

**Pembina Valley
Water Cooperative Inc.
Supplemental Groundwater
Supply Project**

Environmental Setting Report



North/South Consultants Inc.
Aquatic Environment Specialists

**PEMBINA VALLEY WATER COOPERATIVE INC.
SUPPLEMENTAL GROUNDWATER SUPPLY PROJECT**

ENVIRONMENTAL SETTING REPORT

November 2005

A study conducted for UMA Engineering Ltd.

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1.0 Introduction

The Pembina Valley Water Cooperative Inc. (PVWC) currently operates a water system that supplies treated water to approximately 40,000 residents from two surface water sources. The PVWC has identified that the water supply is susceptible to periods of drought and to potential contamination from accidental spills upstream of the water treatment plant. Therefore, in order to reduce the risk of potential water shortages, investigations have been undertaken to develop a supplemental water supply system from an independent source. A recent study by UMA Engineering Ltd. has identified the Bedford Ridge Area as a potential suitable source. This study is part of a larger investigation being undertaken to confirm the availability of a suitable independent supply from a groundwater source.

North/South Consultants Inc. was contracted by UMA Engineering Ltd. to provide an environmental impact assessment of the proposed project. The environmental assessment has been divided into two components: a description of the existing environmental setting, and an assessment of impacts of the proposed project. This report describes the existing environmental setting.

1.1 SCOPE OF WORK

The description of the existing environmental setting is divided into two components; the pumping well site and the proposed pipeline route. The environmental setting of the pumping well site is described in terms of the terrestrial and aquatic environments, including vegetation communities, wildlife and habitat, species at risk and water quality. Identified as a potential groundwater recharge zone, the area located east of the pumping well site to the community of Kerry, is also included in the pumping well site description. The environmental setting along the proposed pipeline route is described with reference to vegetation, wildlife and habitat and species at risk within and immediately adjacent to the proposed pipeline route. In addition aquatic habitat at all water bodies occurring within the alignment of the proposed route is described. For both the pumping well site and pipeline route, the description of the environmental setting relied on both existing information and data, and field investigations.

2.0 Environmental Setting

2.1 EXISTING ENVIRONMENT

2.1.1 Well Site

The pumping well site is located immediately adjacent to PR 404, approximately 8 km north of the town of Sandilands (Figure 1). This location lies within the southwest corner of the Lake of the Woods ecoregion within Canada's Boreal Shield ecozone. At a coarse scale, the ecoregion is underlain by massive, crystalline, acidic, Archean bedrock which has formed hummocky, broadly sloping uplands, as well as lowlands.

Soil materials consist of sandy and gravelly outwash and beach deposits, local areas of stony calcareous loam textured glacial till overlain in places by sandy to coarse-loamy textured lacustrine deposits, and extensive areas of shallow to deep organic deposits. The area's soils are classified as Eluviated Brunisols and Gray Luvisols developed on sandy to loamy textured materials, and Dark Gray Chernozems or Luvisols developed on clayey lacustrine sediments. The poorly drained sites associated with these soils are classified as Humic Gleysols and peaty phases of Gleysolic soils. Organic soils developed on forest, sphagnum or fen peat are dominant in the low-lying terrain surrounding the Bedford Hills (Soil Classification Working Group, 1998).

The Bedford Hills are a prominent physiographic feature in this area. This upland rises nearly 90 metres above the lower-lying terrain of the Whitemouth Lake Lowland to the east and the Southeastern Plain to the west, to an elevation to 390 metres above sea level (m asl). The Bedford Hills are a gently sloping to hummocky area with local relief under 3 metres and a slope averaging 2-5 percent, except in dissected areas along the edge of the upland with higher relief and slopes in excess of 5 percent (Canada-Manitoba Soil Survey, 1980).

Surface drainage varies from very poor to well-drained. However, in the immediate area of the well site, surface drainage is well- to rapidly-drained, owing to the coarsely textured sands and gravels associated with the Bedford Ridge on the west side of the Bedford Hills. Drainage has been improved in places, including the Watson P. Davidson Wildlife Management Area, by man-made drains constructed to enhance runoff and reduce the duration of surface ponding.

Land use consists primarily of forestry, except where other primary uses or legislative protection has been designated. Merchantable forest on well- to poorly-drained mineral soils and on many of the organic soils is utilized by the forest industry. These areas also provide habitat for wildlife and are also used extensively for recreational uses. Land use for agriculture, especially east of the Bedford Ridge, is minimal. The majority of soils have moderately severe to very severe limitations for arable agriculture. The sandy soils require careful management to protect against the risk of wind erosion and to maintain productivity,

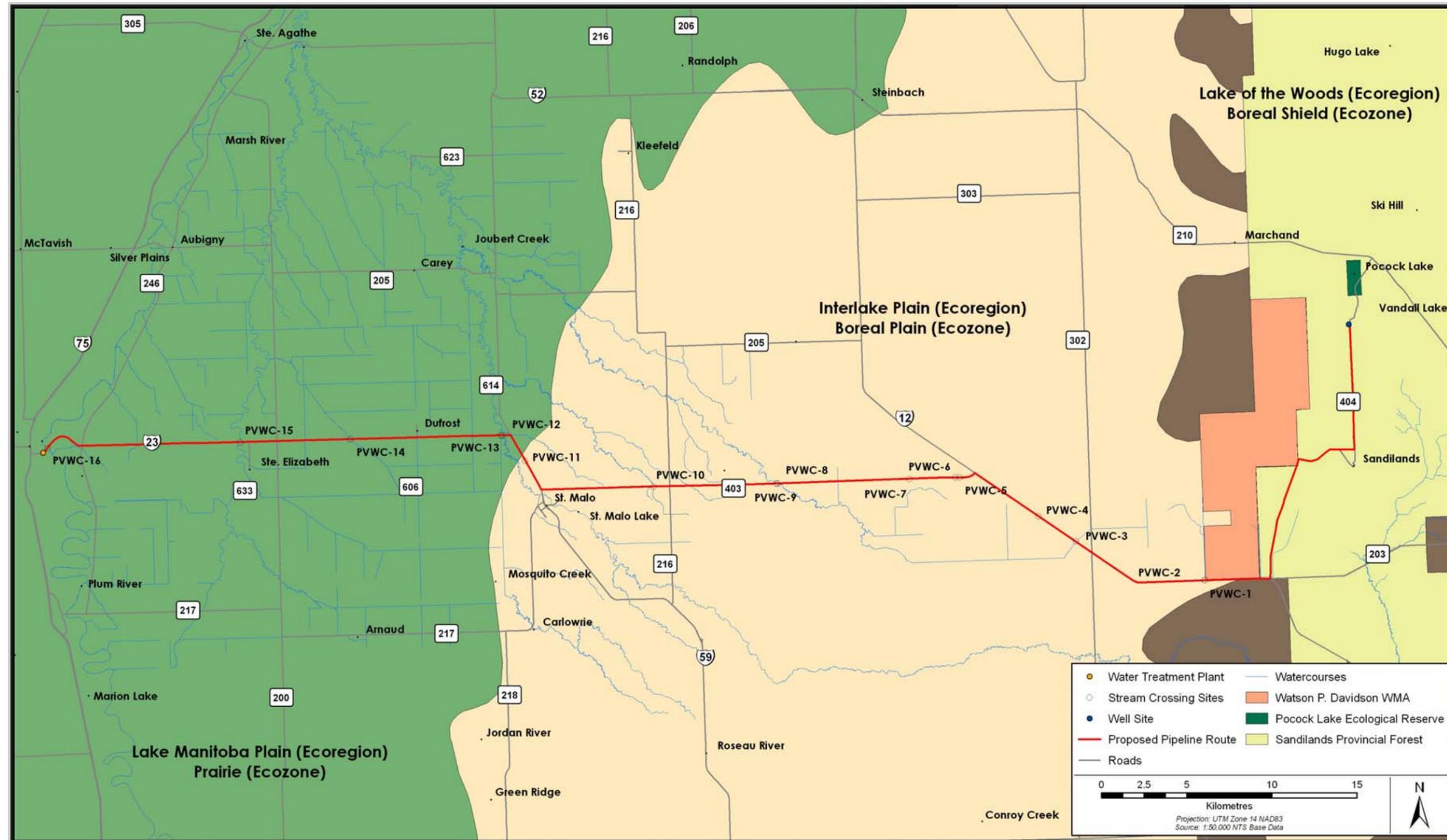


Figure 1. Pembina Valley Water Cooperative Supplemental Groundwater Supply Project study area.

and soils with extremely stony and cobbly surface conditions require stone clearing to permit annual cultivation. There are also areas of low relief dominated by organic soils with imperfectly- to poorly-drained soils whose seasonally high water tables are subject to surface ponding in the spring or following heavy rains.

The climate is generally considered to be warmer and more humid than other Boreal Shield ecoregions located to the north, but its winters are nonetheless markedly cold and summers warm. The mean winter temperature is -13°C, and the mean summer temperature is 15°C. The annual mean temperature is 2.1°C; annual mean precipitation is 605 mm. The average frost-free period is less than 100 days, and degree-days above 5°C accumulated from May to September average 1551 days. The seasonal moisture deficit calculated between May and September is just over 200 mm; the estimated effective growing degree-days accumulated from May to September are 1350 days (Agronomic Interpretations Working Group, 1995).

Terrestrial vegetation is typically a wooded succession of trembling aspen, paper birch, and jack pine to white spruce, black spruce, and balsam fir. Cooler and wetter sites support a white cedar, black spruce, and tamarack succession state. The region is interspersed with numerous wetlands, most of which are peat accumulating forms such as bogs and fens. Characteristic wildlife includes moose, black bear, wolf, lynx, snowshoe hare, and woodchuck. Bird species include ruffed grouse, hooded merganser, pileated woodpecker, bald eagle, turkey vulture, herring gull, and waterfowl.

2.1.1.1 Eastern Recharge Area

A potential groundwater recharge area for the pumping well is located east of the well. A Forest Resource Inventory (FRI) analysis was conducted for an area of 12,214 ha, that extended from the pumping well to the community of Kerry buffered by 3.2 km. The area contains two small headwater tributaries; one flows east into St. Labre Creek and the other flows directly to a peripheral area of the St. Labre Bog. The topography is hummocky; total relief from west to east is approximately 23 m. Most of the area is forested, dominated by jack pine (*Pinus banksiana*) with trace pockets of red pine (*P. resinosa*) in its west half, grading to trembling aspen-dominated (*Populus tremloides*) forest with patches of white cedar (*Thuja occidentalis*), or black spruce (*Picea mariana*) and tamarack (*Larix laricina*) nearer to the community of Kerry. Cleared areas that have been converted to cropland or forage production are evident in the immediate vicinity of Kerry. Small bogs and beaver back-floods exist in association with the tributary streams. Due the similarities in the dry land habitat composition, it is reasonable to assume that this area has similar mammalian and avian species diversity to that of the Watson P. Davidson Wildlife Management Area.

2.1.2 Pipeline Route

The proposed route for the water pipeline, from the pumping well site to the water treatment plant in the town of Morris, will follow existing Provincial Road (PR) and Provincial Trunk Highway (PTH) right's-of-way (ROW) for its entire length, other than a short section north of the town of Sandilands (Figure 1). These PR and PTH ROW are previously disturbed and in most cases highly managed areas.

Due to distance covered by the pipeline route, the landscape it traverses includes three ecoregions within three ecozones. This includes the southwest corner of the Lake of the Woods ecoregion (Boreal Shield ecozone), the southeast corner of the Interlake Plain ecoregion (Boreal Plain ecozone), and the southeast corner of the Lake Manitoba Plain (Prairie ecozone). From east to west, the pipeline corridor's landscape, and land use associated with it, transition from a lightly modified, boreal setting whose predominant industries are forestry and recreation, to a highly modified prairie setting whose primary industry is agriculture.

The pipeline corridor's initial 20 km of length extends south along the PR 404 ROW, remaining within the Lake of the Woods ecoregion and not entering any area protected under legislation. At a coarse scale, the geology, topography, and vegetation composition of this ecoregion has been discussed under the ecological setting section for the pumping well site; therefore, it is not repeated for the pipeline corridor's section.

At the junction of PR 404, PR 203, and PTH 12, the pipeline corridor aligns to the west with PTH 12 for approximately 20 km until it reaches the junction of PR 403. Over this distance, the pipeline passes from the Lake of the Woods ecoregion and into the Interlake Plain ecoregion. This ecoregion's geology consists of flat-lying Palaeozoic limestone, covered by broadly ridged, calcareous glacial till, and by shallow, level lacustrine sands, silts, and clays. Its soils are predominately Dark Gray Chernozems with peaty Gleysols and Mesisols that are associated with poorly drained depressions. Its climate is classified as subhumid low boreal; the summer and winter temperature means are 15.5°C and -14.5°C, respectively, and the annual precipitation mean is 575 mm.

On the eastern edge of this region, the vegetation is representative of closed boreal forest, dominated by trembling aspen and balsam poplar (*Populus balsamifera*), with interspersed climax areas of white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*). Open stands of jack pine exist on dry, sandy sites. Wetland areas within this area typically contain cattail (*Typha* sp.), sedge (*Carex* sp.) and willow (*Salix* sp.) on the emergent fringe, surrounded by black spruce and tamarack. Wildlife representative of the area include white-tailed deer, black bear, moose, beaver, coyote, snowshoe hare, eastern cottontail, various waterfowl, and colonial water birds. On the western edge of this region, the landscape is more representative of farmland, with annual crop production including spring and winter cereals, and oilseeds, and perennial production including tame and native forage.

At the intersection of PTH 12 and PR 403, the pipeline aligns west along the PR 403 ROW and continues to the community of St. Malo. While doing so, the pipeline corridor exits the boreal environment and enters the Lake Manitoba Plain ecoregion of the Prairie ecozone. The geology of this particular area of the ecoregion is limestone bedrock covered by smooth, level, lacustrine sands, silts, and clays. Black Chernozemic soils support herbaceous and woody vegetation on well-drained and moist sites; Gleysolic soils support wetland vegetation such as willow and sedge on poorly drained sites. This part of the ecoregion is considered to be low in relief, although total relief from the westward alignment to the community of Morris is approximately 53 m. Annual cereal and oilseed crop production becomes more prevalent as the pipeline progresses from east to west, but areas of native and introduced perennial forage production are evident adjacent to the PR 403 ROW.

Along this length of the corridor, the pipeline crosses Joubert Creek and further to the west, Coulee des Nault which flow northwest to St. Pierre-Jolys and St. Pierre Sud, respectively. Immediately east of the community of St. Malo, the pipeline corridor and road ROW pass through a shallow, seasonal wetland area. In localized areas where habitat has not been significantly modified or degraded, wildlife includes white-tailed deer, coyote, rabbit, ground squirrel, and some waterfowl which use the creeks and local drains.

From the community of St. Malo, the pipeline corridor aligns north along PTH 59 to its intersection with PTH 23 at La Rochelle, after which it continues west within the PTH 23 ROW to the community of Morris. Along this length, agriculture and more specifically, annual crop production is the dominant land use. Among the only prominent natural features through which the pipeline corridor must pass are the Rat River, a small wetland area associated with this crossing area, the much smaller Marsh River, and the Red River.

The Rat River drains the Rat River Swamp and along the river's water course, it passes alongside the Rat River Wildlife Management Area (WMA) and the St. Malo WMA. However, the pipeline corridor does not approach any of these features or protected areas. The Marsh River drains the local agricultural landscape associated with it, and enters the Rat River at a location 3.0 km south of the Rat River's confluence with the Red River. The Red River is a relatively high volume, shallow grade river originating within the United States. This river drains a vast watershed with a landscape dominated by aggressive agricultural land use. It flows north through the city of Winnipeg, where it meets the Assiniboine River and eventually empties into Lake Winnipeg.

2.1.3 Protected Areas

2.1.3.1 Pockock Lake Ecological Reserve

The Pockock Lake Ecological Reserve encompasses 162 hectares and is located on the east half of Section 27, Township 05, Range 09EPM, and the legal subdivisions 1 & 2 of Section 34, Township 05, Range 09EPM. It was established on 07 May 1982 through the Ecological Reserves Act under which it receives rigorous protective status. The area is administered by Manitoba Conservation, but is not actively managed. Allowable uses must be passive and non-consumptive, unless authorized by Ministerial approval. The stated purposes for these reserves are:

- To afford opportunities for, and to encourage the study of and research into the ecological features of the province;
- To afford opportunities for and to encourage the enjoyment by residents of and visitors to the province of the educational and aesthetic benefits of the ecological features of the province; and
- To preserve, for the above reasons and for posterity,
 1. unique and rare examples of botanical, zoological, and geological features of the province;

2. examples of natural habitats of rare or endangered plants and animals that are native to the province;
3. representative examples of natural ecosystems in the province; and
4. representative examples of ecosystems in the province that have been modified by man and that offer opportunities for the study of and research into the recovery of the ecosystem from modification.

Provincial Road 210 (asphalt) passes within a half kilometre north of the Reserve; PR 404 (gravel) passes through the Reserve's southern half. The ecosystems represented by the Pocock Lake Ecological Reserve are dry uplands and wet bog. Past disturbance and the potential for future disturbance of the reserve area are both low.

The features represented within Pocock Lake Ecological Reserve include a large wetland (Pocock Lake), a beach ridge (Bedford Ridge), and the gradation of natural vegetation between the two from moisture tolerant to drought tolerant species.

The Woodridge soils west of Pocock Lake are excessively drained and gently sloping, while the Lonesand-Kerry Complex east of these soils is low-lying and poorly drained. The land slopes noticeably from the Bedford Ridge west to Pocock Lake. The Sandilands soils, which originate west of PR 404, continue east to the Bedford Ridge and are excessively drained.

The wooded component of the area's vegetation follows a gradient from east to west, changing from jack pine, through white birch (*Betula papyrifera*) to trembling aspen, balsam poplar, black spruce, willow, eastern white cedar and tamarack. Labrador tea (*Ledum groenlandicum*), dwarf birch (*Betula pumila*), green alder (*Alnus crispa*), bulrushes (*Scirpus spp.*), cattail and sedges dominate the upland and wetland understory.

Pocock Lake, in its present state of succession, is more typical of an open water marsh than a bog wetland, owing to recent, successive years of abundant precipitation. It has a prominent fringe of emergent vegetation comprised of willow, reed canary grass (*Phalaris arundinacea*), sedge, and cattail. Submergent vegetation includes water milfoil (*Myriophyllum exalbesens*) and common duckweed (*Lemna minor*). Due the similarity in landscape and habitat availability between Pocock Lake and the Watson P. Davidson Wildlife Management Area, it is reasonable to assume that mammalian and avian species diversity is similar (Appendix B).

