7.0 EXISTING ENVIRONMENTAL SETTING

7.1 Introduction

The environmental setting (baseline) for the assessment was characterized using existing information sources, environmental field studies and technical memoranda. The information sources, field studies and technical memoranda are referenced at the end of the EIS. Environmental studies began in 2006 with the decision to proceed with modernizing the existing Pointe du Bois generating facilities. In 2009, the project was redefined from a rebuild project to a spillway replacement project only and the environmental studies were completed in 2010 on this basis. Since the spatial extent of the potential environmental effects of the spillway replacement project were considered to be less than those of the rebuild project, the environmental studies completed under the rebuild project were considered to be applicable to characterize the environmental setting for EIS purposes. The existing physical, biological (aquatic and terrestrial) and socio-economic components of the environment are summarized in this chapter.

7.2 Study Areas

The study area boundary for the environmental studies was defined in 2006 in association with the modernization of the Pointe du Bois Generating Station (Figure 7.1). The boundary defined the geographic extent for potential environmental effects associated with the rebuild alternative, and thus defined the spatial extent of the environmental studies that were undertaken. Studies for the physical, aquatic, and terrestrial components of the environment were carried out within the study area. Following the decision to proceed with the spillway replacement only, further environmental studies were carried out in the area east of the current facilities, as this area would be affected by construction of the new spillways. Further detail on the study area in relation to each of the environmental components is contained in the following sections.

7.3 Physical Environment

Physical environment studies were carried out in the study area from Lamprey Rapids to Slave Falls. The studies addressed the following topic areas:

- Air quality;
- Noise;
- Climate;
- Surface water regime;
- Ice regime;
- Physiography and landscape;

- Erosion;
- Sedimentation;
- Woody debris; and
- Groundwater.

7.3.1 Air Quality

In Manitoba, air quality issues tend to be local in nature and primarily relate to odour and other pollutants released from specific local sources or activities (i.e., industry, motor vehicles, stubble burning and forest fires). Outdoor air quality in Manitoba is generally good (Manitoba Conservation 2010). The Pointe du Bois area is recreational in nature with a low population density, there is no heavy industry and the general air quality is considered to be good. There is no existing specific air quality information available for the Pointe du Bois area and specific monitoring of air quality in the area was not undertaken.

7.3.2 Noise

Noise monitoring at stationary and spot locations (Figure 7.2) was undertaken at Pointe du Bois in September 2007 to establish baseline levels, to establish noise sources, and to produce and calibrate a sound model of the existing generating station and the surrounding region. The sound model can be used to simulate the effect of added noise sources associated with construction activities to identify areas that might be most affected by those activities. Six locations were used to take 24 hour noise dosimeter measurements (Dose 1 to 6) to establish the daily noise exposure level. Spot noise measurements and a frequency spectrum were taken at the six dosimeter and seven additional locations (Project 7 to 35) to establish sources of noise in the area of the existing facilities.

Continuous noise sources were identified to be the generating station, transformers, and spillway discharges. Non-continuous sources identified included road traffic, industrial equipment, boat traffic, float planes and lawn mowers.

The noise levels from the stationary locations (Table 7.1) ranged from 57.4 to 66.9 L_{dn} dB(A) and 51.2 to 60.3 $L_{eq,24}$ dB(A). The noise levels from the spot locations (Table 7.2) ranged from 27.3 to 61.5 LA_{eq} dB(A).

The L_{dn} noise level is the weighted day-night equivalent noise level where a 10 dB penalty is added to the measured night-time (10 pm to 7 am) noise level to address expected increased annoyance due to noise-induced sleep disturbance.

The L_{eq24} is the equivalent noise level for a 24 hour period.

7.3.3 Climate

Climate data sources for the historical analysis and future scenarios were chosen based on the boundary of the Winnipeg River watershed to characterize the historical climate in the Pointe du Bois area and predict potential future change to the watershed due to change in the climate. The meteorological stations within the watershed (Figure 7.3) include: Great Falls, Kenora Airport, Fort Frances Airport, Winnipeg Airport, Atikokan, Dryden Airport, Red Lake Airport, Sioux Lookout Airport, and Mine Centre. The Winnipeg airport station was also selected due to its extensive meteorological record. Climate normals from Environment Canada were used to characterize the climatic conditions of the watershed area. Climate normals are arithmetic calculations based on observations at a given location over a specified time period. The World Meteorological Organization (WMO) describes normals as averages of climatological data computed for periods of 30 consecutive years. The WMO considers thirty years as a sufficient amount of time to eliminate year-to-year variations (i.e., natural climate variability) and has set the current 30 year period to 1971–2000 as the baseline period.

7.3.3.1 Historical Temperature

The average annual temperature in the watershed area ranged from +0.9°C to +2.8°C with an annual average temperature for the entire area of +2.2°C. The maximum temperature recorded is +41.7°C and the minimum temperature recorded is -47.2°C.

For the winter months of December, January and February average daily temperatures for the entire watershed area were -14.4°C, -17.8°C and -13.5°C, respectively. The average daily minimum temperatures ranged between -19.0°C and -23.0°C and daily maximums between -7.9°C and -12.6°C. The most extreme minimum daily winter temperature recorded was -47.2°C and the most extreme maximum daily winter temperature recorded was +14.8°C.

For the spring months of March, April and May average daily temperatures for the watershed area were -6.2°C, +3.1°C and +11.3°C, respectively. The average daily minimum temperatures ranged between -11.9°C to +4.8°C and the average daily maximums ranged between -0.5°C to +17.7°C. The most extreme minimum daily spring temperature recorded was -40.6°C and the most extreme maximum daily spring temperature recorded was +37.0°C.

For the summer months of June, July and August average daily temperatures for the watershed area were +16.2°C, +19.0°C and +17.7°C respectively. The average daily minimum temperatures ranged between +10.4°C to +13.2°C and the average daily maximums ranged between +22.0°C and +24.6°C.

The most extreme minimum daily summer temperature recorded was -6.1°C, and the most extreme maximum daily summer temperature recorded was+41.7°C.

For the autumn months of September, October and November average daily temperatures for the watershed area were +11.6°C, +4.8°C and -5.2°C respectively. The

average daily minimum temperatures ranged between -8.8°C to +6.4°C and the average daily maximums ranged between -1.5°C to +16.7°C. The most extreme minimum daily autumn temperature recorded was -38.7°C and the most extreme maximum daily autumn temperature recorded was +38.8°C.

7.3.3.2 Historical Precipitation

Average annual precipitation in the watershed area is 652.0mm with a range of 513.7mm to 728.5mm. Rainfall accounts for approximately 77% of the total annual precipitation while snowfall accounts for 23%. Precipitation over the months of November through March is mainly in the form of snowfall while precipitation over the months of April through October is mainly in the form of rainfall.

Average annual rainfall is 502.2mm with a range of 415.6mm to 557.7mm. The average monthly rainfall for the months of April, May, June, July, August, September and October is 22.4mm, 60.1mm, 100.4mm, 89.3mm, 85.0mm, 81.1mm, and 43.7mm, respectively. Rainfall can occur at any time of the year including mid-winter. The most extreme daily rainfall event was 153.5mm.

Average snowfall for the region is 167.8 cm, with a range of 110.6 cm to 204.0 cm. Almost all months of the year record precipitation in the form of snowfall except for the months of July and August. The most extreme daily snowfall event was 44.2 cm.

The average snow depth for the months of November, December, January, February and March were 8.8 cm, 20.8 cm, 35.0 cm, 40.4 cm and 31.6 cm respectively. The most extreme snow depth was 145 cm.

7.3.3.3 Historical Wind

Due to the large geographical extent of the watershed area, the predominant wind speed and wind direction varies between location and month of the year. In general, the average wind speed for the summer and winter ranged from 12.0 km/hr to 13.0 km/hr and for the autumn and spring it is approximately 1 km/hr greater.

It is important to note that differences in wind speeds between stations may be partly due to the location of the wind instrumentation, as the degree of sheltering may vary. The maximum average hourly wind speed recorded was 89.0 km/hr and the maximum hourly wind gust speed was 129.0 km/h.

7.3.3.4 Future Climate

The Intergovernmental Panel on Climate Change (IPCC) refers to the term climate change when there is a statistically significant variation to the mean state of the climate (or of its variability) that usually persists for decades or longer and which includes shifts in the frequency and magnitude of sporadic significant weather events as well as the slow continuous rise in global mean surface temperature (IPCC 2007). The climate system is extremely complex with many physical, chemical, and biological interactions occurring along temporal and spatial scales. Each component of the system has very

different properties; however, they are all linked by fluxes of mass, heat, and momentum. Any changes, either natural or anthropogenic, in a component of the system can cause climate change (IPCC 2007).

Future changes in temperature and precipitation for the Pointe du Bois area were projected by examining Global Climate Models (GCMs) and a Regional Climate Model (RCM). Three future horizon periods were identified: 2010–2039, 2040–2069, and 2070–2099. These periods are referred to as the 2020s, 2050s, and 2080s, respectively.

The model projections show that temperature and precipitation will generally increase with time. With respect to the reference period (1971–2000), it is projected that the mean temperature will increase by +1.3°C for the 2020s, +2.5°C for the 2050s and +3.6°C for the 2080s. Precipitation is also projected to increase by +5% for the 2020s, +8% for the 2050s and +12% for the 2080s.

The model seasonal projections of future climate showed that both temperature and precipitation will generally increase with time for all seasons; however, December, January and February are projected to experience the greatest increase in temperature for the 2020s, 2050s and 2080s, while March, April and May are projected to experience the greatest increase in precipitation for the 2020s, 2050s and 2080s.

Although the projection of precipitation generally shows a pattern that, on average, is increasing, there are some models and emissions scenarios that project drier conditions into the future.

7.3.4 Surface Water Regime

7.3.4.1 Winnipeg River Drainage Basin

The Winnipeg River and its main tributary, the English River, drain a basin that covers an area of approximately 150,000 km^2. Two-thirds of the basin lies within northwestern Ontario with the remainder lying south in northern Minnesota and west in Manitoba. The location of the Pointe du Bois GS within the Winnipeg River drainage basin and its geographical setting in relation to communities and infrastructure in Manitoba, Ontario, and Minnesota are shown in Figure 7.4. All runoff from the basin eventually makes its way down the Winnipeg River to Lake Winnipeg.

The inflows at Pointe du Bois are mainly regulated by several upstream reservoirs operated within the Winnipeg River basin to satisfy a diverse set of interests including flood control, hydroelectric generation, recreation, fisheries, and cottagers. The Lake of the Woods Control Board (LWCB) was formed in 1919 and is one of several boards responsible for managing water in the Winnipeg River Basin. Its purpose is to control and regulate certain major waterways in the basin according to the various interests. LWCB is legislated at both the federal and provincial levels (www.lwcb.ca).

Hydrograph and duration curves of average daily flows at Pointe du Bois from 1912 to 2006 are shown in Figures 7.5 and Figure 7.6 respectively. The estimated average daily

flow at Pointe du Bois is approximately 880 cms, while the all-season and open-water 50th percentile flows are 850 cms and 810 cms, respectively. There have been several large floods in which spillway use occurred at Pointe du Bois, such as October 1941 (2,530 cms), July 1974 (2,505 cms), and October 1992 (2,617 cms), which is the highest recorded flow. The minimum recorded flow of approximately 50 cms occurred in June 1977. Typical low and high flow conditions at Pointe du Bois are shown in Figure 7.7.

7.3.4.2 Water Levels

The existing environment water level regime was developed based on data from key sites within the study area (Figure 7.8). The key sites were identified by the project team as they are areas of interest with respect to describing distinguishing water level variations that characterize the river **reach**es generally or aquatic habitat areas. The key sites are as follows:

- Above Lamprey Rapids;
- Pointe du Bois outer forebay;
- Pointe du Bois inner forebay;
- Pointe du Bois tailrace;
- Below Eight Foot Falls;
- Mouth of Moose Creek; and
- Slave Falls forebay.

The water regime characterization is based on summer and winter daily water levels at the Pointe du Bois and Slave Falls key sites (forebay and tailrace). The water regime characterization at the remaining key sites is based on the hydraulic modeling for daily summer conditions only.

The open water (summer) period is defined as April 15 to November 15. The winter period is defined as November 16 to April 14. All elevations are referenced to the Canadian Geodetic Vertical Datum (CGVD28), 1929 adjustment, unless otherwise noted.

A water surface profile of the reach of the Winnipeg River from Lamprey Falls to the Slave Falls Generating Station is shown in Figure 7.9.

The Pointe du Bois GS is operated in a run of river mode (water is not stored for peaking operation), such that the outer forebay is controlled at or near the target full supply elevation level (FSL) of 299.1 m. The elevation level of forebay is typically operated in the approximate range of 299.0 to 299.1 m, most of the time. The 50th percentile water level in the inner forebay, in the vicinity of the powerhouse intake, is about 0.3 m lower than the outer forebay. The maximum recorded 24-hour water level variation within the inner forebay is about 0.4 m. During periods when the flow exceeds the powerhouse capacity, excess water is passed through the spillways and flows over the spillway rapids to the river downstream of the GS. There is a drop of approximately 14 m

between the Pointe du Bois GS forebay and the tailrace. Under average flow conditions, the water level drops about 0.4 m from the Pointe du Bois tailrace to below Eight Foot Falls. However, a water fall of over 2 m has been recorded at this location under extremely high flows condition. The Slave Falls GS full supply level is 284.6 m.

Water levels downstream of the Pointe du Bois GS are influenced by the amount of water flowing out of the generating station, as well as the regulation of the Slave Falls GS. The 11 km reach between Pointe du Bois and Slave Falls varies between approximately 200 and 1500 m wide, with a very low gradient.

The maximum daily water level variation experienced in the study reach downstream of Pointe du Bois is about 1 m. However, water levels in this reach are usually very steady, with daily water level variations typically less than 0.2 m most of the time.

7.3.4.3 Water Velocity, Flow Patterns, and Depths

A two-dimensional computational fluid dynamics (CFD) model (MIKE 21) was used to produce depth-averaged velocities in the main river reaches of the study area. A three-dimensional CFD model (Flow-3D) was required to adequately represent complex flow patterns and velocities in the vicinity of hydraulic structures, such as the flows from the powerhouse and spillways in the immediate forebay and tailrace areas. The Flow-3D modeling extends 1300 m upstream of the existing spillway structure and extends downstream to include the individual powerhouse units, the spillway rapids, the powerhouse draft tubes, and Eight Foot Falls. Water depths were produced using a one-dimensional hydraulic model, HEC-GeoRAS.

Water velocity and depth grids from Lamprey Falls to Slave Falls for 5th, 50th, and 95th open water percentile flows under steady-state conditions are presented in Figure 7.10A and Figure 7.10B. Water velocities, flow patterns and depths near the Pointe du Bois GS are shown in Figure 7.11A and Figure 7.11B.

The 14 km reach between Lamprey Falls and Pointe du Bois reaches depths up to 35 m, and is characterized by two somewhat distinct “channels” formed by the presence of several islands along the middle of the forebay, flanked by several shallow bays along the shores. Velocities in the forebay are generally low, but velocities over approximately 2.6 m/s can occur in the vicinity of Lamprey Falls under higher flow conditions. Most of the inner forebay reaches depths between 5 m to 10 m, with the channel bed dropping to depths of up to 15 m immediately upstream of the powerhouse. Velocities within the inner forebay can vary up to 1.8 m/s, when the powerhouse is operating at maximum capacity (712 cms).

When the spillway is operating, higher velocities (varying to greater than 5 m/s) can occur in the spillway rapids. The spillway rapids are characterized by highly turbulent and chaotic flow patterns as water plunges into deep pools within the rapids (up to about 15 m deep) and over multiple rock ridges and flow paths throughout. When

spillage occurs, a hydraulic jump may form just downstream of the spillway rapids when higher velocity flows plunge off the rapids into the tailrace.

The tailrace below the spillway rapids is characterized as very turbulent undulating flows with flow patterns influenced by the powerhouse and spillway outflows as well as the river bank. Depths vary from about 4–7 m in the vicinity of the powerhouse, increasing to about 13 m towards the plunge pool below the base of the spillway rapids. Velocities in the tailrace are quite variable, reaching magnitudes greater than 5 m/s below the spillway rapids, under higher flow conditions. Spillway discharge cascades down the spillway rapids, enters the tailrace and continues flowing in a southward direction towards Eight Foot Falls. Flows conveyed through the powerhouse exit through the powerhouse draft tubes directed towards the south bank, and must turn to the east in order to reunite with the main channel, and again to flow south towards Eight Foot Falls. A large-scale eddy forms along the west bank as the river widens downstream of the tailrace area. The depths in the center of the channel vary up to about 20 m, with velocities up to about 1.2 m/s. Nearing Eight Foot Falls, the flow contracts, with velocities increasing to 3.5 m/s under higher flows. The reach between Eight Foot Falls and Slave Falls GS contains a fairly large variation in depths, owing to a deeper pool downstream of Eight Foot Falls (greater than 60m deep). The thalweg is generally about 20 m to 40 m deep in this reach. Maximum depths of the thalweg are as deep as 63 m, but thalweg depths throughout the reach are quite variable, ranging in depths to less than 10 m in a narrow reach about 2 km upstream from Slave Falls GS. The immediate Slave Falls GS forebay is about 20 m deep. Another area that may experience moderately high velocity magnitudes (i.e., up to about 1.5 cms) is a short narrow reach (about 200 m wide) located about 2 km upstream of Slave Falls GS.

7.3.5 Ice Regime

The ice regime on the Winnipeg River in 2007 and 2008 is shown on Photos 7.1 to 7.8. Between approximately mid-November and early May, Winnipeg River hydraulic conditions can be affected by the seasonal evolution of ice cover on the water bodies. The timing and location of ice-impacted hydraulic conditions at different locations are highly dependent upon the local velocities experienced and can vary from year to year as a consequence of the magnitude of the regulated Winnipeg River discharge. The timing of changes in the discharge, and the nature of the meteorological conditions over the winter. Characteristics of the existing Pointe du Bois ice regime include:

- Stationary ice sheet development in lake-like reaches such as parts of the Pointe du Bois or Slave Falls forebay reservoirs or sheltered off-stream areas may begin by about mid-November, with maximum mid-winter thicknesses ranging from 0.5 m to more than 1.2 m. The ice sheets melt in place by about the end of April or early May each year;
- More riverine areas, such as upstream of Lamprey Rapids and between Slave Falls and Nutimik Lake tend to develop an ice cover through the advancement of

border ice from the banks by about mid-December or later, with open water returning in March or April each year. Occasionally these reaches demonstrate breakup of ice and an ice run, but usually the potential for loss of ice cover by this means is limited because of the slowly varying regulated discharge. The time and maximum extent of the ice cover depends upon the severity of the winter and the magnitude of the river flows, normally rendering over-ice travel conditions uncertain and variable, and therefore hazardous in these areas; and

- Areas of higher velocity such as at rapids, falls and near the generating stations may remain open for the entire winter season. The generation of frazil ice and the resulting accumulation of ice downstream of these higher-velocity sections sometimes lead to flow restriction and temporary water level staging upstream.

Date taken: 02-13-2008

Photo 7.1: Above Lamprey Rapids

Date taken: 02-22-2007 Date taken: 02-13-2008

Photo 7.2: Lamprey Rapids Lamprey West

Date taken: 02-22-2007 Date taken: 01-04-2008

Photo 7.3: Forebay Reservoir

Date taken: 02-22-2007 Date taken: 02-13-2008

Photo 7.4: Generating Station Area

Date taken: 02-22-2007 Date taken: 02-13-2008

Photo 7.5: Eight Foot Falls looking South

Date taken: 02-22-2007

Photo 7.6: Slave Falls Forebay

Date taken: 02-22-2007 Date taken: 02-13-2008

Photo 7.7: Slave Falls Generation Station looking Southwest

Date taken: 02-22-20 Date taken: 02-13-2008

Photo 7.8: Sturgeon Falls looking West

7.3.6 Physiography and Landscape

7.3.6.1 Physiography

The Pointe du Bois site is located within the Precambrian Drift Plain of the Canadian Shield physiographic region. The area falls within the Pinawa Ecodistrict of the Lake of the Woods Ecoregion and Boreal Shield Ecozone (Smith et al. 1998). The Pinawa Ecodistrict is a transition area between the Kenora Ecodistrict to the east with a rugged lake and bedrock-dominated environment and the Stead Ecodistrict to the west with a level to depressional glaciolacustrine plain.

Underlying the Pointe du Bois area is Precambrian aged granite, granodiorite, and tonalite rocks. The area is characterized by hummocky terrain with numerous bedrock outcrops and a thin discontinuous overburden cover of glacial drift along with local glaciolacustrine **silt**, clay, and fine sand deposits with peat bogs in low lying depressions. The bedrock outcrops are worn smooth due to glaciation. At Pointe du Bois, ice movement created distinct roche moutonnée (whaleback) erosional patterns in the bedrock trending west-southwest.

Topographically, the Pinawa Ecodistrict ranges from 350 m above sea level (asl) on its eastern boundary to 305 m asl along its western boundary. Slopes vary with grades up to 15 percent with the overall slope being approximately 2.0 m/km towards the west. Topographic relief in the vicinity of Pointe du Bois is low, seldom exceeding 15 m.

7.3.6.2 Geology

The regional area surrounding Pointe du Bois is within the Superior Geological Province of the Canadian Shield. The rock formations are Precambrian aged intrusive volcanics consisting primarily of tonalite, granite, minor granodiorite, and related gneiss and migmatites, Figure 7.12. Contacts between the different rock types are usually tight, and no significant weathering is typically observed.

Locally, the Pointe du Bois site is underlain by massive felsic volcanics (granite to tonalite composition) with gneissic texture in places. Surficial bedrock mapping was conducted at the Pointe du Bois site to assess the type and condition of the bedrock. Additionally bedrock coring was completed to augment the findings of the surficial bedrock mapping, and to determine jointing patterns and conditions at depth relative to the structure foundations.

Three main bedrock types were found at the site:

- Medium grained massive felsic volcanic rock of granite to granodiorite composition;
- Medium grained, massive gneissic granite; and
- Medium to coarse grained granite with seams of pegmatite;

The condition of the bedrock on site was as follows:

- Joints in the bedrock exposed at the surface exhibit a tendency for near-vertical or near-horizontal alignments, with some intermediate fracture directions also visible, while at increasing depth most of the joints encountered are near-horizontal;
- Joints observed at the surface and in the drill cores are tight, with rock-to-rock contact and minor sediment infilling. They exhibit no significant historical movement other than some block movement along shallow, near-horizontal planes which probably is the result of ice wedging in intersecting vertical joints;
- Joints located below ground, but within about 3 m of the surface, exhibit evidence of minor weathering possibly related to exposure to flooding waters and to freeze-thaw cycles. Below that depth, some chlorite precipitation is evident on joint faces. No below-surface fractures exhibited sediment infilling; and
- Rock permeability is generally very low except at some open fractures and joints where pressure testing results indicate there may be potential for significant seepage.

