

**BOTANICAL AND VEGETATION RESOURCE SURVEY OF THE PROPOSED
ALL-SEASON ROAD PROJECT 6 FIELD REPORT
Manto Sipi Cree Nation, Bunibonibee Cree Nation and God's Lake First
Nation**

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January 2017

SUMMARY

Thirty-eight forested and wetland sites were sampled between Manto Sipi Cree Nation, Bunibonibee Cree Nation and God's Lake First Nation along the proposed P6 alignment and quarry areas. Forested sites were classed into 11 vegetation community types, and wetland sites were classed into five community types.

A total of 143 plant taxa were observed in the local assessment area. Eight documented uncommon species (S3 to S3S4) were recorded at or near survey sites. Species included oblong-leaved sundew (*Drosera anglica*), round-leaved bog orchid (*Platanthera orbiculata*), parsley fern (*Cryptogramma acrostichoides*), trailing club-moss (*Diphasiastrum complanatum*), black twinberry (*Lonicera involucrata*), alpine bearberry (*Arctous alpina*), Greenland primrose (*Primula egaliksesis*) and satin willow (*Salix pellita*). No species listed by the federal Species at Risk Act, the Manitoba Endangered Species and Ecosystems Act or the Committee on the Status of Endangered Wildlife in Canada were observed during fieldwork.

During the vegetation surveys, 12 cultural plant species were observed in the local assessment area. Of these, eight species were food plants, three were medicinal plants and three were other uses. Food plants observed included Saskatoon (*Amelanchier alnifolia*), strawberries (*Fragaria virginiana*), cherry (*Prunus* spp.), swamp gooseberries (*Ribes* spp.), cloudberry and head berries (*Rubus chamaemorus*), mossberries (*Vaccinium oxycoccus*), blueberries (*Vaccinium* spp.) and cranberries (*Vaccinium vitis-idaea*). Medicinal plants observed included juniper (*Juniperus* spp.), black spruce (*Picea mariana*) and Labrador tea (*Rhododendron groenlandicum*), while willow sticks (*Salix* spp.) were also valued. The most frequent species observed in sampled plots was black spruce. Other common species included blueberries, willows, Labrador tea, cranberries and mossberries.

Three environmentally sensitive sites were identified from field assessments along the proposed P6 All-Season Road. These sites supported older growth black spruce forest greater than 120 years age (121, 156 and 165 years).

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ACKNOWLEDGEMENTS

The authors would like to thank Manitoba Infrastructure for providing all background information required to conduct this study, Ecologic Environmental for generating the GIS analysis and developing the map products, Custom Helicopters for flying our field crew, the Manitoba Museum for use of their herbarium, and Ryan Perch of God's Lake First Nation and James Mason of Bunibonibee Cree Nation for providing field support.

1.0 INTRODUCTION

1.1 Background

To the northeast of Lake Winnipeg, Manto Sipi Cree Nation, Bunibonibee Cree Nation and God's Lake First Nation have relied primarily on winter road and air travel to transport people and goods. In 2008, the Government of Manitoba announced a strategic initiative to provide improved, safer and more reliable transportation services to connect the remote communities on the east side of Lake Winnipeg with the rest of Manitoba. Manitoba East Side Road Authority (MESRA), formerly Manitoba Floodway and East Side Road Authority (MFESRA), was established as a provincial Crown Agency to manage the East Side Transportation Initiative with the intent of increasing transportation opportunities for communities on the east side of Lake Winnipeg. This task has since been transferred to Manitoba Infrastructure (MI).

As part of the East Side Transportation Initiative, MI is proposing the construction of an all-season road northeast of Lake Winnipeg between Manto Sipi Cree Nation, Bunibonibee Cree Nation and God's Lake First Nation, Project 6 (P6). The proposed P6 All-Season Road will occur at the northeastern extent of the Transportation Initiative network.

1.2 Project Overview

The proposed All-Season Road will consist of approximately 137 km of two-lane gravel highway on new right-of-way (ROW) on provincial Crown land, connecting Manto Sipi Cree Nation, Bunibonibee Cree Nation and God's Lake First Nation (Map 1).

The All-Season Road will be a gravel-surface public highway, with a design width of 10 m. The All-Season Road will intersect two major water crossings over God's River and Magill Creek. The components of the Project include the following:

- All-Season Road on new ROW;
- Up to two bridges at water crossings (bridge replacement at God's River, possible bridge construction at Magill Creek);
- Culverts for stream crossings and drainage equalization;
- Rock quarries and granular borrow areas; and
- Temporary access trails, bridges, staging areas and camps.

The portion of the Project located on Provincial Crown Land requires an Environmental Impact Assessment under the Manitoba Environment Act as a Class II development and under the Canadian Environmental Assessment Act.

The specific objectives established for this study were as follows: i) describe vegetation types and composition, all overstory and understory species, and forest resource information; ii) verify the presence/absence of plant species of conservation concern and plant species of interest such as those traditionally used for medicine, subsistence and cultural purposes; and iii) conduct soil surveys associated with vegetation sampling.

2.0 STUDY AREA

The proposed All-Season Road Project is located northeast of Lake Winnipeg, near Manto Sipi Cree Nation, Bunibonibee Cree Nation and God's Lake First Nation, approximately 950 km northeast of Winnipeg (by air). The P6 All-Season Road extends from Bunibonibee Cree Nation southeast to God's Lake First Nation, and approximately midway is intersected to extend northeast to Manto Sipi Cree Nation. The total distance is approximately 137 km of proposed All-Season Road. For this study, the P6 segment from Bunibonibee Cree Nation to God's Lake First Nation is referred to as P6a and the segment from the junction to Manto Sipi Cree Nation as P6b.

The proposed All-Season Road Project occurs in the God's Lake, Knee Lake and Island Lake Ecodistricts, which are located in the Hayes River Upland Ecoregion and the Boreal Shield Ecozone.

2.1 Spatial Boundaries

The spatial boundaries for the assessment consist of project, local and regional assessment areas and are described below, and illustrated in Appendix II, Map 1.

Project Assessment Area (PAA) – Footprint of the proposed P6 All-Season Road Project, including rock quarries, borrow areas and access roads. The proposed P6 All-Season Road will be centered on a 100 m ROW with a typical clearing width of 60 m and additional clearing as required at horizontal curves to maintain sight distances.

Local Assessment Area (LAA) – One km on either side of the proposed P6 All-Season Road Project, including rock quarries, borrow areas and access roads.

Regional Assessment Area (RAA) – Five km on either side of the proposed P6 All-Season Road Project.

2.2 Existing Environment

2.2.1 Ecological Land Classification

The proposed All-Season Road Project connecting the communities of Manto Sipi Cree Nation, Bunibonibee Cree Nation and God's Lake First Nation, occurs almost entirely within the God's Lake Ecodistrict and the Knee Lake Ecodistrict (Appendix II, Map 2). The Island Lake Ecodistrict occurs at the northeastern portion of the study area. These ecodistricts occur within the Hayes River Upland Ecoregion which extends from the Grass River Basin in east-central Manitoba to northwestern Ontario, and the Boreal Shield Ecozone, which stretches from northern Saskatchewan to Newfoundland (Smith et al. 1998).

2.2.2 Geology and Surficial Geology

The geology of the area consists of Precambrian rock from the Archean era (Geology of Manitoba 2016). In the Oxford Lake area, the lithotec consists of late metasedimentary and metavolcanic rocks (Oxford Lake Group, Island Lake Series, San Antonio formation). The unit consists of greywacke, conglomerate, arkose and arenite, as well as mafic and felsic fragmental volcanic rocks, and porphyritic mafic to felsic flows. In the vicinity are late intrusive rocks of granodiorite, minor tonalite, migmatite and granite. In the God's Lake area, the lithotec dominantly consists of metamorphosed early intrusive rocks, gneisses and migmatites. Early metavolcanic and metasedimentary rocks (Rice Lake Group, Hayes River Group) occur at the north and south ends of the lake. The unit consists of basalt, minor andesite, minor sedimentary and mafic intrusive rocks, ultra mafic rocks and differentiated ultramafic/mafic intrusions. Metamorphic supracrustal rocks with amphibolite also occur (Geology of Manitoba 2016).

The surficial geology of the area is characterized by discontinuous till deposits over bedrock outcrops, organic deposits and glaciolacustrine sediments (Smith et al. 1998). Till deposits are of silt diamicton, largely derived from Phanerozoic carbonate rocks from the Hudson Bay Lowland, and are generally of low-relief. Organic deposits, in low-lying areas, are from <1 – 5 m thick and accumulate in fen, bog, swamp and marsh settings. In permafrost areas, patterned ground and peat palsas are common. The glaciolacustrine sediments are low relief, massive and laminated deposits of clay, silt and minor sand, deposited by deep water of glacial Lake Agassiz. Deposits were commonly scoured and homogenized by icebergs. Glaciofluvial sediments range from fine sand, minor gravel, thin silt and clay interbeds deposited as subaqueous outwash fans to sand and gravel complex deposits with esker ridges and kames. The bedrock outcrops are generally subglacially eroded and unweathered intrusive, metasedimentary and metavolcanic rocks with a glacially scoured irregular surface with high local relief. In areas of permafrost, frost shattered, angular boulder field occur (Matile and Keller 2006).

2.2.3 Soils

Soils are similar across ecodistricts, with mineral soils developed on till, glaciolacustrine or glaciofluvial sediments and non-frozen and frozen organic soils found in peatlands and depressions. In the God's Lake Ecodistrict, mineral soils are characterized as being dominantly well to imperfectly drained Eluviated Eutric Brunisols that have developed on loamy to sandy till deposits and Gray Luvisols that have developed on both loamy to sandy till deposits and upland clayey glaciolacustrine deposits. Vast areas of peat filled depressions form a poorly drained bog and fen complex. Soils found in poorly drained bogs are characterized as Fibrisols, with slightly decomposed sphagnum and feather moss peat and Mesisols with moderately decomposed moss and forest peat. Soils found in fens vary

with slightly decomposed to moderately well decomposed peat with deeper peat more decomposed than peat found at the surface. Organic Cryosols are found in the northern section of the ecodistrict and in peatlands where permafrost is present. To the north within the Knee Lake Ecodistrict, dominant soils are organic which include Organic Cryosols generally found in peatland areas that contain permafrost. Organic soils that are non-frozen include both Fibrisols and Mesisols found in shallow bogs, and patterned fens comprised of woody, forest peat and sedge peat. Mineral soils found in the ecodistrict include Eluviated Eutric Brunisols that have developed on loamy to sandy calcareous till and sandy gravelly fluvio-glacial deposits, and Gray Luvisols found on well to imperfectly drained clayey deposits (Smith et al. 1998). Soils of the assessment area are shown in Appendix II, Map 3.

2.2.4 Topography and Drainage

Topography of the area ranges from undulating to ridged morainal plain comprised of sandy to loamy till deposits. In areas of lower slopes and depressions, bogs and fens comprised of both shallow and deep peat material are found overlying clayey glaciolacustrine deposits. Inclusions of kettled fluvio-glacial deposits, in the form of eskers and esker aprons, can also be found. Elevations range from 150 metres above sea level (masl), to 274 masl (Smith et al. 1998).

Two drainage systems, the Nelson River and Hayes are found in the area, and the many small, medium and large sized lakes drain north-northeastward through a network of rivers and secondary streams.

The major lakes in the area include God's Lake, Oxford Lake and Knee Lake while major rivers of the area include the Hayes and God's Rivers. The P6 alignment is intersected at several locations by streams and creeks, shown in Appendix II, Map 4.

2.2.5 Landscape Level Vegetation

The vegetation across this region of Manitoba is primarily black spruce on both upland and organic sites. Canopies are often more open, and of medium height compared to areas further south. Forest fire has replaced some upland spruce with jack pine, often the dominant species on regenerating sites, while trembling aspen occurs occasionally. Mixed stands of white spruce, balsam fir, trembling aspen and balsam poplar are generally restricted to favorable sites along lakes and rivers. Areas of rocky outcrops favour jack pine, with an understory of ericaceous shrubs, herbs and mosses and lichens. Low growing black spruce in open canopies grow in bogs, along with ericaceous shrubs and sphagnum and other mosses. Tamarack is found in fens, and is mixed with black spruce in transitional peatlands (Smith et al. 1998). The land cover classification is shown in Appendix II, Map 5.

2.2.6 Wetlands

The distribution of wetlands across the region for the P6 study area is based on digitized data from a study on wetland types and their distribution in Manitoba (Halsey et al. 1997). Here, wetlands are distinguished by wetland class (bog, fen, marsh, swamp, shallow water), the presence/absence of a tree canopy (open, wooded, forested), and a landform modifier (e.g., patterned, non-patterned). Mapping at this scale, in many cases resulted in wetland complexes identified, rather than individual wetlands. In the wetland complex class, 30 to 70% of land is comprised of a mosaic of fen and bog habitats, while the remaining represents upland habitat, or non wetland (Appendix II, Map 6). Only bog and fen wetlands were identified in the regional assessment area, based on data from Halsey et al. (1997).

2.2.7 Quarry and Borrow Areas

Due to the widespread presence of wetlands throughout the project area, extensive aggregate for construction of the road will be pulled from other sites, and 29 potential rock quarries have been identified along the alignment, ranging in size from 0.01 km² to 0.47 km². A total of 2.51 km² will be cleared for quarry development, primarily within the local assessment area (2.49 km²), including 0.70 km² in the project area, and an additional 0.03 km² beyond the local assessment area. For all quarries located off the alignment, access roads will be required.

3.0 METHODS

3.1 Sample Site Selection

Information provided by MESRA was used to select potential sites for vegetation sampling of the proposed P6 All-Season Road Project. Information included route alignment high resolution imagery (30 cm), Google Earth imagery and Project shapefiles such as the Land Cover Classification (LCC).

The LCC is a national vector database mapping layer that has been harmonized across the major federal departments involved in land management or land change detection (Agriculture and Agri-Foods Canada, Canadian Forest Service, and Canadian Centre for Remote Sensing). The LCC consists of remotely sensed imagery (Landsat data) as part of the Earth Observation for Sustainable Development of Forests Program.

The National Stratification Working Group ecological framework database (Smith et al. 1998) was used to identify and describe the ecological land classification, to the ecodistrict scale. Other available data sources used included soils (Agriculture and Agri-Food Canada 2013), water crossings (Natural Resources Canada 1999 to 2010) and wetland features (Halsey et al. 1997). Plant species of interest as identified through traditional knowledge studies and engagement activities (i.e., shapefiles) were provided by MESRA.

Potential sample sites for the proposed P6 All-Season Road Project were based on accessibility, vegetation cover type, disturbance, and areas with potential to support species of conservation concern and species of interest.

3.2 Native Vegetation and Soil Survey

Vegetation and soil surveys were planned to occur within a 1 km radius of the proposed P6 All-Season Road Project, where most direct environmental effects are likely to occur. Fieldwork was conducted to record information on the local flora, describe vegetation types and forest conditions, search for species of conservation concern, document culturally important species, and classify soils.