2.1.3.2 Watson P. Davidson Wildlife Management Area

The Watson P. Davidson Wildlife Management Area (WMA) was established in 1961 under the Crown Lands Act as Manitoba's first WMA. It encompasses approximately 5827 ha, of which 2460 ha was originally donated by Watson P. Davidson Jr. Based on recommendations from its Regional staff, the Province added 3367 ha of high capability big game habitat to the WMA in 1974. The WMA is located 6 km east of the community of Zhoda and north of PTH 12, and occupies land parcels in the rural municipalities of Piney and La Broquerie. The stated purposes for provincial WMA's are:

- To maintain vigorous vegetative cover where practicable;

- To not undertake development activity that will jeopardize the purpose for the area was initially set aside;
- To utilize techniques for vegetation manipulation/management which will enhance ecosystem stability; and
- To develop site qualities for public appreciation which are consistent with the natural features of the area.

The soils of the WMA are predominately poorly drained and low in fertility. There are a few pockets of the Menisino soil association in the southern portion of the WMA that are sandy and well-drained. Malonton-Shallow Peat Complex soils also exist within the WMA's central area where there is 30-90 cm of peat lying over sandy lacustrine and outwash deposits. Local topography within the WMA is more irregular than topographic map contour spacing suggests.

Much of the vegetation within the WMA comprises trembling aspen, balsam poplar, and white spruce interspersed between numerous boggy areas dominated by black spruce, tamarack, and white cedar. Also present are mixtures of balsam fir and white birch, as well as white elm (*Ulmus americana*), green ash (*Fraxinus pensylvanica*), and Manitoba maple (*Acer negundo*). The well-drained soils support jack pine, and a number of shrubs, including hazel (*Corylus cornuta*), chokecherry (*Prunus virginiana*), saskatoon (*Amalanchier alnifolia*), pincherry (*Prunus pensylvanica*), highbush cranberry (*Viburnum opulus*), and common juniper (*Juniperus communis*). The poorly drained soils of the Malonton-Shallow Peat Complex support an understory of sedges, common reed grass, willow, alder, dwarf birch, and red-osier dogwood (*Cornus sericea*).

The WMA lies within a major breeding and migration corridor for northern forest owls, including the great gray (*Strix nebulosa*), northern saw-whet (*Aegolius acadicus*), and boreal (*A. funereus*) owls, but also provides habitat for many neo-tropical migrant bird species, upland game birds, white-tailed deer and moose. Waterfowl use is low, but diving and dabbling duck species make use of the few open water areas afforded by beaver back floods and the few man-made ditches within the WMA. Beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*) also utilize the ditch areas, and are harvested by trappers, as are squirrel (*Tamiasciurus hudsonicus*), coyote (*Canis latrans*), and timber wolf (*Canis lupus*). Moose are believed to migrate northward, out of the WMA during summer, and return to the WMA for the winter. Similarly, white-tailed deer appear to use the wooded farmland to the west and south of the WMA during summer, and return to the WMA for the winter. Aerial surveys have estimated that in excess of 300 white-tailed deer and at least 20 moose utilize the WMA's available habitat for winter cover.

Although the WMA's landscape was historically used for grazing and haying, agricultural use is typically not allowed because it is incompatible with objectives of the WMA. As of 1981, one timber sale was active within the WMA and located in a black spruce/white cedar area on land parcels NE19-05-09EPM and 20-05-09EPM. Habitat management has taken place within the WMA by default and by design. Uncontrolled fires occurred during 1968, 1976, and 1980. However, the 1980 fire which began outside the WMA had the desirable effect of maintaining the area's natural open canopy. Following the 1976 fire which burned over a peat-covered area, grasses and legumes were later seeded to stabilize the ash and remaining

soil. Controlled management was undertaken within the WMA during 1977-78 when browse and travel lanes were enhanced by mechanized disturbance, and plantings of red-osier dogwood and white spruce were conducted to enhance natural regeneration. Three shallow pools were excavated within the WMA in 1980, to create artificial wetland areas for waterfowl and other wildlife. Management techniques which have been or may be considered in the future include strip and plot clearing, tree and shrub planting, controlled fires, haying (grazing is not allowed due to the need for vigilant monitoring), artificial wetland development, and selective firewood harvest.

2.2 VEGETATION

The study area intersects three ecoregions in Manitoba: Lake of the Woods, Interlake Plain and Lake Manitoba Plain (Smith et al. 1998). Within the ecoregions are the finer divisions of ecodistricts.

Piney Ecodistrict

This ecodistrict includes the sandy uplands of the Bedford Hills. Vegetation in these well drained areas includes jack pine forests with an understory of dwarf shrubs such as blueberry (*Vaccinium spp.*) and bearberry (*Arctostaphylos uva-ursi*) and lichens and mosses. Some red pine also occurs in the area. Less sandy areas support more mixed forest of spruce (*Picea spp.*), aspen and white birch. There are lowlands consisting of fens and bogs supporting black spruce, tamarack, ericaceous shrubs, sedges, willows and sphagnum mosses. Cedar swamps with a ground cover of mosses occur in low poorly drained areas.

Stead Ecodistrict

The proposed route passes through a small portion of this ecodistrict. Vegetation is a mixture of peatlands, swamps in areas of low elevation and mixed forest in upland areas. Swamps are a mixture of eastern white cedar, alders and willows. Fen peatlands support sedges, shrubs such as bog willow (*Betula pumila*) and tamarack.

Steinbach Ecodistrict

The Steinbach Ecodistrict consists of smooth plains, gravel/sand ridges and low-lying peatlands of fen and bog. Jack pine forests dominate the eastern sandy areas. Aspen and balsam poplar dominate other forested portions where willows and dogwood form the understory. Much of the land has been modified to support crops and cultivation of hay and pastures. Low peatlands support sedges, reed grasses (*Calamagrostis spp.*) and mosses interspersed with tamaracks and black spruce trees.

Winnipeg Ecodistrict

Vegetation in the Winnipeg Ecodistrict has been highly modified by agriculture. Cultivation and construction of drainage ditches has drastically reduced the original cover of tall-grass prairie and meadow grass communities. Remnants of the original vegetation are restricted to unbroken lands and small fringes along road allowances and streams. Deciduous trees such as American elm, green ash, Manitoba maple and cottonwood (*Populus deltoides*) persist on floodplains of rivers and creeks as well as a shrub community of willows, dogwoods and various cranberries (*Viburnum spp.*). Upland sites support oaks (*Quercus macrocarpa*) and aspen stands.

2.2.1 Methods

The site of the pumping well and the potential routing of the pipeline were mapped and the provincial forest resource inventory (FRI) was interpreted. Literature sources were searched for sensitive plant occurrences in the areas of the pipeline route. Field trips were planned to

include a complete growing season with special attention to the blooming periods of Species at Risk plants that potentially could occur along the pipeline route.

2.2.1.1 Field Surveys

Three surveys were conducted during the growing season to be able to identify species at the peak of blooming period. Surveys were done in early June, late July and early September. Surveys encompassed the whole route, including alternatives, and the pumping well location once it was identified. Travel was by truck, ATV and on foot.

Initially the proposed pipeline route travelled south from the pumping well site along PR 404 to the 2nd Baseline, approximately 5 km south of the well site. At that point the route turned west, travelling through the Watson P. Davidson WMA to join a municipal road ROW on the west side of the WMA. From that point the route travelled west along a combination of PTH, PR and developed and undeveloped municipal road ROW to the town of Morris. This previous route alignment was visited in the June field trip.

The current alignment of the proposed pipeline route includes a short section of the route that bypasses the town of Sandilands (Sandilands bypass); this bypass was visited in late July. However, the location of this bypass was subsequently changed. Forest cover of the two bypass routes is similar and therefore it is reasonable to include observations of ground vegetation from the previous bypass route.

2.2.2 Well Site

The proposed well site is located in the Sandilands Forest Reserve in the southern portion of Manitoba's boreal forest. The land has a history of use as the many roads and trails are used for forestry, gravel extraction and year-round recreation activities.

The forests on the well drained elevated ridges support forests of jack pine and red pine plantations with sparse understory of *Cladonia spp.* lichens and ericaceous shrubs including blueberry, bearberry (*Arctostaphylos uva-ursi*) and wintergreen (*Gaultheria procumbens*). Other shrubs are pin cherry (*Prunus pensylvanica*), snowberry (*Symphoricarpos alba*) spiraea (*Spiraea alba*) New Jersey tea (*Ceanothus herbaceus*), saskatoons (*Amelanchier alnifolia*) and common juniper (*Juniperus communis*) (Photo 1). Herbs and grasses found in these dry areas include harebells (*Campanula rotundifolia*), wild sarsaparilla (*Aralia nudicaulis*), bracken ferns (*Dryopteris carthusiana*) wild lily-of-the-valley (*Maianthemum canadense*), rice grass, wheat grass (*Agropyron trachycaulum*), bigbluestem (*Andropogon gerardii*) and purple oat grass (*Schizachne purpurescens*).

In moister sites mixed forests of aspen, balsam poplar, balsam fir, white spruce, black spruce and white birch are found. Shrubs in the understory include beaked hazelnut, mountain maple (*Acer spicata*), raspberry (*Rubus idaeus*), twining honeysuckle (*Lonicera dioica*) and green alder (*Alnus cispa*). Ground cover consists of twinflower (*Linnaea borealis*), bishop's cap (*Mitella nuda*), mosses, bedstraws (*Galium boreale*, *Galium triflorum*) and poison ivy (*Toxicodendron rydbergii*).



Photo 1. Jack pine forest adjacent to the pumping well site, June 2 2005.

Poorly drained areas support alder swamps with various willows. Ground cover is usually mosses, sedges, bluebead lily (*Clintonia borealis*), wild ginger (*Asarum canadense*) and bedstraw (*Galium triflorum*). Where cedar swamps occur the canopy is so thick that only mosses carpet the ground.

Some of the roadsides in the area of the well site have been planted with trefoil (*Lotus corniculatus*), clovers (*Trifolium hybridum*, *Trifolium pratense*), sweetclovers (*Melilotus spp.*) and fescue grasses (*Festuca spp.*).

No plants protected under the federal (SARA) or provincial (MBESA) legislation were found at the well site area. However, red pine and New Jersey tea are ranked by the Manitoba Conservation Data Centre as provincially rare to uncommon. The New Jersey tea shrubs are widespread throughout the sandy soils in the area. Red pine is at the northwest edge of its range here and although native to Manitoba, Red pine has been extensively planted in the Sandilands area as a forestry resource.

Table 1. Forest cover adjacent to the proposed pumping well site. Forest cover was determined from Manitoba Forest Resource Inventory data within a 3.2 km radius of the proposed well site.

Forest Cover	Species	Area (ha)	%
Softwood	Red Pine	1.2	0.0
Softwood	Jack Pine	2360.3	47.1
Softwood	Black Spruce	142.1	2.8
Softwood	Black Spruce/Tamarack	64.3	1.3
Softwood	Black Spruce/ Eastern White Cedar	116.1	2.3
Softwood	Balsam Fir/Black Spruce	22.7	0.5
Softwood	Tamarack	125.4	2.5
Softwood	Eastern White Cedar	297.1	5.9
Mixedwood	Jack Pine/Spruce/Aspen	561.4	11.2
Hardwood	Trembling Aspen	422.5	8.4
Hardwood	White Birch	4.8	0.1
Hardwood	Green Ash	20.7	0.4
Total Productive Forest		4138.7	82.5
Willow/Alder	Willow	592.4	11.8
Willow/Alder	Dwarf birch	39.7	0.8
Total Non-Productive Forest		632.1	12.6
Meadow	Moist Prairie	4.1	0.1
Meadow	Wet Meadow	32.0	0.6
Marsh Muskeg	Muskeg	14.4	0.3
Unclassified	Roads/Railroads/Dikes/Dams	153.7	3.1
Unclassified	Gravel Pits/Mine/Dump Sites	4.9	0.1
Unclassified	Drainage Ditches	23.2	0.5
Unclassified	Beaver Floods	5.0	0.1
Total Non-Forested Land		237.3	4.7
Water	Water	6.6	0.1
TOTAL		5014.8	100.0

2.2.3 Water Pipeline Route

Well site to PTH 12

Beginning at the well site, the pipeline route follows PR 404 ROW to the edge of the Sandilands Forest Reserve at PTH 12 (Photo 2). A small section of the route deviates from PR 404 1 km north of the town of Sandilands, and aligns due west 1 km to rejoin PR 404. This bypass bisects an undeveloped forested area that will require clearing. The forest cover within this undeveloped portion of the route is composed primarily of jack pine forest with a small amount of trembling aspen (Table 2), and was subject to wind storm damage in summer 2005. The ground cover is mosses and lichens with wintergreen, bearberry, blueberry, New Jersey tea and common juniper. In openings there are grasses such as big bluestem, purple oat grass and rice grass. Aspen occurs in moister areas with beaked hazel and speckled alder. Herbs and ground cover include wild ginger, wild sarsaparilla, raspberry, strawberry, and coltsfoot. Some of the wetter areas support alder and hazel thickets.

Ground cover in these sites includes bluebead lily, bedstraw and cowheat (*Melampyrum lineare*).



Photo 2. Proposed pipeline route with roadside ditch along PR 404 ROW within Sandilands Forest Reserve, June 2 2005.

Even though the pipeline route has been rerouted it is worth noting that two ram’s-head lady’s-slipper (*Cypripedium arienatum*) plants were found in a cedar swamp in the Watson P. Davidson W MA. This plant is considered rare by the Manitoba Conservation Data Centre.

Table 2. Forest cover within the proposed Sandilands bypass. Forest cover was determined from Manitoba Forest Resource Inventory data within the proposed 10 m wide right-of-way.

Forest Cover	Species	Area (ha)	%
Softwood	Jack Pine	1.05	69.5
Hardwood	Trembling Aspen	0.34	22.9
Total Productive Forest		1.39	92.4
Unclassified	Townsite/Residential Sites	0.03	2.1
Unclassified	Roads/Railroads/Dikes/Dams	0.08	5.5
Total Non-Forested Land		0.11	7.6
TOTAL		1.50	100.0

PTH 12 to La Rochelle

From the junction of PR 404 and PTH 12 west to La Rochelle, land use includes livestock pastures, annual crop and forage production. The predominantly flat landscape rolls gently from wetland hollows through agricultural fields to gravel ridges (Photo 3). The wetlands are comprised of small cattail marshes and wet willow meadows. Other plants associated with the wetlands includes sedges, wild mint (*Mentha arvensis*), celery-leaved buttercup (*Ranunculus scleratus*), Canada reed grass, canary reed grass, water parsnip (*Sium suave*), creeping spikerush (*Eleocharis palustris*) and swamp milkweed (*Asclepias incarnata*). Gravel ridges support oaks, chokecherry, poison ivy, saskatoons, cranberries, hazelnuts and a variety of herbs. These include hoary puccoons (*Lithospermum canescens*), pale comandra (*Comandra umbellata*), showy milkweed (*Asclepias speciosa*), heart-leaved alexanders (*Zizia aptera*), snakeroot (*Sanicula marilandica*), meadow rue (*Thalictrum sp.*), asters (*Aster spp.*), cream-coloured vetchling (*Lathyrus ochroleucus*) and Solomon-seal (*Maianthemum stellatum*). Sweet grass (*Hierochloe odorata*) and rice grass also occur. As for much of the route, the roadside ditches are annually maintained through mowing.



Photo 3. Proposed pipeline route within roadside ditch along PTH 12 ROW, June 2 2005.

La Rochelle to Morris

The proposed pipeline route passes through landscape heavily altered by agriculture. Much of the land is under cultivation for annual crop production. The road allowances are mowed (Photo 4). Very little of the original native vegetation remains. Small patches of prairie species include big bluestem, wheat grasses (*Agropyron spp.*), alkali cordgrass, smooth brome

(*Bromus inermis*), prairie rose (*Rosa arkansana*), brown-eyed susan (*Rudbeckia hirta*), Canada goldenrod (*Solidago canadensis*), Indian hemp (*Apocynum cannabinum*), narrow-leaved sunflower (*Helianthus maximilliani*), blazing star (*Liatris ligulistylis*), and evening primrose (*Oenothera biennis*). Cattails, sandbar willow (*Salix exigua*), rushes (*Juncus spp.*), spikerushes (*Eleocharis spp.*) and soft stem bulrush (*Scirpus validus*) persist in the lowest portions of wet ditches.

The riparian areas and floodplains associated with river and creek crossings such as the Red, Marsh and Rat rivers, and Joubert Creek, support fringes of elms, ash, Manitoba maple and cottonwood (*Populus deltoides*). Oaks occur on the highest elevations of the banks. Willows and sedges persist in low, less disturbed spots. The riverbanks and floodplains support many weedy and aggressive species such as dandelion (*Taraxacum officinale*), sowthistle (*Sonchus arvensis*), Canada thistle (*Cirsium arvense*), alfalfa (*Medicago sativa*), brome, sweetclovers (*Melilotus officinale* and *alba*), bluegrasses (*Poa spp.*) and reed canary grass (*Phalaris arundinacea*). Leafy spurge (*Euphorbia esula*) occurs in the road allowance between the Marsh River and the Red River.



Photo 4. Proposed pipeline route within roadside ditch adjacent to PTH 23 east of Morris, June 1 2005.

2.3 WILDLIFE AND HABITAT

The study area encompasses portions of three ecoregions, as described in Section 2.2, and therefore includes a high diversity of wildlife habitat supporting a diversity of wildlife species.

2.3.1 Methods

Investigations of wildlife and habitat were restricted to searches of literature, existing databases and key person interviews. Observations made during limited field investigations were used to support existing information and not intended as quantitative studies. Wildlife habitat was characterized during field investigations in areas within a 3.2 km radius of the well site and areas along the proposed pipeline route. Habitat characterization included an estimate of riparian zone width, major vegetative cover, and unique features. Photographs were taken at all sites visited. Potential species utilization was inferred from available habitat and wildlife species habitat requirements and distributions. Field investigations were conducted in coordination with vegetation surveys in early June, late July and early September. Surveys encompassed the whole route, including alternatives, and the pumping well location. Travel was by truck, ATV and on foot.