7.3.6.3 Soils

Overburden soils in the vicinity of Pointe du Bois are typically local in extent, due to the variable topography of the surface of the bedrock and typically consist of minor deposits of wave washed sand, silt, and clay overlying the bedrock. The surface soils are primarily Dystric Brunisols (brown, well drained, B-horizon soils) developed on discontinuous water worked stony till. There are also numerous areas of swamp and marsh that contain soft silts and clays. Along the Winnipeg River and in low-lying areas, Gray Luvisols (soils developed under forest cover with A, B, and C soil horizons) are found on clayey glaciolacustrine sediments. In depressions, peat deposits of varying thickness typically cover these clay sediments.

7.3.6.4 Material Source Areas

The materials required for the Project include impervious fill (clay), granular fill/crushed rock, rock fill, riprap and concrete aggregates. Some of the required materials will be obtained on-site; however, borrow sites may be required to provide additional materials. Several potential borrow sites for each of the earth fill materials have been identified, refer to Figure 3.15. They were evaluated on a number of criteria including materials properties, estimated available volume, location, property ownership, accessibility, social impact, distance to the construction site and anticipated truck traffic on PR 313. Sites considered viable to meet the project needs after initial screening were further investigated with site reconnaissance and subsurface investigations. Representative samples from the potential sites were also subject to geotechnical testing to confirm material properties relative to the design. In addition, environmental testing has been completed (acid generation potential, metals content, mercury content, etc.). Based on the findings, potential sites have been selected for project usage, including the priority of use. The detail on the material sources to be used for the Project is contained in Chapter 3.0 of this EIS.

7.3.7 Erosion

This section evaluates erosion potential in relation to the two reaches of the study area from Lamprey Rapids to Pointe du Bois and from Pointe du Bois to Slave Falls.

7.3.7.1 Shoreline Riverbank Materials

Bedrock and glaciolacustrine clay are the two main shoreline materials present in the area, with minor amounts of till, and organic material as well as man-made features along the shoreline. The classification of shorelines into material types was based on all shoreline material present and was described in terms of the potential for material types to be eroded. Refer to Figure 7.13 for an overview of the shoreline material classification in the study area.

7.3.7.2 Bedrock

Bedrock constitutes the majority of the shoreline material along the Winnipeg River (Photo 7.9). It represents between 53% to 57% of the shoreline within the two reaches of the river. The bedrock consists of igneous rocks of the Precambrian Shield. These are generally comprised of structurally massive intrusive rocks that are felsic in composition. Typical bedrock compositions are granite totonalite, with spatially variable gneissic texture. Shoreline material identified as exposed bedrock outcrops can vary from steep vertical cliffs to low bank heights. Exposed bedrock is typically smooth and weathered by glacial activity and weathering. Overburden materials observed on bedrock shorelines generally include clay and till, although small intermittent pockets of thin organic mats can also be found. Shorelines classified as bedrock have no risk of erosion, because they either have no overburden material or any overlying overburden material is above the range of potential erosion from wave action.

Photo 7.9: Typical Bedrock Shorelines along the Winnipeg River

7.3.7.3 Bedrock Overlain by Glaciolacustrine Clay

Bedrock shorelines with overlying glaciolacustrine clay overburden (Photo 7.10) where the clay/rock interface is 0.50 m or more above the average water level have no risk of erosion from wave action, as the clay is not being subjected to wave energy. The clay overburden consists of a range of thicknesses and slopes from thin clay veneer to deposits up to 3 m of thickness.

Photo 7.10: Example of Bedrock Shoreline with Overlying Clay along the Winnipeg River

7.3.7.4 Bedrock Overlain by Till

Exposed bedrock shorelines with overlying till silt/sand layers occurring as non-continuous cover of various thicknesses (Photo 7.11), with the interface 0.50 m or more above the average water level have no risk of erosion from wave action, as the till is no

longer being subjected to wave energy. Often along the Winnipeg River a lower section of the till has been historically eroded to the exposed bedrock.

Photo 7.11: Example of Bedrock Shoreline with Overlying Till along the Winnipeg River

7.3.7.5 Glaciolacustrine Clay

Glaciolacustrine clay (C) is the second most frequent shoreline material along the Winnipeg River (Photo 7.12). This shoreline material generally consists of fine-grained highly plastic clay to silty-clay soils with thicknesses that range from 0.5 to 3 m. These soils have cohesion properties that are typical of glaciolacustrine clay. This type of material is the most susceptible to erosion from waves on the Winnipeg River. The risk of erosion along clay shorelines varies depending on the steepness of the shoreline slope and therefore clay shorelines have been classified as clay (C – 9% to 10% of total shoreline) or clay with steep slopes >18% (C – 7% of total shoreline). Often sections of clay shoreline have already eroded to a stable or near stable slope when there is the presence of underlying bedrock or till, depending on the depth to contact with the underlying materials.

Photo 7.12: Examples of Clay Shorelines along the Winnipeg River

7.3.7.6 Clay Underlain by Cobble/Bolder Till

Till Silt/Sand layers of various thicknesses underlie the clay soils in some locations along the Winnipeg River (Photo 7.13) representing in total 6% to 14% of the shoreline length along the two reaches of the river. Erosion of these shorelines progresses towards a self-armoured mature condition. The finer till material is eroded and deposited in the lateral zone below the water-shoreline interface. Remnants of the wave-sorted tills result in **cobble**s and **boulder**s at the existing shoreline, providing armouring against further wave action and resulting in a low risk of erosion of the overlying clay soils.

Photo 7.13: Clay Shoreline with Underlying Till Material along the Winnipeg River

7.3.7.7 Clay Overlying Bedrock

Clay overlying bedrock control with the interface within 0.50 m of the average water level (Photo 7.14) represents in total 13% to 17% of the shoreline length along the two reaches of the river. The clay overburden consists of a range of thicknesses and slopes from thin clay veneer to deposits up to 3 m of thickness. This material classification has a low risk of erosion because the shoreline is typically bedrock controlled at the active water-shoreline interface with the clay normally not being subjected to wave energy erosion. However, erosion can occur during periods of higher water levels or high waves, although the potential amount of erosion would be limited.

Photo 7.14: Clay Shoreline with Underlying Bedrock along the Winnipeg River

7.3.7.8 Till Sand/Silt

Till sand/silt shorelines (Photo 7.15) consists of deposited ablation till, typically with a matrix of silt and sand till where the underlying bedrock has not yet been exposed. This shoreline material is primarily observed in the reach from Lamprey Falls to the Pointe du Bois GS and only represents approximately 0.3% of the total shoreline. The thickness of the till material tends to vary from intermittent thin sections of less than a metre to a continuous overlay of 1 to 3 m in thickness. Larger cobbles and boulders generally occur in the matrix, and comprise varying percentages of the material. The risk of erosion of these shorelines varies from low to medium depending on exposure to wave energy.

Photo 7.15: Till Sand Shoreline along the Winnipeg River

7.3.7.9 Organic Material

Organic material shorelines (Photo 7.16) typically exhibit a highly organic soil horizon over clay or sand/silt till mineral soil that are associated with marshes and consist of shallow water along the shore with cattails and reed growth. Near the shore there are also areas of organic matter which were created by old remnant marshes. Along the Winnipeg River, this classification typically occurs in well protected bays and therefore has a low erosion risk. This shoreline material is primarily observed in the reach from Lamprey Falls to the Pointe du Bois and represents approximately 1% of the total shoreline.

Photo 7.16: Organic Shoreline in Marsh Areas along the Winnipeg River

7.3.7.10 Constructed

Shorelines classified as constructed include the concrete and rock (rip-rap) structures at the Pointe du Bois and Slave Falls generating stations. Additionally it includes the shoreline areas that have been altered by cottage owners in the vicinity of Pointe du Bois through construction of docks and boathouses, rock rip-rap and removal of overburden material. Shorelines classified as man-made have no risk of erosion, because they either have no overburden material (constructed structures) or any overlying overburden material is above the range of potential erosion from wave action. This shoreline type represents in total 2% to 4% of the shoreline length along the both reaches of the river.

7.3.7.11 Current Erosion Rates

Current erosion rates were estimated for each of the six shoreline material types: clay, clay with slope steeper than 18%, clay underlain by cobble/boulder till, clay overlying bedrock, till sand/silt, organic material. Erosion rates have not been estimated for bedrock and man-made shorelines, as these shorelines do not erode.

Of the material types listed above, the two most erodible soil materials identified were clay and till silt/sands. Clay exhibits the greatest range of variability of shoreline erosion rates as a result of the different thickness of overburden material, slopes and wave energy exhibited on this bank type. The variability is also attributed to differences in

bank maturity found along the clay shores. Clay shorelines were categorized into four material types: clay with steep banks, clay underlain by cobble/boulder till, clay overlying bedrock and all other clay shorelines. Clay shorelines with banks steeper than 18% were identified as a separate category for clay material because they exhibited the greatest amount of erosion. Whereas clay shorelines underlain by till with cobbles, or overlying bedrock, were separated from other clay shorelines because the natural armouring and bedrock control results in the least amount of erosion, regardless of wave energy.

The estimated maximum annual shoreline erosion rates for each shoreline classification range as follows:

- Clay: 0.05 to 0.14 m/yr
- Clay with slope greater than 18%: 0.05 to 0.19 m/yr
- Clay underlain by cobble/boulder till: 0.04 to 0.10 m/yr
- Clay overlying bedrock: 0.00 to 0.04 m/yr
- Till sand/silt: 0.06 to 0.15 m/yr
- Organic material: 0.03 to 0.04 m/yr

7.3.7.12 Shoreline Erosion due to Riverine Processes

The Winnipeg River is formed of wide sections with narrow interconnecting channels and rapids that are controlled by bedrock riverbed and riverbanks. In the wide reaches, the velocity in the channel is quite low and does not create areas of riverine erosion. In the narrow sections there are increased velocities that could result in erosion of the riverbed; however, these narrow sections are formed from bedrock, which does not erode. These river characteristics result in very little potential for riverine erosion.

7.3.8 Sedimentation

Existing sedimentation was assessed by measuring **total suspended solids** (TSS) at a number of locations in two study reaches, Lamprey Falls to Pointe du Bois and from Pointe du Bois to Slave Falls.

Erosion of lake, forebay and river shorelines through recession of erodible banks, channel migration and nearshore downcutting is a natural process. Sedimentation and total suspended solids in the water column are the end results of these erosion and sediment transport processes. In the project area, erosional processes within each reach of the Winnipeg River are predominantly responsible for the existing sedimentation processes and rates.

7.3.8.1 Total Suspended Solids

The overall average TSS concentration measured for the Winnipeg River during 2007 to 2010 was 4 +/- 2.8 mg/L. The measured TSS concentrations ranged from <2 mg/L to 92 mg/L, with 95% of the concentrations are between 2 mg/L and 6 mg/L.

The average TSS concentrations along the Winnipeg River entering and exiting the Lamprey Falls to Pointe du Bois reach is 4 +/- 0.7 mg/L and 3 +/- 0.9 mg/L, respectively; and in the Pointe du Bois to Slave Falls reach 4 +/- 1.1 mg/L and 4 +/- 1.1 mg/L, respectively. The concentrations in the two reaches are approximately the same indicating that there are no additional contributions to suspended sediment from each river reach section. Therefore, it appears that any shoreline materials eroded within a reach, as measured by the TSS concentrations, deposit as sediment within that reach.

The vast majority of the shoreline in the study area is associated with a slow-moving reservoir that essentially behaves as a lake. Therefore any shoreline materials eroded by wave action appear to settle in the adjacent nearshore area, while any shoreline materials eroded by riverine processes appear to settle in the low velocity areas (back eddies) immediately downstream of the high velocity sections. The annual average TSS concentrations across the transects ranged from 3 to 5 mg/L and the average TSS concentration through the depth also ranged from 3 to 5 mg/L. This suggests that the suspended sediments being measured in the Winnipeg River represent the inflowing sediment load of the river and confirms that the sediment load does not vary significantly between reaches. TSS concentrations vary with the distance from the shoreline where they were collected. Annual average TSS concentrations measured generally had a higher range of concentrations 10 m from the shoreline (2 to 66 mg/L) compared to the sample locations 50 m or further from the shoreline (2 to 8 mg/L).

7.3.8.2 Sediment Budgets

In a typical generating station forebay, sediment sources include the inflowing sediment load of the river that the GS is located on, sediment loads contributed by small tributary streams, and material contributed through localized erosion of the forebay shoreline. Sediment loads contributed by small tributary streams entering the Winnipeg River are likely small. As such, they have not been included in the sediment budgets. An assessment of the recorded TSS concentrations in the Winnipeg River indicates that the sediment load flowing in and out of both reaches is very small and approximately equal. This suggests that the reaches are in similar states of equilibrium with regards to erosion and sedimentation processes due to the maturity of the reservoir.

The primary contribution to sedimentation within each reach is the material contributed through erosion within the reach. The eroded material in both reaches is predominately clay, which has an aggregated material density of approximately 1.8 t/m^3. The annual volume of soil material that is expected to be eroded within each of the reaches was estimated based on the maximum annual erosion rate for each shoreline material, the length of the top of riverbank and the height of the riverbank. As such these estimates

are conservative as the average annual erosion rate is less than the maximum and the erosion rate is continually decreasing over time. The estimated annual volume of eroded material and resulting deposition rates for the Lamprey Falls to Pointe du Bois reach is 5,155 m^3/yr (9,280 t/yr) and for the Pointe du Bois to Slave Falls reach 1,584 m^3/yr (2,850 t/yr). This mass of sedimentation results in an estimated deposition rate of 0.033 g/cm^2/yr in the Lamprey Falls to Pointe du Bois reach and 0.041 g/cm^2/yr in the Pointe du Bois to Slave Falls reach.

7.3.9 Woody Debris

Woody debris, in the context of Manitoba hydroelectric developments, is defined as "woody or other organic material that impedes desired uses of a waterway. Debris can be either fixed (trees or tree parts that remain rooted) or loose (either floating freely or deposited on a shoreline)" (Manitoba Hydro 2000).

Woody debris is readily visible in the Pointe du Bois Project area during the open-water season. Most of it may be found either adjacent to, or directly upon, the shorelines. There is not much debris seen in areas of open or deeper waters. Accumulations of floating material at the powerhouses of both the existing Pointe du Bois GS and Slave Falls GS are minor and are captured and removed on a routine basis. Some of the river-borne debris is known to be conveyed downstream past the facilities via their existing spillway structures.

The existing distribution and status of woody debris along the Winnipeg River upstream and downstream of Pointe du Bois both appear largely to be the result of the historical and ongoing evolution of the Winnipeg River shoreline and the terrestrial environment within the basin. Woody debris conditions may be seen to be characteristically different along the reaches where water levels were raised substantially by the installation of the two existing generating stations at Pointe du Bois and Slave Falls, in comparison to the reaches where only the seasonal timing of the discharges and water levels has been altered, but not their ranges.

A digital video recording of the pre-project shoreline and woody debris regime along the river from upstream of Lamprey Rapids to downstream of Sturgeon Falls at Nutimik Lake, including bays and islands, was completed during the open-water season in 2007. The video record shows that the entire shoreline currently produces and delivers live and/or dead vegetation to the water or water's edge, albeit at varying rates that reflect the co-stability of roots and substrate at different locations. The types and densities of visible woody debris vary widely and continuously along the line of contact between the water and the rolling terrain of the project area.

Incidents of trees, branches and brush uprooting and falling onto the ground or into the water along bedrock-controlled shores due to wind or old age presently are much less frequent than they are in areas of actively eroding clay banks. Where near-shore slopes are mild, clay banks are low, and shoreline recession is very slow, vegetation eventually

may succumb to high water tables or inundation, and then may topple over or be dislodged after considerable additional time has passed. Woody debris may remain on or near the shore indefinitely or until mobilized by higher Winnipeg River discharges and their associated shoreline-scrubbing water levels and currents assisted by wind and wave action. Photos 7.17, 7.18 and 7.19 provide characteristic examples of active and probable woody debris shoreline production sites within the Pointe du Bois study area.

Photo 7.17: Active Clay Bank Failure

Photo 7.18: Backshore High Water

Photo 7.19: Potential Mobilization of Woody Material initially deposited above the Water line

Rates of woody debris production in the study area and the quantities and densities observed at the time of the pre-project survey in 2007, all would be considered to be low to very low in comparison to the ranges of conditions found along shorelines of other Manitoba lakes and rivers. This includes some with natural water regimes and some with highly altered and regulated water regimes.

7.3.10 Groundwater

In the Pointe du Bois area, groundwater is anticipated to occur primarily within fractures and fracture zones in the bedrock. Local shallow overburden aquifers may occur in sand and gravel borrow areas west of the project site and would be expected to be of limited capacity.

The Winnipeg River has served as the water source of choice for the existing Pointe du Bois townsite and the large number of recreational properties that have been developed adjacent to it over the years. As a result, there have been very few groundwater wells installed in the area. The nearest groundwater well is approximately 870 m west of the existing powerhouse. A review of the Manitoba Water Stewardship Groundwater Drill database and department discussion indicated the presence of just one domestic well and eight test wells in the area. The domestic well was installed in 1964 near the old ranger station and the Pointe du Bois Campsite, approximately 1,500 m northwest of the current generating station. This well has since been abandoned with the wellhead removed sometime in 2006. The eight test wells were installed in 1982 in the vicinity of Eight Foot Falls Campground, approximately 1,600 m south of the current generating station. The presence of an additional domestic well in the area was identified by a resident during a public open house.

7.4 Aquatic Environment

Aquatic studies were primarily focused within the study area as illustrated in Figure 6.1. The study area was extended downstream to Numao Lake for the water quality component to capture the potential extent of effects. Lake sturgeon studies also were conducted downstream of Slave Falls GS to supplement an understanding of habitat selection by spawning lake sturgeon. Study results are presented in individual technical reports and in the Pointe du Bois Spillway Replacement Project Aquatic Technical Appendix. The aquatic information provided in the following sections is based on information provided in the Aquatic Technical Appendix.

The aquatic studies addressed the following topic areas:

- Water quality;
- Sediment quality;
- Aquatic habitat;
- Lower trophic levels;

- Fish community; and
- Fish quality.

To facilitate descriptions and discussions of the aquatic environmental setting, the Winnipeg River from Lamprey Rapids to Scots Rapids at the inlet to Numao Lake (a distance of approximately 30 km) was divided into five distinct reaches as follows (Figure 7.14):

- Reach 1: Lamprey Rapids Downstream to Pointe du Bois Generating Station (GS) and Spillway
- Reach 2: Pointe du Bois Spillway Downstream to the Base of the Spillway Rapids
- Reach 3: Pointe du Bois GS and Base of the Spillway Rapids to Eight Foot Falls
- Reach 4: Eight Foot Falls Downstream to Slave Falls GS and Spillway
- Reach 5: Slave Falls GS and Spillway Downstream to Scots Rapids at the Inlet to Numao Lake

7.4.1 Water Quality

Water quality was sampled at several locations from Lamprey Falls to Nutimik Lake during the open-water seasons in 2006–2008 (Figure 7.15) and the ice-covered seasons of 2007–2008 (Figure 7.16).

Water quality data were compared to the Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOGs; Williamson 2002) for the protection of aquatic life (PAL), recreation, and drinking water. Canadian Council of Ministers of the Environment (CCME; 1999 updated to 2011) guidelines for the protection of aquatic life were also considered for parameters not included in the MWQSOGs.

Winnipeg River water quality was similar across the study area. Overall, the water contained a moderate amount of nutrients, was typically well-oxygenated in the open-water and ice-cover seasons (66–123% saturation at the Winnipeg River sites and 39-142% saturation at Blind Bay), soft (hardness of 38-62 mg/L as $CaCO_3$), and had a slightly alkaline pH (7.60–8.46 pH units). Generally, turbidity was low (2-6 NTU) with a moderate transparency (Secchi disk depths generally 1–2 m). TSS in surface waters ranged from <2–10 mg/L over this period. As is commonly observed in ice-covered aquatic ecosystems, some water quality conditions varied between the open-water and ice-cover seasons. Specific conductance, **dissolved oxygen** (DO), and nitrate/nitrite were higher and pH, chlorophyll a and TSS were lower in the ice-cover season along the main flow of the Winnipeg River.

7.4.1.1 Dissolved Oxygen

The mainstem of the Winnipeg River did not thermally stratify and tended to be well-oxygenated throughout the water column in both the open-water (6.58–11.40 mg/L) and

ice-cover seasons (9.95–15.09 mg/L). Conversely, although DO was generally high and within the MWQSOGs for PAL near the surface in Blind Bay (3.85–12.50 mg/L during the open-water season and 10.21 mg/L in winter), notable oxygen depletion (i.e., <2 mg/L) occurred at depth during summer, fall and winter. Low DO concentrations were observed across depth in Blind Bay (<4 mg/L) in October 2006. Therefore, DO concentrations in Blind Bay fell below the MWQSOGs for PAL during some time periods. Similarly, relatively low DO concentrations also occurred in the Winnipeg River between Pointe du Bois and Slave Falls GSs in October 2006 and concentrations were just below the most stringent water quality objective of 6.5 mg/L at depth.

7.4.1.2 Ammonia

Concentrations of ammonia were low (<0.04 mg N/L) and were below the MWQSOGs for the PAL at all sites and sampling times.

7.4.1.3 Nitrate/Nitrite

Nitrate/nitrite concentrations were somewhat higher than ammonia, notably in the ice-cover season, but all measurements were below the interim Canadian Council of Ministers of the Environment (CCME) guidelines for PAL (CCME 1999; updated to 2011) (there are no guidelines for nitrate for Manitoba) as well as the Manitoba water quality guideline for drinking water.

7.4.1.4 Total Suspended Solids and Turbidity

MWQSOGs for TSS and turbidity vary according to the environment; the applicable long-term objective for the study area would generally be an allowable increase in TSS of 5 mg/L (applies to aquatic environments where "background" TSS is ≤ 25 mg/L) for the protection of aquatic life (Williamson 2002); TSS remained below 25 mg/L in the Winnipeg River from 1996–2008, as measured by Environment Canada at the Pointe du Bois GS. As the MWQSOGs refer to a change from background conditions, comparisons to this guideline cannot be made for baseline conditions.

As the Manitoba maximum acceptable concentration (MAC) for turbidity in drinking water is only 1 nephelometric turbidity unit (NTU), all measurements of turbidity collected throughout the study area exceeded this guideline.

7.4.1.5 Colour

All measurements of true colour were at or above the aesthetic drinking water quality objective (≤ 15 TCU) in the study area.

7.4.1.6 pH

Measurements of pH were within the Manitoba guideline for the PAL (6.5–9.0) and the recreation guideline (5.0–9.0) at all sites and times. However, a number of measurements of pH taken on site exceeded the upper range of the aesthetic drinking water quality guideline (i.e., 8.5).