3.2.1 Native Vegetation Survey

A native vegetation survey was used to sample and characterize plant communities. The survey consisted of establishing temporary sample plots on sites with relatively homogeneous vegetation. These included both upland and wetland sites. The sampling of vegetation composition was based on methods outlined in Redburn and Strong (2008). A 30 m transect was used with five 2.5 m by 2.5 m quadrats with a 1 m by 1 m nested quadrat spaced at 5 m increments along the transect for shrubs 1-2.5 m tall and herbs and low

shrubs ≤ 1 m tall, respectively. The composition of tree cover >2.5 m tall was determined using a 20 m by 30 m plot centered on each transect. Plant species presence/absence data was recorded by subplot.

Within each plot, the tallest tree of each species was aged based on growth ring counts from a single core extracted with an increment corer at breast height (1.3 m). Diameter at breast height (DBH) was measured with a diameter tape. A clinometer was used to measure tree height at a distance of 20 m.

3.2.2 Soil Survey

One soil pit was dug inside each upland plot for description. At each soil pit, the thickness (cm) of the humus layer and soil horizons were measured. In wetland sites, a hand held Dutch auger was used to extract, measure soils.

Soils horizons, structure and texture were classified according to the Canadian System of Soil Classification (Soil Classification Working Group 1998). Dilute 10% hydrochloric acid solution was used for determining effervescence and detecting carbonates (basic soils) in the field.

3.2.3 Field Classification and Site Information

In the field, vegetation type classification for upland sites sampled followed Zoladeski et al. (1995) and Ducks Unlimited (2015) for wetlands.

Universal Transverse Mercator (UTM) geographic coordinates were recorded in the field for all temporary sample plots. Photographs were captured at each site visited.

3.3 Botanical Survey

Botanical surveys of the project area involved identification and tabulation of all observed vascular plant species including trees, shrubs, forbs and graminoids, and mosses and lichens.

3.3.1 Species of Conservation Concern

Searches for species of conservation concern concentrated on uncommon plant communities, and unusual habitats and landscape features. A meander search pattern was used when surveying for species of conservation concern.

MESRA defines plant species of conservation concern as species that are ranked as very rare (S1) to rare (S2) by the Manitoba Conservation Data Centre (MBCDC), and those listed under the Endangered Species and Ecosystems Act – Manitoba (ESEA), the federal Species

at Risk Act (SARA) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A database search of the MBCDC provincial records for known locations of species of conservation concern in the vicinity of the Project was requested in the spring of 2016.

The global (G) and sub-national (S) rarity ranking of species used by the MBCDC, according to a standardized procedure used by all Conservation Data Centres and Natural Heritage Programs is as follows:

- 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 impossible to eradicate under present conditions.

The conservation status categories for ESEA, SARA and COSEWIC are as follows:

Special Concern: A species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

Threatened: A species likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

Endangered: A species facing imminent extirpation or extinction.

Extirpated: A species no longer existing in the wild in Canada but exists elsewhere.

Extinct: A species that no longer exists.

3.3.2 Species of Interest

Plant species of interest, such as those traditionally used for medicine, subsistence and cultural purposes, were recorded in the field where observed. Prior to field studies, a list of culturally important species was compiled based on available literature. Generally these include a variety of vegetation including trees, shrubs, flowers, mosses, lichens (Davidson-Hunt et al. 2012). All plant species recorded in the field and culturally important species provided by MESRA for the Project (i.e., shapefiles) were assessed to determine which sites supported those plants. A traditional knowledge study carried out in collaboration

with local community members using workshops and one-on-one interviews to determine culturally important species.

3.3.3 Collection Guidelines

All vascular plants were recorded and those unidentifiable in the field were collected, as voucher specimens, where the population size permits. Identification of vascular plants followed Flora of North America (1993+) and Scoggan (1957), and verification with herbarium specimens located at the Manitoba Museum. Plant nomenclature followed Flora of North America (1993+) and the Manitoba Conservation Data Centre for those plants not listed by Flora of North America (1993+). Voucher specimens will be donated to the Manitoba Museum natural history collection and credited as a donation from the MESRA. Fieldwork was conducted from June 9 to 16, 2016.

4.0 VEGETATION AND BOTANICAL RESOURCES

4.1 Native Vegetation Resources

Thirty-eight forested and wetland (i.e., bog and fen) sites were sampled between Manto Sipi, Bunibonibee and God's Lake along the P6a and P6b alignments. Appendix II, Map 7 shows the distribution of sites within the assessment area.

To summarize and characterize the local vegetation, forested and wetland sites were further classed into specific vegetation community types (Zoladeski et al. 1995; Ducks Unlimited 2015). Classification was carried out in the field based on data collected at each site, including vegetation composition, distribution and structure, and soil type and profile information. Vegetation community descriptions are presented for forested and wetland sites separately, for all vegetation strata present, (i.e. trees, tall shrub canopy, and herb and low shrub understory). Forested (and one wetland, V33) community type descriptions includes tree canopy cover and composition, and age of tallest trees for species present. Canopy cover is defined as dense (crown closure >60%), open (crown closure 26 to 60%), and sparse (crown closure 10 to 25%).

Presence/absence data was recorded for all species in the tall shrub, and the herb and low shrub strata over five quadrats at each site. The distribution of all species based on frequency of occurrence within sites is defined here as widespread (species occurs in 4-5 quadrats), frequent (occurs in 3 quadrats), or scattered (occurs in 1-2 quadrats). Species observed adjacent to or in the vicinity of sites, but not within the plot/ quadrats themselves, are included as incidental species.

Tree species are referred to by common names, all other species are referenced with common and scientific names. For all species encountered in field surveys, see the flora list found in Appendix III.

4.1.1 Forest Community Types

Twenty-six forested sites were sampled from areas of mainly deciduous (4 sites), mixedwood conifer (2 sites), and conifer (20 sites) tree canopies. Over the study area, each habitat type present is represented in the sample of sites, and the predominance of black spruce sites reflects the area's dominant coniferous forest cover. The fire history of the area suggests that some of these forests are very mature stands. Notably in four black spruce stands, the largest trees were aged at over 100 years, (101 to 156 y). Other species were also long lived, five stands had either jack pine, trembling aspen or tamarack aged at over 90 y (91 to 97 y). The oldest tree measured was 165 years, from a tree bog wetland.

Forested sites were further classed into eleven forested vegetation community types, using the Forest Ecosystem Classification for Manitoba (Zoladeski et al. 1995) based on the vegetation composition and structure, and soils present at each site. Site locations, vegetation community classification, soil type and site surface information are provided in Appendix IV, Table A. Community types are summarized in Table 4.1.1., with brief descriptions of vegetation and soils following, below.

Two sampled plots in forest communities were located in or adjacent to potential quarry sites (P6a-15 and Quarry 28, P6a-05 and Quarry 6), and two other sampled plots were located near potential quarry sites, approximately 200m away (P6a-22 and Quarry 23, P6a-02 and Quarry 13).

Community Types	Plot Identification	#	Soil Types	Total Species	Mean Species
Mainly Deciduous Communities					
V5 Aspen Hardwood	P6b-30	1	Brunisol	24	-
V8 Trembling Aspen Mixedwood/ Tall Shrub	P6a-14, P6a-15	2	Luvisol	36	25
V9 Trembling Aspen Mixedwood/ Low Shrub	P6a-10	1	Luvisol	24	-
Mixedwood Coniferous Communities					
V18 Black spruce Mixedwood/ Feathermoss	P6a-05, P6a-08	2	Brunisol, Luvisol	30	19
Coniferous Communities					
V25 Jack pine/ Feathermoss	P6a-12	1	Brunisol	9	-
V26 Jack pine- Black spruce/ Lichen	P6b-25, P6b-27	2	Brunisol	24	13.5
V27 Black spruce/ Shrub- and herb- poor	P6b-33	1	Brunisol	27	-
V28 Jack pine- Black spruce/ Feathermoss	P6a-16	1	Brunisol	31	-
V29 Black spruce/ Feathermoss	P6a-01, P6a-13, P6a-21, P6b-31	4	Luvisol	39	18.8
V30 Black spruce/ Labrador tea/ Sphagnum	P6a-04, P6a-09, P6a-22	3	Gleysol	32	19
V32 Black spruce/ Herb poor/ Sphagnum	P6a-03, P6a-06, P6a-07, P6a-18, P6a-19, P6b-26, P6b-32, P6b-36	8	Organic	60	21.8

4.1.1.1. *Mainly Deciduous Forest Community Types*

Aspen Hardwood (V5)

A single site was classed as Aspen Hardwood. The canopy is dominated by open trembling aspen, with the tallest tree aged at 96 years. Black spruce is also present, the tallest among

this sub-canopy was aged 39 y. Green alder (*Alnus viridis*) is widespread in the tall shrub canopy, with scattered black spruce saplings. The understory is relatively herb rich, with twenty species of herbs and low shrubs occurring. Widespread species include Canada bunchberry (*Cornus canadensis*), prickly rose (*Rosa acicularis*), Labrador tea (*Rhododendron groenlandicum*) and pink pyrola (*Pyrola asarifolia*). One uncommon to widespread species was incidentally recorded, the round-leaved bog orchid (*Platanthera orbiculata*, S3S4). Widespread leaf litter accounts for the ground layer, along with frequent Schreber's moss (*Pleurozium schreberi*), and scattered splendid feathermoss (*Hylocomium splendens*) and unidentified mosses. No species of conservation concern were recorded in this vegetation type.

An Eluviated Dystric Brunisol was classified at this site and was characterized as having a humus form thickness of 5 cm. Soil horizons consisted of an Ahe (3 cm thick), sandy clay Bt (16 cm thick), loamy sand Bm horizon (22 cm) followed by a sandy clay C horizon 22 cm thick. Bedrock was encountered at a depth of 62 cm in the soil pit.

Trembling Aspen Mixedwood/ Tall Shrub (V8)

Two sites were classed as Trembling Aspen Mixedwood/ Tall Shrub with a canopy of open or sparse trembling aspen. Black spruce, balsam poplar and jack pine may be present. The tallest aspen trees were aged at 92 and 94 years. Black spruce (73 y), balsam poplar (85 y) and jack pine (97 y) were non-dominant, and present in one site only. Widespread green alder (*Alnus viridis*), and scattered saplings of black spruce and trembling aspen are found in the tall shrub canopy. A total of 29 herb and low shrub species make up the understory, including widespread bunchberry (*Cornus canadensis*), mooseberry (*Viburnum edule*), smooth wild strawberry (*Fragaria virginiana*), mitrewort (*Mitella nuda*), and prickly rose (*Rosa acicularis*). Ground litter is widespread, with scattered occurrences of Schreber's moss (*Pleurozium schreberi*), *Dicranum* mosses, splendid feathermoss (*Hylocomium splendens*) and other unidentified mosses recorded. No species of conservation concern were recorded in this vegetation type.

The soils associated with this vegetation type were classified as Orthic Gray Brown Luvisols. Humus form thickness ranged from 6 to 10 cm. The soils were characterized as having an Ah horizon ranging from 2 to 3 cm thick, an Ae horizon (2cm), and a silty clay to clay loam Bt horizon (17-23 cm thick). The silty clay loam/silty clay C horizons were encountered at a depth ranging from 22 to 25 cm and thickness ranged from 74 to 92 cm.

Trembling Aspen Mixedwood/ Low Shrub (V9)

One site was classed in this vegetation community with an open trembling aspen canopy (83 y), and a presence of jack pine (81-87 y). The tall shrub canopy is made up of

widespread green alder (*Alnus viridis*), with scattered Saskatoon (*Amelanchier alnifolia*) and mooseberry (*Viburnum edule*). The herb and low shrub layer consists of 19 species, including widespread green alder seedlings, bunchberry (*Cornus canadensis*), dewberry (*Rubus pubescens*), pink pyrola (*Pyrola asarifolia*), and prickly rose (*Rosa acicularis*). Round-leaved bog orchid (*Platanthera orbiculata*, S3S4) was recorded incidentally in the plot. This plant is ranked as uncommon to widespread by the MBCDC. Widespread ground litter, and scattered Schreber's moss (*Pleurozium schreberi*), splendid feathermoss (*Hylocomium splendens*) and unidentified mosses make up the ground cover. No species of conservation concern were recorded in this vegetation type.

The soil at this site was an Orthic Gray Brown Luvisol. Humus form thickness was 8 cm and soil horizons included an Ae of 5 cm, a silty clay loam Bt of 29 cm, and a clay loam C horizon 56+ cm.

4.1.1.2. *Mixedwood Coniferous Forest Community Types*

Black spruce Mixedwood/ Feathermoss (V18)

Two sites were classed into this vegetation type. Open black spruce and trembling aspen make up the tree canopy, while the tallest trees were aged at 64-72 y for black spruce, and 78-83 y for trembling aspen. Typically, these sites have poorly developed tall shrub canopies, and here consists of only scattered green alder (*Alnus viridis*). The herb and low shrub layer is also relatively poorly developed, and includes 27 species. Most frequently occurring is bunchberry (*Cornus canadensis*) and prickly rose (*Rosa acicularis*). Trailing club-moss (*Diphasiastrum complanatum*, S3S4) is uncommon to widespread and was recorded incidentally at one site. Widespread litter and dominant mosses of Schreber's feathermoss (*Pleurozium schreberi*) and splendid feathermoss (*Hylocomium splendens*) account for the ground layer. No species of conservation concern were recorded in this vegetation type.

Soils at these sites were classified as an Eluviated Eutric Brunisol and an Orthic Gray Brown Luvisol. The Eluviated Eutric Brunisol had s humus form thicknesses of 6 cm followed by an Ah (2 cm) and Ae (3 cm) horizon. Under the A horizon, occurred a sandy loam Bm horizon 20 cm thick, followed by a loamy sand C horizon. Bedrock was encountered at a depth of 55 cm. The Orthic Gray Brown Luvisol was characterized as having a humus form that was 6 cm thick, followed by an Ah, 2 cm thick. A clay Bt horizon underlies the A horizons and is 30 cm thick. The sandy clay C horizon was encountered at 32 cm and was 67 cm thick. Bedrock was found below the C horizon.

4.1.1.3. Coniferous Forest Community Types

Jack pine/ Feathermoss (V25)

A single site is described as Jack pine/ Feathermoss, with a tree canopy made up of very sparse jack pine (aged at 86 y), with a presence of black spruce (28 y). The tall shrub layer is absent. The poorly developed herbs and low shrub understory is composed of seven species. Most frequently occurring species are velvet-leaved blueberry (*Vaccinium myrtilloides*) and twinflower (*Linnaea borealis*). Schreber's moss (*Pleurozium schreberi*), reindeer lichens (*Cladina rangiferina* and *C. mitis*) provide a near continuous ground cover, with scattered leaf litter and open ground water. No species of conservation concern were recorded.

The soil at this site was classified as an Eluviated Eutric Brunisol with a humus form 5 cm thick followed by an Ah (3 cm), loamy sand Ae (14 cm) and loamy sand Bm (33 cm thick). The loamy sand C horizon was encountered at 50 cm and was 30+ cm thick.