As for the vegetation surveys, the initial pipeline route that included the Watson P. Davidson WMA was visited during the June field trip. In addition, the initial routing of the Sandilands bypass was visited in late July; the current alignment of the Sandilands bypass was not visited. However, forest cover of the two bypass routes is similar and therefore observations of wildlife habitat and inferences of potential species use made for the previous bypass route are discussed with reference to the new bypass route.

2.3.2 Well Site

The pumping well site is located in the Sandilands Forest Reserve, situated within jack pine forest (Photo 1). Wildlife habitat and associated species within a 3.2 km radius of the well site include a diversity of habitat types and potential species occurrences (Table 1). Forest cover is dominated by jack pine stands on dry sandy soils of the Bedford Ridge, but also includes lesser amounts of hardwood and mixedwood forest. The western portion of the area extends off the Bedford Ridge and includes the black spruce and cedar forests and swamps of the Pocock Lake Ecological Reserve and the Watson P. Davidson WMA (Photo 5). Habitat in these areas are dominated by black spruce, tamarack and cedar forests and swamps, as well as fairly extensive areas of willow, alder and dwarf birch wetlands. These wetlands hold little open water but are typically too wet to support productive forest cover.

The area encompassed by a 3.2 km radius area centred on the well site also includes Pocock Lake. Pocock Lake is more typical of an open water marsh than a bog wetland (Photo 6). However, historically Pocock Lake has contained little open water, appearing more like a bog than an open water marsh. The lake is fringed by emergent vegetation such as cattail, and beyond the shoreline the land is forested. Softwood forests, comprised mainly of black spruce, cedar and tamarack occur on the east and south side of the lake, whereas the west and north sides of the lake contain hardwood forests comprised of aspen, Manitoba maple, and green ash.

The diversity of habitat in the area adjacent to the well site provides suitable habitat for a wide range of wildlife species. A total of 313 wildlife species are known to occur or possibly occur within the entire study area (Appendix B). These include 16 species of amphibians and



Photo 5. Mixedwood forest of white birch and eastern white cedar within the 3.2 km radius of the pumping well site, September 8 2005.



Photo 6. Pocock Lake within the Pocock Lake Ecological Reserve, September 7 2005.

reptiles, 54 mammal species and 243 species of birds. Suitable habitat exists for numerous forest-dependent species including wood warblers, woodpeckers and forest raptors such as the broad-winged hawk and barred owl. Wetland areas and forest swamps enhance the overall diversity of habitat and species, supporting amphibians such as the wood frog, as well as numerous waterfowl for both migration and breeding and wetland associated mammals like beaver, muskrat and water shrews. Small forest clearings provide edge habitat as well as open habitat that support edge dependent species such as the red fox and the clay-colored sparrow.

2.3.3 Pipeline Route

The proposed pipeline route occurs within existing PR and PTH ROWs for its entire length other than an approximately 1 km section north of the town of Sandilands. These PR and PTH ROWs are previously disturbed and in most cases highly managed areas, and therefore provide very limited quality wildlife habitat. In contrast, the Sandilands bypass occurs within an undeveloped forested area.

Well site to PTH 12

The proposed pipeline route occurs within the road side ditch of PR 404 from the well site to approximately 1 km north of the town of Sandilands, where the route aligns west to bypass the community and rejoin PR 404, continuing to the junction with PTH 12.

This section of the Project route occurs in a forest landscape, composed predominantly of jack pine. Wetlands and water bodies are absent from this section of the route, and the habitat is generally uniform. The ROW consists of a road side ditch, maintained to low vegetation, such as grass and forbs (Photo 2). The large areas of native forests support forest-dependent species of wildlife. The ROW presents a break in the forest habitat and provides habitat for wildlife species that prefer forest edge habitat such as clay-colored sparrows or whitetail deer. Such linear openings in forest landscapes are also often used as movement corridors for both small species and large mammals such as whitetail deer and moose. However, such breaks in the forest are typically avoided by forest interior species.

The approximately 1 km long bypass north of Sandilands bisects predominately jack pine forest with a small amount of trembling aspen (Table 2). This area was not surveyed, but similar forest habitat approximately 2 km north was surveyed in early June. Bird species observed at this site included typical conifer and mixedwood associated species such as ovenbird, white-throated sparrow, red-eyed vireo, spruce grouse and brown creeper. Other forest associated wildlife such as black bear and marten likely make use of the bypass area as well.

PTH 12 to La Rochelle

The landscape along this section of the proposed pipeline route consists of rolling land with livestock pastures, annual and perennial agricultural crops, bluffs of forest, and willow and cattail wetlands. The open habitat within the ROW parallel to the PR's and PTH's presents

suitable habitat for edge dependent species. The section of the Project route that is along PTH 12 ROW generally represents poor wildlife habitat, as the roadside ditch is a highly disturbed and a highly managed area, and occurs immediately adjacent to a major provincial highway. The few species of wildlife that may use this area are limited to roadside scavengers, but may also be used for hunting by raptorial birds such as red-tailed hawks or great gray owls.

The ROW adjacent to PR 403 is less disturbed and provides habitat of slightly higher quality than that adjacent to PTH 12. In particular, extensive areas of willow marshes occur adjacent to PR 403 and wildlife species that make use of these marshes may also use the roadside ditch to some extent. In many cases the road side ditches contained water and wetland vegetation, making them somewhat suitable for species such as wood and boreal chorus frogs or red-winged blackbirds.

North of St. Malo adjacent to PTH 59, a relatively broad, well vegetated wetland occurs on both sides of the road (Photo 7). This wetland drains into the nearby Rat River, and provides habitat for wetland species of wildlife, such as sora, possibly yellow rail, LeConte's sparrow, and northern leopard frogs.



Photo 7. Unnamed creek and associated wetland within proposed pipeline route adjacent to PTH 59 north of St. Malo, July 27 2005.

La Rochelle to Morris

West of the Rat River, the proposed route enters a flat landscape that is dominated by annual agricultural crop production. The agricultural lands are primarily cropland and to a lesser

extent hayland. The cropland offers little value to wildlife in this area, other than serving as hunting grounds for some species of birds of prey such as red-tailed hawks, or as feeding areas for migratory waterfowl. In general this area contains little perennial cover, with the road side ditches providing some of this habitat type in the area. These grassed ditches may be used by a few grassland bird species, such as savannah sparrow or western meadowlark, and areas that contain water likely support wood frogs.

The Project route passes through hardwood riparian forests of the Rat, Marsh and Red rivers (Photo 8). The Project route in these forested areas has been cleared of forest cover and is managed to a land cover of grasses and forbs. These areas would attract edge dependent wildlife species and also serve as a movement corridor for some wildlife species. Riparian areas generally support a large diversity and abundance of species, due to high productivity and ecotone with the aquatic habitat. The undisturbed stream banks would provide semi-aquatic wildlife, such as otter or mink, with suitable habitat within the ROW.



Photo 8. Upstream view of the Rat River and riparian forest from PTH 23, July 27 2005.

2.4 AQUATIC RESOURCES

The Project area is almost entirely contained within the Red River watershed. The exception is the proximity of the pumping well site to the headwaters of the Whitemouth River division of the Winnipeg River watershed (Fedoruk 1970). Other than the Whitemouth River headwaters, all surface water in the Project area flows west to the Red River. Within the eastern extent of the Project area, water bodies consist of small headwater creeks and

wetlands, and these headwater creeks increase in size with increasing distance from the well site until reaching the Red River.

2.4.1 Methods

2.4.1.1 Fish Habitat

Fish habitat is found in a wide variety of water bodies, such as lakes, reservoirs, rivers, streams, creeks, marshes, ponds and swamps. According to the *Fisheries Act*, any place that fish depend upon for their requirements of food, shelter, water, reproduction, and growth is considered to be fish habitat. Habitat requirements particular to a species can change at each stage of its life cycle. For example, habitat requirements for spawning will often be significantly different than those required for feeding. Thus, one species of fish may require a wide variety of habitats to successfully complete its life cycle. Fish habitat in the project area is largely restricted to the main water ways, including Joubert Creek, and the Rat, Marsh and Red rivers. There are numerous small creeks and drains within the Project area that may provide seasonal fish habitat as well. The ephemeral creeks at the eastern portion of the study area only receive significant flow during spring, and therefore fish use is limited to spring and perhaps part of summer.

An assessment of fish habitat was conducted for all water bodies occurring along the proposed pipeline route, 25 – 27 July 2005. Each watercourse crossing was located and marked on 1:50,000 topographic map and classified by watershed size. Universal Transverse Mercator (UTM) co-ordinates were determined for each site. Watercourse names were determined from 1:50,000 topographic maps.

A site description was provided for each site. The following information was collected to describe the stream morphology and fish habitat:

- stream order;
- watershed size;
- channel width;
- wetted width;
- maximum depth;
- stage;
- sign of flood above surveyed stage;
- slope gradient;
- velocity characteristics;
- cover type and composition;

- habitat type;
- bottom contour;
- substrate type;
- substrate compaction;
- riparian vegetation;
- aquatic vegetation; and
- unique features.

Aquatic habitat sensitivity to disturbance was classified on the following criteria:

- Potential for erosion on steep slopes as a consequence of disturbing the vegetation cover during construction activity;
- Potential for rutting lowland sites (marshes) adjacent to watercourses by heavy vehicles which could also initiate erosion of underlying organic soils;
- Potential for increased local and downstream suspended and streambed sediment burdens resulting from increased bank erosion;
- Potential loss of cover along stream margins due to removal of or damage to riparian vegetation;
- Potential for stream blockage and impediment to fish passage resulting from introduction of slash material and other debris into watercourses; and
- Potential consequences of the introduction of pollutants such as fuels and lubricants into watercourses, directly or indirectly via the floodplain, from vehicles during construction and maintenance activities.

Based on these considerations sensitivity was classified as none, low, moderate or high.

Potential fish utilization of habitat 50 m upstream and downstream of each site was determined from observations and from study area characterization information. Potential utilization was described for adult and juvenile large-bodied species, such as northern pike, walleye, and suckers, and for small-bodied species such as minnows (Cyprinidae), and sticklebacks (Gasterosteidae). For large-bodied species the habitat was assessed in terms of its potential to provide spawning, rearing, and over-wintering habitat and/or a migratory route. For small-bodied species, habitat was assessed for relative overall quality and the potential for open-water and winter utilization.

An aquatic habitat value classification was assigned to each site based on potential fish utilization and criteria developed by Fisheries & Oceans Canada (1998). Habitats that were considered to be rare and/or highly productive, and/or supported particularly sensitive life stages of fish or provided vital spawning habitat were designated as “critical”. Habitats

considered to be utilized by fish for feeding, growth and migration but not absolutely essential to survival were designated as “important”. Habitats with a low productive capacity and where fish were not expected to be found during most times of the year were designated as “marginal”. Habitats where fish were not expected to be found at any time of the year were designated as “no fish habitat”.

Field investigations of fish species abundance and distribution were not conducted as part of this assessment. Species occurrence within the study area is therefore based on existing information.

2.4.1.2 Water Chemistry

Water chemistry measurements were conducted in surface waters adjacent to the pumping well site to provide baseline information on water chemistry in the area. The pumping well is within the headwaters of the Seine, Rat and Whitemouth river watershed divisions. Water chemistry was measured within two headwater tributaries of St. Labre Creek in the vicinity of Kerry, the headwater area of Sand River, and Pocock Lake. Water chemistry parameters measured included:

in situ parameters

- Dissolved Oxygen
- Temperature
- Turbidity
- pH
- Specific Conductance

Measurements of *in situ* parameters were made at mid-depth using a Horiba U-10 Water Quality Checker.

Water samples collected for laboratory analysis were collected and stored in the dark at 4°C, and shipped Envirotest Laboratories within 24 hours of collection. Parameters analyzed included:

- Dissolved Ammonia - low range
- Dissolved Nitrate/nitrite - low range
- TKN
- DOC
- TOC
- Conductance
- pH
- Dissolved Phosphorus
- Total Phosphorus
- TSS - Low range
- Turbidity
- Chlorophyll a
- Total Metals by ICP-MS + major ions

- Mercury
- Hardness
- Alkalinity
- TDS
- Pheophytin

2.4.2 Fish Habitat

Fish habitat was assessed at 16 stream crossing locations occurring along the proposed pipeline route. Water bodies ranged in size from small headwater creeks and wetland complexes (Photo 9) that provide marginal or no fish habitat, to larger creeks such as Joubert Creek (Photo 10), and small and large rivers such as the Rat and Red rivers (Photo 11) that provide year-round habitat for a range of species and life stages.



Photo 9. Unnamed Creek (PVWC-4) that provides local drainage of wetlands. The creek crosses PTH 12 southeast of PR 403. Photo taken July 25 2005.



Photo 10. Joubert Creek (PVWC-9) at PR 403 crossing, July 27 2005.



Photo 11. Rat River (PVWC-12) crossing at PTH 23, July 27 2005.

Table 3. Fish habitat value and habitat sensitivity ratings at stream crossing sites along the Pembina Valley Water Cooperative pipeline route. Detailed stream crossing assessments area available in Appendix D.

Stream Name	ID	Fish Habitat Value	Rationale	Aquatic Habitat Sensitivity	Rationale
Unnamed Creek	PVWC-1	Marginal	- potential habitat for small-bodied species - low fall and winter water levels - channelized	Low	- low stream gradient - stable banks
Unnamed Creek	PVWC-2	Marginal	- potential habitat for small-bodied species - low fall and winter water levels - heavy instream vegetation - channelized	Low	- low stream gradient - heavy instream vegetation - stable banks
Joubert Creek	PVWC-3	Marginal	- potential habitat for small and large bodied species - low fall and winter water levels - heavy instream vegetation - channelized	Low	- low stream gradient - heavy instream vegetation - stable banks
Unnamed Creek	PVWC-4	No Fish Habitat	- no apparent connection to fish bearing waters - flows within roadside ditch - no water in creek	Low	- low stream gradient - heavy instream vegetation - stable banks
Unnamed Creek	PVWC-5	No Fish Habitat	- no apparent connection to fish bearing waters - flows within roadside ditch	Low	- low stream gradient - heavy instream vegetation - stable banks
Unnamed Creek	PVWC-6	Marginal	- potential habitat for small-bodied species - low fall and winter water levels - heavy instream vegetation	Low	- low stream gradient - heavy instream vegetation - stable banks
Unnamed Creek	PVWC-7	Marginal	- potential habitat for small-bodied species - channelized and excavated into livestock dugout - low water levels throughout much of the year	Low	- low stream gradient - heavy instream vegetation - stable banks
Unnamed Creek	PVWC-8	Marginal	- potential habitat for small-bodied species - low summer, fall and winter water levels	Low	- low stream gradient - stable banks
Joubert Creek	PVWC-9	Important	- diverse habitat for small and large bodied species - potential low winter water levels - spring spawning habitat for large-bodied species	Low	- low stream gradient - fine instream sediments - stable banks

Stream Name	ID	Fish Habitat Value	Rationale	Aquatic Habitat Sensitivity	Rationale
Coulée des Nault	PVWC-10	Marginal	- potential habitat for small and large bodied species - low fall and winter water levels - heavy instream vegetation - channelized	Low	- low stream gradient - heavy instream vegetation - stable banks
Unnamed Creek	PVWC-11	Marginal	- potential habitat for small-bodied species - low fall and winter water levels - heavy instream vegetation	Moderate	- low stream gradient - heavy instream vegetation - saturated banks susceptible to rutting and erosion
Rat River	PVWC-12	Important	- diverse habitat for small and large bodied species - habitat suitable throughout the year	Moderate	- low stream gradient - fine instream sediments - saturated floodplain susceptible to rutting
Unnamed Creek	PVWC-13	Important	- off-current deep pool habitat - close proximity to confluence with Rat River	Low	- low stream gradient - heavy instream vegetation - stable banks
Unnamed Creek	PVWC-14	Marginal	- potential habitat for small and large bodied species - low fall and winter water levels - heavy instream vegetation - channelized	Low	- low stream gradient - heavy instream vegetation - stable banks
Marsh River	PVWC-15	Important	- diverse habitat for small and large bodied species - abundant fish cover - habitat possibly suitable throughout the year	Low	- low stream gradient - heavy instream vegetation - stable banks
Red River	PVWC-16	Important	- diverse habitat for small and large bodied species - abundant fish cover - habitat suitable throughout the year	Low	- low stream gradient - stable banks

Based on stream crossing assessments, fish habitat ranged from “no fish habitat” in small creeks/drains that provide local drainage but contain no connection to fish bearing waters; to “marginal” fish habitat in streams and wetlands that likely support small-bodied species of fish for at least part of the year; and “important” fish habitat where a number of life stages can be fulfilled by a diversity of species of fish. “Critical” fish habitat was not identified at any of the watercourse crossings along the route. Sensitivity of aquatic habitat was assessed as either low or moderate, with no crossing locations assessed with high aquatic habitat sensitivity. A summary of habitat sensitivities and fish habitat values at each crossing is provided in Table 3 and detailed stream crossing assessments are available in Appendix D.

2.4.2.1 Fish Species Utilization

Fifty three fish species are known to, or potentially occur within water bodies in the Project area (Appendix C). The large diversity of fish species is a reflection of the diversity of the fish fauna in the Red River and the lower reaches of its tributaries. In contrast, fish species diversity in the small headwater creeks and wetlands in the eastern half of the Project area would be limited to a number of small-bodied species (minnows) and possibly large-bodied species such as northern pike or white sucker.

2.4.3 Water Chemistry

Water chemistry was assessed at four sites in proximity to the pumping well site (Photo’s 6, 12 and 13). These included headwater streams of the Rat River (Sand River), Whitemouth River (St. Labre Creek tributaries), and Seine River (Pocock Lake). *In situ* measurements are presented in Table 4, and results from laboratory analysis are available in Appendix E.

The Manitoba Water Quality dissolved oxygen objective for the protection of mature life stages of cool-water species is 5.0 mg/l for an instantaneous reading (Williamson 2002). Dissolved oxygen levels greater than or equal to 5.0 mg/l were observed in all water bodies sampled other than site SLT3 on a small headwater tributary of St. Labre Creek near the village of Kerry.

Table 4. Water chemistry parameters measured *in situ* in water bodies adjacent to the pumping well site.

