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Ivanhoe River: The Chute & Third Falls Generating Stations Class Environmental Assessment for Waterpower Projects

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Revision History

Version	Date	Summary Changes/Purpose of Revision
1	January 31, 2014	ORTECH took control of document from WESA (previous authors), formatted to fit their template, address deficiencies and complete for initial draft review.
2	February 7, 2014	Consultation sections were added
3	February 12, 2014	Xeneca comments from Feb 10 and Feb 11 incorporated; new sections added; completed document for Xeneca review
4	March 24. 2014	Xeneca and EA team comments from March 4 through March 11 incorporated; new Lines and Roads reports incorporated; updated terrestrial report incorporated
5	March 28, 2014	Finalized Report

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FOREWORD

The Final Environmental Report

Xeneca Power Development Inc. (Xeneca), the Project proponent, is pleased to present the Final Environmental Report (ER) for the proposed The Chute and Third Falls Hydroelectric Generating Stations on the Ivanhoe River (the "Project"). This document represents the culmination of important and considerable joint effort among regulatory agencies, local residents, public stakeholders, Aboriginal communities Xeneca over the last five years. It was prepared to meet the requirements of the Ontario Environmental Assessment Act and the objectives of the Green Energy Act.

One important function of this Final ER is to advise the public and government ministries and agencies on the outcomes of the completed studies and consultations. Xeneca has welcomed comments and questions from the public, Aboriginal communities and agencies about the proposed Project throughout the ER study and preparation period.

Submission of this Final ER under the Ontario Waterpower Class Environmental Assessment (EA) process represents a significant milestone in the obligations to the Ontario Power Authority under the Feed-In Tariff (FIT) contract issued to Xeneca for this undertaking. In order to initiate construction, Xeneca is required to successfully satisfy the requirements of the Ontario Waterpower Class EA, and subsequently obtain all applicable provincial and federal regulatory permits and approvals; receive approval for final engineering design; and obtain approval of detailed plans and specifications, all within a relatively aggressive schedule. Xeneca has undertaken a multitude of investigations and studies of the Project site spanning a four year period (2010, 2011, 2012 and 2013) that has included natural habitat studies; archaeological investigations; water quality and fish tissue sampling; geotechnical studies; public and agency consultation; and engagement with Aboriginal communities. Xeneca is pleased with the contribution of all agencies in reaching this milestone and looks forward to a continued positive working relationship on the detail design, permitting and construction parts of the Project to meet the FIT program contractual agreements to have the Project in-service by October 2018.

Advancing Provincial Strategies

The government of Ontario has stated many times that a reliable supply of clean energy is necessary to maintain a strong economy and a healthy and prosperous quality of life for Ontario's growing population.

The provincial government has also placed a priority on expanding the amount of energy produced from renewable energy sources. Renewable energy development is a cornerstone of the province's future prosperity and its commitment to protecting the environment. The Ministry of Natural

Resources (MNR) has stated that renewable energy projects contribute to the environmental, social and economic wellbeing of the province. Renewable projects such as waterpower help reduce the impacts of climate change and provide sustainable sources of energy. Supporting the government's green energy initiative, the MNR makes Crown land available for renewable energy development including waterpower (Ministry of Natural Resources, http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@renewable/documents/document/stdprod_087667.pdf). The proposed Ivanhoe River Projects help to fulfill the MNR mandate to support the government's green energy initiative.

Waterpower continues to help to fuel Ontario's growth and is the backbone of Ontario's renewable power supply. In 2011, 22% of electricity generated in Ontario came from hydroelectric facilities. Waterpower has a number of benefits over other sources of clean energy since it can easily respond to sudden changes in energy needs and the facilities generally have long life cycles, on the range of 75 to 100 years. Waterpower is a reliable, clean, local and naturally recurring source of energy. The Ministry of Energy document referenced below notes the additional benefit of water level and flow management provided by reservoirs and dams that help to support recreational activities and contribute to public safety by minimizing flooding (Ministry of Energy, http://news.ontario.ca/mei/en/2010/08/waterpower-projects-support-local-communities.html).

Waterpower is a key contributor to implementing the Ontario government's 20-year Long-Term Energy Plan, Building Our Clean Energy Future. This plan includes building the largest expansion in hydroelectric power in almost 40 years (Ministry of Energy, http://news.ontario.ca/mei/en/2011/02/long-term-energy-plan-takes-another-step-forward.html). The government of Ontario has committed to continue to grow its hydroelectric capacity with a target of 9,000 MW by adding new facilities and maximizing the use of Ontario's existing facilities. The proposed Ivanhoe River Projects will help to fulfill this commitment.

Ivanhoe River Project

The Ivanhoe River is designated by MNR as a Managed Waterway and a General Use River that is open to development including hydroelectric power generation. The development of the Ivanhoe River Projects and other current projects will help support Ontario's existing waterpower industry that employs 1600 direct and 2000 indirect jobs within a renewable sector that has significant potential of global growth. With an initial capital construction cost of an estimated $52 million, the Project represents a significant socio-economic benefit to the Regional community of approximately $26 million during the construction phase. Provincially, the project would return approximately $4.34 million in tax revenues to the province during the life of the forty-year OPA contract. The Ivanhoe River is designated for multiple uses including renewable power development.

Moving Forward

This Final Environmental Report is the foundation of Xeneca's planning and development process that will be used to inform the subsequent detail design and permitting and approval stages. This document is also a record of the binding commitments made by Xeneca as it proceeds with development and operation of the proposed Project.

EXECUTIVE SUMMARY

Xeneca Power Development Inc. (Xeneca) is proposing to construct two hydroelectric generating stations (the "Project") at The Chute and Third Falls sites (the "Facilities") located 44.2 km apart along the Ivanhoe River. This Project is being developed in order to meet government and energy regulatory goals and objectives to generate sustainable and reliable hydroelectric power. The proposed Project will have total nameplate capacities of 3.6 MW at The Chute and 3.9 MW at Third Falls. The Project was awarded 40-year Feed-in-Tariff (FIT) contract from the OPA which, subsequent to a successful Class Environmental Assessment (EA) outcome, would see the Facilities commissioned and delivering electricity to the provincial electricity grid by October 2018. The Chute will be a modified run-of-river facility, providing electricity when it is needed most; Third Falls is a run-of-river facility.

Purpose and Approach

The Project is a Category B project as classified by the Ontario Waterpower Association (OWA) Class Environmental Assessment ("Class EA") for Waterpower Guide (OWA 2014). The Class EA for Waterpower is a tool for planning, evaluation and consultation of the potential effects of a project so that they may be avoided, mitigated or compensated during the development and design of the project. Environmental effects include both the positive and negative effects that a project would or could potentially have on the environment at any stage in the project life cycle. This assessment also considers the effects of the environment on the project, which includes the social economic and human environment. This was accomplished by defining the extent of the Project Area; background data collection and field investigations; continuous consultation with Aboriginal communities, the public, and government agencies; identifying potential impacts and effects; determining appropriate avoidance, mitigation or compensation programs; determining the significance of any residual impacts after mitigation; developing monitoring programs; and determining the effects that the environment could have on the Project (including climate change).

This Environmental Report (ER) covers the assessment and permitting for the entire Project Area including the water control structures, powerhouses and ancillary components (access roads, headponds), temporary works required for construction (laydown areas, construction camps, temporary access roads) and the transmission line. All components were evaluated using the Class EA process (OWA 2014). The assessment is based on conceptual design information on construction and operations, field investigations, desktop studies, and consultation. The aim of providing this information is to ensure that all stakeholders are informed and understand the general scope and extent of the Project, particularly as it relates to how the Project may impact their interests, other uses of the river and the environment.

Project Location and the Zone of Influence

The Project will be built entirely on Ontario Crown land within the Ministry of Natural Resources (MNR) District of Chapleau, along and within the Ivanhoe River. The closest towns to the Project are Foleyet and the City of Timmins (See Figure 1). The Third Falls site is located immediately upstream of the Northern Claybelt Forest Conservation Reserve (Figure 4).

The Ivanhoe Lake Dam, owned and operated by the Chapleau District MNR, is located approximately 40 km upstream of The Chute and approximately 84 km upstream of the Third Falls facility. The operation of the Ivanhoe Lake Dam is governed by the existing Mattagami River Water Management Plan (WMP). The Project will be operated independently of the Ivanhoe Lake Dam and will not impact Ivanhoe Lake or Foleyet.

Project Operations

It is proposed to operate The Chute facility as a modified run-of-river generating facility and Third Falls as a run-of-river generating facility, effectively re-naturalizing river flows downstream of Third Falls based upon the conditions upstream of The Chute headpond.

There are situations where both Facilities would be run-of-river, this would occur during high flow (when natural river flows are greater than the maximum turbine capacity), during Walleye spawning, and very low flow (when natural flows are so low that any available water must be released downstream to protect the environment).

Modified run-of-river operation at The Chute would occur during moderate and low flows when the natural flow in the river is below the maximum turbine flow capacity but above the minimum flow required to protect the environment. During these flow conditions, some of the natural river flow during night-time hours can be stored and used to produce electricity during daytime hours. This results in downstream flows that are smaller than natural river flows during night-time hours and larger than natural river flows during daytime hours when electricity use is higher. The minimum flow in this mode of operation is not less than the minimum turbine capacity . It is emphasized that, over every 24 hour period, the same volume of water would pass down the river as would occur under run-of-river operation. Water is not held in the headpond for long periods of time, typically much less than a day.

In addition to the generating station operations, the Project includes three electrical substations and a power line corridor that connects the Project with Hydro One's Weston Lake substation. The power line corridor will operate at a voltage of 69 kV between Third Falls and The Chute and at 115 kV between The Chute and Weston Lake substation.

Potential Environmental Effects from the Project and the Associated Significance

This Environmental Report (ER) has determined the potential for environmental effects from both the Construction of the Project and the Project Operations. Decommissioning of the Project is not be covered in this ER since this Project will be designed to a typical operating life of 100 years; therefore, if facility decommissioning is to occur, an environmental assessment type process would have to be completed at that time, therefore assuring environmental protection according to the standards of the day.

Geology, Topography and Terrain

Construction will have temporary effects on the terrain and topography, typically where excavation and fill are required for construction. This effect will be mitigated by restoring existing topography and terrain where possible and revegetation as soon as possible. The impact to the terrain and topography is considered to be an *Insignificant Effect* from the Project. There are no impacts anticipated to topography or terrain during the operation phase.

Landslide Hazard

Excavation activities conducted improperly or without proper planning have the potential to cause damage to the surrounding environment, including slope failures and un-controlled sediment transport. This potential impact is mitigated by ensuring that site excavation will be conducted using best management practices and re-using all excavated materials where possible. Project personnel will ensure that environmental concerns are addressed, that contingency plans are in place, and that adequate resources are available. Restoration, including appropriate drainage and erosion control measures, will be implemented as soon as possible following excavation to prevent erosion and assist natural recovery of vegetation. Lastly, the Geomorphology assessment (Parish 2013) determined that the Project's Zone of Influence is in regime (i.e., stable); therefore, mudslides or landslides are not anticipated from construction activities.

During operations, the potential to cause significant shoreline erosion was assessed. To mitigate the risk of landslides, hydraulic modelling was carried out and operating levels were designed so that water level fluctuations for both headponds are limited to 1 m for The Chute and 0.25 m for Third Falls and the fluctuations fall within the existing channel bed, thereby limiting the extent of new shoreline development. The Geomorphic Assessment (Appendix E) concluded that the Ivanhoe River channel is stable, but there may be some bank locations that may become destabilized from operational activities and should be monitored. A comprehensive erosion and sedimentation monitoring program has been planned for 5 years and again in years 7 and 10 following the start of operations. The overall effects related to major slope failures or other hazard lands are considered to be an *Insignificant Effect*.

Erosion

When left exposed, soil has the potential to be transported by wind or water erosion, decreasing the quantity of soil available to support wildlife and vegetation, and harming surface water runoff processes. With the proper implementation of best management practices, minimal impacts are anticipated and will primarily occur during the initial filling of the headponds.

To minimize the water erosion potential during initial filling of the headponds, the extent of both headponds will be constrained to the existing river channel to the extent possible where the potential for shoreline erosion is minimal. Ultimately, in the first 1.9 km section of The Chute headpond and the first 5.5 km of the Third Falls headpond, a new shoreline will be established. The impact on the soil quantity will have an *Insignificant Effect* from the initial inundation activities. To confirm this conclusion an erosion monitoring program as well as water quality monitoring during the construction phase has been proposed.

During operations, rapid changes in shoreline water levels have the potential to increase erosion; however, it was concluded that due to the slope and soil substrate at both headponds there is a low potential for erosion from the operations once a new shoreline has been established. Monitoring is required to confirm this conclusion.

Two bridges are located within the headpond of the Project which may be impacted by erosion. Hydraulic analysis was completed and concluded that potential for erosion impacts on the bridge from the headpond fluctuations is unlikely. Monitoring will confirm this conclusion.

Downstream water fluctuations from the tailrace of The Chute are attenuated by the headpond of Third Falls, and Third Falls will be operated as run-of-river to re-naturalize the flows. The Chute and Third Falls will not affect the erosion potential downstream of the Third Falls tailrace. Monitoring will be conducted downstream of Third Falls to confirm this conclusion. Erosion impacts on soil quantity are not anticipated downstream due to operational activities. The overall effect related to erosion is considered to be *Insignificant*.

Sedimentation

The erosion of bedrock and soils leads to the accumulation of sediments in water bodies that provide habitat for aquatic life and support aquatic vegetation, and affects water quality by raising suspended sediment levels. Parish Geomorphic (Parish 2013) conducted a Sediment Impact Analysis Methods (SIAM) and determined that operations at the two generating stations will likely only accentuate existing channel processes in the study area. Though limited scouring may occur in the upstream portions of the headponds and slowwater areas, the eroded sediment would be deposited within a relatively short distance downstream, thus making the impact local in nature.

During the construction and initial headpond filling stages, the primary method of controlling sediment production will be through the effective isolation of the work area and employing best management

practices. The overall impact to soil quality from sedimentation will be *Insignificant*. To ensure these procedures are implemented and effective, water quality will be monitored on a regular basis as defined by the Monitoring Program.

The nature of intermittent operations at The Chute may result in increased suspended sediment in the Project Area. Mechanical and vegetative controls will mitigate this impact. Studies based on hydraulic modelling show that impact from sedimentation and sediment transport is predicted to be low. Monitoring will be initiated for 5 years and again in years 7 and 10 following the start of operations in order to confirm these predictions. Overall, sedimentation is predicted to create an *Insignificant Effect*.

Surface Water & Ground Water

Hydrology

During construction, adverse hydrology effects arising from the in-water construction works will not occur at each facility, with the implementation of two stages of cofferdams to divert the water flow from the in-water construction areas during two summer low flow seasons. The hydrology effect is deemed *Insignificant*.

During operations, the Project will not alter annual, seasonal or daily hydrological parameters. Specifically the quantity of water entering the upstream zone of influence location over a 24 hour period will be equal to the quantity of water leaving the downstream *Zone of Influence*. Therefore, the hydrology effect is deemed *Insignificant*.

Water Levels, Flows & Movement

During construction, two stages of cofferdams will be installed and removed during two summer low flow seasons. An open river channel will be left to divert the water flow from the cofferdam areas. The water level and water flow in the upstream and downstream areas at each facility will not be changed. The overall effects related to water levels, flows and movement are deemed *Insignificant*.

During operations, Hydraulic Engineering Centre River Analysis System (HEC-RAS) modelling studies were conducted to predict the change of water levels, and develop measures to minimize the changes of water levels and flows. With the implementation of run-of-river operations at Third Falls to naturalize the water flow, low head spillway dams and operating parameters to minimize the 1m fluctuation in the Chute headpond and 0.25 m fluctuation in the Third Falls headpond, the effects on water levels, flows and movement are deemed *Insignificant*.

Water Quality & Quantity

During construction, the major surface water quality effects may be generated from vegetation clearing, construction of in-water works, dewatering of work area at both facilities, water crossings for

access roads, bridges and transmission line corridors, accidental leakage of process wastewater in the concrete batch plant, and domestic wastewater leakage in the construction camp. The vegetation clearing areas will be restricted to minimize the potential soil and water erosion. The construction of powerhouse, headrace, tailrace, and spillway dam would be carried out inside two stages of cofferdams during two summer low flow seasons, thereby preventing the escape of sediment plumes. The cofferdams will be constructed of clean fill with impermeable rubber liner or nylon mesh cargo bags with smaller synthetic sand bags and a polyethylene plastic sheet liner. A sump pump shall be installed immediately downstream of the cofferdams if necessary. Sediment trap and control measures will be adopted for water crossings and bridges along the access roads and transmission line corridors. The process wastewater generated from the concrete batch plant and domestic generated from the construction camp will be collected in properly constructed and approved wastewater storage tanks, and will be transported to a local municipal wastewater treatment plant for offsite treatment. With the implementation of proposed mitigation measures, the effects on surface water quality are deemed *Insignificant*.

During operations, the shoreline erosion arising from the fluctuation at headponds will result in a potential increase of suspended solid concentrations. The increase of water levels at the headponds will result in an increase of water temperature. The changes of water levels and water temperature will generate further effects to the concentrations of dissolve oxygen. To minimize the potential changes of suspended solid and dissolved oxygen concentrations, and water temperature, low head spillway dams and water turbines, operating parameters to naturalize the river flow are selected. With the implementation of proposed mitigation measures, the effects on the suspended solids and dissolved oxygen concentrations are deemed *Insignificant*.

Water Temperature

During construction, the change of water temperature is not anticipated, since there are no changes of water area, water level and water flow at each facility. The predicted water temperature effect is deemed *Insignificant*.

During operations, a water temperature study for the Ivanhoe River was conducted to assess the potential water temperature effect in the river. Since the predicted changes of water areas, residence time, and water levels in the river are minor with the implementation of proposed mitigation measures, the predicted water temperature effect in the river is deemed *Insignificant*.

In addition, a water temperature modeling for the tributaries, using Stream Segment Temperature Model (SSTEMP) Version 2.0 by the United States Geological Survey (USGS) was conducted to predict the change of water temperature in the tributaries. The predicted maximum mean daily water temperature is 21.1^{o}C, which is well below the 1-day mean temperature (25.3° C). Therefore, the predicted water temperature effect in the tributaries is deemed *Insignificant*.

Surface Water Quality - Mercury

During construction, the potential effect on surface water quality from eroding mercury contaminated soil is deemed *Insignificant*, considering the low probability along with the low duration and frequency of this potential effect.

During operations, an impact assessment was conducted to mitigate the potential increase of mercury and methyl mercury levels arising from the flooding of mercury containing soils, and the conversion of inorganic mercury to methyl mercury during warm seasons. The removal of woody vegetation protocol from the headponds was developed to minimize the import of mercury contained materials. The rehabilitation measures were proposed to minimize the potential soil erosion. The run-of-river operations during certain times were proposed to reduces the residence time, and decrease the possibility of conversion of inorganic mercury. With the implementation of proposed mitigation measures, the predicted effect on surface water quality from mercury is deemed *Insignificant*.

Ground Water Resources

During construction, the groundwater effect may be generated from a potential groundwater seepage arising from excavation and blasting in the powerhouse, headrace and tailrace footprint areas, and evacuation of stockpile areas at both facilities. To minimize the potential effect on groundwater, mitigation measures are proposed to install a sump pump and associated sediment pond for treatment prior to discharge to the river. If seepage is higher, engineering measures, including the sealing of the excavation walls, are required to limit the amount of seepage within the cofferdam areas. Considering the low duration and frequency of excavations in restricted footprint areas of powerhouse and potential further groundwater sealing measures for the excavation activities, the potential effect on groundwater is deemed *Insignificant*.

During operations, the elevated water level in the headponds will elevate the groundwater levels in the area immediately adjacent to the headponds. The potential elevated groundwater levels may generate further effects to the groundwater flow discharged to the tributaries within the *Zone of Influence*. With the implementation of low head water turbines, run-of-river operations at Third Falls at the time, operating parameters to minimize the fluctuation in headponds, the effects on groundwater table and flow are deemed *Insignificant*.

In addition, a potential groundwater contamination may be generated from an accidental spill or leakage from the use of hydraulic fluids and cleaning detergent within the powerhouses and the transfer and removal of transformer oil in substations. With the implementation of secondary containment areas, spill control plan and materials, the effect on groundwater quality can be avoid and is deemed *Insignificant*.

Terrestrial Environment

Effects on terrestrial habitat types due to construction, initial inundation and operations include: vegetation clearing, fugitive dust on vegetation, construction noise, human presence, disruption of nesting, habitat loss, and potential collisions with construction equipment. Vegetation clearing will be required for the transmission line, access roads and laydown areas, and the initial inundation of the headpond.

Natural Vegetation & Terrestrial Habitat Linkages

Removal of vegetation cannot be completely mitigated; however, some items such as roads and lines were re-located to minimize clearing, and mitigation measures were identified to further ensure minimal impact. In addition, the clearing should not take place between May 1st and July 31st unless otherwise directed Canadian Wildlife Services (CWS) authorization. The overall effects related to the vegetation clearing are considered to be *Insignificant*.

The long-term operation of the Project will prevent regeneration of limited vegetation communities. Following effective use of mitigation measures, it is not anticipated that there will be any net effects on terrestrial vegetation communities as a result of fugitive dust generation. The following identifies the significance of these net negative effects. As the effect is localized, eventually reversible, and the resource is abundance in the area, this effect is considered to be an *Insignificant Effect*.

When The Chute is operating as a modified run-of-river facility and Third Falls is acting to re-naturalize the flows, there will be a variation in water levels. Re-naturalizing the water flows and levels results in no discernable effect on the downstream terrestrial habitat but headpond water fluctuations may impact terrestrial vegetation. Water levels in The Chute headpond are proposed to fluctuate to a maximum of 1m which most riparian and emergent plants will not tolerate resulting in the loss of emergent and shoreline vegetation. Water levels in the Third Falls headpond are proposed to fluctuate to a maximum of 0.25 m which most riparian and emergent plants will tolerate resulting in an insignificant impact on vegetation in the Third Falls headpond. As the effect is localized to The Chute headpond only, eventually reversible, and the resource is abundance in the area, this effect to terrestrial habitat is considered to be an *Insignificant Effect*. Post construction monitoring should occur to confirm the accuracy of these predictions.

Terrestrial Wildlife

The impact of construction noise and human presence on the terrestrial environment will be mitigated by minimizing the road length, enforcing speed limits on the Project construction site and employee education. There is a potential that some species my leave the Project Area during construction due to construction noise and human presence, the overall effects related to the impact of construction noise and human presence are considered to be an *Insignificant Effect*.

The disruption of nesting, especially for Species at Risk, requires specific mitigation measures such as separation distances, establishing buffers, and/or limiting construction times outside of the breeding period. The impacts of the roads will vary from species to species but will likely not be significant at the population level given the small amount of habitat involved. The disruption of nesting is considered to be an *Insignificant Effect*.

The loss of habitat for species such as the Northern Myotis, Little Brown Myotis & Eastern Small-footed bat from vegetation clearing on the road and transmission corridor is not expected to be significant. Mitigation measures include maintaining clumps of bat snag trees, avoiding maternity colonies, and clearing outside of the breeding season. There are no known hibernacula within the study area. The loss of a relatively small amount of this forest is not expected to have any impact on this species' overall regional population. The overall loss of habitat is considered to be an *Insignificant Effect*.

During the operation of the 115kV power line it is possible that large bird species may collide with the line or be electrocuted. Electrocution of raptors such as bald eagles may occur more frequently than collisions, particularly if they fly into lines mid-span and bridge two conductors or when landing on wires or towers. Best management practices (e.g., avoiding use of shield wires, minimizing guy wires) will be used to minimize the potential for collisions and electrocution. It is anticipated that the impact from operation of the power line is considered to be an *Insignificant Effect*.

Species at Risk

Operations and maintenance activities may cause the potential to disrupt breeding and nesting on species at risk. Ongoing Facility operations and access to the areas by the public may have the potential to displace or alter the behavior of birds nesting in or adjacent to the Project. Additionally vehicle traffic on site may result in collisions with ground nesting birds. This impact will be mitigated through restriction maintenance activities where possible during the breeding season. The geographic extent and frequency of these activities result in an *Insignificant Effect* on breeding birds during operations.

Bald Eagle Habitat - Potential Inundation Impacts

Bald eagle nesting and foraging habitat is present approximately 38km upstream from the proposed Third Falls GS where the water level will increase by a maximum of 20cm, as a result of the initial headpond filling. This increase will not impact the nesting habitat nor bald eagle foraging and perching. The overall effects related to the Bald Eagle habitat are considered to be an *Insignificant Effect*.

Common Nighthawk Habitat – Proposed Inundation Impacts

Common nighthawk habitat is present upstream from the proposed Third Falls GS. The water level is proposed to increase by a maximum of 20cm in the river channel, as a result of the initial headpond

filling. This increase is unlikely to impact nesting or foraging habitat. The overall effects related to the Common Nighthawk habitat are considered to be an *Insignificant Effect*.

There is potential that expanded access into the Third Falls area for operations, maintenance, and the public may result in the potential for increased mortality for common nighthawks which like to site their nests on gravel roads. This impact will be mitigated by limiting nighttime road use where possible and employee education and awareness. The likelihood is low with low frequency therefore the overall significance of this residual impact is *Insignificant*.

Olive-Sided Flycatcher Habitat – Proposed Inundation Impacts

Olive-sided flycatcher habitat is present within the upstream extent of the inundation area of the Third Falls GS. The water level is proposed to increase by a maximum of 20cm in the river channel, as a result of the initial headpond filling. This increase is unlikely to impact nesting or foraging habitat. The overall effects related to the Olive-Sided Flycatcher habitat are considered to be an *Insignificant Effect*.

Canada Warbler Habitat

Canada Warbler habitat will be lost during the initial inundation of the Third Falls headpond however, the area to be cleared is very small in relation to the abundance of this habitat type on the surrounding landscape. The overall effects related to the Canada Warbler habitat are considered to be an *Insignificant Effect*.

Fresh Silty to Fine Loamy: Elm Ash Hardwood Ecosite

Fresh Silty to Fine Loamy: Elm-Ash Hardwood ecosite is considered a rare-treed significant wildlife habitat; approximately 0.7ha of this habitat type will be cleared for the initial filling of the Third Falls headpond, resulting in a net loss of 35%. This loss is significant for this area, and could result in a loss of genetic integrity in this stand. To mitigate this impact a seed harvesting and re-planting strategy will be implemented, reducing the overall significance as an *Insignificant Effect*.

Significant Natural Heritage Features & Areas

Moose Aquatic Feeding Areas - Potential Inundation Impacts

Moose Aquatic Feeding Areas are present in both The Chute and Third Falls initial inundation areas; however, it is predicted that over time, other wetland communities would establish and potentially provide this habitat type. The overall effects from construction related to the Moose Aquatic Feeding Areas are considered to be an *Insignificant Effect*.

When operating, the water level fluctuations are anticipated to be range between 20cm and 1m. The 20cm increase in surface water elevation will be restricted to the existing and will not impact adjacent forest cover that is required by moose for shade and cover. The 1m increase may result in the loss of a

large portion of the feeding areas; however, it is predicted that over time, other wetland communities would establish and potentially provide additional open water communities with submergent wetland. The overall effects from operations related to the Moose Aquatic Feeding Areas are considered to be an *Insignificant Effect*. Post construction monitoring will be planned in order to confirm that aquatic vegetation communities have re-established and that moose are continuing to use the area for feeding.

Aquatic Environment

Fish and Fish Habitat

Several of the construction activities may potentially impact fish and fish habitat such as dewatering activities, access road construction and facility construction. Many of these activities are temporary (such as the cofferdam construction) while others are more permanent (such as the construction of the spillway and dam structures requiring re-structuring of the riverbed). Mitigation measures include removing stranded fish when dewatering; best management practices; fish habitat offsetting; two-dimensional modelling; appropriately sized crossing structures; and using the *Measures to Avoid Causing Harm to Fish and Fish Habitat* recommended by the Department of Fisheries and Oceans (DFO). The overall significance of these effects are *Insignificant or Negligible*. Monitoring activities will include determining the effectiveness of fish habitat offsetting agreed to with agencies will need to be monitored in the post-construction period.

Inundation impacts to the benthic habitat and brook trout habitat in the tributaries

The initial inundation of the headpond has the potential impact fish and fish habitat by altering the fastwater habitats and inundating the brook trout habitats in the tributaries. Six of the eleven fastwater habitats will change from fastwater habitat to lacustrine habitat during low flow conditions. This habitat change will alter the fastwater invertebrate communities, ultimately impacting the fish species relying on those invertebrates as a food source; however, the local species are expected to have an adequate food supply of less preferred benthic species. Changes to fish feeding behaviours are anticipated but a new equilibrium is predicted to establish overtime (NRSI 2014). The overall effect from this Project will be Insignificant. Monitoring will be undertaken to assess population success in the post construction period.

The initial inundation will also impact the lower gradient tributaries in the headponds which has the potential to impact brook trout habitat. Nine tributaries were assessed and one tributary (Komak Creek) was found to contain critical habitat. There was no spawning evidence observed in Komak Creek and similar sporadic spawning opportunities were noted in the area immediately upstream of the inundation effects which remain available to Brook Trout. The overall impact to Brook Trout spawning is anticipated to be *Negligible* in Komak Creek (NRSI 2014)

Northern Pike Spawning Habitat

Water level fluctuations during operations have the potential to affect spawning habitat upstream of The Chute and the reproductive cycle of the Northern Pike. In order to mitigate this impact, operations will be modified during the spawning period until fry are free swimming. Operational impacts to Northern Pike are anticipated to be *Insignificant*.

Walleye Spawning Habitat

Flow fluctuations downstream of The Chute may affect Walleye spawning and egg incubation. To mitigate this, Xeneca has committed to operating the Facility as run-of-river during the spawning period. As well, Walleye offsetting habitat will be constructed in the east channel, and will be designed to ensure optimal conditions for the Walleye during periods of maximum turbine flow. Downstream of The Chute, water levels in the Third Falls headpond will be kept high enough to ensure adequate wetting of the channel. Overall residual effects to Walleye spawning habitat are anticipated to be *Insignificant*.

Fish Injury or Mortality

In-water or near shore blasting during construction may cause a sudden change of hydrostatic pressure resulting in potential trauma and fish mortality or may cause a physical and/or chemical alteration to fish habitat. The use of explosives will be controlled and will follow "Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters" be in accordance with DFO blasting guidelines. This will result in an *Insignificant* effect on fish injury or mortality.

Fish stranding may occur downstream of The Chute, which may lead to mortality. This will be mitigated through providing pathways for fish to retreat with water levels, and restrictions on down-ramping to reduce the rate of water level change. Overall impacts to fish injury or mortality through fish stranding are anticipated to be *Insignificant*.

If entrance velocities during operations are higher than burst swimming capabilities and fish are too large to pass between the trash racks, they can become impinged (NRSI 2014). Trash racks will be installed at each turbine entrance with a spacing of 48mm to give most fish species enough space to pass through unharmed. Also, entrance velocities are proposed to be a maximum of 0.75m/s at each generating station. This entrance velocity is lower than the burst swimming capabilities of adult Northern Pike and Walleye and within the range of burst swimming capabilities for Brook Trout, to mitigate impingement of these species. Overall impacts to fish mortality through impingement are anticipated to be *Insignificant*.

Some small fish (larval fish and some juveniles) as well as adults (diseased or in weakened state) will enter the intake channel and become entrained, passing through the turbines and into the tailrace

channel, potentially resulting in mortality (though the majority of fish will survive).. Overall impacts to fish mortality from impingement are anticipated to be *Insignificant*.

Wetland Habitat

Wetland communities provide several important functions including water filtration, habitat, shoreline protection, and recreational activities. The initial inundation of the headpond will transform 13.9 ha of wetland communities. These habitats are not unique to the area and are readily available outside the headpond area. The proposed access roads and the power line have been designed to avoid construction within wetland communities. Mitigation measures include retaining vegetation and the use primary, secondary and tertiary roads as much as possible. The residual effect on the small portion of Riverine and Wetland Habitats that are impacted is an *Insignificant Effect*. To ensure the water level fluctuations are not impacting vegetation growth, monitoring of vegetation will occur along the Ivanhoe River riverbanks and hydrologically connected wetlands within The Chute and Third Falls headponds. No additional operational impacts are anticipated.

No turtles were observed during 2013 surveys, although potential habitat exists and could be impacted by increased traffic, disturbance to nests along the road and impacts to their aquatic habitat. Mitigation measures include employee training and awareness, signage, and avoiding suitable nesting habitat, resulting in an overall significance as an *Insignificant Effect*. Similar impacts can be expected during operations, though at a reduced volume due to lower traffic levels. Should wood turtles be discovered in the study area, OMNR will be immediately consulted.

Several marsh and open fen nesting bird species at risk, including Black Tern, Yellow Rail, and Short-eared Owl occur in the surrounding area. Although these species were not observed in 2013, suitable habitat is present. There is the potential that construction of the roadways and power lines could result in loss of habitat, disturbance, disruption of breeding, and general habitat disturbance. Road and power line maintenance activities during operations might cause further disturbance or disruption to any birds present. Mitigation measures include avoiding marsh habitat, timing restrictions, using water for dust control and employee awareness resulting in an overall *Insignificant Effect* on these wetland habitats.

Shoreline Dependent Species

Evidence of otters was documented within the Project Area. The initial inundation of the headponds may impact otters by increasing the risk of predation from exposing their dens and changing in the aquatic food base such as molluscs, fish and frogs. Any existing dens located within the first 5.5 km upstream of the proposed Third Falls GS would be flooded out as the change in water level during headpond filling, and the water level is proposed to increase by 1.5m. Upstream of the 6km mark, existing dens may be sufficiently elevated to not be affected by an increase in the water level (NRSI 2014).

Impacts to terrestrial and wetland habitats and associated wildlife during the construction phase can be mitigated through adherence to measures such as avoid initial headpond winter or ice-over period and retaining vegetation to the extent possible. Additionally new shoreline areas will be established that may provide denning habitat after construction of the GS. As the geographic extent and frequency is low, the overall significance of this residual effect is ***Insignificant*.**

With water levels fluctuations in the Third Falls headpond limited to a maximum of 25cm, no impacts to otters are anticipated during operations.

Significant Natural Heritage Features & Areas

Wetland communities and swamp areas that will be inundated have been identified as candidate Significant Wildlife Habitat (SWH) for Marsh Breeding Birds and Amphibian breeding habitat. The impacts to candidate SWH will be minimal and predicted to be negligible based on wetland and swamp communities present within the surrounding landscape. In addition, it is predicted that over time, similar communities would establish and potentially provide additional open water communities with submergent wetland plants resulting in an *Insignificant Effect*.

Air, Noise & Vibration

Air Quality

Air quality is impacted by fugitive dust emissions, increases in combustion exhaust gases and air pollutants from the burning of vegetation.

The potential for increases to particulate matter (or fugitive dust emissions) will be greatest during road construction, aggregate crushing, blasting, drilling and vegetation removal. During this period particulate matter will be released to atmosphere through wind erosion, vehicular traffic, and material handling activities. These impacts are expected to be minor due to the short-term nature of the activities. Mitigation measures include the use of well-established construction best management practices such as dust suppressant re-vegetating disturbed areas and avoiding material handling and earth moving activities during windy conditions. The overall effects related to particulate matter are considered to be an *Insignificant Effect*.

Impacts to air quality from construction equipment exhaust are predicted to be relatively constant throughout the construction period. Mitigation measures include inspecting equipment used on site, routine vehicle maintenance. Overall effects related to emissions are considered to be an *Insignificant Effect*.

Impacts to air quality during operations may result from decaying vegetable matter from within the new headponds, or from emissions from the back-up diesel generator. Air quality impacts from the generator are not likely to occur, based on the newest maintenance standards to be employed at the Ivanhoe project.

Removal of all trees with a diameter of at least 0.05m will significantly reduce the quantity of vegetable matter decaying within the headponds. Overall, impacts to air quality are anticipated to be *Insignificant and positive*, largely from reduced burning of fossil fuels for electricity generation.

Noise and Vibration

Some minor increase to noise may occur during operations in the vicinity of the powerhouses. These will be fenced and locked to prevent any potentially harmful exposures. Noise levels are anticipated to be *Insignificant*.

Land

Existing Land Use or Resource Management Plans

No impacts are anticipated to existing Land Use or Resource Management Plans during construction or operations, existing mining or aggregate extraction activities. Any potential construction or operational impacts to forestry activities have been addressed through consultation with the Sustainable Forest Licence holders.

Site Access

Construction activities may inadvertently damage the Oates and Nova Road bridges, located upstream of the Facilities. The potential effect will be mitigated through the commitment to maintain the operability of the bridges. Operation of the facilities may damage the bridges if storm events cause flooding beyond their capacity. Xeneca has commissioned engineering studies to examine these potential impacts and is working with the bridge owners to ensure that operation of the Facilities has no impact to the bridge structures. The impact from the project construction and operations are anticipated to be *Insignificant*.

Riparian Rights & Privileges

There are no riparian rights or private landowners within the Project Area. Therefore, there are no impacts to consider.

Angling & Hunting

Hunting

Game species have large territorial ranges and though they do have regular interaction with aquatic habitats (for water, consumption of aquatic species, and cooling), they tend to use different habitats at different times of the year and move around to find the best food and cover available to them. Xeneca's construction activities and operations are not expected to have a significant impact on hunting activities, since hunters are able to target these species in other locations near the Project

Area. Furthermore, the surrounding forest is large (>100ha in size) and contiguous, which signifies that similar habitat is abundant in the surrounding area. Thus, it is anticipated that there will be *Insignificant Effect* on hunting as a result of the Ivanhoe Project during both construction and operations.

Fishing

Waterpower facilities have the potential affect the ability of anglers to access fishing sites through restrictions placed on land or water around construction areas. To mitigate this impact, Xeneca will work with the recreational fishing community, tourism operators and other interested parties to ensure impacts to fisheries are kept at a minimum level, access to fishing areas is not impeded, improvements to access the fishery are facilitated and impacts to habitat are minimized. Xeneca has committed to operational constraints during the spring spawning period in order to ensure natural flow conditions during this period (spring and fall for Brook Trout). Should economic impact on commercial interests result from the Project, Xeneca will enter into discussions on avoidance, mitigation and/or compensation. Construction and operational impacts to fishing are anticipated to be *Insignificant*.

Trapping & Baitfishing

Construction may reduce access to trapline or baitfishing sites, through restrictions placed around active construction areas. Operations may affect trapping and baitfishing if they are adjacent to restricted Project facilities such as powerhouses. Xeneca is entering into a business-to-business agreement with the trapline holder in order to ensure that no negative impacts to that tripline occur during the lifetime of the Project. The primary value identified by the trapline license holder is access to Third Falls and, since access to Third Falls will not be restricted and downstream flows will be run-of-river, *no impact* to these values and activities are expected.

Views and Aesthetics

The construction of two new hydroelectric facilities, the inundation of the headponds and the construction of access roads will alter the visual appearance of this part of the river, and alter the pristine character of the Third Falls facility location. As well, inundation of upstream areas of the Ivanhoe River will change the viewscape over the longterm from a riverine to a lacustrine landscape. To mitigate this impact, Xeneca has undertaken extensive planning and consultation with the local community in order to plan a Project that is minimally visually intrusive and retains as many of the existing aesthetic features as possible. The overall significance of this impact during construction and operations is anticipated to be *Insignificant*.

Navigation

The Ivanhoe River is a recognized canoe route and the construction of the Facility may impede the movement of canoes, kayaks, and other small craft on the waterway. To mitigate this impact Xeneca commits to maintaining current public access and navigation to the area; restrictions such as gates will only be placed where it is required for public safety. There will be minimal impacts if any to the portage routes; any portage routes affected during Project operations will be reconstructed in consultation with the public and the MNR. The impacts of construction and operations on navigation are anticipated to be *Insignificant*.

Existing Water Management Plans

Alterations to the existing Water Management Plan, if required, will be carried out under a separate process through the MNR. No impacts to the existing WMP will result from the Ivanhoe Project as the operations of other existing facilities in the watershed will *not be impacted*.

Protected Areas

The Northern Claybelt Forest Complex Conservation Reserve is less than 100m downstream of proposed construction activities. Construction activities have the potential to impact the Conservation Reserve through increased sedimentation and erosion or contamination through spills. Mitigation measures to reduce erosion, sedimentation and spills will also eliminate impacts in the Conservation Reserve. Construction impacts to the Conservation Reserve are anticipated to be *Insignificant.* Operations of the Third Falls facility have been modified to ensure that there are *no impacts* to the Conservation Reserve.

The Nova Township Clay Plain Peatland Conservation Reserve is 135m and Vimy Lake Uplands Conservation Reserve is approximately 25m from a planned power line between The Chute and Third Falls. Given this distance, *no impacts* to these protected areas are anticipated.

The Groundhog River Provincial Park would be crossed by a planned power line between The Chute and Third Falls. Construction activities to occur near or within the Park will have no impact on recreational access or use of the River, and therefore, no impacts are anticipated. Operation of the power line will have no impacts. Residual effects to the Groundhog River Provincial Park are anticipated to be *Insignificant*.

Recreational Land Use

Camping

Construction activities may impact camping site availability when areas are fenced off to protect public health and safety, and the sites may be considered less desirable due to changes in the visual and auditory environment. Additionally, access to and desirability of camping sites may be decreased by

Project operations. It is anticipated that noise from the equipment will be largely masked by the noise of the river and waterfall. Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Construction and operational impacts to camping are anticipated to be *Insignificant.*

Canoeing/Kayaking/Boating

Construction activities may impeded access to canoeing or kayaking routes in the water, or may flood or restrict access to portage trails. In addition, an existing boat launch at The Chute will be inaccessible during construction. Xeneca will to make improvements to the boat launch amenity and restrictions to access will only be placed where necessary to protect public health and safety. Construction impacts to Canoeing/Kayaking/Boating are anticipated to be *Insignificant*.

Operation of the Project may cause permanent impacts to existing portage trails or the boat launch through inundation. Where required, these will be reconstructed to ensure no impact to access to canoeing or kayaking from Project operations. Operational impacts to canoeing, kayaking and boating are anticipated to be *Insignificant*.

Snowmobiling, Hiking and ATV Trails

Some temporary and localized restrictions to access of the trails may result during Project construction. Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Residual effects on the trails are anticipated to be *negligible* during construction. No impacts to snowmobiling are anticipated to result from construction or operations, as no trails exist in the Project Area.

Project operations may result in reduced access to a hiking trail on the eastern shore of the Ivanhoe River. Signage will be used to communicate any access restrictions to the public, and all reasonable efforts will be undertaken to maintain current access. Impacts during operations are anticipated to be *Insignificant*.

Traffic

Due to construction vehicle traffic, access to roads by local residents or recreational users may be affected. However, given the low volume of construction vehicles and the relatively short construction period at each site, these impacts are considered to be very limited in duration and geographic extent, and will have an *Insignificant Effect* on traffic.

Socio-Economic

Locations of People, Businesses, Institutions and Public Facilities

As the Project is constructed and operated entirely on Crown land and there are no residents, businesses, institutions or public facilities in the Project Area, *no construction or operational impacts are anticipated*.

Community Character, Enjoyment of Property, and Amenities

No local communities or properties exist within or near to the Ivanhoe Project Area. All amenities relate to natural, recreation and tourism values, and are discussed elsewhere. *Negligible impacts* are anticipated.

Employment

Employment opportunities will be created during construction and operations. Construction impacts to employment are anticipated to be *moderately significant and positive*; operational impacts to employment will be *positive but largely insignificant*.

Access

Access to The Chute is not anticipated to change significantly during either construction or operations, although active construction areas may be temporarily inaccessible. Access will only be restricted when and were required for public health and safety. Impacts to access at The Chute are anticipated to be *Insignificant*.

Access to Third Falls may be slightly affected during construction as active construction areas are restricted. Access will only be restricted where and when required for public health and safety. Access during operations will be enhanced through the additional project road. Overall access impacts to Third Falls are anticipated to be *Insignificant*.

Public Health and Safety

Wastes and Waste Management

Construction and operation of the Ivanhoe Project will generate wastes. Three local waste management companies have been identified to ensure that all wastes, hazardous and non-hazardous, are collected, transported and disposed of in accordance with all regulations so as to prevent any impacts resulting from wastes generated at the sites. Residual effects are anticipated to be *Insignificant*.

Water Supply

The distance of both The Chute and Third Falls from any drinking water intake or water treatment facility is 6.4 km at the nearest point; *no impacts* to drinking water or water treatment are anticipated.

Worker Safety

During construction and operations, equipment malfunctions or other adverse events may affect worker health and safety. All work will be undertaken in strict accordance with Ministry of Labour guidelines, and first aid equipment will be kept on site throughout the Project lifespan. Residual effects are anticipated to be *Insignificant*.

Dust

Dust can result during construction activities, particularly from vegetation removal, grading, or stockpiling of soils and fill. This has the potential to affect air quality in the vicinity of construction activities. All stockpiled materials will be covered appropriately throughout construction, and wetted down as appropriate. Exposed soils will be revegetated using native plants as soon as possible following construction. Impacts from dust due to construction activities are anticipated to be *Insignificant*.

Dust is not anticipated to be generated by operation of the Project.

Methyl Mercury and Fish Consumption

Mercury is naturally present in soils and rocks in Ontario. The operation of the Project has the potential to increase mercury concentrations in the Project Area. Any flooding of land has the potential to effect the concentrations of available mercury in surface water, including the bioavailable form – methyl mercury, posing a health concern to humans. The MOE's fish consumption advisories for Ontario water bodies ("Guide to Eating Ontario Sport Fish," 2013) recommend monthly consumption limits for sport fish. The median mercury concentrations in the existing Walleye populations in the Project Area are near or above the 'no consumption' restriction for Sensitive Population. The headpond inundation is expected to result in an increase in methyl mercury concentrations in fish tissue with a gradual return to baseline levels over a period of 5 – 20 years. Fish consumption appears to be largely recreational and supplemental reducing the potential effect directly related to human health.

Extensive mitigation has been incorporated in the project design to minimize the potential for increased methyl mercury in fish tissue, by minimizing organic material, minimizing anoxic potential and minimizing new inundation while promoting flushing, provide extensive monitoring and reporting. The overall effect is determined to be *Insignificant*.

