg/L	0.005	-	-	-	-	-	-	0.1	0.025
Barium (Ba)	mg/L	-	-	-	-	-	-	-	-	-
Beryllium (Be)	mg/L	-	-	-	-	-	-	-	0.1	0.1
Bismuth (Bi)	mg/L	-	-		-	-	-	-	-	-
Boron (B)	mg/L	1.5	29	-	-	-	-	29 short term/ 1.5 long term	0.5-6.0 crop dependent	5
Cadmium (Cd)	mg/L		-	-	-	-	-	-	0.0051	0.080
Calcium (Ca)	mg/L	-	-	-	-	-	-	-	-	1000
Cesium (Ce)	mg/L	-	-	-	-	-	-	-	-	-
Chromium Trivalent (Cr III)	mg/L	0.0089	-	-	-	-	-	-	0.0049	0.050
Chromium Hexavalent (Cr	mg/L	0.001	-	-	-	-	-	-	0.008	0.05

Appendix B, Table B-1: Surface-water Quality Data and Applicable Guidelines

Parameter	Units	CCME, Freshwater Aquatic Life		MWQSOG, Freshwater Aquatic Life						
		Long Term	Short Term	Tier I	Tier II		Tier III			
					Chronic	Acute	Narrative	Numerical		
								Freshwater Aquatic Life	Irrigation	Livestock
VI)										
Cobalt (Co)	mg/L	-	-	-	-	-	-	-	0.05	1
Copper (Cu)	mg/L		-	-	-	-	-	-	0.2-1.0 Crop dependent	0.5-5.0 Species dependent
Iron (Fe)	mg/L	0.3	-	-	-	-	-	0.3	5	-
Lead (Pb)	mg/L		-	-	-	-	-	-	0.2	0.1
Lithium (Li)	mg/L	-	-	-	-	-	-	-	2.5	-
Magnesium (Mg)	mg/L	-	-	-	-	-	-	-	-	-
Manganese (Mn)	mg/L	-	-	-	-	-	-	-	0.2	-
Mercury (Hg)	mg/L	0.000026	-	-	-	-	-	-	-	0.003
Molybdenum (Mo)	mg/L	0.073	-	-	-	-	0.073	-	0.01-0.05	0.5
Nickel (Ni)	mg/L		-	-	-	-	-	-	0.2	1
Potassium (K)	mg/L	-	-	-	-	-	-	-	-	-
Rubidium (Rb)	mg/L	-	-	-	-	-	-	-	-	-
Selenium (Se)	mg/L	0.001	-	-	-	-	0.001	-	0.02-0.05	0.05
Silicon (Si)	mg/L	-	-	-	-	-	-	-	-	-
Silver (Ag)	mg/L	0.0001	-	-	-	-	-	0.0001	-	-
Sodium (Na)	mg/L	-	-	-	-	-	-	-	-	-
Strontium (Sr)	mg/L	-	-	-	-	-	-	-	-	-
Tellurium (Te)	mg/L	-	-	-	-	-	-	-	-	-
Thallium (Tl)	mg/L	0.0008	-	-	-	-	-	0.0008	-	-

Appendix B, Table B-1: Surface-water Quality Data and Applicable Guidelines

Parameter	Units	CCME, Freshwater Aquatic Life		MWQSOG, Freshwater Aquatic Life						
		Long Term	Short Term	Tier I	Tier II		Tier III			
					Chronic	Acute	Narrative	Numerical		
								Freshwater Aquatic Life	Irrigation	Livestock
Thorium (Th)	mg/L	-	-	-	-	-	-	-	-	-
Tin (Sn)	mg/L	-	-	-	-	-	-	-	-	-
Titanium (Ti)	mg/L	-	-	-	-	-	-	-	-	-
Tungsten (W)	mg/L	-	-	-	-	-	-	-	-	-
Uranium (U)	mg/L	0.015	0.033	-	-	-	-	0.33 short term/ 0.015 long term	0.01	0.2
Vanadium (V)	mg/L	-	-	-	-	-	-	-	0.1	0.1
Zinc (Zn)	mg/L	0.03	-	-	-	-	-	-	1.0-5.0	50
Zirconium (Zr)	mg/L	-	-	-	-	-	-	-	-	-