Water Body	Site	Depth (m)	pH	Cond. (: s)	Turbidity (NTU)	Dissolved O ₂ (mg/l)	Temp. (°C)
Sand River	SR1	0.25	8.27	292	56	5.60	12.2
St. Labre Cr. Trib.	SLT2	0.80	8.60	347	17	7.06	14.3
St. Labre Cr. Trib.	SLT3	0.80	8.35	203	5	2.47	14.8
Pocock Lake	PL1	1.0	9.1	240	5	10.70	20.0



Photo 12. Water quality sampling site (SLT2) on a small headwater tributary of St. Labre Creek, near the community of Kerry, September 7 2005.



Photo 13. Water quality sampling site (SLT3) on a small headwater tributary of St. Labre Creek, near the community of Kerry, September 7 2005.

2.5 SPECIES AT RISK

Manitoba indigenous species of plants and animals that are at risk of extirpation or extinction receive protection under the Manitoba *Endangered Species Act* (MESA) and/or the Canadian *Species at Risk Act* (SARA). The purpose of these two pieces of legislation is to prevent species from becoming extinct; to facilitate the recovery of species determined to be at risk; and to encourage the management of species to prevent them from becoming at risk. The MESA and SARA provide protection for species of indigenous organisms that are considered “Endangered”, where the species is in imminent danger of extinction, or species considered “Threatened”, where the species is likely to become endangered. The SARA also identifies species that are of “Special Concern” due to the combination of biological factors and threats that put a species at risk of becoming Threatened or Endangered. However, protection under SARA is not afforded to species designated as Special Concern. Currently, the SARA lists species on Schedules 1, 2 and 3, and it is only species listed on Schedule 1 that are afforded protection under the *Act*. Species listed on Schedule 2 or 3 of SARA are either awaiting review by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or final recommendation by the Minister as to listing under the *Act*.

2.5.1 Methods

Prior to the field season a literature search provided a list of vascular plants protected under SARA and MESA. This included a search of the MB Conservation Data Centre (CDC) database for known occurrences of plant and animals species listed under SARA or MESA. In addition, the CDC produced lists of plant and animal species of concern for each ecoregion that the general study area intersects. Herbaria records were searched for blooming dates and habitat information for the species of concern. A request was made to the CDC for records of plants of conservation concern known to occur adjacent to the pumping well site and the proposed pipeline route.

A list of animal species listed under SARA or MESA that, based on distributions and habitat preferences, potentially occurring in the study area was prepared. The potential for these species to be found within the Project area was then assessed. Formal surveys for animal species at risk were not conducted.

2.5.1.1 Field Surveys

Three surveys were conducted during the growing season to be able to identify species at the peak of blooming period. Field trips were scheduled to coincide with the blooming dates for the endangered and threatened plants protected by both acts. Surveys were done in early June, mid July and early September. Due to the size of the potential draw down cone (3.2 km radius) this area was not surveyed in its entirety. The section of the proposed route that bypasses Sandilands was not surveyed for reasons discussed previously, but an area with similar habitat was surveyed during late July.

2.5.2 Well Site

Currently no plants or animals listed as Threatened or Endangered by SARA or MESA have been recorded in the area of the well site and there were no observations of these species during the field studies. However, based on species distributions and habitat preferences, one animal species considered at risk potentially occurs within 3.2 km of the pumping well site (Table 5).

The least bittern (*Ixobrychus exilis*), listed as Threatened on Schedule 1 of SARA, inhabits freshwater marshes with abundant emergent vegetation such as cattail as well as woody vegetation (Manitoba Naturalists 2003, Environment Canada 2005). Field surveys were not conducted for this species, but Pockock Lake may provide suitable habitat for least bitterns.

Although not afforded protection under SARA, three animal species listed as Special Concern are known to or potentially occur adjacent to the pumping well site.

The monarch (*Danaus plexippus*), listed as Special Concern on Schedule 1 of SARA, is a widespread species, closely associated with species of the milkweed plant (Environment Canada 2005). Monarchs likely occur in open habitats where milkweed plants grow.

The northern leopard frog (*Rana pipiens*), listed as Special Concern on Schedule 1 of SARA, is widespread over the southern two-thirds of the province, inhabiting streams, ponds, wetlands, wet meadows and forests with abundant aquatic vegetation during the summer (Preston 1982, Russell and Bauer 1993). Although not observed during field studies, leopard frogs may occur in and around Pockock Lake.

The red-headed woodpecker (*Melanerpes erythrocephalus*), listed as Special Concern on Schedule 3 of SARA, is a migratory woodpecker species that occupies sparsely treed deciduous stands, woodlots and farmyards that contain an abundance of snags (Manitoba Naturalists 2003, Environment Canada 2005). Suitable habitat for this species occurs in the area east of the pumping well near Kerry.

2.5.3 Pipeline Route

The proposed pipeline route occurs within existing PR and PTH ROWs for its entire length other than an approximately 1 km section north of the town of Sandilands. These PR and PTH ROWs are previously disturbed and in most cases highly managed areas, and therefore provide very limited quality habitat for species at risk.

No plant or animal species listed as Threatened or Endangered under either SARA or MESA are known to occur or were recorded along the proposed pipeline route. However, five plant species and two animal species listed as Threatened or Endangered by SARA or MESA potentially occur along the proposed pipeline route (Table 5). These include:

Western prairie fringed orchid (*Platanthera praeclara*), listed as Endangered under SARA and MESA, is known to occur in one location in Canada, the Vita/Stuartburn area. Its

occurrence in Manitoba marks the northern edge of its range in North America. Most of the known population of this species is protected in the Tall Grass Prairie Preserve.

Small white lady's-slipper (*Cypripedium candidum*), listed as Endangered under SARA and MESA, is found in several locations in southern Manitoba in tall grass prairie, mixed grass prairie and roadside ditches. Remnant populations of these orchids are protected on municipal and private land and in the Tall Grass Prairie Preserve near Tolstoi, Manitoba.

Great plains ladies' tresses (*Spiranthes magnicamporum*), listed as Endangered under MESA, is found in southeastern Manitoba in tall grass prairie and adjacent ditches in the Stuartburn area. A population of these orchids is protected in the Tall Grass Prairie Preserve.

Western silvery aster (*Aster sericeus*), listed as Threatened under MESA and Special Concern by SARA, is found in several locations in southern Manitoba in dry prairie and on wooded gravel ridges.

Riddell's goldenrod (*Solidago riddellii*), listed as Threatened by MESA, is found in tall grass prairie.

In May 2005, COSEWIC recommended that the western population of the lake sturgeon (*Acipenser fulvescens*) be listed as Endangered under SARA; however, official status under SARA is pending public consultation. Lake sturgeon are known to occur within the Red River and its tributaries (Stewart and Watkinson 2004).

The least bittern (*Ixobrychus exilis*), listed as Threatened by SARA, inhabits freshwater marshes with abundant emergent vegetation (Manitoba Naturalists 2003, Environment Canada 2005). Suitable habitat for this species occur primarily along the eastern half of the proposed pipeline route, particularly along PTH 59 north of St. Malo and numerous wetlands adjacent to PR 403.

Although not afforded protection under SARA, seven animal species listed as Special Concern are known to or potentially occur along the proposed pipeline route.

The monarch, listed as Special Concern on Schedule 1 of SARA, is a widespread species, closely associated with species of the milkweed plant (Environment Canada 2005).

The silver chub (*Macrhybopsis storeriana*), listed as Special Concern on Schedule 1 of SARA, prefers large rivers with moderate water velocity and sand or gravel substrate. There are known occurrences of this species from the Morris River (Manitoba Conservation 2005), and suitable habitat exists within the Red River, Rat River and potentially the Marsh River.

The bigmouth buffalo (*Ictiobus cyprinellus*), listed as Special Concern on Schedule 3 of SARA, prefers large slow-moving rivers. This species has been recorded in the Red River (Stewart and Watkinson 2004).

The northern leopard frog, listed as Special Concern on Schedule 1 of SARA, is widespread over the southern two-thirds of the province, inhabiting streams, ponds, wetlands, wet

meadows and forests with abundant aquatic vegetation during the summer (Preston 1982, Russell and Bauer 1993). During field investigations, leopard frogs were observed within the PTH 59 ROW north of St. Malo adjacent to a large wetland, as well as along the shore of the Rat River at the PTH 23 crossing. Leopard frogs hibernate in small circular excavations in the surface of the soft substrates of lakes, large creeks, rivers and deep ponds with migration to over-wintering sites beginning in early September (Preston 1982, Environment Canada 2005). Leopard frogs may use the Red, Marsh and Rat rivers to over winter.

The short-eared owl (*Asio flammeus*), listed as Special Concern on Schedule 3 of SARA, is a migratory owl species, breeding primarily in extensive grasslands and dense wetlands in the southern third of the province as well as tundra in the north and over-wintering in the United States (Manitoba Naturalists Society 2003). This species may be found within large wetland complexes as well as pastures along PR 403.

The yellow rail (*Coturnicops noveboracensis*), listed as Special Concern on Schedule 1 of SARA, is a marsh bird, breeding in shallow grass, sedge and cattail marshes, and wintering in the southeastern United States (Manitoba Naturalists 2003, Environment Canada 2005). Suitable yellow rail habitat occurs within a large wetland north of St. Malo adjacent to PTH 59, as well as within numerous wetlands adjacent to PR 403 and wetland habitat along the Marsh River.

The red-headed woodpecker, listed as Special Concern on Schedule 3 of SARA, is a migratory woodpecker species and occupies sparsely treed deciduous stands, woodlots and farmyards that contain an abundance of snags (Manitoba Naturalists 2003, Environment Canada 2005). Woodlots within livestock pastures adjacent to PR 403 and PTH 12 provide habitat suitable for this species.

Table 5. Species listed at risk by SARA or MESA and the likelihood of occurrence within the Project area.

Species	Species at Risk Act	Manitoba Endangered Species Act	Likelihood of Occurrence	
			Well	Pipeline
Plants				
Small White Lady's-slipper	Endangered	Endangered	n/a	Low
Western Prairie Fringed Orchid	Endangered	Endangered	n/a	Low
Great Plains Ladies' Tresses	Not Listed	Endangered	n/a	Low
Western Silvery Aster	Special Concern	Threatened	n/a	Low
Riddell's Goldenrod	Not Listed	Threatened	n/a	Low
Insects				
Monarch	Special Concern	Not Listed	Moderate	Moderate
Amphibians and Reptiles				
Northern Leopard Frog	Special Concern	Not Listed	Moderate	High ²
Fish				
Lake Sturgeon	Endangered*	Not Listed	n/a	Moderate
Silver Chub	Special Concern	Not Listed	n/a	Moderate
Bigmouth Buffalo	Special Concern ¹	Not Listed	n/a	Moderate
Birds				
Short-eared Owl	Special Concern ¹	Not Listed	n/a	Moderate
Least Bittern	Threatened	Not listed	Low	Low
Yellow Rail	Special Concern	Not Listed	n/a	Moderate
Red-headed Woodpecker	Special Concern ¹	Not Listed	Moderate	Moderate

* Recommended by COSEWIC in 2005; awaiting public consultation.

¹ Currently on Schedule 3 of the *Species at Risk Act*

² Observed during field reconnaissance

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4.0 Appendices

Appendix A. Plant species recorded within Pembina Valley Water Cooperative Project study area.

Scientific Name	Common Name	MB CDC S Rank*
<i>Abies balsamea</i> (L.) Mill.	Balsam Fir	S5
<i>Acer negundo</i> L.	Manitoba Maple	S5
<i>Acer spicatum</i> Lam.	Mountain Maple	S5
<i>Achillea millefolium</i> L.	Common Yarrow	S5
<i>Agastache foeniculum</i> (Pursh) Ktze.	Giant Hyssop	S4S5
<i>Agoseris glauca</i> (Pursh) Raf.	False Dandelion	S5?
<i>Agrimonia striata</i> Michx.	Agrimony	S4
<i>Agropyron repens</i> (L.) Beauv.	Couch Grass	SE
<i>Agropyron trachycaulum</i> (Link) Malte	Slender Wheat-grass	S?
<i>Agrostis hiemalis</i> (Walt.) BSP.	Tickle Grass	S5
<i>Agrostis stolonifera</i> L.	Red Top	SE
<i>Alisma plantago-aquatica</i> L.	Water Plantain	S5
<i>Alnus crispa</i> (Ait.) Pursh	Green Alder	S5
<i>Alnus rugosa</i> (Du Roi) Spreng.	Speckled Alder	S5
<i>Ambrosia psilostachya</i> DC.	Perennial Ragweed	S5
<i>Amelanchier alnifolia</i> Nutt.	Saskatoon	S5
<i>Amorpha nana</i> Nutt.	Fragrant False Indigo	S4
<i>Andromeda glaucophylla</i> Link	Bog Rosemary	S4
<i>Andropogon gerardii</i> Vitman	Big Bluestem	S4
<i>Anemone canadensis</i> L.	Canada Anemone	S5
<i>Anemone multifida</i> Poir.	Cut-leaved Anemone	S4S5
<i>Anemone patens</i> L..	Prairie Crocus	S5
<i>Anemone quinquefolia</i> L.	Wood Anemone	S5
<i>Antennaria neglecta</i> Greene	Pussy-toes	S5
<i>Apocynum cannabinum</i> L.	Indian Hemp	S4
<i>Aquilegia canadensis</i> L..	Wild Columbine	S5
<i>Aralia nudicaulis</i> L.	Wild Sarsaparilla	S5
<i>Arctium</i> sp.	Burdock	SE
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	Bearberry	S5
<i>Arenaria lateriflora</i> L.	Blunt-leaved Sandwort	S5
<i>Artemisia biennis</i> Willd.	Biennial Wormwood	S5
<i>Artemisia campestris</i> L.	Plains Wormwood	S5?
<i>Asarum canadense</i> L.	Wild Ginger	S3?
<i>Asclepias incarnata</i> L.	Swamp Milkweed	S4
<i>Asclepias speciosa</i> Torr.	Showy Milkweed	S4
<i>Aster ericoides</i> L.	Many-flowered Aster	S4
<i>Aster lanceolatus</i> Willd.	Calico Aster	S5
<i>Aster nova-angliae</i> L.	New England Aster	S4
<i>Aster simplex</i> Willd.	Small Blue Aster	S5
<i>Astragalus agrestis</i> Dougl.	Milk Vetch	S5
<i>Astragalus canadensis</i> L.	Canadian Milk Vetch	S5
<i>Beckmannia syzigachne</i> (Steud.) Fern.	Slough Grass	S5
<i>Betula papyrifera</i> Marsh.	Paper Birch	S5
<i>Betula pumila</i> L. var. <i>glandulifera</i>	Swamp Birch	S5

Scientific Name	Common Name	MB CDC S Rank*
Regel		
<i>Botrychium virginianum</i> (L.) Sw.	Virginia Grape Fern, Rattlesnake Fern	S5
<i>Bromus ciliatus</i> L.	Fringed Brome	S5
<i>Bromus inermis</i> Leyss.	Smooth Brome	SE
<i>Calamagrostis canadensis</i> (Michx.) Nutt.	Reed Grass	S5
<i>Caltha palustris</i> L.	Marsh Marigold	S5
<i>Campanula rotundifolia</i> L.	Harebell	S5
<i>Carex aquatilis</i> Wahl.	Water Sedge	S5
<i>Carex assiniboinensis</i> Boott.	Assiniboia Sedge	S3S4
<i>Carex aurea</i> Nutt.	Golden Sedge	S5
<i>Carex eburnea</i> Boott	Bristle-leaved Sedge	S4S5
<i>Carex granularis</i> Muhl.	Granular Sedge	S4
<i>Carex lanuginosa</i> Michx.	Woolly Sedge	S5
<i>Carex pseudo-cyperus</i> L.	Cyperus-like Sedge	S4
<i>Carex scirpoidea</i> Michx.	Rush-like Sedge	S5
<i>Carex</i> sp.	Sedge	
<i>Ceanothus herbaceus</i> Raf.	New Jersey Tea	S2S3
<i>Celastrus scandens</i> L.	Bittersweet	S4
<i>Cicuta bulbifera</i> L.	Water Hemlock	S5
<i>Cinna latifolia</i> (Trev.) Griseb.	Slender Woodgrass	S5
<i>Circaea alpina</i> L.	Small Enchanter's Nightshade	S5
<i>Cirsium arvense</i> (L.) Scop.	Canada Thistle	SE
<i>Clintonia borealis</i> (Ait.) Raf.	Bluebead Lily	S4?
<i>Comandra umbellata</i> (L.) Nutt.	Bastard Toadflax	S5
<i>Convolvulus sepium</i> L.	Hedge Bindweed	S4S5
<i>Coptis trifolia</i> (L.) Salisb.	Goldthread	S5
<i>Corallorhiza trifida</i> Chat.	Early Coralroot	S5
<i>Cornus alternifolia</i> L.f.	Alternate-leaved Dogwood	S2S3
<i>Cornus canadensis</i> L.	Bunchberry	S5?
<i>Cornus stolonifera</i> Michx.	Red-osier Dogwood	S5
<i>Corydalis sempervirens</i> (L.) Pers.	Pink Corydalis	S4S5
<i>Corylus cornuta</i> Marsh.	Beaked Hazelnut	S5
<i>Crataegus</i> sp.	Hawthorn	
<i>Cypripedium arietinum</i> R. Br.	Ram's Head Lady's-slipper	S2?
<i>Cypripedium calceolus</i> L. var. <i>parviflorum</i> (Salisb.) Fern.	Small Yellow Lady's-slipper	S4
<i>Cypripedium reginae</i> Walt.	Showy Lady's-slipper	S3?
<i>Diervilla lonicera</i> Mill.	Bush Honeysuckle	S5
<i>Echinochloa crusgalli</i> (L.) Beauv.	Barnyard Grass	SE
<i>Echinocystis lobata</i> (Michx.) T.&G.	Wild Cucumber	S5
<i>Eleocharis palustris</i> (L.) R.&S.	Creeping Spike-rush	S5
<i>Epilobium angustifolium</i> L.	Fireweed	S5
<i>Epilobium palustre</i> L.	Marsh Willowherb	S5
<i>Equisetum arvense</i> L.	Common Horsetail	S5
<i>Equisetum fluviatile</i> L.	Swamp Horsetail	S5
<i>Equisetum hyemale</i> L. ssp. <i>affine</i> (Engelm.) Stone	Common Scouring-rush	S5
<i>Equisetum sylvaticum</i> L.	Woodland Horsetail	S5
<i>Erigeron strigosus</i> Muhl.	Daisy Fleabane	S4S5
<i>Eupatorium purpureum</i> L. var. <i>purpureum</i>	Joe-Pye-Weed	SR