Local, Regional and Provincial Economies

The construction and operation of a new hydro power project is not expected to have any negative effect on mining activities since mining companies are subject to a '400' surface rights reservation around all lakes and rivers (CLAIMaps). Similarly, due to ongoing consultation with the license holders for forestry operations in the area, no impact is anticipated to local logging operations. Some temporary workers will move to the area during construction, which would increase demand for housing, food, and other local services. Additionally, the increased access to the Third Falls facility site through the construction of new access roads may decrease business for local remote tourism operators. Consultation will continue with local mining and forestry operators to ensure the Project is integrated into their business models and agreements regarding access to merchantable timber, for instance, are reached. Construction and operational residual impacts to local, regional and provincial economies are anticipated to be *Insignificant*.

Tourism Values

Existing tourist values are described in the Lands and Resources sections, as all local tourism revolves around recreational use of the natural amenities there described.

Economic considerations of tourist values are described in the Socio-Economic sections.

Heritage and Culture

Archaeology and Built Heritage

There are no known archaeological or Built Heritage values in the Project Area.

Cultural Heritage Landscapes

It is possible that some previously unidentified Culturally Modified Trees may exist in the Project Area, despite extensive field work to date to identify and delineate them. If the trees are within construction footprints, they may need to be cleared. All workers will be trained in a Discovery Protocol to ensure that all reasonable efforts are undertaken to avoid disturbing any trees so identified. Residual effects are anticipated to be *Insignificant*. No additional operational impacts are anticipated.

Aboriginal

Aboriginal Communities and First Nation Reserves

The Project Area does not overlap with any Aboriginal Communities or First Nation Reserves.

Sites of Aboriginal or Cultural Importance

One potential CMT is downstream from The Chute, on an island. It was determined through field investigations to have been modified through natural processes such as ice scour; however, the tree is important to local aboriginal communities, who remain concerned about potential construction damage. There are also two stands of mature White Cedar of importance to local Aboriginal communities. Construction activities may require the removal of some of the White Cedar. The proponent re-routed access roads wherever possible to avoid impacts to the cedar trees; and cedars which still require removal will be removed in consultation with interested First Nations and the SFL holder. All cedar trees not being removed will be marked with flagging tape to ensure they are not disturbed by construction activities. Residual effects are anticipated to be *Insignificant*. No further disturbance or damage to the cedar trees is anticipated to occur during operations.

The naturally modified tree downstream of The Chute will be protected with fencing. No damage will occur to it through construction. It is above the predicted high-water line of the operational period, and *no impacts* are anticipated to occur post-construction.

Traditional Lands

Hunting, harvesting, foraging and trapping activities may be disrupted by construction activities as access will be restricted around the facility and associated infrastructure to address security and public safety. Xeneca commits to maintaining current public access and navigation to the area; restriction such as fences and gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). These minimal restrictions should ensure both that game and flora populations do not change, and that hunters have the same number of opportunities to engage in successful hunting, harvesting and foraging activities. Residual effects are anticipated to be *Insignificant*.

Hunting, harvesting, foraging and trapping activities may be disrupted during operations when inundation makes previously accessible areas inaccessible. Xeneca commits to maintaining current public access and navigation to the area; restriction such as fences and gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). The headponds for both facilities are relatively small; inundation will affect a small proportion of the total area, and impacts to hunting and foraging due to inundation are anticipated to be minimal. These minimal restrictions should ensure both that game and flora populations do not change, and that hunters have the same number of opportunities to engage in successful hunting, harvesting and foraging activities. Residual effects are anticipated to be *Insignificant*.

Furbearing Mammals

Concerns about impacts to furbearing mammals were raised by First Nation communities. Otter denning was documented 8 km upstream of the Third Falls facility. Dens may be impacted by an

increase in water levels, however the most significant level changes occur within the first 6 km of the Third Falls headpond. In order to mitigate effects such as direct mortality, inundation will not occur during the winter or ice-over period in order to ensure no mortality due to individuals become trapped. Following inundation, operational water fluctuations will be within 0.25 m, which should not affect den entrances. Following construction, monitoring will occur to ensure that otters continue to populate this area. Residual effects are anticipated to be *Insignificant*.

Employment

Employment impacts of the Ivanhoe Project for First Nations are expected to be *positive*, as a result of measures included in the confidential economic benefit agreements currently being finalized.

Land Claims

The Project location is in an area where a land claim is on file between the Federal Crown and Nishnawbe Aski Nation which is the Grand Council of Treaty 9. An Agreement in Principle has been reached but no final agreement has been settled. The Ivanhoe Project is *not anticipated to have any impact* on this process.

Economic Development

Economic development of the Ivanhoe Project for First Nations are expected to be *positive impact*, as a result of measures included in the confidential economic benefit agreements currently being finalized, including a generous equity participation program. Therefore, no additional mitigation measures are considered necessary.

Energy and Electricity Considerations

Construction of the Project will *not impact* existing or future waterpower facilities.

Reliability and Security

During construction of the Project portable electrical generators will be required to support construction activities.

Operation of the Project in parallel with current electricity generating systems tied into the electrical grid will have a *positive impact* on overall grid reliability and availability of power especially during peak hours when consumption is highest. Electrical safeguards installed at the substations of each facility will include isolation measures providing a safeguard to the electrical grid in the event of a malfunction.

Electricity Flow Patterns

During the initial construction period electricity demands will be met through use of portable electrical generators. After completion of the electrical distribution line site electrical needs for construction will be met through the distribution line system fed from the 115 kV substation.

The generating stations will not be equipped with black start capabilities and will require an external source of electricity during restarts. In addition the Project will not be equipped with island mode capability and all power generated will be distributed externally to the electrical grid for consumption.

Cumulative Effects Assessment

As a result of substantial concern on the part of public and agencies regarding impacts to the upstream Ivanhoe Lake Dam and the downstream Northern Claybelt Forest Complex Conservation Reserve, the Ivanhoe Project has been designed to eliminate upstream and downstream impacts. As well, the Ivanhoe Project Environmental Assessment is itself a Cumulative Effects Assessment of the previously-separate The Chute GS and Third Falls GS projects. Therefore, the vast majority of potential cumulative impacts have already been addressed through the process to date.

Remaining cumulative impacts will be addressed through the Water Management Planning process, and through consultation with the SFL holders.

Accidents and Malfunctions

Accidents

Increased construction or operational vehicle traffic may result in additional traffic accidents. An Emergency Response Plan will be developed to reduce the risk and ensure that any accidents which do occur are dealt with swiftly and properly. The residual effects of accidents are anticipated to be *Insignificant*.

Spills

Spills of hazardous materials including petroleum hydrocarbons, lubricants, and/or chemicals may result from construction or operations. Proper spill containment equipment will be kept-on site and any spills will be promptly reported and remediated. All equipment will be kept in a good condition to minimize the risks of spills. All hazardous chemicals will be stored in accordance with good practice and all regulatory guidance, and vehicles will be fuelled in designated fuelling areas at least 30 m from any watercourse. Residual impacts are anticipated to be *Insignificant*.

Fire

Fires may occur during construction or operations as a result of lightning strikes, equipment malfunction or worker error. A Fire Preparedness and Prevention Plan will be developed in consultation with the MNR to reduce the risks for fires and ensure any that do occur are dealt with promptly and safely. Residual effects are anticipated to be *Insignificant*.

Flooding

Construction activities including the installation of temporary cofferdams may increase the risk of local flooding. Mitigation measures include installing cofferdams outside the freshet period, where higher flows are less likely, and altering construction plans if weather forecasts show that heavy rains or melt are anticipated. The residual effects of increased flooding risks are anticipated to be *Insignificant*.

An operating dam may increase flood risk by introducing a new barrier to the passage of water downstream. Operating plans for the Ivanhoe Project will include measures to ensure that excess flows during potential flooding events are efficiently passed through the dam structures in order to ensure no impact to flooding risk. Residual effects are anticipated to be *Insignificant*.

Earthquake

The Project Area is located in the Northeastern Ontario Seismic Zone. According to Natural Resources Canada, this zone experiences a very low level of seismic zone activity. The potential effects from an earthquake are mainly associated with the potential damage to the structural integrity of cofferdams in the river. Dam Safety Inspections (DSI) will be conducted as recommended by the MNR in the Dam Safety Reviews Best Management Practices. It is recommended that a dam safety inspection occur after any significant change that may affect the dam.

Dam Failure

Dam failure during operation can cause the sudden release of water to the watershed, potentially causing serious and sudden flooding downstream, with the possibility of impacts to human health and safety. The primary protective measure is the safe design, construction, operation and maintenance of the Ivanhoe projects and ancillary facilities. Following the approval of the Ivanhoe Class EA, a full Dam Safety Study will be commissioned and incorporated into the overall safety plan. The mitigation measures and recommendations in the Dam Safety Plan will be incorporated into the Project's final design in order to reduce the risk to public health and safety from dam failure to near zero. Residual effects of dam failure are anticipated to be *Insignificant*.

Emergency Shutdown

During normal operation, the river flow will overtop the weir when the powerhouse is shut down so that downstream flow is not inadvertently interrupted. However, during an emergency shut-down,

headpond water levels could fall below the crest of the weir and the headpond would have to fill to the weir crest before downstream flow resumes. This would cause a disruption to the downstream ecosystem. To avoid a temporary interruption of flow from an unplanned shut down of one or both of the facilities, a bypass valve in the powerhouse is automatically activated to provide a minimum flow of 2 m^3/s. Residual effects are anticipated to be *Insignificant*.

Climate Change

Impacts of climate change on the Project, including increased extreme weather events and the effects of potentially drier climatic conditions, were considered. The design of the Project should be able to accommodate predicted changes.

Impacts of the Project on climate change were also considered. *No such impacts are anticipated*.

Monitoring

Three phases of monitoring will be implemented for the Project, to verify the extent of effects, effectiveness of mitigation measures and whether additional measures are warranted:

- Pre-construction monitoring
- Construction monitoring
- Operation monitoring

Consultation

The consultation and engagement initiatives were designed to co-ordinate all applicable requirements for the regulatory, public and Aboriginal community notification, engagement and consultation. Xeneca is committed to carrying out effective and responsive consultation activities with all local stakeholders.

Public Consultation

A Public Consultation Process document was created and used when carrying out consultation activities. In total, eight notices were distributed, and five Public Information Centres and one Public Information Meeting were held. All correspondence received was responded to in a timely fashion, and questions and issues raised by the public influenced the Project. For example, public concerns regarding access to an existing boat launch and the condition of existing portage routes post-construction led to a commitment to rebuild and improve the boat launch and ensure that all portage routes remain accessible for the Project's lifespan.

Aboriginal Consultation

An Aboriginal Consultation Process document was created, distributed to First Nations for comment, and used when carrying out consultation activities. Xeneca committed to carrying out engagement through written correspondence and direct telephone communications, including follow-up on numerous occasions if communities were non-responsive. Upon appropriate direct contact, Xeneca sought meetings with community leaders or designated lead person(s) in order to introduce Xeneca and the Project. Xeneca conducted and sponsored community engagement sessions. Xeneca also provided, when requested, access to its professional staff and consultants to answer technical questions. Finally, where a request was made, Xeneca provided necessary resources to support meaningful engagement including the retention of external consultants to peer review material presented to the communities.

Input from Aboriginal communities had influence on the Project design. For example, concerns about a stand of mature White Cedar trees changed the routing of an access road.

Agency Consultation

Federal, provincial and local agencies were kept fully informed of all Project activities. Meetings began with interested agencies at all levels in 2011. The Proponent has made extensive efforts to incorporate all Agency feedback, including consolidating the former The Chute and Third Falls GS projects into this one Environmental Assessment Report, modifying the Third Falls operating regime to avoid impacts to the downstream Conservation Reserve, and implementing substantial additional field work to fully inform baseline analyses.

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1.0 INTRODUCTION AND PURPOSE OF PROJECT

Xeneca Power Development Inc. (Xeneca) is proposing to construct two hydroelectric generating stations (GS) at The Chute and Third Falls sites (the "Facilities"), located 44.2 km apart along the Ivanhoe River. The Facilities combined with the ancillary components comprise the Ivanhoe River: The Chute & Third Falls Generating Stations Project (the "Project"). This Project is being developed in order to meet government and energy regulatory goals and objectives to generate sustainable and reliable hydroelectric power.

The proposed facilities were awarded 40-year Feed-in Tariff (FIT) contracts from the OPA which, subsequent to a successful Environmental Assessment (EA) outcome, would see the facilities commissioned and delivering electricity to the provincial electricity grid by October 2018. The FIT contract capacity for this Project is 3.6 MW (The Chute) and 5.1 MW (Third Falls), but the actual installed capacity of this Project will be closer to 2.9 MW and 3.8 MW, respectively. The following table provides a general overview of the Facilities.

Table 1: General Facility Overview

	The Chute	Third Falls
Capacity provided in the FIT Contract	3.6 MW	5.1 MW
Installed Capacity	2.9 MW	3.8 MW
Coordinates	48° 23' 28.1" N; 82° 27' 3" W	48° 36' 20.7" N; 82° 21' 29.2" W
Annual Output	12,575 Kwh	16,990 Kwh
Inundation extent	6.4 km upstream	44.2 km upstream
Drainage Area	2723 km^2	3242 km^2
Commercial Operation Date	October 2018	October 2018

The main components of each Facility include a headpond, a spillway dam, a powerhouse containing a Kaplan Style turbine, a powerhouse yard, a substation, a tailrace, new access road, a Facility to Facility 69kV power line and a power grid transmission line connected with a 115 kV substation. A headrace channel will convey flow from the river into the intake of each powerhouse and a tailrace channel will convey the flow from the powerhouse back into the river. Each Facility will create a headpond upstream from the dam; the Third Falls headpond will extend to the tailrace of The Chute. Operating in concert, the river will be re-naturalized below the Third Falls tailrace to prevent changes in flow and water level in the Ivanhoe River downstream from the facilities.

These facilities would together provide approximately 30,000 MWh of renewable energy annually. The production of 30,000 MWh of renewable energy represents the equivalent of:

- The displacement of 20,170 metric tons of carbon dioxide equivalent (Citation) or
- The annual greenhouse gas emissions from 4,410 passenger vehicles; (Citation) or
- The sequestering of carbon from nearly 17,350 hectares of pine or fir forests (citation).

This report was prepared in accordance with the requirements of the fourth edition of the Ontario Waterpower Association *Class Environmental Assessment (EA) for Waterpower Projects* published January 7, 2014. Further information on regulatory requirements and the Ontario Waterpower Class EA can be found in Section 7.

1.1 Project Background

The proposed Project is located on the Ivanhoe River, entirely on Crown land. The proposed The Chute GS is located approximately 85 km west of Timmins, and 15 km north of Highway 101; the proposed Third Falls GS is located 79 km west of Timmins, 46 km north of Highway 101 and 44.2 km downstream of The Chute GS. A Project Area map is provided as Figure 1.

Waterpower is recognized as an integral component of Ontario's long term energy plan established by regulatory agencies such as the Independent Electricity System Operator (IESO), Ontario Energy Board (OEB) and Ontario Power Authority (OPA). In advance of provincial energy procurement programs, the Ontario Ministry of Natural Resources (MNR) has, over a period of years, made available to interested proponents sites conducive to waterpower development. In 2007-08, the MNR accepted site release applications for new waterpower development. A number of applications were approved in 2008 in advance of the Provincial Feed-in-tariff (FIT) program, including The Chute and Third Fall on the Ivanhoe River. The company owning the successful separate site release applications for The Chute and Third Falls was brought into the corporate structure of Xeneca Power Development LP prior to the initiation of the Feed-In Tariff (FIT) program and, subsequently, the projects were awarded FIT contracts.

Initially, The Chute and Third Falls facilities were two separate projects based on the distance between the two sites and a preliminary analysis that each site's respective effect on the river hydrology would be distinct. Subsequent economic analyses and hydrological modeling investigations at The Third Falls site have since concluded that the maximum available capacity could be achieved when the headpond for the Third Falls site extends over 44 km upstream into the vicinity of The Chute Facility. Further details on the downstream Zone of Influence can be found in Section 3.4. Ultimately, it was determined that the two facilities are hydrologically linked. The assessment documented in this report considers the combined potential environmental effects of both developments operating as one Project.

1.2 Purpose of the Project

The purpose of this Project is to generate hydroelectricity, a renewable and sustainable resource. The Chute Facility will be a modified run-of-river Facility and will be able to provide electricity when it is needed most; Third Falls will be a run-of-river Facility.

Hydroelectric generating stations are long-lived, lasting upward of 80 years. In 2009, the Ontario government enacted the *Green Energy & Economy Act* (GEEA) with the aim of making the province a global leader in clean, renewable energy. The Feed-In Tariff (FIT) Program administered by the Ontario Power Authority (OPA) was established under the GEEA to encourage the development of renewable energy in Ontario. Waterpower contracts were offered under the FIT program, for small scale Projects like the Ivanhoe Project, in order to allow for expanded waterpower development in the Province.

1.3 Project Categorization

The Class EA for Waterpower Projects defines projects in three categories in order to match projects with criteria and level of effort required for their Environmental Assessment process. This includes types of mandatory notification requirements, key environmental considerations; involved parties and general level of detail expected in the reporting (OWA 2014).

Three different categories of Projects are described in the Electricity Projects Regulation (116/01): Category A, B and C. Category A Projects are exempt from the EA process and include existing facilities undergoing an expansion resulting in less than a 25% increase in nameplate capacity. Category C projects include proposed facilities on unmanaged waterways; Category C facilities require individual EAs (OWA 2014).

A new project on a managed waterway, (defined as “waterways that have water management infrastructure and/or waterpower facilities on them, regardless of whether the project is located within the zone of influence of the existing infrastructure or waterpower facility” (OWA 2014)), is considered to be a Category B project. The Ivanhoe Lake Dam is a water management structure located approximately 40 km upstream of The Chute Facility and approximately 84 km upstream of the Third Falls Facility. Therefore, the Ivanhoe Project is a Category B project, and has been assessed as such under the requirements of the OWA Class EA for Waterpower Projects.

1.4 Scope of the Project

When properly maintained, a typical waterpower plant can operate in excess of 100 years. This Project is designed with this typical operating life; therefore, if facility decommissioning is to occur, an environmental assessment process based on the legislative requirements of the day would have to be

completed, thereby protecting the environment from decommissioning activities. Therefore, decommissioning has not been considered within this Environmental Report. All aspects of the construction and operations have been included.

2.0 WATERPOWER ENVIRONMENTAL ASSESSMENT PROCESS

2.1 Overview of Process

In Ontario all waterpower Projects are subject to the Environmental Assessment Act (EA Act), which requires most developments to complete an Environmental Assessment (EA). The product of the EA is an Environmental Report (ER), which, when approved by regulating agencies, is used to inform the permitting phases of a project; it is neither the beginning nor the end of the approval process.

The Class EA for Waterpower is a tool for planning, evaluation and consultation which incorporates some of the legislative requirements of the agencies with authority over permits and approvals related to the proposed development (OWA 2014). In addition, the Class EA process evaluates the potential effects of a project so that they may be avoided, mitigated or compensated during the development and design of the project. Environmental effects include both the positive and negative effects that a project would have, or could potentially have, on the environment at any stage in the project life cycle. The assessment also considers the effects of the environment on the project, which includes the social economic and human environment (OWA 2014).

The Class EA for waterpower typically covers the assessment and permitting for the entire Project Area including the entire water control structures, powerhouses and ancillary components as: access roads, reservoirs or headponds, and any temporary works required for construction such as laydown areas, construction camps and temporary access roads. In addition, transmission lines that are 115 kV or greater that are associated with a project are considered part of the project and evaluated using the Class EA process (OWA 2014).

Connection lines and substations are also often components of the overall project, but the assessment of these components is sometimes not required under the Class EA. Only those connection lines equal to or greater than 115kV are considered to be Category B projects under the Electricity Projects Act and therefore subject to the Class EA.

The 115 kV connection line is considered as part of the Project. For the purposes of this Project, the 69 kV Facility to Facility connection line is not part of Category B not due to their lower voltage but is included in this overall assessment. This latter line will nevertheless be part of the detailed permitting process.

During an Environmental Assessment, conceptual design information on construction and operations is presented, in addition to data collected through field investigations, desktop studies, and consultation. The aim is to ensure that all stakeholders are informed and understand the general scope and extent of the Project, particularly as it relates to how the Project may impact their interests, other uses of the

river and the environment. Detailed engineering design and specification work will be prepared as part of a separate permitting and approval process required for the Lakes and Rivers Approval Act (LRIA).

2.2 Elevation Requests

Under the Class EA process, when a participant or third party has concerns with the assessment and evaluation undertaken, a Part II order Request can be submitted during the 30 day review period after the ER has been released and the Notice of Completion issued, (OWA 2014). It is important to stress that a Part II Order should only be submitted after the proponent and the third party have attempted to terms on the outstanding issues privately. During and after the review period, the Minister of the Environment, with the assistance of MOE Directors, considers the submitted requests; asks the proponent for further information; and renders one of the following three decisions: denying the requests either with or without conditions; finding that the process has deficiencies that must be addressed; or granting the Part II order request and requiring an Individual EA for the project.

Prior to reaching any one of these three decisions, the MOE may decide to refer the proponent and the third party to mediation in order to assist in reaching a resolution.

2.3 Amendments

There are two classes of modifications defined in the OWA Class EA. A minor modification is defined as a change that is "below the threshold for a significant modification under the Electricity Projects Regulation" (OWA 2014). The Electricity Projects regulation defines a significant modification as that would change the nameplate capacity of a waterpower Facility by 25% or more (OWA 2014).

If a proponent needs to make significant modification(s) to the proposal following the approval of the Class EA or the implementation of the Project takes more than five years following the filing of the Statement of Completion, a formal Amendment to the Class EA may be required. The purpose of the Amendment is to consider the "significance of changes to Projects after completing the Class EA Process….and to require consultation on changes that are environmentally significant" (OWA 2014).

The process by which an Amendment is completed involves technical review and consultation with interested and affected parties as well as updating the potential effects matrix from the OWA Class EA to determine if there are any new potential negative effects to the environment (OWA 2014).

The Amendment is to outline the proposed changes; provide a rationale for proposing these changes; and a review of the mitigation measures that will be applied to minimize any effects. An Amendment to the ER is subject to a minimum 30-day review period with the renewed opportunity to request a Part II Order.

2.4 Methods Employed in the Class Environment Assessment

The preparation of this ER followed the OWA Class EA publication (2014). The process of conducting this environmental assessment entailed the examination and evaluation of each component (i.e. dam) and life-stage (i.e. operation) of the proposed developments and their potential effect on each aspect of the existing environment. Environmental effects are changes that may include, but are not limited to: alteration of natural features; flora or fauna and their habitat; ecological functions; natural resources; air and water quality; and cultural or heritage resources. Environmental effects may also include the displacement, impairment, or interference with existing land uses; land use and resource management plans; businesses or economic enterprises; recreational uses or activities; cultural pursuits; and social environments.

For each of these components, there are three main life-stages of development: construction, operation, and decommissioning. As described in section 1.4, this document addresses construction and operation.

The Class EA applies to a set of projects scoped under the OWA Class EA document (2014) which outlines many of the potential impacts from waterpower projects. Additional work was done in order to assess ecosystem components that make up the environment within the Project Area, and evaluate how the Project would affect these components during life-stages of development. The Environmental Assessment team has adopted the conceptual hierarchy of avoidance, prevention and mitigation for the Project. Where an impact can be neither avoided nor prevented, mitigation measures were considered. All forms of mitigation (including avoiding and prevention) are discussed under the Mitigation Measures within each impact assessment in Sections 11 and 12.

Investigations undertaken in support of this Project identified the anticipated effects of the Project, fort both the Facilities and the ancillary components.

In order to prepare this document the following were undertaken and completed:

1. The Project Area and Study Area were defined. These can be seen in Figure 1 and Figure 2 respectively;
2. Desktop studies were prepared and field work commenced in the Study Area on significant features;
3. Consultation plans were drafted for Aboriginal communities, Public stakeholders and Agencies. Consultation and engagement occurred with all three;
4. A Potential Effects Matrix was completed using the results of the desktop studies, field work, and early stakeholder consultation;

5. Impact Assessment evaluations and Mitigation Plans were prepared for species, habitat and items which would be affected by the project construction and operations;
6. Following mitigation, significance assessments were prepared and residual effects were determined; and
7. Monitoring programs were developed, often in consultation with agencies and relevant aboriginal partners.

3.0 PROJECT DESCRIPTION & LOCATION

The following describes the Project locations and components. The descriptions outlined in this section are used through the report:

- The **Project** includes all aspects of the undertaking for The Chute and Third Falls, including the water control structures, powerhouses and ancillary components (access roads, headponds), temporary works required for construction (laydown areas, construction camps, temporary access roads) and the 115 kV transmission line.
- The **Facility** (The Chute or Third Falls) describes the terrestrial and in-water footprint for either The Chute or Third Falls including ancillary components such as the headpond and electrical connection lines. The Chute Facility location can be found in Figure 3 and Third Falls Facility location in Figure 4;
- The **Project Area** describes those areas which are affected either temporarily or permanently by Project construction and operations for both facilities. This area includes what is also commonly referred to as a Zone of Influence (ZOI) which is a term used in the OWA Class EA to discuss the "immediate area beyond the site directly affected by the project." (OWA, 2014). This area is described in Section 3.4 and is depicted in Figure 5. The entire Project Area can be seen in Figure 1.
- The **Study Area** is the area where field studies were completed which in some cases extends past the Project area. This area is depicted in Figure 2;

The Project will be built entirely on Ontario Crown land within the MNR District of Chapleau, along and within the Ivanhoe River. The Project Area spans three geographic townships: Belford, Nova and Oates. The Area also spans both the District of Sudbury and the District of Cochrane. The Study Area is designated as a General Mixed Use Area under the Crown Land Use Policy Atlas and allows for general resource extraction and management, which includes commercial hydro development, new road development and road maintenance.

3.1 The Chute Generating Station

The Chute Facility is located on the Ivanhoe River in the geographic township of Oates, in the Pineland Forest Forest Management Unit (FMU) in the District of Sudbury. The closest municipality to the Facility is the City of Timmins, located approximately 85 km east of the Facility. Foleyet is approximately 20km south of the Facility. A map of The Chute location can be found in Figure 3.

Access to the Facility will use Laundry Road & Oates Road, both forestry access roads licensed to EACOM Timber Corporation ("EACOM"). Laundry Road is not highly maintained and is primarily used by

the public to access a boat launch and campsite north of the Third Falls. The use of the existing Oates Bridge will be required in order to access the west side of the Facility.

3.2 Third Falls Generating Station

The Third Falls Facility is located on the Ivanhoe River in the geographic township of Belford, in the Gordon Cosens FMU in the District of Cochrane. The closest municipality to the Facility is the City of Timmins located approximately 80 km east of Third Falls. Foleyet is 40 km south of the Facility. A map of the Third Falls location can be found in Figure 4.

The Facility is located approximately 44.2km downstream from The Chute Facility, and approximately 100 m upstream from the Northern Claybelt Forest Conservation Reserve boundary.

Access to the Facility will make use of the following access roads: West Road, Nova Road, and Wadsworth Road. The use of the existing Nova Bridge will be required in order to access the west side of the site.

3.3 Existing Water Control Structures

The Ivanhoe Lake Dam is located approximately 40 km upstream of The Chute facility and approximately 85 km upstream of the Third Falls facility. It is owned and operated by the Chapleau District MNR and is governed by the existing Mattagami River Water Management Plan (WMP). Among the objectives of the WMP is the protection of the ecological and recreational values of Ivanhoe Lake and the downstream water treatment facilities in Foleyet. The existence of the upstream Ivanhoe Lake Dam has been taken into consideration throughout the planning and design process of the proposed Project.

Xeneca has designed The Chute and Third Falls to operate independently of the Ivanhoe Lake Dam and current hydraulic modeling demonstrates that the Project will not impact Ivanhoe Lake or Foleyet. As such, Xeneca has no current or future plans to request a change in the operations of the Ivanhoe Lake Dam or to use Ivanhoe Lake for any aspect of operation of The Chute or Third Falls; the management of levels and flows on Ivanhoe Lake will not be manipulated as a result of the Project.

3.4 Zone of Influence

3.4.1 Introduction

This section outlines the regulatory context of the Zone of Influence (ZOI), how the ZOI was defined within the watershed for the proposed Project, how the geographic extent of the baseline and effects

assessment was determined, and how the downstream endpoint was defined. A map of the ZOI for the proposed Project is shown in Figure 5.

The *Proposed Operating Plan & Water Management Plan Amendment Ivanhoe River Hydro Projects: The Chute, Third Falls* (also referred to as the "Operating Plan") in Appendix D (ORTECH 2014) has been designed such that the flows leaving the Third Falls Facility are re-naturalized to run-of-river conditions and consistent with the type of flows that would occur if the proposed Project did not exist.

3.4.2 Regulatory Context of ZOI

As noted in Section 3.0, the OWA Class EA defines ZOI as the **"**immediate area beyond the site directly affected by the project*" (OWA 2014).* Environmental impacts within the ZOI are to be carefully assessed, while areas outside of the ZOI are deemed not to be directly affected.

Defining the ZOI for watersheds requires careful consideration. Induced alterations to flow, temperature, water quality and sediment regime often attenuate gradually with distance. Defining the ZOI requires an understanding of where the induced alterations are sufficiently attenuated so as to not directly affect the environment, human health and/or private property. It is often possible to define the upstream and lateral inundation extent of a project footprint with a high degree of certainty. The appropriate endpoint of downstream extent must be defined based on the available baseline information. A properly defined ZOI provides clarity to the public and guides the baseline assessment studies.

Extensive dialog with MNR and MOE has occurred since 2010 with respect to the proper interpretation of the ZOI on all Xeneca projects, including this Project. On June 6, 2013, MNR provided written advice to Xeneca on how to address this matter and, in a letter issued by the MOE Regional Director on June 14, 2013, MOE confirmed the MNR advice 'with emphasis on paragraph six of the written advice' (6th bullet point below) which is related to providing a description of the rationale used to define the ZOI.

The MNR advice of June 6, 2013 is as follows:

- *MNR respects the Zone of Influence (ZOI) definition contained in the OWA Class EA for Waterpower Projects (the Class EA). MNR encourages proponents to discuss with/seek clarification from OWA, if required, on how to apply the definition either generally or within the context of a particular project.*
- *MNR will continue to use this definition, the general guidance contained in Section 2.5 of the Class EA ("The Environment Affected and the Expected Range of Effects") and MNR's 2010 interim guidance for "Field Data Collection for Waterpower Projects" to inform our discussion with proponents on how to delineate for each waterpower project an*

appropriate ZOI to enable the proponent to adequately describe the environment affected and the range of effects for the purposes of the Class EA

- *MNR will continue to use the above guidance in conjunction with the broad purposes as set out in Section 2 of the Lakes and Rivers Improvement Act to ensure that in approving the location of the project/facility the operational requirements/constraints, flooding rights, mitigation to reduce impacts, compensation measures to address impacts and monitoring requirements have been adequately identified.*
- *MNR will continue to work collaboratively with proponents to meet the intent of Section 5.0 of the Class EA to identify opportunities to create a process that facilitates coordination with and integration of other legislative and regulatory requirements. In keeping with a coordinated approach, MNR recommends that all requirements of the LRIA, ESA and PLA be considered prior to and throughout the EA process.*
- *MNR recognizes that the Class EA is the primary planning and public engagement framework for waterpower proposals. Consistent with the Class EA, proponents are ultimately responsible for determining the required ecological data collection requirements with consideration being given to advice provided by MNR. It is the proponent's responsibility to determine the potential ZOI (i.e. project scope) under the Class EA.*
- *If MNR and a proponent cannot come to a consensus on a final ZOI during the EA process, MNR would expect a proponent to clearly describe in the final Environmental Report (ER) the methodology used to delineate the ZOI boundary and, in situations where the ZOI does not cover the entire extent of hydrologic alteration resulting from the proposed development, rationalize why a stretch of river was not assessed or consulted on and how it came to its determination that the change to the hydrological regime does not cause an impact to any of the features or values of interest within MNR's mandate. Inclusion of this rationale within the ER will help MNR make a determination as to whether or not sufficient information has been collected to allow MNR to make informed permitting decisions.*

3.4.3 Upstream ZOI

The proposed Project involves the construction of two operationally connected (i.e. cascaded) Facilities: The Chute, and Third Falls.

The upstream ZOI refers to the headpond located upstream of the dam. The cascading aspect of the Project design involves discharging the release of the upstream headpond at The Chute directly into headpond of the next facility (Third Falls) with operations being harmonized among both facilities. Hence, the upstream ZOI is defined as encompassing both headponds and extends from the upstream end of the upstream headpond (i.e. The Chute headpond is 6.4 km upstream of the downstream of Shawmere River confluence) to the dam location at Third Falls. The resulting headponds will directly affect the inundated terrestrial and aquatic habitat. The affected terrestrial habitat will be changed

into aquatic habitat; details on this change are discussed in subsequent sections. The affected aquatic habitat will be changed by generally increased water depth/areal extent and lower flow velocities. In addition, water level fluctuations within the ZOI can fluctuate as a result of daily operations.

The Chute and the Third Falls headpond reaches make up the entire upstream ZOI. No operational scenario exists where the water levels in the two headponds would be less than under natural conditions; this is discussed in further detail in the *Proposed Operating Plan & Water Management Plan Amendment* (also referred to as the "Operating Plan") prepared by ORTECH Consulting Inc. in January 2014 (Appendix D).

The following actions were taken to define the ZOI:

- A LiDAR survey was carried out to obtain detailed topographic mapping throughout the proposed headpond areas.
- A hydrology study (Appendix F, HATCH, 2009, 2011) and hydraulic modeling study (Appendix F, CPL, 2013) were carried out to predict the inundation extent within the mapped topography.
- Maps of pre-Project and post-construction inundation extent were prepared and used for public consultation and the ER document; and
- Maps of the maximum drawdown related daily operation (i.e. 1 meter below normal operating level in The Chute headpond and 0.25 meters in the Third Falls headpond) were prepared.

The inundation extent was defined for two primary conditions; normal flows (i.e. long term average flow) and maximum flood extent (i.e. 1:100 year flood event). In accordance with established regulatory and industry practice, the inundation extent associated with normal flow was used to map the areas where terrestrial habitat is altered to aquatic habitat. The aquatic and terrestrial habitat in the proposed headpond area was assessed for existing baseline conditions and potential changes related to inundation. The work as documented in the remainder of the ER consisted of:

- Mapping baseline habitat conditions with special emphasis on identifying species and habitats of special significance (e.g. sport fish, threatened species, spawning beds).
- Evaluating the proposed change in water depth and flow velocity using the hydraulic study results. Consideration was given to effects on aquatic habitat alteration, impact mitigation, monitoring and adaptive management.
- Considering the proposed effect of inundation of terrestrial habitat to aquatic habitat with emphasis on identifying any special terrestrial habitat that might be lost. Consideration was given to the adaptation of terrestrial and shoreline species with respect to the proposed permanent alteration.

- Considering the proposed daily alteration of levels in the headponds for geomorphologic effects and habitat impacts.
- Considering other potential physical, biological and chemical changes including water quality, temperature and sediment. Separate analyses were carried out for each topic including collection of baseline data and an environmental assessment on the predicted impacts included in Sections 11 and 12. Where a notable change was expected to occur, consideration was given to habitat impacts, impact mitigation, monitoring and, if applicable, adaptive management.
- Considering habitat fragmentation from construction of dam structures and possible entrainment of fish into the powerhouse. Where an impact was identified, consideration was given to mitigation, monitoring and, if applicable, adaptive management.

Also considered was the potential change in existing conditions for riparian and/or adjacent land use. Specifically considered were:

- Any potential change to the maximum flood extent (i.e. identification of any locations where the maximum flood extent would be greater or cover a larger area than under the existing condition).
- Any potential change to the location of the water's edge under normal flows, particularly where the water's edge line makes up a portion of the private property boundary as defined on the legal land title.
- Any potential change to the daily variability in levels of the headponds which could affect water access or navigability at the water's edge.

It was determined that none of the proposed inundation affects private land; however, certain mining claims are affected. The claim holder was given special consideration in the consultation process. Detailed inundation mapping was provided. Two forestry bridges also cross the river within the upstream zone of influence. Engineering assessment and bilateral negotiations were carried out as outlined in the consultation Section (Section 18).

3.4.4 Downstream ZOI

The downstream ZOI is defined as the very short section of river from the Third Falls dam to the boundary of the Northern Claybelt Forest Conservation Reserve which is less than 100 meters downstream.

As noted above, the Operating Plan (Appendix D) proposes to carry out daily operation at The Chute and to re-naturalize to run-of- the operation at Third Falls. Re-naturalization involves removing any residual daytime and nighttime alteration in flow such that the flows moving downstream from Third

Falls are consistent with the flows that would have occurred under existing conditions at any point in time (i.e. run-of-river conditions).

Hydraulic modeling (Appendix F) has shown that much of the daytime/nighttime flow modification will have attenuated naturally over the 44.2 km headpond section between The Chute and Third Falls with headpond level fluctuation being limited to 0.25 meters or less. The remaining flow alteration will be re-naturalized by operating Third Falls in such a manner that flow does not change throughout the day unless such change relates to natural increases or decreases in hydrologic conditions in the watershed.

Effects within Downstream ZOI:

Consideration was given to any possible effects in the short downstream ZOI, including:

1. Flow Alteration: Due to the proposed re-naturalization of flow, the potential for significant alteration from existing downstream conditions is limited. Minor flow alteration can occur during powerhouse start up or shut down. As outlined in the Operating Plan (Appendix D) a special bypass valve in the powerhouse ensures that a minimum downstream flow is maintained at all times, even during an unplanned powerhouse start up and shut down.
2. Tailrace Effect: Due to the splitting of flows between the spillway and the powerhouse, localized alterations in flow can occur immediately downstream of the powerhouse. Since the powerhouse and spillway are located next to each other, the effect is minimal and flow re-joins immediately downstream of the tailrace. Re-joining of the flows occurs before the boundary of the CR. The tailrace area is part of a natural pond that exists between the second set of falls (i.e. the dam and powerhouse location) and the third set of falls (i.e. the most downstream falls that make up Third Falls). The pool appears to be partially fragmented from the upstream and downstream river and showed limited fish activity during the environmental assessment.
3. Temperature: Temperature modeling was carried out (Appendix G, ORTECH, 2013) to determine if the headpond inundation in the upstream ZOI could lead to water temperature changes that would cause effects downstream. The results of the study showed that there will be no notable change in water temperature downstream of Third Falls (i.e. no temperature impact on the downstream ZOI).
4. Water Quality: Water quality sampling and analysis was carried out (Appendix G, HESL 2010, 2011, 2012) to assess water quality changes that could occur due to headpond inundation upstream and continue downstream. The assessment predicts limited changes in water quality parameters due to the proposed Project, except for potential transient changes in mercury. No changes in the levels of dissolved oxygen are expected downstream of Third Falls. However, a comprehensive long-term water quality monitoring program has been proposed.

5. Sediment: A geomorphology study was carried out (Appendix E, Parish Geomorphic, 2013) to assess sediment and erosion potential in the inundation area and immediately downstream of Third Falls. The assessment indicates the river to be generally stable under existing conditions with limited changes expected post-construction. In a stable river, much of the sediment transport occurs as suspended load material (i.e. as opposed to heavier bed load material). While the dam creates some potential for reduction in suspended sediment load, much of the suspended sediment load is expected to continue downstream as under existing conditions. Long term monitoring has been proposed to confirm this analysis (Section 16, Monitoring).

3.4.5 Beyond Downstream ZOI

Consideration was given to any alterations that could directly affect the area beyond the downstream ZOI beyond the Northern Claybelt Forest Conservation Reserve boundary. The Project has been changed from the original design so that any flow alteration will be re-naturalized at Third Falls. Therefore, no flow alteration will occur beyond the identified downstream ZOI. Additionally, any alteration of temperature, water quality and sediment is expected to be minimal. The result is that there will be no significant temperature, water quality or sediment alteration beyond the downstream ZOI in the Northern Claybelt Forest Conservation Reserve. Based on these conclusions no physical, chemical or biological alteration is expected beyond the downstream ZOI.

This analysis is important as the Northern Claybelt Forest Conservation Reserve falls under a special protective objective where the “ecological integrity” of the area must be maintained (MNR, 2005). The proposed commitments to re-naturalize flow at Third Falls, combined with the analysis that temperature, water quality and sediment are not significantly impacted, suggests that the ecological objective for the Conservation Reserve has been adequately addressed. Monitoring has been proposed to verify the impact analysis (Section 16, Monitoring).

4.0 PROPOSED TECHNICAL DESCRIPTION FOR THE CHUTE FACILITY

The descriptions of installed capacity, site layout, components, construction, operation and maintenance for The Chute Facility are summarized in this section.

For details of construction, please refer to the *Construction Management Plan* prepared by Canadian Project Limited in January 2014 (Appendix C, CPL, 2014). For details of operation and maintenance, please refer to the *Proposed Operating Plan & Water Management Plan Amendment* prepared by ORTECH Consulting Inc. in January 2014 (Appendix D).

4.1 The Chute Facility Description of Proposed Development

4.1.1 Installed Capacity

According to the FIT contract, the installed capacity of The Chute Facility is 3.6 MW. However, the proposed installed capacity is 2.9 MW. A single water turbine with an efficiency of above 90% will be installed.

4.1.2 Site Layout

The layout map of The Chute Facility is presented in Figure 3. A headpond, a powerhouse and a tailrace will be built in the eastern channel, which are close to an existing road located on the east side of the river. A powerhouse substation and a 115 kV substation are located to the east of the powerhouse. A spillway and dam structures will be built in the western channel.

4.1.3 The Chute GS Components

The footprints for permanent components for The Chute Facility are summarized in Table 2.

Table 2: Footprint of Permanent Components for The Chute Facility

No.	Components	Number	Unit	Value	Note
1	Headpond [1]	1	m^2	1,000	
2	Spillway [1]	1	m^2	550	
3	Dam structures [1]	1	m^2	450	
4	Auxiliary Dam [1]	1	m^2	2,000	
5	Powerhouse [1]	1	m^2	300	
6	Powerhouse Yard [1]	1	m^2	250	
7	Tailrace [1]	1	m^2	550	

No.	Components	Number	Unit	Value	Note
8	Substation (Powerhouse) [1]	1	m^2	300	69kV
9	115 kV Substation [1]	1	m^2	600	69kV to 115kV step up
10	Access Road[1]	2	m	142 and 174	142m to the powerhouse and 174 m to the auxiliary dam
11	Transmission Line [2]	1	km	51.35	20 m Right-of-Way

Source:[1]. Construction Management Plan (Appendix C, CPL, 2014).
[2]. Distribution Lines and Access Road Summary Report for The Chute prepared by KBM Resources Group in December 2013 (Appendix J, KBM, 2013).

The temporary components for The Chute Facility are summarized in Table 3. The layout map of The Chute Facility during construction is shown in Figure 6.

Table 3: Temporary Components For The Chute Facility

No	Components	Number	Unit	Value	Note
1	Temporary access road to the western spillway	1	m	100	
2	Laydown area on the east side of the river	1	m^2	1,000	
3	Laydown area on the west side of the river	1	m^2	1,000	
4	Vehicle parking area	1	m^2	250	
5	Stockpile area	1	m^2	5,000	
6	Stage 2 Cofferdams	1	m	75	Dewater an area of 2,800 m^2
7	Stage 3 Cofferdams	1	m	110	Dewater an area of 3,000 m^2

Source: Construction Management Plan (Appendix C, CPL, 2014).

4.1.3.1 Description of Permanent Components

The descriptions for the permanent components are summarized below, based on the Construction Management Plan (Appendix C). The footprint information is summarized on Table 2.

Headpond

The headpond will be excavated immediately upstream of the powerhouse in the eastern channel of the river.

Spillway and Dam Structures

An 85 m long spillway will be built in the western channel of the Ivanhoe River, terminating at the dam structure.

Auxiliary Dam

A 110 m long earthen embankment dam will be built be at the downstream limit of an unnamed tributary approximately 200m west and 1 km upstream of The Chute Facility in order to minimize backwater effects into this tributary. The need for the auxiliary dam has been confirmed through detailed survey and geotechnical testing.

Powerhouse and Powerhouse Yard

A water turbine generator and auxiliary mechanical and electrical equipment will be installed in the powerhouse, which includes a concrete foundation and a superstructure which can be constructed of concrete, steel, masonry or timber.

Turbines

Turbine selection is based on the project site head, flow and economics. In instances of low head and intermediate to large flows, Kaplan, Propeller or Cross Flow (Banki-Ossberger) type turbines are deemed most efficient. For very low heads, a horizontal Kaplan is the preferred option as it requires less excavation than the vertical turbine, it is considered 'fish friendly', and can maximize turbine efficiency over a wide range of flows. Regarding additional economics of the turbine selection, cost varies directly with the maximum operating flow, but because a large component of cost is fixed for a development regardless of the flow, an optimum size results through balancing the cost versus the revenue generated from turbines of various sizes (diameters).

Based on the rationale described above, a horizontal or vertical Kaplan turbine will be selected for The Chute Facility due to low head (9.5 m), intermediate long term annual flow (29.7 m^3/s) and economic concerns.

Tailrace

The tailrace will be constructed in the eastern channel of the river, and will provide a path for water which is used for generation to re-join the river.

Substations

The Chute Facility includes two substations. The first substation is the powerhouse substation and will convert electrical energy from generator voltage to intermediate voltage (69 kV). The powerhouse substation will include transforming and switching equipment and will be located close to the powerhouse, connected to the generator by underground cabling.

The second substation is a 115 kV substation, and will convert electrical energy from the intermediate voltage (69kV) for the two Ivanhoe River Facilities (The Chute and Third Falls) and three Kapuskasing River Facilities (under separate proposal) to the final utility interconnect voltage (115 kV). The total footprint area of the 115 kV substation is approximately 600 m^2.

The new 29.1km corridor will cross 11 wetlands and require 21 times of new water crossings. In addition, there would be one new water crossing required at the Groundhog River within the Provincial Park.

Access Road

Access to the east side of The Chute Facility is via the Oates Road. it travels north off of Highway 101 approximately 3 km east of Foleyet, and then travels further north along to the Laundry Road, approximately 2.1 km. On the east bank of The Chute Facility, an existing turn around and an existing road will be utilized to build a 142 m road extension to have access to the powerhouse area.

The Oates Road is a primary forestry access road situated on the Pineland Forest which is licensed to EACOM Timber. The Oates Road is a well maintained road with sufficient base aggregate and surface gravel to support heavy use during the construction phase. Water crossings and drainage culverts were found to be in good condition. Regular road grading would be required to maintain the surface.

