WSR
WEBEQUIE
SUPPLY ROAD

WEBEQUIE SUPPLY ROAD FINAL ENVIRONMENTAL ASSESSMENT REPORT / IMPACT STATEMENT

January 30, 2026

AtkinsRéalis Ref: 661910

SECTION 11: Assessment of Effects on Vegetation and Wetlands

WEBEQUIE FIRST NATION

AtkinsRéalis

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11. Assessment of Effects on Vegetation and Wetlands

Vegetation and wetlands, which include wetlands that are broadly considered peatlands and/or muskeg, were identified as one of the valued components (VC) during the VC scoping and selection as part of the Environmental Assessment / Impact Assessment (EA/IA) process. This section describes and assesses the potential effects that the Project may have on the Vegetation and Wetlands VC.

Existing conditions for the Vegetation and Wetlands VC have been established through fieldwork, desktop studies, and engagement and consultation activities completed by the Project Team. These activities include, but are not limited to, background information review, internet research, mapping of existing vegetation and wetland types, engagement with Indigenous communities and stakeholders, and expert opinion. The existing conditions are being used as baseline conditions to assess and determine the potential effects of the Project. The results of the studies of existing conditions for vegetation and wetlands are provided in Section 9.3 of the Natural Environment Existing Conditions (NEEC) Report in Appendix F.

The assessment of potential effects for the Vegetation and Wetlands VC is presented in the following manner:

- Scope of the Assessment;
- Existing Conditions Summary;
- Potential Effects, Pathways and Indicators;
- Mitigation and Enhancement Measures;
- Characterization of Net Effects;
- Determination of Significance;
- Cumulative Effects;
- Prediction of Confidence in the Assessment;
- Predicted future Condition of the Environment if the Project Does Not Proceed;
- Follow-up and Monitoring Programs; and
- References.

11.1 Scope of the Assessment

11.1.1 Regulatory and Policy Setting

The Vegetation and Wetlands VC is assessed in accordance with the requirements of the *Impact Assessment Act* (IA Act), the *Ontario Environmental Assessment Act* (EA Act), the Tailored Impact Statement Guidelines (TISG) for the Project (Appendix A-1), the provincial approved EA ToR (Appendix A-2), and EA/IA guidance documents.

Table 11-1 outlines the key regulations, legislation, and policies relevant to the assessment of the Vegetation and Wetlands VC for construction and operations of the Project.

Table 11-1: Key Regulation, Legislation, Policy Relevant to Vegetation and Wetlands

Regulatory Agency	Regulation, Legislation, or Policy	Project Relevance
Federal		
Impact Assessment Agency of Canada (IAAC)	*Impact Assessment Act*	The Project is subject to the federal *Impact Assessment Act* (refer to Section 2: Engagement and Consultation). The Tailored Impact Statement Guidelines (TISG) issued by IAAC (2020) for the Project were used to identify requirements for the assessment of Vegetation and Wetlands VC.
Environment and Climate Change Canada (ECCC)	*Species at Risk Act* (SARA)	The purpose of the SARA is to prevent Canadian indigenous species from becoming extinct; to provide for recovery of species that are extirpated, endangered and threatened as a result of human activity; and to encourage management of special concern and other species to prevent them from becoming at risk. There is a potential for vegetation clearing and land disturbance activities associated with the Project in vegetation and wetland assemblages that support mammal, avian, aquatic, and vegetation species at risk, and the habitat that support these species. The SARA prohibits the killing, harming, or taking of threatened or endangered species, regardless of whether these are found on federal, provincial, public, or private land.
Fisheries and Oceans Canada	*Fisheries Act*	The *Fisheries Act* provides for the management and control of fisheries in Canada. It has provisions for fish and fish habitat protection, including prohibitions against causing the death of fish by means other than fishing; and causing the harmful alteration, disruption, or destruction of fish habitat. Fish habitat includes not only rivers, lakes, streams and oceans, but also aquatic plants and riparian areas adjacent to waterbodies. The Project has the potential to affect riparian vegetation that function as fish habitat and SARA freshwater plants, including algae and phytoplankton, during in-water works.
ECCC	Federal Policy on Wetland Conservation	The objective of the Federal Policy on Wetland Conservation ("the Policy") s to "promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future" (Government of Canada 1991). The Policy promotes the recognition of wetland functions in resource management and economic decision making and provides a "no net loss" goal for wetlands: ▪ On federal lands and waters; ▪ In areas affected by the implementation of federal programs where the continuing loss or degradation of wetlands has reached critical levels; and

Regulatory Agency	Regulation, Legislation, or Policy	Project Relevance
		▪ Where federal activities affect wetlands designated as ecologically or socio-economically important to a region. The Project has the potential to affect wetland vegetation, and function.
ECCC	*Environmental Protection Act* (EPA).	The EPA prohibits the discharge of contaminants into the natural environment that will or are likely to have an adverse effect. Any specified undertaking which involves discharging a contaminant into the air (including noise and vibration) or waste management/disposal will require a certificate of approval from ECCC. The Project has the potential to the discharge of contaminants into the natural environment that will or are likely to have an adverse effect, which could affect vegetation and wetlands.
ECCC	*Migratory Birds Convention Act* (MCBA)	The MCBA protects migratory birds and their habitat, such as prohibiting activities that may result in the killing, capturing, injuring, taking, or destroying of migratory birds or the damaging, destroying, removing, or disturbing of nests. Vegetation clearing and land disturbance activities associated with the Project have the potential to adversely effect migratory bird habitat functions.
Provincial		
Ministry of the Environment, Conservation and Parks (MECP)	Ontario *Environmental Assessment Act* (EA Act)	The Project is subject to the Ontario EA Act (refer to Section 1: Introduction). The Terms of Reference (Webequie First Nation 2020), which was approved by the MECP on October 8, 2021, were used to identify requirements for the assessment of Vegetation and Wetlands VC.
MECP	*Environmental Protection Act* (EPA)	The EPA sets responsibilities for the protection of the environment to any person or proponent and the Crown while undertaking activities in the environment. The EPA grants the MECP broad powers to deal with the discharge of contaminants causing negative effects. The Project has the potential to discharge contaminants into the natural environment that will or could have adverse effects to vegetation and wetlands.
MECP	*Endangered Species Act* (ESA)	The purposes of the ESA are: ▪ To identify species at risk based on the best available scientific information, including information obtained from community knowledge and aboriginal traditional knowledge. ▪ To protect species that are at risk and their habitats, and to promote the recovery of species that are at risk. ▪ To promote stewardship activities to assist in the protection and recovery of species that are at risk.

Regulatory Agency	Regulation, Legislation, or Policy	Project Relevance
		Vegetation clearing and land disturbance activities associated with the Project have the potential to adversely effect vegetation and wetlands that support mammal, birds and vegetation species at risk, and their habitat functions. Key amendments to the *Endangered Species Act* were introduced by Bill 5: Protect Ontario by Unleashing Our Economy Act, 2025, before its full repeal and replacement by the *Species Conservation Act* (SCA). Key amendments include the purpose being revised to include social and economic considerations, emphasizing sustainable economic growth alongside species protection; a new habitat definition that is narrower and more limited; removal of “Harass” as a prohibition under the Act; elimination of requirements for the government to develop recovery plans; and Cabinet discretion to add or remove listed species. An interim *Endangered Species Act* framework is currently in place until the SCA is proclaimed with supporting regulations. The amendments to the *Endangered Species Act* and SCA are relevant to the Project, including requirement for an authorization for impacts to species at risk.
Ministry of Natural Resources (MNR)	*Lakes and Rivers Improvement Act* (LRIA)	The purpose of the LRIA, as it relates to vegetation, are to provide for: ▪ The management, protection, preservation and use of the waters of the lakes and rivers of Ontario and the land under them; ▪ The management, perpetuation and use of the fish, wildlife and other natural resources dependent on the lakes and rivers; and ▪ The protection of the natural amenities of the lakes and rivers and their shores and banks. The Project has the potential to affect riparian and aquatic plants, and the riparian ecosystems associated with lakes and rivers.
MNR	*Public Lands Act* (PLA)	The PLA is intended to achieve effective stewardship of public land and to protect Crown interests from activities occurring on adjacent, privately-owned shore lands. The Project has the potential to affect riparian and aquatic plants, and the riparian ecosystems which support healthy lakes and rivers and therefore may be subject to a Work Permit (s) under the Act.
MNR	*Invasive Species Act*	The *Invasive Species Act* sets out regulations to prevent and control the spread of invasive species. Project activities have the potential to result in the introduction/spread of invasive plant species via machinery and equipment transported to the site.

Regulatory Agency	Regulation, Legislation, or Policy	Project Relevance
MNR	*Crown Forest Sustainability Act* (CFSA)	The CFSA was enacted to ensure sustainable management of Ontario's Crown forests by addressing long-term ecological health while balancing social and economic values. It requires forest management planning and operations to conserve biological diversity, emulate natural disturbances, and protect soil, water, air, and plant/animal life. The Project has the potential to have adverse effects on vegetation and wetlands and must align with CFSA requirements.
MNR	*Fish and Wildlife Conservation Act* (FWCA)	The purposes of the FWCA include conserving biodiversity by protecting fish, wildlife species, and their habitats, preventing harm to ecosystems by controlling invasive species and promoting stewardship and responsible resource use through licencing and compliance measures. The Project has the potential to have adverse effects on species at risk, fish and wildlife habitat, and ecological functions. Any activity involving wildlife or habitat alteration may require permits under the FWCA.
MNR	*Aggregate Resources Act*	The *Aggregate Resources Act* in Ontario governs the management of pits and quarries to ensure that aggregate extraction is carried out responsibly. Aggregate extraction in the vicinity of wetlands has the potential to affect hydrology, water quality and vegetation communities. The Project also has the potential to interact with aggregate extraction activities in the region and have a cumulative effect on vegetation and wetland integrity.
MNR	*Forest Fire Prevention Act*	The *Forest Fire Prevention Act* is designed to reduce the risk of wildfires and protect life, property and natural resources. Project activities must adhere to regulations on outdoor burning and fire safety measures. Permits for burning and compliance with fire hazard restrictions may be required, as will measures to minimize fire-related damage to forests, wetlands, and wildlife habitat.
Ministry of Agriculture, Food and Agribusiness	*Weed Control Act*	Parts of the *Weed Control Act* is applicable to road authorities and their responsibilities to prevent the inadvertent establishment of noxious weeds. The control of noxious weeds is applicable to the management of vegetation during the operations phase of the Project.

Regulatory Agency	Regulation, Legislation, or Policy	Project Relevance
Other		
Webequie First Nation	Webequie First Nation in progress/early version Draft Community Based Land Use Plan (CBLUP, 2019a)	The in-progress Draft CBLUP is an overarching document that represents the joint intentions of the community and Ontario and provides overall land use direction. Its relevance is to guide what activities and developments are permitted or not permitted, and where, not to assess project-level impacts. Specific aspects of the proposed Project such as vegetation clearing and land disturbance activities have the potential to affect vegetation and wetlands and the habitat they provide for wildlife and species at risk that are considered within framework of the CBLUP process.
Webequie First Nation	Webequie First Nation On-reserve Land Use Plan (ORLUP) (2019b)	The ORLUP provides information and guidance for community land use and development projects that occur on the reserve. Vegetation clearing and land disturbance activities associated with the Project have the potential to occur in land use areas that may be of cultural interest or value.
Webequie First Nation	Webequie Comprehensive Community Plan (2023)	The Comprehensive Community Plan lays out a roadmap for the community's future. Part of the plan provides information on Webequie First Nation environmental goals (e.g., monitoring of environmental factors) of importance to community members such as wildlife and traditionally harvested foods and medicines. Vegetation clearing and land disturbance activities have the potential to affect vegetation and wetlands that support traditionally harvesting of foods, medicines and wildlife.

11.1.2 Consideration of Input from Engagement and Consultation Activities

The socio-economic baseline study (refer to Appendix L) and the country foods (traditional foods) assessment (refer to Appendix O) completed for the Project, including Indigenous Knowledge and Land and Resource Use shared by First Nations have all contributed to identifying plants species of nutritional, medicinal or spiritual importance to Indigenous communities in study area for the Project.

Based on the studies completed to date and engagement and consultation with Webequie First Nation, the following plants are used for nutritional (i.e., food source), medicinal or spiritual use in the project study area: blueberries (*Vaccinum* sp.), gooseberries (*Ribes* sp.), Northern Sweetflag (*Acorus americanus*), White Cedar (*Thuja occidentalis*), Labrador Tea (*Rhododendron groenlandicum*), and Crowberry (*Empetrum nigrum*). The TISG for the Project also provides a list of species that have known cultural importance to Indigenous communities. These include black spruce, white spruce, tamarack, balsam poplar, cedar, dwarf birch, red willow, trembling aspen, cottongrass, moss, black crowberry, blueberries, raspberries, reindeer moss, sphagnum moss, northern Labrador tea, caribou lichen, bearberry, dogwood, small cranberry, sage, sweetgrass, and lily pads.

Table 11-2 summarizes input related to Vegetation and Wetlands VC received during the engagement and consultation and how inputs are addressed in the EAR/IS. This input includes concerns raised by Indigenous communities and groups, the public, government agencies, and stakeholders prior to the formal commencement of the federal IA and provincial EA, during the Planning Phase of the IA and ToR phase of the EA. The Project Team considered the comments received on the Draft EAR/IS in finalizing the EAR/IS. Details of responses and how the comments have been addressed are provided in the Record of Engagement and Consultation.

Table 11-2: Vegetation and Wetlands – Summary of Input Received During Engagement and Consultation

Comment Theme	How the Comments are Addressed in this EAR/IS	Indigenous Community or Stakeholder
Concerns about drainage of peatlands that will result from the construction of the WSR	Potential effects of temporary dewatering/drainage are assessed in Section 7.3 (Potential Effects, Pathways and Indicators: Surface Water) and Section 8.3 (Potential Effects, Pathways and Indicators: Groundwater). With the implementation of mitigation measures for dewatering as outlined in Section 7.4 (Mitigation Measures: Surface Water), Section 8.4 (Mitigation Measures: Groundwater), and Appendix E (Mitigation Measures) of this EAR/IS, there are no expected permanent changes to either the regional surface water conditions/hydrology or the regional groundwater conditions in the area. No dewatering is anticipated to result in significant permanent changes in the characteristics of the peatland and organics in its vicinity. As described in Section 4 (Project Description), the proposed WSR is a linear facility, with no major obstruction to the water flow or to the hydrology of low-lying areas. Where the road passes through low-lying areas and has the potential to change the local hydrology, mitigation measures including, but not limited to, equalization culverts, drainage blankets and/or subdrains will be placed to minimize or eliminate any such changes.	Attawapiskat First Nation
Include "Fragmentation" as an indicator related to Upland Ecosystems, Riparian Ecosystems & Wetlands.	Fragmentation is identified as a potential effect from vegetation clearing and grubbing activities and is assessed in this EAR/IS section (**Section 11.3.2**) through analysis of the size, shape, number, and distribution of patches within the Local Study Area and Regional Study Area. This includes examining patch area, number of patches, edge length, perimeter and area ratio, density, and nearest neighbour.	Attawapiskat First Nation
Concerns about using herbicides to control vegetation along the road corridor, as herbicides commonly used for this purpose are not safe for use in wetland environments.	Herbicides will not be used for vegetation management. As noted in Section 4 (Project Description), vegetation control will involve cutting, trimming or removal of trees, brush/shrubs and/or groundcover (grass) during the late fall to improve visibility for driver safety or minimize risk of hazard trees falling onto the roadway or supportive facilities. Various types of cutting and	Attawapiskat First Nation

Comment Theme	How the Comments are Addressed in this EAR/IS	Indigenous Community or Stakeholder
	mowing equipment will be used including chainsaws, riding mowers and weed eaters (string trimmers).	
Add Ecosystem Services (carbon sequestration & storage) and Disturbance Regulation (changes to the regulatory functions of wetlands, rivers, and riparian areas) as criteria/indicators for evaluation	The suggested criteria are among functional values identified for the Wetlands Function Assessment, These are described in **Sections 11.2.1.4** and **11.3.3**.	Attawapiskat First Nation
Require the environmental assessment to reflect the particular nature, uniqueness, functions, and significance of muskeg	This section of the EAR/IS (**Section 11**) has included a Wetlands Function Assessment in context to the Local Study Area and Regional Study Area for the Project.	Fort Albany First Nation
Concerns about potential impacts to the integrity of the wetlands located in the James Bay Lowlands and adding related criteria to EA to assess impacts to water chemistry, water table levels, stream sinuosity, soil saturation, water marks, drift lines, sediment deposit, drainage patterns and any other hydrologic data necessary to assess the amount of carbon stored in the wetlands	The suggested criteria are among functional values identified for the Wetlands Function Assessment, as described in **Sections 11.2.1.4** and **11.3.3**.	Mushkegowuk Council
Concerns about methodology of wetland related surveys, and that larger regional studies may be required to understand potential effects on ecological and hydrological cycles.	Wetland surveys were conducted following the approach and methodology described in the Vegetation Study Plan, which was developed with input from relevant agencies and stakeholders at the outset of the EA/IA. The field methodology used to assess wetlands are summarized in this EAR/IS section and are detailed in Section 9.2.6 of Appendix F - the Natural Environment Existing Conditions Report.	Mushkegowuk Council
Concerned that in the absence of peatlands restoration to pre-impact conditions, compensation needs to be considered, and protection measures enforced	All feasible measures will be taken during construction to limit the removals of peatlands (muskeg) and protect adjacent peatlands not directly affected by project activities. That said, there will be some losses to peatlands and other wetland types as a result of project activities. Given the pristine and undisturbed nature of the area, it is also unlikely that enough candidate sites for applying vegetation offsetting opportunities to compensate for the wetland removals areas (See **Section 11.3**: Identification of Potential Effects, Pathways and Indicators) will be available within the local or regional study areas. As such, a portion of the wetland loss compensation will need to be achieved through either restoration outside the Regional Study Area (RSA) or via other mechanisms such as cash in lieu of commitments to fund further research on wetlands and their function within the Hudson and James Bay Lowlands, or specific restoration projects.	Neskantaga First Nation

Comment Theme	How the Comments are Addressed in this EAR/IS	Indigenous Community or Stakeholder
	Peatlands are particularly vulnerable due to their dependence on stable hydrological conditions, unique soil and chemical properties, slow recovery rates, acidic and nutrient-poor conditions, and specialized biodiversity. These characteristics make peatlands particularly susceptible to human caused environmental changes as well as presenting significant challenges to restoration. For example, research from a recent project in Canada involving transplanted sphagnum moss established on a mechanically milled, compressed peat surface suggests that it will take approximately 20 years to develop microforms and natural ecosystem conditions comparable to those in natural bogs (Pouliot et al. 2011). Therefore, in some cases where the only available candidate restoration sites are located in severely disturbed peatlands (e.g., significant removal or long-term compression of peat deposits), restoration objectives may need to be modified to establish a wetland type belonging to an earlier developmental stage. This may include transitions from bog to fen where removals allow for more minerotrophic, as opposed to ombotrophic, conditions, or from bog/fen to swamp or marsh where removals have exposed mineral soils (Graf et al. 2008; Minayeva et.al. 2017). The proposed mitigation measures designed to limit peatland/muskeg losses, and the offsetting approaches to compensate for unavoidable losses are described in **Section 11.4** (Mitigation and Enhancement Measures). All offsetting approaches for compensation for loss of wetlands will be developed in consultation with Indigenous communities and groups, government regulators and stakeholders.	
Question about whether compensation will be provided for unavoidable wetland and stream losses and what are the related plans to compensate for these losses	The proposed mitigation measures designed to limit wetland losses, as well as the offsetting approaches to compensate for unavoidable losses, are described in **Section 11.4** (Mitigation and Enhancement Measures). All wetland offsetting approaches will be developed in consultation with Indigenous communities and groups, government regulators and stakeholders. Offsetting plans with restoration details will include, but not be limited to, the following components: ▪ **Background Information Gathering/Review and Field Investigation** – Consultation with Indigenous communities and groups, Federal/Provincial agencies, and other stakeholders to finalize restoration requirements and objectives.	Neskantaga First Nation

Comment Theme	How the Comments are Addressed in this EAR/IS	Indigenous Community or Stakeholder
	▪ **Site Assessment** – Conduct site assessments of both candidate restoration sites as well as candidate reference sites used to inform restoration objectives and monitoring results. ▪ **Conceptual Restoration (Offsetting) Plan** – Based on field investigations, background review, and consultation with Indigenous communities and groups, Federal/Provincial agencies, and other stakeholders, a Conceptual Restoration Plan will be developed. ▪ **Detailed Restoration Plan –** Preparation of the Detailed Restoration Plan will follow approval of the Conceptual Plan. It will build on the Conceptual Plan and specify the comprehensive restoration strategy for the site. ▪ **Implementation/Construction Oversight –** Oversight of the restoration activities and program including approach to oversee the proponent's contractor activities on-site during key phases of the program. ▪ **Monitoring and Adaptive Management** – Develop and implement a five-year monitoring program for all vegetation restoration/offsetting sites to be undertaken by an Ecological Restoration Specialist and/or Registered Professional Forester.	
Question whether studies of moss will be carried out to establish baseline levels of mercury in the project area	No analysis of moss or lichens for mercury content are planned. However, a country foods assessment (i.e., plants, fish and wildlife) was conducted as part of the human health risk study for the Project and included mercury as parameter for analysis. Mercury levels in groundwater, and surface water were also investigated (refer to Section 7: Assessment of Effects on Surface Water Resources and Section 8: Assessment of Effects on Groundwater Resources).	Neskantaga First Nation
Concerns on impacts of the roads regarding peat, as impacts to peat system will have impacts to the ecological environment and water systems.	As described in Section 4 (Project Description), the proposed WSR is a linear facility with no major obstructions to water flow at river crossings or to the hydrology of low-lying areas. Where the road passes through peatlands and has the potential to alter local hydrology, mitigation measures including, but not limited to, equalization culverts, drainage blankets and/or subdrains will be implemented to minimize or eliminate such changes. Potential impacts of the road on the peatlands are described in this EAR/IS section (see **Section 11.3.3** – Loss or Alteration of Wetland Function).	Webequie First Nation – Meeting on May 13 & 14, 2024

Comment Theme	How the Comments are Addressed in this EAR/IS	Indigenous Community or Stakeholder
The ministry will require a clear explanation of the effects and alternatives assessment methodologies in the EA and will be looking for how key principles such as clarity, consistency and transparency, among others, are met in the documentation.	Details on the assessment of alternatives for the WSR Project are provided in Section 3 (Evaluation of Project Alternatives). Information on the methodologies utilized for the EA/IA is provided in Section 5 (EA/IA Approach).	MECP
Request for further information on areas proposed for vegetation removal (at all stages of Project) for MECP to advise on potential impacts to species at risk.	As described in Section 4 (Project Description), it is proposed that all vegetation (trees) be cleared within the 35 m wide right-of-way (ROW), with the exception of peatland areas (approximately 56 km in length). Other areas within the Project Footprint that will require vegetation removal include aggregate source areas ARA-2 and ARA-4, the ARA-4 access road, and four (4) camps/laydown areas (refer to **Table 11-8** and **Figures 11.1, 11.4**, **11.5** and **11.6**). Potential effects to species at risk are presented in Section 13 (Assessment of Effects on Species at Risk).	MECP
Include an assessment of Significant Wildlife Habitat, rare vegetation, wetlands, Ecoregion/District and Natural Heritage Features in the EA / IA process (to reflect the requirements of the Natural Heritage Reference Manual, 2014)	Significant Wildlife Habitat, rare vegetation, wetlands, Ecoregion/District and Natural Heritage Features and other values are assessed in the following sections of the EAR/IS: ▪ Section 6 (Assessment of Effects on Geology, Terrain and Soils); ▪ Section 7 (Assessment of Effects on Surface Water Resources); ▪ Section 8 (Assessment of Effects on Groundwater Resources); ▪ Section 10 (Assessment of Effects on Fish and Fish Habitat); ▪ **Section 11** (Assessment of Effects on Vegetation and Wetlands); ▪ Section 12 (Assessment of Effects on Wildlife and Wildlife Habitat); and ▪ Section 13 (Assessment of Effects on Species at Risk).	MNR
Provide information on appropriate roadbuilding techniques, and its potential effects on peatlands / wetlands and related mitigation measures	Section 4 (Project Description) includes an overview of the road design features and techniques to mitigate potential effects to peatlands. Further information on the road design features and building techniques is provided in Appendix D-1 – Preliminary Engineering Report.	MNR
Mitigation should include methods to maintain wetland flows and water balances across the entirety of the ROW, because the Hudson Bay lowlands are vast and extensive.	As described in Section 4 (Project Description), the proposed WSR is a linear facility with no major obstructions to the water flow at river crossings or to the hydrology of low-lying areas. Where the road passes through peatlands and has the potential to change the local hydrology, mitigation measures including, but not limited to, equalization culverts, drainage blankets and/or subdrains will be placed to minimize or eliminate	MNR

Comment Theme	How the Comments are Addressed in this EAR/IS	Indigenous Community or Stakeholder
	such changes. Further mitigation measures to address potential impacts of the road on the peatland are also described in this EAR/IS section (see **Section 11.4.6** – Mitigation measures to minimize changes to wetland functions)	
Concerns regarding sampling age of trees over 10 m in height and whether age-class of a stand contributes as a factor in determining appropriateness of potential wildlife habitat, or the visual assessment is enough of an indicator.	Vegetation has been classified and characterized based on a review of background information sources and field surveys to assess potential effects to wildlife habitat, including species at risk. There is recognition that wildlife usage is more dependent on size class and height/cover than actual age of trees. The approach and methodology for biological surveys (e.g., wildlife, vegetation) were outlined in various study plans developed at the outset of the EA/IA and circulated for feedback from relevant agencies and stakeholders. Field methodologies used to characterize existing vegetation and wetland conditions are summarized in this EAR/IS section and are detailed in Section 9.2 of the Natural Environment Existing Conditions Report, provided in Appendix F.	Ministry of Energy, Northern Development and Mines (now Ministry of Energy and Mines)
Provide detail on how engagement with Indigenous groups and the public will inform the effects assessment, as well as the selection of mitigation measures and follow-up program measures.	Please refer to Section 2 (Engagement and Consultation) of EAR/IS for details on engagement and consultation carried out for the Project. **Sections 11.1.3** and **11.1.4** provide information on engagement and consultation inputs received for the Vegetation and Wetlands VC.	IAAC

11.1.3 Incorporation of Indigenous Knowledge and Land and Resource Use Information

To date, the following First Nations have provided Indigenous Knowledge and Land and Resource Use (IKLRU) information to the Project Team:

- Webequie First Nation;
- Marten Falls First Nation;
- Weenusk First Nation;
- Kashechewan First Nation; and
- Fort Albany First Nation.

Table 11-3 summarizes IKLRU information relating to the Vegetation and Wetlands VC and indicates where the information is incorporated in the EAR/IS.

Table 11-3: Vegetation and Wetlands VC – Summary of Indigenous Knowledge and Land and Resource Use Information

Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
Important areas for traditional and cultural uses in the project area	**Information Shared** ▪ The Webequie First Nation's in-progress / early version Draft Community Based Land Use Plan describes Ecozones, Ecoregions, and Ecodistricts,along with watershed and landscape characteristics, water bodies, and vegetation types in the project area, describing their importance for traditional activities, including hunting, fishing, and the harvesting of plants for food, medicine, and practical uses. ▪ The Kaa-shi-ti-kwayak waterways are vital to the Webequie people for gathering medicinal plants. These sacred spaces continue to be places of healing, where traditional plant harvesting practices have been passed down through generations. ▪ The Winisk River and surrounding peatlands are vital to the health of the Weenuski Inninowuk, providing clean water and supporting wildlife that sustains the community. Concerns were raised about the potential for pollution, which could adversely affect water and wildlife, with associated implications for the health of the people and the animals on which they rely. ▪ Community members use or have historically used the watershed areas linked to the Project for hunting, trapping, fishing and water collection. **Concerns** ▪ Request that shared Indigenous Knowledge and land and resource uses be integrated into and analysed in the EA/IA ▪ Community members are concerned about the decreased ability to engage in fishing, water collection, and other key practices due to the impacts	▪ A description of existing conditions for the Vegetation and Wetlands VC is provided in Sections 9.3, 9.4 and 9.5 of Appendix F - the Natural Environment Existing Conditions (NEEC) Report and are summarized in **Section 11.2**, including an overview of Ecozones, Ecoregions, Ecodistricts, watershed and landscape characteristics, and vegetation types in the project study areas. Section 19 (Assessments of Effects on Aboriginal and Treaty Rights and Interests) and Section 20 (Cultural Heritage Resources) includes a description of culturally important areas and potential impacts. ▪ Information on culturally important areas shared with the Project Team was used in the evaluation of alternatives for the Project (see Section 3), assessment of potential effects on vegetation and wetlands (**Section 11**), and other VCs (Sections 6 to 10, Sections 12 to 21, including Aboriginal and Treaty Rights and Interests (Section 19).
Harvesting practices and species of importance (for traditional foods and medicines, use in ceremony and healing)	**Information Shared** ▪ Weenuski Inninowuk gather important plants and berries like cloudberries, cranberries, and blueberries in their traditional lands, especially near Peawanuck. Firewood and berry harvesting occur near family camps, where the land continues to support these practices.	▪ Information on culturally important areas shared with the Project Team was used in the evaluation of alternatives for the Project (Section 3), assessment of potential effects on vegetation and wetlands **(Section 11)**, and other VCs (Sections 6 to 10, Sections 12 to 21, including Aboriginal and Treaty Rights and Interests (Section 19).

Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
	▪ Berries, more specifically blueberries, are among the most consumed traditional foods. The community preserves them using traditional methods and continues to pass down knowledge of their importance in daily and ceremonial life. ▪ Webequie members continue the ancient tradition of harvesting plants for food, medicine, and practical uses. These plants are integral to their culture and provide both sustenance and healing in daily life. ▪ Webequie members gather a wide range of berries and plants, including blueberries, cranberries, juniper, wild rice, and Labrador tea. These species have sustained the community for generations and remain central to their diet and well-being. ▪ Indigenous families rely on plants for both ceremonial and everyday purposes. Tobacco, sage, cedar, and sweetgrass are sacred, used in ceremonies and healing. Moss served as diapers and for lining cradleboards. Trees provided healing remedies – willow bark for cuts, tamarack for boils, spruce gum for wounds, and teas from cedar and birch to heal respiratory ailments. These plants continue to hold importance for the community. ▪ Traditional medicines remain a critical part of Indigenous People's life and are often passed down intergenerationally and on the land. Community members continue to gather cedar, spruce, muskrat root, and other plants for healing. These practices offer an alternative to Western medicine and have been used to treat a range of conditions, including cold, flu, and snow blindness. ▪ Reducing access to sufficient quantities and quality of culturally significant species could impact the passing down of traditional knowledge. ▪ Labrador tea is an essential medicine for the community, used to treat colds and aches. Gathering medicinal plants is part of everyday life, with people collecting remedies from the land whenever they travel. ▪ Traditional medicines, like boiling pinecones to treat coughs and flu remain important. Medicines are found everywhere – in trees, plants, and even water – and continue to be used alongside traditional foods to maintain health.	

Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
	▪ Moss and wood from the forest are used for practical purposes like cleaning, preserving food, and crafting tools such as sleighs, snowshoes, and baskets. Traditional knowledge guides the community in using these materials sustainably. ▪ Seasonal patterns of important harvested species in First Nation traditional territory align with the cycle of the river and are a part of the traditional way of life. ▪ Riversides and swampy regions are home to many of the berries typically harvested. ▪ Across traditional lands, berries (Mooseberry or Lowbush Cranberry, Blueberries, Gooseberries, Raspberries, Red Currant Berries, Raspberries, Bearberries and Strawberries), medicinal plants, and trees are harvested for food, medicinal purposes, firewood, and cultural practices. ▪ Cedar has been recognized as an important medicinal plant, traditionally used to prepare remedies for ailments such as coughs and colds. ▪ Different parts of the plant – fruits, sap, bark, leaves and branches are gathered, depending on their intended use. **Concerns** ▪ Availability of species of berries in Kashechewan First Nation have been observed throughout time; and have been attributed to the hydro power developments within territories. ▪ Cranberries were common in Kashechewan First Nation territory before, but due to tree clearing for hydro power developments cranberries availability has reduced. Berry production has generally decreased in Kashechewan First Nation, with mooseberries being the only species exhibiting accelerated growth. After the Victor Diamond Mine began operations, alterations in berry skin were observed, and there were instances of poor berry growth. ▪ Potential pollution from the road may negatively impact the quality and distribution of plants	

Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
River diversions	**Concerns** ▪ The construction of dams on Albany River is a reminder of settler impacts on Indigenous lands. In 1934, dams were built to support gold mines, altering water levels and disrupting wildlife habitats. This diversion of water had lasting effects on how Indigenous People interacted with the river and their environments, reducing access to resources once provided by the Albany River. ▪ Concerns that the water levels of the river systems and the muskeg may be affected due to water crossings. ▪ Changes in river topography, water levels and flow patterns have been observed during community member lifetimes due to upriver dams. ▪ Declining of water levels has been significant within the last few decades and continuing; and even in the muskeg, the bogs have dried up. ▪ Water levels remain notably low even during summer due to upriver dams, making upstream navigation difficult and requiring boats to be dragged through rapids.	▪ As noted in Section 4 (Project Description), water crossings (rivers and lakes) for the Project will be designed not to change the downstream hydrology (i.e., flows) and will prevent the roadway from acting as a dam by impounding water upstream of the road crossing. Where the road passes through low-lying areas, such as the peatlands, and has the potential to change the local hydrology, mitigation measures including, but not limited to, equalization culverts, drainage blankets and/or subdrains will be placed to minimize or eliminate any such changes.
Concern over dust and fumes from industry	**Concerns** ▪ With industrial traffic comes dust, and First Nation members are worried about its impact on their land. They fear dust will harm water, plants, and animals. Sturgeon, known to be sensitive to environmental changes, are especially vulnerable. The community is deeply concerned about preserving their natural environment. ▪ Increased pollution and construction may lead to widespread and permanent impact on all species and habitats.	▪ An Air Quality and Dust Control Management Plan will be developed and implemented to manage and reduce air contaminant emissions during construction and operations phases. ▪ The Air Quality and Dust Control Management Plan will integrate a monitoring procedure for dustfall effects and measures to control or limit particulate emissions that would mostly come from the passage of vehicles on the road or the handling of soil or aggregates by mobile equipment during construction. ▪ Mitigation measures to address the potential impacts of dust are described in this section, Appendix E (Mitigation Measures) and Section 9 (Assessment of Effects on Atmospheric Environment).

Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
Impacts to muskeg	**Concerns** ▪ The roads bring another concern: illegal dumping. Waste from outsiders has already been a problem on the Winter Access Road, and members fear it will worsen. The muskeg, described as “like a sponge,” soaks up chemicals, making it hard to remove waste. This contamination threatens the health of the people, as waste could seep into their water supply, affecting everyone. ▪ Removing muskeg habitat and mossy areas reduces muskeg’s role in air and water filtration.	▪ Signage to advise road users of prohibited actions, including littering, will be included in the road design. ▪ The need and location of signage (e.g., posted speed limit, prohibited actions or practices, awareness of wildlife habitat or crossing, upcoming rest areas, etc.) will be determined in the Detail Design Phase of the Project. ▪ Routine road patrols or inspections will be conducted to identify conditions which may adversely affect the road, adjacent lands and/or environment, including monitoring for illegal dumping to comply with the quality standards and/or protection measures in the Operation Environmental Management Plan (OEMP) that will be developed and implemented for the Project.
Muskeg road safety	**Concerns** ▪ Community members asked how the roads can safely cross muskeg, which is known for its soft, unstable ground. Heavy trucks may sink, making these roads dangerous for travelers. Community members cautioned that the unique landscape cannot support such infrastructure with significant risk.	As described in Section 4 (Project Description), approximately 56 km (52% in length of the WSR) in the eastern half of the WSR is located in wetland/muskeg terrain (or peatlands). A “floating” road design will be used for this section of the WSR, which includes the placement of aggregate material (gravel) and use of a geotextile fabric and/or geogrid. The floating road design for the east half of the WSR in peatlands will be further examined in the Detail Design Phase of the Project. In accordance with good design practices for floating roads further investigations and assessment will be conducted that include, but not limited to, the following: ▪ Soil, groundwater and ground surveys, sampling and testing (e.g., drilling, monitoring wells) to further characterize the peat, local hydrology and groundwater flow; ▪ Identifying appropriate value for the in-situ peat strength; ▪ Selection of specific type(s) and distribution of geosynthetics (e.g., 1 or 2 geogrids) that allow for effective interlock with aggregate size and shape and that produce a stiff road structure; ▪ Estimates of traffic loading during construction and operations;

Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
		▪ Confirmation of the appropriate distancing for equalization culvert; ▪ Development of appropriate construction sequencing and production rates for construction (i.e., methods and speed). Ideally peat should be loaded slowly to allow for the underlying peat to respond to the increasing load and be given sufficient time to consolidate and gain strength rather than cause shear/weakness. If a floated road is placed too quickly so as to approach, or exceed, the strength of the underlying peat; then failure can occur; and ▪ Development of engineering controls and monitoring program to verify that consolidation is occurring as predicted, including risk management strategies to reduce potential for fill to cause shear stress.
Fire risk from increased traffic	**Concerns** ▪ Increased traffic brings the danger of wildfires. Community members point out that cigarette disposal along the roads could lead to fires, threatening not only their community but also the surrounding environment and anyone in the region.	▪ Signage to advise road users of prohibited actions, including cigarette disposal/littering, will be included in the future road design details. ▪ The need and location of signage (e.g., posted speed limit, prohibited actions or practices, awareness of wildlife habitat or crossing, upcoming rest areas, etc.) will be determined in the future Detail Design Phase of the Project. ▪ Routine road patrols or inspections will be conducted to identify conditions which may adversely affect the road, adjacent lands and/or environment, including monitoring for any prohibited activities to comply with the quality standards and/or protection measures in the OEMP established for the Project.
Observed environmental changes	**Information Shared** ▪ Community members report that changes in rainfall, soil quality, and climate are making it harder to find and harvest plants like berries. This impacts their ability to gather food and medicine, as plants are growing more slowly and less abundantly than before. ▪ Due to less rain, the growth of important plants like blueberries has been stunted. The community has noticed significant	▪ A discussion on how the Project could impact global Greenhouse gases (GHG) emissions that are considered to contribute to climate change, is provided in Appendix H (Greenhouse Gas Emissions Report) and summarized in Section 9.5.2.2 (Characterization of Net Effects, Atmospheric Environment).

Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
	changes over the past two years, with certain areas seeing no blueberries at all. These observations highlight the connection between climate changes and traditional food sources. ▪ Elders have noticed a decrease in rainfall, especially in recent years, leading to a decline in berry harvests. The drying of the land and quick evaporation after the spring thaw are contributing to fewer blueberries and other berries ripening. This change has deeply impacted traditional harvesting practices. ▪ Kashechewan First Nation noted that berries are now smaller and have lost their vibrant red color, turning pink instead. Growth has diminished, and sweetgrass, which was previously collected, is often absent. ▪ Concerns that potential project impacts could spread downstream and through muskeg areas via freshwater contamination. ▪ Community members rely on a diversity of plant species.	▪ Information shared by community members on projected and historic climate change have been considered in the climate change resilience assessment conducted for the Project as part of the EA/IA (refer to Appendix I – Climate Change Resilience Report). The assessment analyzed risks to the Project due to climate change.
Anishinaabe territory pre-contact	**<u>Information Shared</u>** ▪ The Anishinaabe lived across vast lands before contact, from Lake Superior to northern Ontario and Manitoba. Their territory was rich in wildlife, lakes, and rivers, providing everything needed to sustain their way of life, including resources from the boreal forest. Moose, bear, and other animals were crucial for survival, and the land's natural abundance supported traditional practices.	▪ Potential effects on vegetation and wetlands are assessed in this EAR/IS section (**Section 11**) and Section 21 (Cumulative Effects Assessment). Potential project effects on other valued components, including Non-Traditional Land and Resource Use VC and Aboriginal and Treaty Rights and Interests VC are assessed in Sections 6 to 10, and 12 to 21.
Biodiversity in Webequie's traditional territory	**<u>Information Shared</u>** ▪ Webequie sits at the junction of the Ontario Shield and Hudson Bay Lowlands. This rich environment includes wetlands, forests, rivers, and lakes, creating a biodiverse area that sustains a variety of plants and animals, supporting traditional practices and cultural connections. ▪ The forests surrounding Webequie First Nation are primarily black spruce, with some white spruce, balsam fir, and aspen. These forests are home to plants and animals that are central to the community's way of life and continue to provide resources for traditional activities like hunting and gathering.	

Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
		▪ Appendix E of the EAR/IS outlines mitigation measures to eliminate, control or reduce potential adverse effects of the Project. These mitigation measures reflect environmental protection guidelines to protect "Environmentally Sensitive Areas" as described in the Webequie First Nation On-Reserve Land Use Plan (Webequie First Nation, 2019a). Further measures will be provided in the Construction Environmental Management Plan (CEMP) and the OEMP that will be developed and implemented for the Project. Section 4.6 of the EAR/IS describes the proposed framework for the development of the CEMP and the OEMP. ▪ The recommended monitoring program related to the Vegetation and Wetlands VC is outlined in **Section 11.13**. The proposed monitoring program will be conducted by qualified personnel to report on the effectiveness of procedures and mitigation measures. The data collected will be used to evaluate the effectiveness of mitigation measures which will allow for adaptive management of practices for the Project and future environmental activities. Additional details on follow-up monitoring programs for the Project are described in Section 22 of this EAR/IS.
Lack of identified gathering sites in project areas	**Concerns** ▪ Participants did not identify any specific berry or plant gathering sites within the areas impacted by the project, highlighting a potential gap in understanding of how these areas might affect traditional practices.	▪ Ongoing engagement and consultation with Indigenous communities and groups, along with Indigenous Knowledge and land and resource use information, have helped the Project Team identify plant gathering sites and opportunities to address concerns regarding traditional use areas that are of importance to Indigenous Peoples.
Peatlands' regeneration and their role in air and water purification	**Concerns** ▪ The peatlands are described as "cleaning the air for the entire world," emphasizing their critical role in the ecosystem. Participants stressed the need for the hydrology study to better understand water movement in the peatlands and how contamination from development could spread, with Weenusk leading these efforts.	▪ As noted in Section 4 (Project Description), a "floating" road design will be used for the eastern half of the WSR located in peatlands, which includes the placement of aggregate material (gravel) and use of a geotextile fabric and/or geogrid. A "floating" road is a road that is constructed directly on top of the peat (no peat is removed). Planned

Common Theme	Key Information and Concerns	Response and/or Relevant EAR/IS Section
	▪ Peatlands take about 20 years to regenerate, making it crucial to avoid environmental damage. Participants suggest that Weenusk should play a key role in any studies related to water and peatland health, ensuring that their traditional knowledge is integrated into migration plans.	water crossings (rivers or waterbodies) will be designed not to change the downstream hydrology (i.e., flows) and will prevent the roadway from acting as a dam by impounding water. Where the road passes through low-lying areas, such as the peatlands, and has the potential to change the local hydrology, mitigation measures including, but not limited to, equalization culverts, drainage blankets and/or subdrains will be placed to minimize or eliminate any such changes. ▪ The Project Team continues to engage and consult with Indigenous communities and groups throughout the EA/IA process.

Notes: In some instances, the names of First Nations and/or location-specific descriptions were not presented in this table due to potential sensitivity and confidentiality of IKLRU information.

11.1.4 Valued Subcomponents and Indicators

Valued components, including vegetation and wetlands, have been identified in the TISG and by the Project Team and are, in part, based on what Indigenous communities and groups, the public and stakeholders have identified as valuable to them in the EA/IA process to date. Subcomponents (or criteria) of the Vegetation and Wetlands VC are further identified to help inform the report structure and better assess and present the data and assessment results. The assessment of these subcomponents is being conducted using the methodology as outlined in Section 5 (Environmental Assessment / Impact Assessment Approach and Methods). The identified subcomponents for the Vegetation and Wetlands VC are:

- Vegetation Communities, Species and Biodiversity:
  - Upland Ecosystems;
  - Wetland Ecosystems; and
  - Riparian Ecosystems.
- Wetland Functions:
  - Geophysical Functions;
  - Biophysical Functions; and
  - Socio-economic Functions.
- Plant Species and Communities at Risk, of Conservation Concern, or Locally Underrepresented.
- Plant Species and Communities of Traditional Importance to Indigenous Peoples.

"Indicators", are used to assess potential effects to a VC. In general, indicators represent a resource, feature or issue related to a VC that if changed from the existing conditions may demonstrate a positive or negative effect. To determine the appropriate effects indicators, a thorough assessment of Project activities resulting in pathways that have the potential to affect vegetation was conducted. **Table 11-4**. shows the subcomponents and indicators identified for the Vegetation and Wetlands VC.

Table 11-4: Vegetation and Wetlands VC – Subcomponents, Indicators and Rationale

Subcomponent(s)	Indicators	Rationale
Vegetation Communities, Species and Biodiversity	▪ Direct loss of upland, wetland and riparian species, vegetation communities (assemblages). ▪ Fragmentation of vegetation communities. ▪ Alterations to community biodiversity. ▪ Vegetation die-off or community alterations outside of the Project clearing limits.	▪ Clearing and grubbing for the Project will incur direct losses of upland, wetland and riparian vegetation classes. ▪ Installation of a road through established ecosystems will result in habitat fragmentation (Macdonald and Nielsen, 2022). ▪ Clearing and grubbing activities and soil disturbance has the potential to affect biodiversity. ▪ Alterations to vegetation ecosystems (e.g., core area size, and edge length) could affect wildlife usage and seed dispersal patterns (Bennett, 1991; Biglin and Dupingy-Giroux, 2006; MacDonald and Nielsen, 2022). ▪ Indirect effects (e.g., die-off, increased fire potential, invasive species etc.) can lead to changes to vegetation class biodiversity (species composition/diversity) (Biglin and Dupigny-Giroux, 2006; Bignal et al., 2007).
Wetland Functions	▪ Loss or alteration of the geophysical, biophysical, and socioeconomic functions of wetlands	▪ Soil movement and disruption can lead to alterations of the natural hydrology and hydrogeology and thus to wetland function. ▪ Project changes to topography and soil density can increase runoff, causing erosion and sedimentation that can degrade the wetland ecosystems. ▪ Removal or alteration of peatlands can affect the ability of the local environment to sequester carbon. ▪ Project construction and operations can lead to the disruption of the geophysical, biophysical, and socioeconomic functions of wetlands.
Plant Species and Communities at Risk, of Conservation Concern, or Locally Underrepresented	▪ Loss or alteration of plant species and communities of conservation concern.	▪ The Project involves permanent removals of vegetation classes that may contain plant species and communities of conservation concern. ▪ Indirect losses or alterations of plant species and communities of conservation concern may occur as a result of the Project construction and operations.
Plant Species and Communities of Traditional Importance to Indigenous Peoples	▪ Loss or alteration of plant species and communities of traditional importance to Indigenous Peoples for cultural or medicinal purposes or as a source of country foods.	▪ The Project involves permanent removals of vegetation classes that have been identified as containing potential plant species of traditional importance to Indigenous Peoples in the area. ▪ Indirect losses or alterations of plant species and communities of traditional importance to Indigenous Peoples may occur as a result of the Project construction and operations.