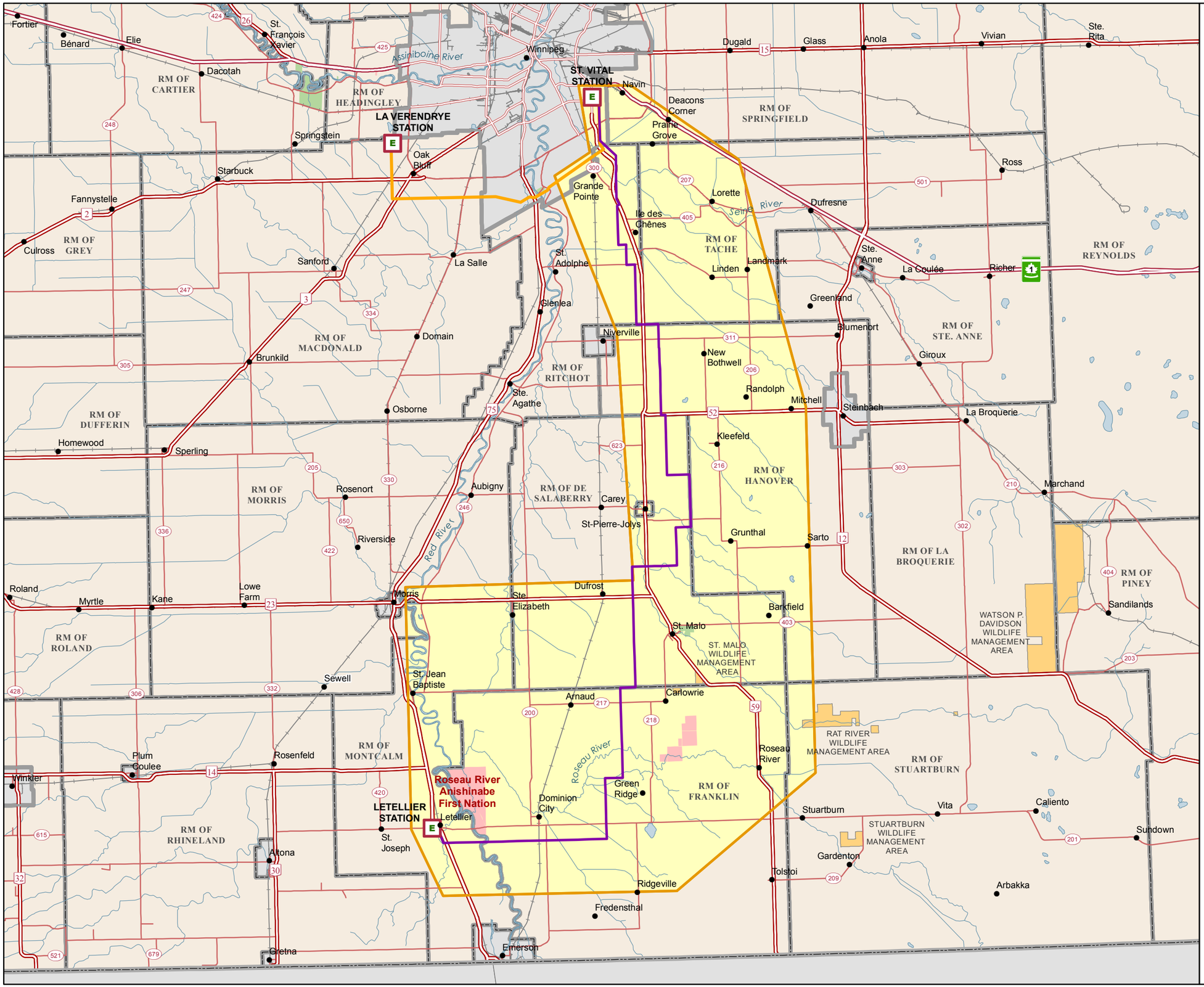
CCME - Canadian Counsil of the Ministers of the Environment (2012)

MB WQSOG - Manitoba Water Quality Standards Objectives and Guidelines (2011)

MB WQSOG for dissolved Cd, Cr (III), Cu, Pb, Ni, and Zn are hardness dependent and should be calculated using the lowest hardness value to generate the most stringent dissolved metal guidelines

CCME short-term for cadmium is a benchmark not a guideline

Framework for phosphorus: ultra-oligotrophic <4, oligotrophic 4-10, mesotrophic 10-20, meso-eutrophic 20-35, eutrophic 35-100, hyper-eutrophic >100



Manitoba Hydro

St. Vital Transmission Complex

Project Infrastructure

- Electrical Station
- Final Preferred Route (V95L)
- La Verendrye - St. Vital (Y36V) Transmission Line
- Project Siting Study Area

Landbase

- Community
- Trans Canada
- Provincial Highway
- Provincial Road
- Railway
- City / Town
- Rural Municipality
- First Nation
- Provincial Park
- Wildlife Management Area