The Laundry Road is not a regularly maintained forest access road and is primarily used by the public to access a boat launce and campsite north of the falls. Most of the water crossings and drainage culverts along the Laundry Road have failed or significantly deteriorated and this route will require the replacement of one water crossing. The Laundry Road would require the addition of sufficient base and surface aggregate to ensure usability during the construction phase.

Western site access is off the Oates Roads just past the Ivanhoe River bridge and includes an existing water crossing on an existing tertiary road and a short section of new access road.

The access road statistics for The Chute Facility is summarized in Table 4. The Roads and Water Crossings Map is shown in Figure 7.

Table 4: Access Road Statistics for The Chute

Route	Type	Length (m)	Highway Crossing	Water Crossing		Wetlands	
				Existing	New	Edge	Crossing
Common Route	Primary	14,319	-	8	-	-	-
East Access	Secondary	1,770	-	1	-	-	-
	Tertiary	559	-	-	-	-	-
	New Access	142	-	-	-	-	-
	Total	2,472	0	1	0	0	0
West Access	Primary	3,493	-	3	-	-	-
	Tertiary	493	-	-	-	-	-
	New Access	174	-	-	-	-	-
	Total	4,160	0	11	0	0	0

Source: Distribution Lines and Access Road Summary Report for The Chute prepared by KBM Resources Group in December 2013 (Appendix J, KBM, 2013a).

4.1.3.2 Description of Temporary Components

The descriptions for the temporary components are summarized below, as detailed in the Construction Management Plan (Appendix C, CPL, 2014). The footprint information is summarized on Table 2.

Temporary access road

A new temporary 100 m spur road will be built on the west side of the river to access the spillway on the west bank.

Laydown and Vehicle Parking Areas

Two laydown areas will be utilized for the temporary storage of materials including granular materials. Temporary laydown areas will be reclaimed at the end of construction. A construction office will be located in one of these laydown areas.

An area for vehicle parking will be built, which is located to the west of the laydown area on the east side of the river.

Stockpile Area

A stockpile area has been identified about 100m west of the river near the auxiliary dam. The site will provide a central location for permanent storage of unsuitable overburden materials that are not used in the reclamation phase, and a temporary stockpile site for materials excavated from the worksites that can be re-used for construction. The stockpile site will be reclaimed at the end of the construction.

Cofferdams

Cofferdams as presented in Drawing 00-151 in the Construction Management Plan (Appendix C, CPL, 2014) will be used for all phases of construction. The cofferdams will be designed to manage the 1:20 year flow rate.

Before the spillway and dam structures are built in the west channel of the river, 70 m long cofferdams will be installed in late summer to form a dewatering area of 2,800 m^2.

Before the construction of headpond, powerhouse and tailrace in the east channel of the river, 110 m long cofferdams will be installed in the next available summer to shape a dewatering area of 3,000 m^2.

Construction Camp

No construction camp will be built for The Chute Facility. Accommodations for workers are available in Foleyet to support the construction workforce.

Concrete Batch Plant

No concrete batch plan will be built for The Chute Facility. Concrete will be supplied by local concrete suppliers in Foleyet and Timmins, such as Custom Concrete and Miller Paving.

Construction Materials

The construction of The Chute Facility will require use of granular material for the construction of access roads, dam structures, cofferdams and concrete structure backfill. While a small portion of the construction material may be obtained from on-site excavations, the majority will be hauled from Category 9 pits in the area.

Xeneca has consulted with the following aggregate permit holders (CPL, 2014):

- Site 603101 EACOM; and
- Site 600021 Betrand Vandal.

Sites 603101 and 600021 are located within 22 km of The Chute Facility. Existing licensed aggregate sites will be used for the Project's aggregate needs. All aggregate and borrow materials required for construction is expected to be sourced from Project excavation and the specified licensed pits listed above. If additional aggregate is required, it will be sourced from aggregate suppliers located in Timmins, Ontario.

4.2 The Chute GS Construction

The construction details and sequence proposed during the conceptual phase are summarized below, as detailed in the Construction Management Plan (Appendix C, CPL, 2014). Figures 6 and 16-19 show details of construction plans and staging.

4.2.1 Site Access

Access to The Chute Facility will be primarily using existing access roads with a small amount of new construction. Approximately 18 km of existing road (Oates Rd. and Laundry Rd.) will be used to access the area from Hwy. 101. A 142 m road extension, utilizing the existing turn around, will be constructed on the east side of the river. An existing road and new temporary 100 m spur road on the west side of the river will be used to access The Chute Facility on the west bank and to construct the auxiliary dam. The temporary spur road will be reclaimed at the end of construction. An approximately 174 m long access road will be constructed to the auxiliary dam area.

The construction of these new access roads will be conducted using excavators, haul trucks and other earth moving equipment. Some drilling and blasting may be required, depending on the bedrock elevation.

4.2.2 Lay Down, Parking and Mobilization

Trees will be cleared during the winter season before site leveling. Timber will be decked for removal by the local Sustainable Forest License (SFL) holder. All clearing operations will conform to the Crown Forest Sustainability Act. Right of first refusal for all merchantable timber will be offered to the sustainable forest license holders (Tembec and EACOM are the license holders).

The site leveling and construction of the laydown, parking and stockpiles will be completed within 2 to 3 months.

4.2.3 Cofferdams

4.2.3.1 Stage 2 Cofferdams for the Spillway Area

Temporary cofferdams will be installed in the river during the construction process. At this time, cofferdams are contemplated to be built to manage the 1:20 year flow rate. The profiles of cofferdams are presented in Drawing 00-151 in the Construction Management Plan (Appendix C, CPL, 2014).

The installation of the Stage 2 cofferdams will start during a prescribed in-stream construction window, currently assumed to be in late-summer. The cofferdams will divert water flow through the eastern channel, allowing construction to proceed on the spillway dam structure.

This construction may involve some blasting for site leveling, which will be followed up by a combination of earthfill and/or concrete construction to complete the structure, depending on the final Project design. Obermeyer gates or an inflatable rubber dam will be installed and dry commissioned during this stage while the cofferdams are still in place, if required.

4.2.3.2 Stage 3 Cofferdams for the Powerhouse Area

The installation of the Stage 3 cofferdams will proceed in the next available in-stream window. If only one construction window is granted each year, this stage is assumed to start in late-summer of the following year. The cofferdams will divert water through low level gates in the spillway, allowing construction to proceed in the headpond, powerhouse and tailrace area.

Once dewatered, the powerhouse area will be excavated by excavator, drill and blast. The blast rock will be removed and hauled to a stockpile area, or re-purposed directly from the excavation for the construction of the auxiliary dam and other Project components as required. This excavation work will include bedrock excavation in the river bed to shape the headpond and tailrace areas.

Following the powerhouse excavation, concrete construction will commence with the placement of a leveling mudslab, followed by successive stages of wood forming, reinforcing and embedded steel installation and concrete pouring. This work will require a mobile or tower crane set up near the edge of the excavation to move forms, reinforcing steel and other materials into and out of the work site. Concrete will likely be placed either by pump truck or crane and bucket. Construction of the auxiliary dam will start in this stage. The construction will occur on a schedule that optimizes the use of local materials excavated from the powerhouse and spillway construction areas.

4.2.4 Waste Removal and Disposal

Non-hazardous Construction Waste

The non-hazardous solid wastes generated during the construction phase will be removed from the site to an approved disposal location. The proponent has identified the following waste disposal services for each type of waste noted below:

- Northern Environmental Services, located in Timmins, for management of construction and demolition waste;
- Erocon Waste Management, located in Timmins, for the removal of construction waste to locally approved landfills;
- Roztek Environmental, located in Timmins, for the removal of sewage waste.

Hazardous Waste

Industrial liquids such as paints, sealants, fuels, and lubricating fluids will be stored in secure containment areas and disposed of in accordance with provincial and federal liquid waste disposal regulations under the Environmental Protection Act, O. Reg. 347, and the Federal Transportation of Dangerous Goods Act). The proponent has identified a hazardous waste disposal provider, and will make an appropriate arrangement prior to construction.

- Veolia, located just outside of Timmins, for the management and removal of any hazardous waste.

4.2.5 Conceptual Construction Schedule

The Construction Sequence Plans for The Chute Facility are shown in Drawing 13-152 in the Construction Management Plan (Appendix C, CPL, 2014). A conceptual description of four stages of construction activities is presented below.

Stage 1 (3-4 months)

The first stage of construction will be to build access to both banks of the river, and commence the tree clearing. The construction activities are summarized below.

- Clear trees within the Project Area during winter months;
- Expand an existing road and turning loop to allow larger vehicles to pass on the east side of the river;
- Build a permanent 142 m access road from the turnaround area to the powerhouse on the east side of the river;

- Construct a temporary 100 m access road to the spillway on the west side of the river;
- Construct a temporary 174 m access road to the ancillary dam on the west side of the river;
- Build two 1,000 m^2 laydown areas, one on either side of the river, to service the primary worksites of the headpond, the powerhouse and the tailrace; and
- Build a 5,000 m^2 Stockpile area near the ancillary dam on the west side of the river, to provide a temporary storage of materials excavated from the worksites that can be reused for construction, and provide a permanent storage of unsuitable overburden materials that are not used in the reclamation phase.

Stage 2 (6-8 months)

The second stage of construction will be to install Stage 2 cofferdams in the west channel, and build the spillway and dam structures. The related construction activities are summarized below.

- Install Stage 2 cofferdams in the western channel of the river in late summer;
- Install the safety booms;
- Construct a temporary portage trail;
- Divert the water flow through the eastern channel to allow the construction of the spillway within the Stage 2 cofferdams;
- Construct the spillway and dam structures;
- Install Obermeyer gates or an inflatable rubber dam;
- Clear trees within the 20 m wide Right-of-Way of power lines in most cases, except on steeper side slopes where additional up-slope clearing may be required;
- Complete power line construction;
- Commence the construction of two substations once the power line routes have been cleared; and
- Complete the clearing of trees and wood debris to an elevation of 0.5 m above the Normal Operating Level.

Stage 3 (8-10 months)

The third stage of construction will be to install Stage 3 cofferdams in the eastern channel, and build the powerhouse, the headpond, the tailrace, and the auxiliary dam. The construction activities at Stage 3 are summarized below.

- Remove the Stage 2 cofferdams for the construction of the spillway and dam structures;
- Install 110 m long Stage 3 cofferdams in the eastern channel of the river in next available late summer;
- Divert water through low level gates in the spillway;

- Excavate the powerhouse area by excavator, drill and blast;
- Excavate the river bed to shape the headpond and tailrace areas;
- Remove and haul the excavated and blast rocks to the stockpile area, or re-purpose directly for the construction of the auxiliary dam and other Project components;
- Commence the concrete construction for the powerhouse by pump truck or crane and bucket;
- Start the construction of the auxiliary dam, optimizing the use of local materials excavated from the powerhouse and spillway construction areas;
- Complete the construction of two substations;
- Construct the powerhouse mechanical and electrical works;
- Remove the Stage 3 cofferdams once the powerhouse construction is completed;
- Reclaim the laydown area and the 100 m temporary access road on the west side of the river; and
- Reclaim the 174 m temporary access road and 5,000 m^2 stockpile area on the west side of the river.

Stage 4 (2-3 months)

The last stage of construction will be to remove temporary works and restore the areas. The construction activities are summarized below.

- Reclaim all temporary works, including the 1,000 m^2 laydown area and 250 m^2 construction parking area on the east side of the river;
- Remove loose woody debris from the inundation area before filling the head pond;
- Re-route the portage trail parallel to the access road on the east side of the river;
- Relocate the safety boom; and
- Fill the head pond.

4.3 The Chute Facility Operation & Maintenance

4.3.1 Introduction

The *Proposed Operating Plan & Water Management Plan Amendment* (or "Operating Plan") prepared by ORTECH Consulting Inc. in January 2014 (Appendix D) for the Project describes and proposes parameters for the long term operation of the Project and facilitates integration of this Project into the existing Mattagami Water Management Plan (WMP). In particular, operating parameters are proposed for:

- Operating levels of the upstream headpond,

- Flow allocation between the powerhouse and the spillway, and
- Downstream Flow and Level control.

The objective of setting operating parameters is to allow flexibility in the electricity generation while limiting significant negative impacts due to variability in flows and fluctuation in levels.

It is proposed to operate The Chute Facility as a modified run-of-river generating Facility with the Facility immediately downstream, Third Falls as a run-of-river generating Facility, effectively re-naturalizing river flows based upon the conditions upstream of The Chute headpond.

Run-of-river operation for both facilities would occur during two (2) types of natural flow conditions:

High Flow - when natural river flows are greater than the maximum turbine capacity. Since the natural flow exceeds the amount of water that can be processed through the turbine, any excess water is bypassed through the spillway structure. The combined flow of the water used in the turbine to generate electricity and the water bypassed over the spillway equals the natural flow. This situation occurs primarily during spring thaw run-off conditions and during major storm events in the spring, summer and fall.

Very Low Flow - when natural flows are so low that any available water must be released downstream to protect the environment: The flow in this situation is typically too low to generate electricity. This situation occurs primarily in late summer and late winter. This situation may also occur during certain years when spring run-off flow is unusually low and the amount of water available is needed downstream to protect the environment.

An important factor in modified run-of-river operation is the availability of storage upstream of the Facility. As described in the project description section above, the amount of storage created as part of the Project is very limited. To achieve the objective of building a Project with limited environmental impact, the conceptual design of the Facility limits the height of structure, the depth and the area of inundation upstream. Consequently, the amount of storage available for operation is inherently limited in relation to the natural flow in the river, thereby limiting the storage to a few hours during moderate and low flows. The ability to use this storage is further constrained by environmental constraints outlined in other parts of this document. It is the limited storage that differentiates modified run-of-river projects from hydroelectric projects that create large storage reservoirs with the ability to store water for weeks or seasons to “peak” when seasonal periods of hot or cold spells raise the need for extra electricity production. Typically, modified run-of-river projects have significantly less environmental impact than peaking hydroelectric projects. Run-of-river operations at Third Falls will have no effects past the Northern Claybelt Forest Conservation Reserve boundary.

4.3.1.1 Intermittent Modified Flows Operations

Modified run-of-river operation at The Chute would occur during moderate and low flows when the natural flow in the river is below the maximum turbine flow capacity but above the minimum flow required to protect the environment. During these flow conditions, some of the natural river flow during night-time hours can be stored and used to produce electricity during daytime hours. There are two modes of modified run-of-river operation as follows:

Moderate Flow - Facility runs at reduced rate at night: When natural river flows are moderate (i.e. between the minimum and the maximum rate of turbine capacity), the Facility runs continuously, but some of the water is saved during night-time hours. This operation results in downstream flows that are smaller than natural river flows during night-time hours and larger than natural river flows during daytime hours when electricity use is higher. However, the minimum flow in this mode of operation is not less than the minimum turbine capacity.

Low Flow - Facility is stopped at night: When natural river flows are low (i.e. below the minimum turbine capacity), the Facility will need to stop operation during some night-time hours and save water until operation is again possible. The lower the natural river flow, the longer the period of stoppage will be. When the Facility operates, it operates at a rate less than maximum turbine capacity. To ensure that the downstream river reach receives enough water flow to protect the environment, the appropriate amount of water is released to the tailrace area through a bypass while the turbine operation is stopped.

It should be noted that over any 24 hour period the same volume of water would pass down the river as would occur under run-of-river operation.

A copy of the Operating Plan is provided in Appendix D with the key features for each Facility summarized below.

4.3.2 Downstream Compensatory Flows

During certain times the facility would operate at the same rate as the natural flow in the river (i.e. “run-of-river”) with no daily variation in downstream flows or water levels due to operation from those experienced naturally. As described above, at other times the facility would “modify” the natural flow in the river during the day by storing some of the natural river flow for part of the day for release later in the day.

The variability in flow can be significant from an area immediately downstream of The Chute to Third Falls (the “Variable Flow Reach”). Within the Variable Flow Reach, water depth, flow velocity and wetted perimeter will change from daytime to night-time while the modified run-of-river operation is occurring. The Variable Flow Reach ends into the embayment area immediately downstream of Third

Falls tailrace and spillway structures where the flow is re-naturalized. The degree of variability downstream of The Chute depends on the mode of operation and the difference between the daytime and night-time flow. While the facility is operating continuously, but at a reduced rate at night, the amount of water discharged at all times is very significant. Daytime flow is typically not more than four (4) times larger than night-time flow. Under continuous operation, the potential for environmental impact is limited as flows will be substantial enough at all times for most environmental requirements.

The amount of water released at night is the minimum amount required to protect the environment. The minimum amount released while operating is at least the minimum turbine capacity. The difference in this mode of operation can result in daytime flows that are in the range of 15 cms (m^3/s) higher than at night-time.

4.3.3 Description of Seasonal Operations

Environmental protection requirements vary significantly depending on the time of year. Operating parameters have to be set to address these changing requirements. Operating seasons can be defined in various ways, including calendar seasons, periods of consistent meteorological conditions and periods of special environmental significance. The approach used in the Operating Plan (Appendix D) divides the year into the following operating seasons:

- ***Spring Freshet:*** The spring freshet period begins with the rapid increase in the spring snow melt flow and ends with the levelling off of flows after flood waters have receded. This period coincides with increases in water temperature and flows that trigger specific aquatic activities.
- ***Summer Low:*** The summer low period begins with the end of the freshet and lasts until the upward inflection that occurs in early fall. The period typically exhibits warm water temperatures and a high degree of activity in the entire food chain. Flows are generally low but highly variable, depending on rainfall events.
- ***Fall Freshet:*** The fall freshet begins with the upward fall inflection and ends with the levelling off of flows after the freshet flows have receded. The period exhibits decreasing water temperatures and moderate flows. The insect activity has become minimal due to cool air temperatures above the water and the associated food chain activity is slowing down.
- ***Winter Low:*** The winter low period begins with the end of the fall freshet and finishes when the spring freshet starts. Water and air temperatures are cold. Most water surfaces freeze during this period and various fish and aquatic species either hibernate or seek deeper waters such as pools and lakes. Flows are generally low and decrease gradually but continuously until spring freshet.

A summary of the predicted frequency The Chute is anticipated to operate in on a seasonal basis is provided in Table 5.

Table 5: The Chute Mode of Operation

Operating Mode	Spring	Summer	Fall	Winter	Annual
Run-of-River (Continuous Operation)	74%	13%	12%	12%	20%
Modified Run-of-River (Continuous Operation)	22%	53%	51%	69%	56%
Modified Run-of-River (Intermittent Operation)	3%	33%	36%	18%	23%
Run-of-River (Facility Not Operating)	1%	1%	1%	1%	1%
	100%	100%	100%	100%	100%

4.3.4 Maintenance and Inspection

A general introduction of access to the facility, inspection and maintenance activities, and associated safe disposal of removed parts and materials during maintenance and inspection is summarized below.

4.3.4.1 Access to the Facility and Surroundings

The water intake should be accessible only to staff trained for safety precautions. Swimming, aquatic sports and fishing must be prohibited near the water intake. Signs must be set up and inspection carried out.

Any maintenance operations carried out by the maintenance staff in the downstream channel area must be implemented when the hydroelectric facility is switched off, and all the valves and gates are closed and secured and the electrical control and monitoring system is inhibited.

The access to the hydroelectric facility, the power distribution and the control and monitoring rooms are authorized only for qualified people.

The access to the area where there are moving or rotating parts are prohibited. The plant safety responsible person must make sure that the protective covers have been placed over the rotating parts.

4.3.4.2 Description of Maintenance and Inspection Activities

During maintenance operations, the hydroelectric units should be stopped, i.e. all the necessary steps should be undertaken to prevent water being supplied to the unit. These provisions must be taken for both the upstream and downstream water channels. Locks should be installed to avoid any dangerous operation.

Electrical parts should be switched off so that no electricity is supplied by the grid. All electrical switches of the auxiliary equipment should be inhibited.

During maintenance, storage areas for the dismantled equipment should be clearly defined and protected. Oil and grease should be stored away from any shock or passageway. Soiled and worn oil, grease should be collected and conditioned in order to be recycled.

While the machine is stopped, the following inspection and maintenance activities will be implemented annually.

- Check the oil quality of hydraulic power unit, generator bearing;
- Check internal lubricating piping;
- Check for cavitation and wear on the runner;
- Check clearance between runner and discharge ring;
- Check there are no foreign parts in the runner water passage;
- Check screw tightening torques; and
- Check for cavitation and wear on the distributor.

During maintenance, approximately 50 L lubricant oil will be replaced annually for turbine bearing.

4.3.4.3 Environmental Rules for Inspection and Maintenance

During maintenance, the following key environmental rules will be implemented.

- Hazardous substances: hazardous substances have to be stored in proper containers, clearly marked and correctly used. Waste has to be correctly disposed.
- Welding and cutting: proper ventilation has to be ensured and if necessary exhaust ventilation has to be applied.
- Environmental protection: oil or other hazardous substances must not get into water or soil. Emergency measures must be planned. Waste must not be burned or buried. Waste has to be handed over to licensed waste management companies.

All federal and provincial legal requirements and regulations have to be kept during the disposal or recycling of parts and components of the facility as well as for materials being necessary for the operation.

Different materials should be separated, including steel, copper, aluminum, casting, plastic cables, etc. The oil, grease and other contamination should be removed from the parts if necessary.

The substance, being hazardous for water and soil, like parts contaminated with oil, have to be stored in separated areas or collecting trays. A disposal via the normal domestic waste is not allowed. The hazardous waste must be transported and disposed of by a licensed hazardous waste disposal provider in a safe manner.

5.0 PROPOSED TECHNICAL DESCRIPTION FOR THIRD FALLS FACILITY

5.1 Third Falls Facility Description of Proposed Development

5.1.1 Installed Capacity

According to the FIT contract, the installed capacity of The Third Falls Facility can be 5.1 MW. However, the proposed installed capacity is 3.8 MW. A single water turbine with an efficiency of above 90% will be installed at The Third Falls Facility.

5.1.2 Site Layout

The layout map of the Third Falls Facility is presented in Figure 4. A headpond, a powerhouse and a tailrace will be built near the west bank of the river. A spillway and dam structures are located to the east of the powerhouse. A powerhouse substation is located to the west of the powerhouse and connects the power lines on the west side of the river.

5.1.3 The Third Falls Facility Components

The permanent components for Third Falls Facility are summarized in Table 6.

Table 6: Permanent Components for The Third Falls Facility

No	Components	Number	Unit	Value	Note
1	Headpond [1]	1	m^2	650	
2	Spillway [1]	1	m^2	900	
3	Dam structures [1]	1	m^2	200	
4	Powerhouse [1]	1	m^2	300	
5	Powerhouse Yard [1]	1	m^2	250	
6	Tailrace [1]	1	m^2	500	
7	Substation [1]	1	m^2	400	
8	Access Road[1]	1	km	4	
9	Power Line [2]	1	km	26.8	20 m Right-of-Way

Source:[1]. Construction Management Plan (Appendix C, CPL, 2014).

[2]. Distribution Lines and Access Road Summary Report for The Third Falls prepared by KBM Resources Group in December 2013 (Appendix J, KBM, 2013b).

The temporary components for The Third Falls Facility are summarized in Table 7. The layout map of The Third Falls Facility during construction is shown in Figure 8. The description of the temporary components can be found in Section 5.2.

Table 7: Temporary Components for The Third Falls Facility

No.	Components	Number	Unit	Value	Note
1	Temporary access road	1	m	40	
2	Laydown area	1	m^2	750	
3	Loading and unloading area	1	m^2	250	
	Construction camp	1	m^2	10,000	
5	Stockpile area	1	m^2	5,000	
6	Concrete batch plant area	1	m^2	3,500	
7	Stage 2 Cofferdams	1	m	200	Dewater an area of 3,600 m^2
8	Stage 3 Cofferdams	1	m	175	Dewater an area of 2,650 m^2

Source: Construction Management Plan (Appendix C, CPL, 2014).

5.1.3.1 Description of Permanent Components

The descriptions for the permanent components are summarized below, based on the Construction Management Plan (Appendix C, CPL, 2014). The footprint information is summarized on Table 2.Headpond

The headpond will be excavated at the immediate upstream of the powerhouse, which is close to the west bank of the river.

Spillway and Dam Structures

A 95m spillway and dam structures will be built to the east of the powerhouse. The dam may be constructed from any or all of the following materials within the engineering constraints for the same; reinforced concrete; RCC – rolled and compacted concrete; earthen/stone, clay and 'rubber' (impermeable barriers). Typical construction will feature a broad overflow weir topped by a control feature (i.e.: an Obermeyer or similar, pneumatically operated dam). The basic dam design for Third Falls consists of a fixed concrete overflow weir-style dam. An overflow weir allows water to overflow without causing damage to the underlying structure. The crest of the overflow is designed to be lower than the adjoining earth dam and powerhouse such that even under extreme flood events, all flow can be directed safely over the weir and without overtopping or damaging the adjacent structures. During

consultation, certain stakeholders expressed concern about the appearance of a large massive concrete weir structure in the river. One First Nation community expressed preference for a rubber dam type weir structure as is currently in use on the nearby Kapuskasing River. The proponent has committed to consider the design alternative and make reasonable efforts to incorporate the stakeholder preference into the final design of the Project.

A subsequent conceptual engineering design review suggests that a rubber dam can be safely incorporated into the weir design. The alternative design would consist of constructing a smaller (i.e. lower height) concrete weir structure and installing a commercially available rubber dam on top of the weir. The rubber portion of the dam is fully inflated during normal operation but can be deflated during flood conditions to allow flood flows to pass more safely. Various rubber dam models are available commercially (eg. Obermeyer, Qingdao Huachen). The combined height of the concrete and the rubber dam would be approximately equal to the fixed concrete overflow weir-style dam.

It was determined that the alternative construction design with the incorporation of a rubber dam requires no change to the overall Construction Management Plan. The overall construction layout, site footprint, construction sequencing and construction timeline remain the same. Also, the inundation impact is identical during normal operation and slightly less during flood operation. As a result, the incorporation of the rubber dam in the design has no additional environmental impacts. The incorporation of the rubber dam in the weir design is not considered a material change to the Project as proposed and consulted on.

Powerhouse and Powerhouse Yard

A powerhouse and a powerhouse yard will be built on the west bank of the river. A turbine generator and auxiliary mechanical and electrical equipment will be installed in the powerhouse. The powerhouse includes a concrete foundation and a superstructure, which can be constructed of concrete, steel, masonry or timber.

Turbines

A horizontal or vertical Kaplan turbine will be selected for The Third Falls Facility due to low head (10 m) and intermediate flows (Long Term Annual Flow 29.7 m^3/s) and economic benefit.

Tailrace

A tailrace will be excavated at the immediately downstream of the powerhouse. The tailrace excavation will be to an elevation of approximately 270.5 masl (metres above sea level) and will extend approximately 30 m downstream of the powerhouse. The tailrace will have an approximate footprint of 450 m^2 and provide a path for water which is used for generation to re-join the river.

Substation

A powerhouse substation will be built on the west side of the river. The transforming and switching equipment will be installed to connect the turbine generator by underground cabling.

Access Road

Access to The Third Falls Facility is from Timmins via 80 km of existing primary road, 16 km of secondary road and 3.5 km of new road, providing access to the west side of the Project (Figure 9). This access uses the Camp Main Road from Hwy 101, Timmins, where it then meets the Strachan Road, and then connects up to the West Road. At the end of the West Road, at a location directly south of the Third Falls Facility, access then follows the west extension of the Nova Road across the Ivanhoe River where it circles north on the Wadsworth Road to a location approximately 6 km west of the Facility. Final access to The Third Falls Facility is via an existing tertiary road, followed by 3.5 km of new access road. This new access road construction will require one new water crossing over a stream that is a tributary of the Ivanhoe River.

The access road statistics for The Third Falls Facility is summarized in Table 8.

Table 8: Access Road Statistics for The Third Falls Facility

Owner Type	Road Type	Length (m)	Highway Crossing	Water Crossing		Wetlands	
				Existing	New	Edge	Crossing
Crown	Primary	79,738	-	36	-	-	-
	Secondary	16,380	-	11	-	-	-
	New Access Road	3,502	-	-	1	-	2
	Total	99,620	-	47	1	-	2

Source: Distribution Lines and Access Road Summary Report for The Third Falls prepared by KBM Resources Group in December 2013 (Appendix J, KBM, 2013b).

5.1.3.2 Description of Temporary Components

Temporary access road

A 40 m long temporary access road will be required to access the east side of the river.

Laydown and Vehicle Parking Areas

A 750 m^2 laydown area has been identified on the west side of the river to service the primary worksites of the headpond/powerhouse and the spillway. The construction office will be located in the laydown area as well as an area for vehicle parking.

A 125 m^2 loading /unloading area has been identified next to the powerhouse, which will eventually be converted into the powerhouse yard.

Stockpile Area

A 5,000 m^2 stockpile area will be built for temporary and permanent storage of excavated materials. Some excavated materials cannot be used for construction and will be deposited within the stockpile area. The stockpile site will be reclaimed at the end of the construction.

Cofferdams

Temporary cofferdams will be installed in the river during the construction phase. The Cofferdams are contemplated to be built to manage the 1:20 year flow rate. The cofferdams are used to divert flow first from the powerhouse area, then the spillway area to allow the construction in dry conditions.

A 200 m long Type A cofferdam with a dewatered area of 3,600 m^2 will be installed for the powerhouse, headpond and tailrace area, before the construction of the powerhouse, headpond and tailrace in late summer.

175 m long Type A cofferdam with a dewatered area of 2,650 m^2 will be installed for the construction of the spillway in next available late summer.

The sections and detail of Type A cofferdams are presented in Drawing 00-151 in the Construction Management Plan (Appendix C, CPL, 2014).

Construction Camp

A construction camp will be located approximately 500 m to the west of the Third Falls Facility, and will be located along the access road. The area for the temporary construction camp is approximately 10,000 m^2. Water required for the construction camp will be supplied by tanker truck from a local water source with an appropriate Permit to Take Water if required.

Concrete Batch Plant

A concrete batch plant will be built, due to the distance from concrete producing centers. A proposed batch plant will be constructed adjacent to the stockpile area. The footprint of the concrete batch plant is approximately 3,500 m^2. An alternate batch plant site is proposed in an existing aggregate borrow area, located on Wadsworth Road, approximately 7 km southwest of The Third Falls Facility. Water required for concrete production will be supplied by tanker truck from a local water source with an appropriate Permit to Take Water if required.

Construction Materials

The construction will require use of granular material for the construction of access roads, dams, yards, cofferdams and concrete structure backfill. While a small portion of the construction material may be obtained from on-site excavations, the majority will be hauled from Category 9 pits in the area.

Xeneca has consulted with the following aggregate permit holders (CPL, 2014):

- Site 74774, Site 74814 and Site 74874 Tembec Industries;
- Site 486 Malette Inc. (Tembec)

Sites 74774, 74814, 74874 and 486 are located within 10 km of The Third Falls Facility. Existing licensed aggregate sites will be used for the Project's aggregate needs. All aggregate and borrow materials required for constructions are expected to be sourced from Project excavation and the specified licensed pits listed above. If additional aggregate is required, it will be sourced from aggregate suppliers located in Timmins, Ontario.

5.2 Third Falls GS Construction

The construction details and sequence proposed during the conceptual phase are summarized below, as detailed in the Construction Management Plan (Appendix C, CPL, 2014). Figures 8 and 20-23 show details of construction plans and staging.

5.2.1 Site Access

A 40 m long temporary access road will be required to access the east side of the river using a temporary bridge across the headpond area. The construction of these new access roads will be conducted using excavators, haul trucks and other earth moving equipment. Some drilling and blasting may be required, depending on the bedrock elevation.

5.2.2 Lay Down, Parking & Mobilization

Laydown, Parking and Stockpile

Before site leveling, trees will be cleared during the winter season. Timber will be decked for removal by the local Sustainable Forest Licence (SFL) holder. All clearing operations will conform to the Crown Forest Sustainability Act. Right of first refusal for all merchantable timber will be offered to the sustainable forest license holder (Tembec and EACOM are the licence holders).

The site leveling and construction of the laydown, parking and stockpiles will be completed within 2 to 3 months.

Construction Camp

The construction camp will be set up and operated according to the requirements of the Health Protection and Promotion Act. The construction camp would be cleared of trees and graded as necessary along the newly constructed site access road. Tree clearing will most like commence during winter months allowing construction to start in late spring or other suitable timing to coordinate with the first in-stream construction window so that Stage 2 cofferdam installation can start once the access road construction is completed, likely in late-summer.

Concrete Batch Plant

At the stage I of construction (2-3 months), tree clearing will most like commence during the winter in order to commence the concrete construction for the powerhouse and the western portion of the spillway by pump truck or crane and bucket at the stage II of construction (8-10 months).

5.2.3 Cofferdams

Stage 2 Cofferdams for the Powerhouse Area

Stage 2 cofferdam will be installed during a prescribed in-stream construction window, currently assumed to be in late-summer. The Stage 2 cofferdam would surround the entire powerhouse, headpond and tailrace area, allowing construction to proceed in dry conditions.

Once dewatered, the powerhouse area will be excavated by excavator and drill and blast. This work will include bedrock excavation in the river bed to shape the headpond and tailrace areas. The blast rock will be removed and hauled to a stockpile/storage area, or re-purposed directly from the excavation on such areas as site roads, in the substation, powerhouse yard or laydown areas for final grading.

Following the powerhouse excavation, concrete construction will commence with the placement of a leveling mud slab, followed by successive stages of wood forming, reinforcing and embedded steel installation and concrete pouring. This work will require a mobile or tower crane set up near the edge of the excavation to move forms, reinforcing steel and other materials into and out of the work site. Concrete will likely be placed either by pump truck or crane and bucket. Construction of the west portion of the nearby spillway and dam will follow the same sequence of concrete construction. Spillway and dam construction may involve some blasting for site leveling.

The Stage 4 bulkheads will be installed to de-water the powerhouse area to complete the mechanical and electrical construction. The powerhouse construction will likely involve steel erection and installation by crane for the roof and potentially the upper portion of the powerhouse walls.

Stage 3 Cofferdams for the Spillway Area

The installation of the Stage 3 cofferdam will proceed in the next available in-stream window. If only one window is granted each year, this stage is assumed to start in late-summer of the following year. The Stage 3 cofferdams will divert water flow through the powerhouse concrete structure, allowing construction to proceed on the remainder of the spillway.

The spillway and east abutment will be accessed from the west using a temporary bridge over the intake channel. This spillway and abutment construction may involve some blasting for site leveling, which will be followed up by a combination of earthfill and/or concrete construction to complete the structure, depending on the final Project design.

5.2.4 Waste Removal and Disposal

Non-hazardous Construction Waste

The non-hazardous solid wastes generated during the construction phase will be removed from the site to an approved disposal location. The proponent has identified the following waste disposal services for each type of waste noted below:

- Northern Environmental Services, located in Timmins, for management of construction and demolition waste;
- Erocon Waste Management, located in Timmins, for the removal of construction waste to locally approved landfills;
- Roztek Environmental, located in Timmins, for the removal of sewage waste.

Hazardous Waste

Industrial liquids such as paints, sealants, fuels, and lubricating fluids will be stored in secure containment areas and disposed of in accordance with provincial and federal liquid waste disposal regulations under the Environmental Protection Act, O. Reg. 347, and the Federal Transportation of Dangerous Goods Act). The proponent has identified a hazardous waste disposal provider, and will make an appropriate arrangement prior to construction.

- Veolia, located just outside of Timmins, for the management and removal of any hazardous waste.

5.2.5 Conceptual Construction Schedule

The Construction Sequence Plans for The Third Falls Facility are shown in Drawing 14-151 in the Construction Management Plan (Appendix C, CPL, 2014). Four stages of conceptual construction activities are summarized below:

Stage 1 (2-3 months)

The first stage of construction will be to build the access road to the west bank of the river. The construction activities are summarized below.

- Build access to the west bank of the river by extending the existing forestry spur road by approximately 3;5 km to the east;
- Clear trees in the footprint areas, temporary construction camp, stockpile area, concrete batch plant area, laydown area, loading and unloading area, and power line Right-of-Way area during winter months;
- Build a 750 m^2 temporary laydown area on the west side of the river;
- Build a 10,000 m^2 construction camp, located approximately 500m to the west of the powerhouse area;
- Build a 5,000 m^2 stockpile area to the east of the construction camp on the west side of the river, to provide a temporary storage of materials excavated from the worksites that can be reused for construction, and provide a permanent storage of unsuitable overburden materials that are not used in the reclamation phase; and
- Build a 3500 m^2 concrete batch plant area immediately to the east of the stockpile area.

Stage 2 (8-10 months)

The second stage of construction will be to build the headpond, powerhouse and tailrace. The related construction activities are summarized below.

- Install 200 m cofferdams with a dewatered area of 3,600 m^2 to prepare the construction area for the powerhouse, headpond and tailrace during the prescribed in-stream construction window, currently assumed to be in late-summer;
- Excavate the powerhouse area and the western portion of the spillway by excavator and drill and blast;
- Excavate the bedrock in the river bed to shape the headpond and tailrace areas;
- Remove and transport the blast rock to the stockpile area, or re-purpose directly from the excavation on such areas as site roads, in the substation, powerhouse yard or laydown areas for final grading;
- Commence the concrete construction for the powerhouse and the western portion of the spillway by pump truck or crane and bucket;
- Complete the tree clearing in the power line Right-of-Way and the construction of the power line;
- Build a temporary 40 m access road; and
- Construct a temporary bridge over the headpond channel.

Stage 3 (4-6 months)

The third stage of construction will be to construct the spillway. The construction activities at this stage are summarized below.

- Remove the Stage 2 cofferdams for the construction of the powerhouse area;
- Install 175 m cofferdams with a dewatered area of 2,650 m^2 in next available late summer;
- Construct the portage trail;
- Conduct site leveling for the spillway, followed up by a combination of earthfill and/or concrete construction to complete the spillway;
- Build the substation and complete the construction of power line; and
- Remove the temporary access to the spillway.

Stage 4 (3-4 months)

The fourth stage of construction will be to complete the equipment installation in the powerhouse. The construction activities are summarized below.

- Remove Stage 3 cofferdams;
- Install gates or bulkhead at the headpond and tailrace;
- Divert the water through the low level gates in the spillway; and
- Use Stage 4 bulkheads to de-water the powerhouse area and complete the installation of electrical and mechanical equipment in the powerhouse.

Stage 5 (2-3 months)

The last stage of construction will be to remove and restore temporary works. The construction activities are summarized below.

- Remove the bulkheads at the headpond and the tailrace;
- Inspect the cleared banks and remove any loose woody debris from the inundation area;
- Close the spillway low level gates and fill the head pond; and
- Complete the removal and restoration of all temporary siteworks.

5.3 Third Falls GS Facility Operation & Maintenance

5.3.1 Operation

A *Proposed Operating Plan & Water Management Plan Amendment* (also referred to as an "Operating Plan") prepared by ORTECH Consulting Inc. in January 2014 (Appendix D for both The Chute and Third Falls Generating Stations was developed for the Project to describe and propose parameters for the long term operation of the Project and to facilitate integration of the Project into the existing Mattagami Water Management Plan (WMP). In particular, operating parameters are proposed for:

- Operating levels of the upstream headpond,
- Flow allocation between the powerhouse and the spillway, and
- Downstream Flow and Level control.

The objective of setting operating parameters is to allow flexibility in the electricity generation while limiting significant negative impacts due to variability in flows and fluctuation in levels.

It is proposed to operate The Chute Facility as a modified run-of-river generating Facility with the Facility immediately downstream, Third Falls as a run-of-river waterpower project, effectively re-naturalizing river flows based upon upstream conditions prior to The Chute project. Third Falls is a close coupled project with no bypass reach therefore no compensatory flow is required.

Run-of-river operations for Third Falls during modified run-of-river operations at The Chute requires use of the Third Falls headpond to buffer inflows which are either above or below natural inflow rates. There are two modes of headpond operation linked to upstream modified run-of-river operations:

1. The Chute runs at reduced rate at night: When natural river flows are moderate (i.e. between the minimum and the maximum rate of turbine capacity), The Chute runs continuously, but some of the water is saved during nighttime hours. This operation results in downstream flows into Third Falls that are smaller than natural river flows during nighttime hours and larger than natural river flows during daytime hours when electricity

use is higher. However, the minimum flow in this mode of operation is not less than the minimum turbine capacity. Third Falls, the downstream site, provides a constant generation rate corresponding to natural upstream inflow rates. To accomplish this task the portion of the inflow which is above the natural rate is stored within the Third Falls headpond and released from the headpond (within 24hrs) at a rate corresponding to the quantity of inflow which his less than the natural rate. This mode of operation results in fluctuating headpond water levels of less than 0.25 m.

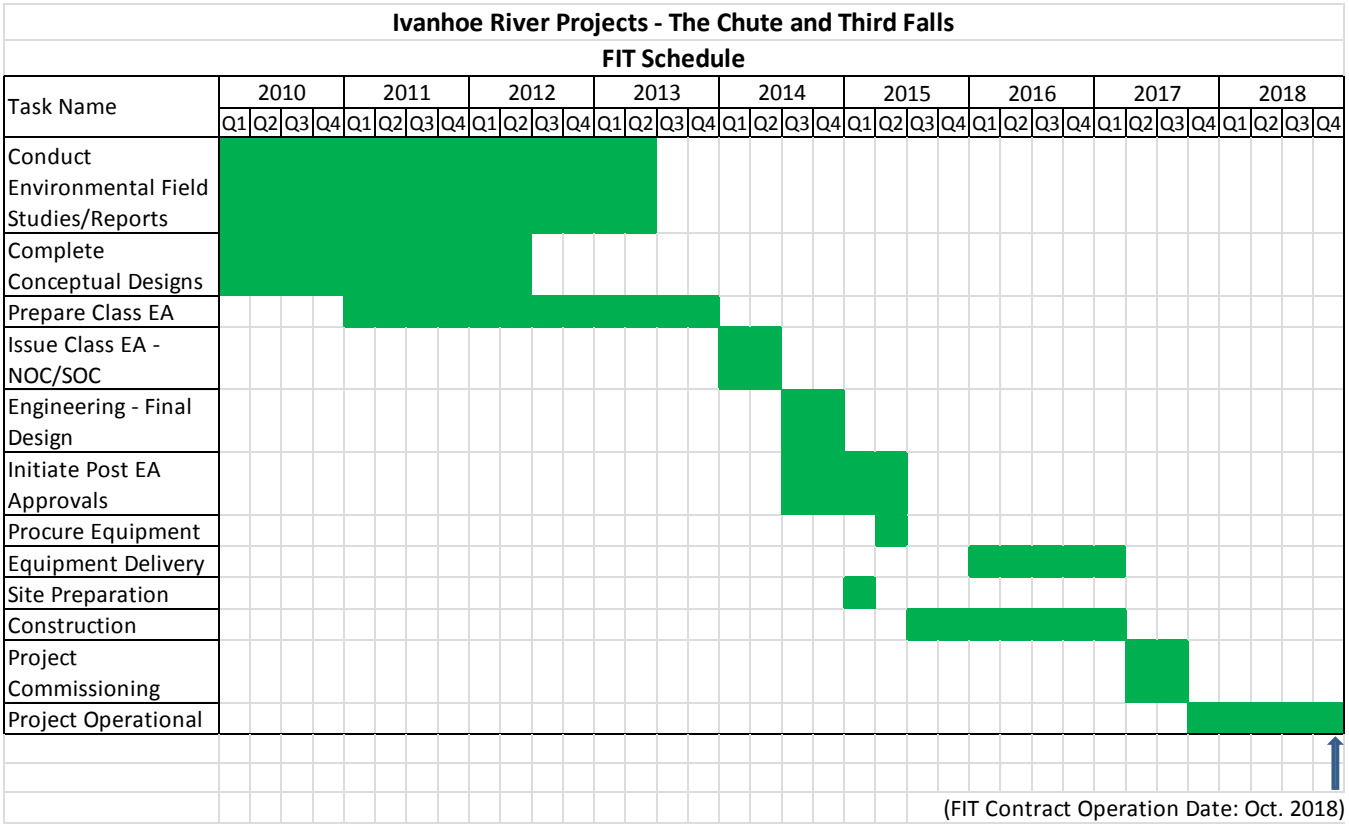
2. The Chute is stopped at night: When natural river flows are low (i.e. below the minimum turbine capacity), The Chute will need to stop operation during some nighttime hours and save water until operation is again possible. The lower the natural river flow, the longer the period of stoppage will be. When The Chute Facility operates, it operates at a rate less than maximum turbine capacity. To ensure that the downstream river reach receives enough water flow to protect the environment, the appropriate amount of water is released through a bypass while the turbine operation is stopped. Operation of the headpond at Third Falls will occur in a manner as discussed in the above section. Regardless of generation capacity at Third Falls, water will be discharged from the tailrace.

Establishment of the operating targets, consistency with the WMP, assessment of potential effects on the river, mitigation and monitoring plans are provided within this Report.

5.3.2 Maintenance and Inspection

For a summary of maintenance and inspection activities and associated safe disposal of removed parts, please refer to Section 4.3.4.

6.0 COMBINED TECHNICAL DESCRIPTION & OPERATIONS THE CHUTE GS & THIRD FALLS GS



6.1 Introduction

The Project components to be used by the two Facilities include:

- A 115 kV substation;
- A 115 kV transmission line corridor; and
- Supporting aggregate sources.

6.1.1 115kV Substation

Each facility will have an onsite substation , close to the powerhouse ,to convert electrical energy from generator voltage (4 kV) to intermediate voltage (69 kV). The 115 kV substation will be built at The Chute. The 69 kV lines will terminate at this transformer and the 115 kV line will originate here.

Transforming and switching equipment will be installed at the 115kV substation. The footprint area of the 115 kV substation is approximately 600 m^2.

6.1.2 Power Line Corridor

There is one 69 kV power line route that would be required for The Third Falls Facility. The 69 kV power line runs south to join up with a power line from The Chute Facility. This power line will travel a total distance of 26.9 km, of which 13.5 km follows an existing road, and 13.3 km will involve new corridor. The map of power line route is show in Figure 10.

The Power line route statistics for The Third Falls Facility is summarized in 0 below.

Table 9: 69 kV Power Line Route Statistics for The Third Falls Facility

Ownership	Type	Length (m)	Water Crossing		Wetlands
			Existing	New	Crossing
Crown	Existing Road	13,505	3	-	3
Crown	New Corridor	13,338	-	2	1
Total		26,843	3	2	4

Source: Distribution Lines and Access Road Summary Report for The Third Falls prepared by KBM Resources Group in December 2013 (Appendix J, KBM, 2013b).