7.4.1.7 Total Phosphorus and Nitrogen

Total phosphorous (TP, mean range 0.019–0.023 mg/L) and **total nitrogen** (TN, mean range 0.461–0.834 mg/L) concentrations were relatively low compared to other rivers in Manitoba. Total phosphorus concentrations were below the MWQSOG for rivers and streams (0.05 mg/L) but occasionally exceeded the MWQSOG for ponds, lakes, and reservoirs and streams near the point of entry to these waterbodies (0.025 mg/L). The study area is classified as meso-trophic to meso-eutrophic, using the CCME phosphorus guidance framework (CCME 1999; updated to 2011).

7.4.1.8 Metals

Of the 35 metals and **metalloids** analysed, only beryllium and tellurium were never detected in surface water samples in the study area. Several trace elements were either infrequently detected (<20% of samples collected at a site) or typically present in very low concentrations (i.e., at or near the analytical detection limit) including: antimony; bismuth; cesium; selenium; thallium; tungsten; uranium; and vanadium.

Most metals were consistently below the MWQSOGs for the protection of aquatic life, including: arsenic; cadmium; chromium; mercury; molybdenum; nickel; and zinc. Boron and uranium were also consistently below the CCME guidelines for PAL (CCME 1999; updated to 2011). Several trace elements occasionally exceeded the MWQSOGs for the protection of aquatic life including copper, lead, iron, selenium, and silver. Thallium also occasionally exceeded the MWQSOGs for the protection of aquatic life, but only in Blind Bay. Conversely, the study area is characterized by concentrations of aluminum that typically exceeded the Manitoba water quality guideline for the protection of aquatic life. Aluminum is a relatively abundant element in the earth's crust and elevated concentrations are often found to occur naturally.

With one exception, metals were present at concentrations below Manitoba drinking water quality guidelines (which are typically less stringent than objectives for the protection of aquatic life), including: antimony; boron; cadmium; chloride; chromium; copper; manganese; mercury; selenium; sodium; sulphate; uranium; and zinc. The exception was iron, which exceeded the aesthetic objective on occasion (13% of samples).

7.4.1.9 Fecal Coliform Bacteria and *Escherichia coli*

Fecal coliform bacteria and *Escherichia coli* were rarely above the detection limit of 10 colony forming units (CFU)/100 mL in the study area. On the few occasions that either was detected, concentrations were relatively low, with all but one measurement less than 20 CFU/100 mL. All measurements were below the Manitoba water quality guideline for primary recreation (200 CFU/100 mL) but (where detected) were above the Manitoba drinking water guideline of 0 CFU/100 mL.

7.4.2 Sediment Quality

Sediment quality was sampled upstream and downstream of the Pointe du Bois GS in 2006 and 2007 (Figure 7.17). Sediment quality data were compared to the MWQSOGs for the protection of aquatic life. Two effect levels are specified in the MWQSOGs: a sediment quality guideline (SQG); and a higher value referred to as the probable effect level (PEL). The SQG is a threshold level below which adverse effects are expected to occur rarely whereas the PEL defines a threshold value which, if exceeded, is expected to lead to frequent adverse effects on biota. Other provincial SQGs (the Ontario SQGs for iron, manganese, nickel, TOC, total Kjeldahl nitrogen [TKN], and phosphorus and the British Columbia Ministry of Environment [BCMOE] SQG for selenium) for substances not represented in the MWQSOG SQGs were also considered.

Arsenic, cadmium, chromium, copper, lead, and zinc concentrations in surficial sediments collected from the Winnipeg River mainstem and Blind Bay were, with one exception, within the SQGs (Williamson 2002).

The exception was a single sample collected from Reach 4 in 2006 which marginally exceeded the Manitoba SQG for arsenic but was well below the PEL[1].

For other metals (for which MWQSOGs do not exist), comparisons of results to Ontario SQGs (Persaud et al. 1993) indicate that iron, manganese, and nickel exceeded the lowest effect level (LEL) but not the severe effect level (SEL) at Blind Bay, and manganese and nickel exceeded the LEL at one and two sites, on the Winnipeg River, respectively. All measurements of selenium were below the BCMOE SQG in the study area.

Total nitrogen (TN) and total organic carbon (TOC) were generally higher in sediments from Blind Bay relative to sites on the Winnipeg River mainstem. There are no Manitoba SQGs for nitrogen, phosphorous, or carbon (Williamson 2002); however, the Ontario LELs for TP and TOC, as well as the SEL for TKN, were exceeded in all samples collected from Blind Bay. Ontario SQGs for nitrogen, TP, and TOC were also exceeded in several samples collected from the Winnipeg River mainstem sites in 2006 and 2007.

In 2006 several polycyclic aromatic **hydrocarbons** (PAHs), often associated with petrochemical contamination, were detected in the sediments in Reach 4. With few exceptions (and only at the level of detection) these PAHs were not detected elsewhere within the study area. Intensive sampling was conducted in 2007 within the area downstream of the Pointe du Bois GS in an attempt to determine the source(s) of the PAHs, as well as to define the area with elevated PAHs. The Manitoba SQGs for several PAHs were exceeded at one or more sites in Reaches 3 and 4 including acenaphthene, benzo(a)anthracene, benzo(a)pyrene, fluoranthene, phenanthrene, and pyrene. While the source of the PAHs was not determined, all sampling sites close to the boat launch at Eight Foot Falls contained detectable levels of several PAHs.

[1]PEL – Probable effect level is the level above which adverse effects are expected to occur frequently.

7.4.3 Aquatic Habitat

The aquatic habitat of the study area was divided into 5 distinct reaches (Figure 7.14) based on the physical characteristics of aquatic habitat. Aquatic habitat was described using variables including area, water depth (shallow and deep habitat zones), water level variation, shallow and deep habitat zones, water movements, **substratum** and rooted vascular aquatic **macrophyte** beds. Overall, Reaches 1, 2, 3, and 4 of the study area comprise two reservoirs (Pointe du Bois and Slave Falls) that are separated by the Pointe du Bois GS and spillway. The aquatic habitat of all five reaches is described as follows:

7.4.3.1 Reach 1

The Pointe du Bois reservoir (Reach 1) extends from Lamprey Rapids to the Pointe du Bois GS, and has a maximum depth of approximately 36.5 m. Two main channels span much of the length of the forebay. Each is approximately 15–30 m in depth and bounded by abundant shallow habitat bays along the north and south shores. Although most of the forebay is lentic (characterized by slow moving water) habitat, notable water movements occur below Lamprey Rapids, at Big Island, and at the immediate forebay area of Pointe du Bois GS. The latter is comprised of the inner forebay on the west side of the river that conveys water from the outer forebay to the powerhouse. The channel is approximately 140 m wide at the opening with a small lentic bay located mid-channel on the west side. Under 95th percentile flow conditions (1580 cms), depth averaged modelled velocities at Lamprey Rapids are estimated to be as high as 2.6 m/s. Water movements are also present in both channels of the reservoir but are discontinuous as low velocity habitat alternates with lentic habitat as water moves over the reservoir bed topography.

The substratum of the reservoir is predominantly depositional. Silt/clay bottom types dominate most of the lentic and deep lotic (characterized by fast moving water) habitat, except in shallow areas where wave action or water velocities re-suspend material. The substratum within 600–800 m downstream of Lamprey Rapids is primarily bedrock or boulder/cobble. Sand is common in shallow bays and along the shores of islands that separate the north and south channels. Bays with organic bottoms occur infrequently and only where local sources of organic materials are available.

The abundance of lentic habitat and shallow water in combination with depositional substrata and low exposure to wave energy in Reach 1 bays create favourable conditions for rooted aquatic plant growth. Reach 1 contained 12 of the 14 species observed in the study area and these species were found to be well distributed throughout the reach in back bay and shoreline areas. Reach 1 also contained over 71% (45 ha) of the total extent of macrophytes in the study area. *Potamogeton richardsonii* was observed most frequently and was found in 60% of the beds observed. *Myriophyllum sibericum* was observed frequently in relatively small proportions within the *Potamogeton* beds. No macrophytes were observed in the immediate forebay area of the Pointe du Bois GS.

7.4.3.2 Reach 2

Reach 2 includes the 300 m reach between the spillways and the base of the spillway rapids. When the Pointe du Bois GS spillway is not in use, the bedrock sill below the spillway is mostly dry (approximately 8.5 ha), except for two relatively large and lentic pools (spillway ponds #2 and #3, comprising a total area of approximately 6 ha) and several smaller ones that are connected by shallow channels that convey spillway leakage. Bedrock parent material dominates the undulating topography of this area with some areas of scattered boulder and cobble. Spillway ponds #2 and #3 are deep relative to width with maximum depths of 10 and 16 m respectively. Leakage from the spillway has varied over time but generally is small and flows through the spillway ponds en route to Reach 3 throughout the open-water season.

During normal operation, flows up to the maximum powerhouse capacity of 712 m^3/s are passed through the powerhouse and excess flows are passed over the spillway. At the all-season 50th percentile flow (850 m^3/s), the spill would be approximately 140 m^3/s at maximum powerhouse capacity (712 m^3/s), resulting in a wetted area of approximately 13 ha in Reach 2. At the 95th percentile all-season flow (1476 m^3/s), spill would be approximately 764 m^3/s at maximum powerhouse capacity, resulting in a wetted area of approximately 15 ha. Differences in the wetted area and velocity between these two flow conditions show that most dewatering at the 50th percentile flow occurs on the west side of Reach 2, with some areas also exposed on the east side.

Under 50th percentile flows, the white water that leaves the spillway structures and connects the series of pools is high velocity habitat, varying in velocity up to about 5 m/s (depth averaged velocity). Most of the remaining area of the two largest pools persists as lentic habitat. Under 95th percentile flows, spillway pond #3 is completely inundated with high velocity water whereas the western half of spillway pond #2, now larger at this inflow, remains lentic. White water areas in Reach 2 modelled under a 95th percentile experience flows with depth averaged velocities ranging higher than 5 m/s.

Rooted aquatic macrophytes were not observed in Reach 2.

7.4.3.3 Reach 3

Reach 3 begins below the Pointe du Bois GS and spillway shelf and extends to the outlet of the narrows at Eight Foot Falls. Shallow habitat is limited to areas near shore, is mainly lotic (62%), and has an area of 90.3 ha. Water depths immediately to the east of the powerhouse generally are about 2–3 m but most of the area within the first 160 m downstream has depths that range from 4–7 m. Moderate and low velocities occur in the immediate Pointe du Bois GS tailrace. Scattered deposits of cobble and boulder exist below the powerhouse, spillway rapids, and near the east bank. Below the powerhouse, deposits of cobble and areas of bedrock are most common. Farther east of the powerhouse, the depth increases from 9 to 13 m in a plunge pool located downstream of the base of the spillway rapids. A relatively large shoal, with minimum depth of 3 m, is located on the western side of the plunge pool, about 120 m east and south of the

powerhouse. The east bank of the plunge pool is shallower and resembles the depth distributions observed below the powerhouse, i.e., most of this area is 5 – 7 m deep. Downstream of the spillway, bedrock and boulder habitat predominates. Boulder deposits are generally patchy below the central spillway area and are often thinly distributed directly on the parent bedrock material. A smaller pool on the northeast corner of the reach, adjacent to the base of the spillway rapids, has a maximum depth of approximately 5 m, is about 100 m across, and is lined with cobble. Under spill conditions high water velocities occur downstream of the spillway ponds and, in combination with the shallow water found in this area, generate white water. Cobble and boulder materials line most of the east bank of the plunge pool.

Further downstream, in the center of the channel downstream to Eight Foot Falls, depths in the main channel are relatively uniform and generally range from 12–20 m, with moderate and low velocities (less than about 1.5 m/s). In the vicinity of Eight Foot Falls, depths generally decrease to 3–5 m and velocity increases. The only areas in Reach 3 where transport and/or depositional processes dominate the substrata are in shallow bay areas where water movements are limited. In these lentic habitats, small patches of sand or clay/silt are present.

In Reach 3 aquatic macrophyte beds, totalling 1.42 ha in area, occur only in a few small back-bay areas. *P. richardsonii* was observed to be most common while *M. sibericum* and *Sagittaria* sp. generally were less abundant and dispersed within *P. richardsonii* dominated beds. No rooted aquatic macrophytes were observed in the upstream third of Reach 3 near the Pointe du Bois GS.

7.4.3.4 Reach 4

Reach 4 encompasses the Slave Falls reservoir which extends from the base of Eight Foot Falls to Slave Falls GS. In this reach, depth increases markedly, a vertically undulating thalweg is often evident, the channel is wider and water movements are slower and more reservoir-like. Maximum depths of the thalweg are as deep as 63 m, but thalweg depths throughout the reach are quite variable, ranging in depth to less than 10 m. Reach 4 is about 68% lentic habitat. Lotic habitat occurs in the center of the channel where velocity is low, except below Cases Bay where the reservoir widens and the main channel alternates between lentic and low velocity habitat. Substratum distributions in Reach 4 indicate that this section of the Winnipeg River is subject mostly to the processes of transport in the thalweg and deposition in lentic habitat of bays. Near Eight Foot Falls, most of the thalweg is deep, low in slope (i.e., <6%), and dominated by sand flats interspersed with localized patches of sand/gravel. These bays are extensive depositional areas in the form of silt flats that extend from near shore to the sand-dominated thalweg.

A narrows located 2.1 km upstream of Slave Falls GS is dominated by a bedrock sill. It has moderate and high water velocities and creates the only visible water surface turbulence in the reach, below that arising from Eight Foot Falls. Maximum depth in the

immediate forebay of Slave Falls GS is about 20 m. The substratum distributions in the immediate forebay of the Slave Falls GS are complex, in part due to re-direction of the historic thalweg, inundation, high slope, and limited velocity.

Reach 4 exhibited the second greatest macrophyte areal abundance (16.5 ha) and species **diversity** (10 species) in the study area. Aquatic plant beds were well distributed throughout the bays and along sheltered shores. The prevalence of silt/clay substrates, shallow water and lentic or low-lotic flows and limited shore exposures created favourable aquatic plant habitat. Similar to Reach 1, *P. richardsonii* dominated in the majority of beds observed (45%); in contrast to Reach 1, *Sagittaria cuneata* (16%) and *Potamogeton gramineus* (11%) more frequently dominated some beds. *Utricularia macrorhiza* was only found in this reach of the study area although it was seldom observed (3.4%).

7.4.3.5 Reach 5

Reach 5 extends from the Slave Falls GS to Scots Rapids at the inlet to Numao Lake. Substratum distributions immediately downstream of the Slave Falls GS and spillway are indicative of predominantly erosional processes. Substrata are comprised primarily of bedrock on the west side of the river and below the spillway. Cobble-and-boulder or bedrock combinations are found downstream of the powerhouse. Similar to the transport habitats upstream in Reach 4, the thalweg habitat of Reach 5 is mainly sand and sandy gravel.

Few suitable habitats are available for rooted aquatic macrophytes in Reach 5 and only a small area of beds was observed (0.08 ha). The beds present were dominated by *S. cuneata* and *M. sibericum*.

7.4.4 Lower Trophic Levels

The following presents a summary of lower trophic groups for studies conducted between 2006 and 2008.

7.4.4.1 Phytoplankton and Attached Algae

Phytoplankton are very small (i.e., <0.1 mm) algae that live suspended in the water column of lakes. Attached algae (**periphyton**) generally colonize the surfaces of plants, hard substrates such as boulder and bedrock shorelines, and open areas of fine sediment. The extent of growth of attached algae depends largely on the stability of the bottom sediments and on water level fluctuations.

Phytoplankton abundance and composition varied between years and among sites. The overall mean phytoplankton biomass was 84,410 mg/m^3. Phytoplankton biomass peaked in August in both 2006 and 2007. In 2006, the phytoplankton composition at each site progressed from a chlorophyte/cyanophyte-dominated community in summer to one composed of cyanophytes in late summer. Cyanophytes remained dominant in fall although diatoms were also moderately abundant. In 2007, diatoms dominated the

phytoplankton communities at the on-current sites during all sampling times, although the abundance of cyanophytes increased slightly during the summer. In contrast, the 2007 phytoplankton composition in Blind Bay (the off-current site) was dominated by chlorophytes and cyanophytes in spring and progressed to cyanophyte and diatom composition by the fall. In spring 2008, the composition of all sites was dominated by diatoms; cryptophytes were also moderately abundant in Blind Bay.

Mean chlorophyll *a* concentrations were generally consistent among years despite the successional variation in phytoplankton groups within each open-water season. Seasonal mean (2006 and 2007) and individual (2008) chlorophyll *a* concentrations at the on-current sites were similar between years and among sites and ranged from 6 to 15 µg/L. In 2007 and 2008, seasonal mean and individual chlorophyll concentrations in Blind Bay were similar to those at the on-current sites; however, the 2006 mean concentration at this site was substantially higher (mean = 21 µg/L) than those measured at any site in 2007 or 2008. At all sites during all sampling periods, chlorophyll *a* concentrations were low in July and October and moderate-to-high in May and August. Additionally, chlorophyll *a* concentrations at Blind Bay in May and July were similar to those measured at the on-current sites, but concentrations measured in August and October were consistently higher than those at the on-current sites.

Primary production is typically limited under ice-cover due to low temperatures and reduced light levels. As expected, chlorophyll *a* concentrations in samples collected under the ice were often barely detectable (range <1–2 µg/L) and consistently lower than during the open-water season.

Periphyton growth on the Pointe du Bois GS and spillway structures and on the rock of the spillway shelf is dependent on water level and flow. Mean ash-free dry weights of periphyton samples collected from natural rock surfaces on the periphery of Reach 2 in 2008 were 78.60 g/m^2 in June, and approximately one-sixth of this value in August (11.31 g/m^2). Mean chlorophyll *a* values were 172.50 mg/m^2 in June and 16.27 mg/m^2 in August, approximately one-tenth of the value found in June.

7.4.4.2 Drifting Aquatic Vegetation

Aquatic vegetation (rooted vascular plants and algae) grow within the littoral zone (the area of a waterbody near the shore where there is sufficient light penetration for photosynthesis to occur). In riverine environments, a relatively large amount of vascular plant and algal biomass is transported downstream by flowing water.

A minimum of 18 aquatic macrophyte taxa, including unidentified algae, were collected from drift traps deployed in the mainstem within Reaches 1, 3 and 4 from 2006 to 2008. Algae, mainly filamentous, were the most abundant type of vegetation collected in drift traps. Mean dry weights of drift samples collected immediately upstream and downstream of the Pointe du Bois GS ranged from 8.58 to 28.73 grams. Mean relative contribution of algae to the total for all drift trap samples generally ranged from 33% to 76%. In 2006, *Potamogeton* spp., Poaceae, Cyperaceae, Juncaceae, *Myriophyllum* spp.,

Vallisneria americana, and *Utricularia* spp. were the dominant macrophytes collected downstream of the Pointe du Bois GS. These were also the most common taxa collected upstream and downstream of Pointe du Bois GS in 2007. In 2008, *Potamogeton* spp., *Myriophyllum* spp., Cyperaceae, *Eleocharis acicularis*, and *Lemna trisulca* were the dominant aquatic plant taxa collected up and downstream of the Pointe du Bois GS.

7.4.4.3 Zooplankton

Zooplankton are very small (i.e., <0.2mm) animals without backbones (invertebrates) living in the water column and are consumed by larval, juvenile, and some adult fish. The availability and quality of food (e.g., amount and kinds of phytoplankton), the number of predators, and water residence time affect the abundance of zooplankton. In rapidly flushed rivers little zooplankton biomass accumulates whereas zooplankton densities tend to be greater in areas where there is little current.

Total mean density (individuals/m^3) of zooplankton was relatively similar in all three study years and ranged from a low of 4,498 in 2007 to a high of 7,277 in 2006. The overall mean for all sites and sampling periods was 5,536 individuals/m^3. Mean density of zooplankton collected at the off-current site in Blind Bay was approximately four times the mean density of zooplankton collected at the on-current sites. The density at the off-current site ranged from 4,681–31,348 individuals/m^3 with an overall mean of 15,085 individuals/m^3. Mean density at on-current sites ranged from 1,767–5,752 individuals/m^3 with an overall mean of 3,673 individuals/m^3.

Cyclopoida and Cladocera were the most abundant taxa, with Calanoida accounting for only 10% and 12% of the mean total collected at off- and on-current sites respectively. Cyclopoida were more abundant at the off-current site (mean 7,967 individuals/m^3) than at the on-current sites (mean 1,674 individuals/m^3). The species diversity of the zooplankton community was similar among study years; 21 species were observed in 2006 and 20 species in 2007 and 2008. Diversity was greatest at the on-current sites with approximately 21 different taxa identified; 14 species were collected at the off-current site location in Blind Bay.

Mean zooplankton density at the off-current site was greatest in the spring/early summer (21,067 individuals/m^3; ± 10,280 SE); and late summer (19,242 individuals/m^3; ± 5,487 SE) sampling periods. At the on-current sites, densities were highest during the late summer (7,233 individuals/m^3; ± 1,296 SE) followed by the spring/early summer (3,557 individuals/m^3; ± 922 SE) sampling periods.

7.4.4.4 Aquatic Macro-Invertebrates

Aquatic macro-invertebrates are small animals without backbones living on or in the substrata of lakes and rivers (e.g., clams, aquatic earthworms, and aquatic insect larvae). Aquatic macro-invertebrates are typically a diverse assemblage, and are adapted to the range of substrate types and water flow regimes (e.g., fast-flowing mainstem rivers, sheltered bays) found in the aquatic environment. The aquatic macro-invertebrate

community within a riverine system is comprised of sediment-dwelling and drifting organisms. While sediment-dwelling macro-invertebrates are relatively sedentary, drifting organisms are a composite of invertebrates originating from a large area and diverse array of habitats. Both sediment-dwelling and drifting macro-invertebrates are important food sources for fish; therefore their abundance and distribution helps define the importance of an aquatic area as feeding habitat.

The overall mean abundance for sediment-dwelling macro-invertebrates in aquatic habitats sampled was 1,667 individuals/m^2. The shallow habitat at Blind Bay (BB-1; off-current) supported a similar mean abundance of benthos as described for the deep habitat (5,184 and 6,073 individuals/m^2, respectively) in this bay. At the deep location in Blind Bay, individual sample abundances ranged from 1,304–26,391 individuals/m^2. Within the shallow habitat, individual sample abundance values ranged from 87–16,130 individuals/m^2. At the on-current sites, the mean invertebrate abundance at the shallow site was greater (986 individuals/m^2) than at the deep location (602 individuals/m^2). Individual sample abundances ranged from 174–8,522 individuals/m^2 within the deep habitat and from 43–21,130 individuals/m^2 in the shallow habitat.

A minimum of 42 sediment-dwelling macro-invertebrate taxa were collected during the study; the majority of these were from the shallow habitats where sediments predominantly consisted of clay (while sediments in deep habitats generally consisted of sand). Except at the deep location at Blind Bay where Chaoboridae were most abundant, non-biting midges (Chironomidae) dominated the **benthic** community at all other habitat types and sampling locations. Olichochaeta, Amphipoda, Ephemeroptera, and Pisidiidae also were common in sediments.