Jack pine- Black spruce/ Lichen (V26)

In these two sites, the tree canopy is composed of jack pine (mean age 89.5 y), while black spruce (mean age 52 y) or paper birch may be present. Jack pine- Black spruce/ Lichen types are sparse to open canopied, with no tall shrub stratum. Twenty-one species of herbs and low shrubs are generally sparsely scattered, most frequently occurring is velvet-leaved blueberry (*Vaccinium myrtilloides*) and twinflower (*Linnaea borealis*). Parsley Fern (*Cryptogramma acrostichoides*, S3S4) was observed with scattered occurrence at one site. This species is identified as uncommon to widespread. Lichens are more frequent than mosses, and the ground layer is generally characterized by a widespread cover of reindeer lichens (*Cladina mitis*), with scattered Schreber's moss (*Pleurozium schreberi*), *Cladonia* and reindeer lichens (*Cladina rangiferina* and *C. stellaris*). Ground litter and woody debris are widespread; one site occurred on a granite outcrop. No species of conservation concern were recorded in this vegetation type.

Soils that were classified for these sites include an Eluviated Dystric Brunisol and Orthic Eutric Brunisol. The humus form thicknesses ranged from 2 to 5 cm. The humus layer was underlain by either a thin Ah horizon (1 cm) or sandy Bm horizon (12 to 15 cm thick cm), followed by a sandy to silty clay C horizon ranging from 18 to 90+ cm in thickness. At one site bedrock was encountered at 25 cm deep in the soil profile.

Black spruce/ Shrub- and herb-poor (V27)

In this single site, the tallest black spruce was aged at 156 years, the sub-canopy tamarack was aged at 34 y. The Black spruce/ Shrub- and herb-poor vegetation type is characterized

by sparse black spruce stands, with poorly a developed tall shrub layer. Bog birch (*Betula pumila*) occurs frequently as a tall shrub, with scattered black spruce and tamarack saplings. Typically floristically poor, the herbs and low shrubs are made up of 21 species, with widespread sheathed sedge (*Carex vaginata*), common juniper (*Juniperus communis*), Labrador-tea (*Rhododendron groenlandicum*), myrtle-leaved willow (*Salix myrtillifolia*), bog whortleberry (*Vaccinium uliginosum*), and bog cranberry (*Vaccinium vitis-idaea*). Alpine bearberry (*Arctous alpina*, S3S4) was observed with scattered occurrence. Widespread leaf litter, Schreber's moss (*Pleurozium schreberi*) and reindeer lichens (*Cladina rangiferina* and *C. mitis*) provide a near continuous ground layer. No species of conservation concern were recorded.

The soil found at this site was classified as an Orthic Eutric Brunisol. Soil horizons consisted of an Of (14 cm thick) followed by an Ah (5 cm thick) then a sandy loam Bm horizon (73 cm thick). Rock and coarse fragments were encountered at a depth of 78 cm and seepage was also observed at this depth.

Jack pine- Black spruce/ Feathermoss (V28)

In this single Jack pine- Black spruce/ Feathermoss site, dominant, open jack pine (to 77 y) and sparsely occurring subdominant trembling aspen (80 y), make up the canopy trees, with a presence of paper birch. The tall shrubs include widespread green alder, and scattered saplings of black spruce and white birch. The understory is composed of 25 species, including the widespread herbs, bunchberry (*Cornus canadensis*), smooth wild strawberry (*Fragaria virginiana*) and white-grained mountain rice grass (*Oryzopsis asperifolia*), and low shrubs of bog cranberry (*Vaccinium vitis-idaea*), mooseberry (*Viburnum edule*) and prickly rose (*Rosa acicularis*). The round-leaved bog orchid (*Platanthera orbiculata*, S3S4) is scattered in occurrence, recorded from one quadrat, and black twinberry (*Lonicera involucrata*, S3S4) was incidentally recorded at one site. These species are ranked as uncommon to widespread by the MBCDC. Leaf litter and Schreber's moss (*Pleurozium schreberi*) are widespread in the ground layer, followed by splendid feathermoss (*Hylocomium splendens*), and scattered *Dicranum* mosses. No species of conservation concern were recorded in this vegetation type.

The soil associated with this vegetation type was an Eluviated Eutric Brunisol. The site had a humus form thickness of 5 cm. The soil was characterized with an Ah (2 cm) followed by an Ae (2 cm) horizon. Following horizons included a silty clay loam Bt horizon of 20 cm, loamy sand Bm horizon of 21 cm, a silty clay loam C1 horizon (25 cm) and a sandy C2 horizon approximately 40+ cm thick.

Black spruce/ Feathermoss (V29)

Four sites made up this community of open black spruce stands, with the tallest trees aged to 76 y. Also present were jack pine (to 81 y), paper birch (46 y) and trembling aspen (56 y). The poorly developed tall shrub layer consists of scattered green alder and black spruce saplings, while scattered white birch and Bebb's willow (*Salix bebbii*) are occasionally present. The herb and low shrub understory has 30 species, with generally frequent occurrence of bunchberry (*Cornus canadensis*) and prickly rose (*Rosa acicularis*), and a scattered occurrence of black spruce seedlings, northern comandra (*Geocaulon lividum*), twinflower (*Linnaea borealis*), and Labrador-tea (*Rhododendron groenlandicum*). Trailing club-moss (*Diphasiastrum complanatum*, S3S4) was recorded incidentally at one site. The ground layer is made up of widespread splendid feathermoss (*Hylocomium splendens*) and Schreber's moss (*Pleurozium schreberi*), with scattered *Dicranum* mosses and plume moss (*Ptilium crista-castrensis*). No species of conservation concern were recorded.

Orthic Gray Brown Luvisols were classified at these sites. These soils had a humus form thickness of 5 cm. The uppermost soil horizons were identified as being Ah, Ae or Ahe horizons with thicknesses ranging from 2 to 9 cm. These horizons were followed by a clay loam, silty clay or silty clay loam Bt horizon ranging from 26 to 40 cm, followed by a sandy clay, clay, silty clay or clay loam C horizon. Seasonal ice was encountered in the C horizon at two of the field sites. No species of conservation concern were recorded in this vegetation type.

Black spruce/ Labrador tea/ Feathermoss Sphagnum (V30)

These three lowland sites are open black spruce stands, where tallest trees were a mean of 77 y, (max. 101 y). Tamarack (70 y) is present in one site. The tall shrub layer is moderately-well developed and composed of frequent black spruce (*Picea mariana*) and white birch (*Betula papyrifera*) saplings, green alder (*Alnus viridis*) and Bebb's willow (*Salix bebbiana*). The understory of this vegetation type can be characterized as poor to rich. Here, 23 herb and low shrub species make up the understory, most with scattered occurrence. Frequent to widespread species include Labrador tea (*Rhododendron groenlandicum*), bog cranberry (*Vaccinium vitis-idaea*), horsetails (*Equisetum arvense* and *E. scirpoides*) and black spruce seedlings. Greenland primrose (*Primula egaliksesis*, S3) was incidentally observed near one site. Schreber's moss (*Pleurozium schreberi*) and splendid feathermoss (*Hylocomium splendens*) are widespread in the ground layer, with scattered *Sphagnum* mosses, green reindeer lichen (*Cladina mitis*), and unidentified mosses. No species of conservation concern were recorded.

Three different soils were classified for this vegetation type, a Humic Luvic Gleysol, Rego Humic Gleysol and Rego Gleysol. The Humic Luvic Gleysol had a humus form thickness of

17 cm that was underlain by an Ah (30 cm thick), silty clay Btg (30 cm), then a sandy clay C horizon (40+ cm thick). Water seepage was evident in the soil pit and seasonal ice was present near to the soil pit. The Rego Humic Gleysol had an Of layer 15 cm thick followed by an Om layer 8 cm thick. Soil horizons included an Ah (12 cm) and sandy loam Cg horizon (27 cm thick) that had evidence of mottling. Bedrock was encountered at 62 cm depth. The site with the Rego Gleysol had an Of (10 cm thick), followed by an Om (15 cm thick), then an Oh (8 cm thick). The organic layers were underlain by an Ah approximately 2 cm thick followed by a Cg horizon 55+ cm thick with evidence of gleying. Seasonal ice was found with the soil profile.

Black spruce/ Herb poor/ Sphagnum (V32)

This type includes eight sites with sparse canopy of black spruce (average age 90, max. 121 y) with generally sub-dominant tamarack (average age 74, max. 93 y). White birch is present in one site only. Black spruce saplings are scattered to frequent across all plots, other tall shrubs occasionally present are speckled alder (*Alnus incana*), velvet-fruited willow (*Salix maccalliana*), and tea-leaved willow (*Salix planifolia*). Over the eight sites, an average of 17 species were recorded in the herb and low shrub understory, made up of widespread Labrador tea (*Rhododendron groenlandicum*) and frequent black spruce seedlings, bog cranberry (*Vaccinium vitis-idaea*) and small cranberry (*Vaccinium oxycoccos*). Other scattered plant species include sedges (*Carex aquatilis* and *C. gynocrates*), three-leaved Solomon's seal (*Maianthemum trifolium*) leatherleaf (*Chamaedaphne calyculata*), round-leaved sundew (*Drosera rotundifolia*) and bog-laurel (*Kalmia polifolia*). Alpine bearberry (*Arctous alpina*, S3S4) was incidentally recorded at one site. The ground layer is composed of widespread mosses (*Sphagnum* spp., *Pleurozium schreberi* and unidentified mosses) and green reindeer lichen (*Cladina mitis*), with scattered splendid feathermoss (*Hylocomium splendens*). No species of conservation concern were recorded.

The organic soils encountered included Terric Humisols, Terric Mesic Humisols, Terric Humic Fibrisol and Humic Mesisol. The Terric Humisols were classified as having an Oh horizon of 45 cm or an Of horizon (10 cm thick) followed by an Om horizon (10 cm thick) then an Oh horizon (22 cm thick). The sandy clay and clay C horizons were encountered at a depth ranging from 42 to 80 cm. The Terric Mesic Humisols encountered at some sites were classified as having an Of ranging from 10 to 230 cm thick, Om horizon (30 to 35 cm thick) and an Oh horizon ranging from 22 to 40 cm thick. The clay C horizon was encountered at a depth of 80 cm. Seasonal ice was also present in the Terric Mesic Humisols.

A Terric Humic Fibrisol and Mesic Humisol were identified at one site each. The Terric Humic Fibrosol was characterized by an Of (20 cm thick), followed by an Om (10 cm thick), and an Oh horizon (20 cm thick). The clay C horizon was encountered at 70 cm and

seasonal ice was present in the soil profile. The Mesic Humisol was comprised of an Of 9 cm thick, followed by an Om (88 cm thick), then an Oh approximately 123 cm thick. The clay C horizon was reached at a depth of 220 cm.

In addition to the organic soils characterized above, two field sites sampled, had soil profiles comprised of organic material but were unable to be classified to the great group as a result of the presence of seasonal ice which hindered augering of soils.

4.1.2 Wetland Community Types

Twelve sites sampled were considered wetlands, characterized by vegetation that is adapted to flooded or saturated conditions, with water permanently or seasonally present, at above or below the surface. Site locations, vegetation community classification, soil type and site surface information are provided in Appendix IV, Table B.

Wetland sites were further classed in to five wetland community types (Ducks Unlimited 2015), based on soil type, vegetation composition and height, and water regime, summarized in Table 4.1.2. Wetland types found along the project area include treed bog and fen communities, including treed, shrub and graminoid fens. A description of the vegetation and soils of the community types encountered follows.

Community Types	Plot Identification	Plots Sampled	Soil Types	Total Species	Mean Species
Treed bog (V33)	P6a-20, P6a-24, P6b-28, P6b-29, P6b-34, P6b-38	6	Organic	32	14
Treed poor fen	P6a-11	1	Organic	17	-
Shrub rich fen	P6a-02	1	Organic	16	-
Graminoid rich fen	P6b-35, P6b-37	2	Organic	17	13
Graminoid poor fen	P6a-17, P6a-23	2	Organic	24	15

Treed Bog (V33 Black spruce/ Sphagnum)

Six sites make up this vegetation type, the very open canopy is made up of black spruce (average 81 y), with a presence of tamarack (average 73 y). The oldest tree encountered during field sampling was found in a treed bog, a black spruce aged at 165 y. The tall shrub layer is composed of mainly black spruce saplings, while scattered tamarack saplings, bog birch (*Betula pumila*) and Bebb's willow (*Salix bebbiana*) may be present. The herb layer is generally floristically poor. There was a total of 32 species recorded in this vegetation type,

though many are scattered in occurrence. All sites have widespread occurrence of leather leaf (*Chamaedaphne calyculata*) Labrador tea (*Rhododendron groenlandicum*), three-leaved Solomon's seal (*Maianthemum trifolium*), and black spruce seedlings. While bog-laurel (*Kalmia polifolia*), cloudberry (*Rubus chamaemorus*) and small cranberry (*Vaccinium oxycoccos*) are frequent to scattered in occurrence. Greenland primrose (*Primula egaliksesis*, S3) was incidentally observed near one site. Ground cover is generally widespread *Sphagnum* mosses, with frequent occurrence of Schreber's moss (*Pleurozium schreberi*) and reindeer lichens (*Cladina rangiferina*, *C. mitis*). No species of conservation concern were recorded.

A Terric Fibrisol, Humic Mesisol, Terric Mesic Humisol and Terric Humic Fibrisols were the organic soils characterized at the treed bog sites. In addition to these soils, another organic soil was encountered, that was not able to be classified due to seasonal ice prohibiting augering past 38 cm in depth. The Terric Fibrisol had an Of (65 cm), Om (10 cm) and an Oh (10 cm) underlain by a clay Cg horizon (29+ cm thick). Seasonal ice was present at a depth of 29 cm. The Humic Mesisol was characterized as having an Of 26 cm thick, followed by an Om 74 cm thick, then an Oh 120+ cm thick. Seasonal ice was encountered at 26 cm deep in the soil profile. The Terric Mesic Humisol encountered at one of the treed bog sites was identified as having an Of (32 cm), Om (26 cm) and an Oh (35+ cm), with the organic horizons underlain by an Ah (21 cm) followed by a C horizon (6+ cm). Seasonal ice was encountered at 18 cm in depth in the soil profile. The Terric Humic Fibrisols were identified as having Of horizons ranging from 20 to 57 cm thick, followed by Om horizons (5 to 8 cm thick), then Oh horizons of 18 to 20 cm thick. An Ah horizon (8 cm thick) underlay the organic horizons in one of the sites. At both sites, the Terric Humic Fibrisols had clay to clay loam C horizons 20+ cm thick. Seasonal ice was found at depths ranging from 28 to 40 cm.

Treed Poor Fen

This is a single site, with a presence of very sparsely scattered tamarack and black spruce trees. The tall shrub canopy has frequent dwarf birch (*Betula pumila*) and scattered tamarack saplings. Thirteen species were recorded in the understory, with widespread sedges (*Carex aquatilis*, *C. magellanica*), marsh five-finger (*Comarum palustre*), three-leaved Solomon's seal (*Maianthemum trifolium*) and dwarf birch (*Betula pumila*). Satin willow (*Salix pellita*, S3S4) and small cranberry (*Vaccinium oxycoccos*) are frequent in occurrence. Unidentified mosses and litter are widespread throughout, with frequent occurrence of water at ground level. No species of conservation concern were recorded.

A Mesic Humisol was classified at this site and was characterized as having an Of (10 cm), Om (75 cm) and an Oh (85 cm). Seasonal ice was noted on a plateau near the site.