A common 115 kV transmission line will be built from the 115 kV substation to connect the two facilities with Hydro One's 115 kV circuit T61S, which is located adjacent to the Weston Lake substation. It has a total line distance of 51.35 km, of which 3 km travels along an existing highway corridor, 18.8 km travels along existing forest access roads; 29.1 km would be new corridor, and 0.5km of line would cross the Groundhog River Provincial Park. The new 29.1km corridor would cross 11 wetlands and 21 water crossings. In addition, there would be one new water crossing required at the Groundhog River within the provincial park.

The power line route statistics for the 115 kV line are summarized in 0 below.

Table 10: Statistics of 115 kV Transmission Power line Corridor

Ownership	Type	Length (m)	Water Crossing			Wetlands
			Highway	Existing	New	Crossing
Crown	Existing Hydro Corridor	3,035	-	-	2	1
Crown	Existing Road	18,779	6	2	-	4
Crown	New Corridor	29,056	-	-	21	11
Provincial Park	Existing Hydro Corridor	480	-	-	1	-
Total		51,350	6	2	24	16

Source: Distribution Lines and Access Road Summary Report for The Chute prepared by KBM Resources Group in December 2013 (Appendix J, KBM, 2013a).

6.1.4 Borrow Sources

The Project construction will require use of granular material for the construction of access roads, embankments, cofferdams and concrete structure backfill. It is estimated that 6,000 m^3 aggregate will be sourced for two facilities.

The aggregate and borrow materials required for constructions are expected to be sourced from the excavation of these two facilities and offsite aggregate sites.

Xeneca has consulted with the following aggregate permit holders:

- Site 603101 Eacom;
- Site 600021 Bertrand Vandal;
- Site 74774, Site 74814 and Site 74874 Tembec Industries;
- Site 486 Malette Inc. (Tembec)

Sites 74774, 74814, 74874 and 486 are located within 10 km of The Third Falls Facility and sites 603101 and 600021 are located within 22 km of The Chute Facility and will be used for the aggregate needs. If additional aggregate is required, it will be sourced from aggregate suppliers located near Timmins, Ontario.

It is estimated that 1,000 m^3 materials will be excavated from the headpond, tailrace and spillway dam areas at each Facility. An estimated 2,000 m^3 aggregate materials for The Chute and 4,000 m^3 aggregate materials for Third Falls will be required for the construction of new access roads, upgrading of existing access roads, construction of embankments and cofferdams, and concrete structure backfill.

The aggregate materials will be transported to each Facility by trucks via the access roads, and will be unloaded in the temporary laydown areas for temporary storage at each Facility.

6.2 Combined Construction

6.2.1 Vegetation Clearing

In the 69kV and 115 kV substation sites and the power line corridor, vegetation clearing will most likely commence between September to April. Merchantable timber will be decked for removal by the Sustainable Forest License (SFL) holder or other party as designated by the MNR. Trees cut in the 115 kV substation and power line Right-of-Way will have their roots left intact to help control erosion. Brush will be disposed of by burning or chipping.

Power line right-of-way clearing and line construction will be completed in the least impacting and most cost effective way. For overland sections (which are not constructed parallel to an access road)

this will likely involve track-mounted equipment working through winter. This allows for easier access across frozen ground using snow to fill in small depressions smoothing out the access instead of having to cut and fill with soil. Adjacent to access roads, the power line work can proceed during winter or summer with relatively minor impact. The right-of-way will be cut 20 m wide in most cases except on steeper side-slopes where additional up-slope clearing may be required.

6.2.2 Water Crossings

At water crossings, clearing will proceed with the proper erosion and water protection techniques implemented (i.e. silt fencing, felling of trees away from the watercourse, etc.). A vegetated buffer will be maintained at all significant water crossings. The right-of-way will not be grubbed in any case, and extra attention will be given to maintaining low level bushes and vegetation that will not cause a safety hazard with the line. Where necessary, temporary bridges will be installed to completely isolate the watercourse from vehicles required for the power line works.

6.3 Changes to the Project

In a June 26, 2013 directive to the OPA, the Minister of Energy stated that existing waterpower FIT contracts were to be offered a 3-year extension to the Milestone Date for Commercial Operation. Prior to the announcement of the 3-year extension, The Chute GS and Third Falls GS had a commissioning date of October 2015.

The Third Falls project was initially presented with two location options. One of these options was placed inside the boundary of the Northern Claybelt Forest Complex Conservation Reserve, and the other option was placed outside the reserve. In order for the option inside the conservation area to be considered, an amendment that de-regulates the reserve land being used for the project was required from the MNR. As the amendment was not approved, only the option outside the Northern Claybelt Forest Complex Conservation Reserve is being presented in this report.

Third Falls was initially proposed as a modified run-of-river Facility similar to The Chute. However, in order to eliminate predicted flow effects which extended downstream into the Conservation Reserve, the operational regime of Third Falls has been changed so that Third Falls will now be operated to moderate and re-naturalize the effects of The Chute, effectively providing run-of-river flows downstream of the Third Falls tailrace.

The original 115 kV line was initially 48 km but the MNR requested that Xeneca increase the line length to avoid some values along the way, increasing the transmission line length.

7.0 APPROVALS AND PERMITS

The list of the regulatory permits that may be required for this undertaking is presented in Table 11 was assembled following a review of the OWA Class EA Guide and consultation with agency stakeholders who have expressed interest in the Project.

Table 11: List of Potential Regulatory Approvals

Responsible Agency	Permit/Approval	Description
Federal		
Department of Fisheries and Oceans Canada (DFO)	Section 20 Authorization to ensure free passage, control harm to fish, or control an obstruction that may be harmful to fish	This authorization relates to the implementation of a fishway, or allowing for free passage of fish.
	Section 35 Authorization for undertaking or activity that may result in serious harm to fish that are part of a commercial, recreational or aboriginal fishery	Authorization requirements subject to review by DFO. (These requirements are part of the changes to the Fisheries Act which came into force in November 2013.)
	Section 36(3) Authorization and review for deposition of deleterious substance in water frequented by fish	Authorization requirements subject to review by DFO.
Environment Canada- Canadian Wildlife Services (EC-CWS)	Species at Risk Act (SARA)	Authorization requirements subject to EC CWS review. Approval for harassment or harm to federally protected species at risk
Transport Canada (Marine)	Navigable Waters Protection Act	Approval for Construction in Navigable Waters
Natural Resources Canada (NRCan)	Temporary Magazine License	Required for purchase and storage of explosives where quantities are in exceedance of 75kg or 100 detonators.
	Explosive Transportation Permit	Required to transport more than 2000 kg of explosives

Responsible Agency	Permit/Approval	Description
Provincial		
	MNR Class EA for Resource Stewardship and Facility Development Projects	Not required for this project
Ministry of Natural Resources (MNR)	Lakes and Rivers Improvement Act (LRIA)	Section 14 Approvals Location Approval and Plans and Specifications Approval Section 23.1 - Water Management Plan amendment
	Public Lands Act (PLA)	Work Permits Land Use Permit - Construction Water Power Lease Agreement (Crown Lease or Easement) - Operations
	Endangered Species Act (ESA)	Authorization requirements subject to review by MNR. Authorization in order to harm, harass or kill any designated species
	Fish and Wildlife Conservation Act Permit/License	Authorization requirements subject to review by MNR. Authorization to destroy beaver dams, dens of other fur bearing mammals, bears and the nests or eggs of birds if deemed necessary.
	Forest Resource License & Approval for Harvest	Required to harvest/cut merchantable timber on crown land during construction.
	Overlapping License Agreement	Required to be obtained with the SFL holder operating in the area.
	Authority to Haul Unscaled Crown Forest Resources	Required in order to haul timber.
	Burn Permit	Permit required to burn scrub brush or slash
	Aggregate Resources Act (ARA) –	Aggregate Permit

Responsible Agency	**Permit/Approval**	**Description**
Ministry of the Environment	Ontario Waterpower Association (OWA) Class EA for Waterpower Projects	Alternative to individual EA for waterpower projects
	Permit to Take Water	Required when dewatering or taking more than 50,000 litres of water a day. Project may be issued a temporary operational permit until amendments to Mattagami WMP are completed.
	Environmental Compliance Approval – Sewage, Waste, Air & Noise	Required for water runoff including oil/water separator and any other similar containment systems
		Required for transformer oil containment system
		Required for sewage holding tanks/treatment facilities (temporary and permanent)
		Required for waste hauling to disposal sites
		Required for diesel generators
		Required for noise emissions.
		Required for rock rusher or temporary concrete batch plants – may not be required
	Waste Generator Registration	Required for generation of subject waste above small quantity exemption criteria.
	Dust Suppressant License	Required for dust suppressants other than water
Ministry of Labour	Notice of Project and Registration of Contractors	
Ontario Energy Board	Electricity Generation License	Leave to construct (section 92) and Wholesaler license. Market authorization from the IESO

Responsible Agency	**Permit/Approval**	**Description**
Other		
Sustainable Forest License holders	Road Use Agreement	

[1] As noted by the MOE in their July 10, 2013 review comments on the Draft ER, the MOE will only consider a short-term Permit to Take Water (PTTW) for the operation of the facility until the amendment to the Mattagami River Water Management Plan has been approved. The exact categorization of the PTTWs for construction and operation will be confirmed during the permitting and approvals phase of development.

7.1 Ministry of the Environment

7.1.1 Ontario Environmental Assessment Act

Under the Environmental Assessment Act (EA Act) some classes of projects which are carried out routinely and have predictable and mitigatable effects can be assessed by a Class Environmental Assessment (Class EA) .

The planning process within the Class Environmental Assessment for Waterpower Projects ,developed by the Ontario Waterpower Association as approved by the Ministry of the Environment, assumed the place of O.Reg 116/01, Electricity Projects, under the EA Act for those projects with a proposed installed capacity of less than 200 MW.

7.2 Ontario Ministry of Natural Resources

7.2.1 Class EA for MNR Resource Stewardship & Facility Developments Projects

Transmission lines that are greater than or equal to 115 kV and are over 2 km in length are Category B undertakings under the O.Reg 116/01 Guide. The Category B screening for both the 69 kV and the 115 kV connection lines are included in this Class EA. As such, the Ministry of Natural Resources (MNR) Resource Stewardship and Facility Development Projects Class Environmental Assessment (MNR-RSFDP Class EA) no longer applies to this Project.

7.3 Canadian Environmental Assessment Act

In the early stages of the planning process, federal regulatory approvals triggered the requirement for a screening-level environmental assessment under CEAA. Since the enactment of the new Canadian Environmental Assessment Act (CEAA, 2012), a federal screening is no longer required, This Environmental Report document is primarily intended to meet Class EA requirements, though federal information requirements have been addressed where possible.

8.0 WATERPOWER CLASS EA POTENTIAL EFFECTS MATRIX

The EA team collaborated in the completion of the Potential Effects Identification Matrix (Table 3 of the Class EA for Waterpower Projects (OWA, Revised January 2014)). This matrix was included in the Project Description document developed by Xeneca, was circulated to regulators in order to begin the planning process and is included here as Table 12.

The purpose of this matrix is to review potential Project effects prior to mitigation, and to rule out other effects due to Project study work and research.

ORTECH

Table 12: Potential Effects Identification Matrix

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
General Natural Environment Considerations									
11.5.1.2	**Air Quality (including GHG Offsets)**	Deposition of fine Particulate Matter (PM) could impact vegetation and transient users along access roads and in the vicinity of the Project Area during construction activities		X					Nearest permanent residence to the Study Area is more than 3km away from the Project
11.5.1.2		Emissions from internal combustion engines used during construction have the potential to impact human health and vegetation		X					Increase in vehicle use on the Project site may impact air emissions on site during construction.
11.5.1.3		Burning cleared vegetation have the potential to impact outdoor air quality in the Project Area	X						Vegetation clearing activities will result in scrub and brush that may be disposed up through burning.
11.5.2		An increase in noise and vibration due to construction activities, blasting, crushing and material handing may impact transient users in the Project Area.	X						Nearest permanent residence to the Study Area is more than 3km away from the Project
12.5.2		Green house gases (GHGs) could potentially be released by the Facilities during operation as result of decomposing organic material in the headponds.		X					Decomposing organic material could potentially release methane (CH_4) into the atmosphere
12.5.3		Exhaust from onsite standby generators during operations has the potential to impact local air quality at the Project Site.		X					Each facility will have one emergency stand by generator
12.5.4		Operational noise from turbine and associated equipment and operations may result in impacts to transient users in the Project Area		X					Nearest permanent residence to the Study Area is more than 3km away from the Project
11.2.3.1	**Water Quality or Quantity (Surface Water)**	Erosion and sedimentation effects arising from vegetation clearing in the inundation areas, construction areas, new access roads and power line corridors	X						The vegetation clearing can lead to erosion, topsoil degradation and sediment loading into surface waters from runoff, and result in an increase of Total Suspended Solid (TSS) level and turbidity.
11.2.3.2		Erosion and sedimentation effects from in-water construction activities	X						The improper installation and removal of cofferdams may result in an increase of Total Suspended Solid (TSS) level and turbidity from disturbing the bed and bank of the surface water and existing water flow.
11.2.3.3		Erosion and sedimentation effects at water crossings or bridges on the access roads and in the power line corridors	X						The construction activities at the water crossings on the access roads and in the power line corridors may result in increased suspended solids from disturbing the bed and bank of the surface water.
11.2.3.4		The domestic wastewater will be generated in the construction camp during construction		X					It is estimated that maximum 40 persons work at the construction camp. The maximum wastewater generate amount is approximately 2.4 m3/day. The main pollutants in the domestic wastewater include Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), NH3-N and Total Suspended Solids (TSS). If the wastewater is discharged directly to the environment, there could be adverse effects on surface water quality.

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.2.3.5		The process wastewater will be generated from the production process of concrete, and equipment flushing during construction		X					The main pollutant in the process wastewater is total suspended solids (TSS). If the process wastewater is discharged directly to the environment, there could be adverse effects on surface water quality.
14.1.2		Accidental spills of hazardous materials may occur during construction		X					Improper loading and unloading, storage and handling of fuels, lubricants and chemicals at the construction sites and improper refueling and maintenance of vehicles at the construction parking area and construction sites may result in contamination to the soil and river.
14.2.2		Accidental spill of lubricant oil, transformer oil and other hazardous substances may result in soil, surface and/or groundwater contamination during operations and maintenance		X					Improper use, transportation, storage and disposal of transformer oils within the substations, improper use, transportation, storage and disposal of hydraulic fluids and cooling oils within the powerhouses and substation areas and improper use, storage and transfer of cleaning detergent for maintenance activities may pose some risk during operations.
12.2.3.1		Suspended solids could increase above baseline values resulting from shoreline erosion created by variability of flow and water levels within the zone of influence during operations		X					Soil quality and soil quantity at the facilities are impacted by erosion, sedimentation, soil compaction and soil contamination.
12.2.3.2		Reduced dissolved oxygen levels in the headpond due to stratification, increased water temperature, altered flows and mixing downstream of the facilities during operations	X						Low dissolved oxygen concentrations may occur within the bottom layer. In addition, increases in water temperature can result in reduction in dissolved oxygen concentration.
12.2.4		The potential increase of mercury and methyl mercury levels can be generated when the mercury contained soil is flooded into the river, and the increased water depth in the inundation area can enhance the methylation of mercury in surface water.	X						The methyl mercury trend may be a result of increased methylating bacteria activity, which are stimulated when dissolved oxygen is low, a condition that may exist at night in the summer when aquatic plants are respiring.
11.2.5	**Water Quality or Quantity (Ground Water)**	Excavations below the groundwater table could potentially have an effect on groundwater during construction.		X					Excavation and blasting in the cofferdams areas for the powerhouse, headrace and tailrace, and in the stockpile areas could potentially have a negative effect on groundwater hydrology and hydraulics.
12.2.5.1		Elevated water levels in headponds may impact the groundwater table in the vicinity of headponds.		X					The operation of increased water level in the headpond areas will elevate the groundwater table in the area immediately adjacent to the headponds.
12.2.5.2		A potential groundwater quality effects will be generated from an accidental spill or leakage from the use of hydraulic fluids and cleaning detergent and the transfer and removal of transformer oils.		X					The use of hydraulic fluids and cleaning detergent within the powerhouses and the transfer and removal of transformer oils in the substations may generate an accidental spill or leakage.

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.3.3.1	Species at Risk and their Habitat	Construction activities may disrupt bald eagle nesting activities	X						Construction of new access roads, upgrades to existing access roads, vegetation clearing and construction activities may result in disruption to highly sensitive bald eagle nesting activities
11.3.3.2		Road construction may impact Forest Nesting Canadian Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee and the Rusty Blackbird	X						Road construction may result in the loss of 8 hectares of forest habitat which could disrupt nesting activities of these significant bird species
11.3.3.3		Transmission corridor and line construction may impact Forest Nesting Canadian Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee and the Rusty Blackbird	X						Transmission corridor and line construction may result in the loss of 258.5 hectares of vegetation which may result in the loss of significant forest nesting habitat for these significant bird species.
11.3.3.4		Construction activities may result in mortality of Common Nighthawks due to roadway collisions	X						there is a possibility that due to an increase in traffic along existing access roads due to construction, and the construction of new access roads, that this could lead to an increase in road strikes of common nighthawks.
11.3.3.5		Potential loss and disruption of maternity roost trees due to vegetation clearing for northern myotis, little brown myotis and eastern small-footed bat	X						Clearing for the facility, inundation, roads, and transmission corridor may result in the loss of snag trees which may some suitable snag trees for these species.
11.3.3.6		Potential loss of hibernacula due to vegetation clearing for Northern Myotis, Little Brown Myotis & Eastern Small-footed Bat			X				There are no known hibernacula within the study area.
11.3.3.7		Potential disruption of Northern Myotis, Little Brown Bat and Eastern Small-footed Bat due to traffic noise and construction activities	X						Construction activates in the Project Area will result in traffic noise and construction related noise and human disturbance which could result in impacts to these species. Forest canopy gaps related to roadways may cause foraging bats to alter travel routs
11.3.38		Potential loss of Northern Myotis, Little Brown Bat and Eastern Small-footed Bat foraging habitat due to vegetation clearing		X					Vegetation clearing for facility construction, Transmission line corridor and roadways may result in loss of foraging habitat for these species
12.3.3.1		Road and Power Line maintenance may impact Forest Nesting Canadian Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee and the Rusty Blackbird		X					Maintaining the road and power line corridor may harm or harass these protected species
12.3.3.2		Common Nighthawk may be impacted by Roadway use during Operations	X						There is a potential that road use at the facility locations could impact Common Nighthawks during operations
9.3.5	Significant Earth or Life Science Features	Significant Earth or Life Science Features may be impacted by Project Construction or Operations			X				No areas of significant Earth or Life Science Features were identified in the study area

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.1.3	Land Subject to Natural or Human Made Hazards	Project construction activities such as excavation may cause increased erosion and bank slumping		X					Excavations conducted improperly or without proper planning have the potential to cause damage to the surrounding environment including slope failures and un-controlled sediment transport.
11.1.4.1		Increased risk of bank instability as a result of shoreline erosion at The Chute		X					For the initial inundation of the headponds, a screening level erosion potential index was developed using LiDAR data. The results suggest that erosion potential at The Chute generating station site is relatively low.
11.1.4.1		Increased risk of bank instability as a result of shoreline erosion at Third Falls	X						For the initial inundation of the headponds, a screening level erosion potential index was developed using LiDAR data. The results suggest that erosion potential at Third Falls site, include steep slopes downstream of the proposed facility with have a relatively high potential for erosion, especially associated with hillslope processes.
12.1.3		Increased risk of bank instability as a result of shoreline erosion from operations				X			The Geomorphic Assessment concluded that the Ivanhoe River channel is stable but there may be some bank locations the may become destabilized from operational activities. These banks are not anticipated to cause any net effects on erosion but should be monitored.
11.3.2.1	Terrestrial Wildlife (Including Numbers, Diversity and Movement of Resident or Migratory Species)	Vegetation clearing due to construction activities (facilities, roads, transmission line) may have an impact on nesting birds	X						construction activities may destroy nests of tree, shrub or ground nesting birds
11.3.2.2		Construction noise, human presence and activity may displace or alter the behaviour of nesting, breeding and foraging birds in the Project Area		X					Noise, human presence and other construction activities may displace or alter the behaviour of birds breeding, nesting and foraging. Increase in vehicle traffic may result in road kill of birds. This might be a significant issue for ground nesting birds such as the Common Nighthawk (See Species at Risk).
11.3.2.3		Vegetation clearing and construction activities may have impacts on other wildlife		X					Vegetation clearing and construction activities may result in short term disturbance of wildlife in the area.
12.3.2.1		Potential that large birds may be impacted by the operating 115kV transmission line	X						large birds may be effected by electrocution or collision with the 115kV transmission line.
12.3.2.2		Vegetation clearing during operations for the ROW may impact small mammals		X					Chemical maintenance of the ROW to facilitate safety of components may impact small mammals.
12.3.2.3		Breeding birds may be impacted by facility operations							Breeding birds may be disrupted by the additional vehicle traffic in Project Area during operations.

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.3.1.1	Natural Vegetation and Terrestrial Habitat Linkages	Vegetation clearing for the 115 kV transmission line corridor may result in a loss of 120.6 hectares of vegetation	X						Vegetation clearing may result in loss of habitat, impacts to water quality, and sediment impacts in some places.
11.3.1.2		Vegetation clearing for the access roads, construction camp, stockpiles & Temporary laydown areas may result in a loss of 8ha of vegetation.	X						Vegetation clearing may result in loss of habitat, impacts to water quality, and sediment impacts in some places.
11.3.1.3		Vegetation clearing for the facility components at the proposed Chute GS and in the inundation area	X						Vegetation clearing may result in a loss of species (northern myotis, and little brown myotis) habitat, impact water quality and sedimentation
11.3.1.4		Vegetation clearing for facility component at the proposed Third Falls GS and in the inundation area	X						Vegetation clearing may result in the loss of 13 ELC communities totalling 103.63 hectares of vegetation, including moose aquatic feeding areas, and a rare vegetation type (Fresh, Silty to Fine Loamy: Elm-Ash Hardwood). This loss will have an impact on species habitat and species diversity.
12.3.1		Terrestrial vegetation may be impacted due to operations at The Chute and Third Falls		X					Operation activities and water fluctuations may have an impact on the vegetation communities in the headpond areas.
12.1.1	Geology, Topography and Terrain	Impacts from construction or operations to bedrock geology.			X				There are no anticipated impacts to Bedrock Geology as a result of Project construction activities
11.1.2		Impacts from construction activities on the terrain and topography.		X					Construction will have temporary effects on the terrain and topography, typically where excavation and fill are required for construction.
12.1.2		Impacts from operations on the terrain and topography.			X				There are no anticipated impacts to Terrain and Topography as a result of Project operations.

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			-H	-L	NIL	UNK	+L	+H	
11.1.4.2	Soils & Sediment Quality	Sources of sediment during the construction phase could include the following activities: • Surface runoff from the construction areas carrying construction-related sediment; • Sediment disturbance due to in-water work construction activities such as cofferdam installation and removal; • Sediment disturbance due to water crossing structure installation for transmission lines; • Sediment disturbance due to water diversion during construction; and • Sediment disturbance due to water crossing structure installation.		X					Sediment in waterbodies from construction sites can reduce the amount of sunlight reaching aquatic plants, clog fish gills, smother aquatic habitat and spawning areas, impede navigation and alter or block in-stream flow. Construction activities resulting in transporting sediment from the project site would result in a decrease in local sediment ultimately impacting aquatic habitat and water quality.
11.1.4.3		Soil Compaction from grading of the roads, foundations for permanent structures such as the powerhouse, and heavy machinery use especially on very moist soils		X					There is a concern that soil compaction as a result of new road building over the Project site could result in impacts to soil health. The effects of soil compaction may limit plant growth due to a lack of water, nutrition or air at their roots. Compact soil may also reduce the ability of water infiltration increasing the amount of surface water runoff.
11.1.4.4		Soil contamination from potential Acid Rock Drainage				X			Blasting and excavation activities may result in acid rock drainage into water bodies
11.1.4.4		Transport of contaminated soils due to construction activities.			X				No contaminated soils are known or anticipated in the project area as the project area has been traditionally used for recreational activities (hunting, fishing, boating) and Aboriginal traditional uses. Therefore the transport of contaminated soils and its effect on human health during construction is not anticipated during the construction phase of this project.
12.1.4.1		Accelerated shoreline erosion from operation related water level changes such as: • The Chute headpond fluctuations • Third Falls headpond fluctuations • The Chute headpond fluctuations on Oates Bridge • Third Falls headpond fluctuations on Nova Bridge • The Chute downstream water fluctuations • Third Falls downstream water fluctuations	X						Rapid changes in shoreline water levels have the potential to increase erosion. Where pore water in the soil dissipates too quickly, pore pressure can loosen soil grains and cause loss of stability in the soil structure, thereby enhancing erosion. A small amount of shoreline erosion occurs naturally in the river; however, accelerated shoreline erosion from daily water level changes can effect natural shoreline vegetation that cannot establish itself, shoreline aquatic habitat, and in extreme cases, erosion can cause an increase in the overall sediment load in the river effecting water turbidity and aquatic conditions
12.1.4.2		Impacts on Sedimentation and Sediment Transport due to operations such as: • Infilling due to inundation of rapids in the headponds; • Increased suspended sediment due to intermittent operations; • impeding sediment transport from the two Facilities and the auxiliary dam at The Chute		X					Sediment in waterbodies from erosion processes due to operations can reduce the amount of sunlight reaching aquatic plants, clog fish gills, smother aquatic habitat and spawning areas, impede navigation and alter or block in-stream flow. Transporting sediment from the project site due to operations would result in a decrease in local sediment impacting aquatic habitat and water quality.
12.1.3		Channel Adjustments			X				Soil and sedimentation releases may produce changes in channelization
14.1.1		Soil contamination through accidental spills.		X					Hazardous materials that are used during the construction or operations could spill impacting soil health.

Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.3.4.1	Significant Natural Heritage Features and Areas	Inundation at The Chute and Third Falls may have impacts to Moose Aquatic Feeding Area	X						Inundation and rising water levels due to headpond filing may result in loses to this significant wildlife habitat.
11.3.4.2		Inundation in the Third Falls headpond may impact bald eagle habitat		X					The proposed increase is not anticipated to impact bald eagle foraging and perching as it will be confined to the existing channel and will not result in the loss of any perch trees along the shoreline.
11.3.4.3		Inundation for Third Falls GS may impact common nighthawk habitat		X					the water level change will be restricted to the existing channel and existing high water mark.
11.3.4.4		Inundation for Third Falls GS may impact Olive-Sided Flycatcher habitat		X					clearing for the third falls GS does not directly impact this species and the proposed water level change is unlikely to impact nesting or foraging habitat as it occurs in the existing channel within the existing high water mark.
11.3.4.5		Vegetation clearing for the inundation area at Third Falls may result in impacts to Canada warbler habitat.		X					A total of 35.9 hectares of combined habitat type for this species will be lost as a result of inundation for the Third Falls headpond. This represents a small amount of the total habitat for this species.
11.3.4.6		Loss of rare treed significant wildlife habitat - Fresh Silty to Fine Loamy: Elm-Ash Hardwood (B105) through clearing of inundation area for Third Falls.	X						Clearing for the Third Falls GS headpond will result in a los of 0.7hectares of 35% of this habitat type resulting in a potential loss of genetic integrity.
11.4.7.1		Marsh Breeding Bird Habitat may be impacted by construction		X					Some losses in this habitat type may occur as a result of construction
11.4.7.2		Amphibian Breeding Habitat may be impacted by construction		X					Some losses in this habitat type may occur as a result of construction
12.3.4.1		Moose Aquatic Feeding Area may be impacted due to inundation and headpond fluctuations during operations		X					Daily fluctuations during operations may impact Moose Aquatic Feeding Area
Aquatic and Riparian Ecosystem Considerations									
11.4.6.1	Shoreline Dependent Species	Otters may be impacted by headpond filling and facility construction	X						Water level fluctuations and headpond filling may result in trapping or flooding Otter dens.
12.4.6.1		Otters may be impacted by daily operations		X					Water level fluctuations as a result of daily operations may impact Otters.
11.4.5.1	Wetland Dependent Species	Wetlands may be impacted by construction and inundation	X						Activities may result in loss to ecosite types
11.4.5.2		Snapping Turtles may be impacted by construction activities		X					No turtles were observed during 2013 surveys, however potential habitat is present. Rad and line construction could impact species.
11.4.5.3		Wetland nesting birds may be impacted by road and powerline construction	X						Road and powerline construction may result in disturbance and annoyance to some bird species.
12.4.5.1		Wetland and Riverine habitats may be impacted during operations	X						Riverine and Wetland habitats may be altered during operations
12..5.2		Snapping turtles may be impacted by operational activities		X					Snapping turtles may be impacted by vehicle traffic during operations

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			-H	-L	NIL	UNK	+L	+H	
12.4.5.3		Wetland nesting birds may be impacted by road maintenance		X					Wetland nesting birds may be impacted due to disturbance and disruption caused by road maintenance during operations
11..4.1.1	Fish & Fish habitat	Construction and dewatering for installation of cofferdams may have impacts on aquatic habitat and fish at the Project	X						Fish may become stranded and aquatic habitat may be impacted by installation and dewatering for cofferdams
11.4.1.2		Installation and construction of the Auxiliary Dam may have impacts on the aquatic habitat at The Chute		X					The auxiliary dam will impact a shoreline mainly comprised of bedrock which would afford negligible habitat value even during the limited periods when the channel is wetted.
11.4.1.3		Facility construction at The Chute may impact spawning habitat and fish abundance	X						Facility construction may remove spawning habitat and impact fish abundance.
11.4.1.4		Facility construction at Third Falls may impact spawning habitat and fish abundance		X					Facility construction may remove spawning habitat and impact fish abundance.
11.4.1.5		Construction at both facilities and inundation may impact macroinvertebrates	X						Invertebrate habitat may be lost or altered as a result of facility construction and inundation.
11.4.1.6		Inundation at Third Falls GS may impact Brook Trout Habitat in upstream tributaries		X					Only 1 out of 9 potential tributaries contained potential brook trout habitat. This tributary (Komak Creek) contained deposits that were suitable for limited spawning. Similar gravel deposits were noted in the area immediately upstream of the maximum backwater effect and these will remain available to Brook Trout and undisturbed by inundation. Presumably more of this habitat will be present upstream of the area surveyed.
11.4.1.7		Aquatic habitat may be impacted as a result of the construction of new road crossings		X					Construction of water crossings to facilitate new roadways may impact aquatic habitat
11.4.1.8		Aquatic habitat may be impacted as a result of the construction of new stream crossings for the Power Line		X					Construction of the powerline will require stream crossings which may result in impacts to aquatic habitat
12.4.1.1		Northern Pike Spawning Habitat may be impacted by inundation at The Chute GS	X						Northern Pike spawning habitat may be altered as a result of operations
12.4.1.2		Northern Pike Spawning Habitat may be impacted by inundation at Third Falls GS	X						Northern Pike spawning habitat may be altered as a result of operations
12.4.1.3		Walleye Spawning habitat may be impacted at The Chute	X						Walleye habitat may be altered as a result of operations
11.4.2	Fish Migration	There is a potential that upstream fish passage at the Chute GS could be impacted by facility construction			X				The proposed Chute GS location is considered to restrict upstream fish passage due to the associated vertical drops in both the east and west channels
11.4.2		There is a potential that upstream fish passage could be impacted at Third Falls by facility construction			X				The lower falls at Third Falls represents an impassable barrier for upstream fish movement into the Project Area.
11.4.2		There is a potential that downstream fish passage could be impacted by Project activities			X				There will continue to be opportunities for fish including larvae drift to pass downstream either through the turbines or over the spillway at both locations
12.4.2.1		There is a potential for Fish Stranding at The Chute due to Operations	X						Fish stranding may occur in the fastwater habitats downstream of the Chute GS as a result of operations

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			-H	-L	NIL	UNK	+L	+H	
11.4.3	**Fisheries**	There is the potential that Project construction could impact baitfish resources		X					Baitfish resources may be displaced by construction activities
12.4.3.1		There is potential that Project operation could impact baitfish resources		X					Baitfish resources may be impacted by operation activities
11.1.4.1	**Erosion & Sediment**	Construction related erosion potential due to: • Excavation activities; • Installation activities related to water crossing structures for transmission lines; • Vegetation clearing for the headpond inundation areas, temporary roads, and permanent roads; and • Grading for construction activities and road construction.		X					When left uncontrolled, soil exposed from construction activities has the potential be transported off of the construction areas by wind or water erosion. This decreases the quantity of soil available to support wildlife and vegetation and regulating surface water runoff processes. In extreme cases, erosion can cause an increase in the overall sediment load in the river with the potential for secondary effects on water turbidity and aquatic conditions. If the eroded soil reaches the water ways, there is a potential to impact surface water quality, aquatic habitat and cause an alteration or blockage of in-stream flow.
11.1.4.1		Erosion due to the initial inundation of The Chute headpond	X						For the initial inundation of the headponds, a screening level erosion potential index was developed using LiDAR data. The results suggest that erosion potential at The Chute generating station site is relatively low.
11.1.4.1		Erosion due to the initial inundation of Third Falls headpond	X						For the initial inundation of the headponds, a screening level erosion potential index was developed using LiDAR data. The results suggest that erosion potential at Third Falls site, include steep slopes downstream of the proposed facility with have a relatively high potential for erosion, especially associated with hillslope processes.
11.1.4.1		Erosion or sedimentation impacts from the initial inundation of The Chute on Oates Bridge		X					The initial inundation will be a slow and at a consistent rate preventing high velocity water or large water fluctuations from transporting additional material from the inundation area. The filling will be accompanied by upstream and downstream sampling of turbidity to ensure the work is not increasing suspended solids or pH in the water beyond acceptable levels.
11.1.4.1		Erosion or sedimentation impacts from the initial inundation of Third Falls on Nova Bridge		X					The initial inundation will be a slow and at a consistent rate preventing high velocity water or large water fluctuations from transporting additional material from the inundation area. The filling will be accompanied by upstream and downstream sampling of turbidity to ensure the work is not increasing suspended solids or pH in the water beyond acceptable levels.
12.1.4.1		Erosion potential from headpond fluctuations at The Chute	X						
12.1.4.1		Erosion potential from downstream water fluctuations from The Chute	X						
12.1.4.1		Erosion potential from headpond fluctuations at Third Falls	X						
12.1.4.1		Erosion potential from downstream water fluctuations from Third Falls	X						
12.1.4.1		Erosion potential on the Oates Bridge upstream of The Chute				X			
12.1.4.1		Erosion potential on Nova Bridge upstream of Third Falls				X			
12.1.4.2		Erosion potential from ice scour from the daily lowering of the water levels in the headpond at The Chute	X						
Report	**Criterion**	**Activity/Description**	**POTENTIAL LEVEL OF EFFECT**						**Comments, Rationale**

Section			-H	-L	NIL	UNK	+L	+H	
12.1.4.2		Erosion potential from ice scour from the daily lowering of the water levels in the headpond at Third Falls	X						
11.4.4	**Fish Injury or Mortality (Impingement and Entrainment)**	Fish injury or mortality during construction and blasting activities	X						Fish may be injured as a result of blasting during construction
12.4.4.1		Fish impingement on trash racks may occur during operations	X						There is a potential for fish impingement on trash racks during operations
12.4.4.2		Fish Entrainment in the Turbine may occur during operations	X						There is a potential for fish mortality due to entrainment in the turbine
11.2.1	**Water levels, Flows and Movement (Surface or Groundwater)**	In-water construction work may alter the water flow during construction			X				Cofferdams will be installed in the summer low flow season for each Facility to divert the water flow from the in-water construction area to the open channel.
11.2.2		In-water construction work may alter the water level and movement during construction			X				A sufficient channel is still open to divert the water flow from the cofferdam areas when each cofferdam is installed and removed during the low flow season in late summer.
12.2.1		The existing hydrogeological conditions may be influenced during operations			X				Upstream of the zone of influence water flows and levels are influenced by the Ivanhoe Lake dam. Downstream of the zone of influence, less than 100 m downstream of Third Falls tailrace flows and levels will be re-naturalized to run-of-river conditions. The Project will not alter annual, seasonal or daily hydrological parameters.
12.2.1.1		During modified run-of-river operations at The Chute, hourly hydrology will be altered from existing conditions.		X					The daily variability in flow during modified run-of-river operation at The Chute may impact certain sensitive aquatic habitat in the Variable Flow Reach downstream of the Facility.
12.2.2		Operations will decrease quantity of water during certain seasons and times of day at the Project location		X					Flow of water will be impacted by operations at the facility which will impact the quantity of water through the Project site
		Changes to the effective dilution of effluents from the Montcalm Mine as a result of variable flows				X			Flows will be re-naturalized downstream of Third Falls, maintaining existing conditions downstream.
		Impacts of variable flows on sewage treatment plant in Foleyet				X			Flows will be re-naturalized downstream of Third Falls, maintaining existing conditions downstream.
12.2.3.3	**Drainage, Flooding and Drought Patterns**	Alteration from natural patterns as a result of construction activities	X						
14.2.5		Increased impacts related to flood events. During operations		X					
14.2.5		Increased impacts during severe drought event during operations				X			

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
12.2.3.3	**Water Temperature**	Inundation may result in the increase of water temperature in the river and tributaries within the Zone of Influence during operations		X					The changes of open water area, residence time and stratification arising from the new headpond areas could generate potential water temperature effect to the river, and could affect the water temperature of cold-water tributaries within the Zone of Influence.
Aboriginal Community Considerations									
11.9.1	**First Nation Reserves or Other Aboriginal Communities**	Project lands may impact reserve lands or aboriginal community rights			X				Project Area is not located on any First Nations reserve lands or lands allocated to any other aboriginal community.
11.9.2.1	**Spiritual, Ceremonial, Cultural, Archaeological, or Burial Sites**	Construction activities at The Chute may lead to the removal of culturally significant White Cedar stands	X						White cedar trees in the area of the truck turn around and access road at The Chute may be impacted by construction activities.
11.9.2.2		Project construction activities may impact a naturally modified tree at The Chute	X						A naturally modified tree (previously thought to be a CMT) may be impacted by construction activities at the Chute.
12.9.2.1		Inundation may result in the removal of mature white cedars in the inundation zone.		X					Trees identified in consultation with Chapelau Cree
12.9.2.2		Project operations may affect CMT downstream of The Chute.		X					Tree determined to be a naturally modified tree
11.9.3.1	**Traditional Land or Resources Used for Harvesting Activities**	Hunting, harvesting, foraging and trapping activities may be disrupted by construction activities (being unable to access site areas)		X					Restriction of access to the waterway during construction may disrupt hunting, harvesting, foraging and trapping activities.
11.9.3.2		Furbearing mammals may be impacted by construction activities			X				Furbearing mammals in the vicinity of the facilities may be impacted by construction activities.
12.9.3.1		Hunting, harvesting, foraging and trapping activities may be disrupted when inundation makes previously accessible areas inaccessible.		X					Access will be maintained to the waterway and around the Facility (boat launch and portages).
12.9.3.2		Furbearing mammals may be impacted by an increase in headpond levels and alteration of habitat resulting in a change in trapping which may impact traditional lifeways and economic resources of aboriginal peoples.		X					
11.9.4	**Employment**	Employment impacts of the Ivanhoe Project for First Nations are expected to be positive, as a result of measures included in the confidential economic benefit agreements currently being finalized.					X		Economic benefit agreement will include further details.

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.9.5	**Lands Subject to Land Claims**	The Project may have an impact on existing land claims on file between the Nishnawbe Aski Nation, for which no final agreement has been reached.			X				No impact to land claims is anticipated from the Project
11.9.6	**Economic Development**	Economic development impacts of the Ivanhoe Project for First Nations are expected to be positive, as a result of measures included in the confidential economic benefit agreements currently being finalized, including a generous equity participation program.					X		Economic benefit agreement will include further details.
11.9.7.1	**Other (Specify)**	The construction of The Chute and Third Falls Facilities may affect the movement of the water (Spirit of Water) within the Project Area.		X					This concern was raised in consultation by Chapleau Cree First Nation
11.9.7.2		Vegetation removal during construction of the Project may affect any culturally significant medicinal plants, such as sage and tobacco, which may be present in the Project Area		X					These species identified in consultation with Chapleau Cree First Nation
11.9.7.3		Construction activities may harass or disturb any culturally significant animal species present in the Project Area.		X					Culturally significant wildlife such as wolf, bear, moose, aquatic life etc.
11.9.7.4		Vegetation clearing required during construction may require the clearing of culturally significant cedar, ash, birch, tamarack and/or spruce trees		X					Vegetation on site reviewed
11.9.7.5		Construction of a hydroelectric project represents a visual change to the environment, and where the environment is culturally significant, this may represent an impact to First Nations		X					Visual assessment prepared
12.9.7.1		Spirit (movement) of the water to be impeded by operation of the Facilities		X					Third Falls has been designed as run-of-river and will re-naturalize flows downstream.
12.9.7.2		Operations may affect culturally significant medicinal plants, such as sage and tobacco, which may be present in the Project Area		X					These species identified in consultation with Chapleau Cree First Nation
12.9.7.3		Development may animal species of cultural or spiritual significance to communities		X					Culturally significant wildlife such as wolf, bear, moose, aquatic life etc.

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
12.9.7.4		The loss of culturally used Cedar, Ash, birch, tamarack, and spruce trees surrounding the Project site as a result of project activities and flooding may impact community cultural and spiritual activities as well as production of traditional tools and traditional lifeways		X					Vegetation on site reviewed
12.9.7.5		The use of concrete for the in-water components of the Facilities is a concern for some Communities		X					Identified in consultation with Chapleau Cree First Nation
12.9.7.6		Visual impacts of the facility could interfere with cultural representations of the landscape	X						Facilities will alter visual representation of the landscape
12.6.7		Development of the dam will present a barrier to navigation and may conflict with traditional lifeways of communities	X						Facilities will alter navigation in the river
Land and Resource Use Considerations									
11.6.2	**Access to Inaccessible Areas (land or water)**	Construction activities may inadvertently damage the Oates Road bridge.		X					Bridge is located approximately 1.9km upstream of the Facility location.
11.6.2		Construction activities may affect the function or longevity of the bridge on Nova Road.		X					Bridge is located approximately 10.9km upstream of the Facility location.
12.6.2.1		The operation of the dam at The Chute Facility may cause increased water levels that affect the function or longevity of the bridge on the Oates Road, located approximately 1.9km upstream of the Facility location.		X					Bridge is located approximately 1.9km upstream of the Facility location.
12.6.2.2		The operation of the dam at The Chute Facility may cause increased water levels that affect the function or longevity of the bridge on the Oates Road, located approximately 1.9km upstream of the Facility location.		X					Bridge is located approximately 10.9km upstream of the Facility location.
11.6.7	**Navigation**	The Ivanhoe River is a recognized canoe route; construction may impede and interfere with navigation		X					Pishkanogami Canoe Route
12.6.7		Ivanhoe River is a recognized canoe route, the operation of the facility may impede and interfere with navigation	X						
11.6.3 & 12.6.3	**Riparian Rights or Privileges**	There are no riparian rights in the Project Area			X				There are no riparian landowners in the project area.

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.6.10.2	Recreational Use & Tourism Values- (land or water)	In-water construction and any terrestrial construction taking place on or adjacent to existing portage trails has the potential to affect navigation by local canoers and kayakers.		X					An existing boat launch will be inaccessible during construction.
11.6.10.3		Snowmobiling may be affected by some temporary and very localized restrictions to access the site during Project construction		X					
11.6.10.1		The Third Falls Facility location is infrequently used by campers currently, if at all. Impacts to site availability may occur during construction.		X					Third Falls is not easily accessible by the public.
11.6.10.1		Some impact to site availability at The Chute, a more popular camping location, may occur during construction, when areas are fenced off to protect public health and safety.		X					
11.6.10.4		During construction, access to hiking trails at The Chute may be limited to protect public health and safety.		X					
11.6.10.4		During construction, access to hiking trails at Third Falls may be limited to protect public health and safety		X					Third Falls is not easily accessible by the public.
12.6.10.1		Operations may result in reduced enjoyment of campsites in the Chute area		X					
12.6.10.1		Operations may result in reduced enjoyment of campsites in the Third Falls area		X					
12.6.10.2		Fluctuating water levels during Project operations could affect users' abilities to launch boats at the existing boat launch at The Chute	X						
12.6.10.2		Fluctuating water levels during Project operations could affect portage routes at Third Falls		X					
12.6.10.3		No potential impacts to local snowmobiling are anticipated to result during operations			X				
12.6.10.4		Operations may result in reduced access to a public hiking trail near the Chute		X					
12.6.10.4		No impact to access to hiking trails is anticipated during the operation of the Third Falls Facility.			X				

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.6.4	Angling and Hunting Opportunities	Effects on hunting fauna, including bear and moose		X					
11.6.4		Effects on local fishing and ice-fishing opportunity due to reduced site access		X					
12.6.4.1		Effects on hunting fauna, including bear and moose during operations		X					
12.6.4.2		Effects on local fishing and ice-fishing opportunity due to reduced site access during operations		X					
11.6.5	Trapping Activities	Construction of the facility may disrupt access to trapline areas		X					No impact to access to trapline areas is anticipated from the Project
12.6.5		Operations may affect trapline if they are contiguous with specific Project facilities restricted to public access for health and safety reasons.		X					No impact to trapline areas or access is anticipated from the Project
11.6.5	Baitfish Harvesting Activities	Construction activities may interfere with Baitfish harvesting activities in the Project Area		X					Investigation required
12.6.5		Operations may affect baitfishing sites if they are contiguous with specific Project facilities restricted to public access for health and safety reasons			X				No activities are anticipated to impact this harvest area.
11.6.6	Views or Aesthetics	The construction of two new hydroelectric facilities will alter the visual appearance of this part of the river, and alter the pristine character of the Third Falls Facility location.		X					This includes construction of entire Facility footprint
12.6.6		The construction of two new hydroelectric facilities will alter the visual appearance of this part of the river, and alter the pristine character of the Third Falls Facility location. As well, inundation of upstream areas of the Ivanhoe River will change the viewscape over the longterm from a riverine to a lacustrine landscape.	X						Inundation will change the viewscape over the long term in a portion of the river from a riverine viewscape into a lacustrine viewscape
11.6.1 & 12.6.1	Existing Land or Resource Management Plans	The Projects operations may land r resource management plans in the area			X				No impacts to Land Use or Resource Management Plans are anticipated from Project operations

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.6.8	**Existing Water Management Plan**	Potential impacts to the Mattagami Water Management Plan		X					No impacts to the existing WMP will result from the Ivanhoe Project as the operations of other existing facilities in the watershed will not be modified at all.
9.6.9.3	**Protected Areas**	Effects of the Project on the on Ivanhoe Lake Provincial Park			X				Park is 25km to the Project; no impacts anticipated
11.6.9.1		Effects of the Project on the on Northern Claybelt Forest Complex Conservation Reserve	X						The Chute facility abuts the Northern Claybelt Forest complex; however, operation of Third Falls Facility has been modified to prevent impacts
11.6.9.2		Effects of the Project on the on Nova Township Clay Plain Peatland Conservation Reserve			X				Conservation Reserve is 135m to Project at closest point; no impacts anticipated.
11.6.9.3		Effects of The Project on the on Groundhog River Provincial Park		X					Power line crosses Groundhog River
11.6.9.4		Effects of the Project on the on Vimy Lake Uplands Conservation Reserve			X				Conservation Reserve is 25m to Project at closest point; no impacts anticipated
12.6.9.1		Effects of operation of the Third Falls Facility the on Northern Claybelt Forest Complex Conservation Reserve		X					
12.6.9.2		The Nova Township Clay Plain Peatland Conservation Reserve exists 135m from a planned power line between The Chute and Third Falls and may be impacted by operations			X				
12.6.9.3		The Groundhog River Provincial Park would be crossed by a planned power line between The Chute and Third Falls		X					
Cultural Heritage Resources Considerations									
9.8.1	**Archaeological Sites**	Disturbance or destruction to significant archaeological sites associated with construction or inundation		X					Stage 1 & 2 archaeological assessments are required for Project area
9.8.1		Disturbance or destruction to significant archaeological sites along access roads		X					Stage 1 & 2 archaeological assessments are required for Project area
9.8.2	**Built Heritage Resources**	Disturbance or destruction to heritage buildings or structures		X					Cultural Heritage self-assessment screening checklist results indicate no built heritage resources near project site
9.8.3	**Cultural Heritage Landscapes**	Disturbance or destruction to prominent natural features that could have special value to people - Waterfalls		X					The Project area contains several waterfalls
9.8.3		Disturbance or destruction to prominent natural features that could have special value to people - potential culturally modified cedar trees		X					The Project area may contain culturally modified cedar trees. Assessment completed.