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: May 21, 2014

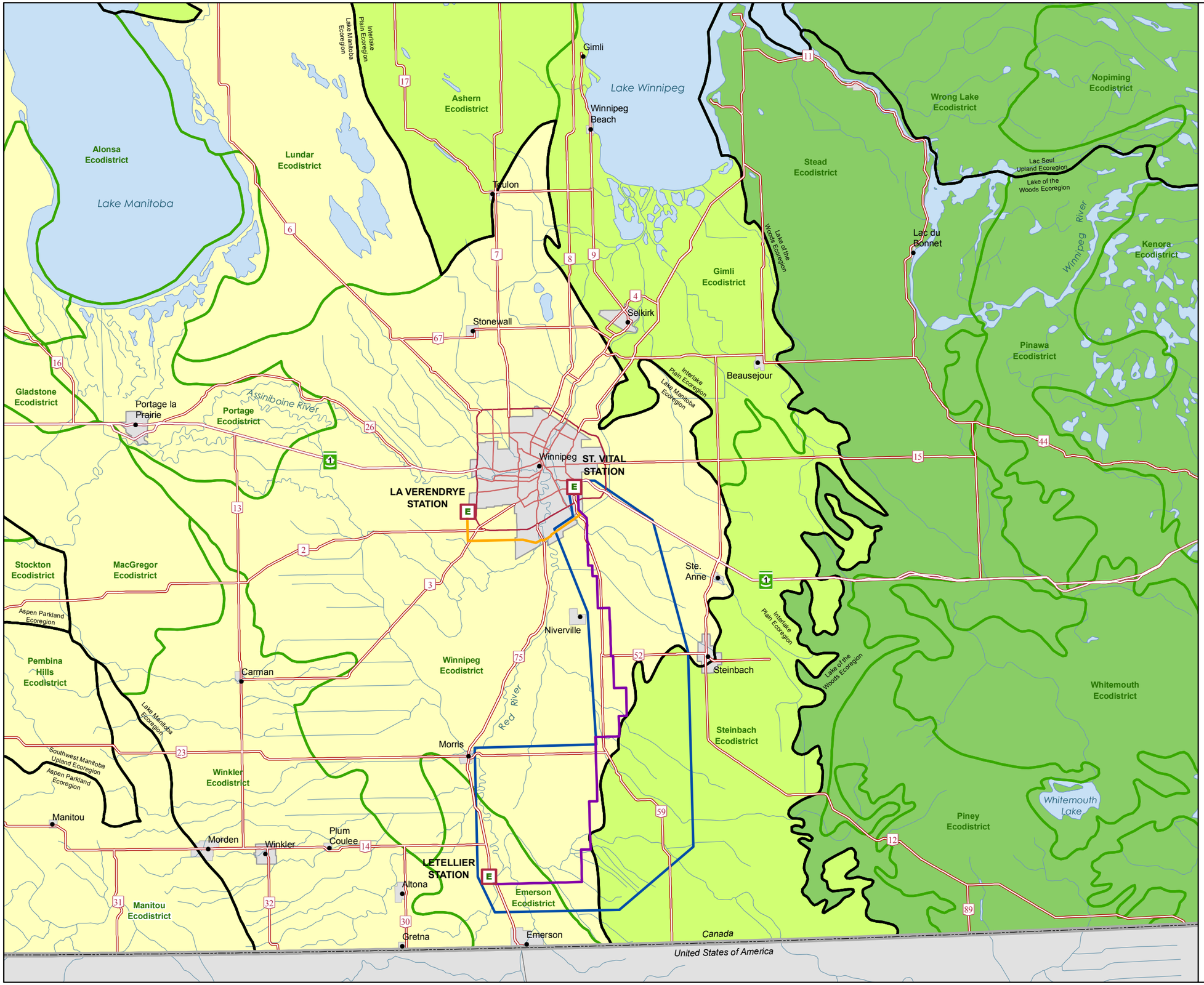
N

0 5 10 Kilometres
0 2.5 5 Miles

1:400,000

Project Siting Study Area

Map 1-1



Manitoba Hydro

St. Vital Transmission Complex

Project Infrastructure

- Electrical Station
- Final Preferred Route (V95L)
- La Verendrye-St. Vital (Y36V) Transmission Line
- Project Siting Study Area

Ecoregions, Ecozones and Ecodistricts

- Boreal Plain Ecozone
- Boreal Shield Ecozone
- Prairie Ecozone
- Ecoregion
- Ecodistrict

Landbase

- Trans Canada
- Provincial Highway
- Provincial Road
- City / Town

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: May 21, 2014

N

0 10 20 Kilometres
0 10 20 Miles

1:750,000

Ecoregions, Ecozones and Ecodistricts

Map 2-1

St. Vital Transmission Complex

Manitoba Hydro

Project Infrastructure

- Electrical Station
- Final Preferred Route (V95L)
- La Verendrye-St. Vital (Y36V) Transmission Line
- Project Siting Study Area

Watersheds and Sub-watersheds

- Assiniboine River Watershed
- Lake Manitoba Watershed
- Lake Winnipeg Watershed
- Red River Watershed
- Winnipeg River Watershed
- Sub-watershed

Integrated Watershed Management Planning Units (IWMP)

- La Salle River
- Netely / Grassmere
- Rat Marsh River Watershed
- Seine River
- West Interlake

Landbase

- Community
- Trans Canada
- Provincial Highway
- City / Town

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: May 21, 2014

N

0 10 20 Kilometres
0 10 20 Miles
1:750,000

Watersheds and Sub-watersheds

Map 2-2

Integrated Watershed Management Planning Units

West Interlake IWMP
Netely / Grassmere IWMP
La Salle River IWMP
Seine River IWMP
Rat Marsh River Watershed IWMP