Shrub Rich Fen

This single site has no tree canopy, with 16 species present. The tall shrub canopy is made up of frequent dwarf birch (*Betula pumila*) and scattered tamarack saplings. Sedges are widespread (including *Carex chordorrhiza*, *C. magellanica* and *C. aquatilis*). Widespread low shrubs and herbs include bog rosemary (*Andromeda polifolia*), bog willow (*Salix pedicellaris*), small cranberry (*Vaccinium oxycoccos*), marsh five-finger (*Comarum palustre*) and bog bean (*Menyanthes trifoliata*). Dwarf birch (*Betula pumila*) seedlings and three-leaved Solomon's seal (*Maianthemum trifolium*) are frequently occurring in the understory. *Sphagnum* mosses and ground litter are widespread, while unidentified mosses are frequent in occurrence. No species of conservation concern were recorded.

The soil classified at this site was a Rego Gleysol which was characterized as having organic surface horizons comprised of an Of horizon 10 cm thick, followed by an Om horizon 15 cm thick, then a thin Oh horizon approximately 8 cm thick. Underlying the organic horizons, was a clay C horizon with evidence of gleying. Seasonal ice was also present at this site at a depth of approximately 25 cm.

Graminoid Rich Fen

No trees or tall shrubs are present in the two sites that make up this vegetation type. A total of 17 species were recorded. Widespread species are bog sedge (*Carex magellanica*) and bog willow (*Salix pedicellaris*), with bog rosemary (*Andromeda polifolia*), tufted clubrush (*Trichophorum caespitosum*) and dwarf birch (*Betula pumila*) seedlings present. Other herbs present include bog bean (*Menyanthes trifoliata*), seaside arrow-grass (*Triglochin maritima*), marsh five-finger (*Comarum palustre*), and sedges (*Carex chordorrhiza* and *C. aquatilis*). Oblong-leaved sundew (*Drosera anglica*, S3S4) occurs frequently in one site. This species is ranked as uncommon by the MBCDC. The ground layer is made up of unidentified mosses and litter, while ground water is widespread in one site. No species of conservation concern were recorded in this wetland type.

Soils found at the graminoid rich fens sites included a Humic Fibrisol and a Typic Humisol. The Humic Fibrisol identified had an Of horizon (90 cm), underlain by an Om (30 cm) then an Oh (100+ cm) horizon. The Typic Humisol was characterized as having an Of 10 cm thick, followed by an Om horizon 35 cm thick which was underlain by an Oh horizon 185+ cm. Seasonal ice was encountered in the soil pit at a depth of 15 cm.

Graminoid Poor Fen

The two sites in this vegetation type have no trees present, but a tall shrub canopy of scattered saplings of dwarf birch (*Betula pumila*), speckled alder (*Alnus incana*) and

tamarack (*Larix laricina*), or tea-leaved willow (*Salix planifolia*). Twenty species were recorded in the low shrub and herb understory, including widespread sedges (*Carex chordorrhiza* and *C. aquatilis*), bog willow seedlings (*Salix pedicellaris*) and marsh five-finger (*Comarum palustre*). Other species present include scattered bog sedge (*Carex magellanica*), beaked sedge (*Carex utriculata*), bog rosemary (*Andromeda polifolia*) and hoary willow (*Salix candida*). The ground cover is made up of litter, open water and unidentified mosses, with scattered *Sphagnum*. No species of conservation concern were recorded.

Soils found at the graminoid poor fens sites included a Humic Mesisol and a soil that was likely organic but could not be identified further as a result of the presence of seasonal ice that hindered augering at a depth of 30 cm. The Humic Mesisol was characterized as having an Of (40 cm), followed by an Om (70 cm), then an Oh (100+ cm) horizon. Seasonal ice was encountered at a depth of 20 cm in the soil profile.

4.2 Botanical Resources

4.2.1 Plants and Distribution of Species

Vegetation composition was recorded at 38 sites along the proposed P6 All-Season Road and quarry areas (see Appendix II, Map 7). A total of 143 plant taxa were observed in the local assessment area (Appendix III). There were 131 plants identified to the species level while 12 taxa were identified to the genus level including six vascular (shrub and herbs) and six non-vascular plants (mosses and lichens). Vascular plants identified only to the genus level were a result of absent or non-mature floral or fruiting parts when observed during the field assessment which are used for identification.

All plants were grouped by primitive vasculars (eg. ferns and horsetails), gymnosperms (conifers), angiosperms (flowering plants) and non-vascular plants. Angiosperms were divided into monocotyledons and dicotyledons with this group (angiosperms) of plants representing the greatest number of species. There were 116 angiosperms (37 monocotyledons and 79 dicotyledons), eight primitive vasculars, five gymnosperms, and 14 non-vascular plants.

Vascular plants were distributed among 40 families, with the angiosperms representing 34 of these. The sedge (Cyperaceae) family was the largest with 20 plant taxa, followed by the heath (Ericaceae) and willow (Salicaceae) families, with 11 species each. Five or more species were observed in each of the rose (Rosaceae), grass (Poaceae), honeysuckle (Caprifoliaceae) and orchid (Orchidaceae) families. The primitive vasculars are distributed among four families including the wood fern (Dryopteridaceae), horsetail (Equisetaceae), club-moss (Lycopodiaceae) and maidenhair fern (Pteridaceae). Species within the gymnosperms were members of the cypress (Cupressaceae) and pine (Pinaceae) families.

The forested and wetland communities in the project area support a wide range of species. Eight documented uncommon species (ranked by the Manitoba Conservation Data Centre) were observed during surveys, shown in Table 4.2.2. and Map 8 (Appendix II). Preferred species habitat descriptions are taken from Flora of North America (1993+) and Scoggan (1957).

Family	Scientific Name	Common Name	Rank	Plot
Pteridaceae	<i>Cryptogramma acrostichoides</i>	Parsley Fern	S3S4	P6b-27
Droseraceae	<i>Drosera anglica</i>	Oblong-leaved Sundew	S3S4	P6b-35
Orchidaceae	<i>Platanthera orbiculata</i>	Round-leaved Bog Orchid	S3S4	P6a-10, P6a-16, P6b-30
Lycopodiaceae	<i>Diphasiastrum complanatum</i>	Trailing Club-moss	S3S4	P6a-05, P6b-31
Caprifoliaceae	<i>Lonicera involucrata</i>	Black Twinberry	S3S4	P6a-16
Ericaceae	<i>Arctous alpina</i>	Alpine Bearberry	S3S4	P6a-19, P6b-33
Primulaceae	<i>Primula egaliksesis</i>	Greenland Primrose	S3	P6a-09, P6a-20
Salicaceae	<i>Salix pellita</i>	Satin Willow	S3S4	P6a-11

Oblong-leaved sundew (*Drosera anglica*) is a boreal species that occurs on calcareous substrates in fens, and drainage tracks in peat bogs. It is uncommon to widespread in Manitoba (S3S4), recorded here in a single graminoid rich fen site, as a frequently occurring species.

Round-leaved bog orchid (*Platanthera orbiculata*) is found in moist coniferous and deciduous forests, and fen forests. It is uncommon to widespread in Manitoba (S3S4), observed here in three sites with scattered or incidental occurrence, under trembling aspen, trembling aspen mixed wood, and jack pine – black spruce canopies.

Parsley fern (*Cryptogramma acrostichoides*) can be found on non-calcareous cliff crevices, and rock outcrops, often in relatively dry habitats. It ranks in Manitoba as intermediate (S3S4) between uncommon and apparently widespread. It was observed in a single jack pine- black spruce site on a granite outcrop, with scattered occurrence.

Trailing club-moss (*Diphasiastrum complanatum*) occurs in dry open coniferous or mixed forests. It is uncommon to widespread in Manitoba (S3S4), observed here in two sites with incidental occurrence, under black spruce mixedwood and black spruce canopies.

Black twinberry (*Lonicera involucrata*) has been found to occur in spruce woods and on limestone ledges. It is uncommon to widespread in Manitoba (S3S4), observed in a single site with incidental occurrence, under jack pine – black spruce canopy.

Alpine bearberry (*Arctous alpina*) is found in open boggy coniferous woods, lichen heaths, gravelly beach ridges, and tundra. It is uncommon to widespread in Manitoba (S3S4), recorded here in two sites with scattered or incidental occurrence, in black spruce communities.

Greenland primrose (*Primula egaliksesis*) can be found along stream banks and in bogs. It is uncommon in Manitoba (S3), and was observed incidentally at two sites, located in the vicinity of black spruce forest and treed bog vegetation.

Satin willow (*Salix pellita*) occurs on sandy or gravelly floodplains, stream and lake margins, marshes, fens, and metamorphic or calcareous substrates. It is uncommon to widespread in Manitoba (S3S4), recorded here in a single treed poor fen site, as a frequently occurring species.

4.2.2 Species of Conservation Concern

No species listed by the federal Species at Risk Act, the Manitoba Endangered Species and Ecosystems Act or listed by the Committee on the Status of Endangered Wildlife in Canada were observed during fieldwork. Vascular species at risk were not expected to occur as the assessment area is beyond the range for these plants. Flooded jellyskin (*Leptogium rivulare*) lichen (a non-vascular species) is listed as threatened by the Species at Risk Act and special concern by the Committee on the Status of Endangered Wildlife in Canada but was not observed during field studies, nor was preferred habitat encountered for this species. No plant species ranked by the Manitoba Conservation Data Centre as very rare (S1) to rare (S2) were observed during field studies.

4.2.3 Invasive and Non-native Species

A number of introduced (non-native) and invasive species are expected to occur across the greater P6 study area. These species are ranked SNA (conservation status rank is not applicable) by Manitoba Conservation Data Centre (2016). Non-native and invasive plants in boreal habitats are commonly perennial herbs and grasses, particularly from among the Asteraceae (composites), Fabaceae (legumes), and Poaceae (grasses) plant families (Langor et al. 2014). Although not naturally found in undisturbed boreal forest habitats, many of these species are introduced along roads, rivers and streams, often following human activities. During the surveys conducted for the P6 Project, no invasive and non-native species were observed in the study plots.

4.2.4 Species of Interest

Plant species traditionally used for medicine, subsistence and cultural purposes were assessed for the study. All plant species recorded during the field surveys were assessed with the culturally important species provided by MESRA for the Project to determine their location in the local assessment area. A traditional knowledge study was carried out in collaboration with local community members using workshops and one-on-one interviews to determine culturally important species. Aboriginal communities have long histories of living on the land as well as knowledge, experience and an appreciation for the plants growing in their resource areas.

Traditional knowledge studies conducted by MESRA in 2016 identified several species of trees, shrubs and herbs as being important to the communities of Manto Sipi Cree Nation, Bunibonibee Cree Nation and God's Lake First Nation. As a result of workshops and personal interviews, more than 17 plants, plus wood and firewood resources were identified by participants from the communities as important for sustenance and cultural practices. Common food plants include blueberry, raspberry, strawberry, cloudberry, cranberry, cherry and Saskatoon. Over six medicinal plants were identified, including black spruce, sweet flag and Labrador tea. Firewood and willow stick collection, and wood cutting was also valued.

Plant species identified as having sustenance and cultural value to the local communities, were assessed at sites surveyed along the proposed P6 All-Season Road and quarry areas (Table 4.2.4.). From the vegetation surveys, 12 cultural plant species were observed in the local assessment area at 38 sampled sites. Of these, eight species were food plants, three were medicinal plants and three were other uses. Food plants observed included Saskatoon (*Amelanchier alnifolia*), strawberries (*Fragaria virginiana*), cherry (*Prunus* spp.), swamp gooseberries (*Ribes* spp.), cloudberry and head berries (*Rubus chamaemorus*), mossberries (*Vaccinium oxycoccus*), blueberries (*Vaccinium* spp.) and cranberries (*Vaccinium vitis-idaea*). Medicinal plants observed included juniper (*Juniperus* spp.), black spruce (*Picea mariana*) and Labrador tea (*Rhododendron* spp.), while plants of other uses were willow sticks (*Salix* spp.), strawberries and Labrador tea.

The most frequent species observed in sampled plots was black spruce, which was recorded in 31 plots. Blueberries were recorded in 28 plots followed by willows in 26 plots and Labrador tea recorded in 25 plots. Other species with high occurrences included cranberries which were recorded in 21 plots and mossberries which were recorded in 16 plots.

Several other plant species were unspecified such as berry picking areas and plant gathering locations. Firewood harvest and wood cutting areas were also identified as important areas and occur at various sites.

Table 4.2.4. Plants of sustenance and cultural value identified by members of the Manto Sipi Cree Nation (MS), Bunibonabee Cree Nation (BB) and God's Lake First Nation (GL), within the regional assessment area, observed in sample plots.			
Community	Local Name	Scientific Name	Plot (P6-)
Food Plants			
GL	<i>Weekes</i>	<i>Acorus americanus</i>	not observed
MS	Saskatoon	<i>Amelanchier alnifolia</i>	10, 16, 30, 31, 33
MS	Strawberries	<i>Fragaria virginiana</i>	1, 8, 10, 14, 15, 16, 21, 27, 30, 31
MS	Cherry	<i>Prunus</i> spp.	15, 31
GL	Swamp Gooseberries	<i>Ribes</i> spp.	1, 5, 21
BB	Cloudbberries	<i>Rubus chamaemorus</i>	3, 7, 20, 28, 29, 34
MS	Head berries (<i>Mistegonemina</i>)	<i>Rubus chamaemorus</i>	3, 7, 20, 28, 29, 34
MS, BB, GL	Raspberries	<i>Rubus idaeus</i>	not observed
GL	Mossberries	<i>Vaccinium oxycoccus</i>	2, 3, 4, 6, 7, 11, 18, 19, 20, 22, 23, 24, 28, 32, 36, 38
MS, GL	Blueberries	<i>Vaccinium</i> spp.	1, 2, 3, 4, 5, 6, 7, 9, 11, 12, 16, 18, 19, 20, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 36, 38
BB, GL	Cranberries	<i>Vaccinium vitis-idaea</i>	3, 4, 5, 6, 7, 9, 12, 13, 15, 16, 18, 19, 20, 22, 26, 29, 30, 32, 33, 34, 36
GL	Medicines	various, unspecified	unspecified
BB	Historic berry picking area	various, unspecified	unspecified
Medicinal Plants			
MS, BB, GL	<i>Wihkes</i>	<i>Acorus americanus</i>	not observed
GL	Water Calla	<i>Calla palustris</i>	not observed
GL	Juniper	<i>Juniperus</i> spp.	15, 27, 33, 36
GL	Black Spruce Bark	<i>Picea mariana</i>	1, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 36, 38
MS	Spruce	<i>Picea</i> spp.	1, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 36, 38
MS, GL	Labrador Tea	<i>Rhododendron</i> spp.	1, 3, 4, 5, 6, 7, 9, 10, 13, 14, 18, 19, 20, 22, 24, 26, 28, 29, 30, 31, 32, 33, 34, 36, 38
MS, GL	Ginger Root	unknown	unknown
BB	Medicinal Plant Gathering Location	various, unspecified	unspecified
BB	Plants for Tea	various, unspecified	unspecified
GL	Berries	various, unspecified	unspecified
GL	Muskeg Leaves	various, unspecified	unspecified

Table 4.2.4. Plants of sustenance and cultural value identified by members of the Manto Sipi Cree Nation (MS), Bunibonibee Cree Nation (BB) and God's Lake First Nation (GL), within the regional assessment area, observed in sample plots.			
GL	Medicinal Plants	various, unspecified	unspecified
Other Uses			
GL	Strawberries	<i>Fragaria virginiana</i>	1, 8, 10, 14, 15, 16, 21, 27, 30, 31
GL	Labrador Tea	<i>Rhododendron</i> spp.	1, 3, 4, 5, 6, 7, 9, 10, 13, 14, 18, 19, 20, 22, 24, 26, 28, 29, 30, 31, 32, 33, 34, 36, 38
GL	Raspberries	<i>Rubus idaeus</i>	not observed
GL	Willow Sticks	<i>Salix</i> spp.	2, 3, 4, 6, 7, 9, 11, 13, 14, 17, 18, 19, 21, 22, 23, 24, 25, 26, 30, 31, 33, 34, 35, 36, 37, 38
GL	Ginger Root	unknown	unknown
BB	Firewood Harvest	various	various
MS	Wood cutting	various	various

4.3 Environmentally Sensitive Sites

Three environmentally sensitive sites were identified from field assessments along the proposed P6 All-Season Road. Each of these sites supported older growth black spruce forest greater than 120 years age. Black spruce was aged at 121 years in plot P6a-03, 156 years in plot P6b-33 and 165 years in plot P6b-38 (Table 4.3.). Old growth forests are stands that have achieved great age without significant disturbance. Trees in the boreal forest generally live 100 years and according to the Canadian Council of Forest Ministries, with old growth onset for black spruce at 110 to 160 years. Two other plots supported black spruce trees near this onset age, with trees 101 years in Plot P6a-22 and 106 years for trees in plot P6a-18. Old growth forests serve as natural reservoirs of genetic diversity and remain important to a balanced ecosystem (Canadian Council of Forest Ministries).