At the outset of the current study, the corpulent rams-horn snail (*Planorbella corpulenta*) (a COSEWIC mid-priority candidate for detailed assessment) was believed to have a distribution in Manitoba that was restricted to portions of the Winnipeg River near Pointe du Bois. In 2007, visual encounter surveys conducted at 30 sites throughout the study area produced sightings of the corpulent rams-horn snail at over half (n=19, or 63%) of the sites visited. Specimens were also encountered in 2007 as by-catch in drift trap samples (n=2) and gillnet sets (n=1, on two different occasions). The snails typically occurred on rocky shorelines where substrate consisted of algae-covered boulders/bedrock and where detritus was not abundant. Corpulent rams-horn snails were found from Lamprey Rapids downstream to Slave Falls GS wherever suitable habitats occurred. No snails were found at 11 sites surveyed in Nutimik Lake in 2008.

Overall, the macro-invertebrates collected in drift traps consisted of 64 identified taxa, 44 of which were from the Class Insecta. During all study years and within all study reaches, Hyalellidae and Hydrachnidae dominated the non-insect group of the macro-invertebrates; while Ephemeridae, Perlodidae, Hydropsychidae, and Chironomidae dominated the insect group.

7.4.5 Fish Community

The following provides a broad overview of the fish community in the study area, based on studies conducted in 2006 to 2010. In addition three fish species of particular ecological, social, cultural or economic value have been designated as valued environmental components (VECs) and are highlighted. Lake sturgeon has been designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as "endangered" in the Winnipeg River and is a candidate for possible listing under the *Species at Risk Act* (SARA). The species is also a key recreational fish species, subject to a catch and release fishery. Northern pike and walleye are key recreational fish species and occupy an ecological niche at the top of the aquatic food chain in the study area.

Thirty-six of the thirty-eight fish species previously reported from the study area were captured in fish community studies conducted between 2006 and 2010 (Table 7.3). The principal large-bodied species captured included walleye, sauger, northern pike, yellow perch, burbot, lake whitefish, cisco, longnose sucker, white sucker, and lake sturgeon. Principal small-bodied species included spottail shiner, emerald shiner, trout perch, and logperch.

Of the four species listed on either SARA or COSEWIC as being "at risk" in the Winnipeg River drainage in Manitoba, only one (lake sturgeon) was captured in the study area. The other three species are known to exist in the Winnipeg River watershed downstream of the study area. The carmine shiner (*Notropis percobromus*) is listed under SARA, Schedule 1–threatened and is known to occur in the Whitemouth River, a tributary of the Winnipeg River approximately 50 km downstream of Pointe du Bois. In addition, the chestnut lamprey (*Ichthyomyzon castaneus*) and northern brook lamprey (*I. fossor*) are listed under SARA, Schedule 3–special concern and are known to occur in the Whitemouth River; however, the COSEWIC status is non-active.

Evidence of fish spawning was found in all reaches of the study area; however, individual species generally utilized only certain areas and/or reaches. The majority of ripe lake sturgeon (as well as lake sturgeon eggs and larvae) were found in Reach 3. Northern pike and walleye appeared to spawn throughout the study area, with the exception of Reach 2.

Drift trap data revealed that the larvae of three families, Salmonidae (cisco, lake whitefish), Percidae (yellow perch, logperch, walleye, sauger), and Cottidae (sculpin) were found in all reaches (with the exception of Reach 2, which was not sampled for fish larvae). Lake sturgeon larvae were most abundant in Reach 3, but were also detected in relatively low numbers in Reach 4. Northern pike larvae were captured in low abundance in all reaches reflecting their tendency to spawn and rear in shallow, low velocity, macrophyte-rich bays.

7.4.5.1 Lake Sturgeon

Lake sturgeon were found to occur in all reaches in the study area, except Reach 2. Reach 1 was found to contain relatively low concentrations of lake sturgeon at all times of the year. In Reaches 3 and 4 from the Pointe du Bois GS downstream to the Slave Falls GS (a distance of approximately 10.3 km), lake sturgeon were found in high concentrations and all life stages.

The size of the lake sturgeon population in Reaches 3 and 4 combined is estimated at 2131 adults (95% confidence interval 1443–3167 adults) based on data collected from 2006 to 2009. The number of lake sturgeon captured in Reach 1 is insufficient to provide an estimate of the population size in that reach; however, low catch per unit effort (CPUE) values suggest a relatively small population size.

Seasonal Distribution and Feeding

In early spring (in ice-free areas that could be fished with standard index gillnets), lake sturgeon were found to be relatively dispersed throughout Reaches 3 and 4. At that time of year, CPUE values were low in both reaches, with adults showing slight preference for the slower deeper habitats of Reach 4. The CPUE for juvenile lake sturgeon in early spring was higher in Reach 4 than Reach 3 indicative of their preference for the deeper, slower moving water at this time of year.

In late spring, adult lake sturgeon were captured in all reaches of the study area (except Reach 2) during spawning investigations, but were most abundant in the upper portions of Reach 3 and Reach 5 in close proximity to the Pointe du Bois GS and the Slave Falls GS respectively. The adult CPUE was highest in Reach 3, followed by Reach 5, and was lowest in Reach 1.

The late spring distribution of lake sturgeon within Reach 3 varied from year to year, depending on flow conditions. In 2006, 2008 and 2009 (all spill years) lake sturgeon were captured throughout the upper portion of Reach 3 below the spillway shelf but were more concentrated on the eastern edge of the main spillway flow. In 2007 (non-spill year) most individuals were captured along the eastern edge of the powerhouse tailrace flow and fewer individuals were found below the spillway. During the spawning season, lake sturgeon appeared to be concentrated in or immediately adjacent to areas of high water velocity. Large mesh gill nets set adjacent to high velocity areas frequently produced higher CPUE values than nets located further away from the main source of flow.

During summer and fall, no adult lake sturgeon were captured upstream of the Pointe du Bois GS (Reach 1); however, nine juveniles were captured in this reach over the period of study. Downstream of the Pointe du Bois GS, both adult and juvenile lake sturgeon were more abundant in Reach 4 than Reach 3 during summer and fall in all years of study. Adults were found to be widely distributed throughout Reaches 3 and 4 during this time period, in a variety of habitats. Unlike juvenile lake sturgeon, no large

congregations of adults were found during this period. In general, adult lake sturgeon were present in shallow, moderate current areas while juveniles were concentrated in deep locations in Reach 4.

Young of the year (YOY) lake sturgeon were only captured in Reach 4, and only during the fall when the fish had attained sufficient size to be vulnerable to gillnets and when fishing for YOY sturgeon was concentrated. YOY and age 1+ lake sturgeon were captured during fall 2008 at depths ranging from 3.8 to 36.8 m in three main locations in Reach 4. The majority of YOY individuals were found in deep, low water velocity areas with hard substrates near the river thalweg. No other YOY lake sturgeon were captured in Reaches 1, 2 or 4 or in any other year of study.

The stomach contents of lake sturgeon collected either by gastric lavage (stomach pumping) or from gillnet fatalities from 2007 to 2008 were found to consist primarily of *Hexagenia* larvae (mayflies). Diptera, Megaloptera and Tricoptera comprised considerable components of the diet while Crustacea, Mollusca and Annelida were also found in some stomachs examined. Parasitic Nematoda and Trematoda were found in the gut contents of all lake sturgeon examined.

Spawning

Lake sturgeon spawned below the Pointe du Bois powerhouse and spillway rapids in Reach 3 and below the Slave Falls GS and spillway in Reach 5. No evidence of lake sturgeon spawning was observed in Reaches 1 or 2. In Reach 4, catches of some sexually mature lake sturgeon along with a small number of eggs may be indicative of some limited spawning or may simply be related to capture of upstream migrating sexually mature fish and downstream egg drift. Lake sturgeon began to congregate in the vicinity of spawning locations in May or early June of each year from 2006 to 2010 as water temperatures approached 10°C. Both spawners and non-spawners (the latter including both adult and large juvenile fish) appeared to use spawning habitats during the spring, as signs of sexual maturity were not evident for many of the fish captured on or near the spawning grounds.

At both spawning locations, the capture of numerous spawning fish, eggs and drifting larvae provided evidence of spawning and successful hatching. Hydraulic conditions and spawning locations varied each year as a result of flow rate (which determined amount of spill over the spillway in each year) and number and location of individual Pointe du Bois GS units in use (particularly at Pointe du Bois). In Reach 3 the relative use of the GS tailrace and spillway outflows for spawning depended on a variety of factors including hydraulic conditions below the Pointe du Bois GS and spill rate.

All years combined, high egg captures were associated with a broad range of depth-averaged flow velocities (i.e., 0.30 – 1.77 m/s) and water depths (i.e., 1.9 –8.5 m) but were always associated with flows emanating directly from the powerhouse or spillway, usually along the periphery of the highest flows present. Overall, substrates associated with egg deposition consisted of hard materials (i.e., bedrock, boulders, and cobble) and

visible water turbulence. Substrates consisted of hard materials including bedrock, boulders and cobble. Lake sturgeon egg data showed that 95% of egg deposition occurred within 85 m of the Pointe du Bois GS or spillway rapids over a range of depths and several hard and clean substratum types. This pattern of egg deposition suggests that lake sturgeon prefer to ascend to a location near the origin of the attractant flow and to use a relatively small area of the available habitat.

Habitat Suitability Index

A habitat suitability index (HSI) lake sturgeon spawning model was developed from existing literature as well as site-specific data collected at Pointe du Bois and Slave Falls from 2006–2010. A detailed description of model development and results are provided in the Pointe du Bois Spillway Replacement Project – Lake Sturgeon Spawning Habitat Suitability Modeling Report (North/South Consultants Inc., in prep.) A summary of the model, and model outputs, is provided below.

Habitat suitability criteria (HSC) values reported in the published literature for lake sturgeon spawning included water velocity, depth and substratum. The HSC values reported in the literature were examined and summarized based on the ranges provided. The range of velocities reported from the literature was from 0.1 – 2.1 m/s, depth varied from >0–12.2 m and substrates were reported to vary from gravel to bedrock.

Field data collected was then incorporated into the model to make it more representative of actual spawning preferences below Pointe du Bois and Slave Falls. Both locations showed that spawning was occurring at depths in the upper range of suitability reported in the literature. Velocity was determined to be a significant variable with respect to spawning site selection with the distinct optimal suitability range between 0.50 and 1.20 m/s. Lake sturgeon spawned over a wide range of substrate types at Pointe du Bois, including bed material types that consisted of boulder, cobble and bedrock over a full range in available water depth (13 m). Variables for flow direction and distance from a barrier were added to the model to better correlate the outputs of the spatial extent of the HSI model to actual observations, shown as critical distance on Figure 7.18A. Water flowing in an upstream direction (i.e., back eddies) was classified as being unsuitable for spawning. The distance from the Pointe du Bois GS and base of the spillway rapids was added to the model to account for the observed decreasing density of egg deposition with increasing distance from the powerhouse and spillway rapids. Sturgeon egg data showed that 95% of egg deposition occurred within 85 m of the powerhouse or spillway rapids over a range of depths and several hard and clean substratum types.

HSI values ranging from 0.75–1.0 are classified as the highest suitability, 0.5–0.75 are considered moderate suitability and 0.25–0.5 have moderately low suitability. Under the 50th percentile flow condition, the areas of highest suitability were located immediately below the Pointe du Bois powerhouse to a distance of approximately 45 m downstream

as well as at the edge of the major outflow area below the spillway rapids (Figure 7.18A). The amount of suitable spawning habitat immediately below the powerhouse does not change with flows in excess of plant capacity. Therefore any changes in the amount of suitable spawning habitat at higher river flows (e.g., 95th percentile flows) are related to habitat conditions below the spillway rapids (Figure 7.18B).

Movements

A total of 1,738 external plastic numbered Floy® tags and 32 internal acoustic transmitters were attached to lake sturgeon between 2006 and 2009 in Reaches 3 and 4. Subsequent recaptures and relocations of these individuals provided detailed information on the frequency and timing of sturgeon movements in the study area. In addition, the recapture of 35 lake sturgeon that had previously been tagged by Manitoba Fisheries Branch between 1991 and 1999 in these same reaches added to the understanding of longer-term behaviour. Most lake sturgeon recaptured in Reaches 3 and 4 appeared to maintain a very limited home range. Recaptures, including those of fish originally tagged by Manitoba Fisheries Branch, were generally relocated in close proximity (i.e., within 1 km) to their original tagging location. Adult lake sturgeon were generally concentrated in Reach 3 during spring, widely distributed throughout Reaches 3 and 4 in summer/fall and somewhat concentrated in the Reach 4 during winter.

Three instances of downstream migration of Floy® tagged adult lake sturgeon past GSs were recorded over all years of study, one individual moved downstream past the Pointe du Bois GS and two individuals moved downstream of the Slave Falls GS. All three fish were found to be in good condition when recaptured.

All juveniles acoustically tagged in deep water areas of Reach 4 in 2006 were subsequently detected at a variety of locations within the same reach (with a few brief detections in the lower end of Reach 3) both during winter and open-water seasons of 2007, 2008 and 2009. Movements were generally localized in a portion of Reach 4 characterized as a deep (12 to 45 m), low velocity habitat, underlain by fine substrates. No juvenile lake sturgeon were found to have emigrated from Reach 4 downstream past the Slave Falls GS and spillway into Reach 5.

7.4.5.2 Northern Pike

Seasonal Distribution and Feeding

Northern pike were relatively common and were found in all reaches and all seasons in the study area. Generally the species was closely associated with aquatic vegetation. Although numbers varied between reaches, seasons and years, this species represented up to 72% of the total catch in some areas. Of the reaches sampled in spring (i.e., Reaches 1, 3, 4), average CPUE of northern pike was highest in Reaches 1 and 4, and lowest in Reach 3. Any northern pike captured in Reach 2 were likely transient individuals

moving downstream from Reach 1. In summer and fall, average CPUE and relative abundance of northern pike in the catch remained relatively low in all reaches.

While northern pike were found to utilize both shallow and deep water as foraging habitat, the species showed a preference for shallow waters less than 5 m in depth. In such locations, small forage species are common and catch proportions and CPUEs of northern pike often followed patterns similar to those of yellow perch, a common prey species. Of the northern pike captured within the study area as part of the index gillnetting programs conducted between 2006 and 2009, 48.5% contained food items and all these had consumed fish. Yellow perch represented 17% of northern pike diet, followed by johnny darter (11%). Burbot, sauger, smallmouth bass, trout perch, walleye and white sucker also were found in stomachs, each representing approximately 6% of the diet. Unidentifiable fish remains were present in the remaining 33% of stomachs containing food items.

Spawning

Habitats both upstream and downstream of the Pointe du Bois GS appear to support spawning populations of northern pike. The majority of ripe males and females were found in Reaches 1 and 4, corresponding to the presence of suitable spawning habitat features (i.e., aquatic vegetation) in these areas. Few northern pike larvae were captured in drift samples suggesting that most spawning and nursery habitat of the species in Reaches 1, 3 and 4 occurs in shallow (0–5 m) nearshore (depositional) areas. Because Reach 2 contains few vegetated or depositional areas, little or no spawning activity likely occurs in the reach. Northern pike were found to be more abundant in Reach 4 than Reach 3 during spring, indicating that the former likely provides the largest quantity of suitable spawning habitat in the study area downstream of the Pointe du Bois GS.

Movements

Overall, most northern pike remained in close proximity to their original tagging location. However, of the 11 northern pike implanted with acoustic tags immediately upstream of the Pointe du Bois GS in 2007, four passed downstream either through the Pointe du Bois GS or over the spillway and were subsequently detected as far downstream as Reach 4. In addition, three of 14 northern pike implanted with acoustic tags downstream of the Pointe du Bois GS moved downstream past the Slave Falls GS.

7.4.5.3 Walleye

Seasonal Distribution and Feeding

Walleye were captured in all reaches except Reach 2 in spring, summer and fall and accounted for up to 17% of the total catch in some locations. In spring the CPUE was higher in Reach 3 than in Reach 4, indicating possible spring movement of adults into the former reach. However, no high congregations of spawning walleye were found in any reach. In summer, walleye proportions in the catch remained higher in Reach 3, although CPUE was higher in Reach 4.

Most walleye in the study area (both juveniles and adults) were found at depths of less than 5 m during seasons of high foraging activity. The majority (64%) of walleye captured between 2006 and 2009 had empty stomachs (which is typical of gillnetting studies). Seventy-five percent of the walleye that contained food items had consumed fish, while 25% had consumed invertebrates such as crayfish. Of the individuals containing fish, most had eaten yellow perch (16.7%), followed by unidentified shiners (8.3%) and white sucker (4%). The remainder contained unidentifiable fish remains.

Spawning

The available data suggest that walleye spawning may be dispersed in several locations within the study area. No high concentrations of spawning walleye were located during field studies. Catches of sexually mature walleye were highest in Reach 3 (particularly in 2009). However, few mature female walleye were captured (less than 5% of the catch) and egg mat sampling in that reach during the likely walleye spawning period in 2009 failed to capture walleye eggs. While HSI modelling shows some highly suitable walleye spawning habitat in Reach 3, a higher abundance of optimal habitat is shown to occur in Reach 4 (Figures 7.19A and 7.19B). Relatively low walleye CPUE in Reach 1 during spring suggests that walleye in the reach may move upstream of the study area to spawn. Larval drift catches in Reaches 1, 3 and 4 contained higher numbers of Percidae larvae than any other fish taxa.

Movements

Of the 12 walleye implanted with acoustic tags immediately upstream of the Pointe du Bois GS in 2007, seven remained in Reach 1 throughout the course of the study. Five walleye passed downstream either through the Pointe du Bois GS or over the spillway and were subsequently detected as far downstream as Reach 4. The majority of walleye Floy® tagged in Reach 4 remained in close proximity to their tagging location; however one individual moved downstream past the Slave Falls GS into Reach 5.

7.4.6 Fish Quality

The following presents a synopsis of results for analysis of muscle mercury concentrations in fish based on samples collected in 2007 and 2008.

Mercury concentrations in the epaxial (dorsal) musculature of eight fish species (lake sturgeon, cisco, lake whitefish, northern pike, spottail shiner, walleye, sauger, and yellow perch) were determined at Pointe du Bois in 2007 and 2008 to provide a baseline for the assessment of their relationship to habitat changes within the broader geographical and historical context of the Project.

Mean length standardized mercury concentration ranged from 0.05 ppm in whitefish to 0.51 ppm in northern pike. Northern pike was the only species that exceeded the 0.5 ppm standard for mercury in commercial fish set by Health Canada. Sauger (0.40 ppm) and walleye (0.33 ppm) had the second and third highest mercury concentrations found.

One possible reason why the mercury levels of the two predatory percid species were substantially lower than for northern pike is the relatively young age of the sauger and walleye available for analysis. It should be noted that the mercury levels in northern pike and walleye were similar to those normally encountered in Manitoba waterbodies that have not been impacted by flooding or point source contamination or that have recovered from the effects of flooding.

7.5 Terrestrial Environment

The study area (Figure 7.1) for the terrestrial studies encompasses the Winnipeg River from Lamprey Rapids to Slave Falls. Studies were carried out along the shoreline of the river corridor, in the areas to be potentially affected by the project construction and in the potential material source areas. Terrestrial habitat is described for the study area under two broad categories: wetland vegetation and terrestrial vegetation and rare plants.

The terrestrial studies addressed the following topic areas:

- Wetland vegetation;
- Terrestrial vegetation and rare plants;
- Invertebrates;
- Amphibians and reptiles;
- Birds; and
- Mammals.

7.5.1 Wetland Vegetation

Wetland habitat includes land areas where ground water, surface water and ice conditions and processes are the dominant influences on vegetation and soils. Wetland classes include bogs, fens, swamps, marshes and shallow water areas. Each of the five wetland classes may be sub-divided into forms and sub-forms based on factors such as surface shape, **soil stratigraphy**, **permafrost** and **hydrology**.

7.5.1.1 Shore Zone Wetlands

Wetland mapping was carried out along the shorelines within the study area. The total shoreline length mapped within the study area is approximately 206 km. Detailed mapping was completed for marshes and those portions of the shallow water wetlands with floating-leaved plants. **Emergent vegetation** was identified along nearly 41 km (20%) of the study area shoreline and floating-leaved along approximately 1% during 2006 and 2007.

The shoreline in the study area predominantly consists of clay and bedrock bank materials. Clay is the most abundant bank material in moderate water velocity areas

whereas bedrock is most abundant in areas of high water velocity. Organic banks occur frequently in sheltered areas. Most of the wetland vegetation (87%) in the study area is found along clay bank material, largely because of its overall abundance. Although bedrock comprises the second highest proportion of shoreline in the study area, only 1% of vegetated shoreline is found along bedrock bank. With regard to individual bank material types, wetland vegetation most commonly occurs along organic shoreline. Together, bedrock and human-made bank material types (e.g., sand beaches) have the lowest proportions of vegetated shorelines.

Detailed wetland mapping was completed along approximately 25.5 km (12%) of the study area shoreline segments with marsh and/or floating-leaved plants. Wetland vegetation was found to occur along 82% of these segments with the remaining 18% comprised of gaps between patches of vegetation along the mapped shore segments.

At particular marsh locations, the entire shore zone wetland mosaic is a sequence of vegetation bands starting from the uplands moving out perpendicular to the shoreline into progressively deeper water. Starting from the uplands, the sequence of shore zone bands are the inland area, upper beach, lower beach, shallow water (where is where most of the marsh occurs) and finally the deep water.

In the study area the inland vegetation group generally consists of one vegetation type dominated by horsetail. The upper beach has five vegetation types with wetland **graminoid** species and occasionally willow and forbs as typical indicator species. In the lower beach group, six vegetation types (predominantly indicated by sedges and grasses with wetland forbs characterizing some types) occur. The shallow water zone includes two vegetation types indicated by mostly emergent aquatic plants with a few floating-leaved plants. The deep water zone is comprised of eight vegetation types, many with only a single species of either floating-leaved or emergent aquatic plants.

The distribution of wetland vegetation also varies with water energy including flow intensity and wave action. Emergent and/or floating-leaved wetland vegetation is most frequently found in areas with low wave energy and/or low to moderate current.

Wetland vegetation was most commonly found growing on submerged clay substrate. The only substrate that did not support any vegetation along the mapped wetland was bedrock. Individually, the substrate that most commonly supported vegetation was the deep organic substrate.

Overall, 79 plant species were encountered during shore zone field studies. Widespread species were marsh reed grass (*Calamagrostis canadensis*), sedge spp., northern bugle-weed (*Lycopus uniflorus*) and tufted loosestrife (*Lysimachia thyrsiflora*). Sessile-fruited arrowhead and broad-fruited bur-reed had the widest distributions across water velocity and wave energy classifications, occurring in 54% and 50% of these sub-zones respectively. This was followed by sedges, various-leaved pondweed and cattails, which occurred in 42% of the sub-zones. Other species occurring on at least 25% of the sub-

zones included large yellow water-lily, narrow-leaved bur-reed, creeping spike-rush, aquatic grass species and meadow willow.