11.1.5 Spatial and Temporal Boundaries

The following assessment boundaries have been defined for the Vegetation and Wetlands VC.

11.1.5.1 Spatial Boundaries

The spatial boundaries for the Vegetation and Wetlands VC are shown on **Figure 11.1** and include the following:

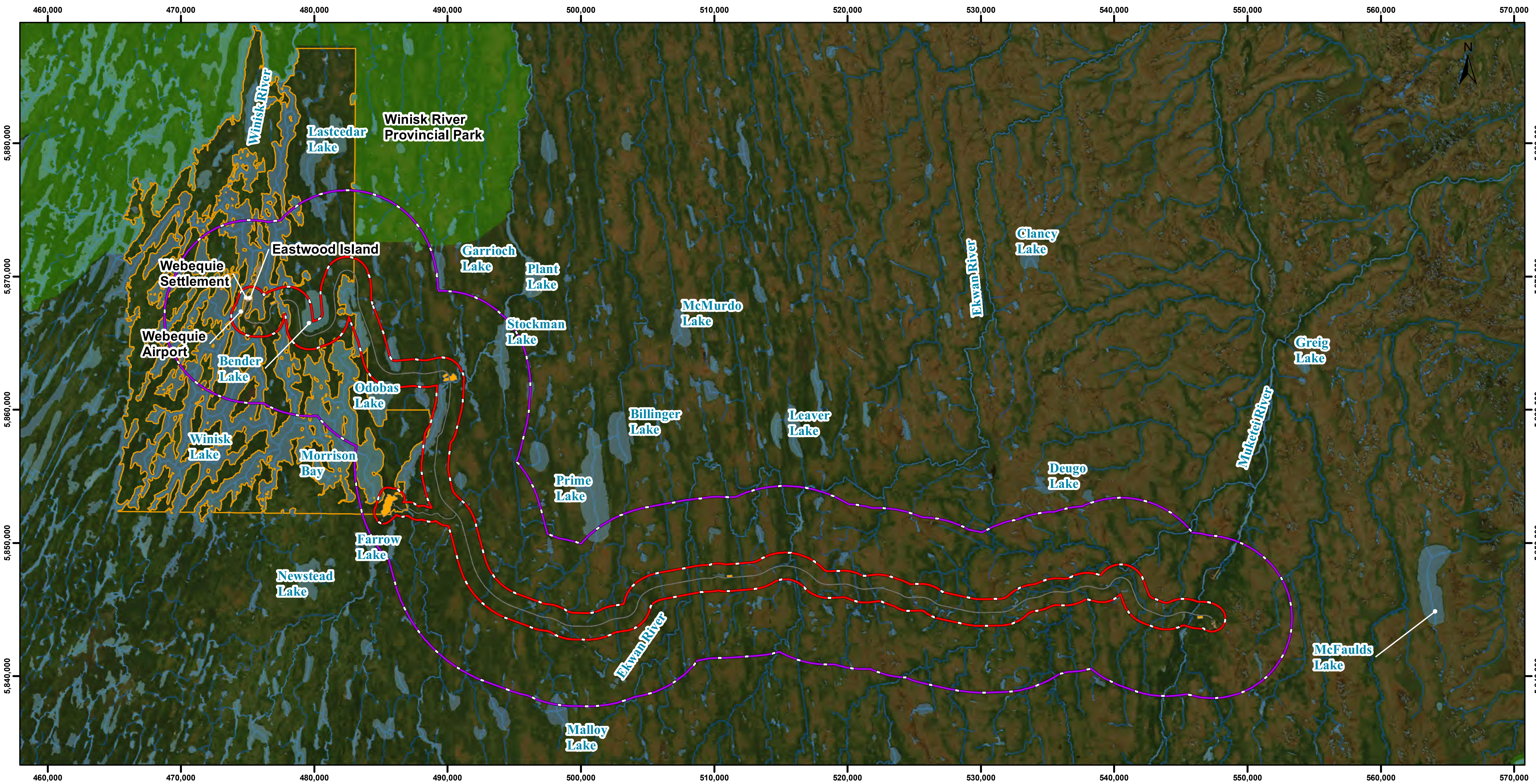
- **Project Footprint (PF)** – the area of direct disturbance (i.e., the physical area required for project construction and operations). The Project Footprint is defined as the 35-m wide right-of-way (ROW) of the WSR; and temporary or permanent areas needed to support the Project that include access roads, construction camps, laydown and storage yards, aggregate pits/quarries, and a Maintenance and Storage Facility.
- **Local Study Area (LSA)** – the area where potential largely direct, and indirect effects of the Project are likely to occur and can be predicted or measured for assessment. The LSA extends 1 km from the centreline of the preliminary recommended preferred route and 500 m from the boundary of the temporary and permanent supportive infrastructure.
- **Regional Study Area (RSA)** – the area where potential largely indirect and cumulative effects of the Project in the broader, regional context may occur. The RSA includes the LSA and further extends 5 km from each side of the LSA boundaries to include the geographical extent to which potential effects from the Project may be expected.

11.1.5.2 Temporal Boundaries

Temporal boundaries for the assessment address the potential effects of the Project over relevant timescales. The temporal boundaries for the Project consist of two main phases:

- **Construction Phase:** All activities associated with the initial development of the road and supportive infrastructure from the start of construction to the start of operation and maintenance of the Project and is estimated to be approximately 5 to 6 years in duration; and
- **Operations Phase:** All activities associated with operation and maintenance of the road and permanent supportive infrastructure (e.g., operations and maintenance yard, aggregate extraction and processing areas) that will start after construction activities are complete, including site restoration and decommissioning of temporary infrastructure (e.g., construction camps). The operations phase of the Project is anticipated to be 75 years based on the expected timeline for when major refurbishment of road components (e.g., bridges) is deemed necessary.

The Project is proposed to be operated for an indeterminate period of time; therefore, future suspension, decommissioning, and eventual abandonment is not evaluated in the EA/IA (refer to Project Description, Section 4.4).



SIZE 11x17

Legend

- Project Footprint (Preferred Route, Camps, Aggregate Source Areas and Access Road)
- Local Study Area ((LSA 1km from Centreline of Preferred Route and 500m from Supportive Infrastructure Facilities)
- Regional Study Area (RSA 5km from either side of LSA Boundaries)
- Webequie First Nation Reserve
- Winisk River Provincial Park
- Waterbody
- Watercourse

WSR
WEBEQUIE
SUPPLY ROAD

NOTES

1. Coordinate System: NAD 1983 UTM Zone 16N.
2. Cadastral boundaries are for informational purposes only and should not be considered suitable for legal, engineering, or surveying purposes.
3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Sciences Sector Centre for Topographic Information; and, Land Information Ontario (LIO) Warehouse Open Data (https://geohub.lio.gov.on.ca/), Ontario Ministry of Natural Resources and Forestry (OMNRF) Download Date : 2021-02-04

DISCLAIMER

Webequie Supply Road (WSR)

Vegetation Program Net Effects Study Areas

Figure Number: 11-1			REV: PA		
Client: Webequie First Nation	Project Number: 661910	Date: 4/17/2025			
DSC			DRN	CHK	APP
			AD	JH	JH

SIZE 11 X 17 Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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11.1.6 Identification of Project Interactions with Vegetation and Wetlands

Table 11-5 identifies the Project activities that may interact with the Vegetation and Wetland VC and result in a potential effect.

Table 11-5: Project Interactions with Vegetation and Wetlands VC and Potential Effects

Project Activities	Potential Effects			
	Loss or Alteration of Vegetation Communities, Species and Diversity	Loss of Alteration of Wetland Function	Loss or Alteration of SAR Plants and SOCC Plants	Loss or Alteration of Plants or Communities of Indigenous Traditional Importance
Construction				
Mobilization of Equipment and Supplies: Transport of equipment, materials and supplies to the Project site area using the winter road network and airport in the Webequie First Nation Reserve.	✓	✓	✓	✓
Surveying: Ground surveys are conducted to stake (physically delineate) the road right-of-way (ROW) and supportive infrastructure components of the Project (i.e., construction camps, access roads, laydown/storage areas, and aggregate extraction and processing areas).	–	–	–	–
Vegetation Clearing and Grubbing: Clearing and grubbing of vegetation (forest & wetland), including removal, disposal and/or chipping.	✓	✓	✓	✓
Construction and Use of Supportive Infrastructure: This includes temporary construction camps, access roads and watercourse crossings, laydown/storage areas, and aggregate extraction (pits & quarries) and processing areas (screening, crushing), including blasting.	✓	✓	✓	✓
Construction of Road: removal and stockpiling of organics, subgrade excavation, placement of fill and gravel, grading and drainage work (e.g., road ditches, erosion protection, etc.).	✓	✓	✓	✓
Construction of Structures at Waterbody Crossings: Culverts and bridges – foundations (e.g., pile driving and concrete works), bridge girders, bridge decks, install of culverts.	✓	✓	✓	✓
Decommissioning / Closure of Temporary Aggregate Extraction and Processing Areas (pits and quarries): Demobilization of extracting and processing equipment, grading and site reclamation/revegetation. This also includes formalizing / re-purposing select pits and quarries proposed as permanent Project components during operations.	✓	✓	✓	✓

Project Activities	Potential Effects			
	Loss or Alteration of Vegetation Communities, Species and Diversity	Loss of Alteration of Wetland Function	Loss or Alteration of SAR Plants and SOCC Plants	Loss or Alteration of Plants or Communities of Indigenous Traditional Importance
Decommissioning of Temporary Construction Camps, Access Roads and Laydown / Storage Areas: Grading and site reclamation/revegetation. This also includes formalizing / re-purposing select access roads to permanent pits and quarries and a construction camp to an operations and maintenance facility as Project components for use during operations.	✓	✓	✓	✓
Emissions, Discharges and Wastes[1]: Noise, air emissions / GHGs, water discharge, and hazardous and non-hazardous wastes.	✓	✓	✓	✓
Completion of Project-Wide Clean-up, Site Restoration / Reclamation and Demobilization: Clean-up of excess materials, site revegetation and demobilization of equipment and materials.	✓	✓	✓	✓
Potential for Accidents and Malfunctions[2]: Spills, vehicle collisions, flooding, forest fire and vandalism.	-	✓	✓	✓
Employment and Expenditures[3]	–	–	–	
Operations				
Road Use: Light and heavy vehicles and maintenance equipment with average annual daily traffic volume of less than 500 vehicles.	✓	✓	✓	✓
Operation, Maintenance and Repair of Road: Includes: vegetation management control within road ROW; repairs/resurfacing of road granular surface and shoulders; dust control; winter/seasonal maintenance (e.g., snow clearing); road drainage system cleanout/repairs to culverts, ditches and drainage outfalls; rehabilitation and repairs to structural culverts and bridges; and road patrols for inspection.	✓	✓	✓	✓
Operation of Pits, Quarries, and Maintenance Yard/Facility: Includes periodic extraction and blasting and processing operations (i.e., crushing, screening) and stockpiling of rock and aggregate materials. Also includes operation and repairs of Maintenance Yard/Facility and components within (office buildings, parking, storage of equipment and materials).	✓	✓	✓	✓
Emissions, Discharges, and Wastes[1]: Noise, air emissions / GHGs, water discharge, and hazardous and non-hazardous wastes.	✓	✓	✓	✓

Project Activities	Potential Effects			
	Loss or Alteration of Vegetation Communities, Species and Diversity	Loss of Alteration of Wetland Function	Loss or Alteration of SAR Plants and SOCC Plants	Loss or Alteration of Plants or Communities of Indigenous Traditional Importance
Potential for Accidents and Malfunctions[2]: Spills, vehicle collisions, forest fire and vandalism.	-	✓	✓	✓
Employment and Expenditures[3]	–	–	–	–

Notes:

✓ = Potential interaction

– = No interaction

[1] Emissions, Discharges, and Wastes (e.g., air, noise, light, solid wastes, and liquid effluents) are generated by many project activities. Rather than acknowledging this by placing a checkmark against each of these activities, "Wastes and Emissions" is an additional component under each Project phase.

[2] Accidents and Malfunctions including spills, vehicle collisions, flooding, forest fires and vandalism may occur at any time during construction and operations of the Project. Rather than acknowledging this by placing a checkmark against each of these activities, "Potential for Accidents and Malfunctions" is an additional component under each Project phase. The potential effects of accidental spills are assessed in Section 23 – Accidents and Malfunctions.

[3] Project employment and expenditures are generated by most Project activities and components and are the main drivers of many socio-economic effects. Rather than acknowledging this by placing a checkmark against each of these activities, "Employment and Expenditures" is an additional component under each project phase.

11.2 Existing Conditions

This section summarizes existing conditions of vegetation and wetlands based on desktop review and field investigations conducted for the Project. Detailed descriptions of the methods for desktop review and field investigations and interpretations of the results are provided in Appendix F – NEEC Report.

11.2.1 Methods

The following sections describe the methods used to characterize existing vegetation and wetlands within the study areas for the Project.

11.2.1.1 Desktop Review of Background Information Sources

Background information was reviewed from a variety of sources including publicly available data sets, relevant legislation, field guides, technical manuals, previous studies, and peer-reviewed publications. In addition, Indigenous Knowledge obtained from Webequie First Nation and other First Nations provided information on traditional use of plants in the Project study areas.

Datasets from both the Land Information Ontario (LIO) and the Far North Land Cover (FNLC) were used to characterize vegetation and wetlands, but when discrepancies were identified, the LIO data took precedence due to its increased accuracy. In addition, aerial imagery, LiDAR, and background data collected from existing topographic and geological data sources were examined. Modelling of vegetation was rejected in favour of visual delineation and typing of vegetation communities by experienced biologists conducting the field programs, or with extensive experience typing vegetation in the region. Background data sources and the results from field surveys were extrapolated to delineate vegetation units using an iterative approach. Please refer to Section 9.3.3 of the Natural Environment Existing Conditions Report – Appendix F for more information.

11.2.1.2 Characterization of Existing Conditions – Data Collection Methods

Field data collection to characterize the existing conditions for vegetation and wetlands as detailed in Sections 9.2 and 9.3 of Appendix F (Natural Environment Existing Conditions Report) were conducted based on Ontario Parks Inventory and Monitoring Program Guidelines allowing for consistency and direct comparisons across programs. Modifications were made to align with the Ecological Land Classification (ELC) system for the Boreal region. At each sampling location, three separate surveys were conducted to assess vegetation diversity, density, dominance, and community structure as well as composition of soils (substrate). The data collected from the surveys was used to drive the assignment of the appropriate ecosite code to each unit. In some heterogenous units, additional sampling efforts were conducted to gather supplementary data on ecotone transitions, inclusions, and complex vegetation communities.

Indigenous community members raised concerns about methodology of wetland related surveys, and that larger regional studies may be required to understand potential effects on ecological and hydrological cycles. Wetland surveys were conducted following the approach and methodology described in the Vegetation Study Plan which was developed with input from relevant agencies and stakeholders at the outset of the EA/IA. The field methodology used to assess wetlands are summarized in Section 11.2.1 and are detailed in the Natural Environment Existing Conditions Report contained in Appendix F.

Sites sampled for field surveys were selected manually in 2019 by Project Team vegetation specialists. This approach was amended in the 2020 field program, following the receipt of the TISG, in favour of a stratified random sampling selection process. The selection process was modified to consider locally underrepresented vegetation classes and landforms that are found in in the RSA. Based on the sampling methods used in 2019 and 2020, there were concerns about balancing spatial dispersion and sampling estimation. Subsequently, the Project team engaged the services of a Biostatistician (Rob Rempel, Ph.D.) to model the 2021 sampling program using the R-package for Generalized Random Tessellation Stratified (GRTS) sampling.

The GRTS approach spatially balances sample sites by evenly distributing them over the landscape, thereby ensuring specific landcover types are neither over-sampled, nor under-sampled. In addition, when creating sampling points three factors were considered: the overall relative distribution of FNLC classes with the overall project RSA, the distribution of FNLC classes surveyed in 2019/2020, and the intentional over-sampling of relatively rare FNLC classes in the RSA. Over sampling of rare sites is required to calibrate the model. Results from the 2019-2020 field program were incorporated into the mapping before applying GRTS for accuracy.

A list of all vascular plants observed at each sampling point was completed and the field data for each site was assigned an ecosite classification according to the Boreal manual. (For a full list of species, please refer to Appendix 9-E of the Natural Environment Existing Conditions report). These sampled sites (units or polygons) were compared to the current mapped vegetation classifications to calculate the level of certainty between known and projected classifications. Results were used to develop the vegetation classification that would be used for assessment of effects across the study areas.

Upland ecosystems were surveyed using Ontario Parks datasheets for Vegetation Plot Layers and Groundcover / Substrate Plot Information. During these surveys, biologists assessed vegetation dominance by height class, characterized the soils, and made notes on potential wildlife habitat and community structure. The quadrats assessed percent cover of each species, with new quadrats added until no new species were found, to create a species area curve. Wetland and riparian ecosystems were surveyed similarly, though they also included measurements for water pH and water table depth, where applicable. Sample selections and surveys were also targeted in areas where Species at Risk (SAR) or rare communities were likely to occur.

11.2.1.3 Vegetation and Wetland Communities Mapping

Upland, wetland, and riparian ecosystems were mapped for the LSA and RSA in accordance with the Boreal Ecological Land Classification System. The Canadian National Vegetation Classification System (CNVC) and Canadian Wetland Classification System were also reviewed during this process (Rubec, 2018; Baldwin et al., 2019). Given the extent of the study areas, it was considered slightly misleading to attempt to extrapolate the more detailed ELC Ecosite classification derived from the field program across the study area given the increasing lack of definitive soils, moisture regime and detailed vegetation composition as you move further from the sample locations. As a result, the ELC Community Class level was used for vegetation community mapping across the landscape, with ELC Community Series designations applied where applicable. A combination of LIO wetland data and FNLC was used the starting point for the wetland and upland vegetation mapping. Further delineation and typing of vegetative units (polygons) were completed using aerial imagery/LiDAR, as well as topographic and surficial geology data sets. The results of the vegetation delineation (and typing) were also used to support various wildlife field programs including the placement of autonomous recording units.

Wetland unit identification was initially done using wetland data found in the LIO data sets. The LIO wetland types are marsh, fen, swamp, bog, or treed peatland based on Section 1.1.2 of the Ontario Wetlands Evaluation System manual, but it should be noted that a number of these types (e.g., fen, bog and treed peatland) correspond to the definitions of both peatlands and muskeg. Following the field programs, typing of wetlands was assigned using the boreal ELC protocol at the Community Series level. As such, the vegetation classifications that are described as either fen or bog can also be considered peatlands or muskeg.

Vegetation units selected for sampling were assessed for species dominance according to height class, biodiversity (determined by a species-area curve), and abiotic factors including soil and substrate information. Data collected from the surveys were used to drive the assignment of appropriate ecosite codes for each unit. For improved context and clarity within complex heterogeneous or transitional ecotones additional surveys were conducted.

11.2.1.3.1 Riparian Areas

Riparian habitat is a transition zone between aquatic and terrestrial ecosystems (Austin et al. 2008) and is defined as areas adjacent to rivers and lakes, or ephemeral, intermittent, or perennial streams that differ from surrounding uplands in plant and wildlife diversity and productivity (Environment Canada 2013). A combination of mapped riparian areas and buffers to water features were used to provide an estimate of the available riparian environments found within the Project study areas.

During the baseline mapping process, delineation of riparian areas was difficult to execute because of the small size and mosaiced nature of these vegetation assemblages. Delineation was particularly challenging along watercourses and lakes adjacent to treed uplands and wetlands. To address this challenge, buffers representing estimated riparian habitat were applied to both lakes and watercourses. The Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement (MNR 2010a) and the Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (MNR 2010b) recommend a minimum distance of 15 to 30 m of naturally vegetated cover be retained adjacent to fish habitat to maintain ecosystem function. The Department of Fisheries and Oceans (DFO) has also indicated that the riparian zone is influenced by various biophysical processes, such as erosion, filtration, and shading (Collison & Gromack, 2022). As such, the application of a standardized buffer might not reflect the true area of riparian habitat, and in some cases riparian habitat wider than 30 m may be required to protect the movement corridors for certain wildlife species.

Based on available literature, riparian areas have been estimated adjacent to watercourses and lakes as part of this assessment, including for the wetlands function assessment summarized in **Section 11.2** (Existing Conditions). Therefore, for this assessment, a 30 m buffer is assumed to represent an appropriate riparian zone width from the edges of watercourses and riparian buffer of 40 m has been applied to lakes. Potential riparian habitat was mapped across the LSA and RSA using available data and applying 30 m and 40 m buffers, as described above. The buffer zone was then overlaid onto the LSA and RSA ELC mapping. All naturally vegetated ecosites (both upland and wetland) within the riparian areas/zones were classified as having riparian habitat potential and were use in riparian calculations.

11.2.1.3.2 Designated Plant Species at Risk, Species and Vegetation Communities of Conservation Concern and Locally Rare/(Underrepresented Vegetation Communities)

In addition to mapping of vegetation, wetlands and riparian areas as described above, the biologists conducted field surveys to identify any SAR plant designated as either Endangered or Threatened under the *Ontario Endangered Species Act* (ESA) and/or the federal *Species at Risk Act* (SARA). The surveys were also intended to record any plant species of conservation concern (SOCC). Plant SOCC include those listed as: Special Concern on the Species at Risk Ontario (SARO) list under the ESA, as Special Concern under SARA, and/or as provincially rare (i.e., having a subnational rank of S1, S2 or S3). The habitat associated with Special Concern and/or provincially rare species with the following subnational ranks (SRANKs – Master et al., 2012).

- S1 – Extremely rare in Ontario with fewer than five (5) occurrences in the province, or very few remaining hectares.
- S2 – Very rare in Ontario with between five and twenty (5 – 20) occurrences in the province, or few remaining hectares.
- S3 – Rare to Uncommon in Ontario with between twenty and one hundred occurrences (20 –100) in the province, or which may have fewer occurrences but still have some extensive examples remaining.

Communities that are assigned lower ranks, such as S4 and S5, are considered common and widespread in Ontario. A rank of S4 denotes a community that is apparently secure in the province, with many occurrences, while S5 indicates it is demonstrably secure in the province.

Prior to conducting field surveys, a list of potential plant SAR and plant SOCC present in the study areas was compiled to inform the fieldwork (refer to Sections 9.2.5 and 9.3.6 of the Natural Environment Existing Conditions report – Appendix F). This list was based on a review of previous studies, available provincial and national databases (Natural Heritage Information Centre (NHIC), Committee on the Status of Endangered Wildlife in Canada (COSEWIC)), and relevant legislation (ESA, SARA). Specific sample locations were chosen within vegetation communities likely to support SOCC or SAR. If any species were found, photos, GPS coordinates, and environmental site descriptions were recorded.

No Locally Rare vegetation classifications have been officially designated by either the provincial NHIC, or local municipal planning authorities within the LSA or RSA. That said, as part of the vegetation assessment, the Project Team examined some of the more uncommon vegetation classifications encountered during the field programs that were considered underrepresented in the study areas (refer to **Section 11.2.2.4** for a list of these.

11.2.1.3.3 Areas and Plants of Traditional Importance to Indigenous Peoples

To determine areas and plants of traditional importance to Indigenous Peoples (e.g., for cultural or medicinal use, or as a source of country foods) the Project Team relied on information that was gathered during from background information sources, the country foods assessment completed for the Project, Indigenous knowledge and outcomes of the engagement and consultation with Indigenous communities (refer to **Section 11.1.2**, Consideration of Input from Engagement and Consultation Activities and **Section 11.2.2.5** Areas and Plants of Traditional Importance to Indigenous Peoples). Particular attention was given to the feedback received from Webequie First Nation. The information obtained through engagement activities and review of background information aided the field surveys and the assessment for vegetation and wetlands. Additionally, the Project Team also considered the list of species in the TISG for the Project that have known cultural importance to Indigenous Peoples. These were further investigated during the surveys and assessment.

11.2.1.3.4 Species and Community Biodiversity

The objectives of the biodiversity component for characterization of baseline conditions were to assess the abundance and distribution of species and ecological units at several scales across the landscape, as well as to assess fragmentation of the landscape within the LSA and the RSA. This analysis was used to support the assessment of effects on upland, wetland and riparian abundance and diversity as well as plant species biodiversity.

The biodiversity indicators, selected for characterizing the baseline vegetation biodiversity within the study areas, were based on a review of existing published data and field data collected during the 2019, 2020 and 2021 field programs (refer to Section 9.3.1 and Section 9.3.2 of the Natural Environment Existing Conditions report – Appendix F). Baseline biodiversity was characterized at three levels: Species, Community, and Landscape.

Diversity and richness values were derived from calculations of Shannon's Diversity ($H' = -\sum_{i=1}^{k} Pi * LnPi$)) and Pielou's Evenness (J' = H' / lnS) indices that were used as the measure of both species and landscape level biodiversity.

Species richness (S) were calculated using Menhinick's index (D = s /√N), for vascular species only. Data collected as part of the baseline vegetation and wetland field surveys were used to calculate these indices.

The Shannon Diversity Index was used at a landscape level to provide a useful metric by substituting species with vegetation classes. The Shannon Evenness Index was also used to calculate class evenness at the landscape level. The formulae used to calculate the Shannon Diversity and Evenness Indices at the landscape level are as follows:

$$H=-\sum[(pi)\times \ln(pi)]$$

Where:

- H = the Shannon Diversity Index;
- pi = n/N (n = patches of a given type/class; divided by N = total number of patches in the study area); and,
- ln(pi) = the log of pi.

The Shannon Evenness Index was calculated by using the formulae:

E = H / ln(k)

Where:

- H is the Shannon Diversity Index; and,
- k is the number of patch classes.

Data from all survey plots within each sampled ecosite polygon were treated as replicates and analysed to develop an overall species richness value for the site. Site values from similar ecosite classes were then combined to form a representative of the average range of species richness and abundance for the whole community class within the LSA and RSA. Field survey data were also used to estimate the biodiversity potential by identifying rare or unique species occurrences or non-native (invasive) species.

The community level assessment focused on several community classes within the LSA, as well as the biodiversity potential of each. Biodiversity potential entailed an assessment of the ability of each ecosite or community to support a variety of self-sustaining plant and animal populations. This assessment was done by comparing the structure and composition of each ecosite or community, along with the rarity of the community at a landscape level. The purpose of this exercise was to ensure that underrepresented, relatively rare communities are given more weight, since their loss would affect landscape biodiversity more than those of more common sites.

The number and type of community classes in the LSA and RSA were used to assess biodiversity at the landscape level. Information on the number and type of community classes in the LSA and RSA were derived from those utilized during the biodiversity assessment and were based on the dominant ecosite, or community class assigned to each polygon during the LSA and RSA mapping process.

The landscape level diversity information included the size, shape, number, and distribution of vegetation class patches within the LSA and RSA along with the following defined metrics:

- **Number of Patches** – the number of patches within the LSA and RSA belonging to each class.
- **Class Area** – the amount of the LSA and RSA belonging to each patch class in hectares.
- **Mean Patch Size** – the average (mean) size of patches within each class.
- **Perimeter Length** – measures the total area of the perimeter of all patches in each class.
- **Mean Perimeter to Area Ratio** – the mean edge density (m/ha) for each class.

In addition to the landscape patch classes, a separate set of metrics was calculated for 'core areas', which are defined as areas more than 50 m from another patch. Core areas are considered to have minimal edge or transitional effects from neighbouring patch or habitat types:

- **Number of Core Patches** – the number of core patches within the LSA and RSA by class. Of note, the 50 m buffer can result in a single contiguous patch being split into multiple core patches depending on the original patch complexity and configuration.
- **Core Area** – the area of core patch for each class.
- **Mean Core Patch Size** – the mean size of each core patch within a class.
- **Core Area Index** – the proportion of each class that is Core Area represented as a percentage.

The results of these landscape level biodiversity metrics created a holistic understanding of the existing mosaic of vegetation types and classes within the LSA and RSA.

To further describe and characterize the baseline landscape and distribution of the vegetation classes within the study area a Nearest Neighbour Analysis was conducted. A Nearest Neighbour Analysis measures the spread or distribution of spatially identifiable landscape features over a defined geographical area and provides a numerical value that describes the extent to which a set of features are clustered or uniformly spaced. These values can then be used to compare future landscape changes to the existing conditions and assist in the determination of the effects of the proposed WSR (potential fragmentation) on habitat connectivity within the environment.

11.2.1.4 Wetland Functional Assessment

The Project Team determined the wetland functional assessment approach through analysis of the criteria described in *Wetland Ecological Functions Assessment: An Overview of Approaches* (Hanson et al., 2008). A modified landscape level (Tier 1) Wetlands Function Assessment methodology was chosen as the most appropriate approach to determining the functional value of wetlands within the WSR study areas. This determination was based on the unique Project landscape and an extensive review of the currently accepted methodologies, as described in Section 9.2.6 of the Natural Environment Existing Conditions Report (Appendix F).

The Project area is almost entirely composed of vast wetland complexes (81.78% of LSA and 80.29% of RSA) interspersed with upland areas and waterbodies. This overall wetland: upland relationship makes the area incompatible with wetland function evaluation systems that target small, discrete wetlands in an upland matrix with identifiable flow inputs and outputs. As a result, a modified landscape level (Tier 1) assessment was adopted, and functional indices were grouped into three categories:

- Geophysical;
- Biophysical; and
- Socio-economic.

Functional indicators identified for the Wetlands Function Assessment reflected criteria including, water chemistry, water table levels, stream sinuosity, soil saturation, water marks, drift lines, sediment deposit, drainage patterns and any other hydrologic data necessary to assess the amount of carbon stored in the wetlands that were suggested by Indigenous community members.

11.2.1.4.1 Geophysical

Given the large number of wetlands involved, functional assessments were not conducted on discrete individual wetlands. Instead, a review of existing scientific studies and papers provided general functional values for hydrology (flood attenuation and erosion protection), hydrogeology (recharge and discharge), biochemical nutrient cycling, water quality, carbon sequestration, and climate regulation based on the wetland types within the study areas.

In addition to qualitative descriptions of relative geophysical functional values, landscape level (Tier 1), semi-quantitative assessments (i.e., based on ordinal values) were modelled using logistic regression in R to assess specific wetland geophysical functions in terms of probability that specific wetlands (ELC polygons) provide functional value. The relative probability values used were based on a review of published literature and other environmental assessments, and were assigned to wetland types, ranging from 0 to 1.

As part of the field surveys, the Project Team collected information on geophysical indicators of wetland function where possible. The indicators included:

- Erosion Protection;
- Flood Attenuation Potential;
- Discharge Potential;
- Recharge Potential;
- Water Quality;
- Nutrient Cycling;
- Carbon Sequestration; and
- Climate Regulation.

11.2.1.4.2 Biophysical Functions

For the analysis of the biophysical wetland functions, the Project Team retained Dr. Rob Rempel, of FERIT Environmental Consulting to determine (define) the functional use or “Functional Habitat” of each wetland type with respect to plant and wildlife species for the following indicators:

- Maintenance of Vegetative Diversity/Integrity;
- Maintenance of Characteristic Breeding Bird Habitat;
- Maintenance of Characteristic Waterfowl Habitat;
- Maintenance of Characteristic Mammal Habitat; and
- Maintenance of Characteristic Amphibian Habitat.

In the Wetland Function Assessment, functional habitats were considered those resource areas or wetland types that provide for the life history needs of a plant or animal, and the functional assessment is the process by which the value of resources is estimated. A statistical modelling technique termed the Resource Selection Function (RSF) that uses logistic regression was used to provide the ability to quantify the absolute or relative probability that a plant or animal uses a specific resource (e.g., wetland or landcover type) (Manly et al., 2002; Johnson et al., 2006, Lele et al., 2013).

The modelling technique was used to quantify the importance of various environmental factors, such as wetland types, conifer forest, or eskers, and to predict the distribution and importance of habitat and how that functional habitat supports biodiversity. Such habitat models were then incorporated into a GIS database to produce distributional maps of species as a function of resource types. This approach supports the wetland function and biodiversity analysis of flora and fauna within the study areas. These RSF predictions of high/low value habitat (at a species level) constitute one of the metrics used for the assessment of existing biodiversity functional value and eventually in estimating potential future adverse effects on these values.

The maintenance of Characteristic Fish Habitat focused on those wetlands proximal to open waterbodies (lakes/rivers) with the potential for direct access to support the life processes of fish. As several wetland functions that support fish habitat are already accounted for in other categories of the functional assessment noted above, the functional value of wetlands to support critical life processes of fish focused on the potential for supporting spawning, nursery, and feeding habitat.

To account for these specific fish habitat functions, all open-wetland types adjacent to open waterbodies (e.g., rivers, large lakes, and ponds) were considered to have a high potential for the maintenance of characteristic fish habitat. Other wetland types adjacent to waterbodies were considered to provide some function through the provision of cover, temperature regulation, and habitat during periods of inundation. To account for these less direct, but important functions, buffers representing High, Medium, and Low fish critical-life-process functional values were applied to all waterbodies (see **Table 11-6**, Waterbody Functional Value Buffers). The size of these buffers was derived from DFO guidelines and accepted literature. Most of the available literature relates to forestry and construction activities, but these are still considered relevant, because they assess changes in fish density around both headwater and larger-order streams. Adjacent to waterbodies, most sources state that 30 m – 60 m is sufficient for maintaining fish habitat but given the extremely low gradients in the study areas, larger buffers were selected to facilitate a conservative approach.

Table 11-6: Waterbody Functional Value Buffers

Wetlands Adjacent to:	Aquatic Habitat Buffers (m)		
	High	Medium	Low
Watercourses			
1st Order (Headwater)	30	60	90
2nd Order	30	60	90
3rd Order	30	60	90
Lakes/Open Water			
Lakes/Ponds (Connected to Stream)	40	80	160
Large Rivers	30	60	120
Isolated Lakes/Ponds	40	80	160

11.2.1.4.3 Socio-economic Functions

Given the remote nature of the study areas, the social and economic uses of the wetlands within the PF, LSA and RSA are severely limited, and access is restricted to areas within a reasonable proximity to Indigenous communities with existing access route so particularly the community of Webequie. Other than localized fuel harvesting, no forestry activities are being conducted within the study areas. Traplines are known to be situated within the study areas, but information on the levels of activity (use) is not known at this time. Consultation with Indigenous communities is ongoing, but when the wetlands functional evaluation for the Project was conducted there was not enough context-specific data available to adequately apply a socio-economic value to the Wetlands Function Assessment in the RSA.

Indigenous Knowledge and Land and Resource Use (IKLRU) data available was used (e.g., polygons of burial sites, hunting, fishing and gathering areas, trails, known habitat) to derive a distinct stand-alone socio-economic functional rating. To address the limited information, it was determined that Indigenous communities view these wetlands in a holistic ecological manner and the socio-economic roles of these wetland environments are intertwined with their ecological characteristics. As a result, the typical grouping of ecological indicators to derive a single aggregated ecological wetland function are not applied. Instead, each of the ecological indicators (Waterfowl, Breeding Birds, Mammals, Vegetation, and Fish/Amphibian Habitat Maintenance) have been considered separately, with equal weight in determining their final wetland functional values. This approach increases the weight of these functions to account for the dual role as both an ecological function and a socio-economic function. Therefore, the socio-economic function is considered to be the combination of the specific socio-economic values derived from the available IKLRU information and a portion of the increased weight of the other ecological functions acting as surrogate values attributable to potential aesthetics, recreation, education, and commercial uses of wetlands by First Nations and the public.

11.2.1.4.4 Aggregated Wetland Function and Diversity

The three broad functional categories (geophysical, biophysical and socio-economic) were modelled using ordinal values derived from published literature, field survey results and consultation with Indigenous communities. The model was used to assign the probability that different wetland community types have in providing specific geophysical, biophysical, and socio-economic functions. The ordinal values derived from the model are based on a simple relationship that was established between qualitative value and relative probability of the specific wetland type providing high functional value: i.e., high (1), moderate/high (0.8), moderate (0.6), low/moderate (0.4), and low (0.2). An aggregate index was created using multi-variate factor analysis and weighted values to summarize the overall results.

The wetland functional assessment also involved the calculation of a diversity index to rank the relative value of ELC types in terms of diversity in predicted use. The RSF modelling of the biotic functions resulted in maps quantifying probability of use for each plant and wildlife species, which were then used to estimate diversity in use.

11.2.2 Results

The following sections summarizes the existing (baseline) conditions for the Vegetation and Wetlands VC. Details of the results are described in Section 9 of Appendix F – the Natural Environment Existing Conditions Report.

11.2.2.1 Regional Context

According to the National Ecological Framework for Canada (Ecological Stratification Working Group, 1995), the majority of LSA (100%) and RSA (97.5%) fall within the Big Trout Lake Ecoregion (2W) of the Boreal Shield Ecozone. A small portion of the RSA (2.5%) extends approximately 4 km east into the James Bay Ecoregion (2E) of the Hudson Plain Ecozone (see **Figure 11.2**). Landscapes within the Big Trout Lake Ecoregion (2W) are relatively flat, alternating between peatlands in low-lying areas and low ridges of mineral material on well-drained upland sites (Crins et al., 2009). Sparse coniferous and mixed forests cover close to half of the ecoregion, and small pockets of hardwood (deciduous) forest grow in river valleys. Open water and bog complexes are the next most prevalent land cover classes in Ecoregion 2W.

Conversely, the James Bay Ecoregion (2E) is flat and poorly drained, with numerous shallow lakes and ponds interspersed among peatlands (typically fen and bog complexes). Coniferous forest is common on well-drained sites, and both coniferous and mixed forests can occur in sheltered river valleys. Ecoregion 2E is warmer and wetter than 2W to the west and is defined by a transition between Paleozoic and Precambrian bedrock (Wester et al., 2018). Such transitional areas (i.e., ecotones) often contain species from both adjacent regions and may support unique organisms adapted to intermediate conditions. Ecotones support complex interactions between species from different ecosystems, and may serve as corridors for wildlife movement, aiding migration and dispersal.

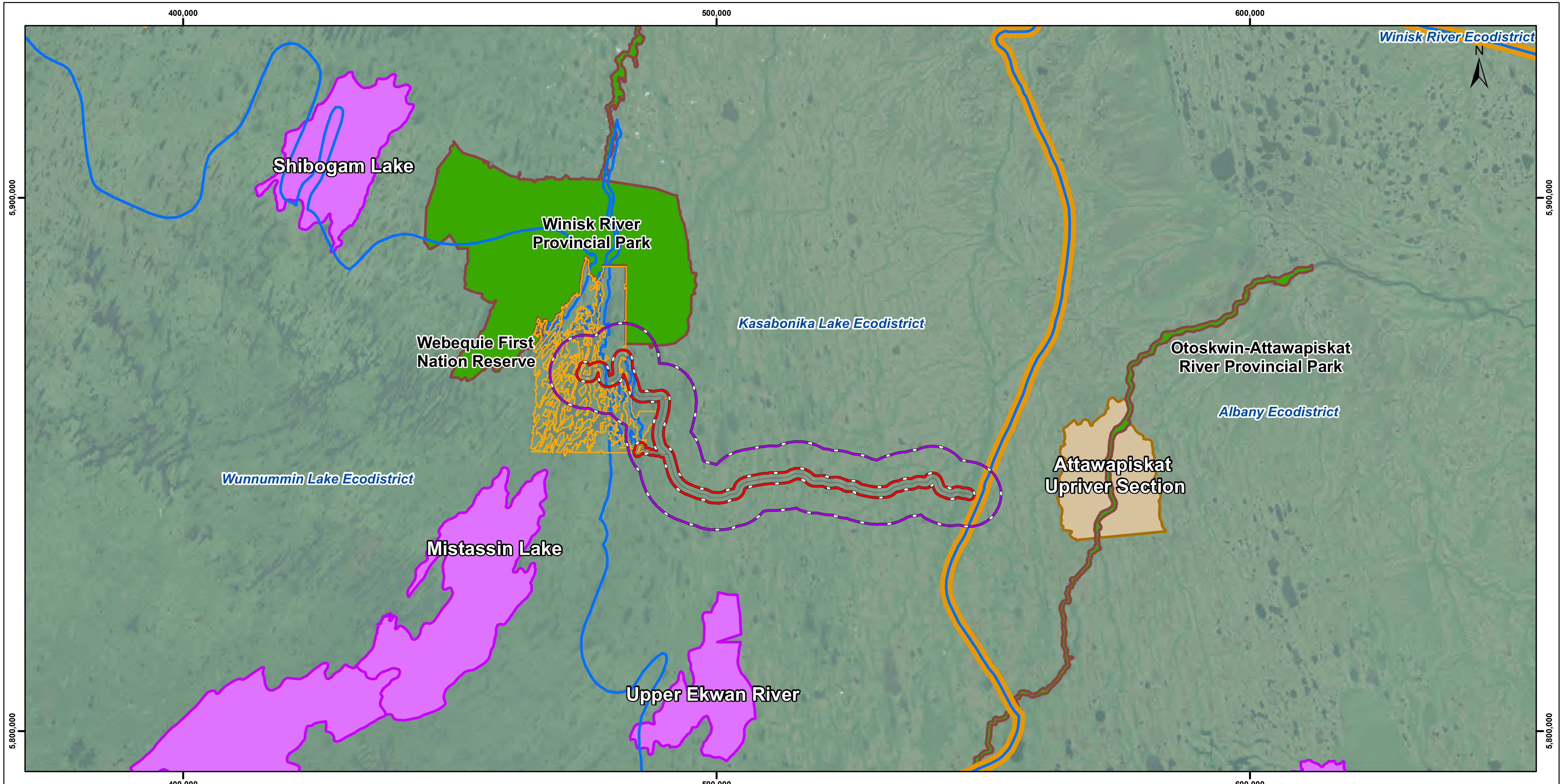
At the Ecodistrict level, the majority of the LSA and RSA (88.9% and 84.5% respectively) are found within the Kasabonika Lake Ecodistrict (2W-2), with portions of the western LSA and RSA (11.1% and 13% respectively) found within the Wunnummin Lake Ecodistrict (2W-3), and part of eastern RSA (2.5%) within the Albany Ecodistrict (2E-1). More specifically, a 94.3 km section of the WSR passes through the northeastern portion of Ecodistrict 2W-2, which is dominated by wetlands (primarily bog and fen complexes) (Wester et al., 2018). The relative landcover percentages for Ecodistrict 2W-2 are bog complex (40%), sparse forest (20%), coniferous forest (19%), fen complex (10%), other natural (6%), and burn (5%). A 12.2 km section of the WSR ROW extends into the western portion of Ecodistrict 2W-3 at Winisk Lake. Landcover within the northern half of this ecodistrict is dominated by sparse forests, while coniferous forests are most prevalent in the south. The relative landcover percentages for Ecodistrict 2W-3 are sparse forest (26%), coniferous forest (25%), mixed forest (12%), bog complex (12%), burn (11%), regenerating depletion (7%), fen complex (5%), and other natural (2%). The easternmost portion of the RSA (excluding the WSR road) extends approximately 4 km into Ecodistrict 2E-1. This ecodistrict is characterized by flat topography and poor drainage, resulting in a landscape dominated by wetlands (primarily bog and fen complexes). The relative landcover percentages for Ecodistrict 2E-1 are bog complex (46%), fen complex (36%), coniferous forest (7%), sparse forest (6%), and other natural (5%).

Multiple provincially designated sensitive areas were identified during the background information review, including provincial and federal parks, Areas of Natural and Scientific Interest (ANSI), and Provincially Significant Wetlands. A total of six provincially designated areas are located within 30 km of the proposed WSR (**Figure 11.2**; **Table 11-7**). Of these, only the Winisk River Provincial Park is within the RSA. This provincial park is located approximately 2.3 km from the WSR and borders the Webequie First Nation Reserve lands. No federally designated sensitive areas or national parks occur within 30 km of the WSR.