Scientific Name	Common Name	MB CDC S Rank*
<i>Euphorbia esula</i> L.	Leafy Spurge	SE
<i>Festuca</i> sp.	Fescue	
<i>Fragaria virginiana</i> Dcne.	Smooth Wild Strawberry	S5
<i>Fraxinus pennsylvanica</i> Marsh.	Green Ash	S5
<i>Galium boreale</i> L.	Northern Bedstraw	S5
<i>Galium triflorum</i> Michx.	Sweet-scented Bedstraw	S5
<i>Gaultheria hispidula</i> (L.) Bigel.	Creeping Snowberry	S5
<i>Gaultheria procumbens</i> L.	Wintergreen	S3S4
<i>Geranium bicknellii</i> Britt.	Bicknell's Geranium	S5
<i>Glyceria grandis</i> Wats.	Tall Manna Grass	S5
<i>Glycyrrhiza lepidota</i> Pursh	Wild licorice	S5
<i>Grindelia squarrosa</i> (Pursh) Dunal	Gumweed	S5
<i>Helianthus maximilianii</i> Schrad.	Narrow-leaved Sunflower	S5
<i>Heuchera richardsonii</i> R Br.	Alumroot	S5
<i>Hierochloa odorata</i> (L.) Beauv.	Sweet Grass	S5
<i>Hippurus vulgaris</i> L.	Mare's-tail	S5
<i>Hordeum jubatum</i> L.	Foxtail	S5
<i>Impatiens capensis</i> Meerb.	Spotted Touch-me-not	S5
<i>Iris versicolor</i> L.	Blue Flag	S4
<i>Juncus balticus</i> Willd.	Baltic Rush	S5
<i>Juncus nodosus</i> L.	Knotted Rush	S5
<i>Juniperus communis</i> L.	Low Juniper	S5
<i>Juniperus horizontalis</i> Moench.	Ground Juniper	S5
<i>Lactuca tatarica</i> (L.) Meyer	Blue Lettuce	S4S5
<i>Larix laricina</i> (Du Roi) Koch	Tamarack	S5
<i>Lathyrus ochroleucus</i> Hook.	Cream-coloured Vetchling	S4S5
<i>Ledum groenlandicum</i> Oeder.	Labrador Tea	S5
<i>Liatris ligulistylis</i> (Nels.) Schum.	Blazing star	S4
<i>Linnaea borealis</i> L.	Twinflower	S5
<i>Listera cordata</i> (L.) R. Br.	Heart-leaved Twayblade	S4?
<i>Lithospermum canescens</i> (Michx.) Lehm.	Hoary Puccoon	S5
<i>Lobelia spicata</i> Lam.	Spiked Lobelia	S4
<i>Lonicera dioica</i> L.	Twining Honeysuckle	S5
<i>Lonicera oblongifolia</i> (Goldie) Hook.	Swamp Ffly Honeysuckle	S4
<i>Lotus corniculatus</i> L.	Bird's-foot Trefoil	SE
<i>Lycopodium dendroideum</i> Michx.	Ground Pine	S5
<i>Lycopus asper</i> Greene	Western Water-horehound	S4
<i>Maianthemum canadense</i> Desf.	Wild Lily-of-the-valley	S5
<i>Matteuccia struthiopteris</i> (L.) Todaro	Ostrich Fern	S5
<i>Medicago lupulina</i> L.	Black Medic	SE
<i>Medicago sativa</i> L.	Alfalfa	SE
<i>Melampyrum lineare</i> Desr.	Cow Wheat	S5
<i>Melilotus alba</i> Desr.	White Sweet Clover	S?
<i>Melilotus officinale</i> (L.) Pallas	Yellow Sweet Clover	SE
<i>Mentha arvensis</i> L.	Common Mint	S5?
<i>Menyanthes trifoliata</i> L.	Bogbean	S5
<i>Mitella nuda</i> L.	Bishop's Cap	S5
<i>Monarda fistulosa</i> L.	Wild Bergamot	S5
<i>Myriophyllum</i> sp.	Milfoil	
<i>Oenothera biennis</i> L.	Evening Primrose	S5

Scientific Name	Common Name	MB CDC S Rank*
<i>Oryzopsis asperifolia</i> Michx.	Mountain Rice Grass	S5
<i>Parnassia palustris</i> L.	Grass-of-Parnassus	S5
<i>Pedicularis canadensis</i> L.	Common Lousewort	S3S4
<i>Petalostemum purpureum</i> (Vent.) Rydb.	Purple Prairie-clover	S4
<i>Petasites palmatus</i> (Ait.) Gray	Palmate-leaved Coltsfoot	S5
<i>Petasites sagittatus</i> (Pursh) Gray	Arrow-leaved Coltsfoot	S4
<i>Phalaris arundinacea</i> L.	Canary Reed-grass	S5
<i>Phleum pratense</i> L.	Timothy	SE
<i>Phragmites australis</i> (Cav.) Trin.	Giant Reed-grass	S5
<i>Picea glauca</i> (Moench.) Voss	White Spruce	S5
<i>Picea mariana</i> (Mill.) BSP	Black Spruce	S5
<i>Pinus banksiana</i> Lamb.	Jack Pine	S5
<i>Pinus resinosa</i> Ait.	Red Pine	S2S3
<i>Plantago major</i> L.	Plantain	SE
<i>Platanthera hyperborea</i> (L.) Lindl.)	Bog Orchis	S5
<i>Poa palustris</i> L.	Fowl Bluegrass	S5
<i>Poa</i> sp.	Bluegrass	
<i>Polygala paucifolia</i> Willd.	Fringed Milkwort	S4
<i>Polygala senega</i> L.	Seneca Snakeroot	S4?
<i>Polygonum amphibium</i> L. var. <i>stipulaceum</i> (Coleman) Fern.	Water Smartweed	S5
<i>Populus balsamifera</i> L.	Balsam Poplar, Black Poplar	S5
<i>Populus deltoides</i> Bart.	Cottonwood	S4
<i>Populus tremuloides</i> Michx.	Trembling Aspen, White Poplar	S5
<i>Potamogeton gramineus</i> L.	Various-leaved Pondweed	S5
<i>Potentilla anserina</i> L.	Silverweed	S5
<i>Potentilla fruticosa</i> L.	Shrubby Cinquefoil	S5
<i>Potentilla palustris</i> (L.) Scop.	Marsh Cinquefoil	S5
<i>Prunus pensylvanica</i> L.f.	Pin Cherry	S5
<i>Prunus virginiana</i> L.	Chokecherry	S5
<i>Pteridium aquilinum</i> (L.) Kuhn	Bracken Fern	S4S5
<i>Pyrola asarifolia</i> Michx.	Common Pink Wintergreen	S5
<i>Pyrola secunda</i> L.	One-sided Wintergreen	S5
<i>Quercus macrocarpa</i> Michx.	Bur Oak	S5
<i>Ranunculus aquatilis</i> L.	White Water Crowfoot	S5
<i>Ranunculus scleratus</i> L.	Cursed Crowfoot	S5
<i>Rhamnus alnifolia</i> L'Her.	Alder-leaved Buckthorn	S5
<i>Rhus glabra</i> L.	Smooth Sumac	S4
<i>Rhus radicans</i> L.	Poison Ivy	S5
<i>Ribes americanum</i> Mill.	Wild Black Current	S5
<i>Ribes triste</i> Pall.	Swamp Red Currant	S5
<i>Rosa arkansana</i> Porter	Prairie Rose	S4
<i>Rubus acaulis</i> Michx.	Stemless Raspberry	S5
<i>Rubus idaeus</i> L.	Raspberry	S5
<i>Rubus pubescens</i> Raf.	Dewberry	S5
<i>Rudbeckia hirta</i> L.	Black-eyed Susan	SE
<i>Rumex occidentalis</i> S. Wats	Western Dock	S5
<i>Salix bebbiana</i> Sarg.	Bebb's Willow	S5
<i>Salix candida</i> Flugge.	Hoary Willow	S5
<i>Salix exigua</i> Nutt.	Sandbar Willow	S5

Scientific Name	Common Name	MB CDC S Rank*
<i>Salix</i> spp.	Various Willows	
<i>Sanicula marilandica</i> L.	Black Snakeroot	S5
<i>Sarracenia purpurea</i> L.	Pitcher Plant	S5
<i>Schizachne purpurascens</i> (Torr.) Swallen	Purple Oat-grass	S5
<i>Scirpus lacustris</i> L. ssp. <i>validus</i> (Vahl) Koyama	Great Bulrush	S4
<i>Scolochloa festucacea</i> (Willd.) Link.	Whitetop	S5
<i>Scutellaria epilobiifolia</i> Hamilton	Common Skullcap	S5
<i>Senecio congestus</i> (R. Br.) DC.	Marsh Ragwort	S5
<i>Shepherdia canadensis</i> (L.) Nutt.	Soapberry	S5
<i>Sisyrinchium montanum</i> Greene	Blue-eyed Grass	S5
<i>Sium suave</i> Walt.	Water Parsnip	S5
<i>Smilacina stellata</i> (L.) Desf.	Star-flowered Solomon's Seal	S5
<i>Smilacina trifolia</i> (L.) Desf.	Three-leaved Solomon's Seal	S5
<i>Smilax herbacea</i> L.	Carrion Flower	S4
<i>Solidago canadensis</i> L. var. <i>canadensis</i>	Canada Goldenrod	S5
<i>Solidago graminifolia</i> (L.) Salsib.	Flat-topped Goldenrod	S5
<i>Solidago rigida</i> L.	Flat-top Goldenrod	S5
<i>Sonchus arvensis</i> L.	Perennial Sow Thistle	SE
<i>Spartina pectinata</i> Link	Prairie Cord-grass	S5
<i>Spiraea alba</i> Du Roi	Narrow-leaved Meadowsweet	S5
<i>Stachys palustris</i> L.	Woundwort	S5
<i>Stipa spartea</i> Trin.	Porcupine Grass	S4
<i>Streptopus roseus</i> Michx. var. <i>perspectus</i> Fassett	Rose Mandarin	S4
<i>Symphoricarpos albus</i> (L.) Blake	Snowberry	S5
<i>Taraxacum officinale</i> Weber	Common Dandelion	S5
<i>Thalictrum dasycarpum</i> Fisch. & Lall.	Tall Meadow Rue	S5
<i>Thuja occidentalis</i> L.	Eastern White Cedar	S4
<i>Tragopogon dubius</i> Scop.	Yellow Goat's Beard	SE
<i>Trientalis borealis</i> Raf.	Northern Starflower	S5
<i>Trifolium hybridum</i> L.	Alsike Clover	SE
<i>Trifolium pratense</i> L.	Red Clover	SE
<i>Trillium cernuum</i> L.	Nodding Trillium	S4
<i>Typha latifolia</i> L.	Common Cattail	
<i>Ulmus americana</i> L.	American Elm	S4?
<i>Urtica dioica</i> L.	Stinging Nettle	S5
<i>Vaccinium angustifolium</i> Ait.	Blueberry	S4
<i>Vaccinium oxycoccus</i> L.	Small cranberry	S5
<i>Vaccinium vitis-idaea</i> L.	Dry-ground Cranberry	S5
<i>Verbascum thapsus</i> L.	Common Mullein	SE
<i>Viburnum lentago</i> L.	Nannyberry	S4?
<i>Viburnum opulus</i> L. var. <i>americanum</i> Ait	High-bush Cranberry	S5
<i>Viburnum rafinesquianum</i> Schultes	Downy Arrow-wood	S4?
<i>Vicia americana</i> Muhl.	American Vetch	S5
<i>Viola adunca</i> Sm.	Early Blue Violet	S5
<i>Viola pedatifida</i> G. Don	Crowfoot Violet	S4
<i>Viola pubescens</i> Ait.	Downy Yellow Violet	S4

Scientific Name	Common Name	MB CDC S Rank*
<i>Viola</i> sp.	Violet	
<i>Zizia aptera</i> (Gray) Fern.	Heart-leaved Alexanders	S5

*Manitoba Conservation Data Centre (MB CDC) S Rank definitions:

- 1 Very rare throughout its range or in the province (5 or fewer occurrences, or very few remaining individuals). May be especially vulnerable to extirpation.
- 2 Rare throughout its range or in the province (6 to 20 occurrences). May be vulnerable to extirpation.
- 3 Uncommon throughout its range or in the province (21 to 100 occurrences).
- 4 Widespread, abundant, and apparently secure throughout its range or in the province, with many occurrences, but the element is of long-term concern (> 100 occurrences).
- 5 Demonstrably widespread, abundant, and secure throughout its range or in the province, and essentially irradicable under present conditions.
- U Possibly in peril, but status uncertain; more information needed.
- H Historically known; may be rediscovered.
- X Believed to be extinct; historical records only, continue search

Appendix B. Wildlife species that are known to or expected to occur within Pembina Valley Water Cooperative Project study area. Season of occurrence presented as B – spring and summer breeding, M – spring and fall migration, and R – year-round resident.

Order	Scientific Name	Common Name	Season
Birds			
Gaviiformes	<i>Gavia immer</i>	Common Loon	M
Podicipediformes	<i>Podiceps auratus</i>	Horned Grebe	B, M
	<i>P. nigricollis</i>	Eared Grebe	M
	<i>Podilymbus podiceps</i>	Pied-billed Grebe	M
	<i>Podiceps grisegena</i>	Red-necked Grebe	B, M
	<i>Aechmophorus occidentalis</i>	Western Grebe	M
Pelecaniformes	<i>Pelecanus erythrorhynchos</i>	American White Pelican	M
	<i>Phalacrocorax auritus</i>	Double-crested Cormorant	M
Ciconiiformes	<i>Botaurus lentiginosus</i>	American Bittern ^{1,2}	B, M
	<i>Ardea herodias</i>	Great Blue Heron ¹	B, M
	<i>A. alba</i>	Great Egret	B, M
	<i>Ixobrychus exilis</i>	Least Bittern	B, M
	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	M
Anseriformes	<i>Branta canadensis</i>	Canada Goose ²	B, M
	<i>Chen caerulescens</i>	Snow Goose	M
	<i>C. rossii</i>	Ross's Goose	M
	<i>Anser aliformes</i>	Great White-fronted Goose	M
	<i>Cygnus clumbianus</i>	Tundra Swan	M
	<i>C. buccinator</i>	Trumpeter Swan	M
	<i>Aix sponsa</i>	Wood Duck	B, M
	<i>Anas strepera</i>	Gadwall	M
	<i>A. platyrhynchos</i>	Mallard ¹	B, M
	<i>A. acuta</i>	Northern Pintail ¹	B, M
	<i>A. rubripes</i>	American Black Duck	B, M
	<i>A. discors</i>	Blue-winged Teal ^{1, 2}	B, M
	<i>A. crecca</i>	Green-winged Teal ¹	B, M
	<i>A. americana</i>	American Wigeon	B, M
	<i>A. clypeata</i>	Northern Shoveller ¹	B, M
	<i>Athya vasisinaria</i>	Canvasback	B, M
	<i>A. americana</i>	Redhead	M
	<i>A. collaris</i>	Ring-necked Duck	B, M
	<i>A. affinis</i>	Lesser Scaup ¹	B, M
	<i>A. marila</i>	Greater Scaup	M
	<i>Melanitta fusca</i>	White-winged Scoter	B, M
	<i>Bucephala clangula</i>	Common Goldeneye ¹	B, M
	<i>B. albeola</i>	Bufflehead	B, M
<i>Mergus merganser</i>	Common Merganser	B, M	
<i>Lophodytes cucullatus</i>	Hooded Merganser	B, M	
<i>Mergus serrator</i>	Red-breasted Merganser	M	
<i>Oxyura jamaicensis</i>	Ruddy Duck	B, M	
Falconiformes	<i>Cathartes aura</i>	Turkey Vulture	B, M

Order	Scientific Name	Common Name	Season
	<i>Accipiter gentilis</i>	Northern Goshawk ¹	B, M
	<i>A. cooperii</i>	Cooper's Hawk ¹	B, M
	<i>A. striatus</i>	Sharp-shinned Hawk	B, M
	<i>Haliaeetus leucocephalus</i>	Bald Eagle	B, M
	<i>Pandion haliaetus</i>	Osprey	B, M
	<i>Falco rusticolus</i>	Gyr Falcon	M
	<i>F. peregrinus</i>	Peregrine Falcon	M
	<i>F. columbarius</i>	Merlin	B, M
	<i>F. sparverius</i>	American Kestrel ¹	B, M
	<i>Circus cyaneus</i>	Northern Harrier ¹	B, M
	<i>Buteo platypterus</i>	Broad-winged Hawk	B, M
	<i>B. jamaicensis</i>	Red-tailed Hawk ^{1,2}	B, M
	<i>B. lagopus</i>	Rough-legged Hawk	M
	<i>Aquila chrysaetos</i>	Golden Eagle	M
Galliformes	<i>Perdix perdix</i>	Gray Partridge	R
	<i>Bonasa umbellus</i>	Ruffed Grouse ^{1,2}	R
	<i>Falcapennis canadensis</i>	Spruce Grouse ^{1,2}	R
	<i>Tympanuchus phasianellus</i>	Sharp-tailed Grouse ^{1,2}	R
	<i>Meleagris gallopavo</i>	Wild Turkey	R
Charadriiformes	<i>Coturnicops noveboracensis</i>	Yellow Rail	B, M
	<i>Rallus limicola</i>	Virginia Rail	B, M
	<i>Porzana carolina</i>	Sora ²	B, M
	<i>Fulica americana</i>	American Coot	B, M
	<i>Grus canadensis</i>	Sandhill Crane	B, M
	<i>Pluvialis squatarola</i>	Black-bellied Plover	M
	<i>P. dominica</i>	American Golden-Plover	M
	<i>Charadrius semipalmatus</i>	Semipalmated Plover	M
	<i>C. vociferus</i>	Killdeer ^{1,2}	B, M
	<i>Tringa melanocleuca</i>	Greater Yellowlegs	M
	<i>T. flavipes</i>	Lesser Yellowlegs	M
	<i>T. solitaria</i>	Solitary Sandpiper	M
	<i>Actitis macularia</i>	Spotted Sandpiper	B, M
	<i>Bartramia longicauda</i>	Upland Sandpiper ²	B, M
	<i>Limosa haemastica</i>	Hudsonian Godwit	M
	<i>L. fedoa</i>	Marbled Godwit	B, M
	<i>Arenaria interpres</i>	Ruddy Turnstone	M
	<i>Calidris alba</i>	Sanderling	M
	<i>C. canutus</i>	Red Knot	M
	<i>C. pusilla</i>	Semipalmated Sandpiper	M
	<i>C. minutilla</i>	Least Sandpiper	M
	<i>C. fuscicollis</i>	White-rumped Sandpiper	M
	<i>C. bairdii</i>	Baird's Sandpiper	M
	<i>C. melanotos</i>	Pectoral Sandpiper	M
	<i>C. alpina</i>	Dunlin	M
	<i>C. himantopus</i>	Stilt Sandpiper	M
	<i>Tryngites subruficollis</i>	Buff-breasted Sandpiper	M
	<i>Limnodromus griseus</i>	Short-billed Dowitcher	M
	<i>L. scolopaceus</i>	Long-billed Dowitcher	M
	<i>Gallinago delicata</i>	Wilson's Snipe ²	B, M
	<i>Scolopax minor</i>	American Woodcock	B, M
	<i>Phalaropus lobatus</i>	Red-necked Phalarope	M
	<i>P. tricolor</i>	Wilson's Phalarope	B, M
	<i>Larus pipixcan</i>	Franklin's Gull	M