7.5.1.2 Upland Wetlands

The area immediately east of the existing spillway is comprised of exposed bedrock outcrops and low lying peat bogs. The scope of the Project includes three isolated ponds formed as run-off catchments in low-lying depressions, ponds #4, #5 and#6 as shown in Figure 7.20. Pond #4 is an isolated pond located approximately 50 m inland of the proposed spillway approach channel. It has an area of approx 1,100 m^2 and a maximum depth of 1.5 m. The shoreline is open and scattered with grassy vegetation and some treed areas. Substrate within the pond consists mainly of fine particles and organic material interspersed with a large quantity of woody debris. Pondweed is the dominant aquatic vegetation. Pond #5 is a relatively small isolated pond (approx 200 m^2) located on the southeast side of the existing spillway, approximately 50 m inland. The substrate is composed of **fines** and organic material with an abundance of woody debris. Pond #6 is the furthest pond from the existing spillway, located approximately 175 m inland to the east. This pond has a footprint area of approximately 600 m^2 and maximum depth of 3.0 m. Shoreline and substrate composition in pond #6 are similar to pond #5 and horsetails and pondweed dominate the aquatic vegetation.

7.5.2 Terrestrial Vegetation and Rare Plants

The physiography of the study area is controlled by Precambrian Shield bedrock, which forms undulating upland and lowland areas. **Igneous bedrock** outcrop is the dominant surface material while peat and **glacial till** occurs in the bedrock depressions. Because of widespread poor drainage, wet soils are common. **Peatland**s often occur in depressions and on the lower portion of slopes. Large fires are the dominant disturbance in uplands and forested peatlands in the study area. Fire has a major influence on vegetation and soil patterns.

7.5.2.1 Vegetation

Broad vegetation types were derived from attributes within the Forest Resource Inventories (FRI) database. Eighteen broad vegetation types and three other classes including water, human disturbance and small islands (<2 ha) occur within the study area (Figure 7.21).

Vegetation cover represents 70% of the overall study area, with jack pine forest and aspen forest being the most common (covering 21% and 20% of the study area, respectively). Other vegetation types with lower coverage include sparsely treed on dry sites (7%), aspen **mixedwood** forest (5%), sparsely treed on wet sites (5%), and low shrub, graminoid and/or emergent (4%).

The remaining vegetation types each cover a very small portion (<4%) of the study area. These include jack pine mixedwood forest, black spruce forest, ash forest, tall shrub,

balsam fir mixedwood forest, black spruce mixedwood forest, white spruce mixedwood forest, balsam poplar forest, balsam fir forest, tamarack forest, white birch mixedwood forest and white birch forest. Water covers approximately 28% of the study area.

Detailed ground sampling within the Project footprints produced the following vegetation types, which provide a finer classification than that of the broad vegetation types:

- Aspen Forest

  Areas dominated by the aspen forest vegetation type are located on upland sites with a rapid to moderately well drained substrate. Trees are dominantly trembling aspen, with American elm, balsam fir, black ash, bur oak, and white birch occurring in low abundance. The tall shrub layer generally has high cover with species such as beaked hazelnut, downy arrowwood, and red-osier dogwood. The **understory** layer of herbs and low shrubs is diverse, typically consisting of wild strawberry, Lindley's aster, bunchberry, two-leaved Solomon's-seal, and prickly rose.

- Aspen Mixedwood (Balsam Fir) Forest

  Mixedwood stands of trembling aspen and balsam fir are associated with well to moderately-well drained lacustrine and till deposits. The shrub and herb layers are generally poorly developed. Common understory species include beaked hazelnut, wild sarsaparilla, bluebead lily, and two-leaved Solomon's-seal.

- Balsam Fir Forest

  Balsam Fir is the dominant species observed in the canopy. Species infrequently observed include jack pine and trembling aspen. The understory is poorly developed and ground cover of the forest floor is mainly needle litter with areas of feathermoss and exposed mineral soil.

- Aspen Mixedwood (Jack Pine) Forest

  The aspen mixedwood (jack pine) vegetation type occurs on areas with steep slopes to level sites, with bedrock outcrops present. Jack pine and trembling aspen dominate the area however stand composition is variable. Other tree species include black spruce, balsam fir, white spruce, tamarack and white birch. Pockets of black spruce and tamarack are common on the wet sites. The understory is also variable in species composition.

- Jack Pine Forest

  Open-canopied jack pine forests on bedrock represent this vegetation type. The shrub and herb layer is typically poorly developed. Species common to these sites include blueberries, common bearberry and common juniper. The forest floor is usually characterized by abundant feathermoss and lichen cover.

- Balsam Fir-Jack Pine Forest

  The canopy of this vegetation type dominantly consists of balsam fir and jack pine with trembling aspen and white birch occurring sporadically. The herb and moss understory development is variable. Ground cover is poor in open areas but increases where tree cover is higher.

- Black Spruce Forest

  Black spruce forests occur in the lowlands, occasionally with the occurrence of jack pine in the canopy. The forest floor is typically covered by a continuous mat of peat mosses and feathermoss. Common blueberry and Labrador tea are low shrubs commonly observed. The herb layer is poor floristically and stemless ladyslipper orchids are infrequently observed in these areas.

- Tamarack Forest

  The tamarack forest type occurs on wet, poorly drained soils, with black spruce also commonly present in the canopy. Speckled alder and beaked hazelnut are dominant in the shrub layer. Other typical shrubs are Labrador tea, wild red raspberry and fly honeysuckle. The herb layer is generally sparse and the moss layer is characterized by peat mosses.

- Balsam Poplar Forest

  The tree layer for this community type consists of balsam poplar. The shrub layer consists of speckled alder, pussy willow and balsam poplar. In the herb layer, dewberry is most abundant and all other species have low cover.

- Tall Shrub (Alder-Willow)

  Characteristic species in the shrub layer of the tall shrub (alder-willow) vegetation type include speckled alder, pussy willow and black spruce. In the herb layer, marsh reed grass and small-fruited bulrush are the most abundant, with northern starflower, vine-leaved colt's-foot, and enchanter's-nightshade being less common.

- Graminoid Marsh

  The vegetation in this wetland type is characterized by emergent species of grasses, rushes and sedges. Common species include marsh reed grass, fowl manna grass, bottle sedge, wool-grass, common cattail and soft-stem bulrush. Pockets of shrubs dominated by Bebb's willow, swamp birch, and speckled alder also occur.

- Tall Shrub/Graminoid

  The tall shrub/graminoid type is found on well drained sites. Trees are absent within these areas, and common shrubs with low cover include Saskatoon, pussy

willow and beaked hazelnut. These dry sites are dominated with bush-honeysuckle, fowl bluegrass, eastern bracken fern, and bur oak as a low shrub.

- Graminoid

  Topographically, these areas are level with vegetation consisting of native grasses that occur in the form of manicured lawns.

- Sparse Shrub/Graminoid

  The terrain in the sparse shrub/graminoid areas is rigid and steeply sloped. Vegetation overall is sparse with species that occur being mainly trembling aspen with balsam poplar, jack pine, white spruce and prairie willow as tall shrubs. Other common species included timothy, Kentucky blue grass, red and alsike clover, and evening primrose.

- Sparse Forb/Graminoid

  Vegetation for the sparse forb / graminoid type is absent to sparse. Native and introduced species occur with smooth brome as a common grass species. The drier sites contain shrubs such as willows, balsam poplar, prickly rose and wild red raspberry. Marsh reed grass, common cattail, and wool-grass are common on the poorly drained sites.

Several non-native plants were observed in the study area during 2008 and 2009 field studies. Many of these plants are considered noxious due to their invasiveness and ability to spread easily and rapidly. These plants were mainly observed along roadways or in disturbed sites and included common milkweed, shepherd's purse, lamb's-quarters, Canada thistle, wild buckwheat, biennial campion, dandelion and quack grass.

7.5.2.2 Rare Plants

Eleven rare plant species (nine terrestrial and two aquatic or semi-aquatic) were observed during surveys conducted from 2006 to 2009 in the Project footprints. They included two tree species (black ash, hop-hornbeam); one tall shrub species (alternate-leaved dogwood); one **ericaceous** species (dwarf bilberry); five forb species (white wood aster, wild ginger, Hooker's orchid, sessile-fruited arrowhead, arrow-leaved tearthumb); and two species of sedges (Merritt Fernald's sedge, bladder sedge).

Rare plant species are ranked by the Manitoba Conservation Data Centre (MBCDC) as S1 (very rare), S2 (rare), S3 (uncommon) and S3/S4 (common to secure). Merritt Fernald's sedge and white wood aster are ranked S1 indicating they may be especially vulnerable to **extirpation**. Dwarf bilberry, Hooker's orchid, hop-hornbeam, and sessile-fruited arrowhead are ranked S2 and may be vulnerable to extirpation in some parts of their range. Species uncommon throughout their range or in the province (S3) include alternate-leaved dogwood, arrow-leaved tearthumb, black ash, bladder sedge, and wild ginger. The Manitoba *Endangered Species Act* (MESA) and the SARA do not list any of these species.

Fifteen other species of concern were observed during surveys in the study area but were not located within the Project footprints. Rattlesnake grass is ranked S1 while fragrant white water-lily, running pine and three-way sedge are ranked S2. Plants ranked S3 include arrow-leaved smartweed, bog goldenrod, leathery grape-fern, slender sedge, bladder sedge, swamp candle, water marigold, marsh St. John's-wort and clasping-leaved twisted-stalk. Teaberry and sensitive fern are ranked S3/S4 and generally are considered common to secure in the province. The MESA and the SARA do not list any of these species.

Plant species of conservation concern that are provincially ranked as very rare (S1) and rare (S2) and that have the potential for interaction with the Project are Merritt Fernald's sedge, white wood aster, dwarf bilberry, Hooker's orchid, hop-hornbeam and sessile-fruited arrowhead. Of these, Merritt Fernald's sedge and white wood aster, the two very rare (S1) species, have been identified as VECs.

Merritt Fernald's sedge was observed in areas consisting of open-canopied jack pine forests on rock outcrop. These areas were rapidly to well-drained and soils were extremely shallow. Associated vegetation included Saskatoon, low sweet blueberry, rusty woodsia and reindeer lichen. One location of Merritt Fernald's sedge was also observed in an existing rock quarry. All plants observed were located in proximity to potential borrow source areas for the Project (BR-2 and BR-3; Figure 7.22).

White wood aster was observed in the east side work area in an area of mixedwood trembling aspen with balsam fir, associated with well to moderately-well drained lacustrine and till deposits. Common understory species in the area include beaked hazelnut, wild sarsaparilla and two-leaved Solomon's-seal.

7.5.3 Invertebrates

The following description of the existing terrestrial invertebrate community is based on information available in the published literature. No project-specific field sampling was conducted.

Terrestrial invertebrate habitats within the study area are diverse and can be examined at the relatively homogenous broad landscape level (i.e., boreal zone) or the more heterogeneous site-specific level (e.g., one tree snag). In combination with deciduous trees, open area and edge communities act as shelter and refuge for diverse leaf miners such as Agromyzidae and Anthomyiidae (Diptera), gall makers such as Tenthredinidae (Hymenoptera), and other phytophages, as well as their predators and parasites. At the forest floor, dead wood and habitats under bark are colonized by many characteristic species, such as beetles (Coleoptera). Soil and leaf layers contain many species of mites and many species of Diptera larvae such as Tipulidae, Mycetophilidae, and Sciaridae. Wetlands and bogs provide some of the most diverse and productive areas in the Boreal Shield and the proximity of water bodies such as lakeshore margins, creeks, and beaver floods influences the quality of terrestrial invertebrate habitat types and the presence of

aquatic juvenile life stages that would subsequently occur as emergent terrestrial adults, such as caddisflies (Trichoptera), mayflies (Ephemeroptera), stoneflies (Plecoptera), and chironomids (Chironomidae).

The monarch butterfly is a terrestrial invertebrate species of conservation concern that has the potential for interaction with the Project–as such, this species has been selected as a VEC. The monarch butterfly has a very limited overwintering distribution restricted to the forests of Central Mexico and the coastal regions of California. The species is listed under SARA, Schedule 1–special concern, but is not listed pursuant to MESA and is not ranked by MBCDC. The monarch butterfly prefers habitat where milkweed and wildflowers such as goldenrod, asters and purple loosestrife exist. While milkweed and wildflowers can be found in the vicinity of Pointe du Bois, they are also widespread in adjacent areas throughout southern Manitoba.

7.5.4 Amphibians and Reptiles

Field investigations for amphibians and reptiles utilized a combination of three survey methods throughout 2007, 2008, and 2010 **anuran** (i.e., frog) call surveys, visual encounter surveys and incidental observations.

Two salamander (mudpuppy, blue-spotted salamander), eight frog (Eastern American toad, boreal chorus frog, gray treefrog, mink frog, northern leopard frog, spring peeper, wood frog, green frog), two turtle (western painted turtle, common snapping turtle), and two snake (red-sided garter snake, northern redbelly snake) species have known distributions within southeastern Manitoba and (with the exception of the northern redbelly snake) were detected in the study area. The northern redbelly snake is likely present in the area but is rarely seen because of its small size and dull colouration.

Amphibian and reptile species of conservation concern that are listed as at risk and that have the potential for interactions with the Project are the northern leopard frog and the common snapping turtle–both of these species have been selected as VECs. The green frog is at its north-western limit within the study area, and was possibly heard during call surveys in the vicinity of an existing borrow area along Highways 214 and 44. As the borrow areas along Highways 214 and 44 are existing borrow areas, no new construction will occur at these locations as a result of the Project.

The northern leopard frog has had a considerable historical contraction of range and loss of populations. Although it has shown some signs of recovery, this species is adversely affected by habitat conversion and habitat fragmentation, among other factors. As such, the northern leopard frog is listed under SARA, Schedule 1–special concern. It is not listed under MESA, and it is ranked G5, S4 by the MBCDC. In general, the northern leopard frog inhabits grasslands and wet woods (Preston 1982) as well as wetlands (i.e., marshes) and buffered shores of lakes and rivers. Northern leopard frogs are considered to be widespread over the southern two-thirds of Manitoba (Preston 1982) and were found to be common in the study area. A map illustrating the locations of northern

leopard frog breeding individuals, tadpoles, young-of-year, and summering adults within the study area is presented in Figure 7.23. Breeding frog call surveys identified this species as calling in several isolated bays north of the Pointe du Bois GS. Both young-of the-year and adults were found along shores of the Winnipeg River both upstream and downstream of the Pointe du Bois GS. Adults were also found incidentally within the Project footprint east of the Pointe du Bois GS and the Pointe du Bois townsite.

Overall, frog call surveys along the Winnipeg River revealed a higher frequency of calling in sheltered bays and inlets, where water was less subject to wind effects and vegetation was more abundant, compared to high velocity areas in the main flow of the Winnipeg River. The latter areas are often characterized by bedrock shorelines and steep embankments, and are therefore areas that generally provide poor frog breeding habitats. The relatively high density of some frog species throughout the study area is indicative of high quality frog habitats.

The characteristics of these habitats include the following:

- The presence of meadow marshes and shallow ponds further inland from the mainstem;
- Relatively intact riparian habitats on the mainstem shorelines, with gradual slopes and abundant vegetation; and
- The presence of bays and inlets off the mainstem that provide calm waters, protection from environmental conditions, and abundant vegetation.

The common snapping turtle is listed under SARA, Schedule 1–special concern, but is not listed under MESA. It is ranked as G5T5, S3 by the MBCDC. Although this species is widespread and still somewhat abundant, its late maturity, great longevity, low recruitment, and dependence on long warm summers for successful incubation make it unusually susceptible to anthropogenic threats. In general, this species inhabits slow-moving water with a soft mud bottom and dense aquatic vegetation, including ponds, sloughs, shallow bays, river edges and slow streams. Females generally nest on sand and gravel banks along waterways. Several observations of the common snapping turtle were made both upstream and downstream of the Pointe du Bois GS, during both visual encounter surveys and as incidental observations, including two potentially nesting individuals on the shore near Lamprey Rapids.

7.5.5 Birds

Field studies for birds in the study area were undertaken from 2007 to 2010.

Two hundred twenty-six bird species are known to occur within the study area based on published range maps (Godfrey 1966; Manitoba Avian Research Committee 2003) and occupy upland, riparian, semi-aquatic, and aquatic habitats associated with the Winnipeg River ecosystem. Functioning habitats in these areas provide the critical life

requisites for reproduction, foraging, security, and thermal regulation. Habitats providing for these life requisites vary among species or species groups, and the bird and mammal assemblages are generally dependent upon the spatial arrangement and area of the various habitat types found within the study area.

A review of the bird species listed as being of concern under SARA or MESA as well as the conservation status of species identified by MBCDC, and potentially found in the study area, are based on published range maps and distribution data, including migrants and/or breeding populations. Such bird species are described below and in Table 7.4.

7.5.5.1 Songbirds and Neotropical Migrants

Many species of neotropical migrants and passerines (i.e., warblers, sparrows, flycatchers, and many other songbird species) are found in the study area. During field studies, 58 species of songbirds (**passerines**) and neotropical migrants were observed and recorded. Of these, the most common species included white-throated sparrow, song sparrow, yellow warbler, chipping sparrow, and veery.

Fifteen observations of Canada warbler, listed under SARA, Schedule 1–threatened, were also made over the course of the field studies. As Canada warbler is a **threatened species** that will potentially have some interaction with the Project, it was selected as a VEC. This species is known to be common in southeastern Manitoba and uses primarily deciduous and mixedwood forest (Manitoba Avian Research Committee 2003). Within the study area, aspen forest, aspen mixedwood forest, balsam fir mixedwood forest, balsam poplar forest and jack mixedwood forest areas are potential Canada warbler habitat. A spatial analysis of these habitat types identified 3715 ha of potential Canada warbler habitat in the study area–of these, 60 ha are within the Project footprint and potential disturbance areas, representing less than 2% of total available Canada warbler habitat in the study area (Figure 7.24).

The olive-sided flycatcher, also listed under SARA, Schedule 1–threatened, was observed only twice during field surveys. This species prefers to reside high in trees with high dead branches or slender tops (commonly found in bogs, or along lakeshores with water-killed trees), recently disturbed areas (burned sites, logged areas, or other woodland openings) or on the top of flat buildings and fence posts.

7.5.5.2 Woodpeckers

Several woodpecker species were observed in the study area, including black-backed woodpecker, downy woodpecker, hairy woodpecker and pileated woodpecker. Pileated woodpecker, an uncommon permanent resident across southern and central Manitoba, is considered to be a "Criteria and Indicator" species in sustainable forest management (Tembec 2004).

7.5.5.3 Raptors

All vultures, eagles, hawks, osprey and falcons are protected under *The Wildlife Act* (Manitoba). The main hawk species observed in the area included the northern goshawk and red-tailed hawk. Two MBCDC-listed bird species of conservation concern were also observed: Cooper's hawk and barred owl, both potentially having nests in the study area.

Bald eagle and osprey were selected as VECs as they are protected species and have the potential for interaction with the Project. Bald eagles are common in Manitoba and usually nest in deciduous and mixedwood habitats adjacent to lake, stream and river shorelines, with major river systems being particularly common (Manitoba Avian Research Committee 2003). Ash, aspen, aspen mixedwood, balsam fir, balsam fir mixedwood, balsam poplar, black spruce mixedwood, white birch and white birch mixedwood forest areas within a couple hundred metres of water bodies are considered to be potential bald eagle habitat. Potential bald eagle habitat in the study area comprised almost 2200 ha–with less than 30 ha (or less than 1% of the study area habitat) contained within the Project footprint and potential disturbance areas.

Similar to bald eagles, ospreys utilize river and stream shoreline habitats, but are found to nest in a broader range of forest types, including deciduous, mixedwood and coniferous stands (Manitoba Avian Research Committee 2003). Broad vegetation types including ash, aspen, aspen mixedwood, balsam fir, balsam fir mixedwood, balsam poplar, black spruce, black spruce mixedwood, tamarack, white birch, white birch mixedwood and white spruce mixedwood forests within a couple hundred metres of shorelines are potential osprey habitat. Total osprey habitat availability within the study area included over 2200 ha. Thirty ha (or just over 1% of the total study area habitat) were within the Project footprint and potential disturbance areas.

Five bald eagle nests and one osprey nest were documented in the study area during all field seasons. During the course of the study, some nests became active or inactive and in some cases were blown down. One blown down bald eagle nesting tree immediately downstream of the existing Pointe du Bois GS spillway was re-colonized and was active as of April 15, 2010 (Figure 7.25).

Common owl species included the great horned owl, northern saw-whet owl, and northern hawk owl. Owl broadcast surveys were conducted in 2007 and 2008 for target species, barred owl and great gray owl. There were no responses from these species during nocturnal surveys. However, the results of the owl broadcast surveys conducted in 2007 as part of the environmental assessment for the Slave Falls Tramway Conversion Project indicated the presence of barred owls in the area south-east of the existing Pointe du Bois facilities (MMM Group Limited 2008).

7.5.5.4 Waterfowl

The majority of observations from migration bird surveys included diving waterfowl such as lesser scaup and redhead, as well as local nesting species such as common goldeneye. Concentrations of waterfowl were found to be low within the area surveyed. Other species observed included Canada goose, double-crested cormorant, common merganser, and red-necked grebe. There was one observation of a flock of eight Bonaparte's gull during the spring of 2008, immediately downstream from the Pointe du Bois GS. No major concentrations of birds were observed during the spring or fall migrations. The common loon is a regular resident of the area; however, no observations of loon broods were documented during any course of the study, with only adult birds observed.

Waterbird broadcast surveys targeted listed species of conservation concern (SARA, MESA, MBCDC), including the yellow rail, as well as other high-quality wetland indicator species such as the American bittern, pied-billed grebe and sora rail. There were no target species documented during waterbird broadcast surveys.

Aquatic and semi-aquatic habitats in the area support a wide variety of waterfowl species. Common birds associated with aquatic habitats in the area included common merganser, common goldeneye, double-crested cormorant, herring gull, and ring-billed gull. Nesting herring gulls were observed on rock reefs upstream and downstream of the dam site. The nesting site downstream was observed to have flooded during high water and was unsuccessful. Both common merganser and common goldeneye are known to occupy tree cavities for nesting, and many suitable nesting sites (e.g., abandoned woodpecker cavities) are available in adjacent mature forests. During spring and fall, small staging concentrations of lesser scaup and redhead are commonly seen. Other species of ducks observed included the mallard, blue-winged teal and the green-winged teal. The Canada goose is very common in the area and nests within the footprint of the existing hydroelectric and ancillary facilities. This adaptable bird can live and breed in many environments, including urban settings, such as the nearby town of Pointe du Bois.