Social and Economic Considerations									
Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.7.1 & 12.7.1	**The Location of People, Businesses, Institutions, or Public Facilities**	No people, businesses, institutions or public facilities reside within or near to the Project Area nor are any anticipated to be affected by the operation of the Project.			X				No riparian properties or private landowners within project area.
11.7.2 & 12.7.2	**Community Character, Enjoyment of Property, or Local Amenities**	Impacts to communities, private properties, or local amenities			X				No communities or private properties exist within the Project Area. All amenities within the Project Area are recreational, and have been covered under Recreational Use.
11.7.3	**Employment**	Construction activities will support direct and indirect local employment.					X		Construction of project will involve influx of temporary workers which will require additional services such as labour, goods and services, retail, food services, and lodging.
12.7.3		Operation and management of project facilities will lead to one to two full-time positions					X		
11.7.5.3 & 14.1.3	**Public Health and/or Safety**	Forest or brush fires caused as a result of project construction		X					
11.7.5.2 & 14.1.2		Accidental spills of hazardous materials may occur during construction	X						
11.7.5.6		Worker Health and Safety concerns associated with facility construction	X						
11.7.5.4		Concerns related to production of waste in and around work site during construction	X						
11.7.5.7		Construction activities may increase levels of dust locally.		X					Dust resulting from stockpiled materials during construction
11.7.5.5		Construction activities may affect water supplies for local communities.			X				Water intake locations and water treatment plant distances are such that no impact is anticipated.
12.7.5.2 & 14.2.2		As maintenance vehicle traffic during operations will be infrequent, elevated risks of accidents during operation are not expected; however, the risk cannot be entirely eliminated.		X					

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
12.7.5.3 & 14.2.3		Accidental spill of lubricant oil, transformer oil and other hazardous substances may result in soil, surface and/or groundwater contamination during operations and maintenance		X					
12.7.5.4		Fires can occur during operation and maintenance activities when a flame is required (i.e. welding) and could potentially result in loss of vegetation and wildlife, adverse effects on surface water quality due to ash-laden runoff and corresponding effects on aquatic biota.		X					
12.7.5.6 & 14.2.6		Operations of the dams will create small quantities of hydrocarbon wastes. These wastes, if not properly handled, have the potential to affect soils, surface waters and groundwater.		X					
12.7.5.7 & 14.2.6		Damage to and safety of Foleyet in the case of dam failure or flood	X						
12.7.5.8		Methyl Mercury and Fish Consumption - Increase in mercury concentration in fish tissue as a result of inundation				X			Mercury is naturally present in soils and rocks in Ontario and is enhanced by atmospheric deposition from human sources such as the combustion of coal and some mining related operations. Inundating land with water results in the partial release of inorganic mercury accumulated in the vegetation and soils. Decomposition of flooded organic matter in soils and vegetation enhances the methylation of mercury to the bioavailable and toxic form of methyl mercury. Mercury and methyl mercury may biomagnify within the food chain and can pose a health concern to humans and wildlife through fish consumption. Mercury concentrations in fish may increase rapidly after impoundment and will decrease and stabilize in subsequent years.
11.7.6	**Local, Regional, or Provincial Economies**	Project construction may have an impact on Forestry operations in the Project Area		X					Consultation will be required with the SFL holder
11.7.6		Project Construction may have an impact on mining claims in the Project footprint		X					Consultation and investigation will be required into mining claims
12.7.6		Project operations may have an impact on mining activities or forestry operations in the project area.		X					Consultation and investigation will be required into mining claims and SFL holder
11.7.7	**Tourism Values**	Remote tourism operators may be impacted by the increased road access to the Third Falls Facility			X				There are no known economic impacts to tourism values in the Project Area.

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.7.5.5	Water Supply	Project operations may impact drinking water intakes in the Town of Foleyet			X				Water intakes for the Town of Foylet are approximately 6.4km upstream of the maximum inundation extent. No impact is expected.
11.7.5.5		Project operations may impact waste water discharge at the Town of Foylet waste water treatment plant			X				Waste water treatment plant located approx. 20km upstream of the Project, no impact expected.
12.7.5.5		The operation of a hydroelectric facility has the potential to cause problems with downstream drinking water supplies, or upstream drinking water supplies where the impoundment affects the hydrology of the drinking water intake.			X				Water intakes for the Town of Foylet are approximately 6.4km upstream of the maximum inundation extent. No impact is expected.
12.7.5.5		Wastewater discharges can be affected by Project operations if the pipes are located within a hydroelectric facility's Zone of Influence (ZOI).			X				Waste water treatment plant located approx. 20km upstream of the Project, no impact expected.
11.6.6	Aesthetic Image of the Surrounding Area	Impacts to the remote aesthetic of the project area; decreased aesthetic and intrinsic value		X					Please see Views and Aesthetics under Land and Resource Use Consideration
11.6.2.1	Other (Specify)	Site access at the Chute Project site may become restricted during construction		X					Construction activities may result in restriction of activities at the site for users at The Chute
11.6.2.2		Some parts of the Third Falls Project site may become inaccessible during construction due to safety concerns.		X					Construction activities at Third Falls may result in the area becoming inaccessible.
12.7.4		Site access to the area around The Chute may be impacted by Project operations		X					
12.7.4		Site access to the area around Third Falls may be impacted by Project operations		X					
Energy/Electricity Considerations									
11.10.1	Reliability (e.g. Voltage Support)	The Project may have an impact on local electricity reliability during construction			X				During construction the Project will not be connected to the electricity grid.
12.10.1		Operation of the Project in parallel with current electricity generating systems tied into the electrical grid will have a positive impact on overall grid reliability and availability of power especially during peak hours when consumption is highest					X		

Report Section	Criterion	Activity/Description	POTENTIAL LEVEL OF EFFECT						Comments, Rationale
			-H	-L	NIL	UNK	+L	+H	
11.10.1	**Security (e.g. Blackstart)**	The Project may have an impact on local electricity security during construction			X				During construction the Project will not be connected to the electricity grid.
12.10.1		The Project will not have black start capabilities.			X				
11.10.2	**Electricity Flow Patterns**	The Project may have an impact on Electricity Flow during construction			X				During construction the Project will not be connected to the electricity grid.
12.10.2		The Project will not be equipped with island mode capability and all power generated will be distributed externally to the electrical grid for consumption.		X					

9.0 EXISTING ENVIRONMENT

The following sections provide an overview of the baseline and current environment in the Project Study Area which was used to assess the potential impacts as determined in the Potential Effects Matrix (Table 12) and to assess the significance of those impacts, as discussed in Sections 11 and 12.

9.1 Geology, Topography and Terrain

A geomorphic assessment was conducted on the Ivanhoe River in order to define existing geology, topography and terrain conditions. The complete report, *Ivanhoe River Hydroelectric Projects The Chute Hydroelectric Generating Station and Third Falls Hydroelectric Generating Station Geomorphic Assessments,* (or "Geomorphic Assessment") prepared by Parish Geomorphic (May 2013) is included in Appendix E of this Report. During the fieldwork, the focus reaches were canoed or walked and channel conditions and dominant processes were documented. Additionally, channel geometries and sediment conditions were measured in detail at sites along the reach. The detailed sites were chosen to coincide with previously surveyed cross-sections used in the HEC-RAS model (hydraulic model, see Appendix F) along with additional cross sections and sediment measurements at significant features.

The following sections describe the existing geology, topography and terrain of the Project Area which provide a baseline to determine construction and operational impacts.

9.1.1 Bedrock Geology

The Study Area is located within the Superior Province of the Canadian Shield. The riverbed along the entire study reach appears to be primarily fine material, with sections of exposed or thinly veiled bedrock, and bedrock and boulders in the rapid sections. The bedrock sections at both facilities control the energy grade, leaving long stretches of relatively flat water upstream, and where exposed, forms shorter sections of rapid, turbulent, and steep channel. It was determined that the bedrock is stable (Parish 2013).

9.1.1.1 The Chute

Bedrock at The Chute Facility site consists of paragneiss, migmatites and undifferentiated metasedimentary rocks. West of the Project Area, ~250 m at the closest proximity to the Facility, the bedrock is a gneissic tonalite suite, with foliated to gneissic tonalite to granodiorite. Approximately 800 m east of the Facility the bedrock is massive granodiorite to granite in composition. Three mafic dikes (one belonging to the Sudbury dike swarm (~1235-1238 Ma) and two of unknown association) are found near the Facility; one is ~500 m north, one is ~500 m south, and the last is ~800 m northwest of The Chute.

The proposed The Chute dam site is located within a rapid formed where the river has cut into bedrock. Along the channel, the rock obstructs flow, forming backwater or 'dead waters' upstream and a steep, bedrock/boulder rapid downstream. Bedrock appears to be relatively shallow in the area (NRSI 2014).

9.1.1.1.1 The Chute Bedload

The riverbed along The Chute Study Area consists of sands and cobbles/boulders and bedrock. The rapids sections are primarily bedrock and boulders. Although this larger material is also exposed upstream, large sections of the channel in these areas are also covered with silt and sand (NRSI 2014). The fine material tends to accumulate in the backwater areas upstream of rapids, and in local areas of flow separation (i.e., eddies, point bars). The median grain size for the sampled sections was approximately 0.5mm (medium sand). As discussed in the Geomorphic Assessment (Parish 2013) found in Appendix E, the general pattern of the bed material has coarse material and bedrock dominating the steep section and finer material dominating the rest of the area, especially at the downstream reach of the Project (Parish 2013).

9.1.1.2 Third Falls

The bedrock immediately surrounding the Third Falls Facility (approximately 1 km radius) consists of metamorphosed mafic intrusive rocks including gabbro and peridotite. Outwards from the immediate area the bedrock also includes metamorphosed volcanic and sedimentary rocks. The entire region is part of the Superior Province of the Canadian Shield. According to geological mapping, a minor fault is interpreted to extend across the Third Falls site. Details about the timing and extent of movement along the fault are not available; however given the geological stability of the Canadian Shield, the fault is likely inactive.

The Third Falls dam site is along a bedrock rapid. Similar to The Chute, bedrock is at or close to the surface, and the channel through the Third Falls inundation area is broken up by short reaches of exposed bedrock (NRSI 2014).

9.1.1.2.1 Third Falls Bedload

The riverbed along the Third Falls inundation area consists primarily of sands, cobbles/boulders and bedrock. The rapids sections are primarily bedrock and boulders, except for accumulations in flow separation zones between the falls. Sand accumulates in the back-water areas upstream of rapids, and in local areas of flow separation (i.e., eddies, point bars). As at The Chute, the median grain size sampled was approximately 0.5mm (medium sand) (Parish 2013). The general pattern of the bed material has coarse material and bedrock dominating the steep falls sections and finer material dominating the channel up in the headpond river reach and downstream of the falls (Parish 2013).

9.1.2 Surficial Geology

The Ivanhoe River watershed lies in the Cochrane and Sudbury Districts, between Halsey Township and the river's confluence with the Groundhog River. The surface geology of the area has largely been dominated by glacial processes, and includes areas of exposed metamorphic bedrock, glacial lake outwash, till deposits, and more recent wetland deposits (marl, peat, etc.) (Parish 2013). Engineering Terrain maps in the *Ivanhoe River Hydroelectric Projects*, *The Chute Hydroelectric Generating Station* and *Third Falls Hydroelectric Generating Station Geomorphic Assessments* (or "Geomorphic Assessment") (Parish 2013*)* report (Figures 2.2 and 2.3) found in Appendix E show the generalized geomorphology surrounding the Facility sites.

9.1.2.1 The Chute

The region upstream of the proposed Facility at The Chute is primarily a low relief terrain composed of silty alluvial material flanked by sandy glaciofluvial deposits (e.g., glacial delta and eskers) to the west and moraine deposits to the east. Immediately downstream (north), glaciofluvial deposits dominate both sides of the river. Within the valley near The Chute site, the site appears to be located in a section dominated by sandy glacial fluvial material (Parish 2013).

9.1.2.2 Third Falls

The surficial geology surrounding Third Falls consists of organic peat/muck and clay and silt of a glaciolacustrine plain, with some low outcrops of bedrock. The area has low local relief with mixed wet and dry drainage. Approximately 300 m directly east of Third Falls is an esker complex consisting of silt and gravel – forming an area of moderate local relief and dry drainage (Parish 2013).

At Third Falls, sandy glacial lake and alluvial plain deposits dominate the upstream topography, with increasing peaty organic deposits located towards the site. The organic terrain continues downstream, although an esker deposit crosses the channel well below the site. Immediately downstream (north) of the proposed dam site, glaciofluvial deposits dominate both sides of the river (Parish 2013).

9.1.3 Landslide Hazard

The baseline condition for landslide hazard was assessed in two steps. A GIS review of terrain, relief and grades was carried out within the area proposed for headpond inundation (Appendix E, ORTECH, June 2011). In the second step, a geomorphic assessment was completed to assess the stability of the river channel and possible impacts on nearby terrain slopes (Appendix E, Parish 2013) identified in the GIS review.

The GIS study identified localized areas of steeper slopes within the proposed headpond inundation area upstream of The Chute (i.e. 1.9 km upstream of the proposed dam) and in the proposed

headpond inundation area immediately upstream of Third Falls (i.e. within 5.5 km upstream that is out of channel, it was determined that the areas with higher potential fell within 1 km of the Third Falls). Other areas of steep slopes were identified in the surrounding terrain but none that fall within the proposed headpond inundation areas.

The results of the slope analysis were combined with aerial photo coverage of the area of interest and provided to the geomorphic consultant for field verification. Both areas were subsequently visited and assessed as part of the geomorphic assessment of the river.

The geomorphology study used the Rapid Geomorphic Assessment (RGA) as designed by the Ontario Ministry of Environment (2003) to assess stream channel stability. The RGA evaluates adjustment processes on the river segment such as degradation, aggradation, and widening. The RGA documents the current adjustment processes occurring in a segment to determine the stage of channel evolution from the current and historic adjustment processes observed. Ultimately, the RGA develops an overall condition score and sensitivity rating for the river segment. The more stable the river regime, the less potential for mudslides or landslides (Parish 2013).

Throughout the Project Study Area, very few signs of channel instability were observed during the field reconnaissance, and the RGA values suggest the channel is “in regime” or stable. The few eroding banks or lateral bars observed along the reach were localized, and not always directly related to channel dynamics (Parish 2013).

The Geomorphic Assessment located in Appendix E concluded that except for localized issues, the banks appeared to be stable. The bank angles at Third Falls are moderately high (2 to 1) and are estimated at 3.3:1 along The Chute reach. There were also a few notable slope failures along the study reach, which appeared to be related to geotechnical issues as opposed to hydraulic issues. There were no geomorphic concerns identified in the Study Area that could lead to channel obstruction, flooding or other public hazards due to existing conditions (Parish 2013).

9.1.3.1 The Chute

From the Geomorphic Assessment carried out in the river (Appendix E), the RGA surveys conducted along the Ivanhoe River in the area of The Chute suggests the channel throughout the Study Area is stable (Parish 2013). The main adjustment processes along the river, according to the RGAs, was widening, followed by degradation. Neither process is very active. The bedrock channel is likely natural and not a symptom of instability, the exposed bedrock implies sediment-limited conditions (Parish 2013).

9.1.3.2 Third Falls

The RGA surveys conducted along the Ivanhoe River at Third Falls suggests the channel throughout the Study Area is stable. The main adjustment process along the river, according to the RGAs, was widening. River widening has occurred downstream of pinch points where bedrock outcrops occur in the river bed and constrain the flow. Water velocities in the pinch points are increased causing localized scour to occur along the river banks immediately downstream. Within the proposed inundation area, widening is evident immediately upstream of the proposed dam site (between the first and second falls) and immediately downstream of the proposed dam site (between the second and third falls, and immediately downstream of the third falls). The widening at these locations is well established and not active (Parish 2013). The baseline conditions in these areas of interest were assessed to provide a reference for future monitoring.

9.1.4 Erosion, Soils & Sedimentation

Soil quality and soil quantity are important biological aspects that support wildlife and vegetation communities. Soil quality refers to the characteristics (physical and chemical) of the soil that support biological life while soil quantity refers to the amount of soil within a specific area. Soil quality and soil quantity are impacted by **erosion, sedimentation**, **soil compaction** and **soil contamination**. Erosion and sedimentation also occur naturally while soil compaction and soil contamination are generally only human induced (Parish 2013).

Erosion is the removal of soil, sediment and rock fragments from the landscape. Sedimentation is the deposition of the eroded material. The potential for in-channel erosion and sediment transport is determined by the energy level in the river and the transportability of the underlying sediment. Fine sediment is typically easier to transport than coarser sediment and is more likely to occur at bankfull flows. Factors that impact deposition include particle size and velocity of the river (Parish 2013).

Erosion and sedimentation are naturally occurring processes; therefore existing levels of erosion and sedimentation are needed to determine construction and operation related impacts to those processes. The following section describes the existing energy levels in the river; sediment type; bankfull river characteristics; and discussion of the land to be inundated for the facilities and Study Area (Parish 2013).

During the data collection process, bank conditions were noted, including general vegetation cover, sediment conditions, notable erosion scars, and other indicators of bank instability. Mature vegetation lined both sides of the Ivanhoe River, and rapids sections were protected by boulders and bedrock. In the longer, backwater reaches, energy gradients were generally very small and bank angles were moderate (2.5:1) with consistent channel dimensions, indicating that little hydraulic bank erosion

activity is likely occurring. At least one hillslope failure was observed along the valley wall, but it appeared to be linked to hillslope activity, as opposed to channel adjustment (Parish 2013).

9.1.4.1 The Chute

Detailed cross-section data were collected across the channel at sites up- and downstream of the proposed dam location. For The Chute cross-sections, measured bankfull channel widths averaged 75m. Mean average depth was 2.4m and mean maximum depth was 4.1m.

The bankfull discharge was estimated at 255 m^3/s at The Chute site which is somewhat greater than the estimate of the two year return period flow for this section of the Ivanhoe River (~200 to 250cms),. This is likely due to the slow water conditions which partly define the reach and/or errors in measuring such small energy gradients. Mean average bankfull velocities were 0.8m/s (Parish 2013).

9.1.4.2 Third Falls

At Third Falls, bankfull widths ranged from 47m to 59m. Mean average bankfull channel depths were 4.2m with maximum depths between 7m and 8.5m. The measured gradients at the detailed sites were low (0.05%). The collected cross-section data provided consistent flow results. The bankfull discharge was estimated at 280 m^3/s for the Third Falls sites which is greater than the estimates of the two year return period flow for these sections of the Ivanhoe River (~200 to 250cms). This is likely due to the slow water conditions which partly define both reaches and/or errors in measuring such small energy gradients (Parish 2013).

9.2 Surface Water & Groundwater

9.2.1 Surface Water Hydrology

9.2.1.1 Introduction

Hatch Ltd., conducted a hydrology study for both facilities in 2009, based on the available hydrology data at the time. The hydrology study was updated in 2011 with additional analyses as required by MOE Draft Permit To Take Water (PTTW) guidelines issued in December 2010. The reports are:

- Hydrology Review for Ivanhoe River Hydropower Sites (Appendix F, Hatch, 2009)
- The Chutes Hydro Project EA Hydrology Memo (Appendix F, Hatch, 2011a)
- Three Falls Hydro Project EA Hydrology Memo (Appendix F, Hatch, 2011b)

A summary of these hydrology studies is presented in this section to introduce watershed, hydrometric stations in the region, and hydrological metrics for the existing conditions at both facilities.

9.2.1.2 Watershed and Hydrometric Stations

The Ivanhoe River is located within MNR's Cochrane and Sudbury Districts in Northeastern Ontario. The river is a tributary of the Groundhog River comprising part of the larger James Bay drainage basin.

The Ivanhoe River flows north, with a drainage area of 2723 km^2 at The Chute Facility. Figure 1 of Appendix F (Hatch, 2011a) shows details of the sub-basins draining to The Chutes. Downstream of the Chute the Third Falls Facility has a drainage area of 3242 km^2 Figure 1 of Appendix F (Hatch, 2011b) shows details of the sub-basins draining to The Third Falls Facility.

Based on the desktop review and agency consultation, three (3) Water Survey of Canada (WSC) hydrometric stations and available hydrology data were identified in the region. The existing hydrometric stations in the region are presented in Figures 2 in the above Hydrology Memos.

9.2.1.3 Long Term Daily Flow Synthesis

The best available hydrology data during the Hydrology Review (2009) was collected from a Water Survey of Canada (WSC) hydrometric station (04LC003) on the Ivanhoe River at Foleyet from 2001 to 2006. A minimum of 20 years of hydrological data is generally considered adequate to statistically define existing conditions. For this reason, the following flow records in the region were been reviewed to synthesize the long term daily flows at the two facilities.

- 04LC003 Ivanhoe River at Foleyet from 2001 to 2006
- 04LD001 Groundhog River at Fauquier from 1920 to 1995
- 04LC001 Groundhog River below Horwood Lake from 1933 to 1961

The Groundhog River at Fauquier station (04LD001) includes the regulation effects of Horwood Lake. Further flow assessment including regional run off and seasonal flow patterns analysis was conducted to match the flow patterns from 2001 to 2006 at 04LC003 and synthesize a 24-year flow series at 04LC003 (Appendix F, Hatch, 2009).

In 2011, an additional 3 years of data at 04LC003 was included in the new long term daily flow synthesis (Appendix F, Hatch, 2011a, Hatch, 2011b).

- 04LC003 Ivanhoe River at Foleyet from 2007 to 2009

Descriptive flow statistics for the Ivanhoe River at both two facilities have been prepared using the Streamflow Analysis and Assessment Software (SAAS) from the Ontario Ministry of Natural Resources (MNR). The descriptive flow statistics using the synthesized flow series for the period of record are summarized in 0 below.

Table 13: Descriptive Mean Daily Flow Statistics for The Chute and Third Falls

Parameter	The Chute Facility		The Third Falls Facility	
	Value (m^3/s)	Date of Occurrence	Value (m^3/s)	Date of Occurrence
Mean Flow	29.7		35.7	
Median Flow	18.9		22.7	
Minimum Flow	1.71	09/04/1975	2.06	09/04/1975
Maximum Flow	293	05/12/1979	356	05/12/1979
Flow Exceeded 20% time	38		45.7	
Flow Exceeded 80% time	10.5		12.6	

The superimposed daily hydrographs at The Chute Facility is shown in Figure 3 of Appendix F (Hatch, 2011a). The superimposed daily hydrographs at The Third Falls Facility is shown in Figure 3 of Appendix F (Hatch, 2011b).

Water flows typically remain low in winter from January to March before they start increasing with the spring freshet. In spring from April to June, water flows typically increase in early April and peak in early May, and decrease in June. In summer from July to September, water flows remain low. In fall from October to December, water flows increase in early October due to fall precipitation events, remaining a relatively high through November and December, and decreasing in late December.

9.2.2 Water Levels, Flows & Movement

Surface water levels within the Study Area are a function of flow rate and channel characteristics such as width and depth.

Canadian Project Limited was commissioned by the proponent to conduct the following two hydraulic modeling studies under various flow conditions for The Chute and Third Falls in 2013.

- Ivanhoe River Site #13 – The Chutes HEC-RAS Modelling Hydraulic Report Supplement, (2013) (Appendix F, CPL, 2013b)
- Ivanhoe River Site #14 – Third Falls HEC-RAS Modelling Hydraulic Report Supplement (Appendix F, CPL, 2013d)

The Hydraulic Engineering Center River Analysis System (HEC-RAS) models were used to predict the pre-project and post-project water levels and flows, after they were calibrated by field survey and LiDAR measurements of water levels. Based on the pre-project modelling results, water levels at project locations between the LTAF and 1:2 year flood flow vary by a range of 0.25 m to 4 m, and an average of 1.9m.

Surface water flows and movement, in addition to Section 9.2.1 are described by NRSI in the report entitled "*Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report", 2013 and briefly restated below:*

- The Ivanhoe River originates from drainage of a series of kettle lakes and feeder tributaries such as Wright Creek, Kinogoma River and Biggs Creek, and flows northward into Ivanhoe Lake. Ivanhoe Lake is long and sinuous, and is located approximately 8km southwest of the community of Foleyet. A concrete dam, currently owned and operated by Chapleau District MNR, regulates water levels in the system and is operated as required under the conditions of the Mattagami River Water Management Plan.
- Downstream of Ivanhoe Lake, the Ivanhoe River is generally low gradient and meandering with short stretches of fast water features such as riffles. The drainage area of the Ivanhoe River is 2,723km^2 (MNR 2010b). The river channel is contained within a well-defined, narrow flood plain. Minor drainages such as Heart Creek and Biting Creek join the Ivanhoe River before the confluence of the Shawmere River approximately 32km downstream of Ivanhoe Lake. Downstream of the Shawmere River confluence, only four additional, unnamed drainages from kettle lakes and muskegs outlet to the Ivanhoe River prior to reaching the proposed Chute Hydroelectric Site approximately 8km downstream. The Ivanhoe River continues northward to join the Groundhog River which flows for approximately 145km before joining with the Mattagami River. The Mattagami River is joined by the Kapuskasing River approximately 12km downstream and continues to flow northward where it contributes its flow to the Moose River and ultimately continues to James Bay.

A discussion on groundwater levels, flows and movement is provided in Section 9.2.5 Groundwater Quantity and Quality.

9.2.3 Surface Water Quality

In 2010, water quality baseline monitoring studies during two seasons (spring and summer) were conducted by WESA Inc. in the Study Area. In 2012 and 2013, water quality baseline monitoring during the three open-water seasons (spring, summer and fall) were conducted by Hutchinson Environmental Sciences Ltd. (Hutchinson).

Due to the following two reasons, the water quality baseline monitoring results in 2012 and 2013 are more representative than the results in 2010 to indicate the local water quality baseline. The monitoring results in 2010 were included in this section for the integrity analysis of historical monitoring data.

- The water quality baseline monitoring in 2012 and 2013 was conducted by Hutchinson, according to the recommendations in the Ontario Ministry of the Environment (MOE) document titled "*From Class EA to Permit to Take Water: A Guide to Understanding the Ministry of the Environment's Technical Requirements for Waterpower (Draft - January, 2012)* " (MOE Guidelines, 2012).
- A minimum one duplicate or replicate was collected and analyzed for each sample in 2012 and 2013 to measure variability in flowing water at the sample location, and provide quality assurance for field sampling and laboratory analytical methods.

The detailed water quality sampling locations and dates, sample numbers, analyzed parameters, sampling method, field sampling records, original laboratory analytical reports, and laboratory certificates are included in the following water quality monitoring reports.

- *2010 Surface Water Quality Monitoring Program: Ivanhoe (The Chute),*WESA Inc., 2011 (Appendix G, WESA, 2011a).
- *2010 Surface Water Quality Monitoring Program: Ivanhoe (Third Falls),*WESA Inc., 2011 (Appendix G, WESA, 2011b).
- *2012 & 2013 Pre-development Water Quality and Fish Tissue Mercury*, Hutchinson Environmental Sciences Ltd, 2013 (Appendix G, Hutchinson, 2013).

A summary of the water quality monitoring program and baseline assessment of water quality monitoring results are provided below.

9.2.3.1 Water Quality Baseline Monitoring Program

9.2.3.1.1 Sampling Location

In 2010, Xeneca commissioned WESA Inc. (WESA) to conduct a surface water quality baseline monitoring study at four (4) sampling locations in the Study Area during two (2) seasons (spring and summer).

In 2012 and 2013, Xeneca commissioned Hutchinson Environmental Sciences Ltd. (Hutchinson) to conduct a surface water quality monitoring program at two (2) sampling locations in the Study Area during three (3) seasons (spring, summer and fall), according to the recommendations in the MOE Guide 2012 (*Class EA to Permit to Take Water: A Guide to Understanding the Ministry of the Environment's Technical Requirements for Waterpower* (Draft - January, 2012)).

With reference to the coordinates of locations in Table 1 (Appendix G, WESA 2011a and WESA, 2011b) and description of locations (Hutchinson, 2013), the water sampling locations are summarized in 0 below, and shown in Figures 25 and 26.

Table 14: Water Sampling Locations

Sampling Locations	Sampling Year	Coordinates or Description of Locations
SW1 near The Chute [a]	2010	E391050 N5359300
SW3 near The Chute [a]	2010	E392552 N5361025
SW1' near the Third Falls [b]	2010	E392552 N5361025
SW3' near the Third Falls [b]	2010	E392552 N5361025
The Chute baseline [c]	2012 & 2013	Approximately 1.3 km upstream of The Chute
Third Fall baseline [c]	2012 & 2013	Approximately 8 km upstream of The Third Falls

Source: [a] Table 1 (WESA, 2011a) in Appendix G.
[b] Table 1 (WESA, 2011b) in Appendix G.
[c] Section 5.1.2 (Hutchinson, 2013) in Appendix G.

9.2.3.1.2 Sampling Date and Number

With reference of Table 2 and 3 (WESA, 2011a, WESA, 2011b), and Table 3 to 9 (Hutchinson, 2013) in Appendix G, the water sampling dates and number in 2010, 2012 and 2013 are summarized in 0 below.

Table 15: Water Sampling Dates and Number in 2010, 2012 and 2013

Sampling Locations	Year	Spring freshet		Summer low flow		Fall increasing flow	
		Sample Date	Sample Number	Sample Date	Sample Number	Sample Date	Sample Number
SW1 near The Chute	2010	May-27	1	Jul-21	1	-	-
SW3 near The Chute	2010	May-27	2[a]	Jul-21	2[a]	-	-
SW1' near the Third Falls	2010	May-28	1	Jul-23	1	-	-
Sampling	**Year**	**Spring freshet**		**Summer low flow**		**Fall increasing flow**	

Locations		Sample Date	Sample Number	Sample Date	Sample Number	Sample Date	Sample Number
SW3' near the Third Falls	2010	May-28	1	Jul-23	1	-	-
The Chute baseline	2012	16-Apr	2[b]	20-Aug	2[b]	03-Nov	2[b]
	2013	17-May	2[b]	10-Sep	2[b]	06-Nov	2[b]
Third Fall baseline	2012	15-Apr	2[b]	18-Aug	3[c]	03-Nov	3[c]
	2013	16-May	2[b]	13-Sep	2[b]	06-Nov	2[b]

Note: [a] It includes one (1) duplicate sample.
[b] It includes one (1) duplicate sample collected at the same location approximately 10 minutes after the initial sample to assess spatial and temporal variance of the flowing river.
[c] It includes one (1) duplicate sample and one (1) replicate sample.

9.2.3.1.3 Field Sampling and Measurement

The field measurement results at each sampling location were recorded after the instruments were calibrated in the field every day. The field measurement parameters and instruments are summarized in 0 below.

Table 16: Field Measurement Parameters and Instruments

Parameter	Field Measurement Instruments in 2010	Field Measurement Instruments in 2012 and 2013
pH	YSI 556 multi-probe meter	YSI model 650 TDS multi-meter
conductivity	YSI 556 multi-probe meter	YSI model 650 TDS multi-meter
temperature	YSI 556 multi-probe meter	YSI model 650 TDS multi-meter
dissolved oxygen	YSI 556 multi-probe meter	YSI model 650 TDS multi-meter
Iron (Ferrous)	Iron (Ferrous) HACH kit	
Turbidity		LaMotte 2020WE turbidity meter

9.2.3.1.4 Laboratory Analysis Parameters

In 2010, a total of ten (10) water samples, which include eight (8) water samples and two (2) duplicate water samples, were submitted to Testmark Laboratories Ltd. (Testmark) of Garson, Ontario, a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory for laboratory analysis.

In 2012 and 2013, a total of twenty six (26) water samples, which include twelve (12) water samples, twelve (12) duplicate water samples and two (2) replicate samples, were submitted to ALS Environmental, a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory for laboratory analysis.

The analysis parameters in 2010, 2012 and 2013 are summarized in 0 below.

Table 17: Parameters analyzed by CALA accredited laboratories in 2010, 2012 and 2013

Category	Parameters analyzed by Testmark in 2010	Parameters analyzed by ALS in 2012 and 2013
Physical parameters	pH	pH, conductivity
Anions	Sulphate Chloride Total Alkalinity Phosphate	Sulphate Chloride Total Alkalinity
Nutrients	Nitrate-N Nitrite-N Total Ammonia (as N) Total Kjeldahl Nitrogen Total Phosphorus	Nitrate-N Nitrite-N Total Ammonia (as N) Total Kjeldahl Nitrogen Total Phosphorus
Suspended and Dissolved Solids	TSS, TDS	TSS, TDS
Organic Carbon	None	Dissolved Organic Carbon
Metals	31 common metals	31 common metals
Mercury and methyl-mercury	Mercury	Mercury and methyl-mercury
Dissolved Oxygen	-	Dissolved Oxygen[1]
Water Temperature	-	Water Temperature[1]

Note: [1] field measurement results

In addition, a total of twenty six (26) water samples, which include twelve (12) water samples, twelve (12) duplicate water samples and two (2) replicate samples, were submitted to Flett Research Ltd., a CALA accredited laboratory, for the analysis of low level methyl-mercury and mercury during three (3) seasons (spring, summer and fall) in 2012 and 2013.

9.2.3.2 Water Quality Monitoring Results

The 2010 field measurement results of pH, conductivity, temperature, dissolved oxygen and Iron (Ferrous) are provided in Table 2 in *Surface Water Quality Monitoring Program: Ivanhoe (The Chute) Ontario* (Appendix G, WESA, 2011a) and Table 2 in the *Surface Water Quality Monitoring Program: Ivanhoe (The Third Falls), Ontario* (Appendix G, WESA, 2011b).

The 2012 and 2013 field measurement results of pH, conductivity, temperature, dissolved oxygen and turbidity given in Table 4 and Table 5 in the *2012 & 2013 Pre-development Water Quality and Fish Tissue Mercury Report* (Appendix G, Hutchinson, 2013).

The Testmark laboratory analysis results at two (2) water sampling locations for The Chute in the Study Area are summarized in Table 2 (Appendix G, WESA, 2011a).

The Testmark laboratory analysis results at two (2) water sampling locations for The Third Falls in the Study Area are provided in Table 2 (Appendix G, WESA, 2011b). The original field sampling records and analytical reports for both two facilities are also included.

The ALS laboratory analysis results at two (2) water sampling locations in the Study Area for both two facilities are summarized in Table 4 to Table 9 (Appendix G, Hutchinson, 2013). The original field sampling records and analytical reports for both two facilities are also included.

To understand the water quality baseline at various sampling locations during different flow seasons, a water quality baseline assessment of water quality monitoring results by parameter is summarized below.

9.2.3.2.1 Physical Parameters

pH

The pH value is the negative common logarithm of the hydrogen ion activity. Corrosion effects may become significant below pH 6.5, and the frequency of incrustation and scaling problems may be increased above pH 8.5 (Health Canada, 1995). The Provincial Water Quality Objective (PWQO) is pH 6.5-8.5.

In 2010, a total of twelve (12) pH values at four (4) sampling locations during two (2) seasons were included in the Testmark Analytical Report, which included eight (8) pH values for eight (8) water samples and two (2) pH values for two (2) duplicate samples. The laboratory pH values ranged from 7.72 to 8.08. The pH values of all these water samples met the PWQO.

In 2012 and 2013, twelve (12) field pH measures results were provided for two (2) sampling locations during three (3) seasons, which were generally close to the laboratory analysis results, except the maximum pH value (8.52) recorded at the Chute sampling location during the spring freshet on 17 May 2013. This result was the only field measurement which didn't comply with the PWQO .The reason for the exceedance of this field pH measurement is likely related to the field equipment, rather than an actual exceedance.

In 2012 and 2013, a total of twenty six (26) pH values at two (2) sampling locations during three (3) seasons were provided in the ALS Analytical Report. The laboratory pH values were consistent at two sampling locations, ranging from 7.76 to 7.87 during spring freshet season, 7.78 to 8.05 during summer low flow season, and 7.79 to 7.89 during fall under increasing flows. The pH values of all these water samples met the PWQO) The duplicate ample results for quality control were undertaken in their laboratory. The laboratory analysis results are considered to be more reliable to use as of local baseline levels than the field measurement pH values.

Conductivity

There is no PWQO for conductivity.

In 2010, no laboratory conductivity results were given in the Testmark Analytical Reports.

In 2012 and 2013, there were twenty six (26) laboratory conductivity results at two (2) sampling locations during three (3) seasons. The sample results at the two (2) sampling locations ranged from 92.9 to 117 µs/cm during spring freshet, 116 to 169 µs/cm during summer low flow and 115 to 131 µs/cm during the fall under increasing flows.

9.2.3.2.2 Anions

Sulphate

There is no PWQO standard for sulphate.

In 2010, a total of ten (10) Sulphate results are provided in the Testmark Analytical Reports. All sample results ranged from 1.3 to 2.2 mg/L.

In 2012 and 2013, a total of twenty six (26) sulphate results are provided in the ALS Analytical Reports. All sample results were consistent, ranging from 2.3 to 2.9 mg/L.

Chloride

Chloride is widely distributed in nature, generally as the sodium (NaCl) and potassium (KCl) salts. Chloride is generally present at low concentrations in natural surface waters in Canada. There is no PWQO for Chloride.

In 2010, a total of ten (10) Chloride results are provided in the Testmark Analytical Reports. All sample results, ranging from 0.95 to 1.6 mg/L.

In 2012 and 2013, a total of twenty six (26) Chloride results were given in the ALS Analytical Reports. All sample results were below the detection limit (2 mg/L).

Alkalinity, Total (as $CaCO_3$)

In accordance with PWQO, Alkalinity should not be decreased by more than 25% of the natural concentration expressed as $CaCO_3$. The pre-development monitoring establishes a temporal natural reference.

In 2010, a total of ten (10) Alkalinity results were given in the Testmark Analytical Reports, ranging from 80.2 to 88.9 mg/L.

In 2012 and 2013, a total of twenty six (26) Alkalinity results are provided in the ALS Analytical Reports. The results ranged from 49 to 52 mg/L during spring freshet, 59 to 84 mg/L during summer low flow, and 57 to 69 mg/L during fall.

9.3.2.3.3 Nutrients

Nitrate-N and Nitrite-N

Nitrate (NO_3^-) and nitrite (NO_2^-) are naturally occurring ions that are ubiquitous in the environment (Health Canada, 1992). There are no PWQO's for Nitrate-N and Nitrite-N.

In 2010, neither of these two ions was measured above the detection limit at four (4) locations during two seasons.

In 2012 and 2013, a total of twenty six (26) results are provided in the ALS Analytical Reports. All results were below the detection limit (0.1 mg/L).

Ammonia

The Provincial Water Quality Objective (PWQO) for ammonia is 20 mg/L.

Ammonia is present in most waters as a result of the biological degradation of nitrogenous organic matter, although it may also reach groundwater and surface waters from industrial waste discharges (Health Canada, 1987).

In 2010, no ammonia results were given in the Testmark Analytical Reports.

In 2012 and 2013, there were twenty six (26) sample results for ammonia at two (2) sampling locations during three (3) seasons. Ammonia was detected in three samples (laboratory detection limit = 0.5 mg/L) ranging from 0.057 to 0.098 mg/L; ammonia was not detected in any other samples. All measured concentrations were well below the PWQO.

Total Kjeldahl Nitrogen (TKN)

Total Kjeldahl Nitrogen (TKN) is the total amount of organic and ammonia nitrogen in the sample. There is no PWQO for TKN.

In 2010, a total of ten (10) TKN concentrations were reported in the Testmark Analytical Reports, all of which were less than 1 mg/L.

In 2012 and 2013, there were twenty six (26) sample results for TKN at two (2) sampling locations during three (3) seasons. The sample results ranged from 0.40 to 0.83 mg/L during spring freshet, 0.41 to 0.60 mg/L during summer low flow and 0.44 to 0.56 mg/L during fall.

Total Phosphorus

The Interim PWQO states that average total phosphorus concentrations for the ice-free period should not exceed 20 µg/L, to avoid nuisance concentrations of algae in lakes.

In 2010, a total of ten (10) Total Phosphorus results were given in the Testmark Analytical Reports, ranging from 2.7 to 17 µg/L, which all were below the Interim PWQO of 20 µg/L

In 2012 and 2013, a total of twenty six (26) sample results were given in the ALS Analytical Reports. Two pairs of results, ranging from 21.8 to 23.5 µg/L at the two sampling location during spring freshet on 16 and 17 May 2013, exceeded the Interim PWQO. The other 22 results were well below the Interim PWQO.

9.2.3.3.4 Total Dissolved and Suspended Solids

Total Dissolved Solids (TDS)

Total dissolved solids (TDS) comprise inorganic salts and small amounts of organic matter that are dissolved in water (Health Canada, 1991). There is no applicable PWQO.

In 2010, a total of ten (10) sample results were given in the Testmark Analytical Reports, ranging from 110 to 210 mg/L.

In 2012 and 2013, a total of twenty six (26) sample results were given in the ALS Analytical Reports. The results at the two sampling locations ranged from 68 to 98 mg/L during spring freshet, 110 to 122 mg/L during summer low flow and 95 to 120 mg/L during fall.

Total Suspended Solids (TSS)

There is no PWQO for Total Suspended Solids (TSS).

In 2010, a total of ten (10) TSS sample results were given in the Testmark Analytical Reports, ranging from <0.4 to 8.7 mg/L.

In 2012 and 2013, a total of twenty six (26) TSS sample results were given in the ALS Analytical Reports. The TSS concentrations were below the detection limit (3 mg/L), in all samples except sampels at The Third Falls and The Chute on 16 and 17 May 2013 when concentrations ranged from 25.6 to 39.2 mg/L.

9.2.3.3.5 Metals

In 2010, a total of ten (10) sample results are provided in the Testmark Analytical Reports. In 2012 and 2013, a total of 26 sample results were provided in the ALS Analytical Reports.

Sixteen analyzed metals had concentrations below the analytical detection limit, ten were found above the detection limits but below the respective PWQOs and five metals had concentrations above the PWQO. Results for these five metals are summarized in 0 below.

Table 18: Summary of Laboratory Results for Metals above the PWQO

No.	Parameter	PWQO (MOE, 1999) (mg/L)	Laboratory Results in 2010 (mg/L)	Laboratory Results in 2012 and 2013 (mg/L)
1	Aluminum (Al)	0.075	0.0057 to 0.0542	0.017 to **0.285**
2	Copper (Cu)	0.005	<0.0010-**0.0336**	<0.0010-0.0011
3	Iron (Fe)	0.3	0.048-0.120	0.069-**0.362**
4	Lead (Pb)	0.001	<0.0010-**0.0019**	<0.0010
5	Zinc (Zn)	0.030	<0.0010-**0.636**	<0.0030-0.0048

<u>Copper (Cu), Lead (Pb) and Zinc (Zn) in 2010</u>

- One (1) sample collected at the SW1' location (see 0 above for location description) for the Third Falls on 23 July 2010 contained a Cu concentration of **0.0336** mg/L, which exceeded the PWQO (0.005 mg/L). No duplicate sample result was given to check the sampling and analytical variance.
- One (1) sample collected at the SW1' location for the Third Falls on 23 July 2010 contained a Pb concentration of **0.0019** mg/L, which exceeded the PWQO (0.001 mg/L). No duplicate sample result was given to check the sampling and analytical variance.
- One (1) Zn concentration of **0.6360** mg/L exceeded the PWQO (0.001 mg/L) in the sample collected at the SW3' location for Third Falls on 28 May 2010. No duplicate sample result was given to check the sampling and analytical variance.

- One (1) Zn concentration of **0.0626** mg/L exceeded the PWQO (0.001 mg/L) in the sample collected at the SW3' location for Third Falls on 23 July 2010. The duplicate sample result was **0.2190** mg/L for the sample run.

Aluminum and Iron in 2012 and 2013

- Two (2) aluminum concentrations sampled at The Chute baseline location on May 17th, 2013, exceeded the PWQO of 0.075 mg/L at **0.267** to **0.285** mg/L, respectively.
- Two (2) aluminum concentrations sampled at The Third Falls baseline location on May 16th, 2013, exceeded the PWQO of 0.075 mg/L at **0.218** to **0.236** mg/L, respectively.
- One (1) iron concentration of **0.310** mg/L exceeded the PWQO (0.3 mg/L) in the sample collected at The Third Falls baseline location on May 16th, 2013.
- Two (2) iron concentrations sampled at The Chute baseline location on May 17th, 2013 were **0.344** and **0.362** mg/L respectively, which exceeded the PWQO (0.3 mg/L).