No plant species of conservation concern listed by SARA, ESEA, COSEWIC or plants ranked very rare to rare by the MBCDC were observed from the field surveys. Many traditional plant species of interest were recorded from the surveys, but these species were more commonly distributed over the landscape.

Table 4.3. Environmentally sensitive sites observed during field studies.	
Environmentally Sensitive Site	Location (Plot)
Older growth black spruce forest age 121	P6a-03
Older growth black spruce forest age 156	P6b-33
Older growth black spruce forest age 165	P6b-38

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APPENDIX I. Definitions of Selected Technical Terms¹.

Bog – Ombrotrophic peatlands generally unaffected by nutrient-rich groundwater that are acidic and often dominated by heath shrubs and Sphagnum mosses and that may include open-growing, stunted trees.

Boreal – Pertaining to the north; a climatic and ecological zone that occurs south of the subarctic, but north of the temperate hardwood forests of eastern North America, the parkland of the Great Plains region, and the montane forests of the Canadian cordillera.

Canopy – The more or less continuous cover of branches and foliage formed by the crowns of trees.

Canopy Closure – The degree of canopy cover relative to openings.

Classification – The systematic grouping and organization of objects, usually in a hierarchical manner.

Community-Type – A group of vegetation stands that share common characteristics, an abstract plant community.

Coniferous – A cone-bearing plant belonging to the taxonomic group Gymnospermae.

Cover – The area of ground covered with plants of one or more species, usually expressed as a percentage.

Deciduous – Refers to perennial plants from which the leaves abscise and fall off at the end of the growing season.

Ecoregion – An area characterized by a distinctive regional climate as expressed by vegetation.

Family – Taxonomic grouping of plants that are related at a particular hierarchical level.

Fen – Wetland with a peat substrate, nutrient-rich waters, and primarily vegetated by shrubs and graminoids.

Flora – A list of the plant species present in an area.

Forest – A relatively large assemblage of tree-dominated stands.

Graminoid – A plant that is grass-like; the term refers to grasses and plant that look like grasses, i.e., only narrow-leaved herbs; in the strictest sense, it includes plants belonging only to the family Gramineae.

Habitat – The place in which an animal or plant lives; the sum of environmental circumstances in the place inhabited by an organism, population or community.

Invasive – Invasive species are plants that are growing outside of their country or region of origin and are out-competing or even replacing native plants (Invasive Species Council of Manitoba).

Mixedwood – Forest stands composed of conifers and angiosperms each representing between 25 and 75% of the cover.

Old Growth – A stand of mature or over mature trees relatively uninfluenced by human activity.

Riparian – Refers to terrain, vegetation or simply a position adjacent to or associated with a stream, flood plain, or standing body of water.

Shrub – A perennial plant usually with a woody stem, shorter than a tree, often with a multi-stemmed base.

Species – A group of organisms having a common ancestry that are able to reproduce only among themselves; a general definition that does not account for hybridization.

Stand – A collection of plants having a relatively uniform composition and structure, and age in the case of forests.

Terrestrial – Pertaining to land as opposed to water.

Understory – Vegetation growing beneath taller plants such as trees or tall shrubs.

Vascular – Having tissues that transport water, sap, nutrients; refers to plants that are not mosses, lichens and algae.

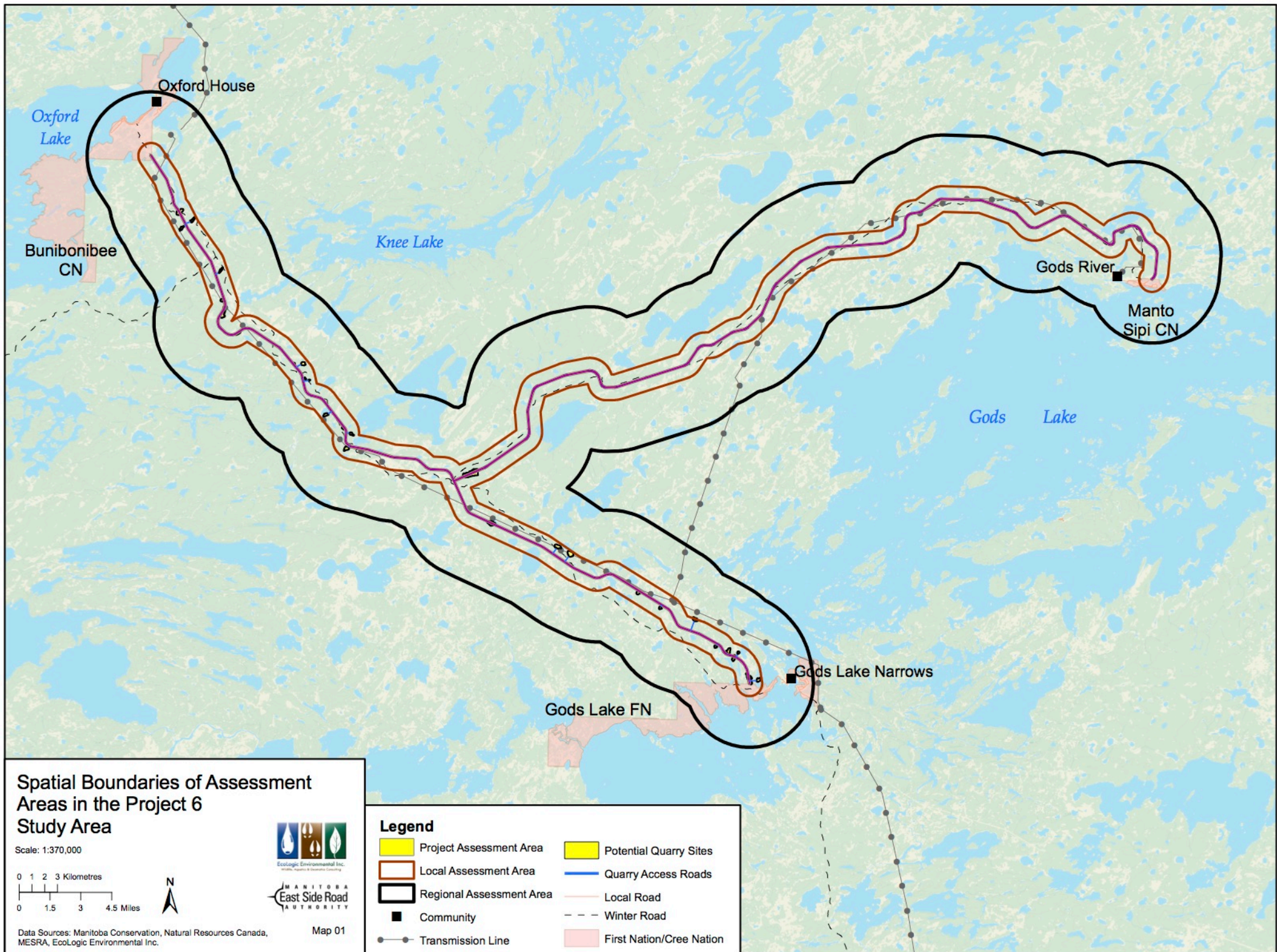
Vegetation – The general cover of plants growing on a landscape.

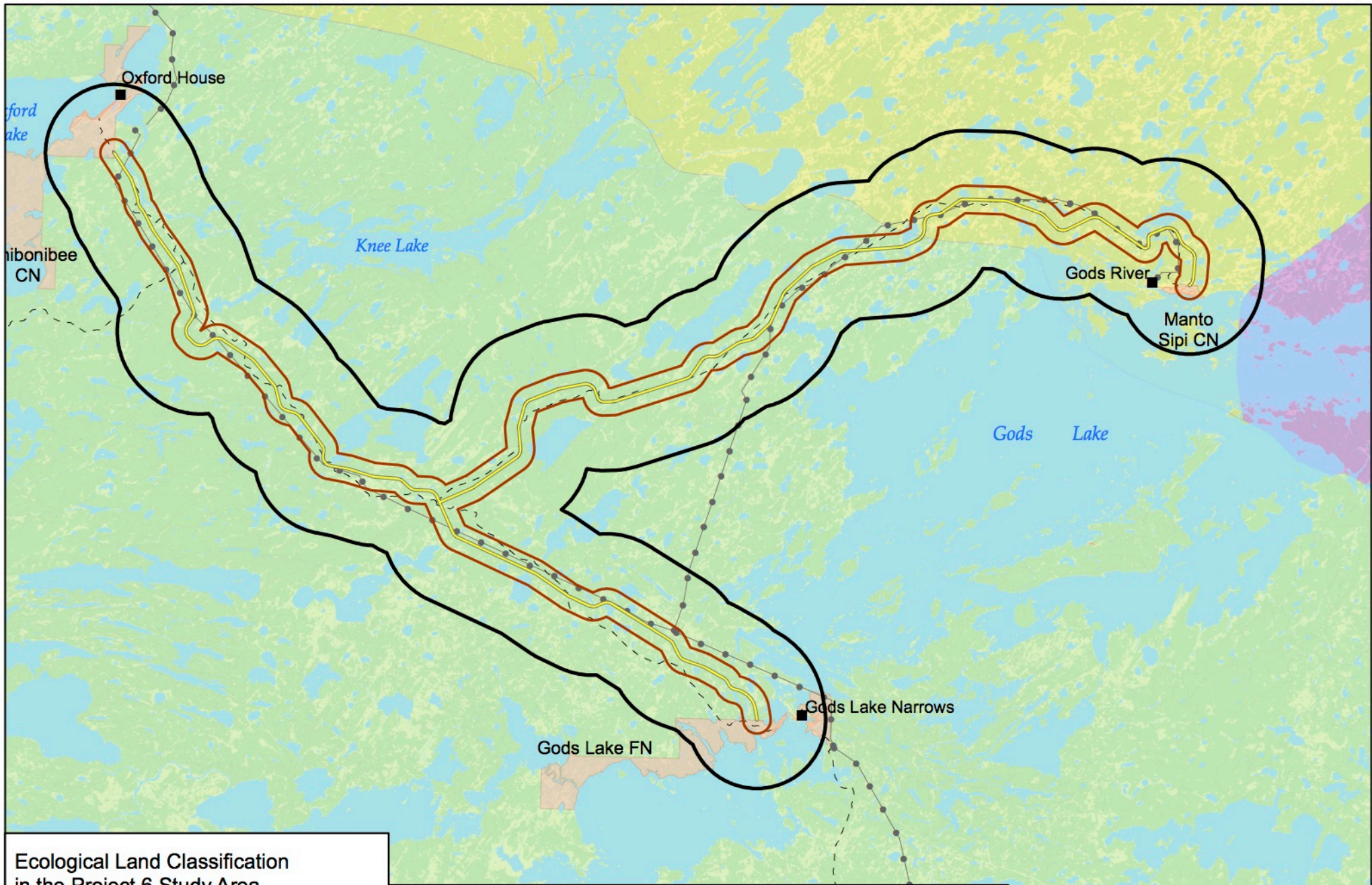
Vegetation Type – In phytosociology, the lowest possible level to be described.

Wetland – Land that is saturated with water long enough to promote hydric soils or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity that are adapted to wet environments.

¹All references Cauboue et al. 1996, unless otherwise noted.

APPENDIX II. Report Maps.





Ecological Land Classification in the Project 6 Study Area

Scale: 1:370,000

0 1 2 3 Kilometres

0 1.5 3 4.5 Miles

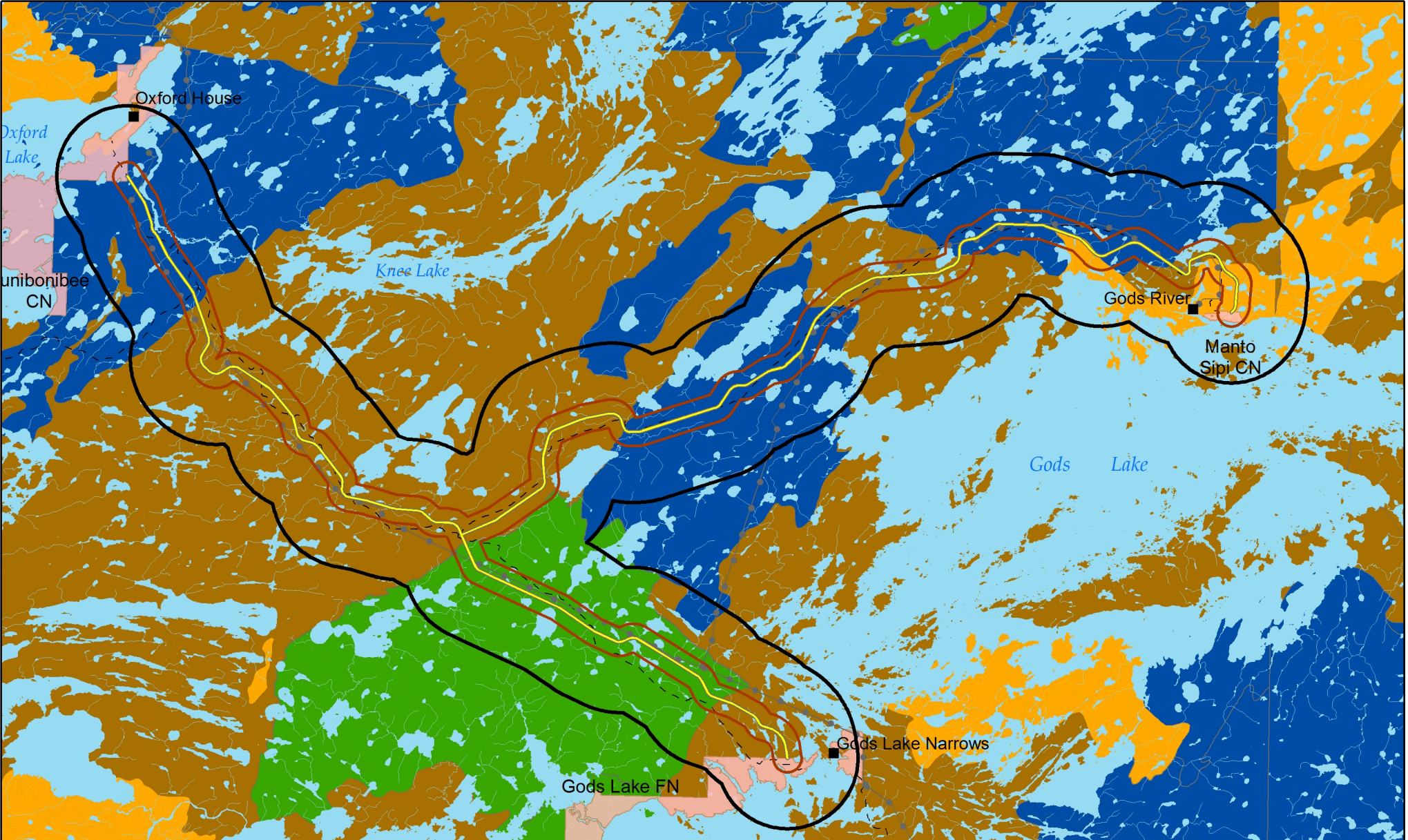


Data Sources: Manitoba Conservation, Natural Resources Canada, MESRA, Ecologic Environmental Inc.