Order	Scientific Name	Common Name	Season
	<i>L. philadelphia</i>	Bonaparte's Gull	M
	<i>L. delawarensis</i>	Ring-billed Gull	M
	<i>L. argentatus</i>	Herring Gull	M
	<i>Sterna hirundo</i>	Common Tern	M
	<i>S. caspia</i>	Caspian Tern	M
	<i>S. forsteri</i>	Forster's Tern	M
	<i>Chlidonias niger</i>	Black Tern	B, M
Columbiformes	<i>Columba livia</i>	Rock Pigeon	R
	<i>Zenaida macroura</i>	Mourning Dove ^{1,2}	B, M
Cuculiformes	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo	B, M
Strigiformes	<i>Bubo virginianus</i>	Great Horned Owl ¹	R
	<i>Aegolius funereus</i>	Boreal Owl	M
	<i>A. acadicus</i>	Northern Saw-whet Owl	B, M
	<i>Strix varia</i>	Barred Owl	R
	<i>S. nebulosa</i>	Great Gray Owl ²	R
	<i>Asio otus</i>	Long-eared Owl	B, M
	<i>A. flammeus</i>	Short-eared Owl	B, M
	<i>Otus asio</i>	Eastern Screech-owl	B, M
	<i>Nyctea scandiaca</i>	Snowy Owl	M
	<i>Surnia alula</i>	Northern Hawk Owl	B, M
Caprimulgiformes	<i>Chordeiles minor</i>	Common Nighthawk	B, M
	<i>Caprimulgus vociferus</i>	Whip-poor-will	B, M
Apodiformes	<i>Chaetura pelagica</i>	Chimney Swift	B, M
	<i>Archilochus colubris</i>	Ruby-throated Hummingbird	B, M
Coraciiformes	<i>Ceryle alcyon</i>	Belted Kingfisher ^{1,2}	B, M
Piciformes	<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker	B, M
	<i>Dryocopus pileatus</i>	Pileated Woodpecker	R
	<i>Picoides villosus</i>	Hairy Woodpecker	R
	<i>P. pubescens</i>	Downy Woodpecker ¹	R
	<i>P. tridactylus</i>	Three-toed Woodpecker	R
	<i>P. arcticus</i>	Black-backed Woodpecker ²	R
	<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker	B, M
	<i>Colaptes auratus</i>	Northern Flicker ¹	B, M
Passeriformes	<i>Empidonax flaviventris</i>	Yellow-bellied Flycatcher ²	B, M
	<i>E. alnorum</i>	Alder Flycatcher ²	B, M
	<i>E. minimus</i>	Least Flycatcher ²	B, M
	<i>Contopus borealis</i>	Olive-sided Flycatcher	B, M
	<i>C. virens</i>	Eastern Wood-pewee ²	B, M
	<i>Sayornis phoebe</i>	Eastern Phoebe ²	B, M
	<i>Myiarchus crinitus</i>	Great Crested Flycatcher ²	B, M
	<i>Tyrannus verticalis</i>	Western Kingbird	B, M
	<i>T. tyrannus</i>	Eastern Kingbird ^{1,2}	B, M
	<i>Lanius excubitor</i>	Northern Shrike	M
	<i>Cyanocitta cristata</i>	Blue Jay ^{1,2}	R
	<i>Perisoreus canadensis</i>	Gray Jay ^{1,2}	R
	<i>Pica pica</i>	Black-billed Magpie ¹	B, M
	<i>Corvus brachyrhynchos</i>	American Crow ¹	B, M

Order	Scientific Name	Common Name	Season
	<i>C. corax</i>	Common Raven	R
	<i>Eremophila alpestris</i>	Horned Lark	B, M
	<i>Progne subis</i>	Purple Martin	B, M
	<i>Tachycineta bicolor</i>	Tree Swallow	B, M
	<i>Riparia riparia</i>	Bank Swallow	B, M
	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow ²	B, M
	<i>Hirundo rustica</i>	Barn Swallow ²	B, M
	<i>Poecile atricapillus</i>	Black-capped Chickadee ^{1,2}	R
	<i>P. hudsonicus</i>	Boreal Chickadee	R
	<i>Sitta canadensis</i>	Red-breasted Nuthatch ²	R
	<i>S. carolinensis</i>	White-breasted nuthatch	R
	<i>Certhia americana</i>	Brown Creeper ²	B, M
	<i>Troglodytes aedon</i>	House Wren ²	B, M
	<i>T. troglodytes</i>	Winter Wren ²	B, M
	<i>Cistothorus platensis</i>	Sedge Wren ²	B, M
	<i>C. palustris</i>	Marsh Wren ²	B, M
	<i>Regulus satrapa</i>	Golden-crowned Kinglet	B, M
	<i>R. calendula</i>	Ruby-crowned Kinglet ²	B, M
	<i>Sialia sialis</i>	Eastern Bluebird ¹	B, M
	<i>Catharus fuscescens</i>	Veery	B, M
	<i>C. minimus</i>	Gray-cheeked Thrush	M
	<i>C. guttatus</i>	Hermit Thrush ²	B, M
	<i>C. ustulatus</i>	Swainson's Thrush ²	B, M
	<i>Turdus migratorius</i>	American Robin ²	B, M
	<i>Dumetella carolinensis</i>	Gray Catbird ²	B, M
	<i>Toxostoma rufum</i>	Brown Thrasher	B, M
	<i>Sturnus vulgaris</i>	European Starling	R
	<i>Anthus rubescens</i>	American Pipit	M
	<i>Bombycilla cedrorum</i>	Cedar Waxwing ^{1,2}	B, M
	<i>B. garrulus</i>	Bohemian Waxwing	M
	<i>Vireo solitarius</i>	Blue-headed Vireo ²	B, M
	<i>V. flavifrons</i>	Yellow-throated Vireo	B, M
	<i>V. philadelphicus</i>	Philadelphia Vireo	B, M
	<i>V. olivaceus</i>	Red-eyed Vireo ²	B, M
	<i>V. gilvus</i>	Warbling Vireo ²	B, M
	<i>Vermivora peregrina</i>	Tennessee Warbler ²	B, M
	<i>V. ruficapilla</i>	Nashville Warbler ²	B, M
	<i>V. celata</i>	Orange-crowned Warbler	M
	<i>V. chrysoptera</i>	Golden-winged Warbler	B, M
	<i>Denroica petechia</i>	Yellow Warbler ²	B, M
	<i>D. magnolia</i>	Magnolia Warbler ²	B, M
	<i>D. pennsylvanica</i>	Chestnut-sided Warbler ²	B, M
	<i>D. virens</i>	Black-throated Green Warbler ²	B, M
	<i>D. tigrina</i>	Cape May Warbler ²	B, M
	<i>D. pinus</i>	Pine Warbler	B, M
	<i>D. coronata</i>	Yellow-rumped Warbler ²	B, M
	<i>D. fusca</i>	Blackburnian Warbler ²	B, M
	<i>D. palmarum</i>	Palm Warbler ²	B, M
	<i>D. castanea</i>	Bay-breasted Warbler	M
	<i>D. striata</i>	Blackpoll Warbler	M
	<i>Mniotilta varia</i>	Black-and-white Warbler ²	B, M
	<i>Seiurus noveboracensis</i>	Northern Waterthrush	B, M
	<i>Setophaga ruticilla</i>	American Redstart ²	B, M
	<i>Seiurus aurocapillus</i>	Ovenbird ²	B, M
	<i>Wilsonia pusilla</i>	Wilson's Warbler	M

Order	Scientific Name	Common Name	Season
	<i>W. canadensis</i>	Canada Warbler	B, M
	<i>Oporornis agilis</i>	Connecticut Warbler ²	B, M
	<i>O. philadelphia</i>	Mourning Warbler	B, M
	<i>Geothlypis trichas</i>	Common Yellowthroat ²	B, M
	<i>Piranga olivacea</i>	Scarlet Tanager	B, M
	<i>Pipilo erythrophthalmus</i>	Eastern Towhee	B, M
	<i>Spizella arborea</i>	American Tree Sparrow	M
	<i>S. passerina</i>	Chipping Sparrow ²	B, M
	<i>S. pallida</i>	Clay-colored Sparrow ²	B, M
	<i>Pooecetes gramineus</i>	Vesper Sparrow ²	B, M
	<i>Chondestes grammacus</i>	Lark Sparrow	B, M
	<i>Passerculus sandwichensis</i>	Savannah Sparrow ²	B, M
	<i>Ammodramus leconteii</i>	Le Conte's Sparrow ²	B, M
	<i>A. nelsoni</i>	Nelson's Sharp-tailed Sparrow	B, M
	<i>Passerella iliaca</i>	Fox Sparrow	M
	<i>Melospiza melodia</i>	Song Sparrow ²	B, M
	<i>M. lincolnii</i>	Lincoln's Sparrow	B, M
	<i>M. georgiana</i>	Swamp Sparrow	B, M
	<i>Zonotrichia albicollis</i>	White-throated Sparrow ²	B, M
	<i>Z. querula</i>	Harris's Sparrow	M
	<i>Z. leucophrys</i>	White-crowned Sparrow	M
	<i>Junco hyemalis</i>	Dark-eyed Junco ²	B, M
	<i>Clacarius lapponicus</i>	Lapland Longspur	M
	<i>C. pictus</i>	Smith's Longspur	M
	<i>Plectrophenax nivalis</i>	Snow Bunting	M
	<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak	B, M
	<i>Passerina cyanea</i>	Indigo Bunting	B, M
	<i>Dolichonyx oryzivorus</i>	Bobolink ²	B, M
	<i>Euphagus carolinus</i>	Rusty Blackbird	M
	<i>E. cyanocephalus</i>	Brewer's Blackbird ²	B, M
	<i>Agelaius phoeniceus</i>	Red-winged Blackbird ^{1, 2}	B, M
	<i>Sturnella neglecta</i>	Western Meadowlark ²	B, M
	<i>Xanthocephalus xanthocephalus</i>	Yellow-headed Blackbird ²	B, M
	<i>Moluthrus ater</i>	Brown-headed Cowbird ²	B, M
	<i>Quiscalus quisqualis</i>	Common Grackle ²	B, M
	<i>Icterus galbula</i>	Baltimore Oriole ²	B, M
	<i>Pinicola enucleator</i>	Pine Grosbeak ¹	M
	<i>Carpodacus purpureus</i>	Purple Finch	B, M
	<i>C. mexicanus</i>	House Finch	B, M
	<i>Loxia leucoptera</i>	White-winged Crossbill	B, M
	<i>L. curvirostra</i>	Red Crossbill	B, M
	<i>Coccothraustes vespertinus</i>	Evening Grosbeak	B, M
	<i>Carduelia pinus</i>	Pine Siskin ²	B, M
	<i>Carduelis flammea</i>	Common Redpoll	M
	<i>C. hormemanni</i>	Hoary Redpoll	M
	<i>C. tristis</i>	American Goldfinch ²	B, M
	<i>Passer domesticus</i>	House Sparrow ²	R
Mammals			
Insectivora	<i>Sorex cinereus</i>	Masked Shrew	R
	<i>S. palustris</i>	American Water Shrew ¹	R
	<i>S. arcticus</i>	Arctic Shrew ¹	R
	<i>Microsorex hoyi</i>	Pygmy Shrew ¹	R
	<i>Blarina brevicauda</i>	Shorttail Shrew ¹	R

Order	Scientific Name	Common Name	Season
	<i>Condylura cristata</i>	Starnose Mole ¹	R
Chiroptera	<i>Myotis lucifugus</i>	Little Brown Bat ¹	B, M
	<i>M. keenii</i>	Keen's Myotis ¹	B, M
	<i>Lasiurus borealis</i>	Red Bat ¹	B, M
	<i>L. cinereus</i>	Hoary Bat ¹	B, M
	<i>Eptesicus fuscus</i>	Big Brown Bat ¹	B, M
	<i>Lasionycteris noctivagans</i>	Silver-haired Bat ¹	B, M
Lagomorpha	<i>Lepus americanus</i>	Snowshoe Hare ¹	R
	<i>L. townsendi</i>	Whitetail Jackrabbit ¹	R
	<i>Sylvilagus floridanus</i>	Eastern Cottontail ¹	R
Rodentia	<i>Marmota monax</i>	Woodchuck ¹	R
	<i>Eutamias minimus</i>	Least Chipmunk ¹	R
	<i>Tamias striatus</i>	Eastern Chipmunk	R
	<i>Citellus tridecemlineatus</i>	Thirteen-lined Ground Squirrel ¹	R
	<i>C. richardsoni</i>	Richardson's Ground Squirrel ¹	R
	<i>C. frankini</i>	Franklin's Ground Squirrel ¹	R
	<i>Tamiasciurus hudsonicus</i>	Red Squirrel ¹	R
	<i>Sciurus carolinensis</i>	Eastern Gray Squirrel	R
	<i>Glaucomys sabrinus</i>	Northern Flying Squirrel ¹	R
	<i>Thomomys talpoides</i>	Northern Pocket Gopher ¹	R
	<i>Peromyscus maniculatus</i>	Deer Mouse ¹	R
	<i>Clethrionomys gapperi</i>	Boreal Red-backed Vole ¹	R
	<i>Microtus pennsylvanicus</i>	Meadow Vole ¹	R
	<i>M. ochrogaster</i>	Prairie Vole	R
	<i>Synaptomys cooperi</i>	Southern Bog Lemming ¹	R
	<i>S. borealis</i>	Northern Bog Lemming ¹	R
	<i>Phenacomys intermedius</i>	Heather Vole ¹	R
	<i>Zapus hudsonicus</i>	Meadow Jumping Mouse ¹	R
	<i>Napaeozapus insignis</i>	Woodland Jumping Mouse ¹	R
	<i>Ondatra zibethicus</i>	Muskrat ¹	R
<i>Castor canadensis</i>	Beaver ^{1,2}	R	
<i>Erethizon dorsatum</i>	Porcupine ¹	R	
Carnivora	<i>Canis lupus</i>	Timber Wolf ¹	R
	<i>C. latrans</i>	Coyote ¹	R
	<i>Vulpes vulpes</i>	Red Fox ¹	R
	<i>Ursus americanus</i>	American Black Bear ¹	R
	<i>Mustela erminea</i>	Ermine ¹	R
	<i>M. nivalis</i>	Least Weasel ¹	R
	<i>M. vison</i>	American Mink ¹	R
	<i>M. americana</i>	Marten ¹	R
	<i>M. pennanti</i>	Fisher	R
	<i>Mephitis mephitis</i>	Striped Skunk ¹	R
	<i>Lontra canadensis</i>	River Otter	R
	<i>Taxidea taxus</i>	Badger ¹	R
	<i>Procyon lotor</i>	Raccoon	R
	<i>Lynx canadensis</i>	Lynx ¹	R
<i>L. rufus</i>	Bobcat ¹	R	
Artiodactyla	<i>Odocoileus virginianus</i>	Whitetail Deer ¹	R
	<i>Alces alces</i>	Moose ¹	R

Order	Scientific Name	Common Name	Season
Amphibians and Reptiles			
Caudata	<i>Ambystoma tigrinum diaboli</i>	Gray Tiger Salamander	R
	<i>A. laterale</i>	Blue-spotted Salamander	R
	<i>Necturus maculosus maculosus</i>	Mudpuppy	R
Anura	<i>Bufo americanus americanus</i>	American Toad	R
	<i>Hyla versicolor</i>	Gray Treefrog	R
	<i>H. chrysoscelis</i>	Cope's Gray Treefrog	R
	<i>H. crucifer crucifer</i>	Northern Spring Peeper	R
	<i>Pseudacris triseriata</i>	Boreal Chorus Frog	R
	<i>Rana sylvatica</i>	Wood Frog ²	R
	<i>R. pipiens</i>	Northern Leopard Frog ²	R
Testudinata	<i>Chelydra serpentina</i>	Common Snapping Turtle	R
	<i>Chrysemys picta</i>	Western Painted Turtle	R
Squamata	<i>Thamnophis sirtalis</i>	Red-sided Garter Snake	R
	<i>T. radix</i>	Western Plains Garter Snake	R
	<i>Storeria occipitomaculata</i>	Northern Redbelly Snake	R
	<i>Opheodrys vernalis</i>	Smooth Green Snake	R

Nomenclature and distributions from Banfield 1974, Burt and Grossenheider 1976, Preston 1982, Godfrey 1986, Russell and Bauer 1993, National Geographic 1999, and Manitoba Naturalist Society 2003).

¹ Known occurrences within the Watson P. Davidson WMA (Imrie, M. 1981).

² Observed during field investigations

Appendix C. Family, species, and common name for fish species known to or expected to occur in the water bodies within in the vicinity of the well site and along the proposed pipeline route area based on species distributions and habitat preferences.