The exceedences of the PWQO standards for aluminum and iron in 2012 and 2013 were probably a result of elevated suspended sediment in spring runoff.

9.2.3.3.6 Mercury

Total Mercury

A total of 12 mercury samples were taken with results ranging from 0.96 to 5.32 ng/L, well below the PWQO of 200 ng/L.

Methyl mercury

There is no PWQO for methyl mercury.

A total of 12 methyl mercury samples were taken with results ranging from 0.03 to 0.17 ng/L.

9.2.3.3.7 Dissolved Oxygen

A total of 12 dissolved oxygen results were recorded at 2 sampling locations in 3 seasons in each of 2012 and 2013. Dissolved oxygen varied seasonally with temperature - as temperature increased dissolved oxygen decreased, which is a normal pattern. Higher concentrations were measured in the spring and fall (~ 10 mg/L and 13.5 mg/L, respectively, interannual average), and slightly lower concentrations were observed in the summer (~ 9.8 mg/L interannual average).

9.2.4 Water Temperature

9.2.4.1 Ivanhoe River Water Temperature

Water temperatures at both two facilities have been recorded during select periods each year since 2011.

In September 2011, the Chapleau District MNR installed ten temperature loggers at ten locations distributed from downstream of Third Falls to the upstream limit of inundation upstream of the Chute in the Study Area. Loggers were set to record temperature continuously at 2 hour intervals until their retrieval in August of 2012. A temperature assessment of the Ivanhoe River was performed by NRSI to create a detailed temperature profile for the Ivanhoe River using temperature data collected by Chapleau District MNR.

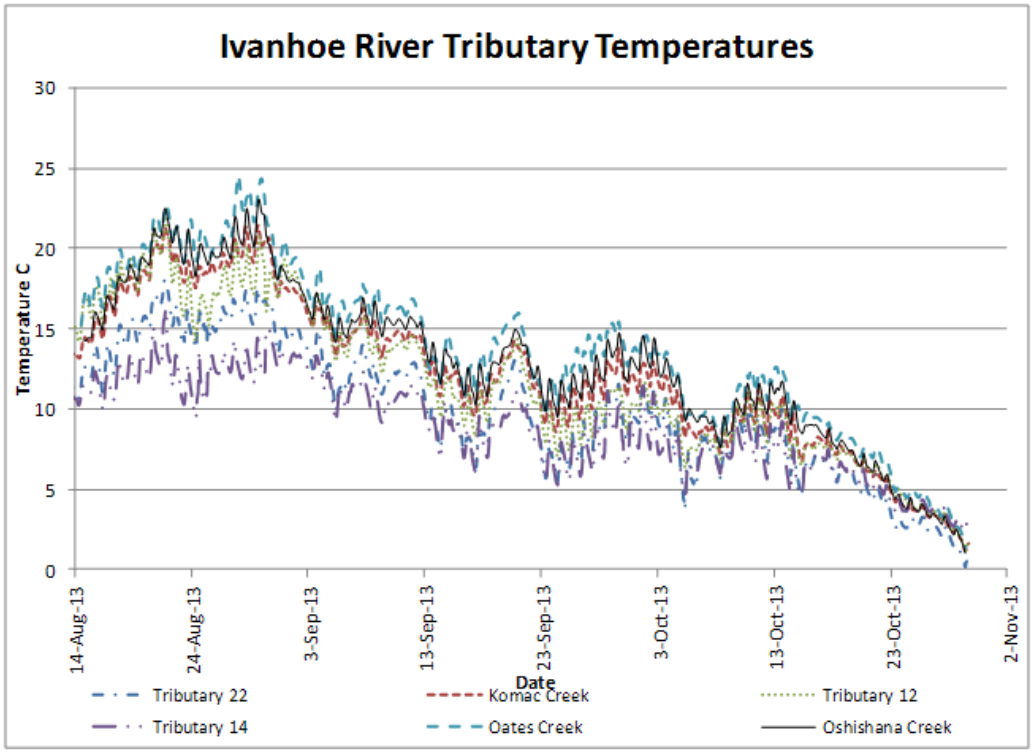
The average daily temperature across ten (10) sampling locations from August 2011 to March 2012 and from April to August, 2012 are shown in Figure 25 and Figure 26 of the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* (NRSI, 2014) in Appendix H. The data shows that water temperatures remain fairly constant across all sampling locations throughout the 12 month period.

The average daily range in temperatures from August 2011 to March 2012 and from April to August, 2012 are shown in Figure 27 and Figure 28 respectively (NRSI, 2014). The maximum range in water temperature on a daily basis for a given location was 4°C (NRSI 2014).

9.2.4.2 Tributary Water Temperature

Tributary water temperatures were recorded during August 2013 and October 2013, as provided in Figure A. Several tributaries exhibit influences of cooler groundwater contributions and provide desirable conditions from Brook Trout. The locations of temperature loggers are shown on Figures 27 and 28.

Figure A: Tributary Water Temperatures



The above information provides a baseline value from which changes to water temperatures can be assessed against.

9.2.5 Groundwater Quantity and Quality

The quantity of available groundwater in a watershed is primarily dictated by the following factors:

- Permeability of underlying geologic materials: The portion of total precipitation that infiltrates into the geologic subsurface depends primarily on the permeability (i.e. ease of transmitting flow) through the surficial materials in the recharge areas. Upland areas within the watershed that exhibit coarse geologic materials, such sands and gravels, allow significantly more precipitation to infiltrate the groundwater system than clay or rock materials.
- Topography: Upland areas where well drained relief provide less time for precipitation to infiltrate into the geologic subsurface provides less contribution to the amount of available groundwater than flat or poorly drained areas.
- Hydro geologic setting: The extent, porosity and permeability of the underlying geologic materials dictate the volume of groundwater in storage and the rate at which groundwater

moves from infiltration areas to discharge areas. Coarse materials, such as sand and gravel provide the primary storage and conveyance of groundwater.

In the Ivanhoe River watershed, thin (1-10 meters thick) veneers of surficial geologic materials typically overly nearly impermeable bedrock. Among the surficial materials that overlie the bedrock, groundwater storage and conveyance primarily occurs in certain glacial moraine deposits (gravelly tills) and glaciofluvial features (sand and gravel eskers). As shown in the *Map of Ivanhoe Tributary Catchment Geology in the Appendix XIII of the Technical Memorandum – Groundwater Discharge in Tributaries, Ivanhoe River* (Appendix H, NRSI, 2014), the tributaries upstream and downstream of The Chute flow through glaciofluvial features that provide a good potential setting for groundwater discharge into tributaries.

In the groundwater regime, upland areas are defined as areas where the water table is below the surface, allowing surface water to infiltrate. Lowland areas are those areas where the water table is at or near the surface and directly interacts with surface water, such as streambeds, ponds and lakes. In the groundwater definition of upland, it is possible to have localized lowland areas within a larger upland area, such as a pond or wetland area in a regional upland. Although localized groundwater discharge may be occurring on a localized scale, the regional area may contribute to more regional conveyance of groundwater.

In the context of groundwater discharge in streambeds, groundwater contribution is typically more sustained throughout the year and significant in discharge rate if it relates to a more regional flow than if it is local in nature. Throughout much of the Ivanhoe River watershed, the bedrock topography generally follows the surficial topography. Given the near impermeable nature of the bedrock, the regional groundwater movement is expected to follow the prevailing relief of the watershed. Topographic relief, from the top of the prevailing glaciofluvial eskers down to the river exceeds 60 meters.

The flow rate at which groundwater moves from infiltration (i.e. recharge) areas to streambeds is dictated by the pressure differential (i.e. the difference in elevation between the recharge and discharge point) and the permeability properties of the geologic material. Conversely, the pressure differential that exists between a recharge area and a discharge area must be in equilibrium with the permeability and the volume of water being transmitted.

Groundwater flow in surficial deposits is strongly dependent on precipitation events and snowmelt. In Northern Ontario, precipitation rates are typically highest in spring and fall. Less precipitation occurs in summer and winter. Winter precipitation occurs primarily as snow and accumulates until spring melt. In addition, the amount of total annual precipitation can vary significantly from year to year.

Groundwater quality, including temperature, can also influence surface waters in proportion to its contribution to total stream flow. As described in Section 9.2.4 Water Temperature several tributary streams are influenced by groundwater inputs, providing habitat for Brook Trout. Groundwater temperature is strongly influenced by the prevailing mean annual temperature, which in turn is strongly influenced by latitude. Meisner et al, 1988, provides a map of groundwater temperatures throughout Canada. According to this literature source, the groundwater temperatures in the Ivanhoe River watershed are estimated to be approximately 3ºC to 4°C throughout the year.

9.3 Terrestrial Environment

Studies on terrestrial vegetation and species were conducted by Natural Resource Solutions Inc. (NRSI) over the course of 2010, 2011, and 2012 during the months of May, June and July. Investigations included vegetation community mapping, wildlife surveys and documenting incidental wildlife observations. These surveys focused on the portion of the inundation area, the shoreline environment, and the Facility footprints. In June and August of 2013 the proponent retained Northern Bioscience to investigate the terrestrial vegetation and species in the area of the connection line, camp areas and access road areas around both Facilities. This investigation included vegetation community mapping, wildlife surveys and documenting incidental wildlife observations. The combined Study Areas for these assessments comprise the Study Area referenced in Section 3 and referred to in Figure 2. Detailed methodologies used in these assessments and results are included in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report (NRSI 2014*) and *Ivanhoe: Baseline Environmental Conditions for Road and Transmission Line Options* (Northern Bioscience 2014) located in Appendix H.

9.3.1 Natural Vegetation & Terrestrial Habitat Linkages

Studies on terrestrial vegetation were conducted in the Study Area over the course of 2010, 2011, 2012 (NRSI 2014), and 2013 (Northern Bioscience 2014) Vegetation mapping was completed using a combination of aerial photograph interpretation and site-specific field investigations. Detailed methodologies used in these assessments and results of the vegetation community mapping are included in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report (NRSI 2014)* and *Ivanhoe: Baseline Environmental Conditions for Road and Transmission Line Options* (Northern Bioscience 2014) located in Appendix H.

The Study Area has a relatively long history of logging reaching back over a century. Forest harvesting began circa 1909 in the Pineland Forest and in the 1910s in the Gordon Cosens Forest. Active forest regeneration began in earnest in the early 1980s (NRSI 2014). As a result, planted stands of primarily black spruce and jack pine occur throughout each forest unit. A number of large jack pine plantations occur throughout the Pineland Forest on sandy upland sites (Northern Bioscience 2014).

9.3.1.1 Ecosites

The Ivanhoe River lies within the Lake Abitibi Ecoregion (3E) of the southern boreal shield ecozone in Northeastern Ontario (Northern Bioscience 2014). Sixteen (16) ecosites were identified during the 2010-2012 field investigation (NRSI 2014) and 38 ecosites (Northern BioScience 2014) were encountered during the 2013 field investigation (Figures 9, 10 11 from Northern BioScience 2013 in Appendix H).

The Moist, Coarse Spruce-Fir Conifer forest community is the predominant ecosite found throughout the area surrounding the Facility locations and ZOI (ecosite B067). The community canopy is dominated by white cedar with abundant white spruce and white birch and some balsam fir. The understory is comprised mostly of blue flag with some red-oiser dogwood. The herbaceous layer is dominated by goldenrod species with an abundance of red raspberry, false solomon's seal, and Canadian anemone. Sensitive fern and unidentified grass species also occasionally occur within this community (NRSI 2014).

9.3.1.1.1 The Chute & Inundation area

Approximately 1.5km downstream of The Chute Facility is an Open Water Marsh community (ecosite B152) which is identified as a moose aquatic feeding area. This ecosite type can also be found 200m upstream of the proposed Chute Facility on the east side of the river. The community type is characterized by less than 25% emergent vegetation and less than 50% floating leaved vegetation. Vegetation in this community includes broad leaved arrowhead, common coontail and common duckweed (NRSI 2014). Further discussion on moose aquatic feeding areas can be found in Section 9.4.8.

Additional ecosite types identified within 129m of The Chute proposed development and inundation area and are described in detail in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* located in Appendix H and include:

- Dry to Fresh, Coarse: Sparse Shrub (B046S). This community extends behind the strip of cedar-conifer forest community on both sides of the river, along the Ivanhoe River at The Chute Facility.
- Fresh, Silty to Fine Loamy: Conifer (B102). This community is found along a 1.3km stretch of the eastern side of the Ivanhoe River approximately 2.5km downstream of the proposed The Chute Facility.
- Mineral Thicket Swamp (B134). This community is found approximately 3.5km downstream of the proposed Chute Facility on the eastern side of the river (NRSI 2014).

The site is surrounded by a relatively flat, undulating plain of deep, fine-textured soils about 300 m above sea level Surrounding forests are predominately mixedwood and hardwood forests of various ages depending on fire and logging history. A number of jack pine plantations are found to the south of The Chute, while the west side is predominantly regenerating mixedwood cutovers 10-15 years old. The Ivanhoe River sits about 10m below the surrounding plain, with a relatively pronounced, steep slope of 20-30° leading down to the river. Along the river, forest communities are predominantly old-growth conifer-dominated stands. On deep soils, forests are particularly rich, supporting large eastern white cedar stands with rich understories of small enchanter's nightshade, ferns, and Canada yew. Large black ash and balsam poplar are also components of these forests. Shallow sites typically support stands of small balsam fir and spruce, with exposed bedrock a common feature of the understory, as well as rich feathermoss communities (Northern BioScience 2014).

On the west side of the river, access is by an old logging road running parallel to the river. The stockpile area is situated about 100 m west of the river on moist, fine-textured soils on the old cutover. A temporary laydown area will be located to the east of the stockpile, about 50 m west of the river, on the edge of the old cutover. Access to this area will be through a temporary access road extending from the existing logging road (Northern Bioscience 2014).

The auxiliary dam will be approximately 200 m west of the river in a low lying draw running north-south parallel to the river, through rich cedar dominated swamps, surrounded by the old cutover on adjacent uplands. On the east side of the river, access is by an existing river access road leading to a boat launch, an extension of Laundry Road. A permanent access road extension will lead from the existing boat launch, through mature a mature cedar stand and shallow balsam fir stands to the powerhouse yard. The temporary laydown area and construction parking will be located on either side of the existing access road above the river in upland cedar dominated conifer stands and aspen dominated mixedwoods on deep fine textured soils along an existing portage trail. The powerhouse yard will be located on bedrock between an existing seasonal island and the east side of the river (Northern Bioscience 2014).

9.3.1.1.2 Third Falls & Inundation Area

The area surrounding the Third Falls Facility is predominately Fresh, Clayey; Cedar – Conifer ecosite on both sides of the river throughout the entire inundation area, including the bedrock island located in the middle of the Ivanhoe River approximately 1km upstream of the proposed Third Falls Facility. The Canopy of this forest community is dominated by eastern white cedar and abundant white spruce. The understory consists mostly of speckled alder and herbaceous layer includes wild sarsaparilla, low sweet blueberry, shrubby cinquefoil, spotted joe-pye-weed, multi-coloured blue flag iris and sensitive fern (NRSI 2014)

This area includes a Fresh Silty to Fine Loamy: Elm-Ash Hardwood community type downstream of The Chute, but located within the inundation area for Third Falls. It is found on a small piece of land between the Ivanhoe River and a small adjoining lake. The canopy is dominated by black ash as well as balsam fir, white spruce, and white birch with some white elm. The sub canopy includes black ash, red osier dog wood, white birch and some white elm. The herbaceous layer includes small's spike-rush, mint species, sensitive fern, un-identified grass species, lake-bank sedge, and swamp milkweed. This community type has been identified as significant within ecoregion 3E due to the rarity of black ash dominant forest communities in the region, and it is consequently considered significant wildlife habitat (SWH) (NRSI 2014). See section 9.3.7 for further discussions on this community type.

Additional ecosite types identified within 120m of the proposed Third Falls development and inundation area are described in detail in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* prepared by NRSI located in Appendix H and include:

- Moist, Coarse: Shrub (B063). This community is found in a tributary floodplain on the west bank of the Ivanhoe River in the northern part of the Project Area. This is a fairly small community, around 200m at its widest, where it meets the Ivanhoe River.
- Fresh Clayey: Spruce-Fir Conifer (B085). This community is found on the southern side of the river where the channel meanders in the middle of the Study Area between the Third Falls Facility and The Chute Facility.
- Fresh Clayey: Aspen – Birch Hardwood (B088). This community can be found on both sides of the Ivanhoe River upstream of the proposed Third Falls Facility.
- Fresh Silty to Fine Loamy: Cedar Conifer (B100). This community is found along one small section of the river on the northern bank.
- Mineral Intermediate Conifer Swamp (B223). There are two communities on each side of the river in the northern section of the Study Area.
- Mineral Rich Conifer Swamp (B224). This community is found in a small area on the west side of the river in the northern part of the Study Area.
- Mineral Meadow Marsh (B142N). These communities are comprised of islands and shoreline habitat found within and adjacent to the Ivanhoe River downstream of the Third Falls Facility. Six Mineral Meadow Marsh communities were identified in Study Area.
- Open Water Marsh: Mineral (B151N). Open water marsh ecosites were also identified downstream of the Third Falls Facility.
- Mineral Shallow Marsh (B148N). This wetland community is located approximately 16km downstream of the Third Falls Facility (NRSI 2014).

Access to the Third Falls facility as described in Section 5.1.3 requires 3.5 km of new access road. This access road will provide access to the west side of the Project. Surrounding upland forests are a mosaic of mature aspen dominated hardwood stands, fire origin jack pine stands, and extensive black spruce dominated bogs. The east side of the Ivanhoe River is a large complex of cutovers 10-20 years old on relatively sandy soils, supported extensive jack pine plantations. The west side of the river remains unlogged, possibly owing to the extensive spruce bogs. The Ivanhoe River runs about 20 m below the surrounding undulating plains, resulting in a substantial 20-30° slope leading down to the river. Large, mature mixedwoods of aspen and white spruce are found along the slopes, with moist, fine textured cedar dominated stands along the river. Bedrock is only exposed at the falls (Northern Bioscience 2014).

The majority of development activities will occur on the west side of the river, along the new road and power line. The construction camp will be located roughly 300 m west of the river, immediately south of the access road on deep fine texture soils in upland jack pine-aspen mixedwoods (Northern Bioscience 2014).

The stockpile area will be located 250 m west of the river, immediately north of the access road, above a large ephemeral draw to the north (See drawing 14-141 in Appendix C), on deep fine textured soils supporting mature aspen forests (Northern Bioscience 2014).

A temporary laydown area 50 m north of the river and along the access road running along an upland peninsular above the river will be located on deep upland soils in mature aspen forests. The substation will be located on the east-facing slope in deep, fine-textured mixedwood stands. The powerhouse on the west side of the river will sit on shallow soils in conifer dominated stands of white spruce and cedar. On the east side of the Ivanhoe River, development will be limited, however a clearing will be made immediately north of the base of the dam on deep, fine-textured mature mixedwoods (Northern Bioscience 2014).

9.3.1.1.3 The 69kV & 115kV Power Line

As discussed in Section 6.1 a 69kV power line will connect the Third Falls GS and The Chute GS to a 115 kV substation located at The Chute. The 69 kV power line corridor running from Third Falls south towards The Chute primarily follows a number of secondary and tertiary forest roads, with only two 1.5 and 2.5km overland sections, respectively. The northernmost 20 km are primarily through 20-30 year-old jack pine plantations on relatively dry, deep, sandy soils. The final 5 km of the corridor to The Chutes follow a secondary access road through mature aspen and mixedwood forests. Forest disturbance is likely to be minimal along this section of the transmission corridor given the presence of existing roads of varying widths and conditions (Northern Bioscience 2014)..

Extensive jackpine plantations dominate sandy plains along the proposed transmission line between the two facilities, forming dry fresh conifer jack pine black spruce stands. Within these stands ground cover is species poor and relatively sparse with communities dominated by blueberry, bush honeysuckle, bruacken fern, feathermosses and lichens. Hardwood dominated stands are typically Dry Sandy Aspen Birch Hardwood. Within these stands, understory species are somewhat richer, with a greater proportion of herbaceous species, but are still relatively poor compared to finer textured soils (Northern Bioscience 2014).

The 115kV power line travels from The Chute GS to highway 101 primarily overland and is largely unable to take advantage of existing road infrastructure. This route can be seen in Figure 10. The first 28 km of this section travelling east, southeast, and south of The Chutes is completely overland, other than crossing a number of forest access roads, in particular Oates Road, and East and West Oswald roads. The final 8-10 km section of the 115kV power line before joining Hwy 101, follows existing forest access roads and an existing transmission line. It is likely that this section will require only minimal forest clearing and disturbance. The final 15-20 km section, depending on option taken, travels east along Hwy 101 to connect with the power grid. This section will travel adjacent to the highway and is likely to require only minimal forest disturbance and clearing, given the large, existing cleared right-of-way along the road edge (Northern Bioscience 2014).

The entire power line corridor occupies approximately 92.6 hectares, and is a total length of approximately 78.2km the make-up of which is described in the table below:

Table 19: 69kV & 115 kV Power line Vegetative Cover Composition

Vegetative Cover Composition	Area
Mature forest	71.3 hectares
Young forest, mainly cutover	25.2 hectares
Already disturbed primarily as existing road corridors from old logging roads, primary access roads, existing transmission corridors and old aggregate quarries which are vegetated	16.0 hectares
Water and non-forested wetland	48.0 hectares
Total	120.6 hectares

(Northern Bioscience 2014)

9.3.1.2 Flora

Vegetation inventories were undertaken during the 2010-2012 field study. These inventories resulted in the identification of 159 plant species, listed in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report (NRSI)* (Appendix H). During this investigation no significant vegetation species were identified (NRSI 2014). Additional inventories were

undertaken during the 2013 field study; again, no significant vegetation species were identified. The following species were noted to be predominant in the Study Area:

9.2.1.2.1 Eastern White Pine

Eastern white pine approaches the northern limit of its distribution and occurs within the Study Area infrequently in scattered stands. White Pine stands occur along the transmission line between The Chute and Third Falls. These stands are isolated and consist of a few large individuals, likely well in excess of 100 years old, with some regeneration evident in open areas and along adjacent road edges. White and red pine are deemed to have conservation value within the Gordon Cosens Forest, and the management goal within the Pineland Forest is to increase abundance back to historic levels (Northern Bioscience 2014).

9.2.1.2.2 Yellow Birch Stand

A small stand of Yellow Birch occurs within the Study Area south of the proposed power line corridor. Yellow birch reaches the northern limit of its distribution within the Study Area, where it occurs at a very low frequency, in economically insignificant quantities. The oldest trees are likely well in excess of 100 years old. While the area was not searched exhaustively for yellow birch, the stand appears to be greater than 0.5ha (Northern Bioscience 2014).

9.2.1.2.3 White Cedar

Two stands of culturally significant eastern white cedar trees have been identified in The Chute access area on the east side of the river. Forest Resource Inventory data identifies two stands fringing the river at this site and fieldwork confirmed that cedar is present in both stands. Stand 1, to the north, identified by Chapleau Cree First Nation, is dominated by White Cedar (approximately 70% of the forest cover) with canopy trees about 140 years old. Stand 2, identified by Northern Bioscience, is a mixed wood, dominated by White Birch with a mixture of White Cedar, poplar and other species (Northern Bioscience 2014). Cedars are scattered throughout the stand, but are most common fringing the river. The White Birch trees in Stand 2 originated about 80 years ago, but some of the White Cedars may be older (Northern Bioscience 2014). Further discussion on these trees can be found in Section 9.9.

9.3.2 Terrestrial Wildlife

Studies on terrestrial wildlife were conducted in the Study Area over the course of 2010, 2011, 2012 (NRSI 2014), and 2013 (Northern Bioscience 2014). These studies include breeding bird surveys, herpetofauna surveys and incidental wildlife observations.

Detailed methodologies used in these assessments and results are included in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report (NRSI 2014)* and *Ivanhoe: Baseline Environmental Conditions for Road and Transmission Line Options* (Northern Bioscience 2014) located in Appendix J.

9.3.2.1 Birds

Breeding bird surveys were conducted in the Study Area over three years in June and July in both 2010 and 2011 and in June 2013.

9.3.2.1.1 June - July 2010 & 2011

During these surveys, 99 bird species were observed; of these, 66 demonstrated possible evidence of breeding and 23 displayed probable evidence of breeding. Ten (10) demonstrated confirmed evidence of breeding, including:

- Canada Goose
- Hooded merganser
- Mallard
- Common Goldeneye
- American black duck
- Ruffed Grouse
- Great Horned Owl
- Gray Jay
- American Crow, and
- Common Merganser

Five significant bird species were identified by the Ontario Breeding Bird Atlas (OBBA) to be known in the vicinity of the Study Area:

- Bald Eagle, Canada warbler,
- Common nighthawk,
- Olive-sided flycatcher and
- Rusty blackbird.

All of these species were observed within the Study Area during the breeding bird surveys, except for the rusty blackbird.

Wetland communities adjacent to upland habitats provide candidate significant wildlife habitat for Waterfowl Nesting areas. Breeding bird surveys were conducted and resulted in the observation of several indicator species, including:

- American Black Duck, Wood Duck
- Blue-winged Teal
- Canada Goose,
- Hooded Merganser,
- Common Merganser,
- Mallard,
- Bufflehead
- Common Goldeneye and
- Red-breasted Merganser

Low numbers of these species were observed (NRSI 2014).

Wetland communities within the Study Area also provide candidate significant wildlife habitat for Marsh Breeding Birds. Breeding bird surveys resulted in the observation of three indicator species, including:

- Ring-necked Duck,
- Ruddy Duck, and
- Sandhill Crane

The number of observations did not meet the criteria for confirmed habitat (NRSI 2014). Additional information on wetland species can be found in Section 9.4

9.3.2.1.2 June 2013

During these bird surveys, 84 bird species were observed, many of which showed evidence of nesting. The most commonly observed species during this visit include:

- Red-eyed Vireo
- Ovenbird
- Swainson's Thrush
- White-throated Sparrow
- American Robin
- American Woodcock
- American Three-toed Woodpecker,

- Boreal Chickadee,
- Boreal Owl, and
- Spruce Grouse

There were no confirmed observations or recordings of Common Nighthawks, Eastern Whip-poor-wills, or Short-eared owls during this visit (Northern Bioscience 2014).

9.3.2.2 Mammals

Evidence or direct observations of 13 species were observed during site investigations during 2010-2012 (NRSI 2014) and 12 species were observed during 2013 site investigations (Northern Bioscience 2014). All observed species represent common species with secure populations within Ontario (NRSI 2014).

9.3.2.2.1 Bats

Three species of bat were considered potentially present in the Study Area: Little Brown Myotis, Northern Myotis, and Eastern Small-footed Bat. None of these were observed during the 2010-2012 study period; however, the habitat type was found in the location around The Chute. Bat recorders detected Myotis sp. on the site in August 2013 around The Chute, indicating foraging activity. Further information on these species can be found in Section 9.3.3.

9.3.2.2.2 Moose

Moose were sighted numerous times in various locations in Study Area 1. In 2010, moose were observed in the water around the nearest island south of the proposed Third Falls location. Moose Aquatic Feeding Areas Significant Wildlife Habitat have been identified within the Study Area by the MNR which indicates the potential for Cervid Movement Corridors. As such, Cervid Movement Corridors are identified as Candidate SWH (NRSI 2014).

Moose were observed on a number of occasions during 2013 field work in Study Area 2. As well, moose signs such as tracks and droppings were seen throughout the Study Area, suggesting that moose are likely present throughout the Study Area with only limited annual movement between seasonal habitats (Northern Bioscience 2014).

9.3.2.2.3 Other Mammals

Lynx were also observed on multiple occasions. A single lynx was observed in July of 2011 on the road near the Nova Bridge. Another single lynx observation occurred in 2013. Wolf scat and tracks were identified along the bank near the proposed Chute GS location during the 2010-2011 field survey.

Wolves were again observed on a few occasions in the area of Third Falls during the 2013 field assessment (NRSI 2014) (Northern Bioscience 2014). Coyotes are noted to be present in the area, likely in low abundance especially away from populated areas. Black bears were commonly observed in the Study Area (Northern Bioscience 2014).

Deer are known to occur within both the Gordon Cosens and Pineland forests but occur at a very low abundance. Population numbers are unknown but likely fluctuate widely due to severity of winters. Woodland Caribou historically occurred within the Pineland Forest, and presently occur within the extreme north, over 100km north of the Study Area. The proposed Study Area is not within identified caribou habitat in the Gordon Cosens Forest (Northern Bioscience 2014).

9.3.2.3 Invertebrates

No incidental observations were made during field visits to the site. No significant invertebrates are known to occur on the site.

9.3.3 Species at Risk

9.3.3.1 Bald Eagle

The Bald Eagle is designated as Special Concern provincially and was identified by the OBBA as being known to occur on the site. Additionally, they were observed during the breeding bird surveys in the Study Area. They are a species of conservation concern whose habitat is considered SWH under the Provincial Policy Statement (PPS). Bald Eagles require large areas with continuous deciduous or mixed forests found on large lakes or rivers. Tall dead trees within 400m of nest sites are required for perching. This habitat type is abundant in the Study Area (NRSI 2014).

A pair of adult bald eagles was observed near the far upstream boundary of the Study Area. The location of this sighting is approximately 2km from a bald eagle nest, which was observed unoccupied at a location between The Chute and Third Falls during the October 2011 field surveys. The proximity of these observations suggests that the observed pair might have associated with the nest. The presence of a male-female pair and the occurrence of a likely active nest further suggest probable breeding evidence for this species within the Study Area. Nests that are suspected of use within the last five years are to be considered SWH for Bald Eagle Nesting and Foraging and therefore are awarded protection under the PPS (NRSI 2014). No Bald Eagle nest was found in 2013, but an adult eagle was observed at The Chute during the 2013 field survey (Northern Bioscience 2014).

9.3.3.2 Canada Warbler

Canada Warbler is listed as being of Special Concern provincially and threatened nationally. They breed in interior forest habitats with a dense, well developed shrub and vegetation understory, often along riparian zones in excess of 30ha (NRSI 2014). They are not highly sensitive to forest fragmentation and will inhabit small woodlots and forest edges, at least in landscapes that are primarily forested (Northern Bioscience 2014). Three Canada Warbler observations were made during field investigations during the summer of 2011, each time a single singing male was observed. These sightings occurred in Mineral intermediate conifer swamp, and Moist Coarse: Spruce-Fir Conifer forest within close proximity to the Ivanhoe River. The observations suggest possible breeding evidence for the species within the Study Area. Habitat for the Canada Warbler is considered SWH under the PPS (NRSI 2014).

9.3.3.3 Common Nighthawk

Common nighthawk is listed as Special Concern provincially, making it a species of conservation concern. Common nighthawk is also listed as Threatened nationally. This species nests on open ground in clearings of dense forests created by logging or fire. They are also known to use ploughed fields, gravel beaches or barren areas with rocky soils, in open woodlands and on flat gravel roofs (NRSI 2014). They are not highly sensitive to forest fragmentation and will inhabit small woodlots and forest edges, at least in landscapes that are primarily forested. (Northern Bioscience 2014). A common nighthawk individual was heard calling at dusk during June 2011 field investigations. The individual was not seen, but was heard approximately 20m north of the Nova Road Bridge, near the west shore of the Ivanhoe River within a spruce-fir coniferous forest community. This observation provides evidence for possible breeding within the Study Area. Habitat for the common nighthawk is considered Significant Wildlife Habitat under the PPS (NRSI 2014).

9.3.3.4 Eastern Small-footed Bat, Little Brown Myotis & Northern Myotis

Eastern Small-footed bat has suffered declines and is a candidate for listing under the Ontario Endangered Species Act (ESA). Should it become listed, its habitat would be protected under the ESA. The Study Area is within the northern edge of the range for this species. The eastern small-footed bat typically hibernates in abandoned mine shafts or caves (Northern Bioscience 2014)(NRSI 2014).

Little brown myotis is listed as Endangered both provincially and federally. As such, their habitat is also afforded protection under the ESA. Little brown myotis winters in humid caves and roosts in caves, quarries, tunnels, hollow trees or buildings with dark warms areas such as attics. Little brown myotis feeds primarily in wetlands and forest edges. This species was not observed in the Study Area during any field investigations in 2011-2012 (NRSI 2014).

The northern myotis is listed as endangered both provincially and federally. Consequently, their habitat is afforded protection under the ESA. The northern long-eared bat hibernates during winter in mines or caves. During the summer months, males roost alone and females form maternity colonies of up to 60 adults in manmade structures, hollow trees or under loose bark. This species was not observed within the Study Area during any field investigations (NRSI 2014).

Aspen is the species most likely to provide ideal bat roosting in northern Ontario, with white pine also able to fill this role. Old aspen stands (~120 years old) have bigger snags with more uniform characteristics. Stands of this age class also provide a relatively open understory, with many canopy gaps, allowing better edge habitat within the forest for foraging for insects (Northern Bioscience 2014).

MNR (2011) suggests that bat maternal habitat consists of forest stands with a minimum snag or cavity tree density of ≥10 snags per hectare of trees ≥25 cm diameter breast height (DBH). Clusters of snag trees of suitable diameter and density were found throughout the study area. Snag tree density ranged from 0 to 100 snags/ha (i.e., 0 to 5 snags/ 500 m^2 plot) for an overall average of 2.4 snags/ha. Most (93%) plots had no snags. Snags were most common in mature hardwoods (Ecosite B119) and least common in cutovers but suitable roost trees were scattered through a range of other ecosites and stand ages (Northern Bioscience 2014).

Although little is known of bat use of the study area, *Myotis* spp. were detected in August 2013. Bats use the area near The Chutes, apparently for foraging but were not detected 6 km south of Third Falls. No bat recordings were conducted elsewhere in the study area but bat use of the study area is probably much more extensive. Use of maternal trees was not documented, but suitable snag trees are common in older hardwood and mixedwood stands in the study area. No hibernacula were discovered. OMNDM data shows several mines 2 to 10 km from the proposed roads and lines but none within 1 km (the buffer recommended in OMNR 2011) (Northern Bioscience 2014).

9.3.3.5 Eastern Wood-Pewee

Eastern wood-pewee is listed as Special Concern provincially. This species is usually found in clearings and forest edges and breeds in nearly any type of wooded habitat including mature woodlands, urban shade trees, roadsides, woodlots, and orchards. They prefer deciduous forest but also live in mixed hardwood-conifer forest of the north. This species was observed during the 2013 field season, at two locations within the Study Area along the proposed access road corridors. Two singing males were discovered at two locations within the Study Area (Northern Bioscience 2014). The observations suggest possible breeding evidence for the species within the Study Area. Habitat for the eastern wood-pewee is considered SWH under the PPS. Eastern Wood-Pewee is a migratory songbird nesting in deciduous and mixed forest. The species is apparently not highly sensitive to forest fragmentation

and will inhabit small woodlots and forest edges, at least in landscapes that are primarily forested (Northern Bioscience 2014).

9.3.3.6 Olive-Sided Flycatcher

Olive-sided flycatcher is listed as Special Concern provincially, making it a species of Conservation concern. This species is also considered Threatened federally. Olive-sided flycatchers prefer semi-open, conifer forests near water bodies with treed wetlands for nesting. Two olive-sided flycatcher observations were made during June 2011 field investigations, each consisting of a single singing male. Each observation was made in isolated pockets of Mineral Intermediate Conifer Swamp located adjacent to the Ivanhoe River. These observations suggest possible breeding evidence for the species within the Study Area. Olive-sided flycatcher habitat is considered SWH and as such, is protected under the PPS (NRSI 2014).

9.3.3.7 Rusty Blackbird

This species was not observed during 2010-2012 field work, but was observed during 2013 field work. It is listed as a Special Concern nationally and Not at Risk provincially. It is not afforded protection under the ESA or SARA. Rusty Blackbird prefer openings in coniferous woodlands border in bodies of water, tree-bordered marshes, beaver ponds, muskegs, bogs, fens or wooded swamps, beaver ponds, fends or wooded swamps and wooded islands on lakes. The extensive occurrence of spruce-fir dominate coniferous forest, as well as several interspersed treed and shrubby thicket swamp communities, along with the Ivanhoe River, provides suitable habitat for rusty blackbird (NRSI 2014). In 2013 this species was observed at The Chute and in another wetland just outside of the Study Area (Northern Bioscience 2014).

9.3.3.8 Eastern Wood-Pewee

This species was observed during the 2013 field season, at two locations within the Study Area along the proposed access road corridors. Two singing males were discovered at two locations within the Study Area (Northern Bioscience 2014). The observations suggest possible breeding evidence for the species within the Study Area. Habitat for the eastern wood-pewee is considered SWH under the PPS

9.3.4 Significant Natural Heritage Features & Areas

9.3.4.1 Significant Wildlife Habitat

Significant Wildlife Habitat (SWH) is designated following criteria identified in the Significant Wildlife Habitat Technical Guide (SWHTG). The SWHTG divides habitat types into four broad categories

(Seasonal Concentration Areas of Animals, Rare Vegetation Communities or Specialized Habitat for Wildlife, Habitat for Species of Conservation Concern, and Animal Movement Corridors) (NRSI 2014).

9.3.4.1.1 Bald Eagle Habitat

SWH was identified for bald eagle nesting, foraging and perching habitat. As well, the nest and an observed pair of bald eagles between The Chutes GS and the Third Falls GS make this habitat for a Species of Conservation Concern under the PPS. The same general vicinity has been documented as being used for foraging and perching along the river. The SWHTG defines confirmed bald eagle nesting habitat as an active nest and 400 – 800m radius around the nest. As such, this habitat is afforded protection under the PPS (NRSI 2014).

Bald Eagle Habitat is shown on Figures 52-54.

9.3.4.1.2 Canada Warbler

SWH is identified for Canada warbler as a species of conservation concern. Adult male Canada warblers were observed singing within the Mineral intermediate Conifer Swamp (B223) and Moist, Coarse: Spruce – Fir Conifer (B069) forest community located between The Chute and Third Falls GS. Consequently, these habitats are designated SWH for the Canada warbler within the Project Area and are afforded protection under the PPS (NRSI 2014).

Canada Warbler Habitat is shown on Figures 52-54.

9.3.4.1.3 Common Nighthawk

SWH is identified for common nighthawk as a species of conservation concern. One common nighthawk was heard calling north of the Nova Road Bridge over the Ivanhoe River during June 2011 field surveys. The individual was heard at dusk, within the Moist, Coarse: Spruce-Fir Conifer (B069) forest community in close proximity to the Ivanhoe River, suggesting that it was likely foraging given the species' crepuscular foraging habits. The individual may also have used the coniferous forest community for nesting, provided that suitable open clearings existed. Consequently, the B069 forest community is designated as SWH and is afforded protection under the PPS (NRSI 2014).

Common Nighthawk Habitat is shown on Figures 52-54.

9.3.4.1.4 Fresh Silty to Fine Loamy: Elm-Ash Hardwood (B105) Ecosite

The Fresh Silty to Fine Loamy: Elm-Ash Hardwood (B105) is located at an outlet in the southern part of the Study Area. The canopy is dominated by black ash as well as balsam fir, white spruce, and white birch with some white elm (Ulmus americana). This community type has been identified as significant

within Ecoregion 3E due to the rarity of black ash-dominant forest communities in the region (NRSI 2014). This community was consequently considered a confirmed SWH (NRSI 2014).

9.3.4.1.5 Moose Aquatic Feeding Areas

Moose Aquatic Feeding Area were identified within the Study Area, downstream and upstream of The Chute GS. During June and July moose will move as far as 30km to reach areas where they can consume large quantities of aquatic plants, especially submergent plants including pondweeds (Potamogeton spp.), and yellow water lily (Nuphur variegatum). Ideal moose aquatic feeding areas provide moose with abundant food and have adjacent stands of lowland conifers to provide shade and hiding cover. As per the MNR's Decision Support System for the Significant Wildlife Habitat Technical Guide "aquatic feeding areas include both the near shore areas providing plant material and the adjacent forest cover" are considered SWH. In prime feeding areas several individuals may be present. This habitat is represented by vegetation community B152 Open Water Marsh: Organic which is located approximately 1.5 km downstream and 200m upstream of the proposed Chute GS on the east side of the river (NRSI 2014).

9.3.4.1.6 Olive-Sided Flycatcher

SWH is identified for olive-sided flycatcher as a species of conservation concern. Olive-sided flycatcher was observed calling within the Mineral Intermediate Conifer Swamp (B223) found downstream of the bald eagle nest on the west side of the Ivanhoe River. Consequently, the B223 swamp community is designated SWH for olive-sided flycatcher and it afford protection under the PPS (NRSI 2014).

Olive-Sided Flycatcher Habitat is shown on Figures 52-54.

9.3.4.2 Wildlife Management Areas

The area falls within Wildlife Management Unit 30 which is part of Cervid Ecological Zone B. Within this area woodland caribou and moose are given management priority, while white-tailed deer populations are to be managed for low density (Northern Bioscience 2014).

9.3.4.3 Animal Movement Corridors

The Ivanhoe Study Area lacks documented animal movement corridors and the continuous forest cover and rugged terrain suggests that it is not a significant movement corridor. Within the Ivanhoe Study Area, watercourses likely serve as corridors for amphibians, turtles, snakes, and riparian mammals such as beaver, mink, muskrat, and river otter. Logging roads likely serve as movement corridors for many mammals judging by the abundance of moose, wolf, and black bear tracks observed (Northern Bioscience 2014).

9.3.5 Significant Earth or Life Science Features

The Project Area does not contain any Areas of Natural and Scientific Interest or Life Science Features.

9.4 Aquatic Environment

The Ivanhoe River originates from a series of kettle lakes and feeder tributaries flowing northward into Ivanhoe Lake. A concrete dam, owned and operated by the MNR, (The Ivanhoe Lake Dam) is presently operating in the Ivanhoe Lake area. The Ivanhoe River continues northward from the Chute and Third Falls locations, to join with the Groundhog River which then flows 145km and meets the Mattagami River, which joins the Kapuskasing River 12km downstream. The Kapuskasing continues northward flowing to the Moose River and ultimately into James Bay (NRSI 2014).

The Study Area contains a number of riffles, runs, falls, tributaries, wetlands and back-water bays which may provide suitable habitat for a number of aquatic species. From 2010-2013. NRSI completed a number of aquatic assessments within the Study Area. Full details on these studies can be found in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* (NRSI 2014). In June and August 2013 Northern Bioscience completed surveys around the facility location and along the road and transmission corridor; this work looked at wetlands, shorelines, water crossings and overhead line crossings. This study focused primarily on terrestrial, wetland and shoreline dependent species and habitats (Northern Bioscience 2014). These can be found in Appendix H.

9.4.1 Fish & Fish Habitat

Over the course of 2010, 2011and 2012, NRSI conducted fish community assessments and a total of 18 fish species were captured within the Study Area, representing a diverse fish community (NRSI 2014). The following species were identified within the Study Area (Figure 2):

- Lake Sturgeon (Hudson Bay-James Bay Population) (*Acipenser fulvescens*)
- White sucker (Catostromus commersonii)
- Lake Whitefish (Coregonis cluepeaformis)
- Blackfin Cisco (Coregonis nigripinnis)
- Mottled Sculpin (Cottus bairdi)
- Brook Stickleback (Culaea inconstans)
- Northern Pike (Esox lucius)
- Iowa Darter (Etheostoma exile)
- Johnny Darter (Etheostoma nigrum)
- Burbot (Lota lota)

- Sopttail Shiner (Notropis hudsonius)
- Logperch (Percina caprodes)
- Yellow Perch (Perca flavescens)
- Longnose Dace (Rhinichthys cataractae)
- Blacknose Dace (Rhinichthys obtusus)
- Brook trout (Salvelinus fontinalis)
- Walleye (Sander vitreus)
- Smallmouth Bass (Micropterus dolomieu)

In addition to the species caught, an additional 4 species are known to exist in the Ivanhoe River based on background information.

- Cisco (Coregonus artedi)
- Common Shiner (Luxilus cornutus)
- Blacknose Shiner (Notropis heterolepis)
- Trout-perch (Percopsis omiscomaycus)

The majority of fish species collected are indicative of a warm/coolwater fish community, however five species have thermal preferences for cold waters. These species are: Mottled Sculpin, Burbot, Lake Whitefish, Blackfin Cisco, and Brook Trout. The presence of these species suggests that areas of suitable cold water thermal regime exist within the Study Area (NRSI 2014).

The fish community is diverse, varying widely in size at maturity and utilizing the full range of feeding environments present within the Study Area (NRSI 2014). In addition the species composition demonstrates a complete range of trophic levels and ecological niches allowing the community to function as a self-sustaining ecosystem (NRSI 2014).

Walleye were the most abundant species captured within the Study Area during Riverine Index Netting (RIN), being most abundant in the area below the Chute. Facility. White Sucker and Northern Pike were the second and third most abundant species captured. Yellow Perch were the fourth most abundance species found in the system, with Lake Whitefish and Blackfin Cisco being found in the lowest quantities (NRSI 2014). Walleye, Northern Pike, Brook Trout and Lake Sturgeon are all important species within this system from an ecological and social perspective, and so they will be discussed in more detail below.

Sampling locations for the Aquatic Habitat programs are shown on Figures 29-51.

9.4.1.1 Walleye

Walleye are a predatory fish species with broad distribution covering much of the eastern United States and central Canada. Walleye prefer large shallow lakes or large, turbid, slow-flowing rivers. In turbid water, Walleye are often more active during the day, as the turbidity provides good shelter from the daylight. They will also utilize shallower areas if there is a sufficient amount of aquatic vegetation, downed trees, or large boulder shoals (NRSI 20134).

The habitat characteristics in which Walleye prefer to reside are present throughout the Project Area. Found in both lakes and rivers, they are tolerant of a broad range of environmental conditions. Walleye spawn at night in areas of fast moving water or riffles over boulder/cobble/gravel areas in water temperatures from 6.7 to 8.9°C. Walleye are active throughout the winter months and reside in the deeper pools away from fast flowing water. Walleye is a widely sought-after recreational and subsistence fish (NRSI 2014).

9.4.1.2 The Chute

Presence

During RIN sampling a totally of 287 fish were caught. Walleye (Table 20) was the only species caught in all sampling locations along the Ivanhoe River (NRSI 2014), indicating that it is highly abundant in the system.