Table 11-7: Designated Sensitive Areas within 30 km of the Webequie Supply Road

Designation	Natural Heritage Feature	Within RSA	Within 30 km of the Webequie Supply Road
Provincial Parks	Winisk River Provincial Park	X	X
	Otoskwin-Attawapiskat River Provincial Park		X
Area of Natural and Scientific Interest (ANSI)	Shibogam Lake Earth Science Candidate ANSI		X
	Mistassin Lake Earth Science Candidate ANSI		X
	Upper Ekwan River Candidate Earth Science ANSI		X
	Attawapiskat Upriver Section Candidate Life Science ANSI		X

Note: No designated sensitive areas fall within the LSA



Legend:

- Project Footprint (Preferred Route, Camps, Aggregate Source Areas and Access Road)
- Local Study Area ((LSA 1km from Centreline of Preferred Route and 500m from Supportive Infrastructure Facilities)
- Regional Study Area (RSA 5km from either side of LSA Boundaries)
- Webequie First Nation Reserve
- Provincial Park
- Ecodistrict
- Candidate ANSI, Earth Science
- Candidate ANSI, Life Science

WSR
WEBEQUIE
SUPPLY ROAD

NOTES

1. Coordinate System: NAD 1983 UTM Zone 16N.
2. Cadastral boundaries are for informational purposes only and should not be considered suitable for legal, engineering, or surveying purposes.
3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Sciences Sector Centre for Topographic Information; and, Land Information Ontario (LIO) Warehouse Open Data (https://geohub.lio.gov.on.ca/), Ontario Ministry of Natural Resources and Forestry (OMNRF) Download Date : 2021-02-04

0 25 50 Km

Webequie Supply Road (WSR)

Project Area EcoRegion, EcoDistricts, and Designated Sensitivities

Figure Number: 11-2			REV: PA		
Client: Webequie First Nation	Project Number: 661910	Date: 5/14/2025			
DSC			DRN	CHK	APP
			AD	JH	JH

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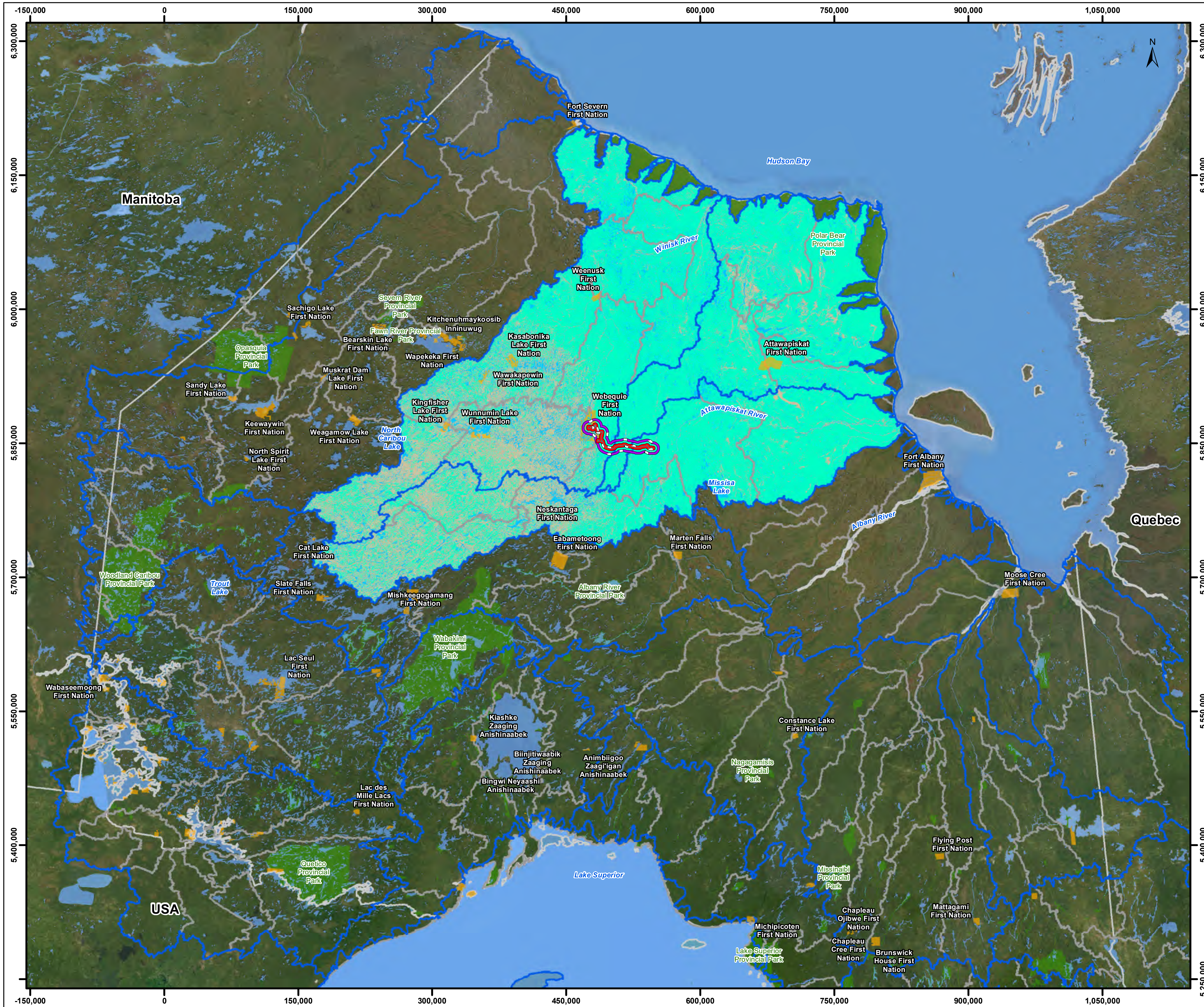
Regional Hydrological functions

The Hudson's Bay-James Bay Lowlands were previously covered by glaciers, compressing the landmass, which was then flooded with their retreat forming the Tyrell Seas 7,000-8,000 years ago. The landmass has been rising through isostatic rebound at approximately 1 m every 100 years. The retreat of the Tyrell Sea due to this rebound left behind a layer of marine silty clay which forms the uppermost horizon of mineral soil throughout the region. As a result of the retreating ice sheet, all waterbodies flow into the James Bay coastline creating variation in otherwise flat landscape. The region is dominated by muskeg (bog/fen) terrain, except near rivers, major creeks, beach ridge complexes and scattered glaciofluvial features. Bog and fen areas contain organic soils that overlay the marine silty clay layer. Fen areas exhibit a low profile and are typically highly saturated, often with a pronounced, directional seepage, deriving their water supply from sources in contact with mineral soil. Bog areas are slightly raised compared with fens, and therefore slightly drier, receiving most of their water supply from rain (Hanson et al, 2008).

Regional Wetland Composition (Watersheds)

The Hudson Bay lowlands are situated within the primary Southwestern Hudson Bay watershed and comprises 53% of the watershed. The remainder of the Southwestern Hudson Bay watershed is occupied by the Severn and Abitibi Uplands. Sixteen (16) secondary watersheds are found within the Southwestern Hudson Bay watershed, and the Project Areas intersects with three (3) of these. These include the Attawapiskat River – Coast, Ekwan River – Coast, and Winisk River – Coast secondary watersheds. Four (4) tertiary watersheds intersecting the RSA area are found within these secondary watersheds. These include the: Missisa River – Lower Attawapiskat River, Upper Ekwan River, Middle Winisk River, and Upper Winisk River watersheds. **Figure 11.3** shows the location and extent of the watersheds and **Table 11-8** and **Table 11-9** describe the relative percentages of each watershed occupied by the RSA and the percentage of wetland, upland, and open water within the LSA and RSA within each watershed.



Legend

- Project Footprint (Preferred Route, Camps, Aggregate Source Areas and Access Road)
- Local Study Area ((LSA 1km from Centreline of Preferred Route and 500m from Supportive Infrastructure Facilities)
- Regional Study Area (RSA 5km from either side of LSA Boundaries)
- First Nation Reserve
- Provincial Park
- Waterbody
- Provincial Boundaries
- Secondary Watershed
- Tertiary Watershed

Land Cover Type within Secondary Watersheds Intersecting Alternatives

- Wetland
- Open Water
- Other

Webequie Supply Road (WSR)

Secondary and Tertiary Watersheds

Figure Number: 11-3			REV PA		
Client: Webequie First Nation	Project Number: 661910		Date: 4/17/2025		
DSC			DRN	CHK	APP
			AD	JH	JH

0 125 250 500 Km

SCALE: 1:4,210,000

WSR WEBEQUIE SUPPLY ROAD

NOTES

1. Coordinate System: NAD 1983 UTM Zone 16N.
2. Cadastral boundaries are for informational purposes only and should not be considered suitable for legal, engineering, or surveying purposes.
3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Sciences Sector Centre for Topographic Information; and, Land Information Ontario (LIO) Warehouse Open Data (https://geohub.lio.gov.on.ca/), Ontario Ministry of Natural Resources and Forestry (OMNRF) Download Date : 2021-02-04

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Table 11-8: Watershed Hierarchy and Relative Percentage of Wetland Based on Far North Land Cover

Watershed Name	Area (ha)	Approx.% of Wetland (Based on LIO Wetland and Far North Land Cover	Area of RSA within Watershed (ha)	% of Watershed Within RSA
Primary Watershed				
Southwestern Hudson Bay	58,911,628.07	56% (Note: Hudson's-James Bay Lowlands portion is estimated to be 81% wetland)	133,921.56	0.23%
Secondary Watershed				
Attawapiskat River – Coast	5,703,510.80	64%	38,631.30	0.68%
Ekwan River – Coast	4,454,848.24	80%	25,773.30	0.58%
Winisk River – Coast	7,642,404.57	54%	69,384.87	0.91%
Tertiary Watersheds				
Missisa River – Lower Attawapiskat River (Attawapiskat River – Coast)	1,251,421.32	83%	38,631.30	3.09%
Upper Ekwan River (Ekwan River – Coast)	1,413,296.65	80%	25,773.30	1.82%
Middle Winisk River (Winisk River – Coast)	1,096,889.87	69%	48,698.23	4.44%
Upper Winisk River (Winisk River – Coast)	1,218,302.93	17%	20,685.94	1.70%

Note: Percentage calculations are based on Baseline data collection study area boundaries which include all alternatives.

When viewed as the percentage of wetland, upland, or open water in the area that the Project occupies within the watershed, it becomes apparent that wetlands are the dominant vegetation classification affecting the hydraulic processes within the study areas. **Table 11-9** shows percentage of wetland, upland, and open water within the portion that the LSA and RSA represents within the watershed.

Table 11-9: Percentage of Wetland, Upland, And Open Water Within the LSA and RSA

Watershed Name	Area of RSA Within Watershed (ha)	% of Wetland in Watershed (Far North LC)	% of Water-shed in RSA (ha)	% of Wetland in RSA	% of Upland in RSA	% of Open Water in RSA	% of Wetland in LSA	% of Upland in LSA	% of Open Water in LSA
Missisa River – Lower Attawapiskat River (Tertiary Watershed)									
Goods Lake	13,264.36	81%	21.10%	91.93%	6.29%	2.87%	92.70%	5.11%	2.19%
Greig Lake – Muketei River	19,714.19	90%	32.83%	93.38%	4.44%	2.16%	88.76%	8.75%	2.49%
Langfeld Lake	5,591.13	83%	9.62%	74.68%	22.19%	3.12%	64.14%	30.97%	4.89%
Kitchie Lake	61.62	87%	0.07%	87.94%	7.85%	3.78%	N/A	N/A	N/A
Upper Ekwan River (Tertiary Watershed)									
Byrne Lake – Ekwan River	12,824.87	87%	18.12%	95.88%	0.46%	3.64%	98.25%	0.02%	1.73%
Jasper Lake	3,058.29	82%	8.68%	95.75%	0.05%	4.18%	95.93%	0.00%	4.07%
Leaver Lake – Ekwan River	9,890.14	90%	10.96%	95.29%	0.62%	4.08%	95.28%	2.49%	2.23%
Middle Winisk River (Tertiary Watershed)									
Lastcedar Lake	1,038.83	86%	2.11%	76.79%	9.24%	13.97%	N/A	N/A	N/A
Farrow Lake	1,225.17	39%	1.95%	65.30%	31.55%	13.11%	N/A	N/A	N/A
Plant Lake – Winiskisis Channel	25,919.99	84%	46.55%	79.92%	7.90%	12.17%	83.16%	4.99%	11.85%
Prime Lake	11,655.25	89%	19.96%	94.79%	N/A	5.21%	96.84%	N/A	3.16%
Pulham Lake	7,355.08	66%	14.02%	95.05%	1.65%	3.29%	98.24%	0.02%	1.74%
Tashka Rapids – Winisk River	1,504.59	49%	4.06%	67.20%	11.52%	21.28%	73.49%	0.00%	26.51%
Upper Winisk River (Tertiary Watershed)									
Winisk Lake-River	20,685.94	19%	18.73%	31.73%	18.96%	49.28%	41.78%	23.90%	34.32%

Notes: 1) Percentage calculations are based on Baseline data collection study area boundaries which include all alternatives. 2) N/A indicates that the watershed does not intersect with the LSA.

11.2.2.2 Vegetation and Wetland Communities Mapping

11.2.2.2.1 Field Survey Results

In total, 101 sites were sampled on the ground and 20 from the air as part of the 2019, 2020 and 2021 programs (See **Figure 11.4**, **Figure 11.5** and **Figure 11.6**), representing 30 different ecosites (refer to Appendix 9-A, Field Data Sheets, of the Natural Environment Existing Conditions Report - Appendix F). The majority (81%) of the sites were wetland ecosites, while the remaining sites (19%) were categorized as upland forest ecosites. These were further categorized into Conifer and Hardwood ecosite types for the upland forest sites and treed or open sites for the wetlands. A detailed list of species identified as part of the 2019, 2020, and 2021 field surveys is presented in Appendix 9-B, Vegetation Species List, of the Natural Environment Existing Conditions Report (Appendix F).

Nine non-native species were identified during the field programs including: Dwarf Snapdragon (*Chaenorhinum minus*), Oxeye Daisy (*Leucanthemum vulgare*), White Sweet-clover (*Meliotus alba*), Common Sow-thistle (*Sonchus oleraceus*), Common Dandelion (*Taraxacum officinale*), Red Clover (*Trifolium pratense*), White Clover (*Trifolium repens*), Tufted Vetch (*Vicia cracca*), and Pineapple weed (*Matricaria discoidea*). These species were not noted in any sampled plots, and their distribution was restricted to areas within the community of Webequie where there is on-going human activity such as airports, roads, and drainage ditches.

11.2.2.2.2 Vegetation Classification

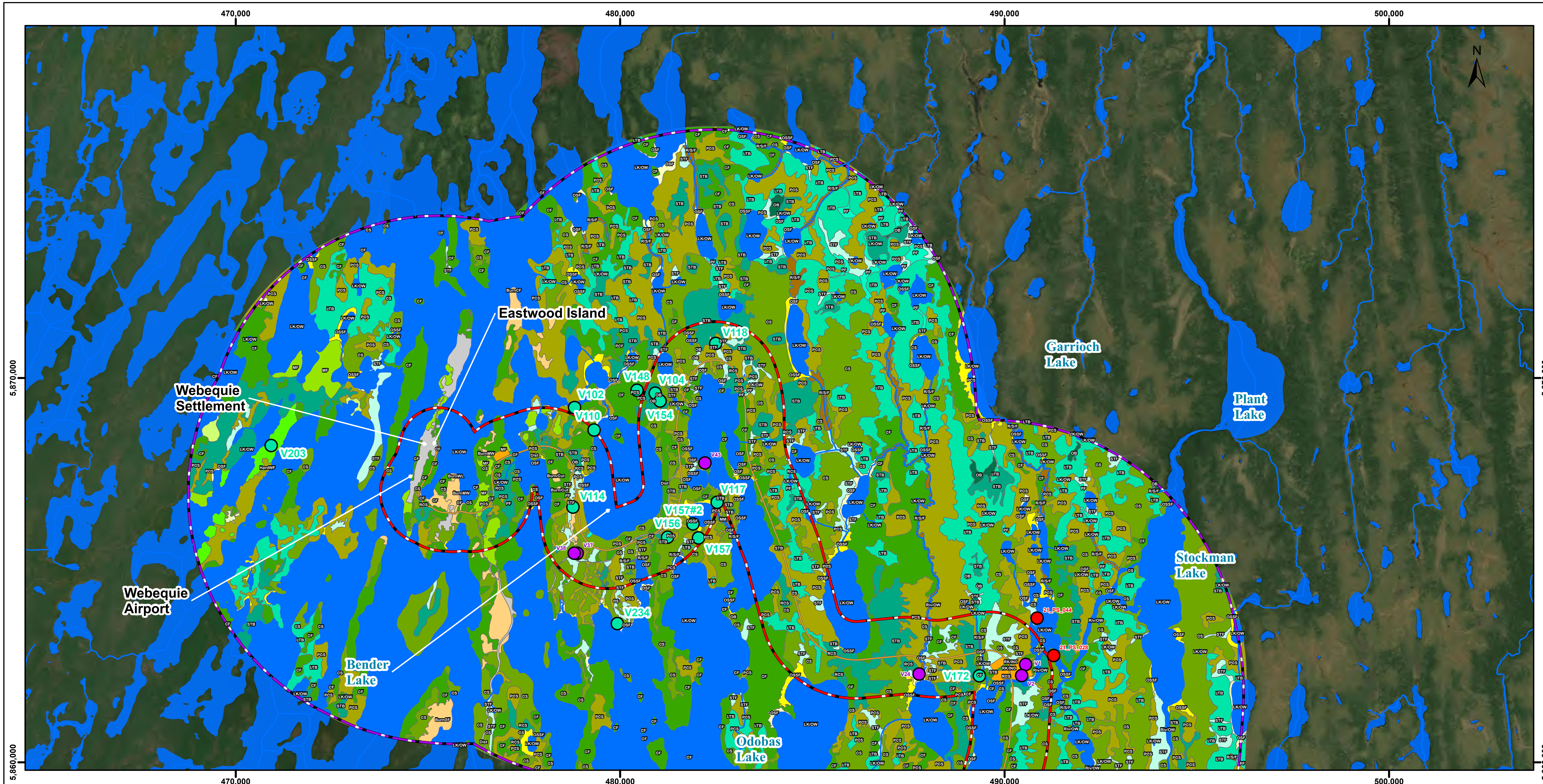
The following subsections describe the mapped classes derived from the field sampling program and mapping process outlined in Sections 9.2 and 9.3 of the Natural Environment Existing Conditions Report (Appendix F) and **Section 11.2.1.3** (Vegetation and Wetland Communities Mapping). The vegetation classes are divided into upland ecosystems, wetland ecosystems and riparian ecosystems for organizational purposes. Of the 5,749 vegetation units mapped within the LSA and RSA, 4,666 are considered wetland ecosystems (see **Figure 11.4**, **Figure 11.5** and **Figure 11.6**). More detailed mapping is contained in Appendix 9-D of the NEEC Report (Appendix F). As shown in **Table 11-10**, wetland ecosystems account for 81.78% and 80.29% of all mapped classifications within the LSA and RSA, respectively. Uplands occupy 8.11% of the LSA and 7.25% of the RSA, and open water accounts for 10.11% of the LSA and 12.46% of the RSA. Riparian areas make up a very small percentage of both the LSA and RSA at 0.07% each.

Table 11-10: Percentage of Upland/Wetland Ecosystems in the LSA and RSA

Mapped Vegetation Type	Local Study Area (LSA)		Regional Study Area (RSA)	
	Area (ha)	% LSA	Area (ha)	% RSA *
Total uplands	2,260.35	8.11%	9,704.71	7.25%
Total wetlands	22,617.16	81.78%	107,527.31	80.29%
Total riparian**	1928.90	0.07%	9530.50	0.07%
Total open water	2,794.02	10.11%	16,671.73	12.46%

***Note**: Area calculations and percentages are calculated using baseline data collection study areas.

****Note:** Area values for riparian habitat represent a double counting since they encompass portions of both upland and wetland environments adjacent to watercourses and waterbodies. (% = percent; ha = hectare)



Legend

- 2021 Sampling
- 2020 Sampling
- 2019 Sampling
- Watercourse
- Project Footprint (Preferred Route, Camps, Aggregate Source Areas and Access Road)
- Local Study Area ((LSA 1km from Centreline of Preferred Route) and 500m from Supportive Infrastructure Facilities)
- Regional Study Area (RSA 5km from either side of LSA Boundaries)
- Waterbody

Vegetation

ELC Class

- CF, Conifer Forest
- PCF, Poor Conifer Forest
- MF, Mixed Forest
- HardWF, Hardwood Forest
- RCS, Organic Rich Conifer Swamp
- CS, Conifer Swamp
- PCS, Poor Conifer Swamp
- MS, Mixedwood Swamp
- TS, Thicket Swamp
- STS, Shore Thicket Swamp
- OSF, Open Shore Fen
- OSF/TS, Open Shore Fen/Thicket Swamp
- OSSF, Open Shore Shrub Fen
- MM, Meadow Marsh
- OWM, Open Water Marsh
- R/M, River/Floating Marsh
- R/S/F, River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)
- STF, Sparse Treed Fen
- OMF, Open Moderately Rich Fen
- PF, Organic Poor Fen
- LTB, Low Treed Bog
- STB, Sparse Treed Bog
- OB, Open Bog
- RK/INC, Rock Inclusion
- BurnCF, Burn-Conifer Forest
- BurnMW, Burn-Cut-Mixedwood
- BurnCS, Burn Conifer Swamp
- Burn/Shrub, Burn/Shrubland
- Burn/Cut, Burn-Cut
- BurnWL, Burn Low/Sparse Treed Bog/Fen
- Dist, Developed/Disturbed
- LK/OW, Lake/Open Water
- Riv/OW, River/Open Water
- Waterbody_50K

WSR WEBEQUIE SUPPLY ROAD

NOTES

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3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Sciences Sector Centre for Topographic Information; and, Land Information Ontario (LIO) Warehouse Open Data (https://geohub.lio.gov.on.ca/), Ontario Ministry of Natural Resources and Forestry (OMNRF) Download Date : 2021-02-04

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Webequie Supply Road (WSR)

2019, 2020, and 2021 Vegetation Classification and Survey Locations

Figure Number: 11-4		REV: PA
Client: Webequie First Nation	Project Number: 661910	Date: 4/16/2025

DSC	DRN	CHK	APP
	AD	JH	JH

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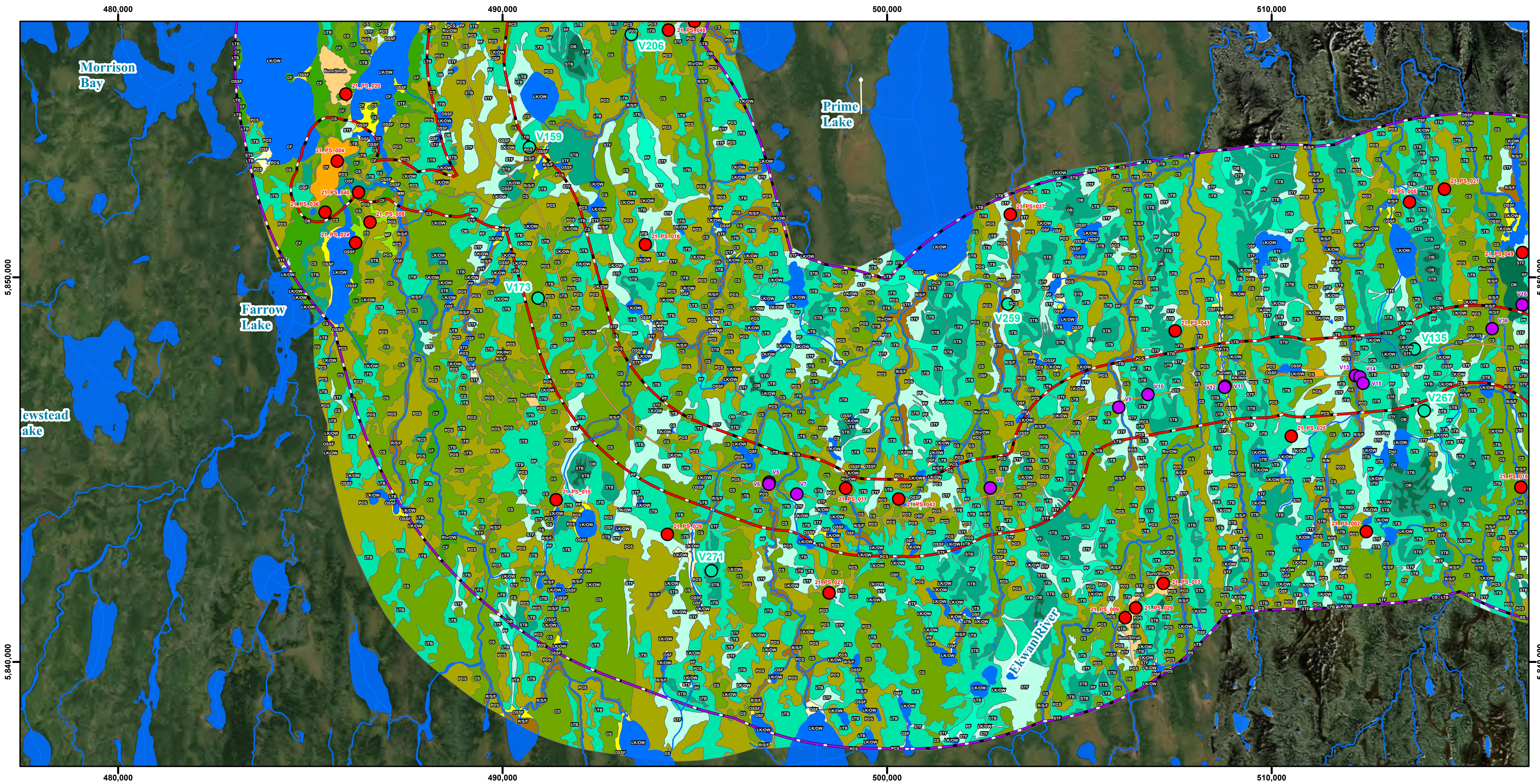

Legend

- 2021 Sampling
- 2020 Sampling
- 2019 Sampling
- Watercourse
- Project Footprint (Preferred Route, Camps, Aggregate Source Areas and Access Road)
- Local Study Area ((LSA 1km from Centreline of Preferred Route) and 500m from Supportive Infrastructure Facilities)
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- OSSF, Open Shore Shrub Fen
- MM, Meadow Marsh
- OWM, Open Water Marsh
- R/M, River/Floating Marsh
- R/S/F, River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)
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- BurnCS, Burn Conifer Swamp
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- BurnWL, Burn Low/Sparse Treed Bog/Fen
- Dist, Developed/Disturbed
- LK/OW, Lake/Open Water
- Riv/OW, River/Open Water
- Waterbody_50K

WSR
WEBEQUIE
SUPPLY ROAD

3.5 1.75 0 Km

Webequie Supply Road (WSR)

2019, 2020, and 2021
Vegetation Classification and Survey Locations

NOTES

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Figure Number: 11-5		REV: PA	
Client: Webequie First Nation	Project Number: 661910	Date: 4/17/2025	
DSC	DRN	CHK	APP
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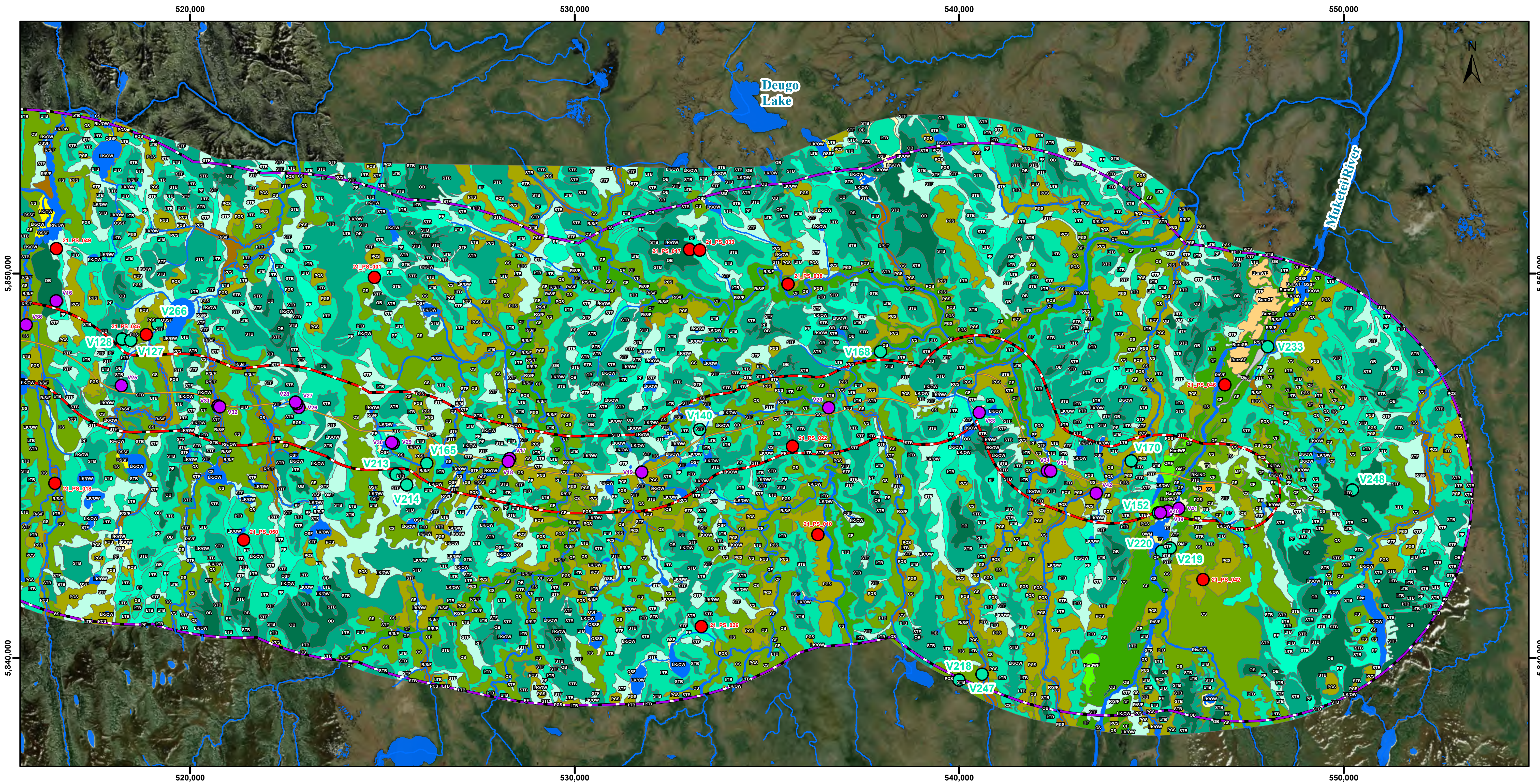

Legend

- 2021 Sampling
- 2020 Sampling
- 2019 Sampling
- Watercourse
- Project Footprint (Preferred Route, Camps, Aggregate Source Areas and Access Road)
- Local Study Area ((LSA 1km from Centreline of Preferred Route) and 500m from Supportive Infrastructure Facilities)
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Vegetation

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- MM, Meadow Marsh
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WSR
WEBEQUIE
SUPPLY ROAD

NOTES

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Webequie Supply Road (WSR)

2019, 2020, and 2021 Vegetation Classification and Survey Locations

Figure Number:	11-6	REV:	PA
Client: Webequie First Nation	Project Number: 661910	Date: 4/17/2025	

DSC	DRN	CHK	APP
	AD	JH	JH

11.2.2.2.3 Upland Ecosystems

Upland ecosystems are relatively rare within the study areas, generally occurring in the western and eastern portions of the study areas (**Figure 11.1**). Twenty-two (22) of the 101 total plots sampled during the baseline vegetation assessment were classified as upland ecosites, which occupy approximately 8.18% of the LSA and 7.25% of the RSA (See **Table 11-11** below). These sites generally occur at the western and eastern terminuses of the WSR, near the community of Webequie and the Wyloo Pty Ltd.'s Exploration Camp, or along major river systems. The upland ecosystem sites to the west are primarily found on till and glacial lake clay mineral soils. In contrast, the central and eastern portions of the study areas were dominated by alluvial floodplain mineral soils. Only one soil core sampled near the eastern terminus of the proposed WSR was of glacial origin.

Table 11-11: Upland Ecosystems Availability in the LSA and RSA Areas

Uplands				
Upland Class	Local Study Area (LSA)		Regional Study Area (RSA)	
	Area (ha)	% LSA	Area (ha)	% RSA
Burned/Cut	77.87	0.28%	554.08	0.41%
Conifer Forest	1,888.98	6.83%	8,405.38	6.27%
Poor Conifer Forest	1.56	0.01%	10.82	0.01%
Hardwood Forest	51.22	0.19%	188.61	0.14%
Developed/Disturbed	104.90	0.38%	207.43	0.15%
Rock Barren	9.07	0.03%	13.40	0.01%
Mixedwood Forest	126.75	0.46%	343.99	0.26%
Total Uplands	**2,240.35**	**8.18%**	**9,704.71**	**7.25%**

Note: Area calculations and percentages are calculated using Baseline data collection Study Areas.

Four different upland ecosite categories were identified from the field surveys: conifer forest, hardwood forest, open rock, and shrub (**Table 11-12**). Conifer forest was the most commonly occurring category, representing 13 of the 22 upland plots and 12.75% of all plots sampled. A total of seven different upland ecosites were identified.

Table 11-12: Summary of 2019-2021 Field Program Upland Ecosite Sampling Plots

Category	# of Plots	Plot No.	Boreal Ecosite Code	Boreal Ecosite Descriptions	% of Total Plots
Conifer Forest	13	V39	B035	Dry, Sandy: Pine – Black Spruce Conifer	12.75%
		V117, V233	B049	Dry to Fresh, Coarse: Jack Pine – Black Spruce Dominated	
		V22	B052	Dry, Sandy: Spruce – Fir Conifer	
		PS-036, PS-046	B065	Moist, Coarse: Pine – Black Spruce Conifer	

Category	# of Plots	Plot No.	Boreal Ecosite Code	Boreal Ecosite Descriptions	% of Total Plots
		PS-024, PS-040	B098	Fresh, Silty to Fine Loamy: Black Spruce – Jack Pine Dominated	
		V2, V148, V168, V172	B099	Fresh, Silty to Fine Loamy: Pine – Black Spruce Conifer	
		V20	B116	Moist, Fine: Spruce – Fir Conifer	
Hardwood Forest	4	V152	B040	Dry, Sandy: Aspen – Birch Hardwood	3.92%
		V21	B055	Dry, Coarse: Aspen – Birch Hardwood	
		V40	B104	Fresh, Silty to Fine Loamy: Aspen – Birch Hardwood	
		V203	B119	Moist, Fine: Aspen – Birch Hardwood	
Shrub (Burned / Cut)	2	V114	B080	Fresh, Clayey: Shrub	1.96%
		PS-029	B096	Fresh, Silty to Fine Loamy: Shrub	
Open Rock	3	V1, V42, V220	B164	Rock Barren	2.94%

11.2.2.2.4 Wetland Ecosystems

Wetland ecosystems are abundant within the study areas, which is primarily comprised of a vast matrix of interconnected wetlands and waterbodies. The majority of wetland types are peatlands/muskeg such as bogs and fens, along with thicket swamps and treed swamps. Wetlands occurring on mineral substrates are rarer within the study area and are concentrated along the edges of lakes, streams and rivers. Seventy-nine of the 101 total ground plots sampled during the baseline vegetation assessment were classified as wetland ecosites which occupy 81.78% of the LSA and 80.29% of the RSA (**Table 11-9**).

Three broad wetland categories were identified from the field survey: swamps, treed bogs or fens and open wetlands (**Table 11-13**). Swamps were the most abundant category sampled representing 32 of 79 wetland plots and 31.68% of all plots sampled. A total of nineteen different wetland ecosites were identified.

Table 11-13: Wetland Type and Abundance Within LSA and RSA

Wetlands				
Wetland Type	Local Study Area (LSA)		Regional Study Area (RSA)	
	Area (ha)	% LSA	Area (ha)	% RSA
SWAMPS				
Burn-Conifer Swamp	0.00	0.00%	4.79	0.00%
Poor Conifer Swamp	4,004.18	14.49%	19,891.17	14.85%
Conifer Swamp	5,728.880	20.73%	23,605.92	17.64%
Intermediate Swamps	0.00	0.00%	503.52	0.37%

Wetlands				
Wetland Type	Local Study Area (LSA)		Regional Study Area (RSA)	
	Area (ha)	% LSA	Area (ha)	% RSA
Rich Swamps	201.72	0.73%	317.21	0.24%
Total Swamps	**9,934.77**	**35.95%**	**43,833.17**	**33.10%**
TREED BOGS and FENS				
Burn Low/Sparse Treed Bog/Fen	16.63	0.02%	16.63	0.01%
Low-Treed Bog	5,390.99	19.51%	27,524.56	20.55%
Sparse Treed Bog	2,859.05	10.35%	14,720.22	10.99%
Sparse Treed Fen	2,812.14	10.18%	10,594.52	7.91%
Organic Poor Fen	558.25	2.02%	3735.79	2.79%
Total Bogs/Fens	**11,637.06**	**42.11**	**56,591.71**	**42.26%**
OPEN WETLANDS				
Open Bogs	158.37	0.57%	2,691.27	2.01%
Open Fens	110.45	0.40%	575.10	0.43%
Open Shrub shore Fen	185.70	0.67%	826.41	0.62%
Open Water Marsh	4.44	0.02%	4.61	0.00%
River/Floating Marsh	4.76	0.02%	7.55	0.01%
Meadow Marsh	0.00	0.00%	0.97	0.00%
River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)	534.20	1.93%	2,935.65	2.19%
Shore Thicket Swamp	0.00	0.00%	25.16	0.02%
Thicket Swamp	47.75	0.17%	55.72	0.04%
Total Open Wetlands	**1,045.68**	**3.78%**	**7,122.43**	**5.32%**

Note: Area calculations and percentages are calculated using baseline data collection study areas.

11.2.2.2.5 Riparian Ecosystems

Riparian areas were comprised of a total of seventeen different ecosites. As discussed in **Section 11.2.1.3.1** (Riparian Areas) these riparian ecosystems were challenging to accurately map based solely on ELC vegetation class. Riparian areas made up a very small percentage of the overall study areas, with an estimated 0.07% coverage of both the LSA and the RSA.

Table 11-14 shows the riparian estimates that include both the visually delineated and buffer estimated areas, whichever was larger. It is important to note that area values for riparian habitat represent a double counting since they encompass portions of both upland and wetland environments adjacent to watercourses and waterbodies.

Table 11-14: Riparian Areas in LSA and RSA by Vegetation Class

Vegetation Classes Within Estimated Riparian Areas	Estimated Riparian Areas within LSA (ha)	% of LSA	Estimated Riparian Areas within RSA	% of RSA
Burn/Cut	8.56	0.03%	29.05	0.02%
Conifer Forest	202.17	0.73%	821.00	0.61%
Conifer Swamp	303.44	1.10%	1050.76	0.78%
Developed/Disturbed	4.37	0.02%	18.27	0.01%
Hardwood Forest	3.35	0.01%	24.02	0.02%
Hardwood Swamp	0.55	0.002%	0.00	0.00%
Low Treed Bog	99.66	0.36%	460.74	0.34%
Lake Riparian (Mapped)	300.59	1.09%	1131.65	0.85%
Mixedwood Forest	15.41	0.06%	29.66	0.02%
Open Bog	8.28	0.03%	35.35	0.03%
Organic Poor Fen	51.57	0.19%	157.45	0.12%
Poor Conifer Swamp	143.35	0.52%	694.96	0.52%
River Riparian (Mapped)	551.92	2.00%	2405.97	1.80%
Rock Barren	0.31	0.001%	0.06	0.00005%
Sparse Treed Bog	65.08	0.24%	210.04	0.16%
Sparse Treed Fen	170.28	0.62%	532.65	0.40%
Total	**1928.88**	**6.98%**	**7601.63**	**5.68%**

*__Note:__ River and Lake riparian values are based on mapped areas. All others are based on buffered estimates.

**__Note:__ Not all vegetation classes listed in Tables 11-11 and 11-13 are found within 30 m of a watercourse or 40 m of a lake.

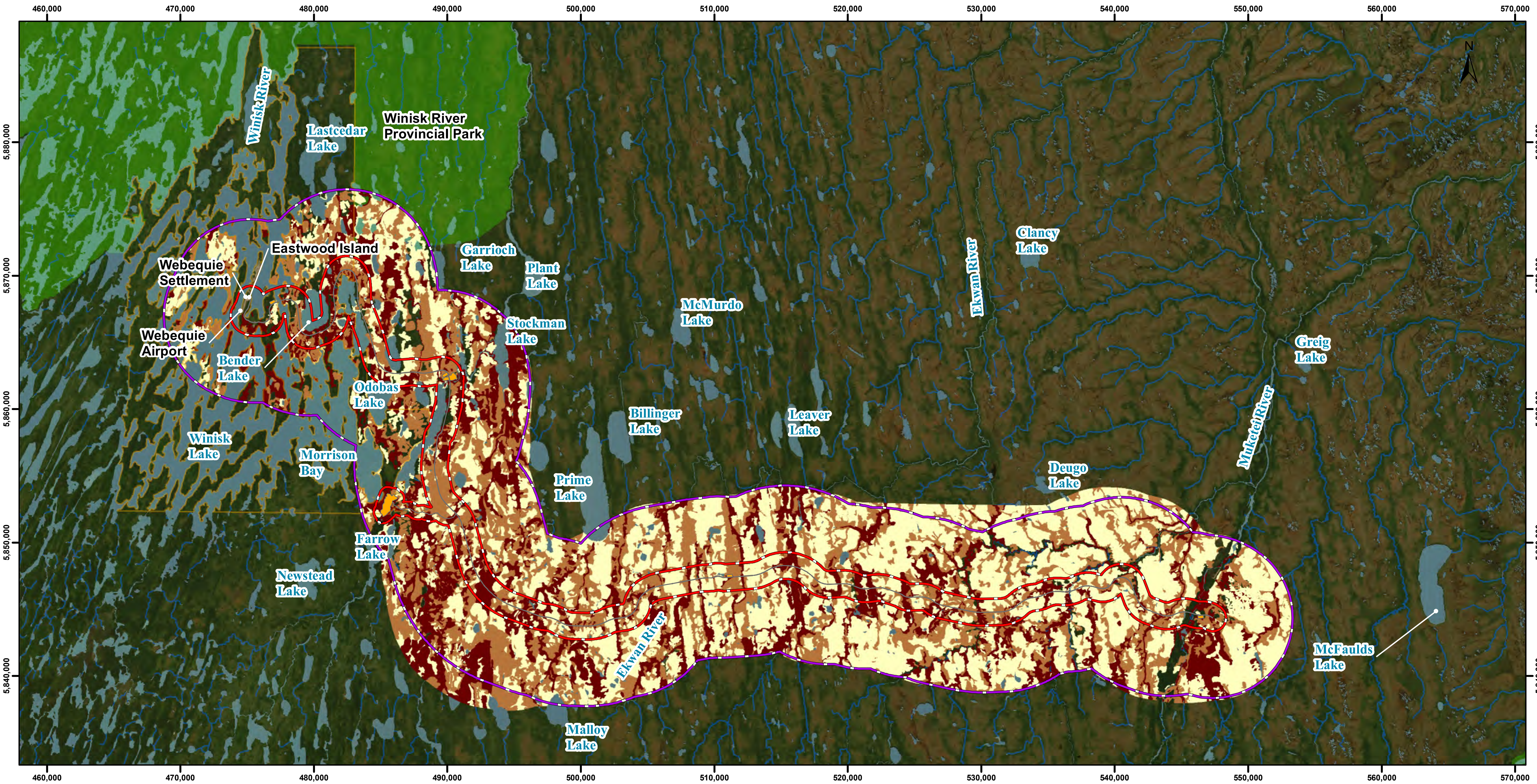
11.2.2.3 Species and Community Biodiversity/Fragmentation

Since the study areas for the Project are located in an undisturbed natural area, they generally exhibited high biodiversity. The diversity results based on the data from the 2019 to 2021 surveys are presented in Section 9.5.2, Tables 9.31 and 9.32 of the Natural Environment Existing Conditions Report (Appendix F). The mapped results are shown in **Figure 11.7** illustrated by the gradient in colour. Biodiversity was shown to be higher in forest units (hardwood or conifer) and areas of transition such as rivers, while the lowest results were found in bog or fen classes.

In summary, the highest levels of species richness (# of species) were found in the Conifer Swamp and Sparse Treed Fen ecosite types while the lowest levels were found in Open Bog and Treed Bog ecosite types. Simpson's Index of Diversity was highest in Open Fen and Conifer Swamp ecosite types and lowest in Open Bog and Treed Bog ecosite types. Inverse Simpson's Dominance was highest in Open Fen and Sparse Treed Fen ecosite types and lowest in Open Bog and Treed Bog ecosite types. Generally, the highest modelled average diversity values are found in Open Water Marsh.

Landscape diversity and habitat fragmentation was assessed through analysis of the size, shape, number, and distribution of patches, and core areas (area remaining inside of 50m from patch edge). The landscape-level diversity assessment looked at existing vegetation class metrics in the baseline data collection RSA. The results of this analysis are found in Section 9.5.3 and Table 9.33 of the Natural Environment Existing Conditions (Appendix F). Generally, the most commonly identified patches within the mapping included Low-Treed Bog (955), Poor Conifer Swamp (839), and Conifer Swamp (633). The class area calculations totals follow closely with the number of patches with the highest being Low-Treed Bog, Conifer Swamp and Poor Conifer Swamp. The highest values for mean patch size were found for Conifer Swamp class, with the next two highest being Burn/Shrubland and Low-Treed Bog. The lowest totals for this metric were Meadow Marsh, Rock Barren, and Hardwood Swamp. The highest number of core patches were found in Low-Treed Bog (1987), Poor Conifer Swamp (1555), and Conifer Swamp (1489). The lowest number of core patches were River/Floating Marsh, and Open Water Marsh.

The nearest neighbour analysis concluded that fragmentation by anthropogenic activity is virtually absent from the LSA and RSA, outside of the two noted areas of human activity in Webequie, and habitat is only split by natural succession of vegetation classes or other natural breaks such as lakes or rivers. The results of the nearest neighbour analysis indicate that there is significant clustering across all vegetation classifications within the study area resulting from non-random processes such as topographic, hydrologic, hydrogeologic, soils conditions. The results of this analysis are found in Section 9.5.3.3 of the Natural Environment Existing Conditions Report (Appendix F).



Legend

- Project Footprint (Preferred Route, Camps, Aggregate Source Areas and Access Road)
- Local Study Area ((LSA 1km from Centreline of Preferred Route) and 500m from Supportive Infrastructure Facilities)
- Regional Study Area (RSA 5km from either side of LSA Boundaries)
- Webequie First Nation Reserve
- Winisk River Provincial Park
- Waterbody
- Watercourse

Simpson's Inverse Dominance

- 3.670000 - 4.144000 (Low)
- 4.144001 - 4.549000 (Medium)
- 4.549001 - 5.661000 (High)

WSR WEBEQUIE SUPPLY ROAD

NOTES

1. Coordinate System: NAD 1983 UTM Zone 16N.
2. Cadastral boundaries are for informational purposes only and should not be considered suitable for legal, engineering, or surveying purposes.
3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Sciences Sector Centre for Topographic Information; and, Land Information Ontario (LIO) Warehouse Open Data (https://geohub.lio.gov.on.ca/), Ontario Ministry of Natural Resources and Forestry (OMNRF) Download Date : 2021-02-04

DISCLAIMER

0 10 20 Km

Webequie Supply Road (WSR)

Biodiversity Values Across Study Area

Figure Number: 11-7		REV: PA
Client: Webequie First Nation	Project Number: 661910	Date: 4/21/2025

DSC	DRN	CHK	APP
	AD	JH	JH

SIZE 11x17

Document Path: \\tor01\PROJECTS\E&W\Projects\661910 - Webequie First Nation Supply Rd\40_Execution\45_GIS_Dwgs\MXD\EARIS\Vegetation\VegSection11_Figures\661910_WSR_BIO_BL_BiodiversityValues_Fig_11_8.mxd

11.2.2.4 Plant Species at Risk and Plant Species and Communities of Conservation Concern

Plant Species

Field surveys conducted in 2019, 2020, and 2021 identified 302 plant species. Vascular plants (trees, shrubs, and graminoids) accounted for 273 species and the remaining 29 species were non-vascular plants such as bryophytes and lichens. The full species list for the field surveys in 2019, 2020, and 2021 is presented in Appendix 9-B of the Natural Environment Existing Conditions Report (**Appendix F**).

Based on desktop research, two species of vascular plants and four lichens of conservation concern were identified in the project region and within the range of the study areas but were not observed during field surveys. Other species of conservation concern identified during the desktop review included: McCalla's Willow (Salix maccalliana- S3), near the Webequie community, and Quill Spikerush (Eleocharis nitida – S2), Lathagrium undulatum var. granulosum ((Degel.) M. Schulz & McCune – S4), and Ephebe hispidula ((Ach.) Horw – SU) near the Attawapiskat River, and two species, Chaenothecopsis marcineae (Selva – S4) and Epilichen scabrosus ((Ach.) Clem. ex Hafellner – SU) located near the Muketei River. The area around the Webequie community was not available for surveys for two years during the COVID-19 pandemic and as a result their presence was not able to be confirmed and none of the species identified near the Attawapiskat or Muketei were observed in the field.

No federally or provincial listed plant species at risk (SARA, ESA) were observed within the Project study area from the field surveys conducted, but two Provincially rare (SOCC) mosses were identified during the field surveys: Yellow Moosedung Moss (Splachnum luteum – S1) and Cruet Collar Moss (Splachnum ampellaceum – S3). However, data for these species in the boreal region of Ontario are lacking and their actual abundance could be greater than currently known.