Map 02

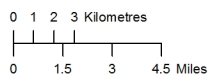
Legend

- | | | |
|--------------------------|--------------------------|--|
| Project Assessment Area | Transmission Line | Ecozone, Ecoregion, Ecodistrict |
| Local Assessment Area | Local Road | 06, 89, 360 - Knee Lake |
| Regional Assessment Area | Winter Road | 06, 89, 364 - Island Lake |
| Community | First Nation/Cree Nation | 06, 89, 365 - Gods Lake |



Soil Classification in the Project 6 Study Area

Scale: 1:370,000



EcoLogic Environmental Inc.
Wildlife, Aquatics & Green Infrastructure



Data Sources: Manitoba Conservation, Natural Resources Canada, MESRA, EcoLogic Environmental Inc.

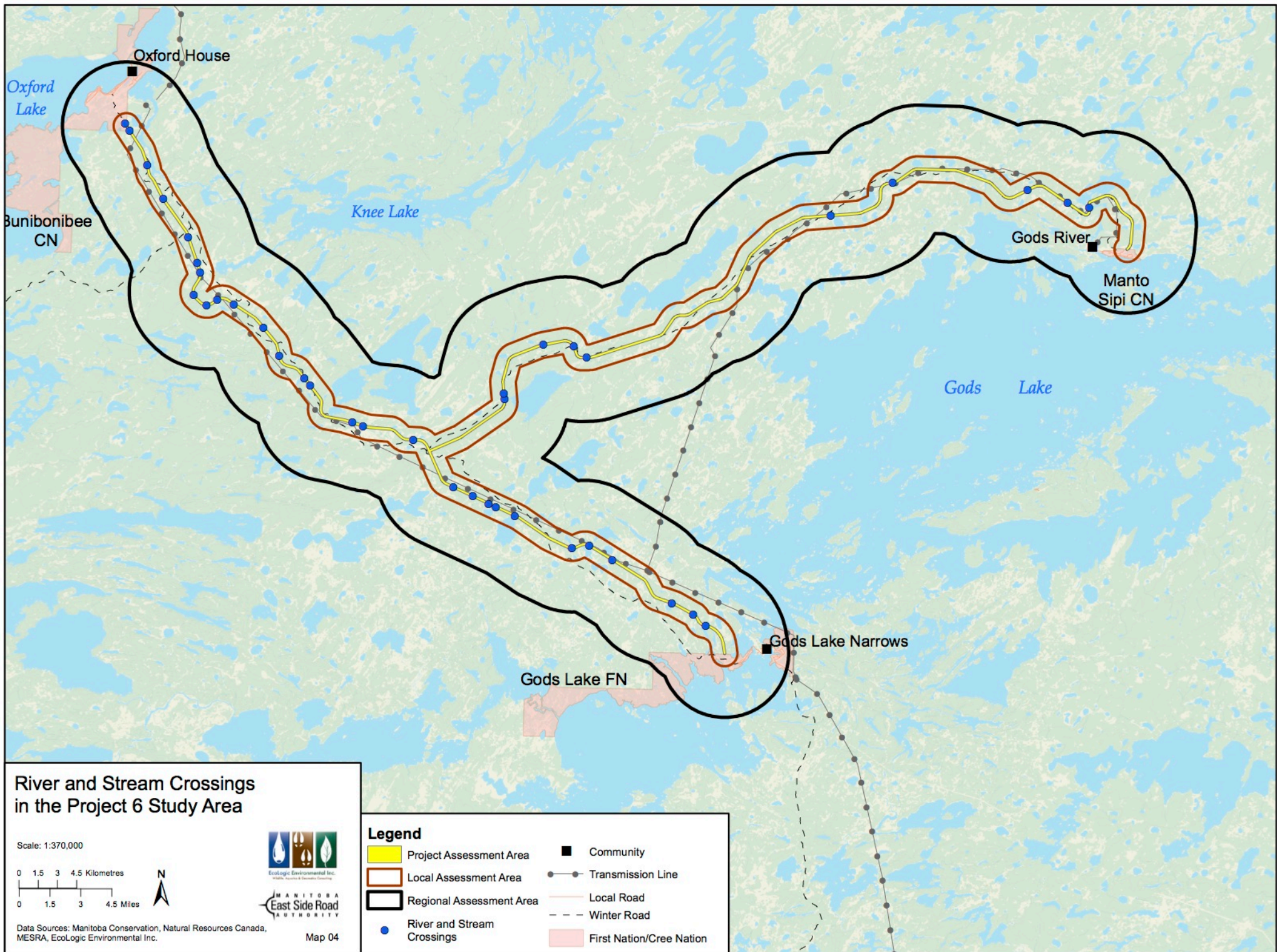
Map 03

Legend

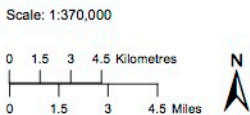
- Project Assessment Area
- Local Assessment Area
- Regional Assessment Area
- Community
- Transmission Line
- Local Road
- Winter Road
- First Nation/Cree Nation

Soil Classification

- Brunisolic Soils
- Cryosolic Soils
- Luvisolic Soils
- Organic Soils



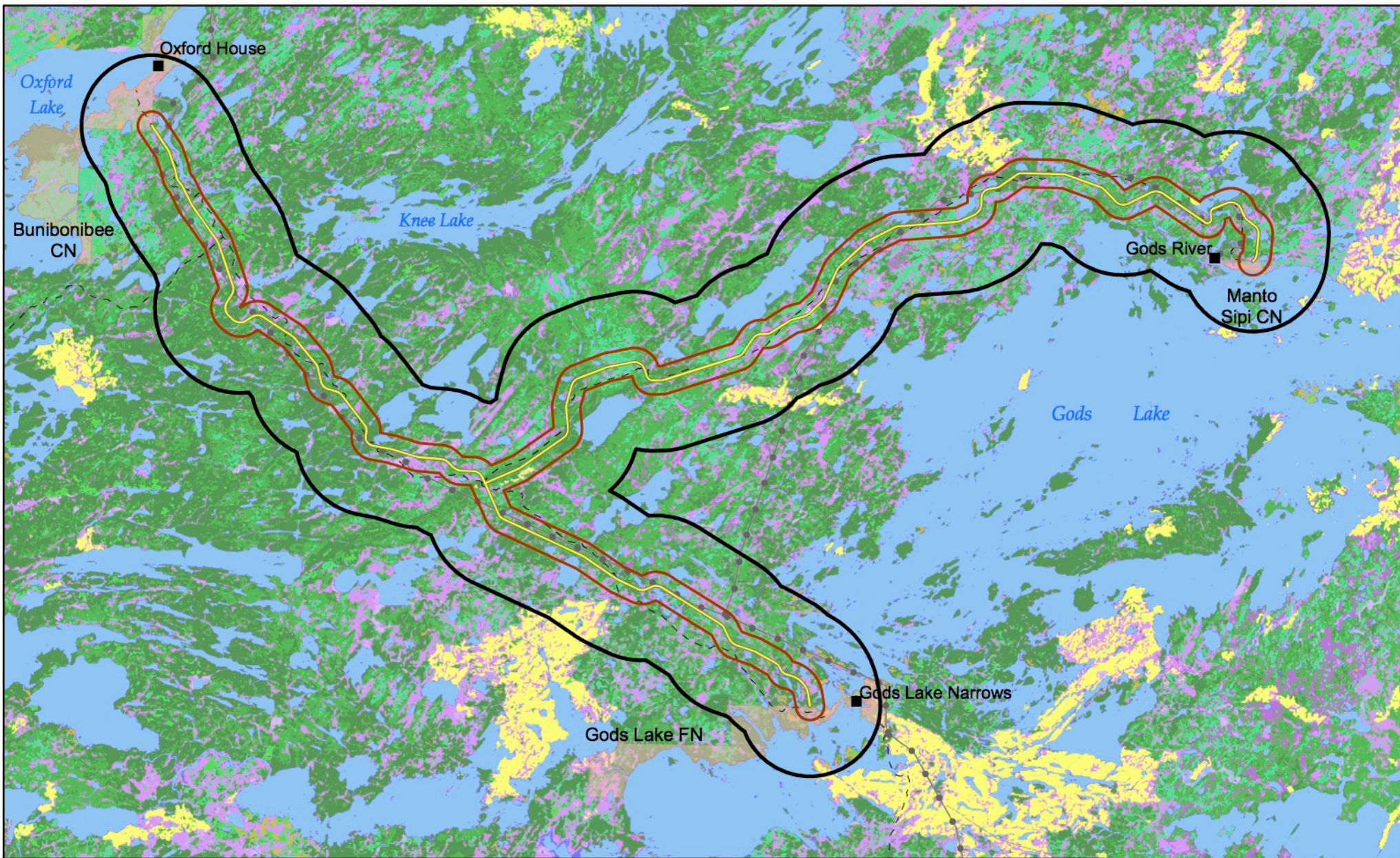
River and Stream Crossings in the Project 6 Study Area



Legend

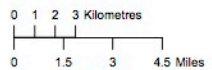
Project Assessment Area	Community
Local Assessment Area	Transmission Line
Regional Assessment Area	Local Road
River and Stream Crossings	Winter Road
	First Nation/Cree Nation

Data Sources: Manitoba Conservation, Natural Resources Canada, MESRA, Ecologic Environmental Inc. Map 04