Table 20: RIN Sampling for Walleye at The Chute GS

Location	Species	Quantity
Upstream of The Chute GS	Walleye	11
The Chute GS Location	Walleye	16

(NRSI 2014)

Spawning

During 2010, 2011 and 2012 the proponent commissioned NRSI to complete spawning surveys for walleye, during these surveys it was determined that both the east and west channel at The Chute provide suitable spawning habitat for walleye (NRSI 2014).

Immediately upstream of The Chute a long set of riffle habitats were observed that contained substrates suitable for spawning walleye. Two smaller areas of coarse substrates were noted upstream towards the Oates Road Bridge crossing that afforded some potential walleye spawning habitat (NRSI

2014). Walleye eggs deposition was confirmed at The Chute during 2010 egg matting surveys at one of the 12 egg mats set. In May 2011 additional egg matting surveys were completed in the area immediately below the Chute, spawning was confirmed with egg deposition occurring on 4 egg mats. Walleye spawning was confirmed throughout the area upstream of The Chute and at Oates Road Bridge in 2011. Eighteen egg mats were set on substrates consisting of cobble, gravel, boulders, and sand and four of these yielded eggs. Additional egg matting surveys were conducted in the spring of 2012. The majority of this egg matting focused on the east and west channels immediately downstream of The Chute. Walleye egg deposition was confirmed on 5 egg mats within the west channel, in April, however no egg deposition was confirmed in the east channel or the mixing area. A second trip occurred in May which confirmed egg deposition on 8 mats within the west channel, and 2 egg mats in the east channel. No eggs were found within the mixing area (NRSI 2014).

A variety of other techniques were used to confirm spawning within the area. Gill netting, visual spot-lighting surveys, angling surveys, fyke netting surveys and trap netting surveys were employed both upstream and downstream of the Chute. During these surveys Walleye were found in ripe and spent spawning states, which further confirmed that Walleye spawning is occurring in the area of The Chute (NRSI 2014) (Table 21).

Table 21: The Chute - Total Suitable Walleye Spawning Habitat

Location	Approximate Spawning Habitat
6.3km upstream of The Chute	2000 m^2
5.5km upstream of The Chute (east and west channel	900 m^2
Oates Road Bridge	2400 m^2
100m upstream of The Chute	1500 m^2
The Chute Eastern Channel	1200 m^2
The Chute Western Channel	800 m^2
The Chute Western Channel (low flow)	800m^2

(NRSI 2014)

Foraging

Walleye prefer to forage in the dark and move into the shallows in the evenings to feed on fish, leeches, crustaceans, molluscs and frogs (Holm et. al. 2009). Within the Ivanhoe River, Walleye likely move into the nearshore areas or the shallow riffle and run habitats to feed. Several shallow riffle habitats exist within the east and west channels at the Chute as well as upstream of the Chute. Riffle and run areas located 6.3km, 5.5km, at Oates Road Bridge and 100km upstream of the Chute also represent habitat where Walleye may potentially be foraging (NRSI 2014).

Nursery and Rearing

Nursery and rearing habitat for Walleye would likely consist of areas with an abundance of cover. Vegetated shorelines, wetlands or mouths of tributaries would provide appropriate nursery and rearing habitat for young Walleye. An appropriate area exists below the island 5.5km upstream of the Chute as well in a small bay below the riffle at Oates Road Bridge. Several appropriate areas are also present immediately downstream of the Chute and in backbays areas like Joe Lake. Approximately 16.3 km downstream of the proposed Chute GS there is a high gradient bedrock feature. Along the northern shoreline, there is a band of submerged and emergent aquatic vegetation, consisting of Richardson's pondweed, ribbon leaf pondweed, water horsetail and common spike rush. This area may also act as potential nursery and rearing habitat for juveniles. Although no juvenile fish were observed in any of these areas during field surveys (NRSI 2014).

9.4.1.2.1 Third Falls

Presence

During RIN sampling a totally of 287 fish were caught. Walleye was the only species caught in all sampling locations along the Ivanhoe River (NRSI 2014), indicating that it is highly abundant in the system, particularly in the Third Falls inundation area.

Table 22: RIN Sampling for Walleye at Third Falls GS

Location	Species	Quantity
Third Falls Inundation Area/Downstream of The Chute	Walleye	131
Third Falls GS Location	Walleye	3
Downstream of Third Falls	Walleye	20

(NRSI 2014)

Spawning

A small run is located approximately 9km downstream of The Chute GS, within the Third Falls inundation area. This run is created by a slight narrowing of the channel as a result of bedrock and bolder along the margins. This area contains suitable walleye spawning habitat and Walleye spawning was confirmed through egg deposition on egg mats (NRSI 2014).

Appropriate Walleye spawning habitat was also observed at Nova Road Bridge. Spawning surveys were completed at this location in 2010. No eggs were observed on egg mats and spawning could not be confirmed at this location (NRSI 2014).

In 2010 and 2011 egg matting surveys was completed at Third Falls. No Walleye eggs were observed during 2010 surveys on any of the 20 egg mats set at Third Falls. Egg matting surveys conducted on May 18 and 19, 2011 at Third Falls resulted in the confirmation of spawning on two egg mats. However, eggs were in poor condition and species could not be identified. The habitat has been identified as suitable for both Walleye and White Sucker spawning (NRSI 2014).

Table 23: Available Spawning habitat in the Third Falls Inundation Area

Location	Approximate Spawning Habitat
Run 9km Downstream from The Chute	150 m^2
Nova Road Bridge	1800 m^2
5 km Upstream of Third Falls	2100 m^2

(NRSI 2014)

Foraging

Walleye prefer to forage in the dark and move into the shallows in the evenings to feed on fish, leeches, crustaceans, molluscs and frogs (Holm et. al. 2009). Within the Ivanhoe River, Walleye likely move into the nearshore areas or the shallow riffle and run habitats to feed. Several shallow riffle and run habitats exist 9km downstream of the Chute, 20km upstream of Third Falls, at Nova Road Bridge and 5km upstream of Third Falls (NRSI 2014).

Nursery and Rearing

Nursery and rearing habitat for Walleye would likely consist of areas with an abundance of cover. Vegetated shorelines, wetlands or mouths of tributaries would provide appropriate nursery and rearing habitat for young Walleye. Several appropriate areas of aquatic vegetation are present downstream of Third Falls. Upstream of Third Falls there is a connected lake with abundant aquatic vegetation as well as several mouths of tributaries that would afford good protection for young Walleye. Although no juvenile fish were observed in any of these areas during field surveys (NRSI 2014).

Methods were taken to age and sex walleye during the field assessment. Data from walleye collected during the field survey placed their ages from 1 year to 10 years. Detailed information on this process can be found in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* (NRSI 2014).

9.4.2.1 Northern Pike

Northern Pike live in riverine and lacustrine habitats throughout North America. Within riverine systems, Pike seem to prefer clear, meandering, warm and heavily vegetated areas. Northern Pike begin to spawn in the early spring following ice-out in water temperatures from 4.0 to 11°C. Spawning occurs over aquatic vegetation in marshes and seasonally inundated vegetation along the river margins and on mid-channel islands. Following the spawning act eggs adhere to aquatic vegetation and are abandoned. Northern Pike were the second most abundant species found in the system, with the highest amounts found immediately downstream of proposed Chute Facility (NRSI 2014).

9.4.2.1.1 The Chute

Presence

The presence of Northern Pike in the system was confirmed in spring surveys in 2010, 2011 and 2012. During RIN Sampling a total of 287 fish were caught in the main stem of the Ivanhoe River. Northern pike were caught at the area around The Chute during this sampling period (NRSI 2014).

Table 24: RIN Sampling for Northern Pike at The Chute GS

Location	Species	Quantity
Upstream of The Chute GS	Northern Pike	2
The Chute area GS Location	Northern Pike	5

(NRSI 2014)

Spawning

No targeted surveys were completed for Northern Pike, however this species was assessed under the general fisheries assessment conducted by NRSI between 2010-2012. Northern Pike spawn very early in the spring right after ice out in flooded shoreline vegetation, aquatic vegetation, wetlands and back-bay areas where vegetation is present. This spawning habitat is limited within the Study Area (NRSI 2013).

A review of aerial photography revealed three relatively large tributaries connected to the Ivanhoe River and one location upstream of the proposed Chute GS. One location was noted approximately 120m downstream of The Chute and the other locations were noted immediately upstream of The Chute and immediately downstream of the Oates Road Bridge. These four locations present potential spawning areas for Northern Pike when the tributaries are flooded in the spring. It is also expected that the flooded vegetation along the main channel of the Ivanhoe River in the spring may also contribute spawning habitats for Northern Pike (NRSI 2014).

Foraging

Northern Pike is an ambush predator and generally waits motionless in weed beds for prey to swim by. It will feed on whatever is readily available including fish, frogs, crayfish, mice, muskrats and ducklings. Young pike feed on zooplankton and aquatic insects for the first years of its life (Holm, et. al. 2009). The habitats mentioned above as appropriate spawning habitats for Northern Pike would also afford appropriate foraging habitat (NRSI 2014).

Nursery and Rearing

Nursery and rearing habitat for Northern Pike would likely consist of areas with an abundance of cover. Vegetated shorelines, wetlands or mouths of tributaries would provide appropriate nursery and rearing habitat for young Northern Pike. The habitats mentioned above as appropriate spawning habitats for Northern Pike would also afford appropriate nursery and rearing habitats for young Northern Pike (NRSI 2014).

9.4.2.1.2 Third Falls

Presence

During RIN sampling a totally of 287 fish were caught in the main stem of the Ivanhoe River. NorthernPpike were caught at all locations except for at the Third Falls GS location (NRSI 2014).

Table 25: RIN Sampling for Northern Pike at Third Falls GS

Location	Species	Quantity
Third Falls Inundation Area/Downstream of The Chute	Northern Pike	18
Third Falls Area GS Location	Northern Pike	0
Downstream of Third Falls (Outside the Project Area)	Northern Pike	6

(NRSI 2014)

Spawning

Oates Creek approx. 3.5km downstream of The Chute and a connected lake and wetland area approximately 5.5km downstream would likely provide northern pike spawning habitat (NRSI 2014). Approximately 6.0, 20 and 26.5km upstream of Third Falls there are three relatively large tributaries (Tributaries 21, 13 and 10) connected to the Ivanhoe River. These three locations present potentially spawning areas for Northern Pike when the tributaries are flooded in the spring. At approximately 8.0, 35 and 38km upstream and 3.8 km downstream of Third Falls there are several additional small back bay areas and tributary outlets that may also afford potential significant Northern Pike spawning

habitat (NRSI 2014). During 2012 reconnaissance surveys, three additional areas were identified that could offer Northern Pike spawning habitat. These areas were located approximately 3.9km, 16.4km, and 19.8km downstream from the proposed Third Falls GS location (NRSI 2014).

Foraging

Northern Pike is an ambush predator and generally waits motionless in weed beds for prey to swim by. It will feed on whatever is readily available including fish, frogs, crayfish, mice, muskrats and ducklings. Young pike feed on zooplankton and aquatic insects for the first years of its life (Holm, et. al. 2009). The habitats mentioned above as appropriate spawning habitats for Northern Pike would also afford appropriate foraging habitat (NRSI 2014).

Nursery and Rearing

Nursery and rearing habitat for Northern Pike would likely consist of areas with an abundance of cover. Vegetated shorelines, wetlands or mouths of tributaries would provide appropriate nursery and rearing habitat for young Northern Pike. The habitats mentioned above as appropriate spawning habitats for Northern Pike would also afford appropriate nursery and rearing habitats for young Northern Pike (NRSI 2014).

During the field program in the summer of 2011, young-of-year Northern Pike were confirmed near tributaries downstream of The Chute in the proposed Third Falls inundation area, and were also confirmed in a large shallow bay 5.5km downstream of The Chute in the Third Falls inundation area. They were also caught downstream of the first falls located approximately 1.5km downstream of the proposed Third Falls GS (NRSI 2014).

9.4.3.1 Brook trout

Brook Trout are a coldwater species targeted by recreational anglers in the Ivanhoe River watershed. This species requires cold, clean water and are highly dependent on localized groundwater upwelling areas for spawning and successful egg development. Brook Trout are highly mobile and could be found both in the main stem of the Ivanhoe River or its tributaries depending on the time of year and available habitats for spawning, juvenile development, foraging and thermal refuge (NRSI 2014).

Brook trout were also identified by the MNR as a valued species which may be present within the Project Area, and were caught in the Project Area during field studies. Brook trout are highly mobile and could be found both in the main stem of the Ivanhoe River or its tributaries depending on the time of year and available habitats. The Shawmere River joins the Ivanhoe River approximately 650 m upstream of the inundation area, and is considered by locals and MNR as a significant coldwater system with a healthy population of Brook trout (NRSI 2014).

Presence

A total of six adult Brook Trout were collected from the main stem of the Ivanhoe River. One individual was captured on a trot line in 2010 at the proposed Third Falls GS location and five others were angled during the spring of 2011 in the fastwater feature approximately 1.66km further downstream. Brook Trout were not collected from any of the tributaries during fish community surveys however, they were observed in two (Tributaries 2 and 27) during habitat surveys (NRSI 2014).

Spawning

In addition to detailed the detailed tributary assessment completed in 2011 on 35 tributaries within the Study Area, the proponent commissioned a Brook Trout spawning assessment for nine tributaries in the Third Falls inundation areas between October 21 and 30, 2013 which was carried out by NRSI. Details of this assessment can be found *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* (NRSI 2014). Suitable spawning habitat was only located in one tributary, Komak Creek – Tributary 21 (See Map 1 - Tributary Assessment in Appendix H) however no spawning Brook Trout or evidence of spawning were observed during the survey. Additionally no Adult Brook Trout or evidence of spawning was found in any of the other tributaries surveyed during this period. The survey located several habitat types which may serve as thermal refuge habitat for adult Brook Trout (NRSI 2014).

9.4.3.2 Lake Sturgeon

Lake Sturgeon is a large bodied, long lived fish with low adult mortality. They have a long life cycle characterized by onset of sexual maturity at 12 to 20 years for males and 20 to 30 years for females and a typical life span of approximately 50 to 80 years. Lake Sturgeon typically spawn over cobble and boulder substrates in swift flowing water 0.3 to 6.0m deep (NRSI 2014).

The timing of spawning is highly dependent on water temperature, and generally occurs from late May to late June. Optimal spawning temperatures are reported to be in the range of 14 to 16°C, although spawning activity may occur anywhere in the range of 8.5 to 18°. It is common for Lake Sturgeon to spawn at the downstream end of impassable barriers and dams in water depths of 1 to 5m (NRSI 2014).

The Hudson Bay - James Bay population of Lake Sturgeon is listed as Special Concern within Canada and Special Concern within Ontario (NRSI 2014).

9.4.3.2.1 Presence

In order to understand if Lake Sturgeon are present in the Ivanhoe River beyond their historically known distribution limit the proponent commissioned an extensive sampling program which was carried out by NRSI in the fall of 2011. The purpose of the initial survey was to determine if the Lower Falls, located downstream of Third Falls is a barrier to upstream fish movement. Details of the methodology employed in this study can be found in section 3.2.2 of the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* (NRSI 2014). The survey sampled an area from the proposed Chute GS to a point upstream of the second significant set of falls approximately 9km upstream of the confluence with the Groundhog River (NRSI 2014).

No lake sturgeon were captured during this study. This study concluded that the Lower Falls is likely posing as a barrier to upstream movement. No Lake Sturgeon were captured within the Chute and Third Falls zone of influence during this study (NRSI 2014). This study concluded that the lower falls presents a barrier to upstream movement as Lake Sturgeon were caught in abundance below this feature (NRSI 2014).

Based on the results of the fall 2011 Lake Sturgeon investigation, this species appears to be restricted to the lower reach of the Ivanhoe River near the confluence with the Groundhog River. There are a number of natural impediments/barriers to fish passage which prevent their occurrence immediately downstream of the proposed Third Falls Hydroelectric site and upstream in the proposed inundation area (NRSI 2014).

9.4.3.2.2 Spawning

A spawning survey was commissioned by the proponent and carried out by NRSI in 2010 and 2011 within the zone of influence of the Chute and Third Falls facilities. Details of the methodology employed in this survey can be found in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* (NRSI 2014) located in Appendix H. No Lake Sturgeon eggs were observed during egg matting surveys further confirming that Lake Sturgeon are not found within the Chute and Third Falls ZOI (NRSI 2014).

9.4.4.1 Benthic & Macroinvertebrates

The benthic macroinvertebrate community of eight fast-water habitats within the Chute and Third Falls Study Area was assessed. Details and methodologies related to this work can be found *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* (NRSI 2014).

9.4.3.2.3 The Chute

Within The Chute ZOI, 24 families representing 9 different orders of benthic macroinvertebrates were identified. Chironomidae was the most abundant family and comprised the majority of the sample at 14 of the 24 stations. Within the Study Area the dominant taxon was determined to be *Rheotanytarsus sp.*, a species belonging to the family Chironomidae. This species is distributed widely throughout North America and is one species of Dipteran that inhabits running-water riffles over course substrates. The dominant feeding group at all twenty-four stations was collectors indicating that of all the food sources available, fine particulate organic matter is the most highly utilized and likely the most readily available (NRSI 2014).

9.4.3.2.4 Third Falls

Within the Third Falls ZOI, 31 families representing 12 different orders of benthic macroinvertebrates were identified. Trichoptera (caddisflies) were identified as the dominant family within the Third falls project area with Ephemeroptera (mayflies) representing the second dominant family. The dominant taxon in the project area is *Hydropsyche bronta/morose* which belongs to the family Hydropsychidae, a family of caddisflies Fine particulate organic matter was identified as the major feeding group at all the stations in this area (NRSI 2014).

Based on the benthic macroinvertebrate community found in the study it is expected that the fast water habitats studied provide foraging opportunities for a number of fish species throughout the year (NRSI 2014).

9.4.4 Fish Migration

The Ivanhoe River is part of the Moose River basin, which is one of the most highly fragmented river systems in the northern third of the world (NRSI 2014). It contains both natural and man-made barriers which pose as barriers to upstream movement to a variety of fish species. In some locations barriers such as hydroelectric generating stations have been constructed, where natural barriers existed. Species such as Lake Sturgeon have been documented to use the entire stretch of river between barriers such as dams on other river systems such as the Mattagami (NRSI 2014).

9.4.4.1 The Chute

9.4.4.1.1 Upstream Migration

The proposed Chute GS location is considered to restrict upstream fish passage due to the associated vertical drops in both the east and west channels (NRSI 2014).

9.4.4.1.2 Downstream Migration

Downstream migration likely occurs at The Chute GS location however, since upstream movement is restricted, once downstream migration occurs fish will not be able to return to habitats upstream.

9.4.4.2 Third Falls

9.4.4.2.1 Upstream Migration

There are three falls at the proposed Third Falls Facility location which represents the limit where upstream movement of fish species would begin into the Project Area. During the field assessment NRSI concluded that the Lower falls represents a significant barrier to upstream fish movement into the Third Falls Facility area. Additionally that the middle falls represents a further barrier to upstream fish movement (NRSI 2014).

9.4.4.2.2 Downstream Migration

The falls/rapids located approximately 7.5km upstream from the Groundhog River, are considered a complete barrier to upstream fish migration. Approximately 1.5km upstream of these rapids is a second significant set of falls/rapids that have also been identified to restrict upstream movement. A smaller set of rapids is situated approximately 14km upstream from this point and the base of Third Falls is located approximately 2.0km further upstream (NRSI 2014).

Tributary 22

Approximately 75-100m upstream of the mouth is a large beaver dam, which is 0.75m high and is likely a barrier to fish movement. This tributary was assessed for brook trout habitat but none were found (NRSI 2014).

9.4.3 Fisheries

The Study Area does not contain a commercial fishery or an aquaculture Facility. The area allows baitfish harvesting, and baitfish species are abundant in the Project Area. At present it does not appear that a baitfish harvester is licensed to use the Project Area to harvest. Recreational, sport and subsistence fishing is the only type of fishery occurring in the area (NRSI 2014).

9.4.4 Fish Injury or Mortality

There are presently no man-made structures in the Project Area which would pose as a source of fish injury or mortality. There are barriers to upstream movement which could be causing fish injury or mortality if any species were to try to pass up them (NRSI 2014).

9.4.5 Wetland Habitat

Wetlands in the Study Area are predominantly large wetland complexes consisting mostly of black spruce swamps on organic soils. Marshes are also present, mostly on lakes and streams. Fens are found in basins isolated from contact with stream water and on upper margins of shoreline wetlands. Many non-treed wetlands are associated with beaver activity. Alder thickets (ecosites B134 and B135) are often found on the edge of active beaver ponds, whereas meadow marshes (Ecosite B142) are found in old, non-flooded, beaver ponds, and are dominated by the sedge Carex stricta, white meadowsweet, and meadow willow (Northern Bioscience 2014). Twenty-two hectares of the proposed transmission corridor route runs through water and non-forested wetland (Northern Bioscience 2014).

9.4.5.1 Wetland Ecosites

9.4.5.1.1 The Chute GS

B152 Open Water Marsh: Organic

This community is located on both sides of the Ivanhoe River, approximately 1.5km downstream of the proposed Chutes GS. It can also be found 200m upstream of the proposed GS on the east side of the river. This community is characterized by <25% emergent vegetation and <50% floating-leaved vegetation. Vegetation in this community includes broadleaved arrowhead, common coontail, and common duckweed. This community is also identified by the MNR Values Resource Mapping as moose aquatic feeding area, which is discussed in more detail in Section 9.3 (NRSI 2014).

9.4.5.1.2 Third Falls GS

B134 Mineral Thicket Swamp

This community is found approximately 3.5km downstream of the proposed Chutes GS on the eastern side of the river. The canopy, sub-canopy and understory are dominated by alder. White elm is also found in the canopy. The herbaceous layer includes sensitive fern, tall meadow rue, horsetail, and strawberry (NRSI 2014).

B223 Mineral Intermediate Conifer Swamp

These communities can be found throughout the Study Area. In the northern portion of the Study Area there are two communities on each side of the river. The canopy is dominated by white spruce, balsam fir, with some white cedar. Black ash is dominant in the sub-canopy with an abundance of red-osier dogwood in the sub-canopy and understory. The understory also contained tall meadow rue, unidentified grass species, and bulblet fern. The herbaceous layer includes wild strawberry, tall

meadow rue, and wild sarsaparilla. There are three communities in the southern portion of the Study Area with similar compositions. These are dominated by white cedar and white spruce, with some balsam fir in the canopy layer. The sub-canopy layer is dominated by red-osier dogwood with some black ash. The herbaceous layer includes unidentified grass species, sensitive fern, small's spikerush, and an unknown mint species (NRSI 2014).

B224 Mineral Rich Conifer Swamp

This community is found in a small area on the west side of the river in the northern part of the Study Area. This is a community dominated by white cedar in the canopy and sub-canopy. The canopy and sub-canopy also contain white birch, white spruce, balsam fir, red-osier dogwood, and speckled alder. The understory was comprised predominantly of tall meadow rue with occasional spotted joe-pye-weed and larger blue flag. The herbaceous layer includes Canada anemone, unidentified grass species, red raspberry, and false Soloman's seal (NRSI 2014).

B142N Mineral Meadow Marsh

These communities are comprised of islands and shoreline habitat found within and adjacent to the Ivanhoe River downstream of the Third Falls GS. Six Mineral Meadow Marsh communities were identified. Dominant vegetation includes Canada blue joint and swamp milkweed. Other species found within these wetland communities includes Richardson's pondweed, lake-bank sedge and broad-leaved arrowhead (NRSI 2014).

B151N Open Water Marsh: Mineral

Open water marsh ecosites were also identified downstream of the Third Falls GS. Three of six communities identified were located adjacent to Mineral Meadow. These wetland communities include low-lying shoreline marsh communities dominated by narrow emergents such as water horsetail and grass species. Other plant species commonly found in these ecosites include broad-leaved arrowhead, floating-leaved arrowhead, tape grass and Richardson's pondweed (NRSI 2014).

B148N Mineral Shallow Marsh

This wetland community is located approximately 16km downstream of the Third Falls GS. The shoreline marsh is dominated by water horsetail and common spike-rush. Aquatic vegetation within the marsh community includes Richardson's pondweed, quillwort and broad-leaved arrowhead (NRSI 2014).

9.4.5.2 Waterfowl

Although a few duck and waterfowl species such as ring-neck duck, ruddy duck and sandhill crane were seen on the Ivanhoe River and some ponds, waterfowl were generally uncommon in the area, and the number of observations did not meet the criteria for confirmed habitat for marsh breeding birds (Northern Bioscience 2014).

Breeding bird surveys were conducted and resulted in the observation of several indicator species for waterfowl nesting habitat including American black duck, wood duck, blue-winged teal, Canada goose, hooded merganser, common merganser, mallard, bufflehead, common goldeneye, and red-breasted merganser in suitable breeding habitat. Low numbers of these species were observed (NRSI 2014).

Candidate SWH has been identified for Waterfowl Nesting Areas and Marsh Breeding Birds. Upland habitats adjacent to wetland communities have been identified within the project area and are considered candidate SWH. Wetland communities provide candidate habitat for Marsh Breeding Birds and are afforded protection under the PPS (NRSI 2104).

9.4.5.2.1 Transmission Lines & Roads

Although a few ducks and waterfowl species were seen on the Ivanhoe River and some ponds, waterfowl were generally uncommon in the area around the transmission line corridor and roads, due to the fact that these areas avoid lakes. Species associated with open country and urban habitats are lacking. A number of waterfowl species were observed on waterbodies in the Study Area during the breeding season, often in pairs indicating that they nest along the shoreline or in adjacent forests. (Northern Bioscience 2014).

There were no waterfowl stopover and staging areas found, or shorebird migratory stopover areas. There are some small lakes, ponds and marshes with abundant aquatic vegetation which may provide possible waterfowl stopover and staging areas (Northern Bioscience 2014).

9.4.5.3 Turtles

No turtles or evidence of turtle nests were seen despite conducting encounter surveys targeting turtle species. The Study Area is near the northern limit of the range of midland Painted Turtle and Snapping Turtle; a Special Concern species. Unsubstantiated reports for Wood Turtle also exist for the area, however the study area is within the northern range of this species within Ontario (Northern Bioscience 2014). Potential turtle habitat and turtle wintering areas are present in the area.

9.4.5.4 Amphibians & Reptiles

Seven species of amphibians and one reptile were observed in the Ivanhoe Study Area during the 2013 fieldwork conducted by Northern Bioscience. The observed species richness is within the range expected in this part of the boreal forest (5–9 species). Eastern American Toad, northern spring peeper, and wood frog were heard calling in June 2013 and Mink Frog and Green Frog were observed in June and August 2013 indicating that amphibian wetland breeding habitat is present in the Study Area. Additionally tadpoles were observed in ditches and vemal pools along roads, indicating that amphibian woodland breeding habitat is present in the Study Area. A single red-backed salamander was observed near the proposed Chute Facility and larvae of salamanders of the genus Ambystoma were observed in several road-side pools along the proposed transmission line corridor. The area is within the range of blue-spotted, spotted salamander, and hybrid A. laterale X A. jeffersonianum (Northern Bioscience 2014).

Snake cover board surveys were completed during the 2010-2012 field assessment near the Facilities. Four individual eastern garter snakes were observed during these surveys (NRSI 2014).

Suitable reptile hibernacula may occur in rock cervices or rock piles, however none were documented or observed during the 2013 field visit. (Northern Bioscience 2014).

No significant herpetofaunal species were identified through background review or field studies during 2010 (NRSI 2014).

9.4.6 Shoreline Dependent Species

Denning sites for mink, otter, gray wolf, eastern wolf, Canada lynx, marten, fisher, and black bear are considered Significant Wildlife Habitat (SWH). Additional mammal observations included beaver dams and slides identified near areas where beavers were observed swimming. Beavers were also observed swimming along the length of the river. Muskrats, fishers, and snowshoe hare were observed as well. Various small mammal holes were identified throughout the Study Area. Further the surrounding forest is large and continuous which make it potentially important habitat for martens and fishers. Further, the surrounding forest is large (>100ha in size) and contiguous, making it potentially important habitat for martens and fishers. Localized areas of deadfalls, log piles and shrubby areas within the study area may also provide suitable habitat for otters and lynx (NRSI 2014).

9.4.6.1 Otters

The study area features relatively undisturbed shoreline habitats of coniferous forest, with areas of downed woody debris in localized areas. These habitat features coupled with a productive fish community in the Ivanhoe River, make the study area a potentially significant habitat for mink and

otters (NRSI 2014). River otters were observed upstream of the proposed Third Falls GS in 2011, around the island approximately 2km upstream. In July 2012, they were observed upstream of the proposed Third Falls GS near Nova Road Bridge and downstream of the proposed Third Falls GS approximately 5km north of the confluence of the Ivanhoe and Groundhog River (NRSI 2014). Denning was confirmed to occur in the area. Further information on Otter Denning is discussed in section 9.4.8 as it is considered Significant Wildlife Habitat.

9.4.7 Species at Risk

9.4.7.1 Lake Sturgeon

Lake Sturgeon in the Ivanhoe River are part of the Hudson Bay-James Bay population which are listed as Special Concern under the Ontario Endangered Species Act. This species inhabits the bottoms of shallow areas of large freshwater lakes and rivers, but migrates each year from early May to late June to swift-flowing water in order to spawn. As described in 9.4.1, Lake Sturgeon were not found to occur within the Project Area due to naturally occurring barriers to upstream movement occurring downstream of proposed Third Falls Facility (NRSI 2014).

9.4.8 Significant Natural Heritage Features & Areas

9.4.8.1 Waterfowl Nesting Areas & Marsh Breeding Bird Habitat

Candidate SWH has been identified for Waterfowl Nesting Areas and Marsh Breeding Birds. Upland habitats adjacent to wetland communities have been identified within the Project Area and are considered candidate SWH. Wetland communities provide candidate habitat for Marsh Breeding Birds (NRSI 2014).

9.4.8.2 Amphibian Breeding Habitat & Amphibian Movement Corridors

Wetland communities have also been identified as candidate habitat for Amphibian Breeding Habitat and associated Amphibian Movement Corridors. These habitats are small compared to wetland communities found in the surrounding landscape (NRSI 2014). Within the Ivanhoe Study Area, watercourses likely serve as corridors for amphibians, turtles and snakes (Northern Bioscience 2014).

9.4.8.3 Otter Denning

SWH is identified for otter denning both upstream and downstream of the Third Falls GS. Extensive searches for denning sites is not recommended as locating them can be very difficult. Otters are known to use abandoned dens of other animals as well as old beaver lodges (NRSI 2014). They will also excavate dens in the river bank with entrances above or below the waterline. No den sites were

confirmed during fieldwork, however SWH is designated based on observations of several otters along or within the Ivanhoe River and of small mammal dens observed within the associated areas. As specified in the SWHTG Ecoregion Criterion "All den sites identified using Table 1.2.2 of this schedule under the habitat of Denning Sites for Mink, Otter, Marten Fisher and Eastern Wolf are to be considered for an animal movement corridor." These ecosites include all treed communities found adjacent to riparian areas with denning sites. These habitats are considered confirmed SWH and are therefore afforded protection under the PPS (NRSI 2014).

9.4.8.4 Lake Sturgeon Habitat

This population of Lake Sturgeon is listed as Special Concern both provincially and federally. This species appears to be restricted to the lower reach of the Ivanhoe River near the confluence with the Groundhog River. There are a number of potential barriers to their movement upstream which limit their occurrence within the Study Area. Lake Sturgeon have been confirmed approximately 21km downstream of Third Falls and approximately 8km upstream of the confluence with the Groundhog River. The section of the Ivanhoe River below this feature is considered SWH for Lake Sturgeon (NRSI 2014). There is no SWH for sturgeon within the ZOI.

9.5 Air Noise & Vibration

9.5.1 Air Quality

Air quality generally refers to a measurement of pollutant concentrations in the atmosphere which may be harmful or injurious to human health, animal or pant life, property, or may unreasonably interfere with the enjoyment of life or property, including outdoor recreation (Cooper 1990). The Ontario the Ministry of Environment uses an Air Quality Index (AQI) system comprised of six air pollutants (fine particulate matter (PM), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), total reduced sulphur compounds (TRS) and ozone (O_3)) as a measure of air quality within the province.

The closest air quality monitoring stations to the Project Area are located in Sudbury approximately 250 km to the south-east and Sault St. Marie located about 300 km to the south-west. Both stations indicate air quality within the area is "Very Good" to "Good" for 97% of the readings, with the remaining 3% recorded as "Moderate"(MOE 2011). Air quality within the Study Area is assumed to exhibit a similar pattern due to the proximity to these monitoring stations and absence of urban or industrialized activity. Air quality within the Study Area will be influenced by naturally occurring events such as forest fires, prevailing winds carrying contaminants into and out of the Study Area and anthropogenic sources such as forestry operations. There are no known industrial sources of emissions and mining / prospecting activities within the Study Area are currently limited.

9.5.2 Noise and Vibration

The existing acoustical environment is dominated by the natural environment and is classified as a Class 1 or rural area by the MOE "Environmental Noise Guideline" NPC-300 (2013). The guideline acoustic criteria established by the MOE seek to address nuisance sources of sound, referred to as noise, which may impact human use and enjoyment of an area.

The existing environment is not subjected to sources of vibration other than forestry operations and naturally occurring events.

9.5.3 Greenhouse Gas Emissions and Offsets

Greenhouse gas (GHG) emissions, consisting primarily of the compounds, Carbon Dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O) are the subject of reporting and reduction targets in Ontario as part of the provincial Climate Change initiative. Sources of GHG emissions include:

- Fossil fuel electricity production (including natural gas);
- Transportation sector (combustion engines);
- Industrial sources, and
- Agriculture (livestock and soils).

GHG offsets are emission reduction projects undertaken by currently unregulated industry or sectors such as farms and forests. (MOE, 2013)

9.6 Land

The Ivanhoe projects are located in Oates and Belford Townships and will be built on provincial Crown land. No known parcels of private land exist within close proximity of the two sites.

9.6.1 Existing Land Use or Resource Management Plans

The proposed Project is situated in the Crown land area identified as the General Mixed Use Areas (G1770), a 1,697,000 ha general use area extending through the Chapleau and Timmins Districts. It encompasses areas of significant mining potential and anticipated future forest extraction activities. The area contains roads and access facilities, along with numerous commercial lodges, commercial outpost camps, and cottages. Primary outdoor recreational activities are fishing, hunting, canoeing and boating. According to Ministry of Natural Resources (MNR) Crown Land Use Policy Atlas (CLUPA) report the future land use priorities in this area include an expansion of the forest, mining, and trapping sectors. This will be intermixed with local recreation and tourism. Road access will be directed towards

facilitating the priority land uses suggested for this area, while at the same time promoting recreational opportunities and tourism.

Commercial activities allowed on Crown land in proximity to the Project include aggregate extraction (generally not permitted in shoreline areas), bait fishing, commercial fur harvesting, commercial hydro development, timber harvesting, commercial tourism, mineral exploration and development, peat extraction, and wild rice harvesting. Crown land can be released for road development and maintenance, rural residential use, agricultural use, private recreational camping, vegetation management, fire suppression, and cottaging purposes (MNR, 2006/2008).

The proposed Third Falls Facility is located south of the Northern Claybelt Conservation Forest Complex. This large complex of land and water protects ecosystems that are characteristic of the Forest. Its combined size, location within the claybelt and diversity of natural features make an important contribution toward the conservation of northeastern Ontario's biological diversity. According to a CLUPA report (C1702: Northern Claybelt Forest Complex), the forest access road is mainly used for commercial reasons. Commercial activities allowed in this part of Ontario include bait fishing, commercial fur harvesting, commercial tourism, energy transmission and wild rice harvesting.

9.6.1.1 Resource/Industrial Activities

Important local economic resources and industries include forestry, mining and aggregate extraction. New hydropower development is discussed within the context of these pre-existing land uses.

9.6.1.2 Forestry

Forestry is one of the primary resource extraction and management activities occurring around the Study Area.

9.6.1.2.1 The Chute: Pineland Forest

The Study Area for The Chute Facility is situated within the Pineland Forest (NF), located in the MNR's Northeast Region, managed by the Pineland Timber Company Ltd. (Pineland), under its Sustainable Forest License (SFL). EACOM Timber Corporation (EACOM), the agent for Pineland, undertakes all forest management activities from its office in Timmins, Ontario.

The Pineland forest management unit covers more than a total of 391,000 hectares (ha), with 99.3% of the land owned by the Crown. The managed production forest area accounts for approximately 80.5% of the Crown land or about 313,000 ha. The remaining Crown area (approximately 19.5%) is not managed for timber production and is composed of non-productive, protected and other Crown Forested areas totaling 10.2%; and non-forested areas totaling 9.3%.

The main economic benefits derived from the forest come from the commercial timber harvest. The Pineland forest is currently being harvested in accordance with an approved Forest Management Plan (FMP) (2011 to 2021). Under the SFL, EACOM retains the license to all timber species on the Pineland Forest with commitments to supply other company mills with timber. Logging contractors employed by EACOM harvest all of the timber on the unit and distribute the material to the mills by trucks or in some cases by rail.

Companies that were identified as harvesting timber from this forest were:

- EACOM Timber Corporation
- True North Hardwood Plywood Inc.
- Grant Forest Products Ltd.
- Niska North Inc.
- Commonwealth Plywood Co. ltd.

A 200 m forest reserve, along the length of the Ivanhoe River, has traditionally been maintained as an Area of Concern (AOC) under the Forest Management Planning process.

Dialogue between Xeneca and EACOM regarding the Project has been and is ongoing. Discussion topics include maintenance of access roads and bridges, use of gravel sources, flooded timber issues and employment opportunities in the area.

9.6.1.2.2 Third Falls: Gordon Cosens Forest

The Study Area for the Third Falls Facility is situated within the Gordon Cosens Forest, and managed by Tembec Inc., which is the Sustainable Forest License (SFL) holder for the forest.

The Gordon Cosens Forest covers approximately 1.82 million ha, with managed productive forest accounting for 1.51 million ha of the total area and approximately 200,000 ha composed of unmanaged forest. Black spruce is the most abundant working group by area within the forest (comprising 70%), followed by poplar (17%), white birch, balsam fir and jack pine.

The Gordon Cosens forest is currently being harvested in accordance with the approved FMP (2010 to 2020). The FMP identifies future harvesting, site preparation, and regeneration areas, as well as infrastructure requirements such as expanded logging road networks. The primary wood user in the forest is Tembec/Spruce Falls Inc., although in 2001, the following six third-party companies were identified as harvesting timber from this forest:

- Excel Forest Products (Opasatika)
- Lecours Lumber Co. (Colstock)
- Tembec Inc. – United Division (Hearst)

- Tembec Inc. (Timmins)
- Columbia Forest Products (Hearst)
- J.E. Martel & Sons Limited (Chapleau).

A 200 m forest reserve, along the length of the river, has traditionally been maintained as an Area of Concern (AOC) under the Forest Management Planning process.

Discussion between Xeneca and Tembec Inc. has been and is ongoing regarding Project elements falling within the FPM.

9.6.1.3 Mining and Mineral/Aggregate Extraction

As of 2009, the surface rights of areas situated in the Townships of Belford and Oates (G-1042 and G-1189 respectively), in the Porcupine Mining Division, along the Ivanhoe River were withdrawn from prospecting, staking out, sale or lease in accordance with the terms of Order No. W-P-127/09, under Section 35 of the *Mining Act*. The area was withdrawn from mining activities by the MNR as the proposed site for The Chute and Third Falls waterpower facilities (see Appendix A).

9.6.1.3.1 The Chute

There are no mining claims or leases in the immediate vicinity of The Chute Facility (Site Information Package (SIP)).

Available aggregate pits in proximity to The Chute GS are located along the Oates Road. These pits are classified as Category 14 and are only useable by the SFL holder with approval being granted through the forest management planning process. Category 14 pits are a maximum of 3 ha in size and are bound by minimum rehabilitation timelines and standards (KBM Roads report).

9.6.1.3.2 Third Falls

According to the Ministry of Northern Development and Mines (MNDM) CLAIMaps website, there are several active mining claims (#3006253, #3006257, #3006258, #3006259, #3006260, #3006261, #3006267,#3006286, #3006287, and #3006288) near the Project Area, mainly claimed by Xstrata Canada Corporation. Dialogue with the mining company is ongoing.

Several active Catagory 9 aggregate pits are located in proximity to the Third Falls GS and may be used as aggregate sources during project construction and maintenance. Use of aggregate from these sites is being discussed with the permit holder and MNR.

9.6.1.3.3 Ivanhoe

As of 2009, the surface rights of areas situated in the Townships of Belford and Oates (G-1042 and G-1189 respectively), in the Porcupine Mining Division, along the Ivanhoe River were withdrawn from prospecting, staking out, sale or lease in accordance with the terms of Order No. W-P-127/09, under Section 35 of the *Mining Act*. The area was withdrawn from mining activities by the MNR to facilitate the proposed site for the Project. The two sites will be subject to long-term waterpower lease agreement via the *Public Lands Act*.

(Source: http://www.mci.mndm.gov.on.ca/mines/lands/withreop/orders2009/wp127-09.pdf)

9.6.1.4 Other Hydropower Operations

The Ivanhoe Lake Dam, located 40 km upstream of The Chute site, is owned and operated by the Chapleau MNR. The operation of the Ivanhoe Lake Dam is governed by the existing Mattagami Water Management Plan (WMP), discussed in greater detail below.

9.6.2 Site Access

9.6.2.1 The Chute

Access to the proposed The Chute Facility is via the Oates Road, which exits north from Highway 101 approximately 3 km east of Foleyet. The Oates Road is a well-maintained primary forest access road situated within the Pineland Forest, which is licensed to EACOM Timber.

Access will be required from both sides of the Ivanhoe River. Access to the proposed development site from the east side of the Ivanhoe River is via the Oates Road (approx. 14.5 km) then along the Laundry Road for approximately 2.2 km. Water crossings and drainage culverts were noted to be in good condition along the Oates Road. The Laundry Road is not a regularly maintained forest access road and is primarily used by the public to access a boat launch and campsite north of the falls. Access to the west side of the proposed Chute GS development site requires crossing the Ivanhoe River via the existing bridge, with tertiary roads providing access to a point 200 m west of the proposed GS location.

The Chute is currently accessible with existing logging roads extending quite close to the proposed hydropower Facility site. This contributes to the current popularity of this site for camping and general recreational use. Twenty-seven metres of additional road, connecting to the existing road, is proposed to extend to the Facility construction site.

9.6.2.2 Third Falls

The Third Falls Facility site is currently less accessible than The Chute. The Third falls GS site is currently accessed via 79.7 km of existing primary road, 16.3 km of secondary access road; 3.5 km of new road will be required.

9.6.3 Riparian Rights & Privileges

There are no private landowners in riparian areas within or adjacent to the Project Area.

9.6.4 Angling & Hunting

The MNR has identified the Ivanhoe River and surrounding area as valued area for hunting and fishing as described below.

9.6.4.1 Hunting

Hunting is a popular activity in this part of Ontario. All areas of the province have been divided into geographically distinct Wildlife Management Units (WMUs) for the purposes of managing wildlife populations. The Project is located in a Wildlife Management Unit (WMU 30). Black bear and moose are the main big game animals hunted. Moose hunting is particularly important to local citizens and constitutes a major event each year. Small game hunting consists of ruffed grouse, spruce grouse, sharp-tailed grouse and snowshoe hare. Many species of waterfowl (ducks and geese) add to the hunting opportunities available in this Forest. Open hunting seasons for the various wildlife species potentially hunted in the site vicinity are provided below:

Table 26: Local Hunting Seasons

Species Open	Hunting Season
Black Bear	August 15 – October 31
Moose	Archery: September 16 – October 5
	Gun: October 7 – November 15
Grouse	September 15 – December 31
Weasel	October 25 – end of February
Red Fox	September 15 – end of February
Snowshoe Hare	September 1 – June 15
Deer	November 5 – November 17

In order to manage black bear populations and provide resident and non-resident hunting opportunities, Crown Land areas known as Bear Management Areas (BMAs) are assigned to

commercial camp owners for the purposes of providing bear hunting services. Bear Management Areas are shown on Figure 56.

9.6.4.1.1 The Chute

Recreational hunting represents an important resource near The Chute Project Area. Species commonly hunted include moose, bear and small game. The Ontario Federation of Anglers and Hunters (OFAH) in cooperation with MNR economists assembled some economic information for hunting related activities on the Pineland Forest using readily available MNR data. The socio-economic hunting analysis was based on moose and bear hunting on the Pineland Forest with the total economic benefit derived from the two species estimated at about $731,000 annually (Pineland FMP).

The site is located within Bear Management Area CP-30-25 (SIP).

9.6.4.1.2 Third Falls

Recreational hunting is also popular among local residents and tourists in the vicinity of the Third Falls Facility, and there are several active local hunting clubs. Common Species hunted in this region include black bear, moose, duck and grouse.

A Bear Management Area (CP-30-23) is located south of the site and borders Nova-Belford townships (SIP).

9.6.4.2 Fishing

Sport fishing represents an important resource at the Ivanhoe River, with year round demand. The river provides for remote as well as road-based angling opportunities. The fishery also provides subsistence for First Nations Communities. The desired sport fishing species include northern pike, walleye, whitefish, and brook trout.

Information gathered via the MNR's Ivanhoe River usage surveys of 2011 and 2012 noted fishery data including species being angled, effort being allocated and levels of harvest as summarized below in Figures B, C and D.