There were few water and wading birds observed during field studies and no concentrations of nesting shorebirds, with only spotted sandpiper and killdeer observed to be using rock and cobble areas near the generating station. The most common species found in the study area was killdeer, which was generally associated with gravel parking lots and roadways. The spotted sandpiper also was found along rock and cobble shorelines and is known to breed in the area. A shorebird ally, American woodcock, was also found at low densities in the area, with one observation recorded during field studies. Field staff also observed what appeared to be a non-breeding piping plover, which is listed as an endangered species by MESA and SARA; however, there was no further confirmation of this bird occupying the area on a permanent basis.

Other breeding water and wading birds included the great blue heron, which is known to colonize in upland jack-pine forest. One great blue heron rookery was observed during the 2007 winter aerial survey, but was found to be abandoned during 2007 summer field surveys. A nesting colony of cliff swallows was observed on the existing powerhouse infrastructure.

7.5.5.5 Upland Game Birds

There are three species of grouse known to exist in the study area. The most common species is the ruffed grouse, often seen along trails and roads near aspen and mixedwood forest. The spruce grouse is found in denser conifer areas, and the sharp-tailed grouse is found in more open willow areas and fens and bogs throughout the study area.

7.5.5.6 Goatsuckers

Two species of **goatsuckers** are known to exist in the study area: whip-poor-will and common nighthawk, both listed under SARA, Schedule 1–threatened. There were no observations of whip-poor-will during any field studies conducted. The common nighthawk was documented three times. This species is known to roost on the ground or in trees in open areas such as logged or burnt forests and woodland openings, or on the top of flat buildings and fence posts.

7.5.6 Mammals

Mammals are an important component of functioning ecosystems within the study area and occupy the many diverse habitats associated with the Lake of the Woods Ecoregion. The Winnipeg River is the major natural feature within the study area that influences mammal distribution and habitat utilization. The many bays, natural inlets, and vast shoreline area provide an abundant supply of high quality riparian habitat in proximity to the adjacent upland habitats. In its current state, it is unlikely that the Winnipeg River isolates or fragments mammal populations, or limits range occupation across the existing landscape. Coniferous, deciduous, and mixed wood forests, interspersed with treed rock and bog areas, characterize the terrestrial habitats used by mammals occurring in the study area.

Mammal species and their habitats are typical of those found throughout the ecoregion. Common mammal species found in areas associated with aquatic riparian ecosystems include beaver, muskrat, river otter, and mink. Species associated with upland habitat include white-tailed deer, moose, gray wolf, coyote, red fox, black bear, marten, fisher, red fox, lynx, fisher and snowshoe hare.

There is limited historical data or specific information on mammal abundance, distribution, and diversity within the study area. Information on the abundance and diversity of small mammals (mice, voles, and shrews) is limited to historical research conducted in the late 1970s (Wrigley et al. 1979). Manitoba Conservation has conducted

periodic aerial surveys of ungulates in the region since the 1970s, with an emphasis on moose and caribou.

7.5.6.1 Ungulates

Trends in distribution and abundance of ungulate species in the region indicate that white-tailed deer are the predominant ungulate in the study area, with moose demonstrating decline and range recession northward from the Whiteshell region. Although boreal woodland caribou is known to have been present in the study area as recently as the mid 1950s, there are no indications of recent or current use of the area. The historical and continuing decline of boreal woodland caribou and current decline in moose in southeast Manitoba and the Whiteshell region is thought to be partially a consequence of the northward range extension of white-tailed deer and the pathogenic relationship of parasites and disease, as well as increased wolf predation. The current range of the Owl Lake boreal woodland caribou population is well defined and falls well north of the study area.

Observed mammals in upland terrestrial habitats were mainly white-tailed deer. There were no visual observations of moose or woodland caribou in the study area during all field investigations or surveys. As indicated, moose populations in the study area are very low, with only two tracks observed during all field studies.

7.5.6.2 Furbearers

Field observations indicated that furbearers were abundant in the area; species utilizing aquatic riparian habitats included beaver, mink and river otter, while observed upland terrestrial species were marten, coyote, red fox, fisher, lynx, and snowshoe hare. Wolverine sign was not observed in the study area during any field surveys conducted. Black bear sign was common throughout the area. A pack of 13 gray wolves was observed during the winter of 2007 in an area of high white-tailed deer concentration.

7.5.6.3 Small Mammals

Small mammal trapping in representative habitats indicated the presence of red-backed vole, meadow vole, deer mouse, water shrew and woodland jumping mouse.

7.5.6.4 Bats

The big brown bat and little brown bat are resident bats potentially occurring in the study area (National Audubon Society 1996). In addition, four species of migratory bat, including Keen's bat, hoary bat, red bat and silver haired bat potentially have nurseries in the study area. Of these, only the little brown bat is listed as a species of conservation concern in Manitoba, however this listing applies only to the Mid Boreal Lowland Ecoregion and not the Lake of the Woods Ecoregion.

7.6 Socio-Economic Environment

The socio-economic study areas include a regional area and a local area (Figure 7.26).

The regional study area captures potential regional effects of the Project, primarily related to transportation, beyond the local study area, and is essentially the same as the Project Preference Zone (PPZ) which has been established for determining eligibility for opportunities related to the Project. Further information about the PPZ is outlined in Section 8.7.1.

The regional socio-economic study area includes the following (Figure 7.27):

- The Rural Municipalities (RMs) of Alexander, Brokenhead and Lac du Bonnet;
- Parts of the RMs of St. Clements, Whitemouth, and Reynolds;
- The Towns of Lac du Bonnet, Powerview-Pine Falls, and Beausejour;
- The Local Government District (LGD) of Pinawa; and
- Sagkeeng First Nation and Brokenhead Ojibway Nation.

The local study area includes captures the potential local effects of the Project primarily related to construction, transportation, accommodation and services.

The local study area includes the Pointe du Bois townsite, the existing Pointe du Bois GS, cottages, and lodges and outfitters in the Pointe du Bois area. Lodges and outfitters in the local study area include Trail End Camp & Outfitters, Pine Island Lodge, Kendall Point Lodge, George Lake Outfitters, Eagle Nest Landing & Lodge, Bows, Bears & Bucks Outfitters, and Big Woods Wilderness Outfitters.

The local study area also includes the local communities of Pinawa and Lac du Bonnet, potential borrow sources for the Project at Seddons Corner, and roadways (PR 313, PR 520, and parts of PTH 11 and PTH 44).

The socio-economic information addressed the following topic areas:

- Population;
- Economy;
- Property ownership and land use;
- Infrastructure and services;
- Personal family and community life;
- Municipal & local government district controls;
- **Commercial resource use**;
- Recreational use and tourism; and
- Heritage resources.

7.6.1 Population

Table 7.5 provides 2006 Statistics Canada data on population for Unorganized Territory Division No. 1[2], the RMs, LGD, towns and First Nations in the study area. Refer to Figure 7.28 for census subdivisions.

The 2006 population in the Unorganized Territory Division No. 1 was 1,130 compared to a total population of 670 in 2001. The population experienced an approximately 40% increase in population. Pinawa and the Town of Lac du Bonnet, which are in the local study area, both experienced decreases in population between 2001 and 2006. Lac du Bonnet's population decreased by approximately 7.0%, while Pinawa's decreased by approximately 3.0%.

Pine Falls-Powerview, which is in the regional study area, also experienced a population decrease between 2001 and 2006. However, the remaining RMs and First Nation communities in the regional study area, with the exception of the RM of Whitemouth, all experienced population increases. The RM of Lac du Bonnet experienced almost a 17% increase in population between 2001 and 2006.

7.6.2 Economy

Table 7.6 presents 2006 data on the major industrial divisions in the regional study area. As indicated in Table 7.6, the predominant employment sectors are "other services". In the incorporated communities (includes the RMs, towns, and LGD), business services, agricultural and other resource based industries, health care and social services are other major employers. Construction industries are the second most ranked employment sector in Unorganized Territory Division No. 1.

Businesses in and around Pointe du Bois include a grocery-retail store, Trail End Camp and Outfitters (lodge), Eagle Nest Landing (lodge), George Lake Outfitters, Eight Foot Falls Campground and Sawmill Bay Campground. Recreation and tourism has been and continues to be a major part of the economy of the area.

Pinawa, which is in the local study area, was established by Atomic Energy of Canada Limited (AECL) in 1963 to house staff. Despite the announced closure of the facility and downsizing, AECL is still Pinawa's largest employer. Employees of the Tantalum Mining Corporation, Manitoba Hydro, North Eastman Health Authority and several other companies, which are based on the natural resource base, also live in Pinawa. The local economy in the Town of Lac du Bonnet, which is also in the local study area, is mainly based on agriculture including small grains and oil seeds. The community also

[2] Although the boundaries of Unorganized Territory Division No. 1 extend beyond the regional study area, there are few residents and the region mainly encompasses the Whiteshell Provincial Park. Hence, it is representative of Pointe du Bois that is located in the park. Data for Unorganized Territory Division No. 19 has not been included as only a small amount of land is with the socio-economic regional study area.

provides a number basic services including educational institutions, medical services, shopping and banking.

Powerview-Pine Falls, which is in the regional study area, has a mixed industrial base economy. Pine Falls was largely economically dependent on Tembec's Pine Falls operation, which has recently been closed. Pine Falls has a hospital, district offices of Manitoba Hydro and Manitoba Conservation, MTS and other small businesses. The Town of Beausejour, which is in the regional study area, has an economy which is largely based on agriculture, services and tourism.

Mining, forestry and tourism are major industries in the RM of Lac du Bonnet. Tourism is popular because of waterbodies which include the Winnipeg River, Lee River and Lac du Bonnet. The RM has a large agricultural area, which includes farming operations for small grains and oilseeds, principally west of the Winnipeg River. Development in rural areas along the major waterways has been increasing, and is resulting in an increased demand for residential development either for retirement or as a recreational property (Lac du Bonnet Planning District Development Plan, 2009).

There is a wide variety of industries in the RM of Alexander. Three of the six generating stations on the Winnipeg River are in the RM. Other dominant industries include agriculture and tourism. Agriculture is also important in the RM of Brokenhead. Production is diverse, ranging from cereals and forage to specialty crops; as well as livestock. The economy in the RM of Reynolds consists mainly of agriculture and natural resources. Peat moss, or sphagnum moss, is a naturally occurring mineral in the RM. As the RM is close to Whiteshell Provincial Park, tourism and recreational opportunities include camping, canoeing, fishing, cross-country skiing and snowmobiling. Agriculture is the most important economic activity in the RM of Whitemouth. Chicken, hog and dairy farming are predominant; however, producers are diversifying to include other activities such as sheep, beef and grain farming and bee apiaries. The Whitemouth River is utilized for fishing, kayaking, canoeing and tubing.

7.6.2.1 Labour Force Characteristics

The **labour force** is defined as the number of people in the potential labour force (i.e., persons 15 years and older excluding institutional residents) who were either employed, or unemployed and looking for work, in the week prior to Census Day (Statistics Canada 2001). Typically, individuals not considered part of the active labour force include full-time students, homemakers retired workers, seasonal workers in an "off-season" who are not for work and individuals with disabilities or illnesses that preclude them from being able to work.

Labour force characteristics of communities in the regional study area are shown in Table 7. 7. Based on the 2006 census, approximately 89% (1,005 people) were of working age within the Unorganized Territory Division No. 1, were of working age and hence made up the potential labour force in the region. The potential labour force constituted 67% (18,525 people) of the RM and LGD regional study area population and 63% (1,635

people) of the First Nations in the regional study area. These figures compare to a provincial average of 79% (Census of Canada 2006).

The **participation rate** of workers of labour force age was fairly comparable throughout the RMs and LGD in the regional study area and Unorganized Territory Division No. 1. The lowest participation rate was 37% in the incorporated towns in the study area to the highest rate of approximately 60% in Unorganized Territory Division No. 1. The average participation rate in the Province of Manitoba was 67%. Similarly, the **employment rate** ranged from approximately 35% in the incorporated towns in the study area to approximately 58% in the RMs and LGD in the regional study area. **Unemployment rate**s ranged from approximately 4% in the incorporated towns in the study area to approximately 19% in the First Nation communities.

Information on education levels in Unorganized Territory Division No. 1 and the regional study area communities in 2006 is shown in Table 7.8. Approximately 28% of the population aged 25 to 64 in Unorganized Territory Division No. 1 had a university certificate, diploma or degree. The RMs, LGD and incorporated towns in the regional study area had over 20% of the population with less than a high school graduation certificate, the highest percentage for both in terms of education level. Those with an apprenticeship or trades certificate or diploma ranged from 12% in Unorganized Territory Division No. 1 to approximately 20% in the incorporated towns.

7.6.3 Property Ownership and Land Use

Land use and property ownership is based on land parcels surveyed under the section-township-range system. Land ownership and tenure within the regional study area is a mixture of provincially-owned lands (i.e., Provincial Parks), Federal lands (i.e., First Nation Reserves) and private land.

The majority of the land within the study area is Crown-owned, although there are a few parcels of private land near the townsite of Pointe du Bois and Eight Foot Falls. Other private lands occur at George Lake east of the Winnipeg River. Manitoba Hydro has a long-term lease with Manitoba for the area encompassing the townsite of Pointe du Bois and the Pointe du Bois GS, extending to the Slave Falls GS. Other leased land in the Pointe du Bois area includes that used for cottages and commercial operations.

7.6.3.1 Provincial Parks

Manitoba's provincial parks are governed by *The Provincial Parks Act*. Provincial parks fall into four main categories: heritage parks, natural parks, recreational parks, and wilderness parks. Heritage parks preserve areas of land which contain a resource(s) of cultural and/or human heritage value. Natural parks serve to protect landscapes, and to provide recreational and resource use opportunities. Recreation parks specialize in providing outdoor recreational opportunities. Wilderness parks serve to preserve natural landscapes. Each provincial park is also further described by the use of one or more land use categories (i.e., activities or land uses occurring within each), including:

wilderness, backcountry, resource management, recreational development, heritage and access.

As illustrated in Figure 7.29 the regional study area includes portions of six provincial parks – Whiteshell Provincial Park, Pinawa Dam Provincial Park, Pinawa Provincial Park, Grand Beach Provincial Park, and Whitemouth Falls Provincial Park**.**

Whiteshell Provincial Park encompasses 2,721 km^2 and is designated a natural park under the *Provincial Parks Designation Regulation*. The majority of the park is classified under the resource management land use category, which generally permits commercial resource use and extraction.

Nopiming Provincial Park encompasses 1,429 km^2 and is designated a natural park. The majority of the park within the regional study area is classified as resource management. The remaining sections of the park are classified as recreational ddevelopment around Bird Lake and backcountry around Bird River.

- Pinawa Dam Provincial Park covers less than 1 km^2 and is designated as a heritage park. The park stands to conserve the heritage of a hydroelectric dam that operated from 1906–1951 on the Winnipeg River.
- Pinawa Provincial Park also covers less than 1 km^2 and is designated a recreation park. It is located south of PR 211 at Seven Sisters Falls.
- Grand Beach Provincial Park covers an area of approximately 24.9 km^2 and is classified as a natural park. The majority of the park is classified as backcountry under land use categories, which serves to protect ancient beach ridges and provides the opportunity for nature-oriented activities. The remainder of the park is classified as recreational Development.
- Whitemouth Falls Provincial Park encompasses 4.8 km^2 is designated as a recreation park. The park permits mixed uses (recreational development, backcountry, and access) with nearly 74 percent of the land area designated backcountry. The park was recently expanded to more than 200 percent its former size and provides habitat protection for the Great Gray Owl, the official bird of Manitoba.

The local study area around Pointe du Bois is located within Whiteshell Provincial Park. The communities of Lac du Bonnet and Pinawa are not located within any provincial parks although a portion of PR 313 provides access to Pointe du Bois and crosses through Whiteshell Provincial Park.

7.6.3.2 Wildlife Management Areas

Wildlife Management Areas (WMAs) are Crown land set aside by the Manitoba Government for the protection of habitat and management, conservation and enhancement of wildlife. WMAs play an important role in the conservation of biodiversity, but are not reserves or sanctuaries. Hunting and trapping are generally

permitted in WMAs, but may be prohibited or restricted in some areas. The use of vehicles, off-road vehicles, watercraft, powerboats, or airboats also may be restricted in some areas.

As illustrated in Figure 7.29, there are five WMAs in the regional study area as follows:

- The Lee River WMA is located east of Lac du Bonnet off PR 520. The WMA is located on a slightly rolling upland landscape with bogs and bedrock outcrops.
- The Thalberg Bush WMA is located 5 km east of Thalberg. This WMA is a primarily forested area surrounded by agricultural lands.
- Mars Hill WMA is located 8 km east of Libau on PR 317. Gravel pits continue to be mined in the end-moraine ridge composed of sand and gravel.
- Catfish Creek WMA is located north east of Grand Beach, adjacent to Mars Hill WMA. This area attracts one of the highest concentrations of neo-tropical bird migrants in North America (Manitoba Conservation 2008).
- Whitemouth Bog WMA is located east of PR 408 and consists of peat covered lowlands of fens and bogs, as well as the remnants of beaches and sand bars that were once the ancient shorelines of glacial Lake Agassiz.

While WMAs are designed to protect management and habitat of all species, emphasis is placed on regionally important species. Lee River, Thalberg Bush and Catfish Creek WMAs all protect the breeding ground and migration corridor of northern forest owls including the great gray, northern saw-whet and boreal owls. The Mars Hill WMA protects an important wintering area for deer, moose and black bears. Whitemouth Bog provides habitat for a variety of plants and animals including several rare and uncommon plant species.

There are no WMAs in the local study area. The closest is the Lee River WMA to the south and north of PR 313 and west of PR 520.

7.6.3.3 Provincial Forests

Provincial forests are located on Crown lands that are managed by the Province of Manitoba. Harvesting of trees is only allowed through a license or permit. Some forests contain Ecological Reserves or Wildlife Management Areas. Other land uses and activities in provincial forest include hunting, berry picking, and recreations trails.

The regional study area includes all or parts of four provincial forests – Whiteshell, Agassiz, Belair and Brightstone Sand Hills as illustrated in Figure 7.29.

- The Whiteshell Provincial Forest was established in 1931. The 3,422 km^2 forest encompasses Whiteshell Provincial Park and areas to the west of the park.
- The Agassiz Provincial Forest was established in 1954 and encompasses an area of 795 km^2 central to the project study area. Included in the forest is the Lewis Bog Ecological Reserve. Peat moss extraction occurs within the forest.

- The Belair Provincial Forest was also established in 1954. This forest is part of the Manitoba Model Forest, which is included in the national Model Forest Network. Currently sand and gravel extraction occurs within the park. The park also serves as a refuge for game birds.
- The Brightstone Sand Hill Provincial Forest was established in 1984 and is located north of the Agassiz Provincial Forest. Gravel extraction is permitted within the forest.

There are no provincial forests in the local study area.

7.6.3.4 Protected Areas Initiative

Manitoba Conservation initiated the Protected Areas Initiative in 1990 with the goal of creating a network of protected areas to preserve the diverse landscape of Manitoba. Protected areas are portions of Crown land that have been set-aside, which may include ecological reserves, provincial forests, provincial parks and wildlife management areas. Figure 7.29 illustrates the location of Protected Areas and Designated Lands in the regional study area.

Areas of Special Interest (ASI) are an important component of the Protected Areas Initiative. ASIs are "candidate sites" which have been chosen for having high potential to efficiently protect groupings of Enduring Features and associated natural, cultural and heritage values identified through the Protected Areas process. ASIs form the starting point for protection discussions for the Enduring Features included within them. Existing commitments and future plans of communities or industry often lead to modification or relocation of areas.

There are 21 ASIs in the regional socio-economic study area: Stead, Catfish Creek Addition, Springer Lake (although currently an ASI it is a proposed ecological reserve), Jackfish Lake, Fort Alexander, Milner Ridge East, Seddons Corner, Milner Ridge West, Miner Ridge North, Whiteshell BC, AECL, AECL Addition, Lac du Bonnet, Lee River Addition South, Lee River Addition North, Great Falls, Brightstone South, Brightstone, Brightstone East, Brightstone Northwest, Anson Lake and Whitemouth Bog (Manitoba Conservation 2011).

There are no Protected Areas or Areas of Special Interest in the vicinity of the local study area around Pointe du Bois although one (Lee River Addition North) occurs to the north of PR 313and one (Lee River Addition South) occurs to the south of PR 313 and west of PR 520. However, they are both removed from the primary roadways (PR 313 and PR 520) in the local study area.

7.6.3.5 Ecological Reserves

Ecological reserves are areas of Crown land set-aside for their unique ecological features and are protected under *The Ecological Reserves Act*. Areas that contain rare or sensitive habitats can be set-aside as ecological reserves with greater restrictions on uses and activities so that the natural region features for which they are set aside endure for

future generations. Since 1987, all ecological reserves, ecologically significant areas and other natural and cultural heritage sites have been brought under the umbrella of the provincial government's Special Places Strategy and Protected Areas Initiative.

There are four ecological reserves in the regional study area: Brokenhead Wetland, Brokenhead River, Whitemouth Bog and Libau Bog(Figure 7.29).

- The Brokenhead Wetland Ecological Reserve, also known as the Gull Lake Wetland, was established in June 2005. It is located along PTH 59, northeast of Brokenhead Ojibway Nation. The wetland is a calcareous fen which is a wetland type considered rare in North America. It contains 23 species of provincially rare and uncommon plants.
- The Brokenhead River Ecological Reserve was established in 1978 and is located to the north of PR 435, east of PTH 12. The reserve protects first growth hardwood forests including oak, elm, ash and spruce.
- The Whitemouth Bog Ecological Reserve was established in 2009. It is located to the east of the Whiteshell Provincial Forest, to the south of PR 307. The reserve protects a tract of rich peatland bog in southeastern Manitoba. The reserve also includes calcareous fens, one of the rarest wetland types in North America, as well as numerous occurrences of rare and uncommon plants, including orchids and lady's-slippers. The habitat also supports many small mammals, owls, and yellow rail – a bird listed as a Species of Special Concern under the *Species at Risk Act*. The provincially and nationally threatened least bittern is also found here.
- The Libau Bog Ecological Reserve was established in 1989 and is located within the Mars Hill WMA. The reserve was established to protect the black spruce/tamarack bogs, floating sedge bogs and orchids in the area.
- There are no ecological reserves in the local study area.

7.6.4 Infrastructure and Services

Infrastructure includes Provincial Trunk Highways (PTHs) Provincial Road (PRs), railways, airports, **transmission line**s, and utilities and services. Each is discussed in detail below.

7.6.4.1 Major Roadways

In the regional study area, there are several major PTHs and PRs as follows (Figure 7.30):

- PTH 44 originates at the junction of PTH 9 in Lockport, which is outside of the regional study area and terminates at the Trans-Canada Highway at West Hawk Lake in the Whiteshell Provincial Park which is also outside of the regional study area. PTH 44 crosses through the southern part of the regional study area in the vicinity of the Town of Beausejour and Seddons Corner. A small portion of PTH 44 to the south of Seddons Corner is in the local study area.