Vegetation Communities

None of the surveyed ecosites are considered provincially rare according to NHIC and no vegetation communities ranked S3 or higher were identified. Based on our field sessions and mapping, locally rare or uncommon communities include Hardwood Forest (14 sites), Mixedwood Forest (21 sites), Meadow Marsh (4 sites), Open Water Marsh (2 sites), Rock Barren (3 sites). These were the only occurrences identified at a mappable scale across the 5,686 mapped features within the LSA and RSA. The combined area of these communities occupies approximately 558 total ha (or 0.42%) of the 133,921.55 ha found within the LSA/RSA. These communities may occur in greater quantities but are difficult to map as they may be complexed with other larger vegetation communities (e.g., Conifer forests or Swamps, and shoreline fen/swamp/bog complexes).

It should be noted that from a global perspective the Ramsar Convention[1] has repeatedly stated that peatlands are one of the most important wetland types on the planet due to their support of biodiversity as well as the regulation of natural processes. These wetland types, and the Hudson's /James Bay Lowlands in particular, have also been singled out for increased consideration by both the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change.

[1] The Ramsar Convention on Wetlands is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. https://www.ramsar.org/

11.2.2.5 Areas and Plants of Traditional Importance to Indigenous Peoples

Given the remote nature of the study areas, and based Indigenous knowledge received, Country Foods Assessment and engagement with Indigenous communities to date, First Nation's use of discrete vegetation communities within the study areas is spatially limited to areas within a reasonable access and proximity to Indigenous communities, and particularly the community of Webequie. The harvesting of plants of traditional importance to Indigenous Peoples for cultural or medicinal use or as a source of country foods are also being assessed part of the Country Food Assessment (Appendix O), Assessment of Effects on Cultural Heritage Resources (Section 20) and Assessment of Effects on Indigenous Peoples and the Exercise of Aboriginal and/or Treaty Rights (Section 19) These assessments have produced some data on location of harvesting areas and plant species specific to the community of Webequie, but data from other communities is limited at this time.

From the engagement and consultation activities with Webequie First Nation members to date, and IKLRU information received, the plants of traditional importance identified for cultural or medicinal use or as a source of country foods include: blueberries (*Vaccinum* sp.), gooseberries (*Ribes* sp.), Northern Sweetflag (*Acorus americanus*), White Cedar (*Thuja occidentalis*), Labrador Tea (*Rhododendron groenlandicum*), and Crowberry (*Empetrum nigrum*). Common Juniper (*Juniperus communis*) was also identified as part of the IKLRU data provided by the community of Webequie. The TISG for the Project also provides a list of species that have known cultural importance to Indigenous Peoples in the region. These include black spruce, white spruce, tamarack, balsam poplar, cedar, dwarf birch, red willow, trembling aspen, cottongrass, moss, black crowberry, blueberries, raspberries, reindeer moss, sphagnum moss, northern Labrador tea, caribou lichen, bearberry, dogwood, small cranberry, sage, sweetgrass, and lily pads. **Table 11-15** below provides a list of the species identified and the vegetation classes in which they were observed during the vegetation field sampling program. Note that this list is derived from vegetation classes that were sampled during the field program, based on the random sampling requirements outlined in the TISG, and therefore some classifications (e.g., Burned/Cut, Mixedwood Forest, Mixed Swamp, Meadow Marsh, Thicket Swamp) are not represented.

Table 11-15: Plants of Traditional Importance and associated Habitat Types

Scientific Name	Common Name	Conifer Forest	Conifer Swamp	Hard-wood Forest	Developed / Disturbed	Treed Bog	Treed Fen	Open Bog	Fen	Rock Barren	Other (River / Lake Eco-types)
Anthoxanthum sp.	Sweetgrass										
Arctostaphylos uva-ursi	Bearberry	X		X							
Artemisia ludoviciana	Sage										
Betula pumila	Dwarf Birch	X	X	X		X	X	X	X		X
Cladonia rangifera	Reindeer Lichen	X	X	X	X	X	X	X	X	X	
Cladonia stellaris	Star-Tipped Cup Lichen	X	X	X		X	X	X		X	
Cornus sericea	Red-Osier Dogwood	X	X	X							
Cornus sp.	Dogwoods	X	X	X	X		X				X
Empetrum nigrum	Black Crowberry	X	X	X		X				X	
Eriophorum (sp)	Cottongrass		X			X	X	X	X		X
Juniperus communis	Common Juniper	X	X	X	X			X			
Larix laricina	Tamarack	X	X			X	X	X	X	X	X
Moss (sp)	Moss	X	X	X	X	X	X	X	X	X	X
Nymphaea odorata / Nuphar variegata	Lily pads		X								X
Picea glauca	White Spruce	X			X						
Picea mariana	Black Spruce	X	X	X	X	X	X	X	X	X	X
Populus balsamifera	Balsam Poplar	X	X	X							
Populus tremuloides	Trembling Aspen	X		X						X	
Rhododendron groenlandicum	Labrador tea	X	X	X	X	X	X	X	X	X	X
Rubus sp.	Raspberries	X	X	X	X	X	X	X	X		X
Sphagnum sp.	Sphagnum Moss	X	X		X	X	X	X	X	X	X
Thuja occidentalis	White Cedar			X							
Vaccinium angustifolium / myrtilloides	Blueberry	X	X	X		X		X		X	X
Vaccinium oxycoccos	Small Cranberry	X	X			X	X	X	X		X

11.2.2.6 Wetland Function Assessment Results

From the mapping and baseline characterization of vegetation within the LSA and RSA the results indicate that, of the 5,685 discreet vegetation patches mapped, 4,591 of the vegetation units are considered wetland, comprising 80.76% of the total classifications. From a spatial perspective, these wetland areas comprise 80.29% of the total area encompassed by the vegetation characterization in the RSA.

Given the values indicating the dominant role wetlands play in the ecology of the study areas for the Project, a Wetlands Function Assessment was conducted to develop a more comprehensive understanding of the role and function of wetlands on a regional scale. A summary of the results of the baseline wetland functional assessment is presented in the following subsections with discussion on:

- Geophysical Wetland Functions;
- Biophysical Wetland Functions; and
- Socio-Economic Functions.

A detailed description of the wetland function assessment, including methods used can be found in Section 9.2.6 and Section 9.4 of the Natural Environment Existing Conditions Report in Appendix F.

11.2.2.6.1 Geophysical Wetland Functions

Wetlands provide vital geophysical functions that are essential for environmental stability and resilience. One of their primary roles is water regulation, as wetlands act as natural sponges, absorbing excess water during floods and slowly releasing it during dry periods, thus regulating local hydrological cycles (Mitsch & Gosselink, 2015). Groundwater recharge is affected by topography, soil permeability and composition of the bedrock. Wetlands are also effective in trapping sediments and filtering pollutants, which helps improve water quality and prevents the degradation of surrounding ecosystems (Zedler & Kercher, 2005). Wetland vegetation plays a role in these functions by slowing the rate of flow, which allows for the filtering of sediment and pollutants and the incorporation of excess nutrients into leaf and stem growth. In addition, abiotic factors such as temperature and water saturation influence the cycling of nutrients spatially and temporally. Wetlands also contribute significantly to carbon sequestration, storing large amounts of carbon in their waterlogged soils, which helps mitigate the effects of climate change (Mitsch et al., 2013; Saraswati et al., 2023). These geophysical functions underscore the importance of wetlands in supporting biodiversity, protecting water resources, and buffering communities against the impacts of climate-related events. The following sections highlight the unique geophysical functions provided by the broad wetland classes found within the LSA and RSA.

Below are brief descriptions of the geophysical functions of each wetland type in the study area. A summary table of the results of the relative probability of geophysical wetland function values is shown in the **Table 11-16.** Based on the review of published literature and use of a modelling tool relative probability ordinal values ranging from 0 to 1 were assigned to each wetland type. These ordinal values were derived from a simple relationship that was established between qualitative value and relative probability of the specific wetland type providing functional value expressed as: high (1), moderate/high (0.8), moderate (0.6), low/moderate (0.4), and low (0.2). The rationale for the ordinal values is discussed in detail in Sections 9.2.6, and 9.4.2 through 9.4.6 of the Natural Environment Existing Conditions Report in Appendix F. The assessment of ordinal values was then modelled in a regression analysis, a simple linear regression is a model that describes the relationship between one dependent and one independent variable using a straight line, to assess specific wetland geophysical functions in terms of probability that specific wetlands provide in terms of functional geophysical value.

Bogs

Three broad categories of bog were observed within the study areas: Open Bog, Low-Treed Bog and Sparse-Treed Bog. Bogs typically exhibit a low hydrologic functionality (Hanson et al., 2008). The form of these features ranges from domed/plateau bogs to net bogs, to treed bogs. The deficiency of surface water flow into bogs limits a bog's efficacy to moderate water flow, and supply shoreline erosion functions.

The saturated soil conditions found in bogs limit their capacity to slow down and/or store influxes of water during freshet and rainfall events; however, this is somewhat moderated during the drier summer months when water levels in bogs recede, allowing for greater levels of storage capacity (Malner, 1975). Bogs generally occur in low energy environments and have little value in reducing erosion. As such, bogs are considered to have a low flood attenuation/water retention/erosion protection value for the purposes of this wetlands function assessment (Leclair et al., 2015).

Fens

Two categories of fen were identified within the study area: Organic Poor Fens and Sparse Treed Fens. Organic Poor Fens displayed the most variety of structural types including string fens, ladder fens, channel fens, water-track fens, and horizontal fens. Fens maintain high groundwater tables and consistent runoff rate throughout the year, provide drainage for bogs, and have an increased rate of evapotranspiration compared to bogs (Verry and Boelter, 1975; Sjörs, 1963; Lafleur and Roulet, 1992). Fens provide moderate protection from local flooding, stream bed scouring, sediment loading and temperature stabilization for cold-water species.

Swamps

Swamps in the study area were composed of two broad categories: those in higher elevation with occasional pockets of mixed wood forest (intermediate or organic rich conifer swamps) and low elevation, transitional area swamps (poor conifer and thicket swamps). Hydrologic flow through swamps is dynamic with flow through groundwater and overland during inundation events (McCarter et al., 2024; Goodbrand, 2013). The hydrological function of riparian swamps decreases with higher elevation and most swamps within the study area were positioned on mid to upper slopes, reducing their function in comparison to their size (Hanson et al., 2008).

Swamps can exhibit a high degree of biochemical function and productivity in relation to other wetland classes. These can vary greatly according to local factors such as climate, temperature, water chemistry, vegetative community, geology, topography, and drainage. For example, stagnant forested swamps can act as carbon sinks due to the abundance of organic matter and slow decomposition rates. In contrast, riparian swamps excel at phosphorus absorption via deposition of dissolved and suspended solids. Due to the dynamic hydrology and position of swamps within the landscape they can act as a nutrient exporter to other ecosystems (Hanson et al., 2008).

Floodplain and Lacustrine Wetlands

Wetlands associated with rivers and waterbodies have been grouped into two main categories: Lacustrine (Open/Open Shore/Fen/Marsh/Thicket Swamp); and Floodplain (River Shore Open – Marsh/Fen/Bog, Low/Sparse/Treed/Fen, Bog, Thicket/Treed Swamp). These wetlands are typically small in scale and form complexes within the transition zones to open water. The position of these wetlands within the landscape allows them to moderate stormwater flow, streambed sedimentation, channel modification and erosion more effectively compared to other wetland classes (Hanson et al., 2008).

The biochemical function of marsh wetlands is high, but the effectiveness of these functions is subject to similar local physical factors as swamps described above. Marshes facilitate the cycling of nitrogen, absorption of phosphorus and reduce sulphates making floodplain marsh complexes important for water quality. Marshes act as both carbon sinks and carbon sources depending on the wetland condition. The status is determined by whether it is in a stage of active vegetative growth, or in decline and drying out through natural successional processes (Hanson et al., 2008).

Shallow open water wetlands are dynamic systems, and their productivity and biochemical function is dependent on external factors such as flow rates, composition, and existing capacity. The variation leads to periods of oxygenated substrate increasing decomposition and can result in fluctuating nutrient supplies and irregular organic matter export. In slow moving waters they can facilitate sediment settling but it is limited by their size within the landscape (Hanson et al., 2008).

Table 11-16: Summary of Wetland Geophysical Function Values by Wetland Class

Vegetation Classification	Erosion Protection*	Flood Attenuation Potential	Discharge Potential	Recharge Potential	Water Quality	Nutrient Cycling	Carbon Sequestration	Climate Regulation
Low-Treed Bog	Low	Low	Low	High	Low	Moderate/High	High	Low
Open Bog	Low	Low	Low	High	Low	Moderate/High	High	Low
Sparse Treed Bog	Low	Low	Low	High	Low	Moderate/High	High	Low
Sparse Treed Fen	Low	Moderate	High	Low	Moderate/High	Moderate/High	Moderate	Moderate
Open Moderately Rich Fen	Low	Moderate	High	Low	Moderate/High	Moderate/High	Moderate	Moderate
Poor Fen	Low	Moderate	High	Low	Moderate/High	Moderate/High	Moderate	Moderate
Conifer Swamp	Moderate/High	Moderate	Moderate	Moderate	High	Low/Moderate	High	Moderate
Organic Rich Conifer Swamp	Moderate/High	Moderate	Moderate	Moderate	High	Low/Moderate	High	Moderate
Poor Conifer Swamp	Moderate/High	Moderate	Moderate	Moderate	High	Low/Moderate	High	Moderate
Thicket Swamp	Moderate/High	Moderate	Moderate	Moderate	High	Low/Moderate	High	Moderate
Meadow Marsh	High	Moderate/High	High	Low	High	Moderate/High	Low	Moderate/High
Open Shore Fen	High	Moderate/High	High	Low	High	Moderate/High	Moderate	Moderate/High
Open Shore Fen / Thicket Swamp	High	Moderate/High	High	Low	High	Moderate/High	Moderate	Moderate/High
Open Shore Shrub Fen	High	Moderate/High	High	Low	High	Moderate/High	Moderate	Moderate/High
Open Water Marsh	High	Moderate/High	High	Low	High	Moderate/High	Moderate	Moderate/High
River/Floating Marsh	High	Moderate/High	High	Low	High	Moderate/High	High	Moderate/High

Vegetation Classification	Erosion Protection*	Flood Attenuation Potential	Discharge Potential	Recharge Potential	Water Quality	Nutrient Cycling	Carbon Sequestration	Climate Regulation
River Shore Open – Marsh / Fen/Bog, Low / Sparse/Treed / Fen, Bog, Thicket/Treed Swamp	High	Moderate/High	High	Low	High	Moderate/High	High	Moderate/High

* Erosion Protection values only apply to wetlands adjacent to waterbodies or watercourses

Note: Ordinal values were assigned as follows high (1), moderate/high (0.8), moderate (0.6), low/moderate (0.4), and low (0.2)

11.2.2.6.2 Biophysical Wetland Functions

Wetlands play crucial biophysical roles in ecosystems by providing essential services to support biodiversity. The diverse habitat structure of wetlands supports a wide variety of species, contributing to high levels of biodiversity and providing essential breeding, feeding, and nesting sites for numerous animals (Barton et al., 2007). The following subsections highlight the distinct biophysical functions performed by each of the broad wetland classes in the study area. These biological functions underscore the ecological importance of bogs in maintaining biodiversity and ecosystem services. A general qualitative assessment of biophysical functions of each wetland type in the study area is presented below.

Six major biophysical functions were examined. These include maintenance of habitat for: vegetation (common, locally rare, SAR, and species of interest to Indigenous communities), breeding birds, waterfowl, mammals, amphibian, and fish. In order to quantify the biophysical functional values for the various wetland types within the baseline study areas, a statistical modelling technique termed the RSF was used to quantity the absolute or relative probability that a plant or animal uses a specific resource (e.g., wetland or landcover type) (Manly et al., 2002; Johnson et al., 2006; Lele et al., 2013). These quantitative analysis results for the biophysical wetland functions analysis were written to a GIS attribute file and linked to the equivalent hexagon shapefile, allowing mapping of species-specific probability of use and areas of high biophysical functional habitat value. The results of this quantitative analysis are presented in Section 9.4 of the Natural Environment Existing Conditions Report (Appendix F).

Bogs

Bogs, a type of wetland characterized by waterlogged, acidic conditions and nutrient-poor soils, perform several unique biological functions that are crucial to ecosystem health. Bogs support specialized plant and animal communities adapted to their harsh conditions. For instance, the presence of carnivorous plants like sundews and pitcher plants, which obtain nutrients from insects, reflects the nutrient-poor environment and the unique biological adaptations in these ecosystems (Schmidt et al., 2011). Bogs also provide habitat for unique species of birds, insects, and amphibians, which rely on these habitats for breeding and foraging (Sweeney et al., 2014). In addition, bogs can remove metals from rainwater and groundwater sources by converting them into inorganic compounds and storing them within the soil.

One of the most distinctive roles of bogs is their ability to act as long-term carbon sinks. The slow decomposition of plant material in bogs, due to anaerobic conditions, leads to the accumulation of peat, which stores significant amounts of carbon (Malmer, 1975). This carbon sequestration function is vital for mitigating climate change by removing carbon dioxide from the atmosphere (Gorham, 1991). It is believed that the enormous carbon accumulation in northern peatlands is the consequence of a discrepancy between plant biomass production and litter/peat decay (Loisel et al., 2014; Yu et al., 2010; Malmer, 1975). Both processes, plant growth and subsequent decomposition are affected by the availability of critical nutrients such as nitrogen (N) and phosphorus (P) (Schillereff et al., 2016). This process is common in peatlands, which typically have limited nutrient contributions from the underlying mineral substrates and atmosphere. This is especially applicable to ombrotrophic peatlands that receive nutrients virtually exclusively from the atmosphere (Li et.al., 2023). Disturbance to these systems can lead to an acceleration in the rate of decomposition, mitigating its capacity for carbon storage.

Fens

Fens are a type of wetland characterized by waterlogged, nutrient-rich conditions, and they perform several unique biological functions that differentiate them from other wetlands like bogs. One of the primary biological functions of fens is their role in nutrient cycling. Unlike bogs, fens are often nutrient-rich due to groundwater inputs, which supply essential minerals and nutrients like calcium and magnesium.

This results in higher plant productivity and supports diverse plant communities, including sedges, grasses, and herbaceous plants, which thrive in these environments (Ramsar Convention, 2015). Fens also contribute to maintaining biodiversity by providing habitats for a wide range of species, including rare and specialized plants such as the fen orchid (*Liparis loeselii*) and animals like waterfowl, amphibians, and invertebrates, many of which are adapted to the moist, nutrient-rich conditions (Mitsch & Gosselink, 2015).

Fens also contribute to the global carbon cycle, though not to the same extent as bogs, by accumulating organic material in their peat layers, which can store carbon for long periods, thus mitigating the effects of climate change (Aurela et al., 2004). This process varies among years with climate and other conditions (Brock et al., 1989).

Additionally, fens help regulate water quality and hydrology in surrounding ecosystems. Their ability to filter and absorb nutrients from surrounding areas prevents the eutrophication of downstream waterbodies by trapping excess nutrients like nitrogen and phosphorus (Tóth et al., 2008).). These unique functions underscore the importance of fens in maintaining ecosystem health, biodiversity, and water quality.

Swamps

Swamps, a type of wetland characterized by standing water and often dominated by woody vegetation such as trees and shrubs, perform several unique biological functions that are vital to both local and global ecosystems. These functions include water filtration, biodiversity support, carbon sequestration, and flood regulation.

Swamps are home to a wide variety of plant and animal species, including many that are specialized to thrive in wet, low-oxygen environments. The complex structure of swamp ecosystems, with their varying levels of vegetation and water depth, creates a variety of niches for different species. This makes swamps important habitats for amphibians, birds, mammals, insects, and aquatic organisms, many of which rely on swamps for breeding, feeding, and shelter (Mitsch & Gosselink, 2015). Additionally, swamps are critical stopover points for migratory bird species. The abundant food sources and sheltered environments make swamps ideal habitats for migratory waterfowl and other bird species that use them as resting and feeding grounds during long-distance migrations (Horton et al., 2015).

Due to their ability to accumulate organic material in waterlogged, anaerobic soils, where decomposition rates are slow, the peat in swamps can become a considerable carbon sink. The carbon sequestration capacity of swamps helps mitigate climate change by reducing atmospheric carbon dioxide levels (Whiting and Chanton, 2001).

Swamps play a crucial role in water purification by filtering out pollutants, excess nutrients (such as nitrogen and phosphorus), and sediments from surrounding water sources. The dense vegetation in swamps, including submerged and emergent plants, traps pollutants and helps to maintain water quality by removing harmful substances before they enter larger water bodies (Mitsch and Gosselink, 2015).

Floodplain and Lacustrine Wetlands

Floodplain and lacustrine wetlands are two distinct wetland types that provide essential biological functions, each with unique ecological roles that support biodiversity, water quality, and carbon cycling.

Floodplain wetlands occur along rivers and streams, where they are periodically inundated by floodwaters. These wetlands perform critical biological functions, particularly in nutrient cycling and water purification. Floodplain wetlands act as natural filters, trapping and processing nutrients and sediments carried by floodwaters, which helps to preserve downstream water quality in aquatic ecosystems

(Tockner et al., 2000). During periods of flooding, these wetlands provide temporary habitat for many species, particularly migratory birds and amphibians, which rely on the rich resources available in floodplain habitats (Junk et al., 2013). Additionally, these wetlands help regulate hydrology by slowing the flow of water, reducing the severity of floods, and allowing groundwater recharge (Yousef et al., 1985; Zedler and Kercher, 2005).

Lacustrine wetlands are found along the edges of lakes and are characterized by their deeper waters compared to other wetland types. These wetlands are important for their role in maintaining biodiversity, as they provide critical habitats for aquatic plants, fish, and other wildlife (Stewart and Kantrud, 1971). The plant communities in lacustrine wetlands, such as cattails and bulrushes, help stabilize lake shorelines and reduce erosion (Dahl, 2011). Similar to Floodplain wetlands, Lacustrine wetlands also contribute to nutrient cycling, acting as buffers that reduce nutrient and pollutant inputs into lakes, thus maintaining water quality (Robertson et al., 1993). Lacustrine wetlands are particularly valuable for their role in providing breeding, feeding, and nesting habitats for a variety of waterfowl and other aquatic species.

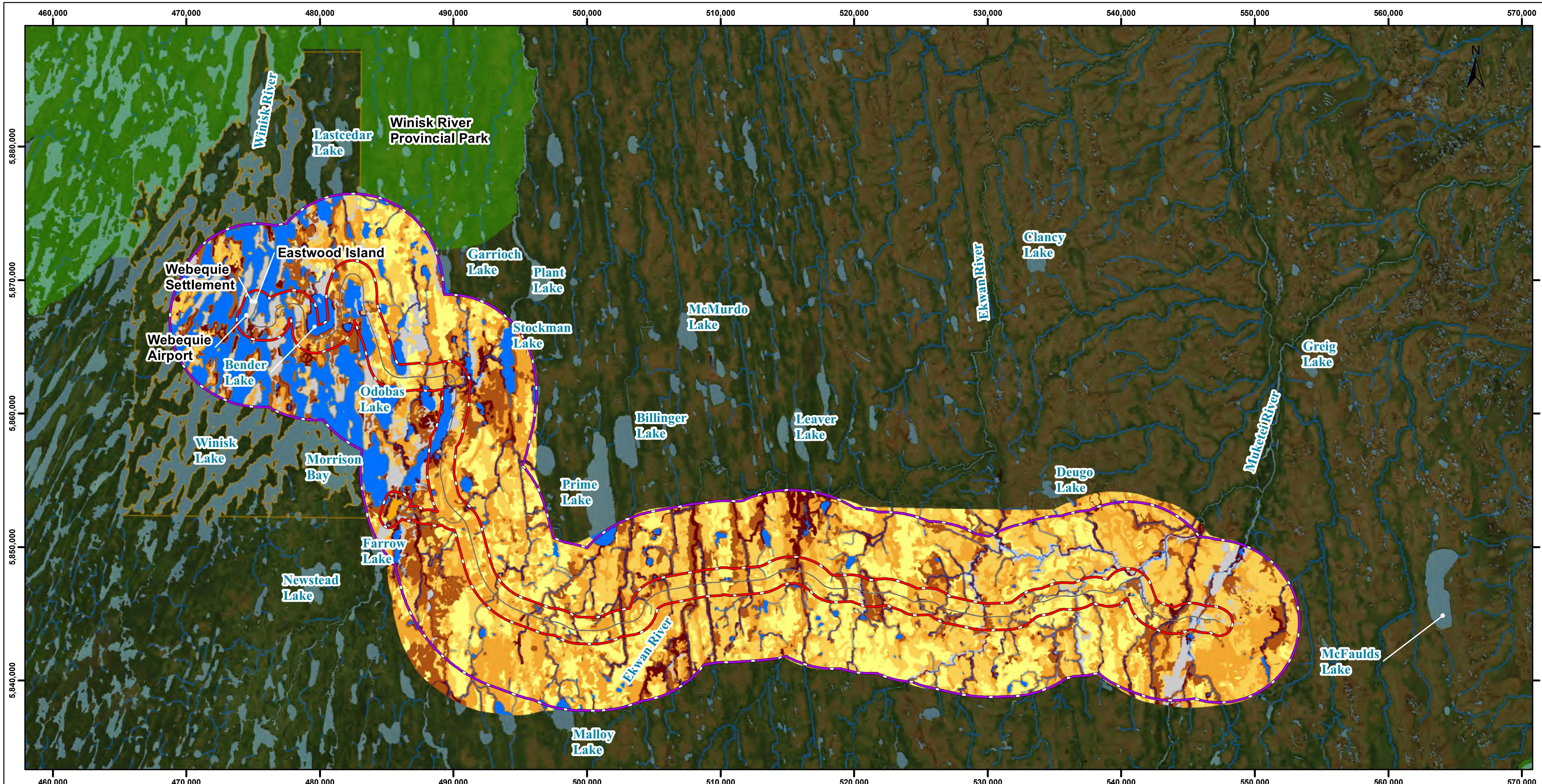
Floodplain and Lacustrine wetlands are also considered carbon sinks due to the accumulation of organic matter in the waterlogged soils (Bunn et al., 2007). Specifically, Lacustrine wetlands help regulate carbon cycles by storing carbon in their sediment layers, although their ability to sequester carbon is influenced by the type of vegetation present (Chmura et al., 2003).

11.2.2.6.3 Socio-Economic Functions

As previously described in **Section 11.2.1.4.3** (Socio-economic Functions) there was not enough context-specific data available to adequately apply a value in the wetland functions assessment for the socio-economic functions of wetlands, which consist of aesthetics, recreation, education, and commercial uses by First Nations and the public. Since Indigenous community's value wetlands in an ecologically holistic way, it is not possible to confidently extricate socio-economic functions from the overall biophysical functions of these environments. Therefore, for the socio-economic component of the wetland function assessment, the Project Team used available IKLRU information provided by communities, along with supplemental data from other VC specific assessments (e.g., wildlife and wildlife habitat, cultural heritage resources) to assess functional value. Using these data sources, socio-economic functions were applied by increasing the weight of the other ecological functions to provide surrogate values attributable to potential aesthetics, recreation, education, and commercial uses of wetlands by First Nations and the public.

11.2.2.6.4 Aggregated Wetland Function

The Wetland Function Ratings Across Study Area map (**Figure 11.8**) was derived by enumerating the values of all functional indices to provide a numeric scale for the final determination of the aggregated functional values as follows; high (1), moderate/high (0.8), moderate (0.6), low/moderate (0.4), and low (0.2). To normalize the values of the modelled indices, weighted values for classes were created based on multi-variate factor analysis, values for each factor summed, and then a quantile classification applied to develop the final functional rating.



Legend

- Project Footprint (Preferred Route, Camps, Aggregate Source Areas and Access Road)
- Local Study Area ((LSA 1km from Centreline of Preferred Route) and 500m from Supportive Infrastructure Facilities)
- Regional Study Area (RSA 5km from either side of LSA Boundaries)
- Webequie First Nation Reserve
- Winisk River Provincial Park
- Waterbody
- Watercourse

Wetland Function Ratings

- Low
- Low/Moderate
- Moderate
- Moderate/High
- High
- Upland
- Open Water

WSR WEBEQUIE SUPPLY ROAD

NOTES

1. Coordinate System: NAD 1983 UTM Zone 16N.
2. Cadastral boundaries are for informational purposes only and should not be considered suitable for legal, engineering, or surveying purposes.
3. Topographic/landcover features obtained from CanVec v12.0 dataset, Natural Resources Canada Earth and Sciences Sector Centre for Topographic Information; and, Land Information Ontario (LIO) Warehouse Open Data (https://geohub.lio.gov.on.ca/), Ontario Ministry of Natural Resources and Forestry (OMNRF) Download Date : 2021-02-04

DISCLAIMER

Webequie Supply Road (WSR)

Wetland Function Ratings Across Study Area

Figure Number:	11-8		REV:	PA	
Client: Webequie First Nation	Project Number: 661910	Date: 4/21/2025			
DSC			DRN	CHK	APP
			AD	JH	JH

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11.3 Identification of Potential Effects, Pathways, and Indicators

Roads and other linear disruptions are influential geographical elements that have the potential to substantially impact the landscapes surrounding them (Müllerová, et.al., 2011). They can affect both the abiotic and the biotic mechanisms of the ecological landscape by altering the dynamics of native plant populations; altering hydraulic flows; transporting both biotic (e.g., invasive species) and abiotic materials (e.g., sediments, dust); and changing the availability of resources, such as nutrients, water, light, and heat (Angold, 1997; Coffin, 2007; Hill and Pickering, 2006; Spellerberg, 1998). The level, intensity and persistence of these effects are variable and dependent on the position of the road in relation to the slope, hydrologic position, prevailing winds and surrounding vegetation systems (Wilcox, 1989; Forman and Alexander, 1998).

The following four primary indicators of effects of the Project on the Vegetation and Wetlands VC were identified as a result of the Project construction and operations phases:

1. Loss or alteration of upland, wetland and riparian vegetation communities/assemblages, species and biodiversity.
2. Loss or alteration of wetland functions. Disruption of the geophysical, biophysical, and socio-economic functions of wetlands.
3. Loss or alteration of species at risk plants and species of conservation concern (Plant Species at Risk (SAR), Plant Species and Communities of Conservation Concern (SOCC) Locally Rare / Underrepresented Vegetation Classes.
4. Loss or alteration plant species and communities of traditional importance to Indigenous Peoples for cultural or medicinal purposes or as a source of country foods.

This section describes the nature of the potential effects, the pathways that link the project activities and the effects, and the indicators that can be used to assess and measure the effects. **Table 11-40** summarizes the potential effects, effects pathways, and effect indicators for the Vegetation and Wetlands VC. Indicators are identified and briefly discussed as a qualitative or quantitative measure used to assess potential effects to the Vegetation and Wetlands VC in the study area.

11.3.1 Threat Assessment Approach

As required by Section 13 of the TISG, the methodology for the effects assessment involves a staged approach. This approach includes an initial assessment of the pre-mitigation effects, known as the 'Threat Assessment' (without consideration of mitigation) followed by an evaluation of the final anticipated net effects after implementing mitigative measures. These two assessments differ in scope: the Threat Assessment is limited to physical removals or the loss of vegetation communities and/or species. In contrast, the full effects assessment provides a quantitative and qualitative description of the effects, using criteria and indicators to assess adverse effects while considering important contextual factors and mitigation. The criteria proposed in the TISG for the initial Threat Assessment, as outlined below, focus specifically on biological effects.

The criteria defined in the TISG include Scope, Severity, Irreversibility (Permanence), Magnitude (determined by Scope and Severity), and Degree of Effect (determined by Magnitude and Irreversibility). Scope, Severity and Irreversibility, as defined in the TISG, along with the rating scales used are described in detail below.

- **Scope** – defined spatially as the proportion of the valued component's occurrence or population within the study areas (PF, LSA, and RSA) that can reasonably be expected to be affected by the predicted effect within 10 years:
  - **pervasive**: the effect is likely to be pervasive in its scope, affecting the valued component across all or most (71% – 100%) of its occurrence or population within the study areas;
  - **large**: the effect is likely to be widespread in its scope, affecting the valued component across much (31% – 70%) of its occurrence or population within the study areas;
  - **restricted**: the effect is likely to be restricted in its scope, affecting the valued component across some (11% – 30%) of its occurrence or population within the study areas; and
  - **small**: the effect is likely to be very narrow in its scope, affecting the valued component across a small proportion (1% – 10%) of its occurrence or population within the study areas.
- **Severity** – defined within the scope as the level of damage to the valued component from the effect that can reasonably be expected; typically measured as the degree of destruction or degradation within the scope or the degree of reduction of the population within the scope:
  - **extreme**: within the scope, the effect is likely to destroy or eliminate the valued component or reduce its population by 71% – 100% within ten years or three generations;
  - **serious**: within the scope, the effect is likely to seriously degrade/reduce the valued component or reduce its population by 31% – 70% within ten years or three generations;
  - **moderate**: within the scope, the effect is likely to moderately degrade/reduce the valued component or reduce its population by 11% – 30% within ten years or three generations; and
  - **slight**: within the scope, the effect is likely to only slightly degrade/reduce the valued component or reduce its population by 1% – 10% within ten years or three generations.
- **Irreversibility (or permanence)** – defined as the degree to which the effect can be reversed and the valued component restored, if the effect no longer existed:
  - **very high**: the effects cannot be reversed, and it is very unlikely the valued component can be restored, and/or it would take more than 100 years to achieve this (e.g., wetlands converted to a shopping centre);
  - **high**: the effects can technically be reversed and the valued component restored, but it is not practically affordable and/or it would take 21-100 years to achieve this (e.g., wetland converted to agriculture);
  - **medium**: the effects can be reversed and the valued component restored with a reasonable commitment of resources and/or within 6-20 years (e.g., ditching and draining of wetland); and
  - **low**: the effects are easily reversible, and the valued component can be easily restored at a relatively low cost and/or within 0-5 years (e.g., off-road vehicles trespassing in wetland).

Following determination of the above values, the combination of Scope and Severity can be used to provide the Magnitude of an effect as illustrated in **Table 11-17**. Subsequently, Magnitude and Irreversibility values can be used to determine the Degree of the effect as illustrated in **Table 11-18**.

Table 11-17: Method to Determine Magnitude of Effect Using Scope and Severity Values

		SCOPE			
		Pervasive	**Large**	**Restricted**	**Small**
SEVERITY	**Extreme**	Very High	High	Medium	Low
	Serious	High	High	Medium	Low
	Moderate	Medium	Medium	Medium	Low
	Slight	Low	Low	Low	Low

Table 11-18: Method to Determine the Degree of Effect Using Irreversibility and Magnitude Values

		IRREVERSIBILITY			
		Very High	**High**	**Medium**	**Low**
MAGNITUDE	**Very High**	Very High	Very High	Very High	High
	High	Very High	High	High	Medium
	Medium	High	Medium	Medium	Low
	Low	Medium	Low	Low	Low

11.3.2 Loss or Alteration of Vegetation Communities, Species and Biodiversity

Loss and alterations to vegetation communities, species and biodiversity will be incurred both directly and indirectly during the construction and operation phases of the Project. These aspects of the local vegetation ecology are inherently intertwined and were assessed holistically. The primary effects pathways associated with the Project are:

- Vegetation clearing and grubbing;
- Installation of water crossing structures; and
- Indirect effect pathways on vegetation and wetlands.

The indirect effect pathways that may be associated with construction and operation activities are further subdivided into:

- Grading and soil disturbance;
- Introduction of invasive species;
- Chemical or hazardous material spills and waste;
- Dust and air emissions, and subsequent deposition;
- Changes to microclimate conditions;
- Potential increased risk of fires;
- Road edge effect zones for species and community biodiversity and composition; and
- Indirect effects to community/species diversity and composition.

The pathways through which loss and harmful alteration of vegetation communities, species and biodiversity may occur are summarized and described below.

11.3.2.1 Vegetation Clearing and Grubbing

There will be a direct loss of vegetation communities and individual species within the Project footprint. These direct losses will occur during clearing, grubbing, and earth grading activities of the Project. Within the road ROW and select supportive infrastructure (e.g. maintenance and storage facility at aggregate sources are ARA-2) these losses will constitute a permanent loss. Vegetation removals during the operation phase are predicted to be negligible and localized and therefore and excluded from calculation of direct vegetation losses. Clearing and grubbing will be largely limited to the initial stages of the construction phase, with some limited occurrences potentially occurring later in construction during the development of aggregate sources, camps and laydown areas. The pathways in which loss or harmful alteration of upland, wetland and riparian vegetation communities may occur are summarized and described below.

Construction activities → Clearing and grubbing of vegetation → Direct loss or alteration of all, or part of, upland, wetland and riparian vegetation within the landscape.

Construction activities → Clearing and grubbing of vegetation → Loss or alteration of vegetation species and community diversity.

Construction activities → Clearing and grubbing of vegetation → Vegetation community fragmentation.

11.3.2.1.1 Direct Vegetation Losses

Temporary disturbances for camps, laydown areas, aggregate sources, and the associated access roads will be progressively rehabilitated during the construction phase. However, due to the short-growing season in the Far North, it is anticipated that these areas - even with rehabilitation – will require years to regain ecological functions comparable to the vegetation communities that existed prior to construction. Therefore, for the purposes of this assessment, the losses within the Project Footprint, outlined in **Table 11-19** below, are considered a permanent direct loss of vegetation.

Table 11-19: Permanent Vegetation Losses Within Project Footprint by Project Component

Project Component	Vegetation Classification (ELC)	Removals (ha)
Preferred WSR Route (ROW of 35 m width)	Burn-Cut	0.77
	Burn-Cut-Mixedwood	0.21
	Conifer Forest	48.08
	Conifer Swamp/Organic Rich Conifer Swamp	101.50
	Developed/Disturbed	5.26
	Hardwood Forest	1.60
	Low Treed Bog	60.68
	Mixedwood Forest	1.02
	Open Bog	0.05
	Open Shore Fen	0.33

Project Component	Vegetation Classification (ELC)	Removals (ha)
	Open Shore Fen/Thicket Swamp	0.02
	Open Shore Shrub Fen	0.61
	Organic Poor Fen	1.38
	Poor Conifer Swamp	76.65
	River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)	5.89
	Rock Barren	0.75
	Sparse Treed Bog	28.37
	Sparse Treed Fen	37.02
	Thicket Swamp	0.07
Total Preferred Route Removals – (35 m ROW)		***370.12***
Aggregate Source ARA-4 Access Road	Conifer Forest	0.40
	Conifer Swamp/Organic Rich Conifer Swamp	4.45
	Poor Conifer Swamp	2.45
	Low Treed Bog	0.41
	Open Shore Shrub Fen	0.23
	Sparse Treed Fen	0.32
Total Aggregate Source ARA-4 Access Road Removals (15 m ROW)		***8.26***
Aggregate Source ARA-2	Conifer Forest	21.33
	Conifer Swamp/Organic Rich Conifer Swamp	8.92
	Poor Conifer Swamp	0.82
	River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)	0.03
	Rock Barren	2.63
	Sparse Treed Fen	0.32
	Thicket Swamp	0.34
Total Aggregate Source ARA-2 Removals		***34.39***
Aggregate Source ARA-4	Conifer Forest	69.25
	Conifer Swamp/Organic Rich Conifer Swamp	32.13
	Low Treed Bog	0.03
	Poor Conifer Swamp	0.12
Total Aggregate Source ARA-4 Removals		***101.53***
Camp 1A	Conifer Forest	4.41
	Mixedwood Forest	3.19
	Sparse Treed Bog	0.56
Total Camp 1A Removals		***8.16***
Camp 2A	Conifer Forest	3.82

Project Component	Vegetation Classification (ELC)	Removals (ha)
	Sparse Treed Bog	0.06
	Sparse Treed Fen	4.23
Total Camp 2A Removals		***8.11***
Camp 3A	Conifer Swamp	6.12
	Sparse Treed Fen	1.58
Total Camp 3A Removals		***7.70***
Camp 4B	Conifer Forest	3.51
	Conifer Swamp	2.45
	Sparse Treed Bog	0.64
	Thicket Swamp	1.56
Total Camp 4B Removals		***8.16***
Total Removals		**546.57**

Overall, approximately 546.57 ha of vegetation loss is expected to occur during clearing, grubbing and grading activities for construction of the road and supportive infrastructure. Most of these losses will occur within the road ROW (370.12 ha), with the aggregate source areas requiring the next highest removals requirements (ARA-4 101.53 ha, and ARA-2 34.39 ha). The total losses for each vegetation community class are outlined in **Table 11-20** below.

Table 11-20: Permanent Vegetation Losses Within Project Footprint by Vegetation Classification

Vegetation Classification (ELC)	Removals (ha)
Burn-Cut	0.77
Burn-Cut-Mixedwood	0.21
Conifer Forest	150.80
Conifer Swamp\Organic Rich Conifer Swamp	155.58
Developed/Disturbed	5.26
Hardwood Forest	1.60
Low Treed Bog	61.12
Mixedwood Forest	4.21
Open Bog	0.05
Open Shore Fen	0.33
Open Shore Fen/Thicket Swamp	0.02
Open Shore Shrub Fen	0.83
Organic Poor Fen	1.38
Poor Conifer Swamp	80.04
River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)	5.92
Rock Barren	3.38

Vegetation Classification (ELC)	Removals (ha)
Sparse Treed Bog	29.62
Sparse Treed Fen	43.47
Thicket Swamp	1.98
Total Removals	**546.57**

The largest individual vegetation community class losses will occur in Conifer Swamp\Organic Rich Conifer Swamp (155.58 ha). These classifications have been combined due to the naturally mosaiced nature of conifer swamp and organic rich conifer swamp communities, which were typically encountered within the study area as a mix of large areas of conifer swamp interspersed with pockets of organic rich conifer swamp. Conifer forest has the next largest losses at 150.8 ha, followed by poor conifer swamp, low treed bog, sparse treed fen, and sparse treed bog with removals of 80.04, 61.12, 43.47, and 29.62 ha respectively. The remaining vegetation class removals range from 0.02 ha to 5.92 ha.

The majority of the overall vegetation losses represent less than 6.5% of the respective availability of these classes within the LSA, and less than one percent of both the LSA and RSA as a whole (see **Table 11-21** below). One notable exception is the Rock Barren classification, which has removals that constitute 38% and 25% of the Rock Barren patches identified in the RSA and LSA respectively. These elevated effects could be the result of the mosaiced nature of the Rock Barren sites within the landscape, and the small size (less than mappable scales for ELC), typically observed for this vegetation class.

Table 11-21: Percentage of Permanent Vegetation Losses Within Study Areas

Local Study Area				
LSA Affected Vegetation Classifications (ELC)	Baseline Area of Vegetation in LSA (ha)	Change in Area of Vegetation in LSA (ha)	Removals in LSA (ha)	Percent of LSA Vegetation Class Removed
Burn-Cut	32.16	31.39	0.77	2%
Burn-Cut-Mixedwood	31.00	30.79	0.21	1%
Conifer Forest	1,706.95	1,556.15	150.8	9%
Conifer Swamp	4,970.07	4,814.49	155.58	3%
Developed/Disturbed	84.62	79.36	5.26	6%
Hardwood Forest	45.30	43.70	1.6	4%
Low Treed Bog	4,134.38	4,073.26	61.12	1%
Mixedwood Forest	125.65	121.44	4.21	3%
Open Bog	73.84	73.79	0.05	0.1%
Open Shore Fen	63.35	63.02	0.33	1%
Open Shore Fen/Thicket Swamp	12.89	12.87	0.02	0.2%
Open Shore Shrub Fen	147.99	147.16	0.83	1%
Organic Poor Fen	336.01	334.63	1.38	0.4%
Poor Conifer Swamp	3,261.36	3,181.32	80.04	2%

Local Study Area				
LSA Affected Vegetation Classifications (ELC)	**Baseline Area of Vegetation in LSA (ha)**	**Change in Area of Vegetation in LSA (ha)**	**Removals in LSA (ha)**	**Percent of LSA Vegetation Class Removed**
River/Fen (Open/Sparse Treed/Thicket) /Swamp/Marsh)	432.74	426.82	5.92	1%
Rock Barren	8.96	5.58	3.38	38%
Sparse Treed Bog	1,986.22	1,956.60	29.62	1%
Sparse Treed Fen	2,221.11	2,177.64	43.47	2%
Thicket Swamp	36.77	34.79	1.98	5%
Totals	**19,711.37**	**19,164.80**	**546.57**	**3%**

Regional Study Area				
Regional Study Area Affected Vegetation Classifications (ELC)	**Baseline Area of Vegetation Class in RSA (ha)**	**Change in Area of Vegetation Class in RSA (ha)**	**Removals in RSA (ha)**	**Percent of RSA Vegetation Class Removed**
Burn-Cut	38.25	37.48	0.77	2.01%
Burn-Cut-Mixedwood	31.00	30.79	0.21	0.68%
Conifer Forest	8,270.54	8,119.74	150.8	1.82%
Conifer Swamp	22,752.57	22,596.99	155.58	0.68%
Developed/Disturbed	187.20	181.94	5.26	2.81%
Hardwood Forest	189.56	187.96	1.6	0.84%
Low Treed Bog	26,156.94	26,095.82	61.12	0.23%
Mixedwood Forest	343.99	339.78	4.21	1.22%
Open Bog	2,478.19	2,478.14	0.05	0.002%
Open Shore Fen	536.20	535.87	0.33	0.06%
Open Shore Fen/Thicket Swamp	34.87	34.85	0.02	0.06%
Open Shore Shrub Fen	730.24	729.41	0.83	0.11%
Organic Poor Fen	3,535.39	3,534.01	1.38	0.04%
Poor Conifer Swamp	18,496.56	18,416.52	80.04	0.43%
River/Fen (Open/Sparse Treed/Thicket) / Swamp/Marsh)	2,717.53	2,711.61	5.92	0.22%
Rock Barren	13.40	10.02	3.38	25.23%
Sparse Treed Bog	13,832.36	13,802.74	29.62	0.21%
Sparse Treed Fen	10,119.73	10,076.26	43.47	0.43%
Thicket Swamp	55.72	53.74	1.98	3.55%
Totals	**110,520.24**	**109,973.67**	**546.57**	**0.49%**

11.3.2.1.2 Loss Or Alteration of Vegetation Species and Community Biodiversity

The loss or alteration of vegetation resulting from Project clearing and grubbing activities and soil disturbance has the potential to affect biodiversity within the study areas (Zeng et al., 2010).

As documented in Section 9.5.1 of the Natural Existing Conditions Report (Appendix F), existing species biodiversity was examined in two ways. The first was a simple measure of species richness, as defined by the number of species found within a given sampled unit. This measure, though useful for the development of monitoring programs designed to capture local changes in diversity, is inadequate for quantifying effects to species diversity from the Project.

A second approach, using RSF models was used to determine the effects to species diversity from the construction of the Project at the community level. Using the RSF modelling, maps were generated to quantify the probability of use for each species, and these values were then used to estimate diversity of prior to and after construction of the Project. This approach builds on the concept of Simpson's Diversity Index where diversity calculations can optionally use percent area covered as the measured metric (Brower, Zar, and von Ende, 1990). When a binary regression is used to estimate the probability of use in an RSF design, it then corresponds to the definition of probability of occupancy (Lele et al., 2013), which can also be interpreted as Percent Area Occupied (PAO). Likewise, in the case of RSF models, probability of use is a relative index of PAO. In either case, the calculation of a diversity index based on PAO by individual species provides an index of relative diversity of use among vegetation ELC types to allow ranking of the functional Simpson's Inverse Dominance value of each ELC type. As part of the modelling process PAO values were developed for breeding birds, waterbirds, mammals, and vegetation class.