Land Cover Classification in the Project 6 Study Area

Scale: 1:370,000

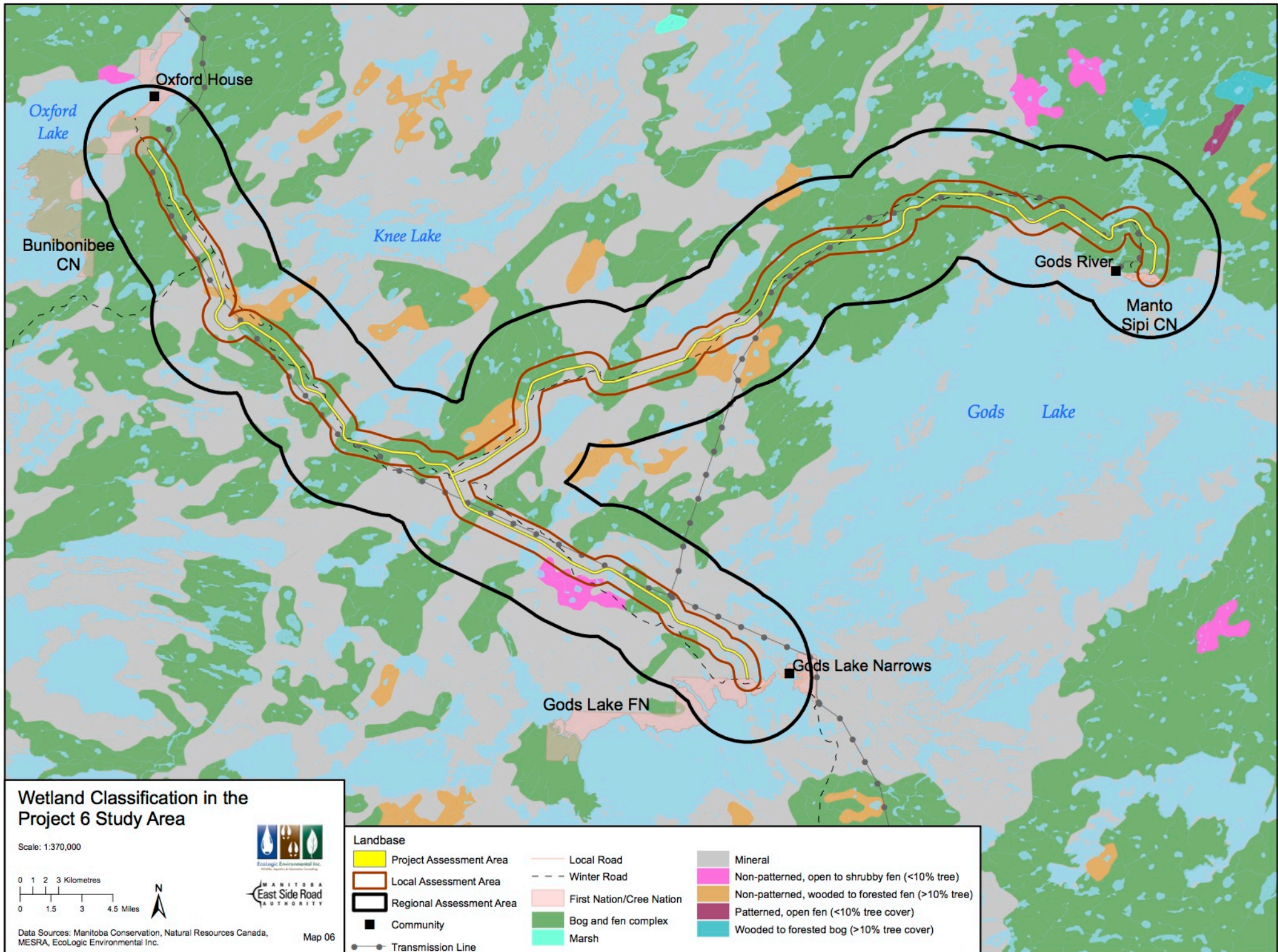


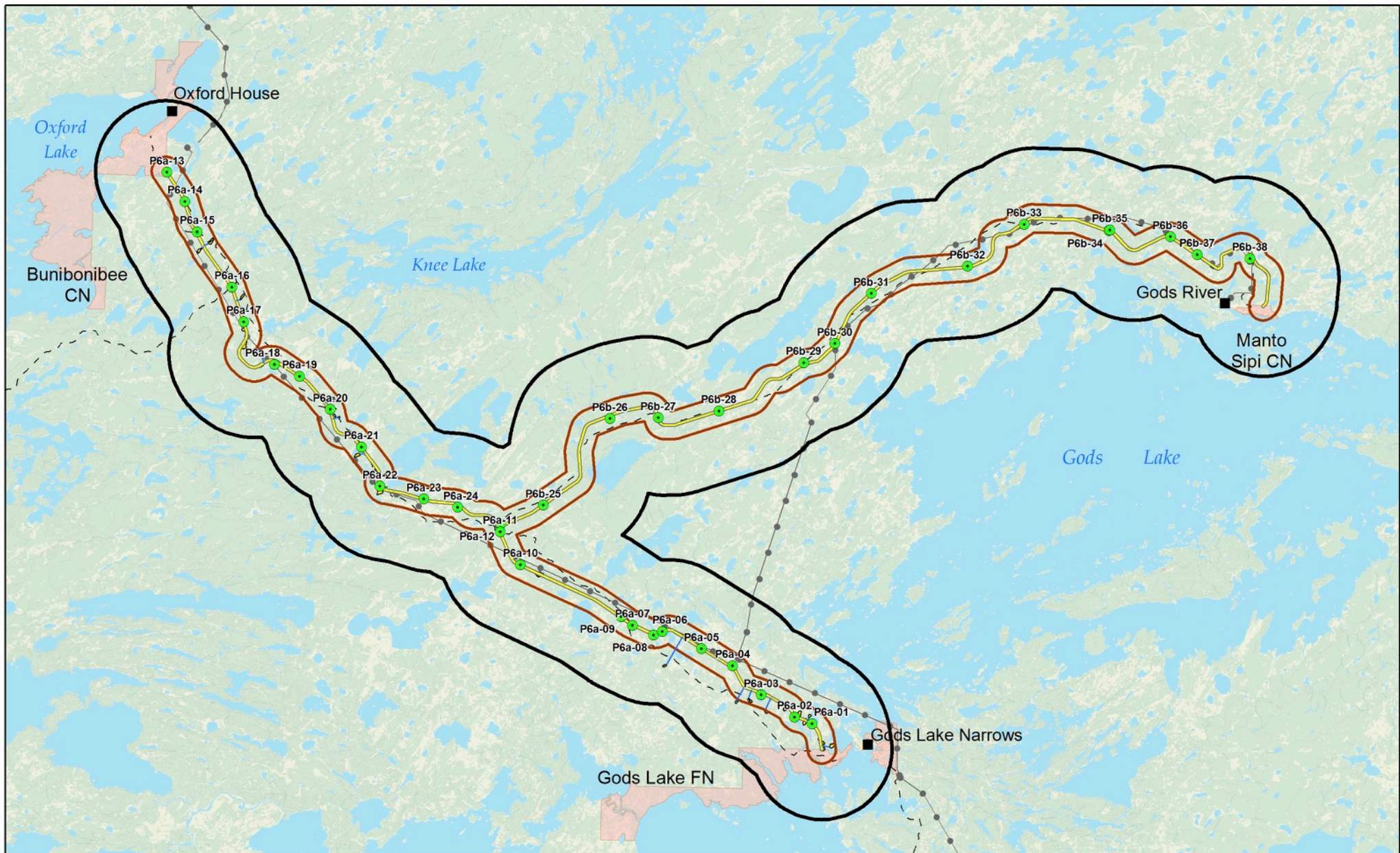
Data Sources: Manitoba Conservation, Natural Resources Canada

Map 05

Legend

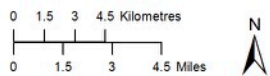
- | | | | |
|--------------------------|--------------------------|-----------------------|----------------------|
| Project Assessment Area | Winter Road | 82-Wetland - Shrub | 220-Deciduous Forest |
| Local Assessment Area | First Nation/Cree Nation | 83-Wetland - Herb | 221-Broadleaf Dense |
| Regional Assessment Area | 20-Water | 100-Herb | 222-Broadleaf Open |
| Community | 33 - Exposed Land | 110-Grassland | 223-Broadleaf Sparse |
| Transmission Line | 51-Shrub tall | 210-Coniferous Forest | 231-Mixedwood Dense |
| Local Road | 80-Wetland | 211-Coniferous Dense | 232-Mixedwood Open |
| | 81-Wetland - Treed | 212-Coniferous Open | 233-Mixedwood Sparse |
| | | 213-Coniferous Sparse | |





Soil and Vegetation Sample Locations in the Project 6 Study Area

Scale: 1:370,000

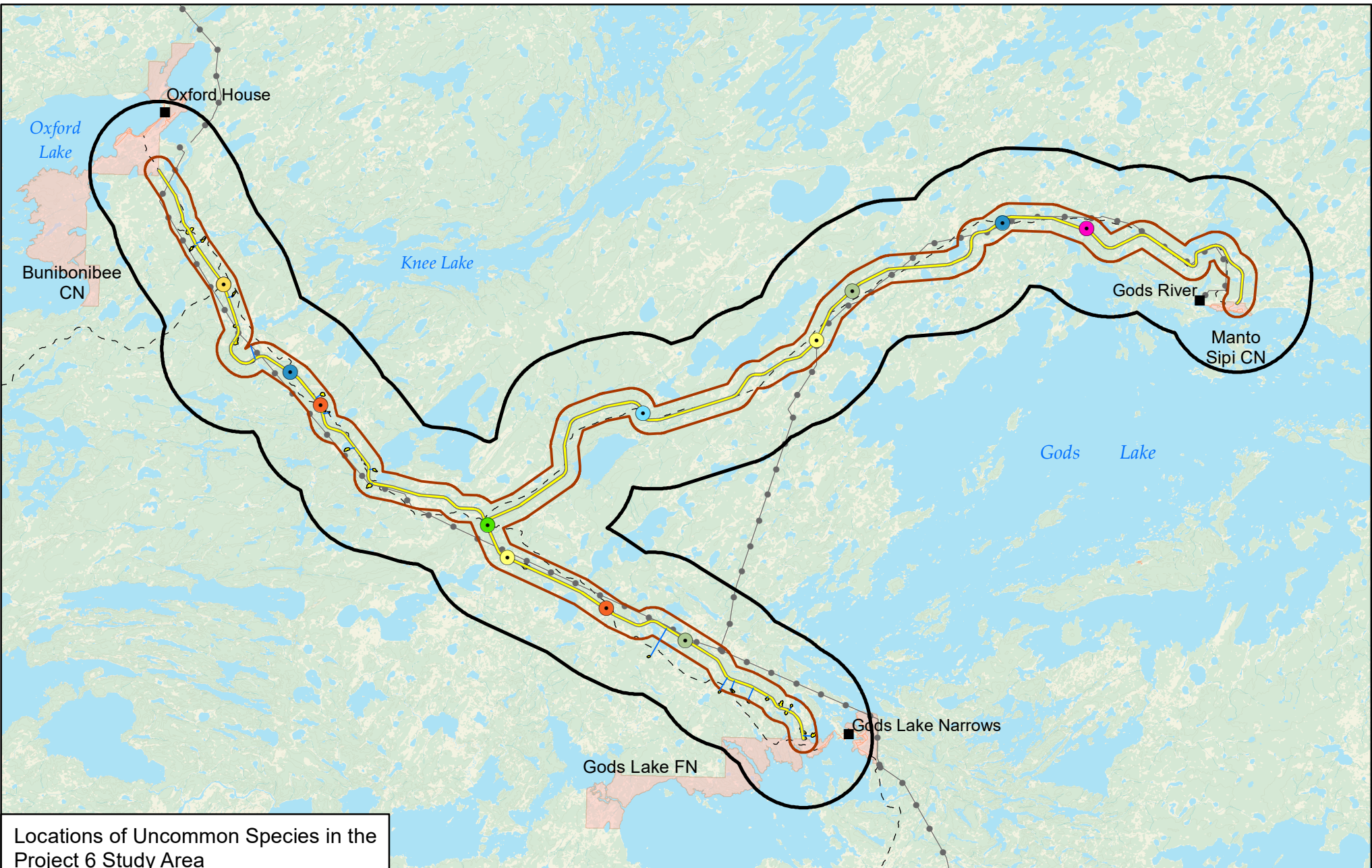


Map 07

Data Sources: Manitoba Conservation, Natural Resources Canada, MESRA, EcoLogic Environmental Inc.

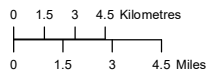
Legend

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|--------------------------|--|
| Project Assessment Area | Potential Quarry Sites |
| Local Assessment Area | Quarry Access Roads |
| Regional Assessment Area | Soil and Vegetation Sample Sites- June 9 -16, 2016 |
| Community | Local Road |
| Transmission Line | Winter Road |
| First Nation/Cree Nation | |



Locations of Uncommon Species in the Project 6 Study Area

Scale: 1:370,000



EcoLogic Environmental Inc.
1000 St. James St. W. Winnipeg, MB R4R 1A1
MANITOBA
East Side Road
AUTHORITY

Map 08

Data Sources: Manitoba Conservation, Natural Resources Canada, MESRA, EcoLogic Environmental Inc.

Legend

- | | |
|--------------------------|--------------------------|
| Project Assessment Area | Potential Quarry Sites |
| Local Assessment Area | Quarry Access Roads |
| Regional Assessment Area | Local Road |
| Community | Winter Road |
| Transmission Line | First Nation/Cree Nation |

Uncommon Species

- | | |
|-----------------------------|------------------------|
| Arctous alpina | Drosera anglica |
| Cryptogramma acrostichoides | Lonicera involucrata |
| Diphasiastrum complanatum | Platanthera orbiculata |
| | Primula egaliksesis |
| | Salix pellita |

APPENDIX III. Flora of Project 6 Field Studies.

Scientific Name	Common Name	Rank
VASCULAR SPECIES		
Ferns and Allies		
DRYOPTERIDACEAE	WOOD FERN FAMILY	
<i>Woodsia ilvensis</i>	Rusty Woodsia	S5
EQUISETACEAE	HORSETAIL FAMILY	
<i>Equisetum arvense</i>	Common Horsetail	S5
<i>Equisetum fluviatile</i>	Swamp Horsetail	S5
<i>Equisetum scirpoides</i>	Dwarf Scouring-rush	S4S5
<i>Equisetum sylvaticum</i>	Wood Horsetail	S5
LYCOPODIACEAE	CLUB-MOSS FAMILY	
<i>Diphasiastrum complanatum</i>	Trailing Club-moss	S3S4
<i>Lycopodium annotinum</i>	Stiff Club-moss	S5
PTERIDACEAE	MAIDEN-HAIR FERN FAMILY	
<i>Cryptogramma acrostichoides</i>	American Parsley Fern	S3S4
Gymnosperms		
CUPRESSACEAE	CYPRESS FAMILY	
<i>Juniperus communis</i>	Common Juniper	S5
<i>Juniperus horizontalis</i>	Creeping Juniper	S5
PINACEAE	PINE FAMILY	
<i>Larix laricina</i>	Tamarack	S5
<i>Picea mariana</i>	Black Spruce	S5
<i>Pinus banksiana</i>	Jack Pine	S5
Angiosperms - Monocotyledons		
CYPERACEAE	SEDGE FAMILY	
<i>Carex aquatilis</i>	Water Sedge	S5
<i>Carex capillaris</i>	Hair-like Sedge	S5
<i>Carex chordorrhiza</i>	Prostrate Sedge	S4S5
<i>Carex concinna</i>	Beautiful Sedge	S4S5
<i>Carex disperma</i>	Two-seeded Sedge	S5
<i>Carex foenea</i>	Hay Sedge	S5
<i>Carex gynocrates</i>	Bog Sedge	S5
<i>Carex lacustris</i>	Lakeshore Sedge	S5
<i>Carex lasiocarpa</i>	Hairy-fruited Sedge	S5
<i>Carex leptalea</i>	Bristle-stalked Sedge	S5
<i>Carex magellanica</i>	Bog Sedge	S5
<i>Carex scirpoidea</i>	Rush-like Sedge	S4S5
<i>Carex trisperma</i>	Three-seeded Sedge	S4S5

<i>Carex utriculata</i>	Beaked Sedge	S5
<i>Carex vaginata</i>	Sheathed Sedge	S5
<i>Carex</i> spp.	Sedge	
<i>Eleocharis palustris</i>	Common Spike-rush	S5
<i>Eriophorum brachyantherum</i>	Closed-sheathed Cotton-grass	S4S5
<i>Eriophorum vaginatum</i>	Sheathed Cotton-grass	S5
<i>Trichophorum caespitosum</i>	Tufted Clubrush	S4
JUNCACEAE	RUSH FAMILY	
<i>Juncus bufonius</i>	Toad Rush	S5
JUNCAGINACEAE	ARROW-GRASS FAMILY	
<i>Triglochin maritima</i>	Seaside Arrow-grass	S5
LILIACEAE	LILY FAMILY	
<i>Maianthemum canadense</i>	Canada May Flower	S5
<i>Maianthemum trifolium</i>	Three-leaved Solomon's Seal	S5
ORCHIDACEAE	ORCHID FAMILY	
<i>Calypso bulbosa</i>	Calypso	S4
<i>Corallorhiza trifida</i>	Early Coral-root	S5
<i>Goodyera repens</i>	Lesser Rattlesnake-Plantain	S4S5
<i>Platanthera obtusata</i>	Small Northern Bog Orchid	S5
<i>Platanthera orbiculata</i>	Round-leaved Bog Orchid	S3S4
POACEAE	GRASS FAMILY	
<i>Agrostis scabra</i>	Ticklegrass	S5
<i>Calamagrostis canadensis</i>	Canada Reed Grass	S5
<i>Calamagrostis</i> sp.		
<i>Leymus innovatus</i>	Hairy Wild Rye	S5
<i>Oryzopsis asperifolia</i>	Rice Grass	S5
<i>Piptatherum pungens</i>	Northern Rice Grass	S4S5
<i>Poa</i> sp.		
TYPHACEAE	CAT-TAIL FAMILY	
<i>Typha latifolia</i>	Common Cat-tail	S4S5
Angiosperms - Dicotyledons		
ARALIACEAE	GINSENG FAMILY	
<i>Aralia nudicaulis</i>	Wild Sarsaparilla	S5
ASTERACEAE	ASTER FAMILY	
<i>Achillea millefolium</i>	Yarrow	S5
<i>Petasites frigidus</i> var. <i>palmatus</i>	Palmate-leaved Coltsfoot	S5
<i>Solidago hispida</i>	Hairy Goldenrod	S5
<i>Symphyotrichum ciliolatum</i>	Lindley's Aster	S5
BETULACEAE	BIRCH FAMILY	
<i>Alnus incana</i> ssp. <i>rugosa</i>	Speckled Alder	S5