- PTH 12 is a north-south, two-lane highway originating at the United States border, which is outside of the regional study area and terminates at PTH 59 near Grand Beach which is inside the regional study area. It crosses through the western portion of the regional study area north of Beausejour.
- PTH 11 is a north-south highway originating at the Trans-Canada Highway to the south of the regional study area and terminates at PTH 59 near Victoria Beach which is inside the regional study area. This two-lane highway travels through Lac du Bonnet, Pine Falls and Sagkeeng First Nation. PTH 11 allows access to the LGD of Pinawa via PR 211 and to Pointe du Bois via PR 313. A portion of PTH 11 is in the local study area.
- PR 313 is the only highway access to Pointe du Bois. PR 313 originates at Lac du Bonnet and terminates at Pointe du Bois, and is located in the local study area.
- PR 520 provides access to Pinawa from PR 313. Access to Pinawa can also be obtained from PR 211 via PTH 11. PR 520 is in the local study area.
- There are a number of other PRs in the regional study area — these include PR 315 which runs from PR 313 to Nopiming Provincial Park which is outside of the study area and PR 433 which also runs from PR 313 to cottages outside of the study area. In addition, PR 307 runs from PTH 11 easterly through the southern part of the Whiteshell Provincial Park.

Manitoba Hydro has recently developed the Slave Falls access road that connects Pointe du Bois to the Slave Falls Generating Station. This road is owned by Manitoba Hydro and is a private road. Other secondary access roads at Pointe du Bois connect to cottage and camping areas, and are part of the local study area.

7.6.4.2 Railways

The Canadian National (CN) Railway and Canadian Pacific Railway (CPR) both have rail lines that cross through the regional study area (Figure 7.30). A subdivision line stems off the CPR main line linking Beausejour to Molson, both of which are in the regional study area.

The Pine Falls subdivision is approximately a 108 km short-line rail owned by Central Manitoba Railway (CEMR). The rail line was purchased by CEMR from CN in 1999. The line originates in Winnipeg, intersecting the communities of East Selkirk, Libau and the Brokenhead Ojibway Nation, and terminates in Pine Falls, which is in the regional study area.

There are no active railways within the local study area.

7.6.4.3 Airports

There are two airports and/or aerodromes in the regional study area (Figure 7.30). The Bird River Aerodrome has one turf and gravel runway and is not maintained in the winter. Adjacent to the airport is a water aerodrome for seaplane landings at the mouth

of Bird River on Lac du Bonnet. The Silver Falls Aerodrome at Silver Falls on the Winnipeg River has one land-based runway as well as a facility for seaplanes.

Aside from these facilities, there is a hand-gliding site located just west of the community of Stead east of PTH 59.

An abandoned aerodrome is located near Beausejour and was used by flying clubs in the regional study area, but was not registered with any aviation organization.

There is one airport in the local study area which is the Lac du Bonnet Regional Airport. The airport has six private hangars and one asphalt runway, and is maintained year-round by the Lac du Bonnet Airport Authority. Located adjacent to the Winnipeg River, the airport also has a water aerodrome with facilities to accommodate seaplanes.

7.6.4.4 Transmission Lines and Stations

There are several existing transmission and sub-transmission lines in the local and regional study area Figure 7.30). There are also numerous distribution lines which provide power to cottages, residences and businesses in the regional study area. The major transmission lines and sub-transmission line are as follows:

- Two 115 kV transmission lines (PC3 & PC4) connect Parkdale Station, which is outside of the study area to the Pine Falls Generating Station.
- Two 115 kV lines (GS21 & GS22) connect the Great Falls Generating Station to the Selkirk Generating Station, which is outside of the study area.
- Two 115 kV transmission lines (SG12-1 and SG12-2) connect the Beausejour East Station and Lac du Bonnet Station and Seven Sisters Generating Station.
- Two 115 kV transmission lines (SR3 & SG12-1) connect the Lac du Bonnet Station to the Great Falls Generating Station. The Great Falls Generating Station is connected to the Pine Falls Generating Station via two 115 kV lines (GP1 & PR2).
- Two 115 kV transmission lines (SG12-2 and SR3) connect Lac du Bonnet Station to the Seven Sisters Generating Station.
- Four 63.5 kV sub transmission lines (LP1, P2, P3 & P4) link Winnipeg, which is outside of the study area, to the Pointe du Bois Generating Station. A portion of these lines are in the regional study area, as well as the local study area around Pointe du Bois.
- A 66 kV line links the Pointe du Bois Generating Station to stations at Bernic Lake and Bird Lake, to the north of Pointe du Bois. Parts of these lines are also in the local study area around Pointe du Bois.
- A 138 kV transmission line (R1) links Slave Falls Generating Station to Pointe du Bois Generating Station. This line is in the local study area as is the **switching station** located in the Pointe du Bois townsite.

7.6.4.5 Utilities and Services

Utilities and services available in communities and First Nations in the regional study area are shown in Table 7.9. The communities and First Nations include Pine Falls/Powerview, Beausejour, Sagkeeng First Nation and Brokenhead Ojibway Nation. Lac du Bonnet, Pinawa and Pointe du Bois, which are part of the local study, are also included in the table.

All communities have municipal water and sewage systems. Most use the Winnipeg River as their major water source, but Beausejour and the Brokenhead Ojibway Nation have access to potable groundwater as a main water source. All have electricity, telephone and internet service. There are fire departments in all communities and First Nations and RCMP detachments in all except for Pointe du Bois. There is also a post office in every community. There are hospitals in Pine Falls-Powerview, Pinawa and Beausejour.

7.6.5 Personal, Family and Community Life

7.6.5.1 Culture, Way of Life and Community Cohesion

The community population at Pointe du Bois expanded with the generating station, beginning with its construction in 1909. Before there was a road connection to the generating station site, many of those who worked at the generating station were required to live in the community, which included staff housing and a volunteer fire department. The community once had a medical clinic, an employee-owned store, a church, a school, a skating rink, a curling rink and a community hall. At that time, the Pointe du Bois townsite was a viable community located amidst a bustling recreation industry, mainly fishing lodges and camps. Some existing houses in Pointe du Bois date back to 1923. The school, which was closed over 20 years ago, is now the community recreation centre and houses Manitoba Hydro offices and the post office. The private operator of the store leases the facility from Manitoba Hydro.

Many cottagers are long-time residents and some are descendents of people who were involved in the construction at the Pointe du Bois Generating Station and/or worked for Winnipeg Hydro. An important cultural value which seems to be held by current cottagers in the vicinity of Pointe du Bois is the sense of connection to the area. While a comparatively small number of cottagers use their properties as their primary residence, results from a cottagers survey indicate that a small majority spend at least a short period of time each season at their cottage. However, only a small minority spend more than half of the winter season at the cottage, with most use occurring during the summer months. A majority of cottagers indicated that the scenery surrounding the cottage, the presence of wilderness and wildlife and its use for recreational activities and for peace and quiet were extremely important.

Ways of life in the regional and local study areas vary. There are likely few, if any, local Pointe du Bois area residents that continue to subsist entirely on the resource economy,

although those that still do would have a strong connection to the land. The most common activities identified from the cottagers included: fishing, walking or hiking, swimming, gathering such as berry-picking, wildlife watching, birding or nature photography.

7.6.5.2 Community Organization

The Whiteshell Cottagers Association Incorporated is a volunteer non-profit organization which promotes the best interests of cottagers who lease or own land in Whiteshell Provincial Park. The Pointe du Bois Cottagers Association represents the interests of local cottagers in the Pointe du Bois area. Besides the cottagers associations, there is little in the way of community organization in the Pointe du Bois area. Not much of the original community of Pointe du Bois remains, other than the local store, post office, recreation centre and some occupied housing. The adjacent community is largely comprised of cottagers.

A greater degree of community organization is present in the study area beyond Pointe du Bois. This includes the LGD of Pinawa and Town of Lac du Bonnet which are also in the local study area. Incorporated towns both in the local and regional study areas have elected mayors and councils. Local and regional study area RMs and LGD have elected reeves or mayors, in the case of the LGD, and council. First Nations in the regional study area elect a Chief and Council. Elected officials in the incorporated towns, RMs, LGD and First Nation communities are responsible for community decision making.

7.6.5.3 Community Interest Zones

A Community Interest Zone (CIZ) is a temporary area of protection afforded to lands adjacent to First Nation communities with acknowledged treaty land entitlement claims. The intent is to protect these areas from development while a First Nation is involved in the site selection or acquisition process. A CIZ includes the area within 30 km of the exterior boundaries of the reserve, where its main administrative office is located. Brokenhead Ojibway Nation has a CIZ around its reserve lands in the regional study area. There are no CIZs in the local study area.

7.6.6 Municipal and Local Government District Controls

Land use planning responsibilities, with a few exceptions, are under the jurisdiction of the individual municipalities. In some circumstances, certain areas of responsibility may also be subject to regional authorities such as planning districts. The following are the planning districts and their members in the regional and local study areas:

- The RM of Alexander is part of the Winnipeg River Planning District which includes the Town of Powerview-Pine Falls.
- The RM of Lac du Bonnet and the Town of Lac du Bonnet are part of the Lac du Bonnet Planning District.

- The RM of Brokenhead and the Town of Beausejour are part of the Brokenhead River Planning District.
- The RMs of Whitemouth and Reynolds are part of the Whitemouth River Planning District.
- The RM of St. Clements is also part of the Selkirk & District Planning Area (which also includes the RMs of St. Andrews, West and East St. Paul which are outside of the regional study area).

The LGD of Pinawa is not part of a planning district.

Municipal jurisdictions in the regional and local study areas have a variety of **development controls** in place, as follows:

- The RM of Alexander has an existing development plan which applies to all lands within the municipal boundary (Winnipeg River Planning District Development Plan). The existing Development Plan, By-law No. 14-90 is under review. Land use regulation is provided within the Rural Municipality of Alexander Zoning By-law No. 08/98. The Town (formerly Village) of Powerview-Pine Falls is subject to its own Zoning By-law (No. 250/00) that regulates land use. Powerview and Pine Falls amalgamated in May 2005 at which time Pine Falls fell under the purview of Powerview's zoning by-law.
- The RM of Lac du Bonnet recently approved (2008) a municipal development plan (Lac du Bonnet Planning District Development Plan, By-law No. 98-09). Land use regulation is subject to the RM of Lac du Bonnet Zoning By-law No. 19-03. The Town of Lac du Bonnet has a separate Zoning By-law (No. 53/06) that regulates land use within the town boundaries.
- The LGD of Pinawa is subject to LGD of Pinawa Development Plan (By-law No. 637-02) and an associated Zoning By-law No. 658-04 governing land use regulation.
- The RMs of Whitemouth and Reynolds have an existing development plan (Whitemouth River Planning District Development Plan [By-law No. 1/96]) as well as municipal zoning by-laws to regulate land use. Currently, these municipalities are in the process of replacing the district development plan under By-law No. 27/10. The RM of Whitemouth is subject to Zoning By-law No. 372/03 while the RM of Reynolds has Zoning By-law No. 11/03.
- The RM of Brokenhead is subject to the Brokenhead River Planning District Development Plan (By-law No. 21) and associated Zoning By-law No. 1688 that regulates land use. Currently, the RM is in the process of replacing its development plan under By-law No. 138-09 and is currently under review by the Minister of Local Government.

- The RM of St. Clements is a member of the Selkirk & District Planning Area. The Selkirk & District Planning Area Development Plan has been adopted (By-law No. 122). Currently, the Planning District is in the process of replacing its development plan under By-law No. 190/08. The RM of St. Clements also has its own Zoning By-law (No. 5/2002) governing land use regulation within the municipality.

As noted above, Pointe du Bois is located in the Whiteshell Provincial Park. Under the master plan for the park, the area is zoned recreational development, which allows for economic development related to tourism and recreation (Department of Natural Resources. 1983. Whiteshell Provincial Natural Park Master Plan. Parks Branch. Winnipeg).

7.6.7 Commercial Resource Use

Commercial resource use in the study area includes forestry, trapping, lodges and outfitters, bait fishing, wild rice harvesting, and aggregate and mineral deposits.

7.6.7.1 Forestry

The regional study area encompasses portions of Forest Management License (FML) No. 1 and portions of Forest Management Units (FMUs) 01, 20, 23 and all of FMU 30 (Whiteshell Provincial Forest). In terms of timber harvesting, some small domestic utilization is occurring (Swanson *pers. comm.* 2011). In addition, the provincial government announced that no logging will be allowed in provincial parks, including Whiteshell Provincial Park. This necessitated changes being made to forest management unit boundaries. As such, Manitoba Conservation is in the process of recalculating the wood supply available for the Pineland Forest Section (FMUs 20 and 23) and Forest Management Licence Area No. 1 (Swanson *pers. comm.* 2011). There are no known commercial forestry activities in the local and regional study areas.

7.6.7.2 Trapping

The study area falls within the Eastern Registered Trap Line (RTL) district. Portions of two registered trapline (RTL) sections fall within the regional study area. They are the Whiteshell and Lac du Bonnet RTL sections. Within these RTL sections, there are a number of individual RTLs that are either located entirely or partially within the regional study area (Figure 7.31).

A portion of the Whiteshell RTL section also falls within the local study area around Pointe du Bois. Within this RTL section, parts of three RTLs (#22, #24 and #25) are located within the local study area around Pointe du Bois. One trapper's cabin is located within RTL #24. There are no RTLs in the local study area around Pinawa and Lac du Bonnet which are part of Open Trapping Area Zone 4. The remainder of the regional study area south of PTH 11 and west of the Winnipeg River encompasses parts of Open Trapping Area Zone 3 and Zone 4.

The approximate value of trapping from 1996–2009 within the study area RTLs was approximately $170,000. Common fur bearing animals trapped within the area include beaver, marten, muskrat, otter, fisher and fox. The most recent 2008–2009 season saw a reduction in overall fur production within the local study area. Discussion with a representative from the Wildlife and Ecosystem Protection Branch suggested that a late winter season may have contributed to low production numbers (Berezanski *pers. comm.* 2011).

7.6.7.3 Bait Fishing

Commercial bait blocks exist in the vicinity of Pointe du Bois on the Winnipeg River. The Pointe du Bois commercial bait block (176) encompasses an area that includes the generating station site (and the local study area), as well as a stretch of the Winnipeg River down to Dorothy Lake. This includes other smaller bodies of water in Whiteshell Provincial Park, and which extends into the portion of the RM of Alexander south of PR 313 west of the provincial park. The Pointe du Bois commercial bait block (176) consists of one allocation for bait fish harvesting and one allocation for leech harvesting (Scaife *pers. comm.* 2011).

7.6.7.4 Wild Rice Harvesting

Wild rice lakes are identified according to the section-township-range system and licenses are issued for development, production or block harvesting. Two development licenses exist in the regional study area (i.e., initial licenses issued to test for development), one associated with the Winnipeg River system (i.e., smaller tributaries or lakes back of the river) and on Osis Lake in Nopiming Provincial Park. Several lakes were identified as having production licenses within the regional study area (i.e., for producing areas), including: Barske, Booster, Lac du Bois (and part of Rice Creek), Strandberg and Waddell lakes. Other locations in the regional study area include unnamed bays on the Winnipeg River and on Lac du Bonnet and several unnamed lakes in Nopiming Provincial Park. One block license was issued in the regional study area (i.e., issued to First Nation community areas) that encompasses unnamed lakes over a large area within Nopiming Provincial Park and to the west and south to the Lac du Bonnet/Lee River and Pinawa areas. There are no known wild rice development or production licenses in the local study area at Pointe du Bois in the Whiteshell (Delong *pers. comm.* 2010).

7.6.7.5 Aggregate and Mineral Deposits

Aggregate and mineral deposits are scattered throughout the regional and local study areas. In the central and northwestern portions of the regional study area, sand and gravel resources in the RMs of Lac du Bonnet, Alexander and a portion of St. Clements are found in glaciofluvial and glaciolacustrine deposits. Most of the glaciofluvial deposits have been mined, some extensively. Most pits are used intermittently, but there are large-scale permanent gravel operations. Beach ridge deposits are the most important source of sand and gravel in the RM of Lac du Bonnet. Most of these deposits

have small intermittent pits and some have been extensively mined. The Milner Ridge area is one of the major suppliers of aggregate in the area, including the RM of Whitemouth.

In the south central part of the regional study area encompassing the RM of Whitemouth, surficial deposits consist primarily of bogs, clays and till plains. Sand and gravel resources occur within beach, littoral and glaciofluvial deposits. Regionally significant sources of sand and gravel are two glaciofluvial deposits east and north of the community of Whitemouth. Other potential aggregate resources include low quality beach ridges and littoral deposits. A limited regional demand is supplied necessitating the RM to obtain sand and gravel from Crown leases outside the municipality (Young 1985).

In the southwestern part of the regional study area within the RM of Brokenhead, surficial deposits are primarily clays and calcareous tills with secondary glaciofluvial, and littoral sand and gravel deposits. Sufficient reserves of medium and high quality sand and gravel are present, including near-surface silica rich sand outcrops that occur along the western portion of the RM from Beausejour to Mars Hill. Near surface bedrock in the Tyndall area is also identified as an alternative source of sand and gravel (Young 1982).

In the local study area, pockets of sand and gravel deposits have been identified in the Whiteshell Provincial Park, including sources of rock and clay. This includes potential sources of granular materials for construction of the Project (Figure 3.15). The Project material source areas for rock and clay are located to the east of the Winnipeg River, to the west along PR 313, and adjacent to the Slave Falls Road at Moose Creek (Figure 3.15). In addition, there are existing aggregate quarries in the local study area at Seddons Corner and Milner Ridge (Figure 3.16).

7.6.7.6 Mineral Interests

No mining claims or leases are registered between the local study area at Pointe du Bois, south along the Winnipeg River shoreline to Slave Falls. There are approximately 140 mining claims registered in the regional study area. Claims are particularly prevalent around Bird River north of Lac du Bonnet and the Whiteshell Provincial Park. Two mineral leases are held in the regional study area, one in Boggy Creek north of the community of Pinawa and the other surrounding Bernic Lake between Whiteshell and Nopiming Provincial Parks (www.gov.mb.ca/stem/mrd/geo/gis/minesmaps.html).

Mustang Minerals Corporation holds the most mineral claims in the regional study area. The company has conducted a pre-feasibility scoping study for the Maskwa Open Pit Nickel Project, which is located off PR 313 in the Bird River/Bernic Lake area in the regional study area. The second largest claim holder in the regional study area is Gossan Resources Ltd.

There are two companies with leases for mining metallic minerals in the local and regional study areas – Atomic Energy of Canada Ltd. (AECL) and Tantalum Mining Corporation of Canada Ltd. (www.gov.mb.ca/stem/mrd/geo/gis/minesmaps.html). AECL holds a surface lease and an underground lease, located in the regional study area in the Lac du Bonnet granite batholith near Pinawa, which expire in 2011 and 2014 respectively. The leases enabled AECL to construct an underground research laboratory to conduct research regarding options for spent nuclear fuel waste. There are plans to decommission the laboratory. Tantalum Mining Corporation of Canada Ltd. holds three leases for the purposes of operating the Tanco Mine on the north shore of Bernic Lake in the regional study area. Tantalum Mining Corporation is the only company actively extracting minerals (tantalum, spodumene, and pollucite).

There are several areas for industrial mineral extraction within the regional study area (www.gov.mb.ca/stem/mrd/geo/gis/minesmaps.html), and one in the local study area, as follows:

- Quarry extraction in the Milner Ridge to Seddons Corner area north of PTH 44 in the RM of Lac du Bonnet (local study area and, as noted above, being considered as granular sources for the Project).
- Granite extraction southeast of Lac du Bonnet, near the LGD of Pinawa (regional study area).
- Sphagnum moss extraction near the community of Shelley, south of PTH 44 in the RM of Reynolds (regional study area).
- Quarry extraction north of Belair in the RM of Alexander, east and west of PTH 59 and the junction with PTH 11 (regional study area).
- Quarry extraction north of Stead and PR 304 east of PTH 59 in the RM of Alexander (regional study area).
- Tyndall limestone extraction near the Town of Garson in the RM of Brokenhead (regional study area).

7.6.8 Recreational Use and Tourism

As Pointe du Bois is located in Whiteshell Provincial Park, a great deal of recreational resource use occurs there. Many people are drawn to the local study area and the surrounding Winnipeg River region for its recreational activities, tourism destinations and businesses such as lodges and outfitters.

Recreational opportunities within Whiteshell Provincial Park are mainly water-oriented, given the dense network of lakes, rivers and streams, including the Winnipeg River. These activities include fishing, power boating, canoeing and kayaking, sailing, swimming, water skiing and jetskiing. Other recreational opportunities within Whiteshell Provincial Park include lodging stays, camping, cycling, hiking, nature

interpretation, berry picking, wildlife viewing and birding. Recreational hunting occurs at various times of the year in accordance with provincial regulations. In the winter, the area caters to cross-country skiing, snowshoeing, ice-fishing, and snowmobiling enthusiasts. The following section focuses on recreational resource use, tourism and lodges and outfitters.

7.6.8.1 Lodges and Outfitters

There are five commercial lodges offering fishing-only services along the Winnipeg River that operate in the local area encompassing the Pointe du Bois GS site to the Manitoba-Ontario boundary and down to Slave Falls and the Pinawa area in Whiteshell Provincial Park. These include: Eagle Nest Landing and Eagle Nest Lodge, Trail End Camp, Kendall Point Lodge, and Pine Island Lodge.

Commercial outfitters operating near Pointe du Bois include Trail End Camp & Outfitters which offers non-resident hunting for black bear and white-tailed deer as well as fishing services. They also offer accommodation with 11 cabins at Pointe du Bois as well as backcountry camping upstream on the Winnipeg River from Pointe du Bois. George Lake Outfitters offers fishing on George Lake and the Winnipeg River. They have two cabins at Eight Foot Falls and offer backcountry camping on George Lake.

Other black bear outfitter operators in the local area include: Bows, Bears & Bucks Outfitters (operating east and west of Pointe du Bois in the park), Big Woods Wilderness Outfitters (operating in the Pinawa area), Hrechkosy's Trail End Camp (operating in the park in the Horseshoe and Echo lakes area, north of Pointe du Bois east to the Lamprey rapids area, and north of the Winnipeg River and the park), Parchland Outfitters (operating around Echo Lake in the park, and Whiteshell Outfitters (operating east of Nutimik and Numao lakes and PR 307 and generally south and west of Tie Creek to the Horseshoe Lake and Big Whiteshell Lake area). One allocation area within the park is currently unassigned, located south of the Winnipeg River from Nutimik Lake to Eleanor Lake south of PR 307.