Using the vegetation class PAO, the Simpson's Inverse Dominance was calculated for each ELC type and summarized at the ELC map polygon level. Simpson's diversity values were all generally > 0.8, so greater discrimination can be revealed using the related Simpson's Inverse Dominance measure (Brower, Zar, and von Ende, 1990), calculated as:

$$\lambda = \sum i \; ni(ni) \, / N(N)$$

$$\delta s = 1/ \, l,$$

Where ni is the PAO for each species i within a 3-ha hexagon and N is the total PAO. Because analysis is for every hexagon (not a random sample), the finite formula applicable for an entire census was used (see Appendix K-1).

By applying the model to a modified shapefile that incorporated landcover change as a result of predicted development activities, the change in probability of use and resulting percent change in Inverse Simpsons Diversity was calculated and is presented in **Table 11-22** below. According to the results there is a potential for 25 of the 30 vegetation classes identified to experience a slight increase in diversity, with only five classes showing an decrease. These increases range between 1% and 9% of the original Simpson's Diversity Index value, and the decreases between 1% and 2%.

Table 11-22: Percent Change in Inverse Simpsons Diversity Following Construction

Vegetation Class (ELC)	Baseline Average Inverse Simpson's Diversity Index	Average Inverse Simpson's Diversity Index**	Percentage Change in Diversity Index
Burn-Conifer Swamp	3.12	3.15	1%
Burn Low/Sparse Treed Bog/Fen	3.77	3.72	-1%
Burn/Shrubland	3.06	3.03	-1%
Burn-Conifer Forest	3.08	3.10	1%
Burn-Cut	3.15	3.12	-1%
Burn-Cut-Mixedwood	3.37	3.34	-1%
Conifer Forest	2.99	2.92	-2%
Conifer Swamp	3.15	3.05	-3%
Developed/Disturbed	3.29	3.23	-2%
Hardwood Forest	3.60	3.48	3%
Low Treed Bog	2.98	2.92	-2%
Meadow Marsh	2.95	2.69	-9%
Mixedwood Forest	3.08	3.06	-1%
Open Bog	3.12	3.05	-2%
Open Moderately Rich Fen	4.56	4.45	-2%
Open Shore Fen	3.05	2.94	-4%
Open Shore Fen/Thicket Swamp	4.04	3.83	-5%
Open Shore Shrub Fen	3.01	2.88	-4%
Open Water Marsh	5.16	5.28	2%
Organic Poor Fen	3.09	3.03	-2%
Poor Conifer Forest	2.56	2.59	1%
Poor Conifer Swamp	3.08	3.00	-3%
River /Floating Marsh	4.71	4.64	-2%
River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)	3.48	3.42	-2%
Rock Barren	4.81	4.76	-1%
Shore Thicket Swamp	2.55	2.52	-1%
Sparse Treed Bog	2.99	2.92	-2%
Sparse Treed Fen	3.16	3.09	-2%
Thicket Swamp	4.85	4.43	-9%

** Negative Values = Decreased Diversity, Positive Values = Increased Diversity*

*** Inverse Simpson's Diversity Values have been calculated based on the baseline data collection study areas.*

11.3.2.1.3 Vegetation Community Fragmentation

The installation of linear infrastructure such as roads can result in fragmentation of upland, wetland, and riparian vegetation communities. Fragmentation of vegetation communities has multiple simultaneous effects that are interwoven in complex ways and that operate over potentially long-time scales (NASEM, 2005). Some of these effects include, but are not limited to, changes to community composition, alterations in biodiversity and an impairment of key ecosystem functions (Haddad et al., 2015). These complex effects of fragmentation were assessed through the analysis of the size, shape, number, and distribution of vegetation class patches within the LSA and RSA along with the following associated metrics. Refer to **Section 11.2.1.3.4:** Species and Community Biodiversity for descriptions of these metrics:

- Area Metrics:
  - Number of Patches;
  - Class Area (ha); and
  - Mean Patch Size (ha).
- Edge Metrics:
  - Total Edge (m);
  - Edge Density; and
  - Mean Patch Edge (m/ha).
- Core Metrics:
  - Core Area (more than 50 m from a patch edge) (ha);
  - Number of Core Patches;
  - Mean Core Patch Size (ha); and
  - Median Core Patch Size.
- Landscape Level Diversity Metrics:
  - Shannon's Diversity and Evenness Indices; and
  - Nearest Neighbour (clustering/dispersal).

The analyzed metrics across vegetation class patches are further described in the following subsections, with the results being presented in **Table 11-24**, **Table 11-25**, and **Table 11-26** (below).

Area Metrics

As described in **Section 11.3.2.1** (Vegetation Clearing and Grubbing) the implementation of the Project will result in removals within multiple vegetation class patches. It was determined that 404 discrete vegetation patches are intersected by the proposed Project Footprint. In most cases, these removals will only affect portions of these patches to various degrees, resulting in the division of the patch into two or more discrete patches. The creation of a new patch is the result of fragmentation of the existing vegetation patches by the Project Footprint. **Table 11-24** outlines the results of the removals analysis of the affected patches within the LSA.

The highest fragmentation occurrences include Conifer Swamp (97), Poor Conifer Swamp (70), Low Treed Bog (59), Conifer Forest (41), Sparse Treed Fen (34), Sparse Treed Bog (38), and River/Fen (Open/Sparse Treed/Thicket)/Swamp (25). Apart from four small Rock Barren sites within aggregate source ARA-2, the remaining affected patches will be subject to varying degrees of partial removals.

Within the LSA, the highest increases in discrete patch creation (i.e. fragmentation) include Conifer Swamp (143), Poor Conifer Swamp (91), Low Treed Bog (79), Sparse Treed Fen (56), Conifer Forest (44), Sparse Treed Bog (38), and River/Fen (Open/Sparse Treed/Thicket)/Swamp (25). The remaining vegetation patch classes demonstrate increases between 0 and 5, apart from Rock Barren, which shows a reduction of 2, due to the removal of 4 entire patches within ARA-2 as described earlier (**Section 11.3.2.1**: Vegetation Clearing and Grubbing). These values are not unexpected, given the high values of patch creation that correspond to the number of patches intersected, and the general availability of these vegetation classes within the environment.

The overall losses of vegetation due to fragmentation represent between 0.002% to 0.4% of all habitat types within the LSA. The exception is Rock Barren with a loss of 0.37%. The Mean Patch metric shows more significant losses to the mean patch size of the respective vegetation class patches within the Project Footprint, with reductions of 35% for Burn-Cut, 34% to Conifer Swamp, 30% to Conifer Forest. Mean patch losses to River/Fen (Open/Sparse Treed/Thicket)/Swamp, Rock Barren, Poor Conifer Swamp Thicket Swamp, Low Treed Bog, Sparse Treed Fen, Mixedwood Forest, Hardwood Forest, Sparse Treed Bog range from 18% to 28%, with the remainder in the range of 0% to 7%.

Minor changes were observed when these metrics were used within the RSA, **Table 11-25** outlines the results of the removals analysis of the affected patches within the RSA.

When examined for the RSA, the highest increases in discrete patch creation include Conifer Swamp (156), Poor Conifer Swamp (97), Low Treed Bog (81), Sparse Treed Fen (57), Conifer Forest (49), Sparse Treed Bog (38), and River/Fen (Open/Sparse Treed/Thicket)/Swamp (25). The remaining vegetation patch classes demonstrate increases in patch creation between 0 and 7, except for Rock Barren and Conifer Swamp. Rock Barren shows a reduction of 2, due to the removal of 4 entire patches within ARA-2 noted above. These values are not unexpected since the high values of patch creation corresponds to the number of patches intersected, and the general availability of these vegetation classes within the environment. Conifer swamp will have an increase of 13 new patches, when compared to patch creation in the LSA alone.

Within the RSA, there will be a further loss of 69.7 ha of Conifer Forest, 35.2 ha of Conifer Swamp, 1.4 ha of Poor Conifer Swamp, 0.44 ha of Hardwood Forest, and 0.23 ha of Open Shore Shrub Fen. The remaining vegetation classes will experience no additional losses. When the percentage of vegetation class loss in relation to the amount of each class within the study area is examined, there is an expected reduction for most classes. For example, the losses to Conifer Forest represent 4.3% of that available class within the LSA, but when the calculation is applied at the RSA scale these losses only represent 1.8% of the available Conifer Forest, which represents a decrease in the loss versus the availability of that class by 2.5%. There is also a similar decrease in the loss percentage in relation to the availability across all classes within the RSA ranging from 0.04% to 2.5%. The exception is Rock Barren which increases by 12% due to the greater abundance of Rock Barren within the RSA.

The relationship for the area metrics is also true for the mean patch size metric related to the assessment of fragmentation. For the RSA mean patch sizes also increase by 0% to 17%, depending on the vegetation class. The mean patch size metric for the RSA still shows considerable losses, with reductions of 32% for Burn-Cut, 22% to Thicket Swamp, and 20% to Conifer Swamp. Mean patch size losses to Rock Barren, Conifer Forest, Mixedwood Forest, River/Fen (Open/Sparse Treed/Thicket/Swamp, Poor Conifer Swamp), and Sparse Treed Fen range from 10% to 16%. The remaining vegetation class patches show losses between 0% to 8%.

The overall vegetation class losses represent between 0.002% to 0.8% of these habitat types within the RSA. The exceptions include Rock Barren (25.2%), Thicket Swamp (3.5%), Burn-Cut (2%), and Conifer and Mixedwood Forest at 1.8% and 1.2% respectively.

Table 11-23: Vegetation Patches Intersected

Vegetation Class (ELC)	Number of Patches Intersected
Burn-Cut	3
Burn-Cut-Mixedwood	2
Conifer Forest	41
Conifer Swamp	97
Developed/Disturbed	2
Hardwood Forest	1
Low Treed Bog	59
Mixedwood Forest	3
Open Bog	1
Open Shore Fen	3
Open Shore Fen/Thicket Swamp	1
Open Shore Shrub Fen	7
Organic Poor Fen	6
Poor Conifer Swamp	70
River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)	24
Rock Barren	7
Sparse Treed Bog	34
Sparse Treed Fen	38
Thicket Swamp	5
Total Vegetation Patches Affected	404

Table 11-24: Area Metrics for Baseline Conditions and for Affected Vegetation from the Project in LSA

Patch Vegetation Class (ELC)	Baseline Number of Patches in LSA	Number of Patches with Project LSA	Number of new Patches in LSA	Baseline Total Class Patch Area (ha) in LSA	Total Class Patch Area with Project LSA (ha)	Losses (ha) in LSA	Percent of Vegetation Class Loss vs Availability (%)	Baseline Mean Patch Size in LSA (ha)	Mean Patch Size with Project LSA (ha)	Mean Patch Size Losses (%)
Burn-Cut	8.00	12.0	4.00	32.68	31.9	0.77	0.02%	4.09	2.7	35%
Burn-Cut-Mixedwood	4.00	4.0	0.00	31.00	30.8	0.21	0.01%	7.75	7.7	1%
Conifer Forest	118.00	162.0	44.00	1888.98	1807.8	81.15	0.04%	16.01	11.2	30%
Conifer Swamp	292.00	435.0	143.00	5930.60	5810.2	120.42	0.02%	29.30	19.2	34%
Hardwood Forest	5.00	6.0	1.00	51.21	49.6	1.60	0.03%	10.24	8.3	19%
Low Treed Bog	280.00	359.0	79.00	5390.99	5330.3	60.68	0.01%	19.25	14.8	23%
Mixedwood Forest	15.00	18.0	3.00	126.75	122.5	4.21	0.03%	8.45	6.8	19%
Open Bog	48.00	48.0	0.00	158.37	158.3	0.05	0.0003%	3.30	3.3	0%
Open Shore Fen	61.00	62.0	1.00	101.98	101.7	0.33	0.003%	1.67	1.6	2%
Open Shore Fen/Thicket Swamp	3.00	3.0	0.00	12.91	12.9	0.02	0.002%	4.30	4.3	0%
Open Shore Shrub Fen	74.00	79.0	5.00	172.79	172.2	0.61	0.004%	2.34	2.2	7%
Organic Poor Fen	81.00	86.0	5.00	558.25	556.9	1.38	0.002%	6.89	6.5	6%
Poor Conifer Swamp	276.00	367.0	91.00	3984.18	3905.5	78.63	0.02%	14.44	10.6	26%
River/Fen (Open/Sparse Treed/Thicket)/SW	68.00	93.0	25.00	534.20	528.3	5.92	0.01%	7.86	5.7	28%
Rock Barren	14.00	12.0	-2.00	9.07	5.7	3.38	0.37%	0.65	0.5	27%
Sparse Treed Bog	179.00	217.0	38.00	2859.05	2829.4	29.62	0.01%	15.97	13.0	18%
Sparse Treed Fen	207.00	263.0	56.00	2812.14	2768.7	43.47	0.02%	13.59	10.5	23%
Thicket Swamp	12.00	15.0	3.00	47.75	45.8	1.98	0.04%	3.98	3.1	23%

Note: *** All Patch analysis has been calculated based on the baseline data collection in the study areas.*

Table 11-25: Area Metrics for Baseline Conditions and for Affected Vegetation from the Project in the RSA

Patch Vegetation Class (ELC)	Baseline Number of Patches in RSA	Number of Patches with Project RSA	Number of new Patches in RSA	Baseline Total Class Patch Area in RSA (ha)	Total Class Patch Area with Project RSA (ha)	Losses in RSA (ha)	Percent of Vegetation Class Loss vs Availability (%)	Baseline Mean Patch Size in RSA (ha)	Mean Patch Size with Project RSA (ha)	Mean Patch Size Losses (%)
Burn-Cut	9	13	4	38.3	37.5	0.77	2.0%	4.25	2.88	32%
Burn-Cut-Mixedwood	4	4	0	31.0	30.8	0.21	0.7%	7.75	7.70	1%
Conifer Forest	322	371	49	8405.4	8254.6	150.8	1.8%	26.10	22.25	15%
Conifer Swamp	666	822	156	23937.2	23781.6	156	0.6%	35.94	28.93	20%
Hardwood Forest	13	14	1	189.6	188.0	1.60	0.8%	14.59	13.43	8%
Low Treed Bog	955	1036	81	27524.6	27463.4	61.12	0.2%	28.82	26.51	8%
Mixedwood Forest	21	24	3	344.0	339.8	4.21	1.2%	16.38	14.16	14%
Open Bog	171	171	0	2691.3	2691.2	0.05	0.002%	15.74	15.74	0.002%
Open Shore Fen	196	197	1	556.1	555.8	0.33	0.1%	2.84	2.82	1%
Open Shore Fen/Thicket Swamp	3	3	0	34.9	34.8	0.02	0.1%	11.62	11.62	0.1%
Open Shore Shrub Fen	190	197	7	791.5	790.7	0.83	0.1%	4.17	4.01	4%
Organic Poor Fen	218	223	5	3735.8	3734.4	1.38	0.0%	17.14	16.75	2%
Poor Conifer Swamp	839	936	97	19871.2	19791.1	80.04	0.4%	23.68	21.14	11%
River/Fen (Open/Sparse Treed/Thicket)/Swamp)	212	237	25	2935.7	2929.7	5.92	0.2%	13.85	12.36	11%
Rock Barren	18	16	-2	13.4	10.0	3.38	25.2%	0.74	0.63	16%
Sparse Treed Bog	561	599	38	14720.2	14690.6	29.62	0.2%	26.24	24.53	7%
Sparse Treed Fen	543	600	57	10594.5	10551.1	43.47	0.4%	19.51	17.59	10%
Thicket Swamp	13	16	3	55.7	53.7	1.98	3.5%	4.29	3.36	22%

Note: *** All Patch analysis has been calculated based on the baseline data collection in the study areas.*

Edge Metrics

An edge is defined as the border between two patches of vegetation classes. Edge density equals all edges of a given class in relation to the total study area. Mean patch edge is a measure of the average length of edge habitat for each vegetation class patch. These edge metrics were used to measure and analyze changes to the perimeter of all patches of each vegetation class affected by the development of the Project and how they may contribute to fragmentation. An increase in edge habitat is typically the result of increased landscape fragmentation and can result in changes to biodiversity within a patch and within the broader ecosystem (NASEM, 2005; Willmer et al., 2022). **Table 11-26** below outlines the results of the edge analysis of the affected patches.

There is a net gain of 153,986 metres (153.9 km) of edge habitat across all vegetation patch classes within the RSA. This increase is the result of newly created edge communities along both sides to the proposed road and ancillary facilities. Most edge habitat gains occur in the Conifer Swamp (44,846 m), Poor Conifer Swamp (36,207 m), Low Treed Bog (26,205 m), Conifer Forest (18,396 m), Sparse Treed Fen (15,664 m), Sparse Treed Bog (15,664 m), and River/Fen (Open/Sparse Treed/Thicket)/Swamp (1332 m). The Hardwood Forest, Organic Poor Fen, Mixedwood Forest, and Open Shore Shrub Fen show gains ranging of 839 m, 324 m, 195 m, and 139 m respectively. Most of the remaining classes show minor decreases in edge habitat lengths between 21 m and 72 m, which represent less than a 1% loss for each patch class. These edge length losses correlate directly with the observed reductions in patch size of bisected patches. The exceptions to these losses are in the Thicket Swamp (-566 m), and Rock Barren (-1,553), which lose considerably more edge habitat 21.34%, and 2.04%, respectively. As discussed earlier, the results for the lesser represented patch classes, such as Rock Barren, and Thicket Swamp could be misleading due to the small size and mosaiced distribution of these patch types within the broader landscape. Hence, the challenge of mapping these small inclusions can potentially result in under-reporting effects to these classes.

Overall, there is a marked increase in the amount of edge habitat created by the Project. Most vegetation classes also showed an increase in edge density, apart from Burn-Cut and Burn-Cut – Mixed Wood, which had marginal decreases. Additionally, the mean patch edge values show a reduction across all patch vegetation classes, ranging from a 0.01% for Open Bog to 31% for Burn-Cut.

Table 11-26: Edge Metrics for Baseline Conditions and for Affected Vegetation from the Project in RSA

Patch Vegetation Class (ELC)	Baseline Total Edge in RSA (m)	Total Edge with Project in RSA (m)	Gains (+)/Losses (-) (m) in the RSA	Gains (+)/Losses (-) (m) (%) in RSA	Baseline Edge Density in RSA	Edge Density with Project in RSA	Gains (+)/Losses (-) (m) in RSA	Baseline Mean Patch Edge in RSA)	Mean Patch Edge with Project in RSA)	Mean Patch Edge Losses (%)
Burn-Cut	11287	11215	-72	-0.6%	0.1	0.1	-0.23%	1254	863	31.2%
Burn-Cut-Mixedwood	5488	5451	-38	-0.7%	0.0	0.0	-0.28%	1372	1363	0.7%
Conifer Forest	1117623	1136019	18396	1.6%	8.3	8.5	2.06%	3471	3062	11.8%
Conifer Swamp	2866902	2911748	44846	1.6%	21.4	21.8	1.98%	6497	4924	24.2%
Hardwood Forest	25667	26506	839	3.3%	0.2	0.2	3.70%	1974	1893	4.1%
Low Treed Bog	3578666	3604871	26205	0.7%	26.7	27.0	1.15%	3747	3480	7.1%
Mixedwood Forest	49954	50149	195	0.4%	0.4	0.4	0.80%	2379	2090	12.2%
Open Bog	380338	380317	-21	0.0%	2.8	2.9	0.41%	2224	2224	0.01%
Open Shore Fen	242880	242859	-21	0.0%	1.8	1.8	0.40%	1239	1233	0.5%
Open Shore Fen/Thicket Swamp	12961	12918	-43	-0.3%	0.1	0.1	0.08%	4320	4306	0.3%
Open Shore Shrub Fen	308761	308899	139	0.0%	2.3	2.3	0.46%	1625	1568	3.5%
Organic Poor Fen	778745	779069	324	0.0%	5.8	5.8	0.45%	3572	3494	2.2%
Poor Conifer Swamp	2691296	2727503	36207	1.3%	20.1	20.5	1.76%	3208	2914	9.2%
River/Fen (Open/Sparse Treed/Thicket)/Swamp	936426	937757	1332	0.1%	7.0	7.0	0.55%	4417	3957	10.4%
Rock Barren	7277	5724	-1553	-21.3%	0.1	0.0	-21.02%	404	358	11.5%
Sparse Treed Bog	1895071	1907224	12153	0.6%	14.2	14.3	1.06%	3378	3184	5.7%
Sparse Treed Fen	1847490	1863155	15664	0.8%	13.8	14.0	1.26%	3402	3105	8.7%
Thicket Swamp	27726	27160	-566	-2.0%	0.2	0.2	-1.64%	2133	1697	20.4%

Note: *** All Patch analysis has been calculated based on the baseline data collection in the study areas.*

Core Metrics

In addition to the landscape patch classes, a separate set of metrics was calculated for ‘core areas’, which are defined as areas more than 50 m from another patch. Core, or interior, areas are considered to have minimal edge or transitional effects from neighbouring patch or habitat types, resulting in an undisturbed/unaltered representation of patch characteristics. These core areas serve to buffer susceptible species from the potentially negative edge effects of plant or wildlife species populations in adjacent patches. This is particularly important when adjacent patches are disturbed by human induced developments, which can result in increased predation risk, interspecific competition, and/or parasitism (Herse et al., 2018; Pérez-Rodríguez et al., 2018; Ries et al., 2004; Tscharntke et al., 2012). **Table 11-27** below outlines the results of the Core analysis of the affected patches.

Due to the linear nature of the road, a considerable number (404) of existing vegetation patches will be encroached upon and/or bisected (See **Table 11-23**). Of these affected vegetation patches, 256 are large enough to retain a core area when the 50 m-edge buffer is applied. Generally, there is a net gain to the number of core patches across all vegetation classes. For example, Conifer Swamp, Low Treed Bog, and Poor Conifer Swamp exhibit core patch increases of 38, 29, and 27, respectively. These gains are the result of the bisection of larger baseline core areas into smaller areas. The exception to this trend is Rock Barren and Thicket Swamp, each of which lose 1 core patch, due to their naturally small patch sizes within the landscape.

Though the number of core patches will generally increase, there will be considerable losses in Core Area for some patch classifications such as Conifer Swamp (187.75 ha), Conifer Forest (160.36 ha), Poor Conifer Swamp (142.89 ha), Low Treed Bog (91.35 ha), Sparse Treed Fen (50.61), and Sparse Treed Bog (41.53 ha). The remaining classes show decreases in Core Area between 0.0001 and 3.32 ha. These losses represent less than a 10% loss of Mean Core Patch Size for each patch class, with the exception of Thicket Swamp and Rock Barren, which show Mean Core Patch Size gains of 10.9%, and 100%, respectively. These increases in Mean Core Patch Size for the Thicket Swamp, and Rock Barren patch classes, could be misleading due to the loss of an entire core area for each class.

Overall, within the RSA, Core Area losses are small (0.01 and 0.0001 ha, respectively). This leaves the larger core areas intact, which subsequently increases the mean size of the remaining core areas.

Table 11-27: Core Metrics for Baseline Conditions and for Affected Vegetation in RSA

Patch Vegetation Class (ELC)	Baseline No. of Core Patches in RSA	No. of Core Patches with Project in RSA	Gains (+) / Losses (-) In RSA	Baseline Class Core Area in RSA (ha)	Class Core Area with Project in RSA (ha)	Core Area Losses in RSA (ha)	Baseline Mean Core Patch Size in RSA (ha)	Mean Core Patch Size with Project in RSA (ha)	Mean Core Patch Reduction (-)/ Increase (+) In RSA (%)
Conifer Forest	637	654	17	3739.03	3578.67	160.36	5.870	5.472	-6.8%
Conifer Swamp	1530	1568	38	11675.85	11488.10	187.75	9.851	9.060	-8.0%
Hardwood Forest	14	14	0	86.55	83.24	3.32	6.182	5.945	-3.8%
Low Treed Bog	1987	2016	29	12152.69	12061.34	91.35	6.116	5.983	-2.2%
Mixedwood Forest	34	35	1	144.51	141.70	2.81	4.250	4.049	-4.7%
Open Shore Shrub Fen	106	106	0	69.24	69.18	0.07	0.653	0.653	-0.1%
Organic Poor Fen	358	359	1	1082.03	1081.43	0.60	3.022	3.012	-0.3%
Poor Conifer Swamp	1555	1582	27	8798.19	8655.30	142.89	5.658	5.471	-3.3%
River/Fen (Open/Sparse Treed/Thicket)/Swamp	318	319	1	379.50	377.67	1.83	1.193	1.184	-0.8%
Rock Barren	2	1	-1	0.08	0.08	0.0001	0.040	0.079	99.8%**
Sparse Treed Bog**	1008	1020	12	6759.38	6717.85	41.53	6.706	6.586	-1.8%
Sparse Treed Fen	1014	1023	9	3666.53	3615.92	50.61	3.616	3.535	-2.2%
Thicket Swamp**	10	9	-1	3.03	3.02	0.01	0.303	0.336	10.9%**

Note: * All Patch analysis has been calculated based on the data collection study areas for existing conditions.

Note: Although the mean core patch area increases for Sparse Treed Bog and Thicket Swamp, they each also lose one core patch because of their naturally small patch sizes in the RSA.

Landscape Diversity Metrics

When applied at the landscape level, the Shannon Diversity Index provides an estimate of how diverse given vegetation patch classes are within the study area. These diversity and evenness values rise along with the number of classes present and the evenness of their abundance. Generally, when applied to real-world ecological data, the Shannon diversity index's range of values is usually 1.5 – 3.5, and the evenness index from 0.0 to 1.0 (Rain, R. Shannon, 2024). In the diversity index, higher values indicate lower diversity values and in the evenness index, higher numbers indicate higher levels of evenness. As shown in **Table 11-28**, the existing baseline landscape diversity within the RSA is slightly above average, and with the implementation of the Project will result in a 0.09% reduction in both diversity and evenness.

Table 11-28: Shannon's Diversity and Evenness Indexes at the Regional Landscape Level

Project Stage	Shannon's Diversity Index	Shannon's Evenness Index
Baseline Conditions	2.218744	0.640194
Conditions with Project Post Construction	2.216749	0.639619
Change	0.001995 or 0.09%	0.000575 or 0.09%

Note: *All diversity and evenness analysis has been calculated based on the baseline data collection study areas.*

11.3.2.2 Water Crossing Structures

The direct effects related to the installation of bridge and culvert crossings is the loss of all, or part of local riparian vegetation communities and potential changes to surface and groundwater hydrology. There is a potential for watercourses to be altered both upstream and downstream of installed bridges and culverts. The pathways in which loss or harmful alteration of riparian vegetation classes may occur are summarized and described below.

Construction activities → Construction of permanent or temporary structures (culverts and bridges) at waterbody crossings → Direct loss of riparian vegetation.

Construction activities → Construction of permanent or temporary structures (culverts and bridges) at waterbody crossings → Direct losses and alteration of upstream and downstream riparian vegetation.

Construction activities → Construction of permanent or temporary structures (culverts and bridges) at waterbody crossings → Changes to surface and groundwater hydrology→ Indirect losses and alteration of riparian vegetation.

The proposed road will require 31 waterbody crossings, which include 30 watercourses and one lake. To cross the waterbodies, six bridges are proposed to be constructed over major waterbodies, and 25 culverts of various types (e.g., open bottom arch culverts and corrugated steel pipes) are proposed to be placed at minor waterbodies.

Riparian vegetation communities are considered those vegetation assemblages bordering watercourses, lakes and wetlands with open water. The mapping and calculations for riparian areas in the RSA, consisted of delineating riparian zones where visible on aerial maps, and including a standard 30 m buffer in areas, where aerial delineation was not possible. These riparian areas were all classified as "River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)" in earlier tables, yet are composed of small, unmappable units of various vegetation classes. To assess the riparian removals in the road ROW specifically, a detailed assessment of the affected vegetation classes within these riparian zones was conducted using a combination of field observations and detailed aerial imagery.

Using this methodology, it was determined that approximately 16.33 ha of riparian vegetation will be either removed or permanently altered during construction of the road and associated water crossing structures. Of this total, the maximum loss of riparian habitat occurs in the unbuffered River Riparian areas (5.9 ha), followed by Conifer Swamp (4.16 ha), Sparse Treed Fen (1.83 ha), Conifer Forest (1.63), and mapped Lake Riparian (1.18 ha) classes. Potential removals in all other riparian classes are less that 1 ha. These removals represent 0.85% of the available riparian habitat found within the LSA, dropping to 0.17% when extended out to the RSA. **Table 11-29** below provides an accounting of the riparian removals from the construction of water crossing structures as well as the totals by vegetation class.

Due to the variability of aquatic, hydrological and geomorphological process at water crossings, there is no definitive estimate as to the extent to which extended indirect effects (e.g., changes to hydrologic flows, invasive species sedimentation) may occur. It is assumed that major effects will occur near the water crossing structure with decreasing severity further from the structure. For the purposes of this assessment, as per the findings of a study by Caitlin et.al. (2022), we have assumed that higher impact effects may occur within 20 m and moderate impact effects up to 60 m. We have also assumed that some minimal effects may occur up to 250 m from the Project. The potential impacts and extent estimates related to these pathways are discussed further in **Sections 11.3.2.3.1** to **11.3.2.3.8** (Loss or Alteration of Vegetation Communities, Species and Biodiversity).

Table 11-29: Riparian Area Losses within LSA and RSA

Riparian Vegetation Classes within Estimated Riparian Areas	Riparian Area Removals/Alteration by Vegetation Class (ha)	Estimated Riparian Areas in LSA (ha)	% Loss of or alteration of Riparian Habitat in LSA	Estimated Riparian Areas in RSA (ha)	% Loss or alteration of Riparian Habitat in RSA
Burn/Cut	0.01	8.56	0.12%	37.61	0.03%
Conifer Forest	1.63	202.17	0.81%	1023.16	0.16%
Mixedwood Forest	No Removals	15.41	N/A	45.08	N/A
Hardwood Forest	0.03	3.35	0.90%	27.37	0.11%
Conifer Swamp	4.16	303.44	1.37%	1354.19	0.31%
Poor Conifer Swamp	0.64	143.35	0.45%	838.31	0.08%
Hardwood Swamp	No Removals	0.55	N/A	0.55	N/A
Developed/Disturbed	0.05	4.37	1.14%	22.64	0.22%
Mapped Lake Riparian*	1.18	300.59	0.39%	1432.24	0.08%
Mapped River Riparian*	5.97	551.92	1.08%	2957.89	0.20%
Low Treed Bog	0.79	99.66	0.79%	560.40	0.14%
Sparse Treed Bog	0.04	65.08	0.06%	275.12	0.01%
Open Bog	No Removals	8.28	N/A	43.63	N/A
Sparse Treed Fen	1.83	170.28	1.07%	702.93	0.26%
Organic Poor Fen	No Removals	51.57	N/A	209.01	N/A

Riparian Vegetation Classes within Estimated Riparian Areas	Riparian Area Removals/Alteration by Vegetation Class (ha)	Estimated Riparian Areas in LSA (ha)	% Loss of or alteration of Riparian Habitat in LSA	Estimated Riparian Areas in RSA (ha)	% Loss or alteration of Riparian Habitat in RSA
Rock Barren	No Removals	0.31	N/A	0.38	N/A
Totals	**16.33**	**1928.88**	**0.85%**	**9530.51**	**0.17%**

Note: N/A indicates that no removals are anticipated (i.e., 0% loss or change).

11.3.2.3 Indirect Effect Pathways on Vegetation and Wetlands

The following sections outline the indirect pathways that can lead to losses or alteration of vegetation species, communities and diversity during the construction and operations of the Project. Though less obvious and more difficult to quantify, indirect effect pathways can often have more widespread and long-lasting impacts on vegetation than direct effect pathways (Coffin, 2007; Didham et al., 1998; Forman and Alexander, 1998; Laurance et al., 2009; Trombulak & Frissell, 2000).

The following pathways summarize the indirect effects on vegetation and wetlands that may as result of the Project:

Construction and operation → Grading and soil disturbance → Alterations to local topography and drainage patterns → Reduction in soil quantity and quality through changes to physical, chemical or biological properties of soil → Increase of erosion and sedimentation → Potential impacts to vegetation growth, survival, composition and distribution beyond the vegetation removal limits.

Construction and operation → Introduction of invasive species → Spread of invasive species through improper cleaning of machinery or use of non-local soil supplies → Localized growth of invasive species → Changes in local community vegetative composition.

Construction and operation → Chemical or hazardous material spills and waste → Contact with water, soil and/or vegetation→ Direct vegetation losses or alterations to soil pH, soil nutrient levels and water quality → Potential impacts to growth, survival, composition and distribution beyond the vegetation removal limits.

Construction and operation → Air and dust emissions and subsequent deposition → Smothering of vegetation or alterations to soil composition and water quality → Potential impacts to growth, survival, composition and distribution beyond the vegetation removal limits.

Construction and operations → Increased temperature and the availability of light, in the vicinity of the roadway resulting from changes in canopy/shade conditions → Alterations in plant community composition and diversity within and near the ROW.

Construction and operations → Increased, access-related human fire ignition and increased fuel supply conditions → Potential for increased fires in the Project area → Alteration of natural ecosystem processes and intensification of climate change through a disruption of carbon cycling and storage.

11.3.2.3.1 Grading and Soil Disturbance

Grading and other construction activities may result in changes to local topography and drainage patterns, which may reduce soil and water quantity and quality through changes to their physical, chemical or biological properties (Shuldiner et al., 1979; Brown, 1980; Rahbarisisakht et al., 2021). Consequently, this may lead to impacts to vegetation growth, survival, composition and distribution beyond the vegetation removal limits.

Losses to soil quality and quantity from grading and soil disturbance can be caused by compaction, erosion, and chemical contamination of soils. As soil quality deteriorates, its capacity to hold water, sustain plant life, and recycle nutrients is impaired, resulting in ongoing soil loss due to erosion (El-Ramady, et al, 2014; Lal, 2015). The eroded sediments can then end up washing into ditches and other watercourses, leading to changes in soil and vegetation community composition downstream (Bilby, 1989).

Compaction of soils can further lead to impacts on soil densities, soil permeability, rates of infiltration, soil erosion and soil moisture, all which can affect individual plants or whole vegetation communities. Areas most prone to compaction are low lying, poorly drained areas, which represent 80.29% of the study area, and that exhibit saturated or near saturated soils. When compacted, these soils have limited permeability and drainage capacity and may inhibit and/or block drainage passages and groundwater flows. This can result in raising the upslope water table and causing vegetation mortality through root inundation, while at the same time decreasing the water table downslope, resulting in further damage to vegetation (Stoeckeler,1965; Swanson et.al., 1988). In most cases, these effects will likely be localized to the margins of the proposed roadway and the support facilities (Forman and Alexander, 1998; Rahbarisisakht et al., 2021).

Changes to drainage patterns through grading can lead to increases in flooding or drying of vegetation communities (Stoeckeler, 1965; Shuldiner et al., 1979; Walker et al., 1987). Prolonged flooding or drying eliminates some plant species while favouring others because of changes in soil oxygen levels, nutrients, and the abilities of different species to tolerate saturated or dry soil conditions (Casanova and Brock, 2000). This can lead to changes in vegetation community composition and biodiversity.

Assessing how far the effects of grading extend from areas of active soil disturbance to nearby vegetation is complex due to numerous influencing factors (Neher et al., 2013). However, a study by Willier et al. (2022) provided valuable insights by investigating the extent and impact of edge effects on woody vegetation along roads that cut through treed peatlands in Alberta's Boreal Plains ecozone. The study utilized airborne laser scanning technologies and GIS systems to analyze 22 poor fens and 26 rich fens and to estimate the extent that changes in the flow of surface and subsurface water, resulting from the bisection of these features by roads. They concluded that the edge effects studied (flooding and drying), in road-bisected fens produced pronounced differences in canopy cover within 100 to 250 m of road edges in both rich and poor treed fens. The scale of edge effects due to changes in hydrology observed in the study, which included alterations in canopy cover of up to 40%, are also likely to affect tree and shrub structure, and understory composition.

For the purposes of this assessment, we have assumed the highest magnitude of effects on vegetation loss and alteration from soil disturbance and changes in hydrology would be within 20 m of the road edge, with moderate to high effects up to 40 m, moderate effects at 60 m, and minimal effects up to 250 m, as per Caitlin et.al. (2022).

Overall, it is expected that the alterations to drainage patterns and associated surface and groundwater flows from grading and other construction activities will have a limited, localized (< 250 m) effect on general vegetation community diversity. The primary effects will likely be localized to areas adjacent to the roadway or Project facilities and will likely only affect those portions of the adjacent vegetation patches in proximity to these areas.

11.3.2.3.2 Introduction of Invasive Species

Construction and operation activities for the Project have the potential to introduce non-native invasive plant species into the study area, where they are currently absent. Equipment and personnel involved in construction and operations may transport seeds or plant parts on their equipment or clothing, potentially spreading invasive species to new locations (Boivin et al., 2008; Hansen and Clevenger, 2005; Lonsdale and Lane, 1994). The introduction of these species can disrupt plant communities and decrease habitat quality by affecting plant community structure and species diversity through competition and alterations to soil microorganisms, nutrients, and soil moisture (Mack et al. 2000; Carlson and Shepherd 2007; Truscott et al. 2005; Rentch et al., 2005).

The construction of roads, and linear features in general, produce edge environments that can influence adjacent interior habitat by allowing for increased light infiltration, alteration of temperature regimes, increased exposure to chemicals and increased dust and trash, thus altering the naturally occurring biophysical conditions of these areas and increasing the competitiveness of invasive species (Emma, 2015, Findlay and Bourdages, 2000; James and Stuart-Smith, 2000; Laurance, 2000; Laurance et al., 2007; Dubé et al., 2011). In these ways, roads are well known to be vectors for the spread of invasive plants, particularly in nutrient poor environments, which can increase pH and nutrient levels near the road, and result in edge conditions more suited to invasive species (Jodoin et al., 2008; Johnston and Johnston, 2004; Müllerová et al., 2011; Panetta and Hopkins, 1991; Schmidt, 1989).

The distance that invasive species can penetrate beyond the immediate area of the disturbed road edge is variable, and dependent on the conditions present in the surrounding vegetation (Wilcox, 1989). However, this distance is the key to understanding the magnitude of these effects on the overall health and diversity of local or regional vegetation communities. To derive estimates of the potential effect zones affected by invasive species, several studies in similar environments were reviewed.

Studies conducted by Wolf and Croft (2014) determined that data trends showed that road effects on species composition primarily occur from 15 m to 50 m from the road edge. Arevalo et al. (2008) determined that the pattern of plant species richness was shown to rapidly stabilize towards the interior (> 10 m) of vegetation patches. Another study on road effects by McDonald and Urban (2006) indicated that marked differences in vegetation species composition between forest edges and the interior spaces only penetrated approximately 5 m into the forest.

A study by Buss et.al., (2023), comparing edge effects of well pads and industrial roads on mixed upland boreal forest vegetation in Alberta found that understory species richness was lower at the disturbance edge and was dominated by introduced species and species with lighter seeds and with medium-distance dispersal mechanisms. Disturbance edges were characterized as having higher soil moisture content, higher soil temperature, and a thinner organic matter layer compared to the forest interior (> 10 m). They concluded that alterations in soil moisture, temperature, organic matter depth or vegetation community composition was likely a driver for introduced species at disturbance edges (< 10 m).

Given the variability of vegetation communities within the study area, it is challenging to precisely estimate the impact of invasive species. However, based on the referenced studies, it is assumed that the most pronounced effects will occur in close proximity to the road ROW, with decreasing severity as distance increases. By extrapolating the findings of these studies to the vegetation communities within the Project Footprint, it is estimated that the greatest impact on vegetation community diversity will occur within 20 meters of the road ROW and other supportive infrastructure areas, moderate effects within

40 meters, and minimal effects at 60 meters similar to **Section 11.3.2.3.1** (Grading and Soil Disturbance). Preventing the introduction of invasive species is often more efficient and cost-effective than their removal once established, and this will be the primary focus of the mitigation efforts to address their potential introduction in the study area (Panetta and Hopkins, 1991).

11.3.2.3.3 Chemical or Hazardous Material Spills and Waste

When introduced to natural ecosystems, chemical or hazardous spills (e.g., petroleum products) from vehicles and equipment, or improper storage and handling of waste, can affect soil quality and in turn effect upland, wetland, and riparian ecosystems. Direct contact of spills on plants (e.g., SAR, SOCC, species of traditional use) can also result in injury or mortality and the growth and health of Plant SAR, plant SOCC and traditional use plants. Consequently, spills can adversely influence the landscape, affecting plant health, diversity and community composition. Studies on the effects of road development on the environment have determined that these projects have the potential to alter the surrounding chemical environment through direct and indirect modifications of the chemical properties in both water and soil (Müllerová et.al., 2011). These can include alterations to soil pH, soil nutrient levels and groundwater quality.

There have been many studies related to impacts from the release of chemical or hazardous material spills from roadsides associated with vehicles and equipment, but the impacts of the materials used in road construction have seen few investigations on potential impacts to the environment. The impact of road materials can be markedly profound if alkaline gravel is utilized for road construction in largely nutrient-poor environments dominated by stress tolerant plants (Hill and Pickering, 2006). The use of these types of materials can increase local soil pH and increase the rate of organic matter breakdown. They can also increase the availability of the basic nutrient cations such as Calcium and Magnesium, raise the solubility of Molybdenum and Phosphorus and elevate the quantity of Nitrates- in the soil (Bertrand et al., 2007; Bolan et al., 2003; Schimel et al., 1996;). Potential alterations in soil conditions can also enable the establishment of more competitive, frequently non-native species (Dulière et al., 1999; Hobbs and Huenneke, 1992; Chapin, 1987). The direct vegetative responses to unnaturally elevated pH in soil substrates may be faint (Mackun et al., 1994), but studies have shown that acidophilic vegetation is negatively influenced over longer time periods (Calvo-Polanco et al., 2017; Zinko et al., 2006). Based on the conclusions of the above noted studies, there is potential for Project-related substrate changes that may affect soil quality such as a reduced organic horizon, higher bulk density, increased nutrient availability and increased pH levels in sites near the road.

The potential chemical changes to soil quality due to road construction and operations activities, and specifically spills are predicted to be limited and localized within the ROW and near the Project Footprint, similar to the identified effect zones of invasive species (**Section 11.3.2.3.2**: Introduction of Invasive Species). These effect zones may be expanded in areas where waterbodies act as vectors of further spread, such as near stream crossings (Forman and Deblinger, 2000). Overall, the magnitude of the effect of roads on soil chemistry and corresponding vegetation community composition is determined by proximity from the road, the microtopography within the ROW, traffic volume and the area cleared for the ROW (Neher et al., 2013).

11.3.2.3.4 Dust and Air Emissions, and Subsequent Deposition

Construction and operation of the Project is predicted to generate air and dust emissions such as carbon monoxide (CO), oxides of sulphur (SOx), including sulphur dioxide (SO_2), oxides of nitrogen (NOx), particulate matter (e.g., $PM_{2.5}$) and total suspended particulate matter (Thorpe and Harrison, 2008). Air emissions such as SOx and NOx will result from the use of fossil fuels in generators, vehicles, and equipment during the Project’s lifespan. Air emission, and subsequent deposition, can affect upland, riparian and wetland ecosystems through changes to soil quality by altering soil pH, nutrient content and soil composition (Viskari et al., 2000). Changes to soil from atmospheric inputs are determined by several complex geochemical factors, which include nutrient uptake by plants, decomposition of vegetation, cation and anion exchange in soil, soil sensitivity to acidification and duration and quantity of atmospheric inputs (Živkovic et al., 2017); Jung et al. 2011; Bunn et al. 2007; Turchenek et al., 1998).

Accumulation of dust produced from the Project may result in localized changes to vegetation in the LSA. Dust resulting from the disturbance, transport and stockpiling of earth materials and vehicle and equipment movement on the road during construction and operations have the potential to affect vegetation through direct interaction (e.g., smothering over time), and/or transport of harmful chemicals or nutrients which alter soil and water conditions (Forman and Alexander, 1998). Dust that falls on plants could directly damage vegetation and lead to death, and/or may alter the chemical composition of soils, nutrient availability, and pH affecting local vegetative growth, and community composition (Santelman and Gorham, 1988; Angold, 1997). Direct effects of dust deposition are predicted to be localized to areas adjacent to the roadway (approximately 10 to 20 m), apart from watercourse locations where potential dispersal extents would be significantly larger (up to 200 m) depending on the watercourse characteristics (Angnold, 1997; Bunn et al., 2007). The chemical transport capacity of dust is directly related to the quantity of sediment released from the road and surrounding soils which is in turn dependant on sediment supply and transport capability (Anderson and Simons, 1983). Sediment quantities are determined by road geometry, soil exposure, slope, length, width, surface area, and maintenance procedures (Shaheen, 1975; Anderson and Simons, 1983; Grayson et.al., 1993; Zhou et al., 2019; Rahbarisisakhat et al., 2021), as well as soil properties and adjacent vegetation composition (Horner and Mar, 1983). Rates of dust deposition and accumulation are dependent on the rate of supply from the source, wind speed, precipitation events, topography and vegetation cover (Rusek and Marshall, 2000; Zechmeister et al., 2005).

A study conducted on a tundra ecosystem adjacent to the Dalton Highway in northern Alaska (Auerbach et.al., 1997) with a gravel surfaced highway that been operational for 15 years and subject to persistent road traffic and dust disturbance found that the indirect effects of dust (i.e., alteration of soil chemical composition) on vegetation were more notable in acidic tundra soils. In low pH areas they found that the soils adjacent (~2 m) to the road had lower nutrient levels, altered organic horizon depth, higher bulk density, and lower moisture. Most taxa vegetation biomass was found to be reduced near the road at both sites showing a reduction of ~80% adjacent to the roadway at distances of 5 m vs 100 m from the road in acidic sites and ~ 50% at non-acidic sites. Species richness in acidic tundra next to the road was less than half of that at 100 m away from the road. It was also noted that community structure was altered most noticeably in acidic tundra, with Sphagnum mosses, dominant in acidic low arctic tussock tundra, virtually eliminated near the road.

The findings from studies by others are consistent with the modelling results and conclusions of the Project Team found in Section 9 (Assessment of Effects on the Atmospheric Environment) and Appendix G (Air Quality Impact Assessment Report). During construction, the results of the modelling indicate a maximum dust deposition value of 12 g/m^2 over 30-days at 50 m distance from the road centre line without dust control (water trucks) and 10 g/m^2 over 30-days with controls. These values represent 166% and 143% respectively of the provincial ambient air quality criteria (AAQC). Given the depletion effects, dust surficial concentration on ground decreases beyond 50 m from the road centerline is predicted to reach a maximum 5.4 g/m^2 (including background) at 150 m distance from the road which is lower than the 7.0 g/m^2 AAQC limit value. These values drop dramatically during operations to 4.3 g/m^2 (61% of the AAQC) over 30-days at 50 m of the road centerline decreasing systematically outside 50 m reaching at maximum, 3.7 g/m^2 at 150 m distance.