Family	Species	Common Name
Petromyzontidae	<i>Ichthyomyzon castaneus</i>	Chestnut Lamprey
	<i>I. unicuspis</i>	Silver Lamprey
Acipenseridae	<i>Acipenser fulvescens</i>	Lake Sturgeon
Hiodontidae	<i>Hiodon alosoides</i>	Goldeye
	<i>H. tergisus</i>	Mooneye
Cyprinidae	<i>Carassius auratus</i>	Goldfish
	<i>Cyprinella spiloptera</i>	Spotfin Shiner
	<i>Cyprinus carpio</i>	Common Carp
	<i>Notropis cornutus</i>	Common Shiner
	<i>Macrhybopsis storeriana</i>	Silver Chub
	<i>Margariscus margarita</i>	Pearl Dace
	<i>Notemigonus crysoleucas</i>	Golden Shiner
	<i>Notropis atherinoides</i>	Emerald Shiner
	<i>N. blenius</i>	River Shiner
	<i>N. hudsonius</i>	Spottail Shiner
	<i>N. stramineus</i>	Sand Shiner
	<i>Phoxinus eos</i>	Northern Redbelly Dace
	<i>Phoxinus neogaeus</i>	Finescale Dace
	<i>Pimephales promelas</i>	Fathead Minnow
	<i>Rhinichthys cataractae</i>	Longnose Dace
<i>R. obtusus</i>	Western Blacknose Dace	
<i>Semotilus atromaculatus</i>	Creek Chub	
Catostomidae	<i>Carpiodes cyprinus</i>	Quillback
	<i>Catostomus commersoni</i>	White Sucker
	<i>Ictiobus cyprinellus</i>	Bigmouth Buffalo
	<i>Moxostoma anisurum</i>	Silver Redhorse
	<i>M. erythrurum</i>	Golden Redhorse
<i>M. macrolepidotum</i>	Shorthead Redhorse	
Ictaluridae	<i>Ameiurus melas</i>	Black Bullhead
	<i>A. nebulosus</i>	Brown Bullhead
	<i>Ictalurus punctatus</i>	Channel Catfish
	<i>Noturus gyrinus</i>	Tadpole Madtom
	<i>N. flavus</i>	Stonecat
Esocidae	<i>Esox lucius</i>	Northern Pike
Umbridae	<i>Umbra limi</i>	Central Mudminnow
Percopsidae	<i>Percopsis omiscomaycus</i>	Troutperch
Gadidae	<i>Lota lota</i>	Burbot
Gasterosteidae	<i>Culaea inconstans</i>	Brook Stickleback
Moronidae	<i>Morone chrysops</i>	White Bass

Family	Species	Common Name
Centrarchidae	<i>Ambloplites rupestris</i>	Rock Bass
	<i>Lepomis macrochirus</i>	Bluegill
	<i>Micropterus dolomieu</i>	Smallmouth Bass
	<i>M. salmoides</i>	Largemouth Bass
	<i>Pomoxis nigromaculatus</i>	Black Crappie
Percidae	<i>Etheostoma exile</i>	Iowa Darter
	<i>E. nigrum</i>	Johnny Darter
	<i>Perca flavescens</i>	Yellow Perch
	<i>Percina caprodes</i>	Logperch
	<i>Percina maculate</i>	Blackside Darter
	<i>P. shumardi</i>	River Darter
	<i>Sander canadensis</i>	Sauger
	<i>S. vitreus</i>	Walleye
Sciaenidae	<i>Aplodinotus grunniens</i>	Freshwater Drum

Species distributions and habitat preferences from Scott and Crossman (1973) and Stewart and Watkinson (2004).

Appendix D. Detailed Stream Crossing Assessments

ROW Watercourse Crossing Assessment



Photos 1 & 2: Downstream view, north of PTH 12 (left picture) and east view of PTH 12 (right picture) of the creek. Red arrow indicates the direction of flow



Photos 3 & 4: View of the creek crossing location (looking north) from the south side of PTH 12 (left picture) and an east view from the south side of PTH 12 (right picture).

Location			
UTM:	14U 0687714 / 5460367	Reach:	1
		Survey Length:	50 m
		Watercourse Name:	Unnamed Creek
		Site:	PVWC-1

Site Description	Assessment																																																
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Watershed Size:</td> <td style="width: 50%;">n/a</td> </tr> <tr> <td>Regulated:</td> <td>No</td> </tr> <tr> <td>Channelized:</td> <td>Yes</td> </tr> <tr> <td>Channel Width:</td> <td>5.1 m</td> </tr> <tr> <td>Wetted Width:</td> <td>3.0 m</td> </tr> <tr> <td>Maximum Depth:</td> <td>0.25 m</td> </tr> <tr> <td>Stage:</td> <td>Moderate</td> </tr> <tr> <td>Sign of flood above surveyed stage:</td> <td>0.26 m</td> </tr> <tr> <td>Valley Slope Gradient:</td> <td>Left - 1% Right - 1%</td> </tr> <tr> <td>Velocity Characteristics:</td> <td>Slow</td> </tr> <tr> <td>Stream Gradient:</td> <td>1%</td> </tr> <tr> <td>Cover Type and Composition:</td> <td>Total - 80% Over Veg. - 30% In. Veg. - 70%</td> </tr> <tr> <td>Habitat Type:</td> <td>Run - 100%</td> </tr> <tr> <td>Bottom Contour:</td> <td>Uniform</td> </tr> <tr> <td>Substrate Type:</td> <td>Fines - 50% Gravel - 40% Cobble - 5% Boulder - 5%</td> </tr> <tr> <td>Substrate Compaction:</td> <td>H</td> </tr> <tr> <td>Water Temperature:</td> <td>18.4°C</td> </tr> <tr> <td>Turbidity:</td> <td>43 NTU</td> </tr> <tr> <td>pH:</td> <td>8.36</td> </tr> <tr> <td>DO:</td> <td>2.83 mg/ml</td> </tr> </table>	Watershed Size:	n/a	Regulated:	No	Channelized:	Yes	Channel Width:	5.1 m	Wetted Width:	3.0 m	Maximum Depth:	0.25 m	Stage:	Moderate	Sign of flood above surveyed stage:	0.26 m	Valley Slope Gradient:	Left - 1% Right - 1%	Velocity Characteristics:	Slow	Stream Gradient:	1%	Cover Type and Composition:	Total - 80% Over Veg. - 30% In. Veg. - 70%	Habitat Type:	Run - 100%	Bottom Contour:	Uniform	Substrate Type:	Fines - 50% Gravel - 40% Cobble - 5% Boulder - 5%	Substrate Compaction:	H	Water Temperature:	18.4°C	Turbidity:	43 NTU	pH:	8.36	DO:	2.83 mg/ml	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="text-align: center;">Aquatic Habitat Sensitivity</th> </tr> <tr> <td style="width: 50%;">Low</td> <td style="width: 50%;">The well compacted streambed material is not susceptible to erosion and downstream sedimentation. In addition, the bank is low, stable and well vegetated, reducing the risk of erosion.</td> </tr> <tr> <th colspan="2" style="text-align: center;">Fish Habitat Value</th> </tr> <tr> <td style="text-align: center;">Marginal</td> <td>This creek provides minimal fish habitat value during open-water season which is limited by low habitat diversity, potential poor water quality, shallow water depth and distance from suitable over wintering habitat.</td> </tr> </table>	Aquatic Habitat Sensitivity		Low	The well compacted streambed material is not susceptible to erosion and downstream sedimentation. In addition, the bank is low, stable and well vegetated, reducing the risk of erosion.	Fish Habitat Value		Marginal	This creek provides minimal fish habitat value during open-water season which is limited by low habitat diversity, potential poor water quality, shallow water depth and distance from suitable over wintering habitat.
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¹ For example: walleye, pike, suckers

² For example: sticklebacks, minnows

ROW Watercourse Crossing Assessment



Photos 1 & 2: Upstream view of the creek from south side of PTH 12 (left picture) and looking west from north of PTH 12 (right picture) Red arrow indicates the direction of flow



Photos 2 & 3: View of the creek crossing location (looking east) on the south side of PTH 12 (left picture) and 100 m upstream of PTH 12 (right picture). Red arrow indicates the direction of flow.

Location			
UTM:	14U 0680138 / 5462627	Reach:	1
		Survey Length:	50 m
		Watercourse Name:	Joubert Creek
		Site:	PVWC-3

Site Description		Assessment
<p>Watershed Size: n/a</p> <p>Regulated: No</p> <p>Channelized: Yes</p> <p>Channel Width: 5.0 m</p> <p>Wetted Width: n/a</p> <p>Maximum Depth: 0.42 m</p> <p>Stage: High</p> <p>Sign of flood above surveyed stage: n/a</p> <p>Valley Slope Gradient: Left - 1% Right - 1%</p> <p>Velocity Characteristics: Slow</p> <p>Stream Gradient: 1%</p> <p>Cover Type and Composition: Total - 90% Over Veg. - 20% In. Veg. - 80%</p> <p>Habitat Type: Run - 100%</p> <p>Bottom Contour: Uniform</p> <p>Substrate Type: Fines - 90% Gravel - 10%</p> <p>Substrate Compaction: n/a</p> <p>Water Temperature: 18.6°C</p> <p>Turbidity: 62 NTU</p> <p>pH: 8.35</p> <p>DO: 3.60 mg/ml</p>	<p>Riparian Vegetation: The crossing will be located within the developed PTH 12 ROW; vegetation within the ROW is managed grass, and forbs.</p> <p>Aquatic Vegetation: Yes</p> <p>Unique Features: The creek flows through a concrete bridge with 3 openings and fans into the roadside ditch with minimal flow for a considerable distance on either side of the drain.</p> <p>Summary: This headwater reach of Joubert Creek has been channelized and flows south across PTH 12 through wetland habitat. The creek fans into the roadside ditch for a considerable distance on either side of the drain.</p>	<p>Aquatic Habitat Sensitivity</p> <p>Low</p> <p>The fine streambed material is subject to erosion and downstream sedimentation. However the slope to the bank is low, stable and well vegetated, reducing the risk of erosion.</p>
		<p>Fish Use</p>
<p>Large-bodied Species¹</p> <p>Spawning: Possibly.</p> <p>Migration: Possibly.</p> <p>Rearing: Possibly – expect to find juveniles in the spring.</p> <p>Over-wintering: No.</p>		<p>Fish Habitat Value</p> <p>Marginal</p> <p>This creek provides fish habitat value during open-water season which is limited by low habitat diversity, potentially poor water quality and shallow water depth. Over-wintering may occur in areas of greater water depths.</p>
<p>Small-bodied Species²</p> <p>Open-water Presence: Yes.</p> <p>Over-wintering: Possibly.</p>		

**Pembina Valley Water Cooperative
Stream Crossing Assessment**

¹ For example: walleye, pike, suckers
² For example: sticklebacks, minnows



ROW Watercourse Crossing Assessment



Photo 1: View of the Joubert Creek crossing location (west to east) on the north side of PR 403. Red arrow indicates the direction of flow



Photo 2: View of the Joubert Creek crossing location (east to west) on the north side of PR 403. Red arrow indicates the direction of flow



Photo 3: Downstream (south of PR 403) view of Joubert Creek from the crossing location. Direction of flow indicated by the red arrow.

Location			
UTM:	14U 0662538 / 5466029	Reach:	1
		Survey Length:	50 m
		Watercourse Name:	Joubert Creek
		Site:	PVWC-9
Site Description		Assessment	
		Aquatic Habitat Sensitivity	
		Low	
		The fine streambed material is subject to erosion and downstream sedimentation. However the slope to the bank is low, stable and well vegetation, reducing the risk of erosion.	
		Fish Habitat Value	
		Important	
		Joubert Creek provides foraging, spawning and rearing habitat for a number of both small and large-bodied species of fish. Over-wintering may occur in areas of greater water depths. During periods of low water, fish passage may be obstructed by both natural and man made structures.	
Stream Order:	4	Riparian Vegetation:	The crossing will be located within the developed PR 403 ROW; vegetation within the ROW is managed grass, and forbs. Adjacent to PR 403 ROW, riparian vegetation consist of a mixed hardwood forest.
Watershed Size:	n/a	Aquatic Vegetation:	Yes
Regulated:	Yes	Summary:	Joubert Creek is medium sized, meandering creek with fine sediments. Habitat at the crossing is typical of the creek in this area consisting of run habitat. The lack of riparian forest at the crossing location reduces fish cover, but the riparian forest is prominent just upstream of the proposed crossing location.
Channelized:	No	Fish Use	
Channel Width:	11.8 m	Large-bodied Species¹	
Wetted Width:	11.8 m	Spawning:	Yes.
Maximum Depth:	>1.0 m	Migration:	Yes.
Stage:	High	Rearing:	Yes – expect to find juveniles in the spring.
Sign of flood above surveyed stage:	0.8 m	Over-wintering:	Yes.
Valley Slope Gradient:	Left - 21% Right – 2%	Small-bodied Species²	
Velocity Characteristics:	Slow	Open-water Presence:	Yes.
Stream Gradient:	n/a	Over-wintering:	Yes.
Cover Type and Composition:	Total – 30% Over Veg. – 10% In. Veg. – 80% Crown Clos. – 10%		
Habitat Type:	Run – 100%		
Bottom Contour:	Uniform		
Substrate Type:	Fines – 100%		
Substrate Compaction:	n/a		
Water Temperature:	18.7°C		
Turbidity:	38 NTU		
pH:	8.74		
DO:	7.35 mg/ml		
		¹ For example: walleye, pike, suckers	
		² For example: sticklebacks, minnows	

ROW Watercourse Crossing Assessment



Photo 1: Downstream view of the Creek (left picture) and upstream view (right picture) Red arrow indicates the direction of flow



Photos 2 & 3: View of the Creek crossing location (east to west) on the north side (left picture) and the south side (right picture) of PR 403. Red arrow indicates the direction of flow.

Location																																																																															
UTM:	14U 0655338 / 5465839																																																																														
Reach:	1																																																																														
Survey Length:	50 m																																																																														
Watercourse Name:	Coulée de Nault																																																																														
Site:	PVWC-10																																																																														
Site Description	Assessment																																																																														
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Watershed Size:</td> <td style="width: 70%;">n/a</td> </tr> <tr> <td>Regulated:</td> <td>No</td> </tr> <tr> <td>Channelized:</td> <td>Yes</td> </tr> <tr> <td>Channel Width:</td> <td>8.0 m</td> </tr> <tr> <td>Wetted Width:</td> <td>10.0 m</td> </tr> <tr> <td>Maximum Depth:</td> <td>>1.0 m</td> </tr> <tr> <td>Stage:</td> <td>High</td> </tr> <tr> <td>Sign of flood above surveyed stage:</td> <td>n/a</td> </tr> <tr> <td>Valley Slope Gradient:</td> <td>Left - 1% Right - 1%</td> </tr> <tr> <td>Velocity Characteristics:</td> <td>Slow</td> </tr> <tr> <td>Stream Gradient:</td> <td>1%</td> </tr> <tr> <td>Cover Type and Composition:</td> <td>Total - 60% Over Veg. - 10% In. Veg. - 40% Deep Pool. - 50%</td> </tr> <tr> <td>Habitat Type:</td> <td>Run - 100%</td> </tr> <tr> <td>Bottom Contour:</td> <td>Uniform</td> </tr> <tr> <td>Substrate Type:</td> <td>Fines - 100%</td> </tr> <tr> <td>Substrate Compaction:</td> <td>n/a</td> </tr> <tr> <td>Water Temperature:</td> <td>20.5°C</td> </tr> <tr> <td>Turbidity:</td> <td>27 NTU</td> </tr> <tr> <td>pH:</td> <td>9.07</td> </tr> <tr> <td>DO:</td> <td>8.85 mg/ml</td> </tr> </table>	Watershed Size:	n/a	Regulated:	No	Channelized:	Yes	Channel Width:	8.0 m	Wetted Width:	10.0 m	Maximum Depth:	>1.0 m	Stage:	High	Sign of flood above surveyed stage:	n/a	Valley Slope Gradient:	Left - 1% Right - 1%	Velocity Characteristics:	Slow	Stream Gradient:	1%	Cover Type and Composition:	Total - 60% Over Veg. - 10% In. 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ROW Watercourse Crossing Assessment



Photo 1: View of the Rat River crossing location (west to east) on the south side of PTH 23. Red arrow indicates the direction of flow



Photo 2: View of the Joubert Creek crossing location (east to west) on the north side of PR 403. Red arrow indicates the direction of flow



Photo 4: Downstream (south of PTH 23) view of Rat River. Direction of flow indicated by the red arrow.

Location																																																																																	
UTM:	14U 0646478 / 5468834																																																																																
Reach:	1																																																																																
Survey Length:	50 m																																																																																
Watercourse Name:	Rat River																																																																																
Site:	PVWC-12																																																																																
Site Description	Assessment																																																																																
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Watershed Size:	n/a	Riparian Vegetation:	The crossing will be located within the developed PTH 23 ROW; vegetation within the ROW is managed grass, and forbs. Adjacent to PTH 23 ROW, riparian vegetation consist of hardwood forest.																																																																														
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<p>Large-bodied Species¹</p> <p>Spawning: Yes.</p> <p>Migration: Yes.</p> <p>Rearing: Yes - expect to find juveniles in the spring.</p> <p>Over-wintering: Yes.</p>		<p>Important</p> <p>The Rat River provides suitable migration, foraging, spawning and rearing habitat for a number of both small and large-bodied species of fish. Over-wintering may occur in areas of greater water depths.</p>																																																																															
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ROW Watercourse Crossing Assessment



Photo 1: Looking east along the south side of PTH 23.



Photo 2: Looking east along the north side of PTH 23.

Location			
UTM:	N/A	Reach:	1
		Survey Length:	50 m
		Watercourse Name:	Unnamed Creek
		Site:	PVWC-13

Site Description		Assessment
Stream Order:	n/a	Aquatic Habitat Sensitivity
Watershed Size:	n/a	
Regulated:	No	Low
Channelized:	Yes	<p>The fine streambed material is subject to erosion and downstream sedimentation. However the slope to the bank is low, stable and well vegetated, reducing the risk of erosion. The low gradient of the stream reduces the risk of downstream sedimentation.</p>
Channel Width:	14.0 m	
Wetted Width:	14.0 m	
Maximum Depth:	>1.0 m	
Stage:	Moderate	
Sign of flood above surveyed stage:	n/a	
Valley Slope Gradient:	n/a	
Velocity Characteristics:	No apparent flow	
Stream Gradient:	<1%	
Cover Type and Composition:	Total – 20% Over Veg. – 20% In. Veg. – 80%	
Habitat Type:	Pool – 100%	
Bottom Contour:	Uniform	Fish Habitat Value
Substrate Type:	Fines – 100%	Important
Substrate Compaction:	Low	<p>The low diversity of habitat in this creek limit it's quality; however, the proximity to the Rat River, may make the creek appealing as an off-current area for some species. The creek is likely used throughout the open-water season by both small and large-bodied species, and may support fish in winter as well.</p>
Bank Stability:	100% stable	
Fish Use		
Large-bodied Species¹		
Spawning:	Possibly pike.	
Migration:	Yes.	
Rearing:	Yes – expect to find juveniles in the spring.	
Over-wintering:	Possibly.	
Small-bodied Species²		
Open-water Presence:	Yes.	
Over-wintering:	Yes - possibly.	