Additional lodge and non-lodge outfitting for white-tailed deer can occur almost anywhere within Game Hunting Areas (GHAs) 26, 34 and 36 (Figure 7.31). GHA 26 is located north of the Winnipeg River from Seven Sisters GS to the Manitoba-Ontario boundary and beyond the regional study area. GHA 34 is located west of the Winnipeg River and PTH 11to the Belair area to the north, and PTH 59 and PTH 12 on the west to the Beausejour area and points south of the regional study area. GHA 36 is bounded by the Winnipeg River and PR 307 on the north, PTH 11 on the west, the Trans Canada Highway on the south (beyond the regional study area), and the Manitoba–Ontario border on the east, including most of Whiteshell Provincial Park (Figure 7.31). The local study area around Pointe du Bois is located within parts of GHAs 26 and 36. White-tailed deer outfitters operating in GHA 26 include: Big Woods Wilderness Outfitters, Hrechkosy's Trail End Camp, Big Game Outfitters, Parchland Outfitters, J.D. Jumbo Outfitting and Black River First Nation Outfitters. Deer outfitters operating in GHA 34

consists of Bloodvein River Outfitters. White-tailed deer outfitters operating in GHA 36 includes Whiteshell Outfitters and George Lake Outfitters.

7.6.8.2 Recreational Activities

As previously noted there is intensive cottage development in the local study area. Most of the cottages are not permanently occupied, but a large percentage of cottagers use their properties in all seasons. Summer is by far the most used season of cottages by cottagers and their families with respondents from a cottager survey reporting an average of 52 days between June 1 and August 31 spent at the cabin. The single-most common reason chosen by respondents in the cottager survey for using their cottage was for recreational activities. Information regarding recreational activities in the local study area is outlined below. Much of this information was obtained through the various surveys (cottager, seasonal camper, day user), as well as through key person interviews.

7.6.8.3 Fishing

Fishing is a major recreational activity in the Pointe du Bois area with 99 percent of all respondents from the cottager survey, and 100 percent of seasonal campers surveyed reporting that they or their immediate families participate in fishing at least occasionally.

Representatives of the cottager associations concurred in the views of the lodges, outfitters and campground representatives that fishing was the number one recreational activity in the local study area. Large portions of the lodge, outfitter and campground clientele are fishers. Fishing in the Pointe du Bois area occurs from boats and shore.

7.6.8.4 Power Boating

Motorboat activities are popular among day users especially in combination with fishing. Virtually all day users (97%) surveyed planned to participate in water-based activities with fishing and power boating near the top of the list. Seasonal campers surveyed on their choice of Pointe du Bois over other areas indicated that fishing (59%) and use of waterways for boat trips (27%) were the most important reasons for choosing the area. A majority of cottagers who responded to the survey (55%) partook in power boating / jet skiing.

A public boat launch is located at Eight Foot Falls and provides access to the Winnipeg River between Pointe du Bois and Slave Falls. Boat access to the Pointe du Bois forebay is provided by a public boat launch located at Sawmill Bay at Pointe du Bois. Information gathered during consultation for the project has indicated that the boat launch at Sawmill Bay is heavily used. The parking lot does not have enough capacity and there are long wait times to launch and land boats.

Manitoba Hydro also has a boat launch at Pointe du Bois which is used to access the Pointe du Bois forebay. It is located on a small peninsula located northwest of the Pointe du Bois GS. A portion of the peninsula has been divided into lots with water access to

boathouses located there. The boathouses and Manitoba Hydro boat launch locations are shown on Figure 7.32.

7.6.8.5 Paddle Sports (Canoeing/Kayaking)

The Winnipeg River is a designated canoe route within Whiteshell Provincial Park. Several canoe campsites are located on island and shoreline locations upstream and downstream of Pointe du Bois in the local study area. At the Pointe du Bois Generating Station, a designated portage is located on the west side of the river. The portage comes in at the townsite boat launch and goes through the townsite where canoeists re-enter the water near the beach.

7.6.8.6 Swimming:

Swimming in the Pointe du Bois region is a significant recreational activity with 90% of cottagers and 95% of seasonal campers indicating they participate at least occasionally in it while at the cottage. There are two main designated facilities where swimming occurs; a swimming pool and man-made beach near the Pointe du Bois Sub Station switchyard on the west side of the river, south of the powerhouse.

7.6.8.7 Camping:

There are two campgrounds, Sawmill Bay and Eight Foot Falls, plus one lodge, Eaglenest Landing, that offer camping spots close to Pointe du Bois. Sawmill Bay and Eight Foot Falls both offer seasonal camping spots, as well as daily camp spots. Scouts Canada operates a camp on George Lake that is accessed through the Pointe du Bois area. The site is accessed either by canoe or boat from Eight Foot Falls. In the winter, the site is accessible by snowmobile, but the site is not accessed until at least mid-February due to ice conditions crossing the Winnipeg River.

7.6.8.8 Hiking, Jogging and Cycling

There are no designated hiking or jogging trails within the local study area. However, hiking and jogging are known to occur along the roads within the local study area.

While no designated cycling infrastructure exists in the local study area, 63% of respondents to the cottager survey and 77% of seasonal campers surveyed reported that they cycle at least occasionally.

The Trans Canada Trail (TCT) is located within the local study area at Pinawa, continuing north in close proximity of PR 520 to the Pinawa Dam Provincial Park and on to PR 313. The TCT continues west crossing the Winnipeg River on the PR 313 bridge before turning north and continuing on to Grand Beach Provincial Park. Local trails also exist in both Lac du Bonnet and Pinawa.

7.6.8.9 Snowmobiling:

Snowmobiling is a popular leisure activity in the area. Anecdotal information from Manitoba Conservation and Manitoba Hydro staff suggests that snowmobiles

occasionally used the Slave Falls tramway corridor in the winter although now it has been converted to a private road owned by Manitoba Hydro. On the provincial snowmobile association website (SNOMAN), there is a marked bush trail that appears to follow the path of the former tramway to the Slave Falls generating station. At an open house, a representative of the local snowmobile club, Lee River Riders, suggested that this bush trail is rarely used as it does not link with any other trails or lead to a warm up cabin. This trail is also not maintained. Although specific numbers were not offered, the club representative indicated that there are "lots" of members from Pointe du Bois.

There are several designated snowmobile trails within and adjacent to the local study areas surrounding Lac du Bonnet, Pinawa, Seddons Corner, PRs 313, 520, 211, and PTHs 44 and 11. These trails are subject to change from year to year depending on local conditions, construction activity and the local snowmobile club's ability to maintain their trail systems.

7.6.8.10 Cross-country Skiing and Snowshoeing

The Whiteshell Cross-country Ski Club maintains approximately 40 km of cross-country ski trails in the local study area at Pinawa. The trails are located on the Pinawa Golf Club and north of the Pinawa channel.

The TCT is designated for snowshoeing and cross-country ski uses, but it is not groomed. Snowshoeing also occurs in the local study area on informal, backcountry trails.

7.6.8.11 Golfing

There are two golf courses in the local study area: the Pinawa Golf Club in Pinawa and the Black Bear Golf Club in Lac du Bonnet.

7.6.9 Heritage Resources

Heritage resources are defined in *The Manitoba Heritage Resources Act* to include: "a heritage site; a heritage object, and any work or assembly of works of nature or of human endeavour that is of value for its archaeological, paleontological, pre-historic, historic, cultural, natural, scientific or aesthetic features, and may be in the form of sites or objects or a combination thereof" and are considered to be non-renewable resources. They are tangible objects of human effort that have survived the rigors of time and which confirm the occurrence of past human activities. Heritage resources provide a vital cultural link between the past and present; they sustain and support, and in turn are supported by an oral tradition of long term **occupancy** in the vicinity of the Pointe du Bois GS by local Anishinaabeg. Heritage resources are defined in *The Manitoba Heritage Resources Act* to include: a heritage site; a heritage object, and any work or assembly of works of nature or of human endeavour that is of value for its archaeological, paleontological, pre-historic, historic, cultural, natural, scientific or

aesthetic features, and may be in the form of sites or objects or a combination thereof, and are considered to be non-renewable resources. All heritage resources are protected under Manitoba's *Heritage Resources Act* (1986). Found human remains during fieldwork or Project activities are subject to *The Manitoba Heritage Resources Act* (1986) and Manitoba's *Policy Respecting the Reporting, Exhumation and Reburial of Found Human Remains* (1987).

The archaeological record of the Winnipeg River provides a compelling history of continuous use and occupation by *aadizookaanag*, legendary ancestors of the present day Anishinaabeg over the past 9,000 years. The land and waters were well suited for *pimadizawin* (good life) since three major ecozones overlap in this area.

Archaeological surveys were undertaken in upstream, downstream and in the vicinity of the Pointe du Bois GS in 2007 and 2008 to locate any existing heritage resources

In 2007, a total of 27 stops (surface or reconnaissance survey and shovel testing) (Figure 7.33) were undertaken to adequately locate any existing heritage resources. Six new **archaeological sites** were identified which provided a total of 47 artefacts. These sites were primarily small concentrations of lithic debitage or waste flakes found amongst root balls of overturned trees. Water levels were high during the time of the survey, preventing a full investigation of potential archaeological sites on the river shorelines.

A second survey was undertaken in 2008 and the field team investigated 110 locations between Lamprey Falls and the Slave Falls Generating Station (Figure 7.34). Most of the known 54 archaeological sites were revisited, although in many cases, the locational data was extremely vague. This was especially the case with sites which had been recorded in the 1950s and 1970s. The field team investigated at the locations which appeared to most closely correspond to the available locational data and had topographical features which may have resulted in an early occupation site. Eight new archaeological sites were identified but six were minor sites containing artefacts which did not permit the cultural identification. One site also contained a fur trade (or more recent) component with a blacksmith manufactured file which has been fashioned into a crude knife.

Two of the new sites were identified as Thunderbird Nest I and Thunderbird Nest II. Thunderbird nests, shallow pits encircled with large and medium-sized boulder, are revered as the homes of the Thunderbirds (*Binesiwag*), legendary creatures of Native American mythology whose wing flapping creates the sound of thunder. These stone features are held in high esteem by First Nations and are considered sacred places by them. The Winnipeg River area contains the highest frequency of Thunderbird nests in Manitoba.

The field team recovered additional archaeological materials from five previously recorded sites. They were able to document the current conditions at many archaeological sites which have not been revisited for a considerable time, in some cases, more than 50 years. Many of these early recorded sites had been documented during

low water episodes and could not be exactly located. However, using a "best fit" analysis of the existing data and the current terrain, they were able to obtain global positioning system coordinates for the probable location of the sites.

The archaeological sites which had been identified during the field programs have their conditions listed as "unaffected" as they have been identified at current water levels.

Table 7.1: Dosimeter Noise Level			
Dosimeter (Dose) Location	Location Description	$L_{eq,24}$ dB(A)	L_{dn} dB(A)
1	Approximately 600 m downstream of the powerhouse, near cottage access road	51.2	57.4
2	Approximately 275 m downstream of the powerhouse, near the water's edge	59.3	62.4
3	Approximately 110 m downstream of the powerhouse, near the water's edge	60.3	66.9
4	West side of intake channel, near the water's edge approximately 225 m upstream of the powerhouse	52.1	58.3
5	Approximately 800 m upstream of the powerhouse, near the water's edge.	53.3	59.8
6	On the central island next to spillway, approximately 225 m upstream of the powerhouse	59.2	66.3

Table 7.2: Spot Noise Measurements LAeq Levels			
Spot ID	**Time**	**Location**	**LA_{eq} dB(A)**
Project 9, 10 (Dose1)	16:12	Downstream approximately 600 m from powerhouse, near road, cabin area	43.8
Project 11, 12 (Dose 2)	16:42	On rocky outcrop, near water plant approximately 275 m downstream of the powerhouse	56.0
Project 13, 14 (Dose 3)	16:59	On shore opposite generation station approximately 110 m downstream	60.5
Project 16, 17 (Dose 6)	18:15	On central island, next to Spillway approximately 225 m upstream of the powerhouse	59.7
Project 15, 19, 20 (Dose 4)	12:20	In low area near bridge to spillway approximately 225 m upstream of powerhouse	38.9
Project 21, 22 (Dose 5)	12:45	Near cabins, approximately 800 m upstream from powerhouse	43.9
Project 7, 8	15:44	Approximately 1000 m downstream of powerhouse, near cabin area, 15 m to water	41.4
Project 24, 25	13:30	Approximately 50 m upstream of powerhouse in front of bunkhouse	56.6
Project 26, 27	13:54	Approximately 50 m downstream of powerhouse beside sloping road to powerhouse	60.5
Project 28, 29	14:06	Approximately 150 m downstream of powerhouse near transformer station	61.5
Project 30, 31	14:20	Approximately 220 m downstream of powerhouse near water in view of spillway	56.6
Project 32, 33	14:51	Approximately 300 m west of powerhouse near railway and cabins	32.9
Project 34, 35	15:12	Near dock in Eight Foot Falls campground, approximately 1100 m downstream of powerhouse	27.3

Table 7.3: List of Fish Species Captured in the Study Area, 2006 - 2009		
Family	**Common Name**	**Scientific Name**
Petromyzontidae	Silver lamprey	*Ichthyomyzon unicuspis*
Acipenseridae	Lake sturgeon	*Acipenser fulvescens*
Hiodontidae	Mooneye	*Hiodon tergisus*
Cyprinidae	Golden shiner	*Notemigonus crysoleucas*
	Emerald shiner	*Notropis atherinoides*
	River shiner	*Notropis blennius*
	Spottail shiner	*Notropis hudsonius*
	Blacknose dace	*Rhinichthys atratulus*
	Longnose dace	*Rhinichthys cataractae*
	Northern redbelly dace	*Phoxinus eos*
Gasterosteidae	Brook stickleback	*Culaea inconstans*
	Ninespine stickleback	*Pungitius pungitius*
Catostomidae	Longnose sucker	*Catostomus catostomus*
	White sucker	*Catostomus commersonii*
	Golden redhorse	*Moxostoma erythrurum*
	Shorthead redhorse	*Moxostoma macrolepidotum*
	Silver redhorse	*Moxostoma anisurum*
Esocidae	Northern pike	*Esox lucius*
Osmeridae	Rainbow smelt	*Osmerus mordax*
Salmonidae	Cisco	*Coregonus artedi*
	Lake whitefish	*Coregonus clupeaformis*
Percopsidae	Trout perch	*Percopsis omiscomaycus*
Gadidae	Burbot	*Lota lota*
Centrarchidae	Rock bass	*Ambloplites rupestra*
	Smallmouth bass	*Micropterus dolomieu*
	Black crappie	*Pomoxis nigromaculatus*

Table 7.3: List of Fish Species Captured in the Study Area, 2006 - 2009		
Family	**Common Name**	**Scientific Name**
Percidae	Yellow perch	*Perca flavescens*
	Blackside darter	*Percina maculata*
	Iowa darter	*Etheostoma exile*
	Johnny darter	*Etheostoma nigrum*
	River darter	*Percina shumardi*
	Logperch	*Percina caprodes*
	Sauger	*Sander canadensis*
	Walleye	*Sander vitreus*
Cottidae	Mottled sculpin	*Cottus bairdi*
	Slimy sculpin	*Cottus cognatus*

Table 7.4: Potential Bird Species and Concern Ranking d Concern Ranking			
Common Name	**Scientific Name**	**Concern Ranking**	**Comment**
Piping plover	*Charadrius melodus*	SARA – endangered, Schedule 1 MBCDC* – S1B (breeding, very rare)	one observation – unconfirmed by NSC field staff, expected non breeder and rare occurrence
Peregrine falcon	*Falco peregrinus*	SARA – threatened, Schedule 1 MESA – endangered	none found during field surveys or known to occur in the study area
Golden-winged warbler	*Vermivora chrysoptera*	SARA – threatened, Schedule 1 MBCDC – S3B (breeding, uncommon)	none found during field surveys but study area is at the northern edge of the species known breeding range
Canada warbler	*Wilsonia Canadensis*	SARA – threatened, Schedule 1	15 found during field surveys of the study area
Redheaded woodpecker	*Melanerpes erythocephalus*	SARA – threatened, Schedule 1	none found during field surveys or known to occur in the study area
Common nighthawk	*Chordeiles minor*	SARA – threatened, Schedule 1	3 were observed during field surveys of the study area
Olive-sided flycatcher	*Contopus cooperi*	SARA – threatened, Schedule 1	2 were observed during field surveys of the study area
Yellow rail	*Coturnicops noveboracensis*	SARA – special concern, Schedule 1	none found during field surveys
Yellow rail	*Coturnicops noveboracensis*	SARA – special concern, Schedule 1	none found during field surveys
Rusty blackbird	*Euphagus carolinus*	SARA – special concern, Schedule 1	none found during field surveys or known to occur in the study area
Short-eared owl	*Asio flammeus*	SARA – special concern, Schedule 3	none found during field surveys or known to occur in the study area
Whip-poor-will	*Caprimulgus vociferus*	SARA – threatened, Schedule 1	none found during field surveys or known to occur in the study area
Horned grebe	*Podiceps auritus*	COSEWIC – special concern	none found during field surveys or known to occur in the study area
Great blue heron	*Ardea herodias*	MBCDC – S4S5B (breeding, widespread. Apparently secure - secure)	one rookery found during the 2007 aerial winter survey and found to be abandoned during 2007 summer field surveys – Note: local resident observed heron colony off the George Lake Portage, however, this observation is unconfirmed.
Cooper's hawk	*Accipiter cooperii*	MBCDC – S4S5B (breeding, widespread. Apparently secure - secure)	two observations documented during field surveys
Barred owl	*Strix varia*	MBCDC – S3S4 (uncommon to widespread)	several observations during the field surveys conducted in 2007, no observations in 2008, 2009, or 2010
Great grey owl	*Strix nebulosa*	MBCDC – S4 (widespread, apparently secure)	no observations during the field surveys but known to occur in the study area

*MBCDC ranking is for the Lake of the Woods Ecoregion

Table 7.5: Population			
Community	**Population**	**Population density/km²**	**Population change/%**
Division No. 1, Unorganized Territory*			
Pointe du Bois area	1,130	0.3	68.7
Incorporated Communities:			
RM of Alexander	2,978	1.9	7.1
Town of Powerview-Pine Falls	1,294	256.0	-7.6
RM of Brokenhead	3,940	5.2	1.6
Town of Beausejour	2,823	527.8	1.8
RM of Lac du Bonnet	2,812	2.6	16.9
Town of Lac du Bonnet	1,009	448.9	-7.3
RM of St. Clements	9,706	13.3	6.5
RM of Whitemouth	1,480	2.1	-8.5
RM of Reynolds	1,410	0.4	8.6
LGD of Pinawa	1,450	11.3	-3.3
Total	**28,902**	**126.95**	**1.6**

*Given the limited amount of Unorganized Territory Division No. 19 land within the regional socio-economic study area, data for Division No. 19 has not been included

Table 7.6: Labour Force Characteristics				
Characteristics (2006)	**Unorganized Territory Division No. 1***	**Incorporated Communities**	**First Nation Communities**	**Incorporated Towns**
The potential labour force	1,005	18,525	2,140	4,100
The active labour force	605	12,135	1,125	2,405
Employed	545	11,580	890	2,270
Characteristics (2006)	**Unorganized Territory Division No. 1**	**Incorporated Communities**	**First Nation Communities**	**Incorporated Towns**
Unemployed	55	555	235	135
Persons not in the labour force	400	6,390	1,015	1,685
Participation rate	60.2%	56.2%	54.4%	37.0%
Employment rate	54.2%	58.3%	44.1%	34.7%
Unemployment rate	9.10%	4.8%	19.7%	4.3%

*Given the limited amount of Unorganized Territory Division No. 19 land within the regional socio-economic study area, data for Division No. 19 has not been included

Table 7.7: Labour Force By Industry			
Industry Division	**Unorganized Territory, Division No 1 (%)***	**Incorporated Communities (%)**	**First Nation Communities (%)**
Agricultural and other resource-based industries	5.9%	12.7%	8.7%
Construction industries	11.9%	7.5%	6.8%
Manufacturing industries	1.7%	8.7%	1.9%
Wholesale trade	5.1%	3.6%	0.0%
Retail trade	8.5%	9.3%	4.8%
Finance and real estate	3.4%	3.2%	1.9%
Health care and social services	7.6%	11.4%	23.7%
Educational services	9.3%	6.1%	15.5%
Business services	8.5%	16.0%	9.2%
Other services	39.0%	21.1%	27.5%
Total All Industries	100.9%	99.6%	100.0%
	(590 persons)	(12,080 persons)	(1035 persons)

*Given the limited amount of Unorganized Territory Division No. 19 land within the regional socio-economic study area, data for Division No. 19 has not been included

Table 7.8: Education Levels				
Characteristics (2006)	Unorganized Territory, Division No. 1*	Incorporated Communities	First Nation Communities	Incorporated Towns
Percentage of population (aged 25-64) with less than a high school graduation certificate	15.2%	24.0%	54.7%	20.7%
Percentage of population (aged 25-64) with a university certificate, diploma or degree	28.0%	10.3%	6.4%	11.4%
Apprenticeship or trades certificate or diploma	12.0%	15.3%	13.6%	19.9%

*Given the limited amount of Unorganized Territory Division No. 19 land within the regional socio-economic study area, data for Division No. 19 has not been included

Table 7.9: Utilities and Services								
Utilities and Services	Pine Falls	Pinawa	Lac Du Bonnet	Beausejour	Pointe du Bois	Sagkeeng First Nation	Brokenhead First Nation	Wabaseemoong First Nation
Public Water System	●	●	●	●	●	●	●	●
Municipal Sewer	●	●	●	●	●	●	●	●
Natural Gas				●				
Hydro Electricity	●	●	●	●	●	●	●	●
Telephone	●	●	●	●	●	●	●	●
Internet	●	●	●	●	●	●	●	●
RCMP/Community Police	●	●	●	●		●	●	●
Fire Department/Hall	●	●	●	●	●	●	●	●
Hospital	●	●		●				
911 service			●	●				
Ambulance Service	●	●	●	●			●	●
Medical Airlift								
Medical Clinic	●	●	●	●		●	●	●
Care Home	●	●	●	●		●	●	
Preschool		●	●	●		●		●
Elementary School	●	●	●	●		●	●	●
Secondary School	●	●	●	●		●	●	●
Bank/Financial Centre	●	●	●	●		●	●	●
Community Centre	●	●	●	●	●	●	●	
Arena	●	●	●	●		●		●
Hotels	●	●	●	●			●	
Post Office	●	●	●	●	●	●	●	●
Garbage pick up	●	●	●	●			●	

Table 7.9: Utilities and Services								
Utilities and Services	**Pine Falls**	**Pinawa**	**Lac Du Bonnet**	**Beausejour**	**Pointe du Bois**	**Sagkeeng First Nation**	**Brokenhead First Nation**	**Wabaseemoong First Nation**
Garbage Drop off	●	●	●	●	●		●	
Recycling Pick up				●				
Recycling Drop Off		●	●	●	●		●	