Therefore, we have predicted that potential effects from dust that may result in the alteration or loss of vegetation will occur up to 50 m from the road centerline, with moderate and minor effects occurring at distances up 100 and 150 m respectively.

11.3.2.3.5 Changes to Microclimate Conditions

It is expected that there will be some localized alterations in microclimate conditions during construction and operations of the Project, such as increased temperature and the availability of light, in the vicinity of the roadway resulting from changes in canopy/shade conditions due to removals (Chen et al., 1992, 1993; Gill et al, 2008). These microclimate changes may influence plant community diversity within the ROW and near road. They can also influence the rate of peat accumulation and decomposition (Holmquist et al., 2007; Laiho, 2006).

Increased light infiltration and altered temperature regimes have been found to detrimentally alter the biophysical conditions required by sensitive interior native plant species and increase the competitiveness of exotic species (Bocking, 2015; Findlay & Bourdages, 2000; James & Stuart-Smith, 2000; Laurance, 2000; Laurance et al., 2007; Dubé et al., 2011). These deviations in temperature and light, as well as changes to wind speed and humidity at the forest edge affect vegetation as well as adjacent vegetation assemblages (Spellerberg, 1998).

A study by Garcia et al. (2007) showed that the vegetation and microclimate change abruptly within the first 5-10 m of the forest-road edges, leaving the interior spaces undisturbed. However, a similar study by Ewers and Banks-Leite (2013) showed that changes in temperature near forest edges extended up to 20 m inside the forest.

Therefore, we have conservatively predicted that microclimate effects may result in vegetation alteration or loss within 10 m of the road ROW limits, moderate effects within 20 m and minimal effects at 50 m.

11.3.2.3.6 Increased Risk of Fire

Wildfires are a normal and necessary component of natural forest ecosystems in the study area. That said, excessive wildfire occurrences, specifically wildfires resulting from human activities, can upset natural ecosystem processes and intensify the rate of climate change through a disruption of carbon cycling and storage (Kuklina et.al., 2023, Mack et al. 2011; Pan et al. 2011; Gibson et al. 2018; Chen et al. 2021a,b). Key environmental elements affecting the frequency, configuration and intensity of wildfires include the local landform structure, fuel combustibility and availability, vegetation classes, overall climatic and weather conditions (e.g., wind), as well as the frequency and likelihood of natural and human sources of ignition (Hessl, 2011, Hessl et al., 2004, Kernan and Hessl, 2010, Kellogg et al., 2008, Lutz et al., 2009, Perry et al., 2011, Syphard et al., 2008). A number of studies have shown that fires originating from human activities are typically found in close proximity to human infrastructure such as roads, resource extraction, and settlements (Brosofske et.al., 2007; Maingi and Henry, 2007; Syphard et al., 2007; 2008; 2009; Vega Garcia et.al.,1995; Yang et.al., 2007, 2008).

The initiation of human caused wildfires can be either deliberate or accidental. A number of human activities, such as the discard of unextinguished cigarette butts, the incomplete burning of carbon particles from automobile exhaust pipes, vehicle accidents, improperly managed and extinguished campfires, controlled burns that get out of control, and house/campfires due to insufficient heating or electrical systems, can result in wildfires given the correct environmental conditions such as droughts and adequate fuel supply. It is well established that road edges can support and act as corridors to propagate the spread of invasive plant species (Parendes and Jones, 2000; Trombulak and Frissell, 2000, Spellerberg, 1998; Saunders and Hobbs, 1991; Stoner & Adams, 2004). These species are often more combustible resulting in a fuel source that is more prone to ignition than interior native species

(Arienti et al., 2009; D'Antonio and Vitousek, 1992), contributing to an increased probability of human and natural ignitions in the vicinity of roadways (Arienti et al., 2009; Syphard et al., 2007, 2008; Yang et al., 2007, 2008). In forested areas, wind induced mortality of trees in forest edges, along with temperature and humidity alterations, can influence the availability of fuels and fuel combustibility (Chen et. al., 1992, 1993). A study on the influence of forest roads on human- and lightning-caused wildfire ignitions found that human-caused ignitions were concentrated close to roads, in high road density, and in developed areas (Narayanaraj and Wimberly, 2012). In contrast, lightning-caused ignitions were concentrated in low road density areas, away from urban areas. The study also found that though a high percentage of minor fires occurred in areas with greater road densities, these fires only made up a minor ratio of the overall burned area.

There are assertions in some studies that roads may minimize the spread of fires by serving as fire breaks and allowing quicker access for fire suppression activities (Price & Bradstock, 2010; Narayanaraj & Wimberly, 2011). However, this potential positive effect is counteracted by increased access-related human fire ignition and increased fuel supply conditions (Syphard et al., 2007).

Due to the unpredictable nature of fires, there is no way to accurately quantify the distance from the Project that this effect pathway may affect local vegetation. Therefore, we have predicted a distance of approximately 250 m, in keeping with the farthest distance used in assessing the other indirect effect pathways.

11.3.2.3.7 Indirect Road Edge Effect Zones for Community and Species Diversity and Composition

As discussed in the previous sections, the distance these effect pathways could potentially penetrate into the natural environment beyond the road edge varies depending on the source volumes (e.g., exhaust fumes, leaks / spills, etc.), the movement vector (air, dust, topography, waterbody), and the vegetation class found next to the roadway. The predicted 'Road Edge Effect Zone' for the Project is based on the literature reviews of the effects pathways discussed above and is presented in **Table 11-30** below. For pathways where the literature was not as clear on the 'Road Edge Effect Zone', the most conservative effect zones were used.

Table 11-30: Indirect Road Edge Effect Zones to Community/Species Diversity and Composition

Effect Pathway	Potential High Effect Zone (m)	Potential Moderate Effect Zone (m)	Potential Low Effect Zone (m)
Grading and soil disturbance	20	60	250
Introduction of invasive species	20	40	250
Chemical or hazardous material soils and waste	20	60	250
Dust and air emissions, and subsequent deposition	20	60	200
Microclimate Alterations	20	60	250
Increased Risk of Fires	20	60	250

As noted in earlier sections, the distance from the road edge that these effects extend is also dependent on the characteristics of the adjacent vegetation classes. The studies conducted in the Canadian boreal upland forests, found that edge effects do not typically extend past 60 m (Dabros and Higgins 2023; Echiverri et al. 2022; Harper et al. 2015; Brown, 1980). Therefore, in upland forested areas proposed values of 20 m, 40 m, 60 m and 250 m were used to assess indirect effects in upland forested areas within the study area. However, the open vegetation classes within the study area are almost exclusively wetland environments. There is agreement throughout the studies reviewed that most localized effects to wetlands will occur within close proximity to the road. That said, both windblown and waterborne effects have a potential to extend further into vegetation classes. Therefore, for wetlands the proposed impact zone distances of 20 m, 40 m, 60 m, and 250 m from the road were used, as presented in **Table 11-31**.

Table 11-31: Road Edge Indirect Effect Zones by Broad Vegetation Type

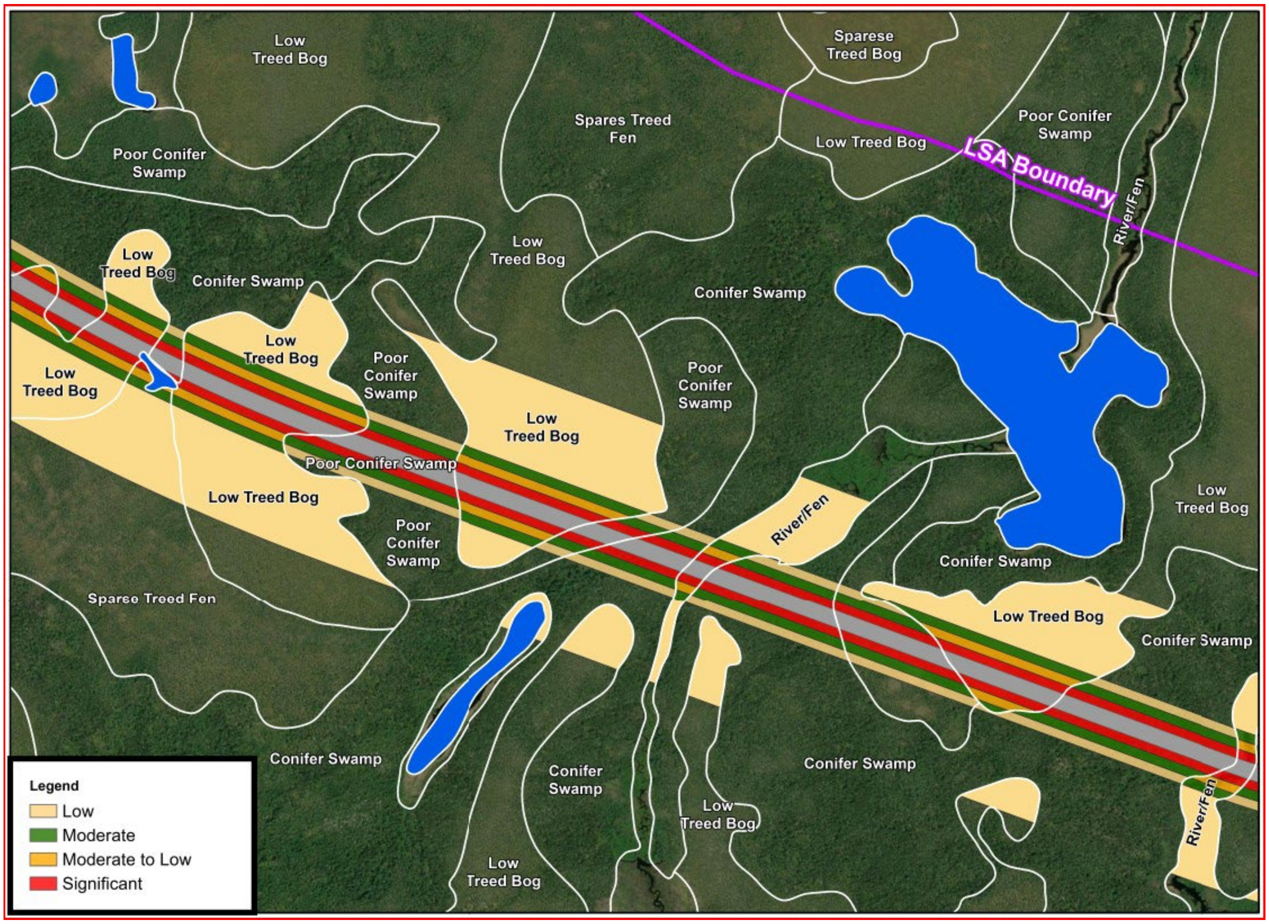
Vegetation Form	Potential High Effect Zone (m)	Potential Moderate Effect Zone (m)	Potential Moderate to Low Effect Zone (m)	Potential Low Effect Zone (m)
Upland/Forested Swamp Wetlands	20	40	N/A	60
Open Wetland	20	40	60	250

Note: for open wetlands an additional zone (Moderate to Low) has been added to capture increased transport potential.

11.3.2.3.8 Indirect Effects to Community/Species Diversity and Composition

When the above generalized, localized effect zone assumptions are applied to the landscape found within the study area, it was found that an asymmetric area with convoluted boundaries outlined the estimated limits of potential negative effects. These boundaries generally reflect the sequence of unequal effect-distances for ecological and geophysical variables from which the quantitative estimates were derived as illustrated in **Figure 11.9**.

Figure 11.9: Example of Variable Estimated Road Edge Effect Zone of Potential Indirect Effects



As a result, is it predicted that approximately 464.9 ha of various vegetation classes, adjacent to the roadway and associated infrastructure, could be subject to indirect effects within the LSA and RSA. These areas represent approximately 1.6% of the LSA and 0.3% of the RSA. The remaining effect zones affect similar percentages of the vegetation classes found within the LSA and RSA (i.e., potential Moderate effects 0.6% and 0.3%, Moderate to Low of 1.6% and 0.3%, and Low of 7% and 2%). A breakdown of these affected areas by vegetation class, and percentage of the available area of the respective classes within both the LSA and broader RSA can be found in **Table 11-32**.

Table 11-32: Potential Areas of Indirect Effects by Vegetation Class

Vegetation Class	Area Potentially Affected in LSA (ha)	Area Available in LSA (ha)	% of Available Vegetation Class in LSA	Area Available in RSA (ha)	% of Available Vegetation Class in RSA
Potential Areas of High Indirect Effects					
Burn-Cut	0.7	32.2	2.3%	38.3	2.0%
Burn-Cut-Mixedwood	0.6	31.0	2.0%	31.0	2.0%
Conifer Forest	66.2	1706.9	3.9%	8281.4	0.8%

Vegetation Class	Area Potentially Affected in LSA (ha)	Area Available in LSA (ha)	% of Available Vegetation Class in LSA	Area Available in RSA (ha)	% of Available Vegetation Class in RSA
Conifer Swamp	131.6	4970.1	2.6%	22752.6	0.6%
Developed/Disturbed	3.0	84.6	3.6%	187.2	1.6%
Hardwood Forest	1.8	45.3	4.0%	189.6	1.0%
Low Treed Bog	72.6	4134.4	1.8%	26156.9	0.3%
Mixedwood Forest	1.8	125.7	1.4%	344.0	0.5%
Open Bog	0.1	73.8	0.1%	2478.2	0.004%
Open Shore Fen	0.5	63.4	0.8%	536.2	0.1%
Open Shore Fen/Thicket Swamp	0.1	12.9	0.5%	34.9	0.2%
Open Shore Shrub Fen	1.5	148.0	1.0%	730.2	0.2%
Organic Poor Fen	1.7	336.0	0.5%	3535.4	0.05%
Poor Conifer Swamp	94.9	3261.4	2.9%	18496.6	0.5%
River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)	7.6	432.7	1.8%	2717.5	0.3%
Rock Barren	0.5	9.0	5.4%	13.4	3.6%
Sparse Treed Bog	33.1	1986.2	1.7%	13832.4	0.2%
Sparse Treed Fen	45.5	2221.1	2.0%	10119.7	0.4%
Thicket Swamp	1.0	36.8	2.8%	55.7	1.9%
Potential Areas of Moderate Indirect Effects					
Burn Low/Sparse Treed Bog/Fen	0.01	7.4	0.2%	16.6	0.1%
Low Treed Bog	75.1	4134.4	1.8%	26156.9	0.3%
Open Bog	0.28	73.8	0.4%	2478.2	0.01%
Open Shore Fen	0.46	63.4	0.7%	536.2	0.1%
Open Shore Fen/Thicket Swamp	0.12	12.9	0.9%	34.9	0.3%
Open Shore Shrub Fen	1.7	148.0	1.2%	730.2	0.2%
Organic Poor Fen	1.9	336.0	0.6%	3535.4	0.1%
River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)	7.7	432.7	1.8%	2717.5	0.3%
Sparse Treed Bog	32.8	1986.2	1.7%	13832.4	0.2%
Sparse Treed Fen	44.5	2221.1	2.0%	10119.7	0.4%
Thicket Swamp	1.1	36.8	2.9%	55.7	2%
Potential Areas of Moderate to Low Indirect Effects					
Burn-Cut	1.0	32.2	3.0%	38.3	3%
Burn-Cut-Mixedwood	0.64	31.0	2.1%	31.0	2%
Burn Low/Sparse Treed Bog/Fen	0.07	7.4	0.9%	4.8	1%

Vegetation Class	Area Potentially Affected in LSA (ha)	Area Available in LSA (ha)	% of Available Vegetation Class in LSA	Area Available in RSA (ha)	% of Available Vegetation Class in RSA
Conifer Forest	64.0	1706.9	3.8%	8281.4	1%
Conifer Swamp	130.0	4970.1	2.6%	22752.6	1%
Developed/Disturbed	2.2	84.6	2.6%	187.2	1%
Hardwood Forest	1.7	45.3	3.7%	189.6	1%
Low Treed Bog	76.4	4134.4	1.8%	26156.9	0.3%
Mixedwood Forest	1.9	125.7	1.5%	344.0	1%
Open Bog	0.61	73.8	0.8%	2478.2	0.02%
Open Shore Fen	0.40	63.4	0.6%	536.2	0.1%
Open Shore Fen/Thicket Swamp	0.20	12.9	1.5%	34.9	1%
Open Shore Shrub Fen	2.1	148.0	1.4%	730.2	0.3%
Organic Poor Fen	2.8	336.0	0.8%	4.6	60%
Poor Conifer Swamp	95.1	3261.4	2.9%	3535.4	3%
River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)	7.7	432.7	1.8%	2717.5	0.3%
Rock Barren	0.47	9.0	5.3%	13.4	4%
Sparse Treed Bog	31.6	1986.2	1.6%	13832.4	0.2%
Sparse Treed Fen	45.3	2221.1	2.0%	10119.7	0.4%
Thicket Swamp	1.2	36.8	3.4%	55.7	2%
Potential Areas of Low Indirect Effects					
Burn-Cut	1.0	32.2	3%	38.3	3%
Burn-Cut-Mixedwood	0.60	31.0	2%	31.0	2%
Burn Low/Sparse Treed Bog/Fen	2.5	7.4	33%	16.6	15%
Burn/Shrubland	0.035	9.8	0.4%	151.9	0.02%
Conifer Forest	59.7	1706.9	3%	8281.4	1%
Conifer Swamp	127.3	4970.1	3%	22752.6	1%
Developed/Disturbed	1.8	84.6	2%	187.2	1%
Hardwood Forest	1.6	45.3	3%	189.6	1%
Low Treed Bog	804.1	4134.4	19%	26156.9	3%
Meadow Marsh	0.54	0.6	95%	1.0	56%
Mixedwood Forest	2.2	125.7	2%	344.0	1%
Open Bog	4.5	73.8	6%	2478.2	0.2%
Open Shore Fen	10.4	63.4	16%	536.2	2%
Open Shore Fen/Thicket Swamp	4.1	12.9	32%	34.9	12%

Vegetation Class	Area Potentially Affected in LSA (ha)	Area Available in LSA (ha)	% of Available Vegetation Class in LSA	Area Available in RSA (ha)	% of Available Vegetation Class in RSA
Open Shore Shrub Fen	24.8	148.0	17%	730.2	3%
Organic Poor Fen	42.9	336.0	13%	3535.4	1%
Poor Conifer Swamp	95.9	3261.4	3%	18496.6	1%
River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)	100.5	432.7	23%	2717.5	4%
Rock Barren	0.38	9.0	4%	13.4	3%
Sparse Treed Bog	277.7	1986.2	14%	13832.4	2%
Sparse Treed Fen	463.6	2221.1	21%	10119.7	5%
Thicket Swamp	8.0	36.8	22%	55.7	14%

11.3.2.4 Summary of Threat Assessment

From the assessment of the effects on, or threat to, existing vegetation and wetlands in the study area, it is estimated that permanent removals as result of the Project are well under 10% of the available habitat within the LSA and RSA. This results in a relatively small scope and slight severity of effects according to the metrics for characterization of effects as supplied in the TISG. The exception is Rock Barren which has removals that constitute 37% of the Rock Barren patches identified in the RSA. These elevated effects could be the result of the mosaiced nature of the Rock Barren sites within the landscape, and the small size (less than mappable scales for ELC), typically observed for this vegetation class. Irreversibility of the effect is high, and the magnitude and degree of effects are low and medium, respectively. The definition of the criteria used to characterize the effects of: Scope, Severity, Irreversibility (Permanence), Magnitude, and Degree were previously described in **Section 11.3.1** (Threat Assessment Approach) and the results of the assessment are presented in **Table 11-33**.

Table 11-33: Vegetation Community/Diversity Loss Threat Assessment Prior to Application of Mitigation

Effect	Scope	Severity	Irreversibility	Magnitude	Degree
Characterization of Loss or Alteration of Vegetation Communities, Species and Diversity	**Small** – Total vegetation losses represent 2% of the LSA and 0.16 % of the RSA. The majority of the individual vegetation class losses and potential losses due to direct or significant indirect effects represent less than 6.5% of the respective availability of these classes within the LSA, and less than one percent of both the LSA and RSA as a whole (see **Table 11-20** and **Table 11-21**). The exception is Rock Barren which has removals that constitute 37% of the Rock Barren patches identified in the RSA. These elevated effects could be the result of the mosaiced nature of the Rock Barren sites within the landscape, and the small size (less than mappable scales for ELC), typically observed for this vegetation class.	**Slight** – Within the scope, the effect is likely to only slightly degrade/reduce the valued component or reduce its availability within the LSA and RSA by 1% – 10% within ten years or three generations.	**Very High** – The effects of direct losses cannot be reversed in the majority of the project footprint, in areas with the potential for restoration within peatlands it is very unlikely the valued component can be restored, and/or it would take more than 100 years to achieve this (e.g., areas where peatlands are bisected by the road)	**Low** – Slight Severity + Small Scope	**Medium** – Low Magnitude + Very High Irreversibility

11.3.3 Loss or Alteration of Wetland Function

Road construction can disrupt the geophysical, biophysical, and socio-economic functions of wetlands, leading to long-lasting ecological and human-related consequences. In general, the pathways leading to direct and indirect effects on wetland functions are equivalent to those discussed in **Section 11.3.1** (Threat Assessment Approach) and include clearing and grubbing; grading and soil disturbance activities; installation of new water crossing structures; introduction of invasive species; chemical and hazardous material spills; and dust and air emission and subsequent depositions. These effect pathways can also lead to loss or alteration of wetland functions by disrupting hydrological processes; causing habitat fragmentation; changing microclimatic conditions; increased risk of fire; altering soil chemistry and composition; and disrupting species movement or vegetation succession.

Indigenous community members requested that the environmental assessment for the Project to reflect the particular nature, uniqueness, functions, and significance of muskeg. Sections 11.3.3 (Loss or Alteration of Wetland Function) and 11.7.2 (Loss or Alteration of Wetland Function) include a Wetlands Function Assessment in context to the Local Study Area and Regional Study Area for the Project.

The following sections outline the results of the qualitative assessment and quantitative modelling on the potential effects to wetland functions due to the construction and operations of the Project.

11.3.3.1 Geophysical Function

Construction and operations → Grading and soil disturbance → Changes to natural hydrology → Loss or alternation of geophysical wetland function.

Construction and operations → Grading and soil disturbance → Changes to soil structure, density and composition → Loss or alternation of geophysical wetland function.

Wetlands are highly sensitive to changes in their geophysical characteristics, and road construction can lead to alterations in these functions.

Wetlands depend on a delicate balance of water inflow and outflow. Roads built through or near these wetlands can alter the natural hydrology by blocking or redirecting water flow and increasing surface runoff to these features. Roads can also act as physical barriers, changing the flow of surface and groundwater, which can lead to changes in water levels and flow paths, and result in the drying out of certain areas of wetlands (Tague and Band, 2001; O'Neill et al., 2004). This can reduce wetland functionality, affecting plant and animal species dependent on specific hydrological conditions.

Soil compaction from construction activities can reduce its permeability and affect the soil's ability to retain water. This increases runoff rates, causing potential erosion and sedimentation that can degrade the wetland ecosystems (Forman & Alexander, 1998). Furthermore, roads built through wetlands often alter the natural deposition of nutrients and organic material, reducing soil fertility and adversely effecting plant growth and health.

Project related alterations to these geophysical processes can affect wetland function during both construction and throughout the operations phase of the Project.

11.3.3.2 Biophysical Function

Construction and operations → Creating a physical barrier between habitat areas → Alterations in plant community composition and diversity → Alterations in biophysical wetland function.

Construction and operations → Changes to wildlife and human movements → Impacts to plant populations and seed dispersal → Alterations in biophysical wetland function.

Construction and operations → Changes to speed and composition of runoff → Alteration and degradation of plant and animal communities and contribute to the spread of invasive species → Alterations in biophysical wetland function.

Construction and operations → Clearing and grubbing of peatlands and changes to topography, hydrology and critical atmospheric intakes → Loss of carbon sequestration ability → Loss or alterations in biophysical wetland function.

Wetlands are integral to several biophysical processes, such as carbon sequestration, biodiversity support, and water filtration and the Project construction can impact these functions in a variety of ways.

The WSR has the potential to act as a physical barrier, fragmenting wetland habitats and isolating species populations. The isolation of wetland areas can prevent genetic exchange between populations, reduce species diversity, and make species more vulnerable to environmental stressors (Trombulak and Frissell, 2000). Additionally, many plant and animal species that rely on wetlands to carry out their specialized life processes may become displaced, leading to population declines (Pomezanski and Zietara, 2025; Rytwinski and Fahrig, 2012).

In general, roads also pose a threat to wildlife through vehicle collisions, noise, light pollution, and the presence of humans. For example, birds may abandon nesting sites due to noise or human presence, and amphibians may be disturbed during their breeding cycles. Amphibians, reptiles, and small mammals are particularly vulnerable, especially in wetlands, where they may be forced to crossroads during seasonal migrations or daily movement. Wildlife mortality from roads contributes to major population declines in some species and these declines can have a direct effect on plant populations that rely on animal-led seed dispersal (Triay-Limonta, O. et al., 2024).

Construction of the road and its long-term effects during operations will also likely alter the volume and rates of surface runoff (Yousef et al., 1985). This runoff may carry pollutants such as petroleum products from potential vehicle and equipment leaks; spill events and dust and/or air emissions with metals, nutrients or chemicals that can enter nearby wetlands, leading to eutrophication, soil degradation, and the contamination of water resources (Bryson and Barker, 2002; Gibson et al., 1994). Increased sedimentation from potential soil erosion may also smother aquatic vegetation, disrupt the growth of plant life, and harm aquatic species (Forman & Alexander, 1998). In the case of wetlands, where the vegetation and water chemistry are sensitive, even low levels of pollution can have considerable effects. This alteration can lead to the degradation of plant and animal communities and contribute to the spread of invasive species (Chakraborty, S.K. et al., 2023; Lazaro-Lobo and Ervin, 2021; Li et al., 2014; Bignal et al., 2007).

Additionally, according to a study by Beaulne et al. (2021) on the carbon sequestration of peatlands in northern Canadian boreal environments, both forested and non-forested peatlands showed considerable carbon storage capabilities. Effects on the ability of the local environment to sequester carbon are expected to be impacted by direct vegetation removals for the road development. In addition, impacts to carbon sequestration could also occur as a result of Project related changes to topography, hydrology and critical atmospheric intakes, causing further changes to, or loss of, peatland functions (Saraswati et al., 2023).

In general, most untouched peatlands throughout the boreal zone are Nitrogen limited (Vitt, 2006), and the introduction of atmospheric Nitrogen and Phosphorous through human activity has the potential to change peatlands from Nitrogen limited to Phosphorous limited (Aerts et al., 1992; Bragazza et al., 2012; Penuelas et al., 2013). It is well established relationship that the availability of Phosphorous can act as an important regulator of Nitrogen fixation in the production of plant biomass, microbial breakdown of plant matter and subsequent sequestration of carbon and Nitrogen (Hill et al., 2014; Schillereff et. al., 2021; Tatjana et al. 2017, Toberman et al., 2015; Li et.al., 2023). The subsequent potential changes in vegetation distribution and composition caused by the addition of nutrients and base cations present in potential dust deposition could have an acute impact on plant production and microbial decomposition resulting in changes to carbon accumulation and nitrogen cycling in the peatlands (Grantz et al.,2003; Cape eta al., 2004; Green et al., 2008; Li et al., 2023). Available literature indicates that temporary localized accumulations of Phosphorous rich dust encourages carbon accretion in peatlands (Ratcliffe et al., 2020; Sjostrom et. al., 2022), but extended deposition can trigger a net carbon deficit in extensive deep peat deposits through acceleration of decomposition processes (Schillereff et al., 2021).

It is through these complex biophysical processes that Project construction and operations can have both a direct and indirect effect on wetland function.

11.3.3.3 Socio-Economic Function

Construction → Disruption to access and availability of resources for Indigenous Peoples → Loss or alteration of socio-economic wetland function.

Construction and operations → Increased access to previously remote areas → Potential for over-harvesting, illegal hunting, and unregulated development → Further indirect stress and damage to wetlands → Loss or alteration of socio-economic wetland function.

Wetlands contribute to a variety of socio-economic functions and values to the public and Indigenous Peoples such as aesthetics, recreation, education, and commercial and traditional use within a local, regional, national and global context. The Project construction may affect these wetland functions both directly and indirectly.

Indigenous Peoples rely on wetlands in study area for traditional activities such as fishing, hunting, and gathering. According to Webequie's three key land use documents (the in-progress Draft CBLUP, Comprehensive Community Plan and On-Reserve Land Use Plan), recreation and outdoor activities are integral their way of life. As the Wellness Coordinator from Webequie First Nation expressed, "The land defines us. Our physical health and strength are derived from it. To preserve our connection to the land, we must actively engage with it." (Webequie First Nation, 2023). The disruption caused by road construction could reduce accessibility and availability of these resources, affecting the livelihoods and cultures of local communities (Khanani, R.S. et al., 2021). Installation of roads in broader context of the region could also lead to increased access to previously remote areas, by non-indigenous people, causing over-harvesting, illegal hunting, and unregulated development, further stressing wetlands.

Boreal wetlands have the potential to serve as important sites for ecotourism and recreational activities such as bird watching, fishing, and hiking. Road construction can both positively and negatively affect tourism. On the one hand, roads can improve access to these areas, potentially increasing tourism and local revenue. On the other hand, the degradation of the wetland ecosystem due to road construction and increased access to remote areas, may lead to reduced biodiversity or increased pollution, and diminishing the natural beauty and ecological value that attract tourists (Bennett, V.J., 2017). This could have negative consequences for local economies that depend on tourism.

Although the construction of roads is often seen as a driver of economic development that provides access to natural resources, the long-term economic benefits may not outweigh the detrimental social, ecological and social values of wetland ecosystems if they are adversely affected (Saraswati et al., 2020). Wetland loss or alterations can lead to the loss of the ecosystem services they provide such as water filtration, flood regulation, and carbon sequestration, which may in turn result in increased costs for flood management, water treatment, and climate change mitigation (Taylor and Druckenmiller, 2021; Saraswati et al., 2023). Furthermore, road construction can open up lands to further development, leading to increased urbanization and the loss of more natural habitats.

In general, road construction projects, along with consideration of other proposed resources development in the region may have a profound and wide-ranging effects on all major wetland functions. However, the extent of effects to socio-economic functions of wetlands in study area due the Project are difficult to predict with certainty and confidence based on the limited available information.

11.3.3.4 Modelling Effects to Wetland Function

To more quantitatively determine the potential effects of the Project on wetland functions, models were developed using existing baseline conditions and then applied under the proposed future development scenario to measure changes. The methodology for this approach is detailed in Section 9.2.6 and 9.4 of the Natural Environment Existing Conditions Report (Appendix F). The following section summarizes the results of the modelling.

In the context of the models, biotic and abiotic factors are what make up upland, riparian and wetland ecosystems. Biotic factors are living things within an ecosystem; such as plants, animals, people and bacteria, while abiotic are non-living components; such as water, soil and atmosphere. The way these components interact is critical in how an ecosystem functions.

In total, there were 50 biotic and abiotic functional values calculated in the wetland function assessment. Once the normalized weights for the 50 functional values were obtained, an aggregate index of functional values was generated by calculating a weighted sum for each of the 18,140 records in the data set. These were then summarized by ELC type to determine the relative importance of each wetland vegetation class type in terms of functional value.

The analysis was repeated for both the current condition and the proposed future disturbance within the Project Footprint. The results of the modelling as presented in **Table 11-34**, show very slight changes (+/- < 5%) in the aggregate wetland function index across all wetland vegetation classes. The expected margin of error for the model is +/- 2.2%.

A number of these changes reflect a positive increase in functional values in reaction to the proposed road. This is due to a number of factors, including a mix of positive and negative responses in the biotic models. For example, if model coefficients for an upland bird species were negative for wetland habitat, then converting wetland to upland would elicit a positive response for that species. From an indigenous land-use perspective, the road development will generally increase access for harvesting and hunting, which is also considered a positive response.

Based on the functional modelling that was completed for the potential Project effects, the overall changes to wetland function are anticipated to be minimal.

Table 11-34: Current and Future Aggregate Index of 50 Functional Values for Each Wetland Vegetation ELC Type

Wetland Vegetation ELC Type	Current Condition	Future Disturbance	% Change
Burn-Conifer Swamp	0.245	0.251	2%
Burn Low/Sparse Treed Bog/Fen	0.238	0.243	2%
Conifer Swamp	0.231	0.232	0%
Low Treed Bog	0.192	0.194	1%
Meadow Marsh	0.261	0.266	2%
Open Bog	0.2	0.201	0%
Open Moderately Rich Fen	0.252	0.24	-5%
Open Shore Fen	0.26	0.26	0%
Open Shore Fen/Thicket Swamp	0.29	0.276	-5%

Wetland Vegetation ELC Type	Current Condition	Future Disturbance	% Change
Open Shore Shrub Fen	0.261	0.262	0%
Open Water Marsh	0.278	0.285	2%
Organic Poor Fen	0.222	0.222	0%
Organic Rich Conifer Swamp	0.238	0.25	5%
Poor Conifer Swamp	0.224	0.226	1%
River /Floating Marsh	0.281	0.295	5%
River/Fen (Open/Sparse Treed/Thicket)/Swamp/Marsh)	0.269	0.27	0%
Shore Thicket Swamp	0.26	0.263	1%
Sparse Treed Bog	0.197	0.197	0%
Sparse Treed Fen	0.22	0.221	0%
Thicket Swamp	0.287	0.285	-1%

11.3.3.5 Summary of Threat Assessment

The results of the assessment of the potential effects on, or threat to, the existing wetland functions within the LSA and RSA indicate that while permanent wetland removals are anticipated during the development of the Project, these removals are well under 10% of the available habitat within the LSA and RSA. This results in a relatively small scope and slight 'Severity' rating, according to the metrics for characterization of effects as identified in the TISG. The 'Irreversibility' of the effects are considered high, and the' Magnitude' and 'Degree' of the effects are considered low and medium (refer to **Table 11-35** below).

The changes in wetland function do not align neatly with the TISG metrics for characterizing effects. While most wetland types are expected to experience negligible adverse changes in functional values, the remaining wetland functional values either show no change or an increase of up to 5%. These values do not account for indirect effects as outlined in **Section 11.3.2.3,** which could potentially impact wetland functions. However, these indirect effects are not expected to affect enough wetland areas to reach or exceed a 10% change, thus the characterization for Scope and Severity effects remains at the levels of Restricted and Moderate, respectively. The definitions of the criteria used to characterize the effects of: Scope, Severity, Irreversibility (Permanence), Magnitude, and Degree have been previously described in **Section 11.3.1** (Threat Assessment Approach) and the results of the assessment of effect to wetland function are presented in **Table 11-34** above.

Table 11-35: Wetland Function Preliminary Threat Assessment Prior to Application of Mitigation

Effect	Scope	Severity	Irreversibility	Magnitude	Degree
Loss of Alteration of Wetland Functions	**Small** – The regional effects on wetland function represent less than 1% of all wetland classes in LSA and RSA.	**Slight** – Within the scope, the effect is only expected to slightly degrade/reduce the valued component or reduce its availability within the LSA and RSA by 1% – 10% within ten years or three generations. The wetland function model showed very slight (0% to 5%) changes in the aggregate wetland function index across all vegetation patch classes and number of these changes reflect a positive increase in functional values in reaction to the road development. Although it is recognized that there will inevitably be a greater local effect, these effects should be minimal, especially with adaptive management practices employed as necessary to achieve a more positive outcome.	**Very High** – The local effects cannot be reversed, and it is very unlikely the valued component can be restored, and/or it would take more than 100 years to achieve this (e.g., areas where peatlands are bisected by the road). Although there will be an irreversible local effect, these effects should be minimal on a regional scale, especially with adaptive management practices employed as necessary to achieve the desired outcome.	**Low** – Slight Severity + Small Scope	**Medium** – Low Magnitude + Very High Irreversibility

11.3.4 Loss or Alteration of Plant Species at Risk and Plant Species and Communities of Conservation Concern

This section describes the potential effects to plant SAR designated as either Endangered or Threatened under the Ontario ESA and the federal SARA, including plant SOCC identified as Special Concern in the SARO list under the ESA; protected federally under SARA; provincially listed as rare (i.e., provincial/subnational rank of S1, S2 or S3); and/or species considered regionally or locally rare as previously described in **Section 11.2.2.4** (Results). The potential effects to plant species at risk and plant species and communities of conservation concern are related to the same direct and indirect pathways of effects discussed in **Section 11.3.2** (Loss or Alteration of Vegetation Communities, Species and

Biodiversity) and the associated sub-sections. It is nearly impossible to quantify potential indirect effects of only plant species or communities at risk in the PF, LSA or RSA. Therefore, we have only attempted to quantify the potential direct losses in the following sections.

11.3.4.1 Plant Species at Risk

Based on the review of background information sources and results of field surveys, there were no federally or provincially listed plant species at risk (SARA, ESA) documented or observed in the study area for the Project. Consequently, there are no potential effects expected to impact federal and provincial plant species at risk.

11.3.4.2 Plant Species and Communities of Conservation Concern

Two provincially designated rare mosses were identified during the field surveys to support the EA/IA: Yellow Moosedung Moss (*Splachnum luteum* – S1) and Cruet Collar Moss (*Splachnum ampellaceum* – S3). These rare moss species were documented in the LSA but were not found within the Project Footprint and are not anticipated to experience impacts from the Project. However, background data on the presence of these species in the boreal region within the Project study area is lacking and their actual abundance may be greater than is currently documented from the field surveys completed to date. Therefore, the spatial extent of any adverse effects to these provincially listed SOCC cannot be predicted with certainty.

Results from field surveys also identified five locally uncommon vegetation communities. Locally uncommon communities were identified as community types that were underrepresented within the LSA and RSA (refer to **Section 11.2.2.4**). The five rare vegetation communities include: Hardwood and Mixedwood forests; Meadow and Open Marshes; and Rock Barrens. Two of these vegetation communities are directly affected by the Project.

Vegetation clearing and grubbing activities for the Project will result in the removal of 1.6 ha of Hardwood Forest and 4.2 ha of Mixedwood Forest. These removals represent 3.53% of the available Hardwood and 3.35% of the available Mixedwood forest communities found within the LSA. When extended to the RSA, the percentages lost of these communities are 0.84% and 1.22%, respectively.

The potential effects to these species and communities of concern are summarized in **Table 11-36**.

Table 11-36: Locally Rare Vegetation Community Losses

Locally Rare Affected Vegetation Classifications (ELC)	Baseline Area of Locally Rare Vegetation Communities in LSA (ha)	Area of Locally Rare Vegetation Communities with Project in LSA q (ha)	Baseline Area of Locally Rare Vegetation Communities in LSA (ha)	Area of Locally Rare Vegetation Communities with Project in RSA (ha)	Removals of Rare Vegetation Communities (ha)	Percentage of Locally Rare Communities Removed in LSA	Percentage of Locally Rare Communities Removed in RSA
Hardwood Forest	45.30	43.70	189.56	187.96	1.6	3.53%	0.84%
Mixedwood Forest	125.65	121.44	343.99	339.78	4.21	3.35%	1.22%

The assessment of indirect effect pathways (**Section 11.3.2.3**: Indirect Effects Pathways on Vegetation and Wetlands) indicated that although largely mitigated, the indirect effects that do remain will be localized to within 250 m for open wetlands. Using these effect zones, there is the potential for low level effects to 95% of the locally rare Meadow Marsh available within the LSA. It should be noted that the patches/polygons of this vegetation classification are thought to be more common within the study areas than the project mapping suggests since they commonly exist in very small un-mappable areas, mosaiced into shoreline ecosystems.

11.3.4.3 Summary Threat Assessment

The assessment of the effects on, or threat to, existing vegetation and wetlands indicate that while there are no anticipated removals of any provincially or federally listed plant SAR or plant species of conservation concern, there are permanent removals of vegetation classes that have been identified as locally rare in the study areas. These removals are well under 10% of the available habitat within both the LSA and RSA, resulting in a relatively small Scope and slight Severity according to the metrics used to characterize effect as specified in the TISG. Irreversibility of the effect is considered medium, and the Magnitude and Degree are of effects are both considered low, as presented in **Table 11-37**.

Table 11-37: Preliminary Effects to SAR Plants and Plants/Communities of Conservation Concern Prior to Application of Mitigation

Effect	Scope	Severity	Irreversibility	Magnitude	Degree
Loss or Alteration of Plant Species at Risk and Plant Species and Communities of Conservation Concern	**Small** – No Federally, or Provincially designated plant SAR or rare communities of conservation concern (S1, S2 or S3 rank) were found within the LSA or RSA. However, there are removals of locally rare vegetation community patches that represent 3.13% (Hardwood) and 3.32% (Mixedwood) of these vegetation patches found within the LSA and 0.85% and 1.24% respectively, within the RSA.	**Slight** – Within the scope, the effect is likely to slightly degrade / reduce the valued component or reduce its availability within the LSA and RSA by 1-10% within ten years or three generations.	**Medium** – The effects can be reversed and the valued component restored with a reasonable commitment of resources and/or within 6-20 years (e.g., restoration of other areas to Hardwood and Mixedwood).	**Low** – Slight Severity + Small Scope	**Low** – Low Magnitude + Medium Irreversibility

Overall, the effect on locally rare species and communities of conservation concern are low and include the loss of some rare communities from the landscape. No known locally rare plants species will be removed based on the direct vegetation removals required for the Project.

11.3.5 Loss or Alteration Vegetation Plant Species and Communities of Traditional Importance to Indigenous Peoples

11.3.5.1 Plant Species and Communities of Traditional Importance to Indigenous Peoples

Based on available Indigenous Knowledge information shared by communities and feedback from community members most Project interactions with the harvesting of plants for cultural or medicinal use or as a source of country foods occur at known sites and at features along portages or historic travel routes. To assess potential effects on culturally important plant communities, portages or historic travel route features were mapped as vector lines, and the Project Team conservatively assumed 100 m to either side of the line was potentially in use by Indigenous Peoples. Using this assumption approximately 9.3 ha of buffered portage or historic travel route areas and 89 ha of area described as a Juniper plant source at the ARA-4 aggregate source site will be removed during construction.

It is assumed that plant species of traditional importance to Indigenous Peoples, as identified in **Section 11.2.2.5**, are present in most vegetation patches at levels similar to comparable vegetation assemblages. For example, Mixedwood Forest is likely similar to Conifer Forest in Indigenous use plant species presence, and Poor Conifer Swamp is similar to Conifer Swamp. As a result, these classes have been aggregated to determine the level of potential effect from Project construction and operations. **Table11-38** below shows the amount of each vegetation class removed and the percentages that these removals represent in both the LSA and RSA.

Table 11-38: Removals Percentages of Vegetation Class Containing Species of Traditional Importance to Indigenous Peoples

Vegetation Class	Number of Species	Removals (ha)	Percentage (%) of Removals in LSA	Percentage (%) of Removals in RSA
Conifer/Mixedwood Forest	19	155.22	7.3%	1.7%
Conifer/Poor Conifer Swamp	17	235.62	2.4%	0.5%
Hardwood Forest	16	1.60	3.1%	0.8%
Treed Bog (Low/Sparse)	13	90.75	1.1%	0.2%
Treed Fen (Sparse)	12	43.47	1.5%	0.4%
Open Bog	12	0.05	0.03%	0.00002%
Fen (Rich/Poor)	10	1.38	0.2%	0.0004%
Rock Barren	10	3.38	37.2%	25.2%
Other (River/Lake Ecotypes)	12	7.10	0.9%	0.2%

Overall, the effect on species of traditional importance to Indigenous Peoples is expected to be low. Losses of vegetation classes with the potential to support plants of importance to Indigenous Peoples are less than 5% within the LSA, with the exception of Conifer/Mixedwood Forest at 7.3% and Rock Barren at 37%. These values are reduced further at the RSA scale with the majority at less than 1% (see **Table 11-38** above). There is the potential for an increase in harvesting of plants within previously inaccessible areas by non-Indigenous gatherers, but this is expected to be opportunistic with minimal impact on supply and use of plants of importance to Indigenous peoples. The increased access provided by the road to potential gathering sites in the study areas may also serve to offset any losses from non-Indigenous gatherers.

11.3.5.2 Summary Threat Assessment

The assessment of the effects on, or threat to, existing vegetation and wetlands indicate that there are permanent removals of vegetation classes that have been identified as containing potential plant species of traditional importance to Indigenous Peoples in the area. These removals are well under 10% of the available habitat within the LSA and RSA resulting in a relatively small scope and slight severity according to the metrics used to characterize effects as specified in the TISG. Irreversibility of the effect is considered medium, and the magnitude and degree effects are low and low as summarized in **Table 11-39**.

Table 11-39: Preliminary Effects to Plant Species and Communities of Traditional Importance to Indigenous Peoples Prior to Application of Mitigation

Effect	Scope	Severity	Irreversibility	Magnitude	Degree
Loss or Alteration of Vegetation Plant Species and Communities of Traditional Importance to Indigenous Peoples	**Small** – Indigenous Peoples will experience minimal impacts on plant species or communities of traditional importance and use. These include approximately 89 ha of area described as a Juniper plant source at the ARA- 4 aggregate source site, and 9.3 ha of areas buffering various portage or historic travel route areas that require removal during construction. Note Juniper is a very common plant throughout the upland vegetation classes within the study area, and the actual removals near travel routes include an assumed buffered area either side of the actual trail/travel route.	**Slight** – Within the scope, the effect is likely to only slightly degrade/reduce the valued component or reduce its availability within the LSA and RSA by 1-10% within ten years or three generations.	**Medium** – The effects can be reversed and the valued component restored with a reasonable commitment of resources and/or within 6-20 years (e.g., restoration of other areas to Hardwood and Mixedwood).	**Low** – Slight Severity + Small Scope	**Low** – Low Magnitude + Medium Irreversibility

11.3.6 Effects Summary

Table 11-40 below summarizes the potential effects, effects pathways, effect indicators, the nature of the interaction (direct or Indirect) with the other VC's which could be linked and/or influenced by these effects for the Vegetation and Wetlands VC.