<i>Alnus viridis</i>	Green Alder	S5
<i>Betula papyrifera</i>	Paper Birch	S5
<i>Betula pumila</i>	Dwarf Birch	S5
BORAGINACEAE	BORAGE FAMILY	
<i>Mertensia paniculata</i>	Tall Lungwort	S5
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY	
<i>Linnaea borealis</i>	Twinflower	S5
<i>Lonicera dioica</i>	Limber or Twining Honeysuckle	S5
<i>Lonicera involucrata</i>	Black Twinberry	S3S4
<i>Lonicera villosa</i>	Blue Fly Honeysuckle	S5
<i>Symphoricarpos albus</i>	Snowberry	S4S5
<i>Viburnum edule</i>	Low-bush Cranberry	S5
CORNACEAE	DOGWOOD FAMILY	
<i>Cornus canadensis</i>	Bunchberry	S5
DROSERACEAE	SUNDEW FAMILY	
<i>Drosera anglica</i>	Oblong-leaved Sundew	S3S4
<i>Drosera rotundifolia</i>	Round-leaved Sundew	S4S5
ELAEAGNACEAE	OLIVE FAMILY	
<i>Shepherdia canadensis</i>	Canada Buffaloberry	S5
EMPETRACEAE	CROWFOOT FAMILY	
<i>Empetrum nigrum</i>	Black Crowberry	S5
ERICACEAE	HEATH FAMILY	
<i>Andromeda polifolia</i>	Bog-rosemary	S5
<i>Arctostaphylos uva-ursi</i>	Bearberry	S5
<i>Arctous alpina</i>	Alpine Bearberry	S3S4
<i>Chamaedaphne calyculata</i>	Leatherleaf	S5
<i>Gaultheria hispidula</i>	Creeping Snowberry	S4S5
<i>Kalmia polifolia</i>	Pale Laurel	S5
<i>Rhododendron groenlandicum</i>	Labrador Tea	S5
<i>Vaccinium myrtilloides</i>	Velvet-leaf Blueberry	S5
<i>Vaccinium oxycoccos</i>	Small Cranberry	S5
<i>Vaccinium uliginosum</i>	Bog Whortleberry	S5
<i>Vaccinium vitis-idaea</i>	Bog Cranberry	S5
FABACEAE	PEA FAMILY	
<i>Lathyrus ochroleucus</i>	Pale Vetchling	S5
FUMARIACEAE	FUMITORY FAMILY	
<i>Corydalis sempervirens</i>	Pink and Yellow Corydalis	S5
GROSSULARIACEAE	CURRENT FAMILY	
<i>Ribes oxyacanthoides</i>	Canada Wild Gooseberry	S5

<i>Ribes triste</i>	Wild Red Currant	S5
LENTIBULARIACEAE	BLADDERWORT FAMILY	
<i>Utricularia intermedia</i>	Flat-leaved Bladderwort	S4S5
<i>Utricularia</i> sp.		
MENYANTHACEAE	BUCKBEAN FAMILY	
<i>Menyanthes trifoliata</i>	Bog Bean	S5
MONOTROPACEAE	INDIAN-PIPE FAMILY	
<i>Monotropa uniflora</i>	Indian-pipe	S4
ONAGRACEAE	EVENING PRIMROSE FAMILY	
<i>Chamerion angustifolium</i>	Fireweed	S5
PRIMULACEAE	PRIMROSE FAMILY	
<i>Primula egaliksesis</i>	Greenland Primrose	S3
<i>Primula mistassinica</i>	Bird's-eye-primrose	S5
PYROLACEAE	WINTERGREEN FAMILY	
<i>Orthilia secunda</i>	One-sided Wintergreen	S5
<i>Pyrola asarifolia</i>	Pink Wintergreen	S5
<i>Pyrola chlorantha</i>	Green-flowered Wintergreen	S5
RANUNCULACEAE	CROWFOOT FAMILY	
<i>Actaea rubra</i>	Red Baneberry	S5
<i>Aquilegia brevistyla</i>	Small-flowered Columbine	S4
<i>Caltha palustris</i>	Marsh Marigold	S5
<i>Ranunculus lapponicus</i>	Lapland Buttercup	S4S5
RHAMNACEAE	BUCKTHORN FAMILY	
<i>Rhamnus alnifolia</i>	Alder-leaved Buckthorn	S5
ROSACEAE	ROSE FAMILY	
<i>Amelanchier alnifolia</i>	Saskatoon	S5
<i>Comarum palustre</i>	Marsh Cinquefoil	S5
<i>Dasiphora fruticosa</i>	Shrubby Cinquefoil	S5
<i>Fragaria virginiana</i>	Smooth Wild Strawberry	S5
<i>Prunus pensylvanica</i>	Pin Cherry	S5
<i>Rosa acicularis</i>	Prickly Rose	S5
<i>Rubus arcticus</i> ssp. <i>acaulis</i>	Stemless Raspberry	S5
<i>Rubus chamaemorus</i>	Cloud Berry	S5
<i>Rubus pubescens</i>	Trailing Dewberry	S5
<i>Sibbaldiopsis tridentata</i>	Three-toothed Cinquefoil	S5
RUBIACEAE	MADDER FAMILY	
<i>Galium boreale</i>	Northern Bedstraw	S5
<i>Galium labradoricum</i>	Northern Bog Bedstraw	S4S5
SALICAEAE	WILLOW FAMILY	

<i>Populus balsamifera</i>	Balsam Poplar	S5
<i>Populus tremuloides</i>	Trembling Aspen	S5
<i>Salix bebbiana</i>	Bebb's Willow	S5
<i>Salix candida</i>	Hoary Willow	S5
<i>Salix maccalliana</i>	Velvet-fruited Willow	S4
<i>Salix myrtilifolia</i>	Myrtle-leaved Willow	S5
<i>Salix pedicellaris</i>	Bog Willow	S5
<i>Salix pellita</i>	Satin Willow	S3S4
<i>Salix planifolia</i>	Flat-leaved Willow	S5
<i>Salix pseudomonticola</i>	False Mountain Willow	S4S5
<i>Salix</i> sp.	Willow	
SANTALACEAE	SANDALWOOD FAMILY	
<i>Geocaulon lividum</i>	Northern Comandra	S5
SAXIFRAGACEAE	SAXIFRAGE FAMILY	
<i>Mitella nuda</i>	Mitrewort	S5
VIOLACEAE	VIOLET FAMILY	
<i>Viola adunca</i>	Early Blue Violet	S5
<i>Viola renifolia</i>	Kidney-leaved Violet	S4S5
<i>Viola</i> spp.		
NON-VASCULAR SPECIES		
BRYOPHYTES		
<i>Dicranum</i> sp.	Dicranum Moss	
<i>Hylocomium splendens</i>	Splendid Feather Moss	S4S5
<i>Pleurozium schreberi</i>	Schreber's Moss	S4S5
<i>Polytrichum</i> sp.	Polytrichum Moss	
<i>Ptilium crista-castrensis</i>	Knights Plume Moss	S4S5
<i>Sphagnum</i> spp.	Peat Moss	
LICHENS		
<i>Cladina mitis</i>	Green Reindeer Lichen	S4
<i>Cladina rangiferina</i>	Grey Reindeer Lichen	S5
<i>Cladina stellaris</i>	Northern Reindeer Lichen	S5
<i>Cladonia</i> sp.	Cladonia	
<i>Cladonia uncialis</i>	Prickle Cladonia	S5
<i>Peltigera</i> sp.	Pelt Lichen	
<i>Stereocaulon tomentosum</i>	Woolly Coral Lichen	SU
<i>Umbilicaria</i> sp.	Rocktripe Lichen	

APPENDIX IV. Site Information for Forested and Wetland Sites.

Table A. Site information for forested sites sampled, P6a and P6b, 2016.										
Plot ID	UTM E¹	UTM N	Vegetation Community	Soil	Aspect (degrees)	Slope (%)	Surface expression	Tree Age² (yr)	Tree Height² (m)	Tree DBH² (cm)
P6a-01	0400544	6047723	V29	Luvisol	334	2	Near level	BS 56, JP 46, TA 56	BS 25, JP 20.5, TA 17.5	BS 16.6, JP 25, TA 14.2
P6a-03	0396918	6049768	V32	Organic	180	3	Undulating	TL 74, BS 121	TL 13.7, BS 14.5	TL 23.5, BS 17.6
P6a-04	0394871	6051859	V30	Gleysol	212	3	Undulating	BS 69	BS 13	BS 13.9
P6a-05	0392652	6053072	V18	Brunisol	30	5	Undulating	BS 72, TA 83	BS 19, TA 20	BS 25.9, TA 18
P6a-06	0389866	6054299	V32	Organic	190	2	Undulating	BS 67	BS 12.5	BS 11.7
P6a-07	0387737	6054741	V32	Organic	-	0	Level	BS 76, TL 76	BS 12, TL 13,	BS 12.6, TL 19.3
P6a-08	0389227	6054048	V18	Luvisol	-	0	Near Level	BS 64, TA 78	BS 15.5, TA 17	BS 25.2, TA 22
P6a-09	0386909	6055369	V30	Gleysol	112	3	Undulating	BS 61	BS 12.5	BS 12.3
P6a-10	0379750	6059070	V9	Luvisol	90	2	Undulating	JP 81, JP 87, TA 83	JP 21.5, JP 21, TA 24	JP 34.1, JP 37.5, TA 21.6
P6a-12	0378333	6061977	V25	Brunisol	46	2	Undulating	JP 86, BS 38	JP 18, BS 12.5	JP 19.3, BS 14
P6a-13	0354533	6087048	V29	Luvisol	0	0	Level	BS 69, WB 46, TA 94	BS 13, WB 10.5, TA 21.5	BS 15.6, WB 9.5, TA 26.3
P6a-14 ³	0355792	6084967	V8	Luvisol	-	-	-	TA 94	TA 21.5	TA 26.3
P6a-15 ³	0356693	6082815	V8	Luvisol	258	2	Undulating	TA 92, BS 73, JP 97, BA 85	TA 22, BS 16.5, JP 22.5, BA 18.5	TA 39.4, BS 21.6, JP 24.2, BA 22.3
P6a-16	0359169	6078855	V28	Brunisol	196	4	-	JP 77, TA 80	JP 22.5, TA 22.5	JP 24.8, TA 30.2

Table A. Site information for forested sites sampled, P6a and P6b, 2016.

Plot ID	UTM E ¹	UTM N	Vegetation Community	Soil	Aspect (degrees)	Slope (%)	Surface expression	Tree Age ² (yr)	Tree Height ² (m)	Tree DBH ² (cm)
P6a-18	0362192	6073344	V32	Organic	0	0	Level	BS 106	BS 11.5	BS 14.3
P6a-19	0363995	6072499	V32	Organic	340	1	-	BS 92	BS 16.5	BS 19.6
P6a-21	0368384	6067460	V29	Luvisol	0	0	Level	BS 76, JP 81	BS 16.5, JP 21	BS 18.4, JP 20.8
P6a-22	0369710	6064654	V30	Gleysol	157	2	-	BS 101, TL 70	BS 25.5, TL 25	BS 21.3, TL 26.6
P6b-25	0381367	6063301	V26	Brunisol	20	5	-	JP 88	JP 19	JP 20.7
P6b-26	0386128	6069487	V32	Organic	254	1	Undulating	BS 88, TL 87	BS 16.5, TL 17.5	BS 15.5, TL 23.5
P6b-27	0389585	6069537	V26	Brunisol	320	1	-	JP 91, BS 52	JP 19, BS 14.5	JP 16.5, BS 16.2
P6b-30	0402164	6074833	V5	Brunisol	52	3	-	TA 96, BS 39	TA 23.5, BS 13	TA 21.4, BS 13.3
P6b-31	0404769	6078411	V29	Luvisol	18	2	-	BS 72, JP 71	BS 16.5, JP 18.5	BS 23.5, JP 27.7
P6b-32	0411617	6080351	V32	Organic	260	2	-	TL 93, BS 95	TL 21, BS 21.5	TL 19, BS 19
P6b-33	0415661	6083336	V27	Brunisol	176	1	-	BS 156, TL 34	BS 12.5, TL 10	BS 14.8, TL 8.4
P6b-36	0426091	6082450	V32	Organic	130	2	-	BS 71, TL 42	BS 12.5, TL 12	BS 15, TL 13.7

1: All UTMs are Zone 14 U, NAD 83.

2: Species include: balsam poplar (BA), black spruce (BS), jack pine (JP), trembling aspen (TA), white birch (WB).

3: Forest tent caterpillar presence.

Table B. Site information for wetland sites sampled, P6a and P6b, 2016.

Plot ID	UTM E ¹	UTM N	Vegetation Community	Soil	Aspect (degrees)	Slope (%)	Surface expression	Tree Age ² (yr)	Tree Height ² (m)	Tree DBH ² (cm)
P6a-02	0399270	6048185	Shrub Rich Fen	Organic	0	0	Level	-	-	-
P6a-11	0378289	6061413	Treed Poor Fen	Organic	0	0	Level	TL 32, BS 33	TL 7.5, BS 10.5	TL 7.7, BS 10.2
P6a-17	0359999	6076385	Graminoid Poor Fen	Organic	0	0	0	-	-	-
P6a-20	0366160	6070140	Treed Bog (V33)	Organic	354	2	Undulating	BS 89	BS 12	BS 12.7
P6a-23	0372830	6063748	Graminoid Poor Fen	Organic	258	1	Undulating	-	-	-
P6a-24	0375242	6063154	Treed Bog (V33)	Organic	268	2	Undulating	TL 62	TL 9.5, BS 6	TL 12.5, BS 5.7
P6b-28	0393888	0070023	Treed Bog (V33)	Organic	0	0	0	BS 48	BS 6	BS 7.6
P6b-29	0399933	6073480	Treed Bog (V33)	Organic	10	2	-	BS 59, TL 83	BS 7.0, TL 8.5	BS 6.9, TL 10.1
P6b-34	0421721	6082888	Treed Bog (V33)	Organic	220	2	-	BS 44	BS 7.5	BS 9
P6b-35	0421773	6082942	Graminoid rich fen	Organic	0	0	0	-	-	-
P6b-37	0428013	6081172	Graminoid rich fen	Organic	136	1	-	-	-	-
P6b-38	0431756	6080891	Treed Bog (V33)	Organic	198	5	-	BS 165	BS 8.5	BS 13.7

1: All UTM's are Zone 14 U, NAD 83.

2: Species include: black spruce (BS), tamarack (TL).

APPENDIX V. Report Photographs.



Photograph 1. Aspen hardwood



Photograph 2. Trembling aspen mixedwood/ tall shrub



Photograph 3. Trembling aspen mixedwood/ low shrub



Photograph 4. Black spruce mixedwood/ feathermoss



Photograph 5. Jack pine/ feathermoss



Photograph 6. Jack pine- black spruce/ lichen



Photograph 7. Black spruce/ shrub- and herb- poor



Photograph 8. Jack pine- black spruce/ feathermoss



Photograph 9. Black spruce/ feathermoss



Photograph 10. Black spruce/ Labrador tea/ feathermoss (Sphagnum)



Photograph 11. Black Spruce/ herb poor/ Sphagnum (feathermoss)



Photograph 12. Treed bog



Photograph 13. Treed poor fen



Photograph 14. Shrub rich fen



Photograph 15. Graminoid rich fen



Photograph 16. Graminoid poor fen