¹ For example: walleye, pike, suckers

² For example: sticklebacks, minnows

ROW Watercourse Crossing Assessment



Photo 1: View of the unnamed creek looking downstream on the north side of PTH 23. Red arrow indicates the direction of flow



Photo 2: View of the unnamed creek looking upstream on the south side of PTH 23. Red arrow indicates the direction of flow



Photos 4 & 5: Downstream (left photo) looking from east to west and looking west to east (right photo) of the Unnamed Creek at the crossing location. Direction of flow indicated by the white arrow.

Location			
UTM:	14U 0637547 / 5468614	Reach:	1
		Survey Length:	50 m
		Watercourse Name:	Unnamed Creek
		Site:	PVWC-14

Site Description	Assessment
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<p>Watershed Size: n/a</p> <p>Regulated: No</p> <p>Channelized: Yes</p> <p>Channel Width: 5.0 m</p> <p>Wetted Width: 4.6 m</p> <p>Maximum Depth: 0.5 m</p> <p>Stage: Moderate</p> <p>Sign of flood above surveyed stage: 0.5 m</p> <p>Valley Slope Gradient: Left - 30% Right - 30%</p> <p>Velocity Characteristics: Slow</p> <p>Stream Gradient: n/a</p> <p>Cover Type and Composition: Total - 80% In. Veg. - 90% Boulder - 10%</p> <p>Habitat Type: Run - 100%</p> <p>Bottom Contour: Uniform</p> <p>Substrate Type: Fines - 100%</p> <p>Substrate Compaction: n/a</p> <p>Water Temperature: 18.9°C</p> <p>Turbidity: 15 NTU</p> <p>pH: 8.91</p> <p>DO: 7.02 mg/ml</p>	<p>Riparian Vegetation: The crossing will be located within the developed PTH 23 ROW; vegetation within the ROW is managed grass, and forbs.</p> <p>Aquatic Vegetation: Yes</p> <p>Unique Features: The ditch on the southeast side of the creek contained water, backed up from the creek approximately 14 m from the highway.</p> <p>Summary: This Unnamed Creek is small and gently meanders through agricultural fields and drains into the Marsh River. It has low velocity with fine sediment substrates and algal mats are dominant throughout the channel. Habitat at the crossing is typical of the creek in this area consisting of run habitat.</p>
	Aquatic Habitat Sensitivity
	Low
	The fine streambed material is subject to erosion and downstream sedimentation. However the slope to the bank is low, stable and well vegetated, reducing the risk of erosion.
	Fish Use
	Fish Habitat Value
	Marginal
	This creek provides minimal fish habitat value during open-water season and is limited by low habitat diversity, potentially poor water quality and shallow water depth. Over-wintering may occur in areas of greater water depths.
	Large-bodied Species¹
	Spawning: Possibly.
	Migration: Possibly.
	Rearing: Possibly. – expect to find juveniles in the spring.
	Over-wintering: No.
	Small-bodied Species²
	Open-water Presence: Yes.
	Over-wintering: No

¹ For example: walleye, pike, suckers

² For example: sticklebacks, minnows

ROW Watercourse Crossing Assessment



Photos 1 and 2: View of the Marsh River south side crossing location from the left bank (left photo) and right bank (right photo). White arrow indicates the direction of flow.



Photos 3 and 4: Downstream (left photo) and upstream view (right photo) of the Marsh River from the crossing location. Direction of flow indicated by the white arrow.

Location	
UTM:	14U 0631081 / 5468431
Reach:	1
Survey Length:	50 m
Watercourse Name:	Marsh River
Site:	PVWC-15
Site Description	Assessment
<p>Stream Order: 4</p> <p>Watershed Size: n/a</p> <p>Regulated: No</p> <p>Channelized: No</p> <p>Channel Width: South: 27.5 m North: 50.0 m</p> <p>Wetted Width: South: 27.5 m North: 50.0 m</p> <p>Maximum Depth: >1.4 m</p> <p>Stage: Moderate</p> <p>Sign of flood above surveyed stage: 1.9 m</p> <p>Valley Slope Gradient: Left South 9% North 13% Rt. South 6% North 6%</p> <p>Velocity Characteristics: Slow</p> <p>Stream Gradient: <1%</p> <p>Cover Type and Composition: Total – 10% Over Veg. – 10% In. Veg. – 90%</p> <p>Habitat Type: Run – 100%</p> <p>Bottom Contour: Uniform</p> <p>Substrate Type: Fines – 100%</p> <p>Substrate Compaction: Low</p> <p>Bank Stability: 100% stable</p> <p>Water Temperature: 19.1°C</p> <p>Turbidity: 325 NTU</p> <p>pH: 8.9</p> <p>DO: 7.32 mg/ml</p>	<p style="text-align: center;">Aquatic Habitat Sensitivity</p> <p>Low</p> <p>The fine streambed material is subject to erosion and downstream sedimentation. However the slope to the bank is low, stable and well vegetated, reducing the risk of erosion. The low gradient of the stream reduces the risk of downstream sedimentation.</p>
<p>Riparian Vegetation: The crossing will be located within the developed PTH 23 ROW; vegetation within the ROW is managed grass, forbs and low shrub. An area with dense willow shrubs is located on the east bank on the north side of PTH 23 beneath the power line. Adjacent to PTH 23 ROW, riparian vegetation consist of a mixed hardwood forest and a saturated floodplain containing cattail.</p> <p>Aquatic Vegetation: Yes</p> <p>Unique Features: The ditch on the southwest side of the river contained water, backed up from the river approximately 20 m from the river.</p> <p>Summary: The Marsh River is broad, low gradient, and turbid with a fine sediment substrate. Habitat at the crossing consists of low velocity run habitat, typical of the river.</p>	<p style="text-align: center;">Fish Habitat Value</p> <p>Important</p> <p>This perennial river provides suitable migration, foraging, spawning and rearing habitat for a number of both small and large-bodied species of fish. Over-wintering may occur in areas of greater water depths.</p>
<p>Fish Use</p> <p>Large-bodied Species¹</p> <p>Spawning: Yes.</p> <p>Migration: Yes.</p> <p>Rearing: Yes – expect to find juveniles in the spring.</p> <p>Over-wintering: Possibly</p>	
<p>Small-bodied Species²</p> <p>Open-water Presence: Yes.</p> <p>Over-wintering: Possibly</p>	
<p>¹ For example: walleye, pike, suckers</p> <p>² For example: sticklebacks, minnows</p>	

ROW Watercourse Crossing Assessment



Photo 1: View of the Red River crossing location (east to west) on the south side of PTH 23. White arrow indicates the direction of flow and the orange arrow the location of a small drain that enters the river.



Photos 2 and 3: View of the Red River north side crossing location from the left bank (left photo) and right bank (right photo). White arrow indicates the direction of flow.



Photos 4 and 5: Downstream (left photo) and upstream view (right photo) of the Red River from the crossing location. Direction of flow indicated by the white arrow.

**Pembina Valley Water Cooperative
Stream Crossing Assessment**

Location			
UTM:	14U 0619780 / 5468078	Reach:	1
		Survey Length:	50 m
		Watercourse Name:	Red River
		Site:	PVWC-16

Site Description		Assessment
Stream Order:	4	Aquatic Habitat Sensitivity Low The fine streambed material is subject to erosion and downstream sedimentation. However the slope to the bank is low, stable and well vegetated, reducing the risk of erosion.
Watershed Size:	n/a	
Regulated:	Yes	
Channelized:	No	
Channel Width:	102 m	
Wetted Width:	102 m	
Maximum Depth:	>1.4 m	
Stage:	High	
Sign of flood above surveyed stage:	3.0 m	
Valley Slope Gradient:	Left - 6% Right - 4%	
Velocity Characteristics:	Slow	Fish Use
Stream Gradient:	n/a	Fish Habitat Value Important The Red River is a large river that provides a diversity of habitat and supports a large diversity of fish species throughout the year.
Cover Type and Composition:	Total - 20% Over Veg. - 60% In. Veg. - 10% Cut Bank - 30% Crown Clos. - 5%	
Habitat Type:	Run - 100%	
Bottom Contour:	Uniform	
Substrate Type:	Fines - 100%	
Substrate Compaction:	n/a	
Water Temperature:	23.7°C	
Turbidity:	480 NTU	
pH:	8.8	
DO:	5.22 mg/ml	
		Large-bodied Species¹
		Small-bodied Species²
		Open-water Presence:
		Over-wintering:
		Spawning:
		Migration:
		Rearing:
		Over-wintering:
		Summary:
		Riparian Vegetation:
		Aquatic Vegetation:
		Unique Features:

¹ For example: walleye, pike, suckers

² For example: sticklebacks, minnows



Watercourse Crossing Assessment

 <p>Photo 1: South of PTH 12.</p>  <p>Photo 2: North of PTH 12.</p>	Location			
	UTM: 14U 0687714 / 5460367		Watercourse Name: Unnamed Creek	Site: PVWC-2
	Site Description		Assessment	
	This drain was covered with heavy instream vegetation such as cattails and bulrushes. It passes under PTH 12 through a 0.5 m culvert.		Aquatic Habitat Sensitivity	
		Low		
		Due to the low gradient and the presence of instream vegetation, the transport of suspended or loosened streambed sediments would be minimal, even during high flow.		
		Fish Habitat Value		
		Marginal		
		Fish habitat potential is limited by lack of water, low habitat diversity, abundant instream vegetation, and potential poor water quality.		

Watercourse Crossing Assessment

 <p>Photo 1: View of Unnamed Creek north of PTH 12.</p>  <p>Photo 2: View of Unnamed Creek south of PTH 12.</p>	Location			
	UTM: 14U 0677943 / 5464093		Watercourse Name: Unnamed Creek	Site: PVWC-4
	Site Description		Assessment	
	This Unnamed Creek is a roadside ditch that crosses the highway and was dry at the time of survey.		Aquatic Habitat Sensitivity	
		Low		
		Due to the low gradient and the presence of instream vegetation, the transport of suspended or loosened streambed sediments would be minimal, even during high flow.		
		Fish Habitat Value		
		No Fish Habitat		
		Habitat during open-water season likely limited by lack of water, low habitat diversity, lack of fish cover, potential poor water quality, and lack of connectivity to fish bearing waters.		

Watercourse Crossing Assessment

No picture available.	Location		
	UTM: 14U 0673315 / 5466390	Watercourse Name:	Unnamed Creek
	Site:		PVWC-5
	Site Description	Assessment	
This drain crosses PR 403 through a small culvert. There was water along the ditch until PTH 12.	Aquatic Habitat Sensitivity		
	Low Due to the low gradient and the presence of instream vegetation, the transport of suspended or loosened streambed sediments would be minimal, even during high flow.		
	Fish Habitat Value		
	No Fish Habitat Habitat potential during open-water season likely limited by lack of water, low habitat diversity, lack of fish cover, potential poor water quality, and lack of connectivity to fish bearing waters		

Watercourse Crossing Assessment

 <p>Photo 1: Upstream view of Unnamed Creek.</p>  <p>Photo 2: Downstream view of Creek.</p>	Location		
	UTM: 14U 0673072 / 5466390	Watercourse Name:	Unnamed Creek
	Site:		PVWC-6
	Site Description	Assessment	
This Unnamed Creek crosses PR 403 and flows south through a willow wetland.	Aquatic Habitat Sensitivity		
	Low Due to the low gradient and the presence of instream vegetation, the transport of suspended or loosened streambed sediments would be minimal, even during high flow.		
	Fish Habitat Value		
	Marginal Fish habitat potential is limited by lack of water, low habitat diversity, poor connection to fish bearing waters, dense instream vegetation, and potential poor water quality.		

Watercourse Crossing Assessment

 <p>Photo 1: Downstream view of Unnamed Creek.</p>  <p>Photo 2: Upstream view of Unnamed Creek.</p>	Location		
	UTM: 14U 0670359 / 5466291		Watercourse Name: Unnamed Creek Site: PVWC-7
	Site Description	Assessment	
	This creek was within a pasture and was used as a cattle watering hole. There were deep pools at the road but no water upstream or downstream of the pools.	<p style="text-align: center;">Aquatic Habitat Sensitivity</p> <p>Low</p> <p>Due to the low gradient and the presence of instream vegetation, the transport of suspended or loosened streambed sediments would be minimal, even during high flow.</p> <p style="text-align: center;">Fish Habitat Value</p> <p>Marginal</p> <p>Habitat potential during open-water season likely limited by lack of water, low habitat diversity, lack of fish cover, potential poor water quality, and poor connectivity to fish bearing waters</p>	

Watercourse Crossing Assessment

 <p>Photo 1: West view along PR 403.</p>  <p>Photo 2: East view of PR 403.</p>	Location		
	UTM: N/A		Watercourse Name: Unnamed Creek Site: PVWC-8
	Site Description	Assessment	
	This creek is adjacent to PR 403 and is covered with grasses and cattails. At the time of assessment there was stagnant water with no flow.	<p style="text-align: center;">Aquatic Habitat Sensitivity</p> <p>Low</p> <p>Due to the low gradient and the presence of instream vegetation, the transport of suspended or loosened streambed sediments would be minimal, even during high flow.</p> <p style="text-align: center;">Fish Habitat Value</p> <p>Marginal</p> <p>Habitat potential during open-water season likely limited by lack of water, low habitat diversity, lack of cover, potential poor water quality, poor connection to fish bearing waters.</p>	

Watercourse Crossing Assessment

 <p>Photo 1: Downstream view of Unnamed Creek on west side of PTH 59..</p>  <p>Photo 2: East view of Unnamed Creek.</p>	Location		
	UTM: 14U 0647800 / 5467350	Watercourse Name:	Unnamed Creek
		Site:	PVWC-11
	Site Description	Assessment	
<p>This drain appears to be back flooded from the Rat River. The drain is situated in a large wetland area on the west side of PTH 59</p>	Aquatic Habitat Sensitivity		
	<p>Moderate</p> <p>Due to the low gradient and the presence of instream vegetation, the transport of suspended or loosened streambed sediments would be minimal, even during high flow. The floodplain is saturated and susceptible to rutting.</p>		
	Fish Habitat Value		
	<p>Marginal</p> <p>Fish habitat potential is limited by lack of water, low habitat diversity, abundant instream vegetation, and potential poor water quality.</p>		

Appendix E. Water quality results from laboratory analysis of water samples collected adjacent to the Pembina Valley Water Cooperative pumping well site.

Parameter	Site			
	SR1	SLT2	SLT3	PL1
Total Metals				
Zinc -total (mg/L)	0.03	0.01	<0.01	<0.01
Vanadium - total (mg/L)	0.004	<0.001	<0.001	<0.001
Uranium - total (mg/L)	0.0011	<0.0001	0.0001	<0.0001
Tin - total (mg/L)	<0.0006	<0.0006	<0.0006	<0.0006
Thallium - total (mg/L)	<0.0001	<0.0001	<0.0001	<0.0001
Silver - total (mg/L)	<0.0001	0.0003	0.0001	0.0013
Selelnium - total (mg/L)	<0.001	<0.001	0.001	<0.001
Nickel - total (mg/L)	0.004	<0.002	<0.002	<0.002
Molybdenum - total (mg/L)	0.0015	<0.0002	<0.0002	<0.0002
Mercury - total (mg/L)	<0.0001	<0.0001	<0.0001	<0.0001
Lead - total (mg/L)	0.001	<0.0005	<0.0005	<0.0005
Copper - total (mg/L)	0.001	<0.001	<0.001	<0.001
Cobalt - total (mg/L)	0.0009	<0.0002	0.0004	<0.0002
Chromium - total (mg/L)	0.001	<0.001	<0.001	<0.001
Cadmium - total (mg/L)	0.00003	<0.00002	<0.00002	<0.00002
Beryllium - total (mg/L)	<0.001	<0.001	<0.001	<0.001
Barium - total (mg/L)	0.0476	0.281	0.0244	0.0169
Arsenic - total (mg/L)	0.0084	0.0013	0.001	0.0006
Antimony - total (mg/L)	<0.001	<0.001	<0.001	<0.001
Ammonia - dissolved (mg/L)	0.97	0.03	0.004	0.04
Mercury - dissolved (mg/L)	<0.00005	<0.00005	<0.00005	<0.00005
Nitrate + Nitrite (mg/L)	<0.005	0.019	0.007	0.005
Total Dissolved Phosphorous (mg/L)	0.114	0.015	0.032	0.01
Total Phosphorous (mg/L)	0.311	0.025	0.097	0.039
Dissolved Organic Carbon (mg/L)	39	16	34	24
Total Dissolved Solids (mg/L)	250	230	170	170
Total Kjeldahl Nitrogen (mg/L)	4.2	0.6	1.5	1.1
Total Organic Carbon (mg/L)	42	15	34	23
Total Suspended Solids (mg/L)	31	3	3	10
Turbidity (NTU)	18	3.1	1.6	1.4
Chlorophyll a (ug/L)	9	130	1	26
Phaeophytin a (ug/L)	5	31	3	7
Odb/Oda (ABS ratio)	1.45	1.57	1.2	2.55
Sulphate - dissolved (mg/L)	24	13	21	13
Chloride - dissolved (mg/L)	<9	<9	<9	<9
pH	7.33	7.88	7.22	8.02
TDS	188	216	137	148
Calcium - dissolved (mg/L)	45.6	59.6	38.5	36.8
Potassium - dissolved (mg/L)	4.06	1.37	0.37	0.98
Magnesium - dissolved (mg/L)	13.3	16.8	6.97	13.2

Sodium - dissolved (mg/L)	0.86	2	1.02	1.13
Hardness - CaCO ₃ (mg/L)	169	218	125	146
Conductivity (umhos/cm)	319	378	223	259
Alkalinity - total CaCO ₃ (mg/L)	168	205	115	138
Bicarbonate - HCO ₃ (mg/L)	205	250	141	168
Carbonate - CO ₃ (mg/L)	<0.6	<0.6	<0.6	<0.6
Hydroxide - OH (mg/L)	<0.4	<0.4	<0.4	<0.4