Table 11-40: Potential Effects, Pathways, and Indicators for the Vegetation and Wetlands VC

Potential Effect	Project Phase	Effect Pathway	Effect Indicators	Nature of Interaction and Effect (Direct or Indirect)	Linked VCs
Loss or alteration of vegetation communities, species and biodiversity ▪ Upland Ecosystems ▪ Wetland Ecosystems ▪ Riparian Ecosystems	Construction and Operations	**Clearing and Grubbing** of vegetation may result in loss or alteration of vegetation communities, species and affect species/community biodiversity.	Loss or alteration of all, or part of, upland, wetland and riparian vegetation within the landscape (quantity – hectares and quality). Loss or alteration of all, or part of, upland, wetland and riparian vegetation within the landscape (quantity – hectares and quality). Fragmentation – Construction of the road as a linear infrastructure feature on the landscape may result in the fragmentation of upland, wetland, and riparian vegetation communities. Changes to community connectivity (patch) characteristics and edge creation. Microclimate – Localized alterations in microclimates conditions due to albedo effect and changes in canopy/shade conditions, leading to changes to local plant species composition. Carbon Sequestration – Direct loss of peatlands for road construction and the immediate vicinity of the roadway reduces the ability of the local environment to sequester carbon. Nitrogen and Phosphorous from human activities (i.e. dust) has the potential to indirectly change peatlands from Nitrogen limited to Phosphorous limited affecting local plant species composition.	Direct Direct Direct and Indirect Direct and Indirect	The assessment of this VC is informed by the effects assessment for other VCs: ▪ Geology, Terrain and Soils (Section 6) ▪ Surface Water (Section 7) ▪ Groundwater Resources (Section 8) The assessment of this VC informs the effects assessment for other VCs: ▪ Fish and Fish Habitat (Section 10) ▪ Wildlife and Wildlife Habitat (Section 12)
	Construction and Operations	**Water Crossing Structures –** New water crossing structures may result in loss or alteration of riparian vegetation communities caused by changes to hydrology with respect to surface water flows and water levels.	Loss or alteration to riparian vegetation communities. Changes to water flow patterns and water levels. Maintenance may require further vegetation removals. And lag time could result in temporary flooding.	Direct and Indirect	
	Construction	**Grading and Soil Disturbance** – Grading, excavations and earth moving activities can alter topography and drainage patterns that may reduce soil quantity and quality through changes to physical, chemical or biological properties of soil, and increase erosion/sedimentation potential in tum impacting vegetation growth, survival, composition and distribution beyond the vegetation removal limits.	Changes to soil quantity and quality, and drainage patterns (upstream flooding/downstream drying). Loss or alteration to vegetation community composition and distribution.	Direct and Indirect	
	Construction and Operations	**Invasive Species** – Construction equipment and personnel have the potential to introduce invasive (non-native) plant species into new areas by transporting seed or plants on equipment or clothing and may alter vegetation communities.	Changes to vegetation community species composition.	Indirect	
	Construction and Operations	**Chemical or Hazardous Materials** – Spills (e.g., petroleum products) or improper storage of waste can affect soil quality and alter the health and growth of upland, riparian and wetland ecosystem.	Changes to soil quality and vegetation species composition and assemblages. Alteration or loss of vegetation communities from soil contamination.	Direct and Indirect	
	Construction and Operations	**Dust and Air Emissions** from construction and operations activities, and subsequent deposition, can affect upland, riparian and wetland ecosystems through changes to soil quality and direct contact with plants.	Changes to vegetation community assemblages. Loss (i.e., die-off) or alteration (i.e., growth or health) of vegetation communities or plants from contamination.	Indirect	
	Construction and Operations	**Fire Potential** – Increase in risk of fire due to changes in local landform structure, microclimate conditions and the frequency and likelihood of natural and human sources of ignition.	Direct loss of all or parts of vegetation communities, or significant alteration of vegetation community plant species composition	Indirect	

Potential Effect	Project Phase	Effect Pathway	Effect Indicators	Nature of Interaction and Effect (Direct or Indirect)	Linked VCs
Loss or Alteration of Wetland Function	Construction and Operations	**Clearing and Grubbing** – of vegetation may result in loss or alteration of wetland vegetation communities, species and affect wetland biodiversity.	Loss or alteration of all, or part of wetland vegetation within the landscape (quantity – hectares and quality). Fragmentation – Construction of the road as a linear infrastructure feature on the landscape may result in the fragmentation of wetland vegetation communities. Changes to community connectivity (patch) characteristics and edge creation. Microclimate – Localized alterations in microclimates conditions due to albedo effect and changes in canopy/shade conditions, leading to changes to wetland vegetation communities. Carbon Sequestration – Direct loss of peatlands for road construction and the immediate vicinity of the roadway reduces the ability of the local environment to sequester carbon. Nitrogen and Phosphorous from human activities (i.e. dust) has the potential to indirectly change peatlands from Nitrogen limited to Phosphorous limited affection local wetland plant species composition.	Direct Direct Direct and Indirect Direct and Indirect	The assessment of this VC is informed by the effects assessment for other VCs: ▪ Geology, Terrain and Soils (Section 6) ▪ Surface Water (Section 7) ▪ Groundwater Resources (Section 8) The assessment of this VC informs the effects assessment for other VCs: ▪ Fish and Fish Habitat (Section 10) ▪ Wildlife and Wildlife Habitat (Section 12)
	Construction	**Water Crossing Structures** – Loss of all, or part of local riparian wetland communities increased potential for erosion and sedimentation as well as changes to surface and groundwater water flows.	Losses or significant alterations to wetland vegetation composition.	Direct and Indirect	
	Construction	**Grading and Soil Disturbance** – Alterations of topography may result in changes to the natural flow of both surface and groundwater water causing flooding or drying of wetlands. Redistribution, compaction, erosion and sedimentation of soils can result in supplementary wetland vegetation loss beyond clearing limits.	Changes to wetland soil quantity and quality, and drainage patterns (upstream flooding/downstream drying). Loss or alteration to wetland vegetation community composition and distribution.	Direct and Indirect	
	Construction and Operations	**Invasive Species** – Introduction of invasive plant species.	Changes to wetland vegetation species composition.	Indirect	
	Construction and Operations	**Chemical or Hazardous Materials** – Increase in chemical, and other wastes entering the environment through indirect releases from spills, and leaks from unmaintained equipment, or improper storage.	Contamination related die-off of wetland vegetation.	Indirect	
	Construction and Operations	**Dust and Air Emissions** from construction and operations activities, and subsequent deposition, can affect wetland ecosystems through changes to soil quality and direct contact with plants.	Contamination related die-off of wetland vegetation.	Indirect	
	Construction and Operations	**Fire Potential** – Increased fire risk due to changes in local wetland structure, fuel availability, local vegetation classes, microclimate conditions, as well as the frequency and likelihood of natural and human sources of ignition.	Increase in frequency or magnitude of forest fires leading to wetland loss.	Direct and Indirect	
Loss or Alteration of Vegetation Communities and Plant Species of Conservation Concern	Construction and Operations	**Clearing and Grubbing** – of vegetation may result in loss or alteration of vegetation communities, and plant species of conservation concern.	Loss or alteration of all, or part of, upland, wetland and riparian vegetation communities of conservation concern or vegetation communities with the potential to support plant species of conservation concern within the landscape (quantity – hectares and quality). Fragmentation – Construction of the road as a linear infrastructure feature on the landscape may result in the fragmentation of upland, wetland, and riparian vegetation communities of conservation concern.	Direct Direct	The assessment of this VC is informed by the effects assessment for other VCs: ▪ Geology, Terrain and Soils (Section 6) ▪ Surface Water (Section 7) ▪ Groundwater Resources (Section 8) The assessment of this VC informs the effects assessment for other VCs: ▪ Fish and Fish Habitat (Section 10)

Potential Effect	Project Phase	Effect Pathway	Effect Indicators	Nature of Interaction and Effect (Direct or Indirect)	Linked VCs
			Changes to community connectivity (patch) characteristics and edge creation. Microclimate – Localized alterations in microclimates conditions due to albedo effect and changes in canopy/shade conditions, leading to changes to potential local plant species of conservation concern. Carbon Sequestration – Direct loss of peatlands for road construction and the immediate vicinity of the roadway reduces the ability of the local environment to sequester carbon. Nitrogen and Phosphorous from human activities (i.e. dust) has the potential to indirectly change peatlands from Nitrogen limited to Phosphorous limited affecting local vegetation communities or plant species of conservation concern.	Direct and Indirect Direct and Indirect	▪ Wildlife and Wildlife Habitat (Section 12)
	Construction	**Crossing Structures** – Loss of all, or part of local riparian wetland communities increased potential for erosion and sedimentation as well as changes to surface and groundwater water flows.	Losses species of conservation concern, or significant alterations to vegetation communities which support plant species of conservation concern.	Direct and Indirect	
	Construction	**Grading and Soil Disturbance** – Alterations of topography may result in changes to the natural flow of both surface and groundwater water causing flooding or drying of wetlands. Redistribution, compaction, and erosion of soils can result in supplementary wetland vegetation loss beyond clearing limits.	Changes to water availability (flooding/drying) resulting in losses or alterations to the survivability of plant species of conservation concern.	Indirect	
	Construction and Operations	**Invasive Species** – Introduction of invasive plant species.	Changes to plant species composition affecting the to the survivability (out compete) of plant species of conservation concern.	Indirect	
	Construction and Operations	**Chemical Runoff/Wastes** – Increase in chemical, and other wastes entering the environment through direct application, herbicide application, spills, and leaks from unmaintained equipment.	Contamination related die-off of vegetation resulting in direct losses of or affecting the to the survivability of plant species of conservation concern.	Indirect	
	Construction and Operations	**Dust/Air Quality** – Increase in dust and exhaust pollutants from construction and operations activities.	Contamination related die-off of vegetation resulting in direct losses of, or affecting the to the survivability of plant species of conservation concern.	Indirect	
	Construction and Operations	**Fire Potential** – Increased fire risk due to changes in local landform structure, fuel availability, local vegetation classes, microclimate conditions, as well as the frequency and likelihood of natural and human sources of ignition.	Increase in frequency or magnitude of forest fires leading to direct losses of or affecting the to the survivability of communities and/or plant species of conservation concern.	Direct and Indirect	
Loss or Alteration of Vegetation Communities and Plant Species of Traditional Importance to Indigenous Peoples	Construction and Operations	**Clearing and Grubbing** – of vegetation may result in loss or alteration of vegetation communities, and plant species of traditional importance to Indigenous Peoples.	Loss or alteration of all, or part of, upland, wetland and riparian vegetation communities of traditional importance to Indigenous Peoples or vegetation communities with the potential to support plant species of traditional importance to Indigenous Peoples within the landscape (quantity – hectares and quality). Fragmentation – Construction of the road as a linear infrastructure feature on the landscape may result in the fragmentation of upland, wetland, and riparian vegetation communities of traditional importance to Indigenous Peoples. Changes to community connectivity (patch) characteristics and edge creation.	Direct Direct	The assessment of this VC is informed by the effects assessment for other VCs: ▪ Geology, Terrain and Soils (Section 6) ▪ Surface Water (Section 7) ▪ Groundwater Resources (Section 8) The assessment of this VC informs the effects assessment for other VCs: ▪ Fish and Fish Habitat (Section 10) ▪ Wildlife and Wildlife Habitat (Section 12)

Potential Effect	Project Phase	Effect Pathway	Effect Indicators	Nature of Interaction and Effect (Direct or Indirect)	Linked VCs
			Microclimate – Localized alterations in microclimates conditions due to albedo effect and changes in canopy/shade conditions, leading to changes to potential local plant species of traditional importance to Indigenous Peoples. Carbon Sequestration – Direct loss of peatlands for road construction and the immediate vicinity of the roadway reduces the ability of the local environment to sequester carbon. Nitrogen and Phosphorous from human activities (i.e. dust) has the potential to indirectly change peatlands from Nitrogen limited to Phosphorous limited affecting local vegetation communities or plant species of traditional importance to Indigenous Peoples.	Direct and Indirect Direct and Indirect	
	Construction	**Crossing Structures** – Loss of all, or part of local riparian wetland communities increased potential for erosion and sedimentation as well as changes to surface and groundwater water flows.	Losses species of traditional importance to Indigenous Peoples, or significant alterations to vegetation communities which support plant species of traditional importance to Indigenous Peoples.	Direct and Indirect	
	Construction	**Grading and Soil Disturbance** – Alterations of topography may result in changes to the natural flow of both surface and groundwater water causing flooding or drying of wetlands. Redistribution, compaction, and erosion of soils can result in supplementary wetland vegetation loss beyond clearing limits.	Changes to water availability (flooding/drying) resulting in losses or alterations to the survivability of plant species of traditional importance to Indigenous Peoples.	Indirect	
	Construction and Operations	**Invasive Species** – Introduction of invasive plant species.	Changes to plant species composition affecting the to the survivability (out compete) of plant species of traditional importance to Indigenous Peoples.	Indirect	
	Construction and Operations	**Chemical Runoff/Wastes** – Increase in chemical, and other wastes entering the environment through direct application, herbicide application, spills, and leaks from unmaintained equipment.	Contamination related die-off of vegetation resulting in direct losses of or affecting the to the survivability of plant species of traditional importance to indigenous peoples.	Indirect	
	Construction and Operations	**Dust/Air Quality** – Increase in dust and exhaust pollutants from construction and operations activities.	Contamination related die-off of vegetation resulting in direct losses of, or affecting the to the survivability of plant species of traditional importance to Indigenous Peoples.	Indirect	
	Construction and Operations	**Fire Potential** – Increased fire risk due to changes in local landform structure, fuel availability, local vegetation classes, microclimate conditions, as well as the frequency and likelihood of natural and human sources of ignition.	Increase in frequency or magnitude of forest fires leading to direct losses of, or affecting the to the survivability of communities and/or plant species of traditional importance to Indigenous Peoples.	Direct and Indirect	

11.4 Mitigation and Enhancement Measures

This section presents the proposed mitigation and enhancement measures to eliminate, reduce, control, or offset (compensate) potential adverse effects to the Vegetation and Wetlands VC during the construction and operation phases of the Project, as detailed in **Section 11.3** (Identification of Potential Effects, Pathways and Indicators). Mitigation measures are described and presented for each of the following four primary effects identified:

- Loss or alteration of all or part of vegetation communities, species and biodiversity:
  - Upland Ecosystem;
  - Riparian Ecosystems; and
  - Wetland Ecosystems.
- Loss or alteration of wetland function.
- Loss or alteration of plant species at risk and plant species and communities of conservation concern.
- Loss or alteration of plant species or communities of traditional importance to Indigenous Peoples.

A three-tiered hierarchical approach to mitigation and enhancement, involving avoidance, reduction and control (minimize), and compensation or habitat offsetting, has been taken to address potential effects to vegetation and wetlands. This reflects the generally accepted principle that it is preferred to avoid affects to vegetation communities first followed by measures to control and reduce effects or implement compensation. Restoration or reclamation will be utilized to mitigate direct losses to vegetation and wetlands. These restoration activities will occur on two fronts. The first, will involve the immediate restoration of disturbed areas and the second approach will be to utilize accepted habitat restoration techniques to apply habitat off setting to compensate for the direct loss and alteration to upland, riparian and wetland ecosystems as a result of Project. At this stage in the project's development, the specifics of these activities are uncertain, but an overview of the potential compensation requirements and approach is provided in **Section 11.4.5**, with details contained in Appendix K-3.

Site specific management plans that describe protocols and procedures to mitigate potential effects to vegetation and wetlands will be developed and implemented as outlined in Section 4.6 (Management Plans) of this EAR/IS. During the construction phase, a Construction Environmental Management Plan (CEMP) will be implemented and during operations an Operation Environment Management Plan (OEMP) will be implemented. Management plans will be consistent with the requirements of the Project's permits and authorizations to minimize the potential effects of construction and operations activities on vegetation and wetlands. Management Plans will guide the proponent contractors in complying with applicable environmental legislation by providing criteria, standard protocols, and mitigation measures to eliminate, reduce, and/or offset potential adverse effects to vegetation and wetlands. Additional details of the proposed framework for developing the CEMP and the OEMP are provided in Appendix E. During construction and/or operations, the following key environmental management plans relevant to vegetation and wetlands within the broader CEMP and OEMP will be developed and implemented.

- Vegetation and Invasive Species Management Plan;
- Soil Management Plan;
- Waste Management Plan (including Hazardous, Contaminated and Controlled Materials);
- Air Quality and Dust Control Management Plan;
- Surface Water and Storm Water Management Plan;

- Erosion and Sediment Control Plan;
- Site Restoration and Monitoring Plan; and
- Spill Prevention and Emergency Response Management Plan.

Indigenous community members will have an active role in developing and implementing management plans.

An Environment Committee will be established to facilitate communication and engagement during construction and operations of the Project. Committee members will include Webequie First Nation Elders and Knowledge Holders, other First Nations with interest in participating, and appropriate project representatives, to: facilitate communication and engagement during construction and operations of the Project; facilitate use of Indigenous Knowledge in project activities; facilitate evaluation of land use information; and facilitate development of appropriate monitoring programs, protocols and management plans as it relates to Vegetation and Wetlands VC.

A summary of the key mitigation measures to address potential adverse effects of the Project to the Vegetation and Wetland VC as outlined in this section and Appendix E of the EAR/IS are presented in **Table 11-41**.

11.4.1 Loss or Alteration to Vegetation Species, Communities and Biodiversity

It is generally not feasible to fully avoid or eliminate the removal of vegetation during the development of a roadway. However, the effects have been controlled, minimized and reduced by employing the following key standard mitigation and best management practices during the planning and design stage, and construction and operation phases of the Project:

Planning and Design Measures

- Project components (i.e., roadway, structures, camps/laydown areas, access roads, and aggregate extraction) have been designed to minimize the footprint area and reduce impermeable surfaces.
- Where possible, flexibility in design standards has been applied to reduce Project Footprint and removals requirements (e.g., limit size of roadside ditches).
- To the extent possible, new bridges and culverts at waterbody crossing have been designed at right angles to reduce the footprint of the structures and thereby limit the vegetation removals required in riparian areas.
- Mitigation measures have been included in the Project design to limit changes in hydrology and include installing culverts or temporary bridges using best management practices and following conditions of environmental approval.
- Develop and implement management plans in the CEMP and OEMP related to the protection of vegetation and wetlands. An important plan to develop is for Erosion and Sediment Control (ESC) to minimize run-off, limit erosion on exposed slopes and substrates, and prevent the introduction of sediment or other deleterious materials that would adversely affect vegetation and watercourses. The ESC Plan will describe applicable best management practices and will follow existing permits and guidelines to limit erosion and sediment/soil transport from wind and water. The CEMP and OEMP will also include components relating to soil management that provide direction on topsoil stripping,

stockpiling, salvage, and prioritized areas for restoration/reclamation, which are expected to mitigate changes to soil quality and quantity.

- Clearing activities at wetland/peatland areas will be planned to occur during the winter, where possible, to avoid unnecessary disturbance of soils and vegetation as well as minimize compaction of soils.

Construction and Operations

- During construction, clearing and grubbing will be limited to the permanent development area and associated temporary supportive infrastructure (e.g., access roads, camps). During operation, it will be limited to those areas within road ROW requiring vegetation management for that phase of the project.
- Restoration, reclamation and clean-up activities will occur progressively throughout construction. These activities will include, but not be limited to, removing refuse, grading disturbed areas, contouring disturbed slopes to a stable profile, re-establishing natural drainage patterns, and seeding/planting to re-establish vegetation. Temporary disturbance areas will be restored to a natural state under the direction of qualified professionals.
- Removal limits for the Project Footprint (road ROW, camps/laydown areas, aggregate sources, and access roads) will be flagged or fenced to restrict vehicle and worker activities outside of designated areas and prevent direct vegetation loss or alteration outside of these locations.
- Mitigation measures outlined in Appendix E (Mitigation Measures) and those developed as part of the CEMP and OEMP (e.g., Soil Management Plan, Site Restoration and Monitoring Plan, etc.) will be implemented to address items such as re-grading, soil compaction, and final restoration/reclamation of disturbed areas.
- Vegetation control during the operations phase will be limited to mechanical methods that involve cutting, trimming or removing trees, brush (shrubs) and/or groundcover (grass) in the late fall to improve visibility for drivers or minimize the risk of hazard trees falling onto the roadway or supportive facilities. Various types of cutting and mowing equipment will be used including chainsaws, riding mowers, and weed eaters.

The standard mitigation measure and best management practices described above will serve to limit the effects on species diversity, and composition of vegetative species from the Project. The development of the CEMP and OEMP will also include specifics of within applicable management plans to minimize effects to species diversity and composition.

The following subsections outline the further mitigation measures for project-specific to address potential effects during the construction and operation phases of the Project, with the objective to reduce, control or minimize the direct and indirect loss or alteration of species, communities and biodiversity within upland, riparian and wetland ecosystems.

11.4.1.1 Vegetation Clearing and Grubbing

Mitigation measure to address the potential effects of clearing and grubbing activities on vegetation and wetlands include the following:

- All vehicles and heavy equipment will remain within designated clearing limits.
- Implement tree felling and grubbing procedures to minimize risk of damage to adjacent vegetation.

- Ensure adherence to the procedures outlined in the ESC Plan to control run-off, minimize erosion on exposed slopes and substrates, and prevent the introduction of sediment or other deleterious materials from vegetation assemblages and watercourses.
- Where practicable, clearing and grubbing will occur in stages as road construction advances, where practicable, advances to limit erosion and sedimentation.
- When feasible, all equipment, materials, and supplies for clearing and grubbing activities will be stored in designated areas when not in use. Designated areas during construction include construction camp(s) and areas for stockpiling, waste storage, fuel storage and refuelling.
- Vegetation is to be primarily removed by mechanical means, except within 10 m of a waterbody. In these areas, vegetation will be removed manually, using chain saws and other hand-held equipment, while leaving the under growth and duff layer undisturbed to prevent erosion, until such time as construction of foundations for bridges and culverts is initiated.
- Designated areas for brush, timber and mulch will be located a minimum of 50 m from any waterbody, with the exception of the aggregate/rock source area ARA-2, which will include a vegetation buffer zone of a minimum of 100 m in width from the unnamed lake.
- Within the clearing limits, all brush and trees, except those identified to be saved, are to be cut level with the ground, and all surface debris, fallen timber, slash and brush disposed of as directed or permitted. Disposal may involve burning, spreading and compacting, chipping, or transport of merchantable or unmerchantable timber to Webequie First Nation for community use.
- No burning of cleared and grubbed material will occur in areas with deep organic soils.
- Prior to any vegetation removal, all areas having the potential to contain rare plant species will be surveyed. Any identified rare specimens will be transplanted by qualified personnel before clearing begins.
- Section 5.1 in Appendix E (Mitigation Measures) provides further detail on mitigation measures related to clearing and grubbing activities. Further guidance on mitigation measures will also be provided in the Vegetation and Invasive Species Management Plan as part of the CEMP and OEMP developed and implemented for the Project.

11.4.1.2 Water Crossing Structures and Changes to Hydrology

The direct effect of the installation of bridge and culvert crossings for the road is the loss or alteration of riparian vegetation communities and potential changes to surface water and groundwater. Mitigation measures to address potential effects include:

- Where practicable, waterbody crossings will be designed using single-span elements (bridges or culverts) to minimize encroachment into stream channels and reduce effects on water flow, water levels under variable flow conditions, and riparian vegetation.
- All watercourse crossings will be constructed in accordance with DFO's Measures to Protect Fish and Fish Habitat (2022) and applicable Codes of Practice (DFO, 2024) and MNR's Environmental Guidelines for Access Roads and Water Crossings.
- Temporary watercourse diversions will be constructed during low-flow conditions. They will be designed to accommodate flows, thereby preventing upstream flooding and maintaining downstream flow conditions to minimize effects on vegetation during temporary works. Flow to downstream vegetated areas will be maintained at all times while the worksite is isolated (i.e., during construction of temporary crossings such as culverts and bailey bridges).

- When pumped diversions are required, water will be drawn from near the surface of the waterbody to minimize turbidity. The pumping system will be sized to accommodate expected watercourse flow and maintain both upstream and downstream vegetation during the lifetime of the diversion. Pumps will be discharged onto geofabrics, filter bags or alternatives approved by the Proponent to dissipate the energy of discharge, mitigate erosion of channel bank vegetation, and provide water quality treatment.
- Groundwater dewatering and pumping activities to allow for installation or repair of structures is regulated through a permitting process (e.g., Environmental Activity and Sector Registry (EASR), or Permit to Take Water (PTTW)). As part of the supporting the PTTW or EASR applications, hydrogeological studies will be undertaken to detail the dewatering impacts on groundwater levels and any indirect effects to vegetation near the dewatering sites. Site specific discharge plans, mitigation measures and monitoring plans to protect water quality and vegetation will be further developed as part of the permitting process and industry best management practices will be implemented to minimize potential temporary groundwater drawdown, manage dewatering volumes and treat dewatering effluent.
- To maintain or enhance hydraulic connections between the upgradient and downgradient sides of the road and allow groundwater to flow naturally, crushed stones (rockfill) and/or equalization culverts will be used at wetland (peatland) crossings at intervals of 100 m to 250 m.
- In cut areas, groundwater seepage (if any) will be controlled and managed through roadside drainage systems (e.g., roadside ditches), allowing groundwater to infiltrate into the ground and recharge the local groundwater regime.
- All culverts and bridge structures will be monitored on a scheduled basis to prevent obstructions from causing flooding or drought conditions in vegetation communities adjacent to the road. Particular attention will be paid during the spring freshet.
- Further details on mitigation measures to address potential adverse effects can be found in Appendix E (Mitigation), Section 5.7 – Temporary Watercourse Crossings, Section 5.8 – Temporary Watercourse Diversions, and Section 5.11 – Bridge and Culvert Installations.

11.4.1.3 Indirect Effects Pathways

The following sections outline the mitigation measure applicable to the indirect pathways that can lead to losses or alteration of vegetation species, communities and diversity during the construction and operations of the Project.

11.4.1.3.1 Grading and Soil Disturbance

Grading and soil disturbance from excavations and earth moving activities can alter topography and drainage patterns that may affect soil quantity and quality and increase erosion/sedimentation that in tum could impact vegetation growth, survival, composition and distribution. Changes to drainage patterns from grading and soil disturbance can also increase or decrease drainage flows and surface water levels causing flooding or drying of vegetation communities as well as changes to groundwater flow through wetlands.

Mitigation measures to address potential effects from grading and soil disturbance activities include Erosion and Sediment Control (ESC) measures (e.g., OPSS 805, Construction Specification for Temporary ESC Measures) that will be developed in the detail design phase of the Project and implemented during construction to prevent erosion and migration of soils from disturbed areas from rainfall events and wind. Further details on the ESC measures to prevent and reduce potential effects on vegetation from grading and soil disturbance are provided in Appendix E (Mitigation Measures), Section 5.16 (Erosion and Sediment Control). Project guidance on mitigation measures will also be provided in the Erosion and Sediment Control Plan as part of the CEMP and OEMP to be developed and implemented for the Project. Key mitigation measures include the following:

- Erosion and sediment control measures will be inspected by the proponent's Contractor on a regular basis and after every major rain or spring melt event, with necessary repairs being made immediately after deficiencies are identified. Inspections will be confirmed by the proponent's Contractor and include opportunities for Indigenous Monitors to participate in the monitoring program.
- Procedures outlined in the ESC Plan shall be followed to control run-off, minimize erosion on exposed slopes and substrates, and prevent sediment or other deleterious materials from entering vegetation assemblages and watercourses.
- Vegetation cover shall be preserved for as long as possible. Wherever practicable, it will be removed in stages as construction of the road advances, with site grading and disturbance activities being halted during heavy rainstorms and exceedingly wet conditions.
- The Project will provide direction on topsoil stripping, stockpiling, salvage and placement on the landscape, which is expected to mitigate changes to soil quality and quantity. This guidance (i.e., protocols and procedures) will form part of the Soil Management Plan and be developed and implemented as part of the CEMP and OEMP for the Project.
- Machines and equipment used for site grading will be selected, where practicable, to minimize soil disturbance and soil compaction. Compacted areas will be ripped or otherwise treated to loosen soil and facilitate natural revegetation.
- In order to maintain existing drainage flow paths through the flat floodplains and peatlands in the east-west segment of the road, equalization culverts (approximately 1 m diameter) will be placed at regular intervals along the road to maintain localized minor flow paths across the road.
- To prevent barrier effects from the road and ensure the maintenance of existing groundwater flows, materials selected for road construction, especially the portion below the existing ground surface / groundwater table, will have the same or higher permeability compared to the surrounding native soils.
- As necessary, underlying crushed stones (rockfill) and/or equalization culverts will be used in wetlands (peatlands) to maintain natural hydraulic connections between the upgradient and downgradient sides of the road and allow groundwater to flow naturally through it.
- The road design has considered consolidation and compression processes of the peat layers associated with road construction (loading), which may result in reduced permeability of the peat, and thus alter natural groundwater flow directions and pathways. This aspect of the road design will be further evaluated in the detail design phase for the Project.
- All disturbed banks and shoreline areas will be restored to their original conditions as soon as practicable, including re-vegetation if necessary.

11.4.1.3.2 Introduction of Invasive Species

Construction and operation activities have the potential to introduce invasive (non-native) plant species into the Project's study areas, which can disrupt plant communities and decrease habitat quality by affecting plant community structure and species diversity directly through competition.

A Vegetation and Invasive Species Management Plan will be prepared as part of the CEMP and OEMP to describe procedures that prevent the introduction and spread of invasive species. Some of the proposed measures to prevent the introduction of invasive species are described in Section 5.23 of Appendix E (Mitigation Measures). In summary, some of the key preventative measures include:

- All construction equipment (including tools, clothing, and vehicles) that arrive on the site will be visually inspected to confirm they are in clean condition, free of mud and debris that could harbor invasive vegetation species. All inspections of equipment and vehicles destined for the Project will adhere to the Clean Equipment Protocol for Industry (2016) and requirements of the Canada-Ontario Invasive Species Centre and the Ontario Ministry of Natural Resources (ontarioinvasiveplants.ca).
- Qualified environmental monitors will document all invasive species occurrences observed.
- If imported fill/soil is used outside of the study areas for the Project, the proponent's contractor will confirm the materials are free of contaminants, including roots, stem fragments, and seeds of invasive plant species.
- All reclamation areas (previously disturbed work sites) will be restored with native trees, shrubs and/or groundcover seed mixes.
- Should any invasive species be located within the study areas, they will be targeted for removal using manual or mechanical methods. The use of herbicides will only be considered where other control methods have proven ineffective. Should it be deemed necessary, any herbicides would be applied by a licensed applicator in accordance with Ontario regulations.
- Education and training programs will be implemented to familiarize workers with potential invasive species, with associated reporting procedures.

11.4.1.3.3 Chemical or Hazardous Material Spills and Waste

Chemical or hazardous spills (e.g., petroleum products) from vehicles and equipment, or improper storage and handling of waste or fuel, can affect soil quality and in turn effect upland, wetland, and riparian ecosystems. The transport and handling of hazardous materials or chemicals will be carefully managed by the proponent's contractor. Procedures for the transportation, storage, and handling chemicals and fuels will be implemented for the Project to avoid spills or release of contaminants to the environment.

A Waste Management Plan and Fuel Storage and Handling Plan for construction and operations will be prepared as part of the CEMP and OEMP to describe procedures for handling and storing fuels and waste; the disposal of wastes such as used oil, filter and grease cartridges, lubrication containers, construction-related debris and surplus materials; and the storage and disposal of domestic garbage and camp wastes (e.g., food and grey water). The proposed mitigation and protection measures are described in Sections 5.2., 5.5, and 5.17 of Appendix E (Mitigation Measures). Some of the key measures include:

- All hazardous materials products will be transported in accordance with the federal *Transportation of Dangerous Goods Act*, Ontario *Dangerous Goods Transportation Act* and Ontario *Technical Standards and Safety Act* and will include materials transported in tanker trucks, drums, or other approved containers.
- All employees involved in handling and/or storing fuels and hazardous materials will be qualified to handle these materials and have a Workplace Hazardous Materials Information System training.
- Designated fuel storage areas will be established at the permanent Maintenance and Storage Facility (MSF) and/or temporary construction camps with barricaded double-walled above-ground storage tanks (ASTs) or other suitable fuel tanks with secondary containment measures (e.g., berm system) for safety. A fuelling truck may also be used for refuelling vehicles and equipment on-site and filling fuel tanks in temporary construction camps.

- Fuelling and storage areas will include appropriate drainage controls including secondary containment with a storage capacity of at least 110% of the fuel tank. Drainage will be retained in a sump where hydrocarbons can be captured and separated prior to the release of any rainwater run-off, as appropriate.
- Equipment with reduced mobility, such as heavy lift cranes and excavators, will have fuel delivered by a mobile tank and re-fuelling will take place on site, according to safety procedures. Where fuelling of vehicles and other mobile or heavy equipment is required at sites along the road then fuelling will not be permitted within 50 m of a permanent waterbody.
- Explosives to be used for blasting activities at aggregate source areas (i.e., ARA-2 and ARA-4) for rock and aggregate materials will be stored in a secured container. Siting of these storage areas will meet the provincial standards and licensing requirements as specified in the Mines and Mining Plants Regulation of the Ontario *Occupational Health and Safety Act*.
- Solid waste (hazardous and non-hazardous) and liquid waste (oils, lubricants) generated during the construction phase will be stored at temporary construction camps, and during the operations phase at the permanent MSF. Solid waste handling and storage areas at camps and the MSF will include a waste recycling area to reduce the amount of solid waste generated. Liquid industrial waste such a waste oils, lubricants and other used oil will be stored in drums at camps and the MSF and will be regularly shipped for disposal. Organic solid waste at the camps and MSF will be temporarily stored in bear-proof containers before being transported to a waste disposal site.
- Domestic wastewater and sewage in the form of liquid effluent generated at construction camps and the Maintenance and Storage Facility may be treated on-site using a portable treatment facility (plant), a conventional septic system with a tank and leaching bed, or transported off-site by tanker truck for treatment at approved sewage disposal facilities. The appropriate approvals (e.g., environmental compliance approvals, federal approvals) will be acquired, as needed. Note that the specific sewage and wastewater treatment systems for camps and the MSF is to be determined during the detail design phase and is based on further assessment of site conditions and the selected construction contractor.
- To avoid potential impacts to vegetation, surface water and groundwater from winter operations of the road, no storage, handling or application of sand or salt is proposed for de-icing of the WSR during the winter season. However, sand may be applied in select locations based on road safety concerns.
- If chemical or hazardous material spills occur as result of the Project, the proponent’s contractor will implement the procedures in the Spill Prevention and Emergency Response Management Plan to be prepared as part of the CEMP and OEMP. The proposed mitigation and protection measures to manage spills should they occur are described in Section 5.2 of Appendix E (Mitigation Measures). Some of the key measures include:
  - The proponent’s contractor will designate a qualified supervisor as the on-site spills and emergency response coordinator. The emergency response coordinator will have the authority to redirect manpower and equipment to respond in the event of a spill.
  - Individuals working on-site and handling hazardous materials and waste will be trained and aware of the procedures in the Spill Prevention and Emergency Response Management Plan.
  - Emergency spill kits will be available near fuel and hazardous materials handling locations (e.g., spill kits at temporary laydown areas and/or temporary construction camps) and in vehicles.
  - Construction equipment and vehicles will be regularly maintained to minimize leaks.
  - Absorbent pads, or other precautions, such as high-density polyethylene groundsheets, will be used to contain fuel and prevent it from being spilled onto the ground surface.

- All spills of petroleum products or other hazardous substances will be reported to the MECP Spill Action Centre immediately after the incident occurs and the Contractor will follow any instructions given by the MECP regarding spill response.

11.4.1.3.4 Dust and Air Emissions, and Subsequent Deposition

Construction and operation of the Project is predicted to generate air and dust emissions and subsequent deposition that can affect upland, riparian and wetland ecosystems through changes to soil quality, as well as in some cases dust that falls on plants could directly damage vegetation and lead to death.

An Air Quality and Dust Control Management Plan will be prepared as part of the CEMP and OEMP to describe the procedures to minimize air quality and dust emissions during construction and operations of the Project. Dust control practices are described in Appendix E (Mitigation Measures), Section 5.18. In summary, some of the key measures to reduce and control air and dust emission include the following which are detailed in Section 9 of this EAR/IS (Assessment of Effects on the Atmospheric Environment):

- Engine idling policies and procedures will be implemented to reduce fuel consumption of vehicles and equipment, and to limit GHG emissions.
- The Project will use energy efficient, lower-emission vehicles and equipment, where practical.
- The proponent's contractor will implement effective dust suppression techniques, such as on-site watering, as necessary to minimize fugitive dust from the road, earth stockpiles and disturbed areas as required. Should chemical dust suppressants, such as magnesium chloride, be required, they will not be applied within 50 m of a water crossing or beyond the road footprint. In general, the use and application of dust suppressants, where applicable, will be conducted in accordance with Ministry of Transportation Ontario Provincial Standard Specification 506 – Construction Specification for Dust Suppressants.
- A Construction Blasting Management Plan will be prepared as part of the CEMP and OEMP to describe the procedures to limit the amount of chemical residue in the environment that may harm vegetation. The Blasting and Communication Management Plan will include measures to address stakeholder and Indigenous community notification, storage, transport and use of explosives, environmentally significant areas, and waterbodies. Prior to blasting, terrestrial surveys will be conducted to identify environmentally sensitive features within 250 m from the blasting location and where required mitigation measures will be modified or enhanced, if needed.

11.4.1.3.5 Changes to Microclimate Conditions

There will be some localized alterations in microclimate conditions during construction and operation of the Project, such as increased temperature and the availability of light, in the vicinity of the roadway that may result in changes to canopy/shade conditions due to the vegetation removals and grading and drainage associated with the road. To address potential changes to microclimate conditions that may influence plant community diversity within the ROW and in close proximity road the following mitigation measures are proposed:

- The design of culverts and roadside drainage systems, including final grading within the road ROW will to the extent practicable minimize potential changes to local microclimatic conditions (e.g., increased drifting and local albedo effects).
- The use of vegetation windbreaks and snow fencing will be considered along stretches of the roadway where cleared areas for the road have created increased wind conditions affecting adjacent vegetation.

11.4.1.3.6 Increased Risk of Fire

Wildfires are a normal and necessary component of natural forest ecosystems in the study area. However, the Project and human activities associated with its construction and operations could increase the risk of forest fires in the study area. Mitigation measures to be implemented to avoid and/or minimize the increased risk of fire will be consistent with the direction provided by the Industrial Operations Protocol under Ontario Regulation 207/96. These will include:

- No fires being started without first taking sufficient precautions to ensure that the fire can be kept under control (i.e., development and implementation of a fire prevention and preparedness plan)
- To the extent possible, burning of brush and wood from vegetation clearing activities will be avoided during the dry season. In northern Ontario the dry season typically occurs during the peak summer months (July/August) of a given year.
- Should burning be required for the disposal of biomass, a Burn Permit under the Ontario *Forest Fire Prevention Act* will be obtained from the MNR. All conditions imposed by the Burn Permit will be adhered to.
- In the event that burning is required, any active fires shall be monitored by the proponent's contractor for the duration of the burning activities. No fires shall be left unattended. A primary control zone will be established around burn sites. In the event that a wildfire occurs, it will be immediately reported by the proponent and to the MNR.
- All reasonable steps will be taken in order to prevent a fire from burning out of control or spreading from land owned or occupied for construction purposes, including having wildlife suppression equipment on hand to take immediate action in the event a small fire is ignited.
- In the event that a wildfire is identified where construction or operation activities are taking place, all reasonable attempts will be made to extinguish the wildfire using available equipment, services and workers on-site.
- Signage indicating current fire hazard potential, updated regularly, will be posted along all road at adequate intervals during construction and operations.
- No fires will be permitted at designated rest areas for use by the public during operations of the Project.

11.4.2 Loss or Alteration of Wetland Function

There will be a direct loss of wetland function within the Project Footprint removal areas, but the extent of loss will be directly dependent on the ability to appropriately design and mitigate for potential losses. Understanding the key functional features of each wetland class encountered and altered, mostly from a geophysical context, and maintaining how they interact (baseline conditions) with neighbouring classes as much as possible will provide the best solutions to limit the extent of loss or impact to the function of each class of wetland as result of the Project.

The mitigation measures listed in **Section 11.4.1** (Loss or Alteration to Vegetation Species, Communities and Biodiversity) are all applicable to the goal of mitigating the loss or alteration of wetland functions from the Project. However, it is recommended that a wetland function monitoring program be further developed and implemented as part of the follow-up monitoring for the Project (refer to **Section 11.13**) to help fully understand and confirm predicted effects of the roadway on wetland functions, including if supplemental mitigation measures or adaptive management actions are warranted. **Section 11.13** provides an overview of the proposed wetland function program, and the details of the program are described in Appendix K-4. The wetland function monitoring program is based on a detailed Level 3 Wetland

Functions Assessment protocol with the objective to capture and assess various observable wetland functions through future field surveys results on hydrologic and hydrogeologic, soils, water quality, vegetation, and wildlife characteristics.

Other than a direct accounting of wetland losses, the method used in the baseline and **Section 11.4.4** (Loss or Alteration of Plant Species at Risk and Plant Species and Communities of Conservation Concern) to determine initial impacts to wetland function uses a regional approach. This is considered adequate for the determination of effects in this document, but to capture localized wetland functional changes during construction and operations, more detailed information is required which can be acquired through the development and execution of a Wetlands Function Monitoring Program as described in Appendix K-4.

11.4.3 Loss or Alteration of Plant Species at Risk and Plant Species and Communities of Conservation Concern

As no Federally or Provincially listed plant species at risk or Communities of Conservation Concern were documented or found from field surveys conducted in the study area for the Project, there are no predicted effects. There are also no predicted effects on the two Provincially rare mosses identified during field surveys as they were observed well outside of the proposed vegetation removal's areas.

As described in **Section 11.3.4**, there will be some direct losses of underrepresented vegetation communities (Hardwood and Mixedwood Forests), and some potential low level indirect effects to Meadow Marsh
(See **Section 11.3.4**). These vegetation classes are considered locally rare, but the mitigation measures listed above in **Section 11.4.1** and those in Appendix E are all applicable to the goal of minimizing potential direct and indirect adverse effects to these areas during the construction and operation phases of the Project.

11.4.4 Loss or Alteration of Plant Species and Communities of Traditional Importance to Indigenous Peoples

As described in **Section 11.3.5** (Loss or Alteration to Vegetation Species and Communities of Traditional Importance to Indigenous Peoples), there will be some direct loss of vegetation communities known to contain plant species of traditional importance to Indigenous Peoples in the study area.

The mitigation measures listed above in **Section 11.4.1** (Loss or Alteration to Vegetation Species, Communities and Biodiversity) and those in Appendix E (Mitigation Measures) are all applicable to the goal of minimizing the potential localized adverse effects to vegetation communities and species of traditional importance to Indigenous Peoples during the construction and operation of the Project.

Indigenous community members asked whether compensation will be provided for unavoidable wetland and stream losses and what are the related plans to compensate for these losses. Section 11.4.5 outlines offsetting approaches to compensate for unavoidable losses of upland, wetland and riparian areas.

11.4.5 Off-setting Activities – Upland, Wetland and Riparian Vegetation

Restoration or reclamation of disturbed areas and clean up activities will occur progressively throughout the construction phase of the Project. These activities will include, but not be limited to, removing refuse, grading disturbed areas, contouring disturbed slopes to a stable profile, re-establishing natural drainage patterns and seeding/planting to establish vegetation. Native seed mixes and approaches will be used to allow for natural regeneration to achieve the desirable groundcover, trees and/or shrubs with the goal to stabilize disturbed soils and minimize erosion potential within the road ROW and other areas, where applicable. Details of the restoration activities, along with guidance to the proponent's contractor, will be documented in the Site Restoration and Monitoring Plan to be developed and implemented as part of the CEMP for the Project.

For permanent losses to upland, wetland and riparian areas, it is proposed that an Ecological Restoration Plan (the Plan) be developed in consultation with First Nations, Federal/Provincial agencies, and stakeholders with the goal of providing in-kind compensation for the losses to the vegetation classes described in **Section 11.3.2.1.1** (Direct Vegetation Losses). The Plan will employ scientific Ecological Restoration Templates as a proven approach to the design and implementation of successful ecological restoration. The ER Templates are proposed to be based on ecological land classification (ELC) models and/or site-specific reference models, as determined on a site-specific basis. The Ecological Restoration Templates allow for the design and implementation of restoration projects in a systematic and efficient manner yet provide a practical and adaptive approach for implementing successful restoration of complex ecological systems. Although each of the Off-setting Restoration Plans developed within the Ecological Restoration Plan will be site-specific, the general proposed approach for upland and wetland restoration is included in Appendix K-3. Note that the restoration plans to be developed for riparian areas have not been included since they will be a combination of the upland and wetland processes depending on the status of the lands adjacent to the waterbody. The process for development of the Off-setting Restoration Plans will include the following key steps:

- Background Information Gathering/Review – consultation with First Nations, government agencies and stakeholders and collect and review relevant background information;
- Field Investigations/Site Assessment – Conduct comprehensive baseline surveys on reference and candidate restoration sites;
- Conceptual Restoration Plan – Based on field investigations, background review, and consultation with First Nations, Federal/Provincial agencies, and stakeholders, a Conceptual Restoration Plan will be developed;
- Detailed Restoration Plan – Preparation of the Detailed Restoration Plan will follow approval of the Conceptual Plan. It will build on the Conceptual Plan and specify the comprehensive restoration strategy for the site;
- Implementation/Construction Oversight – Oversight of the restoration activities will be highly dependent on the overall construction schedule, including remediation activities, soil treatments, and other facets of the project. This will constitute an overall strategy to oversee contractor's activities on-site during key phases of the program; and,
- Management and Monitoring – The management and monitoring programs will be developed based on Adaptive Management principles.

11.4.6 Mitigation Measures Summary

The key mitigation measures to address potential adverse effects of the Project on the Vegetation and Wetland VC as outlined in this section and Appendix E of the EAR/IS are presented in **Table 11-41**.

Table 11-41: Summary of Potential Effects, Mitigation Measures and Predicted Net Effects for Vegetation and Wetlands VC

VC Subcomponent	Indicators	Project Phase	Project Component or Activity	Potential Effect	Key Mitigation Measures	Predicted Net Effect
Vegetation Communities, Species and Biodiversity	▪ Direct loss of upland, wetland and riparian species, vegetation communities (assemblages). ▪ Fragmentation of vegetation communities. ▪ Alterations to community biodiversity. ▪ Vegetation die-off or community alterations outside of the Project clearing limits.	▪ Construction / Operations	▪ Construction and use of supportive infrastructure. ▪ Construction of road. ▪ Grading and soil disturbance/compaction. ▪ Installation and maintenance of watercourse crossing structures. ▪ General management and maintenance requirements during operations. ▪ Emissions, discharge and waste during construction and operations. ▪ Decommissioning of temporary construction camps, access roads and laydown/storage areas. ▪ Site restoration / reclamation and demobilization.	▪ Direct destruction of upland, wetland, or riparian vegetation species and communities. ▪ Indirect degradation and/or alteration of upland, wetland, or riparian vegetation communities and/or plant species composition.	▪ Project routing and design. ▪ Vegetation clearing and grubbing standards. ▪ Erosion and sediment control. ▪ Waste and hazardous materials handling standards. ▪ Road surface materials and dust management standards. ▪ Appropriate signage during and post construction. ▪ Clearly delineating no-go zones. ▪ Habitat offsetting + enhancement.	Yes
Wetland Functions	▪ Loss or alteration of the geophysical, biophysical, and socioeconomic functions of wetlands.	▪ Construction / Operations	▪ Construction and use of supportive infrastructure. ▪ Construction of road. ▪ Grading and soil disturbance/compaction. ▪ Installation and maintenance of watercourse crossing structures. ▪ General management and maintenance requirements during operations. ▪ Emissions, discharge and waste during construction and operations. ▪ Decommissioning of temporary construction camps, access roads and laydown/storage areas. ▪ Site restoration/reclamation and demobilization.	▪ Direct losses or changes to wetland functions (i.e., road installation, grading, etc.). ▪ Indirect losses or changes to wetland function (i.e., introduction of invasive species, changes to microclimate conditions, etc.).	▪ Project routing and design. ▪ Vegetation clearing and grubbing standards. ▪ Erosion and sediment control. ▪ Waste and hazardous materials handling standards. ▪ Road surface materials and dust management standards. ▪ Appropriate signage during and post construction. ▪ Clearly delineating no-go zones. ▪ Habitat offsetting + enhancement. ▪ Appropriate signage during and post construction. ▪ Clearly delineating no-go zones. ▪ Wetland function monitoring program.	Yes
Plant Species and Communities at Risk, of Conservation Concern, or Locally Underrepresented	▪ Loss or alteration of plant species and communities of conservation concern.	▪ Construction / Operations	▪ Construction and Use of Supportive Infrastructure. ▪ Construction of Road. ▪ Grading and soil disturbance/compaction. ▪ Installation and maintenance of watercourse crossing structures. ▪ General management and maintenance requirements during operations. ▪ Emissions, discharge and waste during construction and operations. ▪ Decommissioning of temporary construction camps, access roads and laydown/storage areas. ▪ Site restoration/reclamation and demobilization.	▪ Destruction of upland, wetland, or riparian vegetation communities/assemblages. ▪ Localized degradation and/or alteration of upland, wetland, or riparian vegetation communities and/or plant species composition.	▪ Project routing and design. ▪ Habitat delineation and mapping. ▪ Vegetation clearing and grubbing standards. ▪ Erosion and sediment control. ▪ Habitat offsetting + enhancement. ▪ Appropriate signage during and post construction. ▪ Clearly delineating no-go zones.	Yes

VC Subcomponent	Indicators	Project Phase	Project Component or Activity	Potential Effect	Key Mitigation Measures	Predicted Net Effect
Plant Species and Communities of Traditional Importance to Indigenous Peoples	▪ Loss or alteration of plant species and communities of traditional importance to Indigenous Peoples for cultural or medicinal purposes or as a source of country foods.	▪ Construction/ Operations	▪ Construction and Use of Supportive Infrastructure. ▪ Construction of Road. ▪ Grading and soil disturbance/compaction. ▪ Installation and maintenance of watercourse crossing structures. ▪ General management and maintenance requirements during operations. ▪ Emissions, discharge and waste during construction and operations. ▪ Decommissioning of temporary construction camps, access roads and laydown/storage areas. ▪ Site restoration / reclamation and demobilization.	▪ Destruction of upland, wetland, or riparian vegetation communities/assemblages. ▪ Localized degradation and/or alteration of upland, wetland, or riparian vegetation communities and/or plant species composition.	▪ Project routing and design. ▪ Habitat delineation and mapping. ▪ Vegetation clearing and grubbing standards. ▪ Erosion and sediment control. ▪ Habitat offsetting + enhancement. ▪ Appropriate signage during and post construction. ▪ Clearly delineating no-go zones.	Yes

11.5 Characterization of Net Effects

Net effects are defined as the effects of the Project that remain after application of proposed mitigation measures. The effects assessment follows the general process described in Section 5 (Environmental Assessment / Impact Assessment Approach). The focus of the effects assessment is on predicted net effects (**Section 11.7**), which are the effects that remain after application of proposed mitigation measures (**Section 11.4**). Potential effects with no predicted net effect after implementation of mitigation measures are not carried forward to the net effects characterization or the cumulative effects assessment.

Table 11-42 presents definitions for net effects criteria, developed with specific reference to the Vegetation and Wetlands VC. These criteria are considered together in the assessment, along with context derived from existing conditions and proposed mitigation measures, to characterize predicted net effects from the Project on the Vegetation and Wetlands VC.

Table 11-42: Criteria for Characterization of Predicted Net Effects on Vegetation and Wetlands VC

Characterization Criteria	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	Direction relates to the value of the effect in relation to the existing conditions.	**Positive** – Net gain or benefit; effect is desirable. **Neutral** – No change compared with existing conditions and trends. **Negative** – Net loss or adverse effect; effect is undesirable.
Magnitude	Magnitude is the amount of change in measurable parameters or the VC relative to existing conditions. For the Vegetation and Wetlands VC magnitude will be measured using the scope parameters found in the TISG Threat assessment.	**Negligible** – A measurable change of vegetation community or species availability between 1 and 10% that is not expected to cause significant losses of a vegetation community, or specific species, and the net effect will be unlikely to affect the overall availability. **Low** – A measurable change of vegetation community or species availability between 11 and 30% that is not expected to cause significant losses of a vegetation community, or specific species, and the net effect will be unlikely to affect the overall availability but is above negligible. **Moderate** – A measurable change of 31 to 70% that could cause impacts to vegetation communities or species within the area. This level of effect would cause an observable effect to the affected communities, or specific species but would be within the adaptive capability of the species. **High** – A measurable change of 71 to 100% that may not be manageable, and the change exceeds the ability of a vegetation community or species to continue sustained existence within the area.
Geographic Extent	Geographic extent refers to the spatial area over which a net effect is expected to occur or can be detected within the Project Footprint, Local Study Area and Regional Study Area.	**Project Footprint** – The effect is confined to the Project Footprint or Project Development Area. **Local Study Area** – The effect is confined to the Local Study Area. **Regional Study Area** – The effect extends beyond the Local Study Area boundary but is confined within the Regional Study Area.

Characterization Criteria	Description	Quantitative Measure or Definition of Qualitative Categories
Timing	Timing criteria indicate the timing (e.g., dates or seasons) importance of the net effect.	**Low** – Timing of project activity will have no effect on the viability of local and regional populations and/or render ecosystem communities unsuitable for important seasonal life processes. **Medium** – Timing of project activity will moderately affect the viability of local and regional populations and/or render ecosystem communities unsuitable for important seasonal life processes. **High** – Timing of project activity will significantly affect the viability of local and regional populations and/or render ecosystem communities unsuitable for important seasonal life processes.
Duration	Duration is the period of time required until the measurable indicators or the VC returns to its existing (baseline) condition, or the net effect can no longer be measured or otherwise perceived.	**Short-term** – Net effect restricted to no more than the duration of the construction phase (approximately 5 years). **Medium-term** – Net effect extends through the operations phase of the Project (75-year life cycle). **Long-term** – Net effect extends beyond the operations phase (greater than 75 years). **Permanent** – Recovery to baseline conditions unlikely
Frequency	Frequency refers to the rate of occurrence of an effect over the duration of the Project or in a specific phase.	**Continuous** – The effect is expected to occur continually. **Frequent** – The effect is expected to occur intermittently. **Infrequent** – The effect is expected to occur rarely.
Context	Context considers sensitivity and resilience of the VC to particular project-related changes.	**Low** – Vegetation community, or specific species is not sensitive to described activities or impacts. **Moderate** – Vegetation community, or specific species have moderate resilience is somewhat sensitive to described activities or impacts but has capacity to assimilate change. **High** – Vegetation community, or specific species have weak resilience to stress and is very sensitive to described activities or impacts with little capacity to assimilate change.
Reversibility	Reversibility describes whether a measurable indicator or the VC can return to its existing condition after the project activity ceases.	**Reversible** – The net effect is likely to be reversed after activity completion and rehabilitation. **Irreversible** – The net effect is unlikely to be reversed.
Likelihood of Occurrence	Likelihood of occurrence is a measure of the likelihood that an activity will result in an effect.	**Unlikely** – The effect is not likely to occur. **Possible** – The effect may occur, but is not likely. **Probable** – The effect is likely to occur. **Certain** – The effect will occur.

11.6 Potential Effect Pathways Carried Through for Further Assessment

Potential effects as outlined in **Table 11-41** of **Section 11.4.6** (Mitigation Measures Summary) cannot be entirely mitigated given that the Project crosses a large geographical area with minimal human impacts or infrastructure. As such none of the potential effect pathways can be completely eliminated with implementation of the of mitigation measures and are carried forward for further assessment (**Section 11.7**: Predicted Net Effects).

11.7 Predicted Net Effects

Net effects are defined as the effects of the Project that remain after application of proposed mitigation measures. The following section provide an assessment of the net effects to the Vegetation and Wetlands VC, including characterization of the net effects using the criteria in **Table 11-42**, and following the application of mitigative measures identified in **Section 11.3** (Predicted Net Effects). The four predicted net effects on the Vegetation and Wetlands VC are:

1. Loss or alteration of all or part of vegetation communities, species and biodiversity.
2. Loss or alteration of Wetland Function.
3. Loss or alteration of species at risk plants and species and communities of conservation concern.
4. Loss or alteration of plant species and communities of traditional importance to Indigenous Peoples.

11.7.1 Loss or Alteration of Vegetation Communities, Species and Diversity

Loss and alterations to vegetation communities, species and diversity will be incurred both directly and indirectly during the construction and operation phases of the Project. These aspects of the local vegetation ecology are inherently intertwined and were assessed holistically. The primary pathways associated with direct losses and alterations to vegetation by the Project are clearing and grubbing; soil grading and excavation and installation of water crossing structures in the road ROW.

11.7.1.1 Construction

The direct losses or alterations to vegetation communities are limited to the construction period during the clearing, grubbing, grading for: the road, temporary construction camps, aggregate extraction areas (ARA-2 and ARA-4) and installation of water crossing structures. With the application of the mitigation measures outlined in **Section 11.4,** vegetation management will be limited to the removal limits required for the construction of the road and supportive infrastructure facilities. There may be some opportunities for minor reductions in predicted vegetation removals, such as the aggregate extraction areas, if material estimates versus actual volumes needed during construction differ and consequently result in the reduction in clearing requirements; however, this is not considered significant.

Approximately 546.57 ha of vegetation loss is expected to occur during clearing, grubbing and grading activities for the construction phase of the Project. Most of the vegetation losses represent less than 6.5% of the available vegetation classes within the LSA, and less than 1% in the RSA (see **Table 11-21** in **Section 11.3.2**: Loss or Alteration of Vegetation Communities, Species and Biodiversity).

Some permanent fragmentation is also expected due to the linear nature of the development. A considerable number of existing vegetation patches (404) will be encroached upon and/or bisected, resulting in removals within a number of identified vegetation classes. In most cases these removals will only affect portions of any discreet individual vegetation patch to various degrees, resulting in the division of the patch into two or more discrete patches and result in a net gain of vegetation patches. This increase in discreate patch numbers, typically an increase of 1 to 7 for most vegetation classes, and up to 156 new patches for more common classes such as Conifer Swamp, corresponds to a reduction in mean patch size between a 0.002% to 0.8% for most affected vegetation classes within the RSA. This fragmentation also affects the availability of edge habitat, which will result in a net gain of 153,986 metres (153.9 km) across all vegetation classes within the study area. This increase is the result of newly created edge communities along both sides to the proposed road and supportive infrastructure facilities.

Of the total vegetation patches encroached upon or bisected, 256 are large enough to have a core area. Core Areas are defined as interior areas of a contiguous vegetation patch that are free of edge effects. In this study an interior buffer of 50m was applied to each vegetation patch, the areas remaining were considered to be core areas. Generally, there is a net gain to the number of core area patches across all vegetation classes. For example, Conifer Swamp, Low Treed Bog, and Poor Conifer Swamp exhibit core area patch increases of 38, 29, and 27, respectively. The exception to this trend is Rock Barren and Thicket Swamp, each of which lose 1 core area patch. These gains are the result of the bisection of existing larger core areas into smaller core areas. Though the number of core patches will generally increase, there will be significant losses in total core area for some patch classifications such as Conifer Swamp (187.75 ha), Conifer Forest (160.36 ha), Poor Conifer Swamp (142.89 ha), Low Treed Bog (91.35 ha), Sparse Treed Fen (50.61), and Sparse Treed Bog (41.53 ha). The remaining classes show minor decreases between 0.0001 and 3.32 ha. These losses, though sizeable, represent less than a 10% loss of Mean Core Patch Size for each patch class, with the exception of Thicket Swamp, and Rock Barren which show Mean Patch Size Gains of 10.9%, and 100%, respectively.

Approximately 16.33 ha of riparian vegetation will be removed during the construction of the roadway and associated water crossing structures. Of this total, the maximum loss of riparian habitat occurs in the mapped River Riparian areas (5.9 ha), followed by Conifer Swamp (4.16 ha), Sparse Treed Fen (1.83 ha), Conifer Forest (1.63), and mapped Lake Riparian (1.18 ha). Potential removals in all other riparian classes are less that 1 ha. These removals represent 0.85% of the available riparian habitat found within the LSA, dropping to 0.17% when extended out to the RSA.

The effects to species diversity across the RSA, was assessed through a calculation of a diversity index that ranked the relative value of ELC types in terms of diversity in predicted use. The results suggest that there is a potential for 25 of the 30 vegetation classes identified to experience a slight increase in diversity, with only five classes showing an decrease. These increases range between 1% and 9% of the original Simpson's Diversity Index value, with decreases between 1% and 2%.

Indirect losses or alterations to vegetation are more difficult to quantify, as there are numerous variables that could affect these outcomes. However, the assessment of indirect effect pathways indicated that although largely mitigated, the effects that do remain will be localized to within 60m of the Project Footprint for upland forests and swamps, and 250 m for open wetlands, The range of areas where indirect effects could affect vegetation units are shown on **Figure 11.9** and described in **Table 11-29**. These are considered minimal ranging from 0.1% to 4% of the available vegetation classification within the LSA, with the exception of Meadow Marsh and Open Shore Fen/Thicket Swamp, where 95% and 32% respectively fall within these potential effect zones. It should be noted that the patches/polygons of these two classifications are located within the lowest anticipated indirect effect zone. They are also more common within the study areas than the project mapping suggests since they commonly exist in very small un-mappable areas, mosaiced into shoreline ecosystems. Following the implementation of mitigation measures these indirect effects are anticipated to be either completely eliminated or minimized to negligible levels resulting in no significant loss or alteration of vegetation classes within the study area.

Overall, the assessment results suggest that although there are some vegetation losses due to the removal of portions of vegetative patches, there is a minimal net effect on loss or alteration of vegetation communities, species and diversity, with implementation of the mitigation measures outlined in **Section 11.4.1** (Loss or Alteration to Vegetation Species, Communities and Biodiversity).

The characterization of net effects for the loss or alteration of vegetation communities, species and diversity from construction of the Project are summarized in **Table 11-43**.

Table 11-43: Characterization of Loss or Alteration of Vegetation Communities, Species and Diversity During Construction

Characterization Criteria	Result	Rationale
Direction	Negative	The direction of this effect will be negative, as there will be net direct losses of vegetation units within the Project Footprint. There will also be a reduction in overall core area size and edge length as a result of the Project. Community and species diversity will remain relatively unchanged.
Magnitude	Negligible	The majority of the vegetation losses represent less than 6.5% of the respective availability of these classes within the LSA, and less than one percent in the RSA (see **Table 11-18**).
Geographic Extent	Project Footprint	The effect will be limited primarily to the Project Footprint.
Timing	Medium	Timing of construction activities for the Project will moderately affect the viability of local and regional populations and/or render ecosystem communities unsuitable for important seasonal life processes. For example, winter under frozen ground conditions would be the best time for construction of certain sections (e.g., wetlands and river crossings) as opposed other season where soft ground conditions may be present (particularly Spring Freshet). Working in these unconsolidated soil conditions could result in increased disturbance of vegetation, unnecessary compaction of soils/peat affecting surface and subsurface flows and increased sedimentation.
Duration	Long-term	The duration of the net effects is expected to be long-term, lasting greater than the assumed 75-year operation phase of the Project.
Frequency	Frequent	The removals are expected to occur on frequent basis throughout the construction phase as the works are progressively advanced.
Context	Moderate	The predicted net effects result in loss alteration of vegetation and wetlands but will have minimal effect within the LSA and RSA where removals represent 1% – 10% of the vegetation classes available. Vegetation communities are well represented within the study areas and specific species are adaptable and largely present in numerous ecosystems.
Reversibility	Irreversible	The effects of loss and alteration are difficult to reverse, and it is unlikely the vegetation and wetlands can be restored, unless the road was removed. Restoration activities will be implemented for disturbed areas during construction that are not required for operations such as temporary construction camps and aggregate source areas.
Likelihood of Occurrence	Certain	The effects are certain will occur. Avoidance of loss to vegetation and wetland is not possible if the Project occurs.

11.7.1.2 Operations

During the operations phase of the Project, the only effect to vegetation and wetlands anticipated are those indirect effects associated with operation activities for the road and water crossing structures which may be required over time, such as repairs to bridges, culverts, ditches, road surfaces, as well as snow and vegetation management. No direct loss of vegetation units is anticipated and following the implementation of mitigation measures indirect effects are anticipated to be either completely eliminated or minimized to negligible levels resulting in no significant alteration of vegetation classes within the study area. The characterization of predicted net effects for the loss or alteration of vegetation and wetlands during operations of the Project is summarized in **Table 11-44**.

Table 11-44: Characterization of Loss or Alteration of Vegetation Communities, Species and Diversity During Operations

Characterization Criteria	Result	Rationale
Direction	Neutral	The direction of this effect will be neutral, as no loss of additional vegetation communities is expected as a result of project operation.
Magnitude	Negligible	The magnitude of the effect is predicted to be negligible, as the effect is not expected to increase during the operations phase.
Geographic Extent	Project Footprint	The effect will be limited primarily to the Project Footprint.
Timing	Low	All operations activities will occur within the road ROW and at supportive infrastructure locations. Timing of project operations activities will have no effect on the viability of local and regional vegetation populations and/or render ecosystem communities unsuitable for important seasonal life processes.
Duration	Short-term	Any potential loss of all, or parts of vegetation communities, if it did occur which is improbable, would be short-term and restored as per the mitigation requirement in **Section 11.4** (Mitigation and Enhancement Measures).
Frequency	Infrequent	Additional loss of vegetation communities during operations is not expected.
Context	Low	Effects are limited to habitats that are common throughout the study area and throughout the larger region. As such, these habitats are considered resilient to disturbance.
Reversibility	Irreversible	The effect is irreversible as the roadway is not proposed to be removed.
Likelihood of Occurrence	Unlikely	Effects of the Project during operations are unlikely to occur with implementation of mitigation measures.

11.7.2 Loss or Alteration of Wetland Function

The potential effects of the Project on wetland functions were modelled for both biotic (living) and abiotic (non-living) environments. Biotic functional values were modelled using a RSF approach to estimate probability of use for selected species of birds, amphibians, mammals, and wetland vegetation, while abiotic and Indigenous values using a semi-quantitative approach, and values were assigned to each wetland type based on literature and other information sources. In total, there were 50 individual functional values calculated in the assessment. A regional assessment of effects on wetland function was conducted and the results predicted minimal effects on functional values, of less than 1%, for all wetland classes within the LSA and RSA.

11.7.2.1 Construction

There will be a direct net loss of wetlands during construction from vegetation removal due to clearing and grubbing activities. There may also be a localized effect on the functions of the wetlands adjacent to the Project Footprint that are bisected by the development. The net effects are predicted to be minimal following the implementation of mitigation measures. The wetland function model process described in **Section 11.3.3** (Loss or Alteration of Wetland Function) shows very slight changes in the aggregate wetland function index across all wetland classes (0% to 2.2% – within the expected margin of error for the model). In some cases, these changes reflect a positive increase in functional values in reaction to the road development, which could be due to increases in some of the biotic models resulting from positive changes such as increased access, increases in edge habitat etc.

Some negative changes to the function of the various wetland vegetation patches within close proximity to the road are expected via potential indirect effects (i.e., potential changes to water regimes, invasive species, sediment deposition, spills etc.). Though largely mitigated, the indirect effects that do remain will be localized to within 60 m of the Project Footprint for upland forests and swamps, and 250 m for open wetlands as shown in **Figure 11.9**. As described in **Table 11-32**, the areas affected are predicted to be minimal for all vegetation classes affected, ranging from 0.1% to 4% of the available vegetation classification within the LSA. The exceptions are Meadow Marsh and Open Shore Fen/Thicket Swamp of which 95% and 32% respectively, could experience negative indirect effects. It should be noted that these wetland classes would only be indirectly affected, and then only at the lowest anticipated level. In addition, these classes are more common within the study areas than the project mapping suggests as they exist in very small unmappable areas mosaiced into shoreline ecosystems. Following the implementation of mitigation measures, these indirect effects to wetland functions are anticipated to be either completely eliminated or minimized to negligible levels. A summary of the net effects of destruction of vegetation assemblages caused by operations activities based on the characterization criteria is presented in **Table 11-45**.

Table 11-45: Characterization of Net Effects on Loss or Alteration of Wetland Function during Construction

Characterization Criteria	Result	Rationale
Direction	Negative	The direction of this effect will be negative, as there will be net direct loss of wetlands within the Project Footprint and changes to wetland function of adjacent wetlands.
Magnitude	Negligible	The majority of the wetland losses represent less than 6.5% of the respective availability of these classes within the LSA, and less than one (1%) percent in the RSA (see **Table 11-18**). There will also be a 0 to 2.2 percent change (-/+) in modelled aggregate wetland functions, which is considered negligible.
Geographic Extent	Local Study Area	The effects will be limited primarily to wetland areas within the LSA adjacent to the Project Footprint.
Timing	Medium	Timing of Project construction activities will have moderate affect on the viability of local and regional populations and/or render ecosystem communities unsuitable for important seasonal life processes. For example, the winter under frozen ground conditions would be the best time for construction of certain sections (*e.g.*, wetlands and river crossings) of the road as opposed to soft ground conditions during other seasons (particularly Spring Freshet). Working in these unconsolidated conditions could result in increased disturbance of vegetation, unnecessary compaction of soils affecting surface and subsurface flows and increased sedimentation.

Characterization Criteria	Result	Rationale
Duration	Long-term	The duration of the net effects is expected to be long-term, lasting greater than the assumed 75 years period for operations of the Project.
Frequency	Frequent	The removals are expected occur throughout the construction phase, resulting in frequent incremental reductions of the vegetation classes.
Context	Moderate	Functional values will be significantly degrade/reduce for the wetlands directly affected within the Project Footprint but have a minimal effect within the LSA and RSA where removals represent 1% – 10% of these vegetation class areas. Vegetation communities are well represented within the study areas and specific species are adaptable and largely present in wetland ecosystems providing a significant level of resilience at both the community and species level.
Reversibility	Irreversible	The effects to functional values of wetlands would be difficult to reverse, and it is unlikely they could be fully restored.
Likelihood of Occurrence	Certain	The effects from the construction phase are certain to occur.

11.7.2.2 Operations

During the operations phase of the Project the only anticipated effects to wetland function are indirect effects associated with operation activities for the road and water crossing structures. No further loss of vegetation units is anticipated during operations and following the implementation of mitigation measures, indirect effects are anticipated to be either completely eliminated or minimized to negligible levels resulting in no significant alteration to the function of the wetlands within the study area. A summary of the characterization of net effects on wetland functions during the operations phase is presented in **Table 11-46**.

Table 11-46: Characterization of Net Effects on Loss or Alteration of Wetland Function during Operations

Characterization Criteria	Result	Rationale
Direction	Neutral	The direction of the effect is neutral, as no loss of additional wetlands are expected as a result of project operation.
Magnitude	Negligible	The magnitude of the effect is predicted to be negligible, as the effect is not expected to increase during the operations phase.
Geographic Extent	Project Footprint	The effect will be limited primarily to the Project Footprint.
Timing	Low	All operations activities will occur within the road ROW and at supportive infrastructure locations. Timing of project operations activities will have no effect on the functional viability of local and regional vegetation populations and/or render ecosystem communities unsuitable for important seasonal life processes.
Duration	Short-term	Any potential; loss of all, or parts of wetlands, if it did occur, would be short-term and restored as per the mitigation requirements in **Section 11.4** (Mitigation and Enhancement Measures).
Frequency	Infrequent	Further loss of wetland vegetation communities during operations is not expected.

Characterization Criteria	Result	Rationale
Context	Low	Effects are limited habitats that are common throughout the study area and throughout the larger region. As such, these habitats are considered resilient to disturbance.
Reversibility	Irreversible	The effect is irreversible as the roadway is not proposed to be removed. Some loss of wetland functions if did occur may be potentially recovered (e.g., surface and groundwater flows) through application of additional site-specific mitigation in **Section 11.4** (Mitigation and Enhancement Measures).
Likelihood of Occurrence	Unlikely	The effects of the Project during operations are unlikely to occur following application of mitigation measures.

11.7.3 Loss of Alteration of Plant Species and Communities of Conservation Concern

11.7.3.1 Construction

Two locally rare upland vegetation communities, Hardwood and Mixedwood Forest, are affected by vegetation clearing and grubbing activities for the Project. The removals represent 3.13% (Hardwood) and 3.32% (Mixedwood) of these vegetation communities within the LSA and 0.85% (Hardwood) and 1.24% (Mixedwood) within the RSA (see **Table 11-34**, **Section 11.4.5**: Offsetting Activities). Following removals, the remaining portions of these locally rare communities could potentially be affected by indirect effects (e.g., changes to hydrology, sedimentation, dust deposition etc.) from construction activities such as grading, the construction of crossing structures, and general movement of materials and machinery. The areas proposed for removals are minimal at all identified levels of effect ranging from 1% to 4% of the available vegetation classification within the LSA (See **Table 11-29**). Meadow Marsh is also a locally rare vegetation class but it is found almost completely within the Low indirect zone as illustrated in **Figure 11.9** and **Table 11-29**. Following the implementation of mitigation measures, these indirect effects are anticipated to be either completely eliminated or minimized to negligible levels resulting in no significant loss or alteration of vegetation plant species or communities of conservation concern within the study areas. A summary of the characterization of net effects on plant species and communities of conservation concern during the construction phase is presented in **Table 11-47**.

Table 11-47: Characterization of Net Effects on Loss or Alteration of Plant Species and Communities of Conservation Concern During Construction

Characterization Criteria	Result	Rationale
Direction	Negative	The direction of this effect will be negative, as there will be net direct losses of two locally rare vegetation communities (Hardwood and Mixedwood Forest) vegetation assemblages within the Project Footprint. No indirect effects to Meadow Marsh are anticipated.
Magnitude	Negligible	The removals of locally rare vegetation community patches represent 3.13% (Hardwood) and 3.32% (Mixedwood) of these vegetation patches found within the LSA and 0.85% and 1.24% respectively within the RSA. No indirect effects to Meadow Marsh are anticipated.
Geographic Extent	Project Footprint	The effect will be limited primarily to the Project Footprint.

Characterization Criteria	Result	Rationale
Timing	Medium	Timing of Project construction activities will have moderate affect the viability of local and regional populations and/or render ecosystem communities unsuitable for important seasonal life processes. For example, winter under frozen ground conditions would be the best time for construction in certain areas s (*e.g.*, wetlands and river crossings) as opposed to soft ground conditions during other seasons (particularly Spring Freshet). Working in unconsolidated conditions could result in increased disturbance of vegetation, unnecessary compaction of soil affecting surface and subsurface flows and increased sedimentation.
Duration	Long-term	The duration of the net effects is expected to be long-term, lasting greater than the assumed 75-year period for operations of the road.
Frequency	Frequent	The removals are expected occur throughout the construction phase resulting in frequent incremental loss of the identified locally rare communities of conservation concern.
Context	Low	The effect is likely to only slightly degrade/reduce the vegetation classes identified as rare within the LSA and RSA by 3% – 3.3%.
Reversibility	Reversible	The net effect on the locally rare Hardwood and Mixedwood upland vegetation classes is likely to be reversed after completion onsite restoration and proposed off setting as described in **Section 11.4.5** (Offsetting Activities).
Likelihood of Occurrence	Certain	The effects are certain to occur.

11.7.3.2 Operations

During the operations phase of the Project the only effect to locally rare vegetation communities are those indirect effects associated with repairs to the roadway and water crossing structures that may be required over time. No direct loss of vegetation units of conservation concern is anticipated and following the implementation of mitigation measures indirect effects are anticipated to be either completely eliminated or minimized to negligible levels resulting in no significant loss or alteration of communities of conservation concern within the study area. A summary of the characterization of net effects on plant species and communities of conservation concern during the operations phase is presented in **Table 11-48**.

Table 11-48: Characterization of Net Effects on Loss or Alteration of Communities of Conservation Concern During Operations

Characterization Criteria	Result	Rationale
Direction	Neutral	The direction of this effect will be neutral, as no loss of additional locally rare vegetation communities is expected as a result of the project operation.
Magnitude	Negligible	The magnitude of the effect is predicted to be negligible, as the effect is not expected to increase during the operations phase.
Geographic Extent	Project Footprint	The effect will be limited primarily to the Project Footprint.
Timing	Low	All operations activities will occur within the road ROW and at other supportive infrastructure locations (i.e., ARA-4 aggregate site). Timing of project activity will have no effect on the functional viability of locally rare communities of conservation concern and/or render ecosystem communities unsuitable for important seasonal life processes.

Characterization Criteria	Result	Rationale
Duration	Short-term	Any loss of all, or parts of locally rare vegetation communities, if it did occur, would be short-term and restored as per the mitigation requirements in **Section 11.4** (Mitigation and Enhancement Measures).
Frequency	Infrequent	Loss of locally rare vegetation communities during operations is not expected, and if it did occur it would be isolated in and infrequent.
Context	Low	Loss of locally rare vegetation communities during operations is not expected.
Reversibility	Reversible	The locally rare vegetation communities occur in upland areas and as such the net effect is reversible should isolated communities of conservation concern require removal through mitigation identified in **Section 11.4** related to site restoration and/or offsetting.
Likelihood of Occurrence	Unlikely	Effects of the Project during operations are unlikely following application of mitigation measures.

11.7.4 Loss of Alteration of Plant Species and Communities of Traditional Importance to Indigenous Peoples

Given the remote nature of the study areas, the uses of discrete vegetation communities by Indigenous peoples are severely limited, with access restricted to areas within a reasonable proximity of Indigenous communities in the area, particularly the community of Webequie. Available data was used to make aerial assumptions of use (e.g., a hundred-meter use buffer was applied to travel routes). The details of the assumptions are found in **Section 11.2.1.3.3**.

11.7.4.1 Construction

Using the assumptions described in **Section 11.2.1.3.3**, it was determined that approximately 89 ha of area described as a Juniper source at the ARA-4 aggregate source site, and 9.3 ha of various portage or historic travel route areas will be removed during construction. Note Juniper is a very common plant throughout the upland vegetation classes within the study area, and the actual removals within travel routes include the buffered areas to either side of the actual travel r routes. The net effects ratings for this effect pathway are described below in **Table 11-49** below.

Table 11-49: Characterization of Net Effects on Loss or Alteration of Rare or Traditionally Important Vegetation Species and Communities During Construction

Characterization Criteria	Result	Reason
Direction	Negative	The direction of this effect will be negative, as there will be net direct loss to vegetation communities supporting plant species of importance to Indigenous peoples.
Magnitude	Negligible	Areas identified as sensitive be local indigenous Peoples will experience minimal impacts. These include approximately 89 ha of area described as a Juniper source at the ARA-4 aggregate source site, and 9.3 ha of various portage or historic travel route areas. Note Juniper is a very common plant throughout the upland vegetation classes within the study area, and the actual removals within travel routes include the buffered areas to either side of the actual travel route.

Characterization Criteria	Result	Reason
Geographic Extent	Local Study Area	The effect will be limited primarily to the Project Footprint.
Timing	Medium	Timing of Project construction activities will moderately affect the viability of vegetation plant and community utilization by local Indigenous Peoples for harvesting. Winter would remain the preferred time for construction in order to limit soils compaction and avoid the majority wildlife breeding processes.
Duration	Long -term	The duration of the net effects is expected to be long-term, lasting greater than 75 years beyond operations.
Frequency	Frequent	The removals are expected occur throughout the construction phase resulting in frequent reductions of the vegetation classes, supporting species of importance to local Indigenous Peoples, affected during construction. Mitigative measures should serve to eliminate or significantly reduce further indirect effects to both community and species composition.
Context	Low	Effects are s likely to only slightly degrade/reduce the vegetation classes that are known to support plant species of importance to local Indigenous peoples. These classes are well represented within the study areas and specific species are adaptable and largely present in numerous ecosystems providing a significant level of resilience at both the community and species level.
Reversibility	Reversible	The net effect on the upland vegetation classes that are known to support plant species of importance to local Indigenous peoples are likely to be reversible after activity completion and rehabilitation. Wetland vegetation classes that are known to support plant species of importance to local Indigenous peoples will be difficult to restore to pre-project condition, but restoration efforts are proposed to be designed to restore the areas to classes appropriate for the support of the plant species of importance to l Indigenous peoples.
Likelihood of Occurrence	Certain	The effect will occur.

11.7.4.2 Operations

During operations, the only effect to vegetation classes that are known to support plant species of importance to Indigenous peoples are indirect and associated with repairs to the roadway and water crossing structures which may be required over time. No further loss of vegetation units is anticipated, and following the implementation of mitigation measures these indirect effects are anticipated to be either completely eliminated or minimized to negligible levels. A summary of the net effects on wetland vegetation assemblages that are known to support plant species of importance to local Indigenous Peoples caused by operations activities based on the characterization criteria is presented in **Table 11-50**.

Table 11-50: Characterization of Net Effects on Loss or Alteration of Rare or Traditionally Important Vegetation Species and Communities During Operations

Characterization Criteria	Result	Rationale
Direction	Neutral	The direction of this effect will be neutral, as no destruction of additional vegetation communities that are known to support plant species of importance to local Indigenous Peoples is expected as a result of project operation.
Magnitude	Negligible	The magnitude of the effect is predicted to be negligible, as the effect is not expected to increase during the operations phase.
Geographic Extent	Project Footprint	The effect will be limited primarily to the Project Footprint.
Timing	Low	All operations activities will occur within the Project ROW. Timing of project activity will have no effect on the functional viability of local and regional populations and/or render ecosystem communities unsuitable for plant species that are of known importance to Indigenous peoples or affect important seasonal life processes of wildlife harvested by local Indigenous peoples.
Duration	Short-term	Any destruction of all, or parts of vegetation communities of importance to local Indigenous peoples, if it did occur, would be short-term and restored as per the mitigation requirements in **Section 11.4**.
Frequency	Infrequent	Additional destruction of vegetation communities of importance to local Indigenous peoples during operations is not expected. Mitigative measures will ensue weather and seasonal events, affecting processes that support species of importance to local Indigenous peoples, such as flooding, drought etc., will be minimized.
Context	Low	Additional destruction of vegetation communities of importance to local Indigenous Peoples during operations is not expected.
Reversibility	Reversible	The net effect to vegetation communities of importance to Indigenous peoples that occur in upland areas is reversible through restoration if the roadway was removed. Wetland areas can be restored but may require significantly more time. That said restoration procedure can focus on providing plant species of importance to Indigenous peoples.
Likelihood of Occurrence	Unlikely	Additional net effects to vegetation communities, or plant species of importance to local Indigenous peoples are not expected during operations and are unlikely following application of mitigation measures.

11.8 Summary of Net Effects

A summary of the characterization of net effects for the Vegetation and Wetlands VC is provided in **Table 11-51**.

Table 11-51: Summary of Predicted Net Effects on the Vegetation and Wetlands VC

Predicted Net Effect	Project Phase	Net Effects Characterization								
		Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Context	Reversibility	Likelihood of Occurrence
Loss or alteration of vegetation communities, species and biodiversity	Construction	Negative	Negligible	Local Study Area	Medium	Long-term	Frequent	Low	Irreversible	Certain
	Operations	Neutral	Negligible	Project Footprint	Low	Short-term	Infrequent	Low	Irreversible	Unlikely
Loss or Alteration of Wetland Function	Construction	Negative	Negligible	Local Study Area	Medium	Long-term	Frequent	Low	Irreversible	Certain
	Operations	Neutral	Negligible	Project Footprint	Low	Short-term	Infrequent	Low	Irreversible	Unlikely
Loss or Alteration Rare Vegetation Species and Communities	Construction	Negative	Negligible	Project Footprint	Medium	Long-term	Frequent	Low	Reversible	Certain
	Operations	Neutral	Negligible	Project Footprint	Low	Short-term	Infrequent	Low	Reversible	Unlikely
Loss or Alteration Vegetation Species and Communities of importance to local Indigenous Peoples	Construction	Negative	Negligible	Local Study Area	Medium	Long-term	Frequent	Low	Reversible	Certain
	Operations	Neutral	Negligible	Project Footprint	Low	Short-term	Infrequent	Low	Reversible	Unlikely

11.9 Determination of Significance

Several methodologies can be used to determine whether an adverse environmental effect is significant or not significant, as outlined in the Interim Technical Guidance Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act (CEA Agency, 2018). Adverse consequences on the Vegetation and Wetlands VC would include:

- Loss or alteration of vegetation communities;
- Loss or alteration of wetland function;
- Loss or alteration of plant species and communities of conservation concern; and
- Loss or alteration of plant species and communities of traditional importance to Indigenous communities

As presented in Section 5.2.6 (Environmental Assessment/Impact Assessment Approach: Determination of Significance), a qualitative aggregation method was used to determine significance based on the sequential interaction among the magnitude, geographic extent, duration, frequency, reversibility, and likelihood of occurrence criteria for effects. The net effects criteria were presented in **Table 11-42**. Consideration has also been given to potential management concerns, and concerns expressed by Indigenous communities and groups, the public, government agencies and stakeholders during engagement and consultation activities conducted for the Project (**Table 11-2** and **Table 11-3**).

As described in Table 5-6, the following sequential interactions form the basis for determination of significance of adverse net effects on the Vegetation and Wetland VC:

A predicted net effect is considered significant if it is:

- High in magnitude, local or regional in extent, long-term to permanent in duration, represents a management concern (i.e., net effects would alter the sustainability of the VC beyond a manageable level, or result in change not in accordance with provincial and federal guidelines) and has been identified as a key concern or interest by Indigenous communities and groups. In other words, Project effects would alter biological diversity and/or ecosystem function to such a degree that species and/or vegetation communities could not sustain themselves.

A predicted net effect is considered not significant if the effect is:

- Low to moderate in magnitude, local in extent, short-term in duration, does not represent a management concern, and has not been identified as a key concern or interest by Indigenous communities and groups.

11.9.1.1 Loss or Alteration of Vegetation Communities, Species and Biodiversity

The net effects of loss or alteration of vegetation communities, individual species, or species biodiversity are predicted to be negligible in magnitude for both the construction phase and operations phase. There is an expected loss of 546.57 ha caused by construction activities associated with clearing, grubbing, grading, and installation of crossing structures, camps, aggregate extraction areas, and associated access roads. These losses would be local in extent, representing between 0.2% and 9% of the respective availability of vegetation classes within the LSA, and between 0.002 and 3.55% in the RSA as a whole. During the operations phase of the Project, direct losses to vegetation communities and/or significant losses of species abundance or diversity are not anticipated. There may be some localized degradation of plant species or vegetation community health resulting from indirect effects of operations activities (e.g., dust depositions, hydrological changes) but with the implementation of the mitigation measures outlined in **Section 11.4**, the predicted effects are anticipated to be negligible.

11.9.1.2 Loss or Alteration of Wetland Function

The net effects of loss or alteration of wetland functions are predicted to be negligible in magnitude for both the construction phase and operations phase. It is anticipated that the majority of the wetland vegetation losses will occur during construction, and would be localized in extent: representing between 0.2% to 5% of the respective availability of vegetation classes within the LSA, and between 0.002% to 3.55% in the RSA. (There would also be a 0 to 2.2 percent change (-/+) in modelled aggregate wetland functions as result of the Project, which is a negligible change from existing functional values). During operations, direct loss of vegetation communities and/or significant loss of function in the remaining wetlands are not anticipated. There may be some localized changes in the function of wetland communities and/or of plant species health due to indirect effects from general maintenance activities (e.g., dust or air emissions, hydrological changes etc.) but with the implementation of the mitigation measures outlined in **Section 11.4**, the predicted effects are anticipated to be negligible.

11.9.1.3 Loss of Alteration of Plant Species and Communities of Conservation Concern

The net effects to the locally rare communities of conservation concern are predicted to be negligible in magnitude for both the construction phase and operations phase. These losses would be localized in extent and limited in duration to the operational phase. During construction, the removals of locally rare vegetation communities represent 3.13% (Hardwood Forest) and 3.32% (Mixedwood Forest) of the patches found within the LSA, and 0.85% and 1.24% respectively within the RSA.

11.9.1.4 Loss or Alteration Rare or Traditionally Important Vegetation Species and Communities

The net effects on vegetation communities potentially containing rare species, or plants of traditional importance to Indigenous Peoples are predicted to be negligible in magnitude for both the construction phase and operations phase. Anticipated losses are localized and include an approximately 89 ha area that has been described as a source of Juniper plants at the ARA-4 aggregate source site, and 9.3 ha that has either served historically as a travel route(s), or is currently used for travel (i.e., portaging).

11.10 Cumulative Effects

In addition to assessing the net environmental effects of the Project, the assessment for the Vegetation and Wetlands VC also evaluates the significance of net effects from the Project that overlap temporally and spatially with effects from other past, present and reasonably foreseeable developments (RFDs) and activities (i.e., cumulative effects).

For a VC that has identified net effects, it is necessary to determine whether the effects from the Project interact both temporally and spatially with the effects from one or more past or present RFDs or activities, since the combined effects may differ in nature or extent from the effects of individual Project activities.

Where information is available, the cumulative effects assessment estimates or predicts the contribution of effects from the Project and other human activities on the criteria, in the context of changes to the natural, health, social or economic environments.

For this Vegetation and Wetlands VC assessment, the net effects, described in **Sections 11.7** and **11.8**, that are characterized as having a likelihood of occurrence of “probable” or “certain” and a “low” to “high” magnitude have been carried forward to the cumulative effects assessment. Net effects within this characterization are most likely to interact with other RFD and activities.

As identified in **Table 11-51**, the magnitude of the net effects on the Vegetation and Wetlands VC is predicted to be negligible and the likelihood of occurrence is “probable” or “certain” only during the construction phase. In all instances, the net effect is expected to be localized and is not predicted to be significant following application of mitigation and completion of the construction period. Although the Vegetation and Wetlands VC net effects do not meet the above criteria regarding magnitude to be carried forward to the cumulative effects assessment, the net effects to the VC do overlap spatially and/or temporally with other past, present and RFDs or physical activities. Therefore, based on the temporal and spatial overlaps of net effects with RFDs and activities and expressed concerns of Indigenous communities received during engagement and consultation (i.e., effects to peatlands), the Vegetation and Wetlands VC is carried forward to a cumulative effects assessment.

The predicted net effects of the Project on the Vegetation and Wetlands VC that are carried forward for the assessment of cumulative effects within the Vegetation and Wetlands VC RSA include:

- Loss or alteration of upland, wetland and riparian vegetation communities, species and biodiversity.
- Loss or alteration of wetland functions.
- Loss or alteration of species at risk plants and species of conservation concern
- Loss or alteration plant species and communities of traditional importance to Indigenous peoples for cultural or medicinal purposes or as a source of country foods.

Results of the cumulative effects assessment for the Vegetation and Wetlands VC with consideration of RFDs and activities are presented in Section 21.

11.11 Prediction Confidence in the Assessment

Prediction confidence in the assessment of net effects on species diversity is moderate to high based on the baseline surveys completed that adopted a stratified random sampling approach as required under the TISG for the Project with a limited the number of sampling locations within these study areas for the project components. Prediction confidence in the assessment of net effects on vegetation community diversity is high because of the calculated accuracy and quality of the ELC data, created through remote sensing and verified through the field data collection program.

For the assessment of changes to wetland functions, the prediction confidence in the net effects is moderate since the assessment of wetland functions affected by the Project were conducted at a regional level using a combination of 50 quantitative and semi-quantitative data of individual wetland functional values. Once the vector of normalized weights for the 50 functional values was determined, the aggregate index of functional values was calculated using a weighted sum for each of the 18,140 records in the data matrix. This weight represents an aggregate index of functional value across all 50 values for each ELC polygon. Although the derived index provides a useful high-level summary of functional value across the LSA and RSA and among ELC types and how these values change under proposed project disturbances, more detailed observations derived from the recommended Wetlands Function Monitoring program as outlined in **Section 11.13** are needed to develop a more comprehensive understanding of the net effects of the road on the function of the various wetland types.

Mitigation measures proposed for vegetation and wetlands identified in **Section 11.4** are well-established and have proven success for environmental protection. As the net effects predicted assume the application of mitigation measures, this adds to the confidence in predicted net effects and their characterization of significance.

11.12 Predicted Future Condition of the Environment if the Project Does Not Proceed

The predicted future condition of the environment for vegetation and wetlands is not anticipated to diverge noticeably from the current condition if the Project does not proceed.

The status of species at risk and species and communities of conservation concern are unlikely to change if the Project does not proceed.

It is also extremely unlikely that community diversity and wetland function will change considerably unless other potential resource developments (i.e. mining) occur in the area, or extreme natural processes (i.e., disease, pests, severe weather or fire events) occur in the immediate area.

Climate change has the potential to result in changes to vegetation species, communities and wetland function through extreme weather events such as heat waves, droughts, and flooding. Vegetation patterns may also shift as climatic averages in temperature and precipitation change.

11.13 Follow-Up and Monitoring

The purposes of the follow-up and monitoring programs are to:

- Verify environmental effects predictions made during the EA/IA for the Project;
- Provide data with which to evaluate the effectiveness of mitigation measures and modify or enhance these measures, where necessary;
- Provide data with which to implement adaptive management measures for improving future environmental protection activities;
- Document additional measures of adaptive measures to improve future environmental protection activities; and
- Document compliance with required conditions as stipulated in permits, approvals, licenses and/or authorizations.

The Project invites community members to participate in developing and implementing monitoring programs to assess the effectiveness of proposed mitigation measures and potential adverse effects to the environment. Where effects are considered unacceptable and/or based on concerns raised by Indigenous community members or other stakeholders, further mitigation options will be considered by the road operator in consultation with Indigenous communities and stakeholders.

The recommended monitoring program elements related to the Vegetation and Wetlands VC are summarized as follows:

- Qualified environmental inspector(s) and/or Indigenous Environmental Monitors will be appointed to guide implementation, monitor, and report on the effectiveness of the construction procedures and mitigation measures.
- Following construction of the Project, annual reports documenting the recommended long-term restoration and monitoring programs (**Section 11.4**) will be submitted to the appropriate regulatory agencies and interested Indigenous communities and groups by qualified professional.
- A dedicated Wetlands Function Monitoring Program will be developed and implemented. Details of this proposed program are presented in Appendix K-4.
- A Vegetation and Wetlands Off-Setting (compensation) Program will be developed and implemented in accordance with the methodologies outlined in **Sections 11.4.5** and Appendix K-3.
- Modifications to restoration and monitoring programs, including adaptive management actions will be implemented by the Project proponents, if the annual reporting identify deficiencies are occurring.
- For the life of the Project, if additional, unpredicted, Project-related impacts are occurring to vegetation, wetlands, swift remedial action will be undertaken by the Project proponent, aided by qualified professionals.

Additional details on the proposed follow-up and monitoring for the Project are described in Section 22 of this EAR/IS, Follow up and Compliance Monitoring Programs.

11.14 References

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