Figure B: Angling Surveys

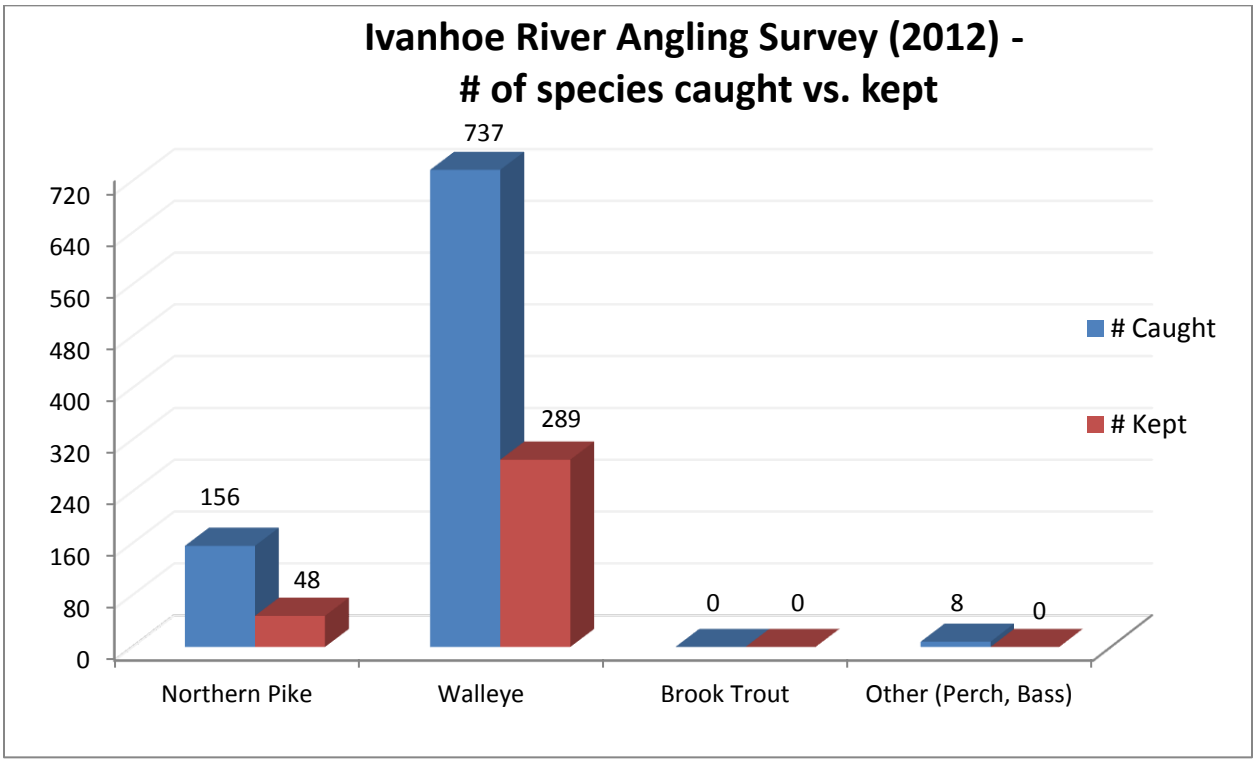


Figure C: Breakdown of Species Caught Anglers

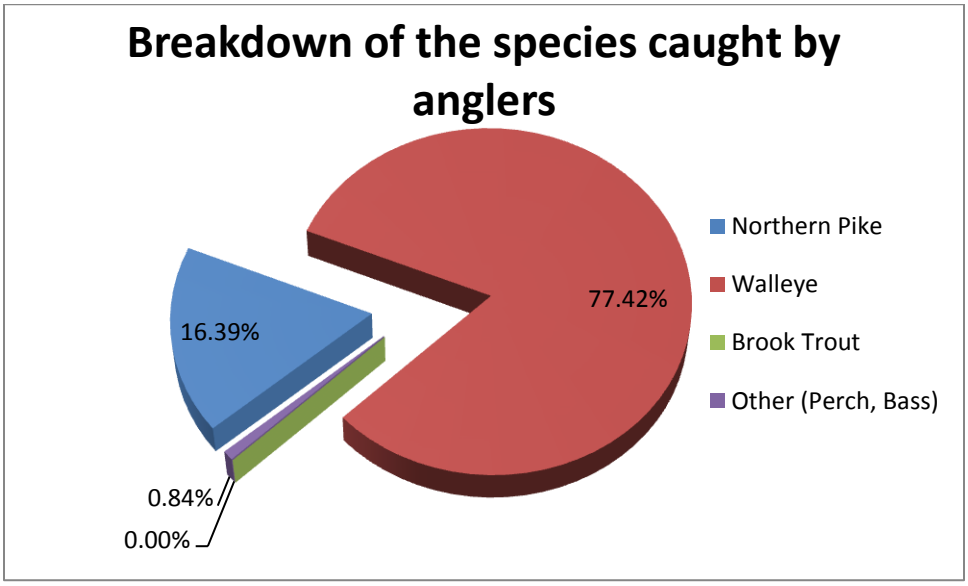


Figure D: Recorded Fish Locations

Recorded Fishing Locations

The Chute	18
Upstream of The Chute	2
Downstream of The Chute	23
Joe Lake	14
Small Lake	2
River	5
Ivanhoe River	4
Oates Creek	1
At Third Falls	3
Downstream of Third Falls	1
Other	6
Unspecified	1
Total:	80

Impacts to fishing activities as a result of the Ivanhoe Project are discussed below in Sections 11.6.4 and 12.6.4.

9.6.4.2.1 The Chute

The river stretch below The Chute is used extensively for angling, particularly in the spring and fall in the vicinity of the falls. Walleye and northern pike are the primary species sought after by anglers, and support a number of remote tourism outfitters operating in the area.

The MNR Chapleau District sent an Ontario Federation of Anglers and Hunters (OFAH) survey to anglers and hunters in July 2011 and July 2012. The OFAH's survey resulted in a total of 84 participants. Results indicated that 64 out of the 84 participants undertake angling activities within the Pineland Forest.

During the Ivanhoe PIC in July 2012, two anglers informed Xeneca of their use of the river downstream from The Chute.

9.6.4.2.2 Third Falls

The MNR SIP notes that walleye and northern pike are the primary species sought after by recreational anglers. During field visits, Third Falls is used for recreational angling and boat caches were found below the falls.

9.6.4.2.3 Ivanhoe

An economic study conducted by Engel Consulting Groups for the MNR in 2003 estimated that the actual expenditures per person per day for fishing (for non-lodge, non-remote based fishing) were $95.43, with a willingness to pay an additional $28.35, resulting in a total economic value of $123.78 per day in 2003 dollars.

The MNR Ivanhoe River Creel usage surveys in 2011 illustrate that most recreational anglers and commercial outfitters visit the river more than 10 times per year. Angling locations include areas both upstream and downstream of The Chute site and downstream of Third Falls. Walleye (pickerel), northern pike and brook trout form the three most sought after species.

9.6.5 Trapping & Baitfishing

9.6.5.1 Trapping and Baitfish Harvesting

Commercial trapping of fur bearing animals is a popular activity throughout the region during the open season. All Crown land open for trapping in the province has a registered trapline system to control trapping. Each trapline represents a specific geographical area, in which the holder of the trapline license is allowed to conduct trapping activities. Each trapline is issued a quota for the animals which can be trapped within the area. The quota is specific to each trapline, being based on past harvest levels, or recent furbearer population surveys. Numerous trappers can or may be licensed under one trap line. Traplines near the Project Area are shown on Figure 57.

Table 27: Local Trapping Seasons

Furbearer Open Trapping Seasons	
Species	**Open Season**
Beaver	October 15 – April 30
Otter	October 5 – March 31
Canada Lynx	October 25 – last day of February
Mink	October 15 – last day of February
Muskrat	October 5 – May 21
Fisher	October 25 – last day of February
Marten	October 25 – last day of February
Red fox	September 15 – last day of February
Raccoon	October 15 – January 15
Red squirrel	October 25 – last day in February
Weasel	October 25 – last day in February
Skunk	No closed season

Black bear	August 15 – October 31

9.6.5.1.1 The Chute

Commercial trapping and baitfish harvesting are all identified activities within the Study Area. It does not appear that any trap / baitfish cabins are present within the expected Zone of Influence (MNR, 2010a). The site is located on the border of trap lines CP 11 and 12 with the site being situated within CP 12; Appendix A-2 identifies the individual trap lines. Two baitfish harvesting areas are located in Oates Township (Appendix A-2).

9.6.5.1.2 Third Falls

Commercial trapping and baitfish harvesting are noted to be licensed and occur in and around the Project Area. Targeted species that are assigned quotas include beaver, lynx and marten, while all other fur bearing animals have open quotas. The site is located within trap line CP005. According to MNR documentation (2010a), it appears that there is a trap cabin approximately 6 km upstream and another 5 km downstream. Adjacent trap line owners are also known to use the Third Falls area, both upstream and downstream of the project location.

The geographical townships of Belford, Montcalm, Ossin and Nova are designated baitfish harvest areas.

9.6.6 Views & Aesthetics

Currently, both The Chute and Third Falls are relatively undeveloped. Third Falls in particular has high tourism and aesthetic values related to being relatively pristine. The local community values these landscapes for their appearance, as expressed to the field team during a number of PICs and through letters and emails.

9.6.7 Navigation

The Ivanhoe River Canoe Route is a recognized canoe route that links James Bay and has been used as an Aboriginal corridor. Also known as Pishkanogami Canoe Route by the Aboriginals, it follows the Kinogama and Ivanhoe Rivers for 105 km from the now deserted town of Kormak to the Ivanhoe River. The Route is only accessible by canoe and air and can be reached by local outfitters offering “fly-in” packages, and includes a 3 km portage trail. [8] This route supports a moderate degree of primarily local usage. The Canoe Route is shown on Figure 58.

9.6.8 Existing Water Management Plans

9.6.8.1 Mattagami Water Management Plan

The Mattagami Water Management Plan was created in 2006 under the Lakes and Rivers Improvement Act (LRIA), and is in effect until 2016. It aims to balance environmental, economic and social needs when operating hydro facilities in the Mattagami Watershed. Among the objectives of the WMP are protection of the ecological and recreational values of Ivanhoe Lake and the Associated Ivanhoe Lake Dam, and the downstream water treatment facilities in Foleyet.

Xeneca has designed The Chute GS to operate independently of the Ivanhoe Lake Dam, and current modeling demonstrates that the Project will not impact Ivanhoe Lake or Foleyet. As such, Xeneca has no current or future plans to use Ivanhoe Lake for operation of The Chute GS. The management of levels and flows on Ivanhoe Lake will not be manipulated as a result of the proposed hydropower developments.

Xeneca is working with the MNR on updating the Mattagami Water Management Plan, as may be required, as a result of the Ivanhoe Project. The Ivanhoe Project will not necessitate changes to operating plans at other hydro facilities or dams.

9.6.9 Protected Areas

Please refer to Figure 1 to see the location of protected areas in relation to the Ivanhoe Project Area.

9.6.9.1 Northern Claybelt Forest Complex Conservation Reserve

The Northern Claybelt Forest Complex Conservation Reserve is located between Timmins and Kapuskasing, and is one of the largest Conservation Reserves in Ontario, preserving a significant portion of Northeastern Ontario's biological Diversity. Few roads lead into the Reserve; the interior is accessible only by boat, air, and snowmobile during the winter. The Northern Claybelt Forest Complex Conservation Reserve is less than 100m from Third Falls.

The MNR is charged with protecting the existing important values within the Conservation Reserve. While the Ivanhoe Project does not take place within it, it is less than 100m downstream of the hydro Facility, and therefore Project activities will be constrained in order to ensure no loss of important biological function.

9.6.9.2 Nova Township Clay Plain Peatland Conservation Reserve

The Nova Township Clay Plain Peatland Conservation Reserve (NTCPPCR) is a 3,281ha feature located in the Gordon Cosens Forest, within the Project Area and approximately 135m from the planned

transmission line. No roads lead into its interior; however, there are roads along its borders. It is very flat, with peatlands present in the northern centre section of the site.

The MNR has the mandate to protect existing values within the NTCPPCR. While the Ivanhoe Project has no infrastructure planned within the Conservation Reserve, a transmission line does run 135m from one edge between The Chute and Third Falls.

9.6.9.3 Ivanhoe Lake Provincial Park

The Ivanhoe Lake Provincial Park (ILPP) is located approximately 8 km south of Foleyet, and 25km south of The Chute GS (see Figure 1). Although it had been a popular spot for overnight camping, in October 2012, the MNR decided to switch the ILPP along with nine other parks to non-operational status, due to low visitation levels. Non-operational status would prohibit overnight camping in these parks. The Ivanhoe Lake Provincial Park is, at its closest point, over 23km from the Project Area.

Due to public opposition to this plan, the MNR agreed to negotiate with local municipalities to arrange deals whereby the parks could be kept open for camping. The MNR and the City of Timmins entered into such a pilot project for the ILPP in January 2013, and under this deal, the ILPP turned a profit of $2000. However, due to low advance site booking at the park, its future was again in doubt for the 2014 season. The deadline for seasonal campers to buy permits has been extended to March 2014, at which time discussions on the park's future will resume.

9.6.9.4 Groundhog River Provincial Park

The Groundhog River begins southeast of Foleyet and flows north into the Mattagami River. The southern limit of Groundhog River Provincial Park is located approximately 2-1 kilometres southeast of the community of Foleyet (Figure 1). The northern most boundary, on the Mattagami River, is located approximately 54 kilometres northeast of the town of Kapuskasing . The boundary of this waterway class provincial park contains approximately 11,036 hectares of Crown land (0. Reg. 331/06). This did not include all the lands that were identified in Ontario's living Legacy Land Use Strategy (MNR 1999). Deferred lands from the original boundary occur upstream and downstream of Fauquier, which may result in additional lands being identified for park purposes in the future. The purpose of the waterway designation is to protect outstanding recreational water routes and to provide high quality recreational and education experiences. The distribution line between Third Falls and The Chute crosses the Groundhog River Provincial Park.

9.6.9.5 Vimy Lake Uplands Conservation Reserve

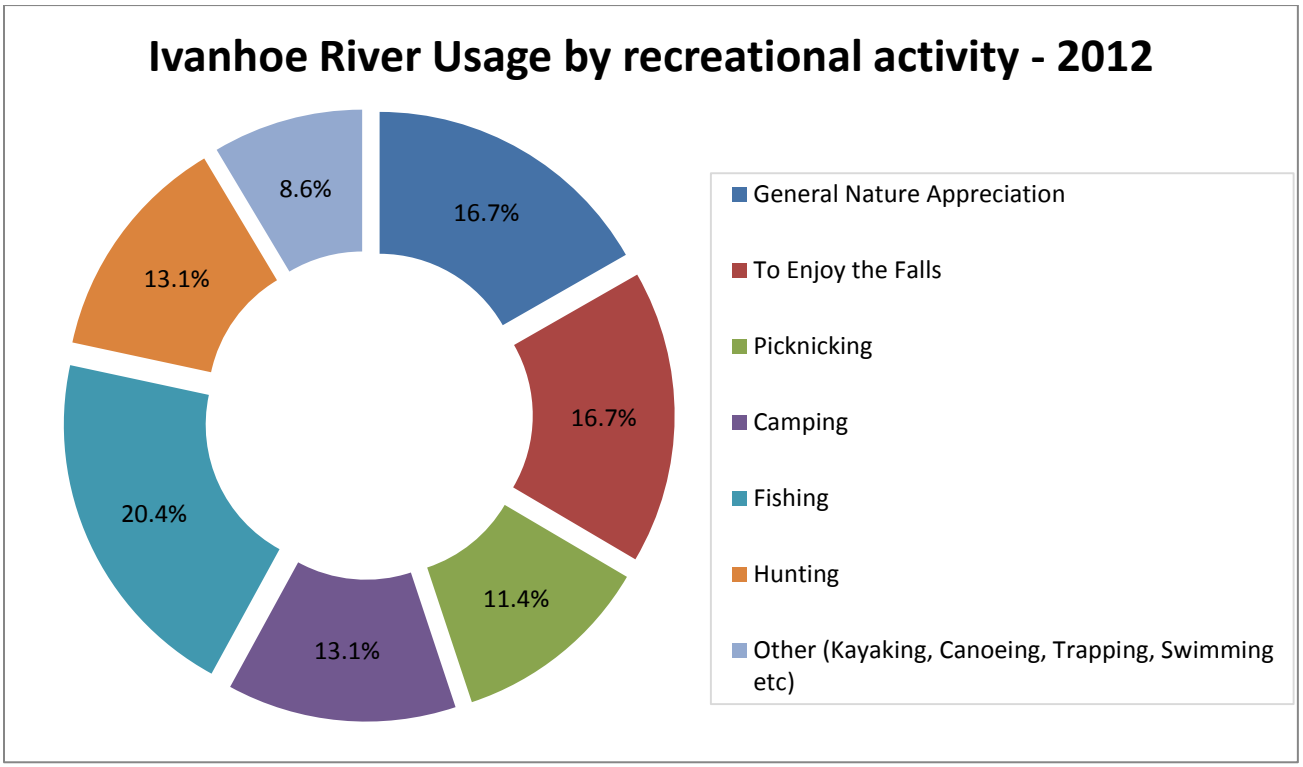
The 3,432 ha Vimy Lake Uplands Conservation Reserve is located east of Foleyet, in EcoDistrict 3E-5. It is dominated by Mixed Forest, and falls within the Groundhog River Watershed. It shows minimal signs

of disturbance, and is being managed for a variety of purposes including research, education, natural heritage, recreational purposes and aboriginal use. This Conservation Reserve is approximately 25m from the distribution line running between The Chute and Third Falls.

9.6.10 Recreational Land Use

The Project Area and surrounding area are valued for canoeing, hunting and fishing (Appendix A), according to the MNR and local residents. Information was collected on current recreational use of the river through usage surveys in 2011 and 2012 conducted by the MNR. These uses include nature appreciation, picnicking, camping, kayaking, swimming, fishing and hunting with more visits near The Chute than the Third Falls location (Figure E).

Figure E: 2012 Recreational Usage of Ivanhoe River

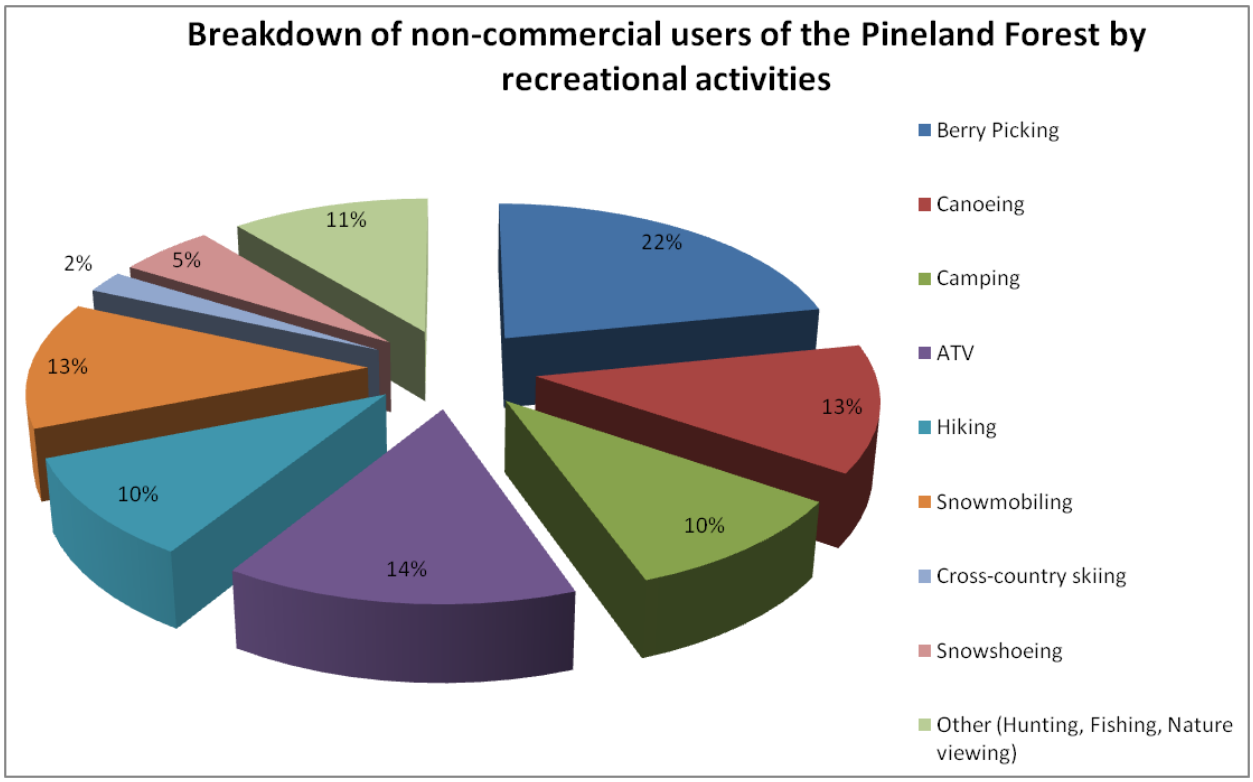


9.6.10.1 The Chute

A socioeconomic survey undertaken by the MNR on recreational activities in the Pineland Forest, which surrounds The Chute location, had a total of 90 participants. Sixty-four respondents indicated that they used the Forest recreationally in 2009 while the remainder specified that they do not. According to the results, users spend an average of 42 days/year participating in Crown land recreational activity. Figure F illustrates the activities that generated the most interest. Factors for

those who stated that they do not visit the Forest included a lack of interest in outdoor activity and current increases in gas prices.

Figure F: Non-Commercial Users of Pineland Forest



9.6.10.1 Camping

According to the MNR SIP, the area east of the falls is used for camping, primarily by residents of Foleyet and Timmins, throughout the spring, summer and fall.

9.6.10.2 Canoeing, Kayaking and Boating

The resource based tourism map provided by the Pineland Forest Management Plan (FMP) [9] illustrates a canoe route and active portage trails on the Ivanhoe River in the Project vicinity. A rudimentary boat launch exists at the end of The Chute access road.

9.6.10.3 Snowmobiling

The areas around the proposed sites are not located in the Ontario Federation of Snowmobile Club maps. However, conversation with a camper near The Chute site revealed that snowmobiles are used in the winter to access ice-fishing sites in the Project Area. Snowmobiling is not expected to otherwise occur in the vicinity of the Project.

9.6.10.4 Hiking and ATV Trails

A hiking trail runs along the eastern shoreline of the Ivanhoe River from the boat launch upstream beyond the falls. Figure 3 shows the location of the boat launch.

9.6.10.4.1 Third Falls

Though canoeing, fishing and hunting occur in the vicinity of the Third Falls Facility, tourist demand in the region is shifting. Traditionally the region's tourism industry has depended heavily upon hunting and fishing, but more recently demand for eco-tourism has increased[7]. Eco-tourists seek to enjoy a low-impact, natural experience with few roads, towns, or other infrastructure, in an area with high diversity of plant and animal life, and landscape diversity. These can be found in the vicinity of the Third Falls location.

9.6.10.5 Camping

Cottaging and private camping areas exist in the Gordon Cosens Forest, though there do not appear to be any camps set up in the immediate vicinity of the Third Falls Facility. A land use permit has been issued for a cottage camp in the unincorporated Township of Montcalm, approximately 15 km downstream of the proposed location of the Third Falls site on Ivanhoe River.

9.6.10.6 Canoeing, Kayaking and Boating

The resource based tourism map provided by the Pineland Forest Management Plan (FMP) [9] illustrates a canoe route and active portage trails on the Ivanhoe River in the Project vicinity. The Canoe Route is shown on Figure 58.

9.6.10.7 Snowmobiling

The areas around the proposed sites are not located on the Ontario Federation of Snowmobile Club maps. However, conversation with a camper near The Chute site revealed that snowmobiles are used in the winter to access ice-fishing sites in the Project Area. Snowmobiling is not expected to otherwise occur in the vicinity of the Ivanhoe Project.

9.6.10.8 Hiking and ATV Trails

There is access to the third set of falls via an ATV trail running west from the Nova SR Road. The trail is used by hunters, anglers, and trappers based on stakeholder input. Boat caches can be found below the falls.

9.7 Social & Economic

The purpose of compiling an economic and a socio-demographic profile is to develop an understanding of the trends, issues and dynamics of the local communities in proximity to the Project. This information can also be used to create a socioeconomic baseline against which potential Project impacts can be compared.

Information used to characterize the socio-economic environment has been obtained from various sources including government and local documents and websites (e.g. Statistics Canada, Ontario Provincial Park, Forest Management Plan, and CLUPA), agency correspondence, telephone interviews with the Local Services Board of Foleyet, literature reviews and field observations. Information obtained at the Public Information Centres (PICs), held on January 17, 2011; January 27, 2011; July 11, 2011; July 26, 2012; and October 16, 2013, were also incorporated into this section.

9.7.1 Locations of People, Businesses, Institutions & Public Facilities

The Chute and Third Falls Facilities are situated on Crown land on the Ivanhoe River, in the geographic townships of Oates and Belford respectively. There are no incorporated municipal governments in or surrounding the Project location. No known parcels of private land exist in close proximity to the two sites.

The closest towns to the Ivanhoe Project are Foleyet, located about 20 km south of The Chute and 45 km south of Third Falls, and Chapleau, located approximately 90 km southwest of The Chute and 110 km southwest of Third Falls. The closest city is the City of Timmins, located approximately 85 km east The Chute and 80 km east of Third Falls.

No people, businesses, institutions or public facilities reside within or near to the Project Area, nor are any anticipated to be affected by the Project.

9.7.2 Community Character, Enjoyment of Property and Amenities

No local communities or properties exist within or near to the Ivanhoe Project Area. All amenities relate to natural, recreation and tourism values, and are discussed elsewhere.

9.7.3 Employment

Employment is a significant concern among local residents and Aboriginal groups. Employment is discussed in detail in Section 9.7.7, below, under Local, Regional and Provincial Economies.

9.7.4 Access

9.7.4.1 The Chute

Access to the proposed The Chute Facility is via the Oates Road, which exits north from Highway 101 approximately 3 km east of Foleyet. The Oates Road is a well-maintained primary forest access road situated within the Pineland Forest, which is licensed to EACOM Timber.

Access will be required from both sides of the Ivanhoe River. Access to the proposed development site from the east side of the Ivanhoe River is via the Oates Road (approx. 14.5 km) then along the Laundry Road for approximately 2.2 km. Water crossings and drainage culverts were noted to be in good condition along the Oates Road. The Laundry Road is not a regularly maintained forest access road and is primarily used by the public to access a boat launch and campsite north of the falls. Access to the west side of the proposed Chute GS development site requires crossing the Ivanhoe River via the existing bridge, with tertiary roads providing access to a point 200 m west of the proposed GS location.

The Chute is currently accessible with existing logging roads extending quite close to the proposed hydropower Facility site. This contributes to the current popularity of this site for camping and general recreational use. Twenty-seven metres of additional road, connecting to the existing road, is proposed to extend to the Facility construction site.

9.7.4.2 Third Falls

The Third Falls Facility site is currently less accessible than The Chute. The Third falls GS site is currently accessed via 79.7 km of existing primary road, 16.3 km of secondary access road; 3.5 km of new road will be required.

9.7.5 Public Health and Safety

The current health and safety environment is largely unknown. Statistics on accidents among tourists or employees of the forestry and/or mining companies are not published. Given the absence of private property in and surrounding the Project Area, rates of accidents are assumed to be very low.

The Ivanhoe Lake Dam, upstream of The Chute, has failed in previous years with impacts to Foleyet, including serious flooding. Dam failure and dam safety, therefore, are very important issues to local residents and communities.

9.7.5.1 Water Supply

A search of the Ministry of the Environment's electronic Water Wells database did not return any well records within a 1-km radius of the Project Zone of Influence. An October 2010 land title search in the vicinity of the Project Area noted that the nearest privately owned lands were the CN Railway and those in Foleyet south of the Project location. Therefore, permanent or seasonal domestic water supplies that might draw from the Ivanhoe River are not present within the Project's Zone of Influence.

The water supply intake for Foleyet is located approximately 20 km upstream of the proposed project and is operated by the Ontario Clean Water Agency (OCWA).

The river, both upstream and downstream of the Project Area is used predominantly for recreation (fishing, swimming, boating, etc.). It is possible that recreational users are taking river water for personal consumption.

9.7.5.2 Mercury and Fish Consumption

As part of the water quality baseline monitoring studies conducted in 2011, 2012 and 2013, large piscivorous fish tissue samples were obtained from Walleye and analyzed to determine the existing level of total mercury in fish tissue in the Study Area (see Appendix G). The median concentrations of total mercury for four locations within the Study area were:

- 0.71 ug/g – Upstream of The Chute, large fish, median (range 0.52 - 0.95 ug/g).
- 0.48 ug/g – Downstream of The Chute, large fish, median (range 0.23 – 1.9 ug/g).
- 0.51 ug/g – Upstream of Third Falls, large fish, median (range 0.25 – 0.81 ug/g).
- 0.56 ug/g – Downstream of Third Falls, large fish, median (range 0.40 – 1.03 ug/g).

The values for "downstream of The Chute" and "upstream of Third Falls" both relate to the proposed Third Falls headpond. The values for "upstream of The Chute" relate to the proposed headpond at The Chute. The values "downstream of Third Falls" lie outside the Zone of Influence but within the Study Area. All measured mercury was conservatively assumed to be the bioavailable and toxic form methyl mercury.

The MOE publishes fish consumption advisories for Ontario water bodies ("Guide to Eating Ontario Sport Fish," 2013) which recommend monthly consumption limits for sport fish. The methyl mercury threshold limits underlying the suggested consumption advisories are:

- 0.26 ug/g– for Sensitive Populations (i.e., children or women of child bearing age) monthly consumption restrictions suggested above this value.
- 0.52 ug/g – for Sensitive Populations no consumption suggested above this value.

- 0.61 ug/g – for the General Population, suggested consumption restriction above this value.
- 1.84 ug/g – for the General Population, no consumption suggested above this value.

The median values under the existing conditions for Third Falls headpond and downstream are near or above the 'no consumption' restriction for the Sensitive Population. For The Chute headpond, the median value is above the lower threshold value for General Population but well below the 'no consumption' restriction for General Population. The median values are not inconsistent with the wide range of existing condition baseline values documented on other rivers by Xeneca (i.e. Blanche River - 0.16 ug/g, Vermillion River – 0.18 ug/g, Frederick House River – 0.27 ug/g, and Kapuskasing River – 1.80 ug/g).

9.7.6 Tourism Values

All tourism in the vicinity of the Project Area relates to recreational use of natural amenities for activities such as canoeing, fishing, hunting and camping, all previously described in Section 9.6. Economic values of tourist activity were covered above in Section 9.7.

9.7.7 Local, Regional and Provincial Economies

9.7.7.1 Foleyet

Foleyet is a community in the Sudbury District, Ontario, Canada, midway between Chapleau and Timmins on Highway 101. The town was created during the construction of the Canadian Northern Railway (CNR) through the area in the early years of the 20th Century and is currently administered by a local services board (FLSB).

The Statistics Canada 2011 Population Census lists the population of Foleyet to be 193 people. This represents a 10.6% decrease in the population from 2006 levels and a 25.2% decrease since 2001 (Table 1). Foleyet's population decline can be traced in part to employment and economic issues over the past few decades: in 2001, Foleyet's unemployment rate was 21.4%; in 2006, the unemployment rate had declined to 11.1%, likely attributable at least in part to residents leaving the area in search of employment opportunities.

Most Foleyet labour force participants work in either sales and service positions, or in the trades and manufacturing. About half of the town's labour force works in a capacity that might be related in whole or in part to tourism, such as hotels and restaurants. The last year for which the census reported income data for Foleyet is 2001. In that year, the average full-time full-year income was just over $42,000; however, due to the large part-time/part-year labour force, the average income for all Foleyet workers was approximately $26,700.

Table 28: Population Statistics for the Town of Foleyet, Canada Census 2011

Canada Census – Foleyet (Ontario) Community Profile			
	2011	**2006**	**2001**
Population:	193	216	268
Percentage difference	-10.6%	-25.2%	n/a

Foleyet employers include the CNR, which runs a rail yard in Foleyet, and a construction camp (C. D'Amours Contracting) located within two kilometres of the town. There are no mining and forestry companies operating in Foleyet, though major organisations in both sectors exist in close municipalities like Timmins and Chapleau (Dayton, 2012), and subcontractors work the forests in proximity to Foleyet.

Limited career options, the decline of the pulp and paper industry within the Northern Ontario region and the desire for a more urban lifestyle led to an overall decline in population levels, and form some of the main reasons for Foleyet's economic decline (Local Service Board of Foleyet, 2012).

9.7.7.2 Timmins

The City of Timmins is centrally located in north-eastern Ontario, on Highway 101. It began as a mining community, but evolved into the major business center for the area. Found on the Canadian Shield, Timmins is covered with extensive coniferous forest growth providing lumber and pulp and paper resources. The general area has many lakes and scenic rivers that make it ideal for recreation and tourism.

The community of Timmins has a population of 43,165 people according to the 2011 Census. This represents a 0.4% increase in the population from 2006 levels (Table 2). In 2006, the unemployment rate was 7.1%, a significant decline from the 11.1% reported in 2001. However, given population declines over that same period, this may be attributable at least in part to economic migration. The two largest employment sectors in Timmins are sales and service (5,720 workers in 2006) and trades (4,330 in 2006). A relatively small proportion of the sales and service economy can be directly linked to tourism (approximately 100). The average income of a full-time, full-year worker in 2006 was just over $51,520; factoring in the part-time/part-year labour force, this number becomes approximately $36,300.

Table 29: Population Statistics for the City of Timmins, Canada Census 2011

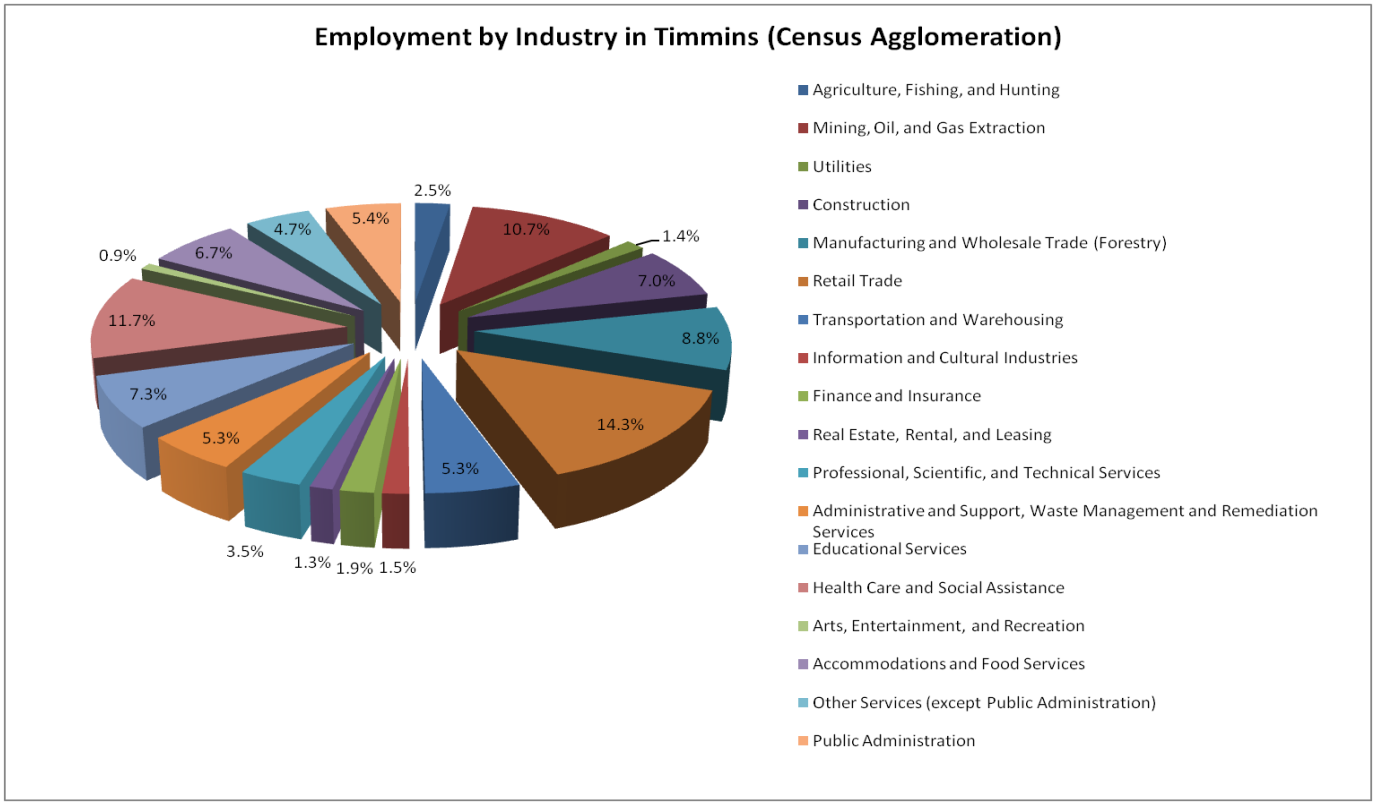
Canada Census – Timmins (Ontario) Community Profile			
	2011	**2006**	**2001**
Population:	43,165	42,997	43,686
Percentage difference	+0.40%	-1.60%	n/a

Timmins is the major economic centre for a vast section of Northeastern Ontario stretching from Hearst in the west to James Bay in the North, the Quebec border in the east to the northern section of Timiskaming District in the south.

Major settlement of Timmins began in the early 1900s when gold was discovered and the Dome Mine built. The City was founded in 1912, a by-product of the Porcupine Gold Rush. Since that time the City's economy has been based on mining and forestry (Timmins Industry Analysis, 2013), which together employ about 20% of the workforce. Industrial manufacturers and suppliers also employ many Timmins residents (Timmins Industry Analysis, 2013).

Additionally, small business operations play an important role in job creation and building Timmins to a full service, modern city. Eighty-one percent (81%) of all employees work for businesses with ten or fewer employees. More than 94% of the workforce is employed by businesses with fewer than 50 employees (Timmins Industry Analysis, 2013). Moreover, the interconnectedness of the communities in and around the area also makes Timmins a regional centre for education, health care, governmental services, and retail and accommodation (Figure G).

Figure G: Employment by Industry in Timmins



9.7.7.3 Chapleau

Chapleau is also located in the Sudbury District, in the heart of the Canadian Shield. Chapleau is geographically isolated: the nearest cities – Timmins, Sault Ste. Marie and Sudbury – are all more than a two hour drive away. It is home to the world's largest Crown Game Preserve.

Chapleau is a bilingual community with approximately 2,116 residents as listed in the 2011 Census. This represents a 10.1% decrease in the population from 2006 levels and 25.2% decrease from 2001 (Table 30). The unemployment rate rose between 2001 and 2006, from 9.1% to 13.1%. Trades employ the most workers, 305 in 2006, with sales and service a close second (300). The average income for a full-time full-year worker was just over $50,000 in 2006; factoring in part-time and part-year workers, this number becomes approximately $35,800.

Table 30: Population Statistics for Chapleau, Canada Census 2011

Canada Census – Chapleau (Ontario) Community Profile			
	2011	**2006**	**2001**
Population:	2116	2354	2832
Percentage difference	-10.10%	-16.90%	n/a

The two largest employers within the Chapleau presently are the Tembec mill and the Canadian Pacific Railway (CPR). Additional list of major public and private sector employers are presented in Figure H.

Figure H: Chapleau Major Employers

Major Public Sector Employers	Major Private Sector Employers
Services de Santé de Chapleau Health Services	Tembec Inc.
Various School Boards	Canadian Pacific Railway
Ontario Ministry of Natural Resources	True North Timber
Township of Chapleau	Aux Trois Moulins Motel, Restaurant and Confectionery
Ontario Provincial Police	Northern Haul Contracting

[

9.8 Heritage & Culture

Waterpower Projects in Ontario are required to undertake Cultural and Heritage assessments in order to assess their impact on these archeological resources, built heritage and cultural landscapes within a Project footprint. These assessments are regulated by the Ministry of Tourism Sport and Culture. A note with regards to marine archaeological assessment for this Project Area; due to the heritage assessment discussed in Section 9.8.2 not finding any built heritage features and the waterway at both proposed facilities featuring waterfalls and fast running water it is reasonable to assume that no marine archaeological or cultural resources could be expected to be found in the locations immediately at the proposed Facility locations (E. Laratta, personal communication, Nov 4, 2013).

9.8.1 Archaeological Sites

In order to assess archaeological potential within the Project Area Xeneca retained Woodland Heritage Services Limited (Woodland Heritage) to complete archaeological assessments on the Project footprint

(Appendix K). These assessments were done over three different areas, The Chute Facility footprint, tailrace and inundation area, the Third Falls Facility, footprint, tailrace and inundation area, and new access roads, temporary construction areas and transmission corridors. Detailed depictions of the Study Areas for each of these assessments can be found in the relevant assessments in Appendix K.

9.8.1.2 The Chute

In December 2010 Woodland Heritage completed their report *Stage 1 Archaeological Impact Assessment of Proposed Chute Dam, Ivanhoe River Hydroelectric Project* (Appendix K). This study found areas of high archaeological potential within the Study Area, and recommended that a stage 2 archaeological assessment be completed. This was largely due to the construction of components in proximity to the waterway and the existence of rapids which would have required travellers to go around them by portaging. The assessment found that two pools above the proposed site would be good fishing locations which contribute to the archaeological potential. The assessment found that an island upstream from the proposed Facility is a high potential area which required additional assessment (Woodland Heritage Services Limited 2010a).

In October 2012 Woodland Heritage completed their report *Stage 2 Archaeological Impact Assessment of Proposed Chute Dam, Ivanhoe River Hydroelectric Project* (Appendix K). This investigation focused on 7 areas of high potential, these areas were investigated using archaeological test pits. Detailed methodology on this process can be found in the report in Appendix K. All of the test pits were negative for archaeological materials, including those in areas of high potential. Woodland Heritage recommended that no further assessment work was required in the Study Area (Woodland Heritage Services Limited 2012a). This was confirmed in a letter by MTCS on February 8, 2013 (Appendix K).

9.8.1.3 Third Falls

In December 2010 Woodland Heritage completed their report *Stage 1 Archaeological Impact Assessment of Proposed Third Falls, Ivanhoe River Hydroelectric Project* (Appendix K) this study found areas of high archaeological potential within the Study Area, and recommended that a stage 2 archaeological assessment be completed. This was largely due to the construction of components in proximity to the waterway and the existence of rapids which would have required travellers to go around them by portaging. The assessment found that three pools above and below the proposed site would be good fishing locations which contribute to the archaeological potential. The steep river valley at the Facility location does not contribute to high potential along the shorelines upstream of the Facility; however an upstream island was considered an area of high potential. (Woodland Heritage Services Limited 2010b).

In October 2012 Woodland Heritage completed the report *Stage 2 Archaeological Impact Assessment of Proposed Third Falls Dam, Ivanhoe River Hydroelectric Project* (Appendix K). This investigation

focused on 10 areas of high potential, these areas were investigated using archaeological test pits. Detailed methodology on this process can be found in the report in Appendix K. All of the test pits were negative for archaeological materials. Woodland Heritage recommended that no further assessment work was required (Woodland Heritage Services Limited 2012b). This was confirmed by MTCS on January 31, 2013 (Appendix K).

9.8.1.4 Access Roads & Transmission Lines

The access roads and transmission lines for the Project were assessed under a separate assessment. This report titled *Stage 1 Archaeological Impact Assessment of Proposed Third Falls* (Appendix K) was completed by Woodland Heritage in August of 2013. This assessment found that neither the proposed access roads routes nor the transmission line corridor were in areas of high archaeological potential, and that further archaeological assessment work was not required (Woodland Heritage Services 2013).

9.8.2 Built Heritage

In 2013 the proponent undertook a self-assessment for built heritage in the Project area using the cultural heritage screening checklist which can be found in Appendix K. The results of this screening found that there were no criteria for further assessment.

9.8.3 Cultural Heritage Landscapes

In 2013 the proponent undertook a self-assessment for cultural heritage landscapes in the Project area. This assessment determined that there were some prominent natural features such as waterfalls and potential culturally modified trees which could hold special value to people, which could potentially be seen as cultural heritage lands which could represent some cultural heritage landscapes. Further review on these features was required prior to determining if a heritage assessment was required.

9.8.3.1 Waterfalls

The Study Area contains numerous waterfalls, particularly at the Facility locations. In preparing the archaeological assessment a great deal of historical research on the past use of the waterway was undertaken. This research indicates that that the waterfalls are not of any particular importance (Luke Dalla Bonna, personal communication 2013). As these waterfalls were not considered culturally significant, a full heritage assessment was not completed with regards to them.

9.8.3.2 Potential Culturally Modified Trees (CMTs) – The Chute

Culturally Modified Cedar Trees were also thought to be present on the Project site. Following discussions with Chapleau Cree First Nation, and notification of a registered CMT at one location in the

Project Area, Woodland Heritage investigated cedar trees in the area surrounding the proposed Facility for evidence of cultural modifications. The results of this assessment can be found in the *Stage 2 Archaeological Impact Assessment of Proposed Chute Dam, Ivanhoe River Hydroelectric Project.* Overall they found no CMTs, and when they investigated the registered tree they found that this tree lacked the characteristics of a culturally modified tree and that it had likely been naturally modified as a result of materials being washed over the falls (Woodland heritage Services Limited 2012a). Following this investigation Woodland Heritage requested the CMT registration at this location be revoked. A confirmation that this location is of no further concern under Section 48 of the Ontario Heritage Act was received February 27, 2014 and can be found in Appendix K (Woodland Heritage Services Limited 2012a).

This tree is considered significant to Chapleau Cree First Nation, and as such consultations surrounding it have been ongoing. The proponent has opted to treat this as a significant tree as it is important to the Community. As a result further discussions and mitigations will be discussed in the Aboriginal Section, 9.9 and 11.9. The tree at this location may continue to be referred to as a potential culturally modified tree throughout this document and in reference documents in order to note its significance within the First Nations community, although it has been demonstrated that is in fact naturally modified. Consultations with this Community can be found in section 17.3.3

9.8.3.3 Potential Culturally Modified Trees (CMTs) – Third Falls

Potential Culturally Modified Trees were also thought to be present at the Third Falls Facility location. Archaeological Services Inc. (ASI) was retained to investigate these trees and determine if they were CMTs. Four potential culturally modified trees were identified during a field visit by the local MNR staff during 2013. The results of this assessment can be found in the *Heritage Resource Assessment of Possible Culturally Modified Tress Proposed Third Falls, Ivanhoe River Hydroelectric Project* located in Appendix K. This assessment looked at three of the four potentially modified trees located in the inundation area at the Third Falls Facility. The assessment concluded that two of the trees were likely modified due to ice and wood debris from objects being swept over the falls. The third tree had more characteristics of a CMT as it appeared to have a beveled cut and what could be abrasions or axe marks in the surface. However it was determined that the narrow width of the scar and the depth of the cut imply that the modifications were the result of natural modifications from water born debris. The investigation determined that these three trees were modified by natural means and were not culturally modified (ASI 2014).

As a result of these assessments, it's been determined that there are no cultural landscapes requiring further heritage assessment.

9.9 Aboriginal

9.9.1 Aboriginal Communities and First Nation Reserves

In the process of developing the Project eight (8) First Nations and one (1) Métis community were identified through agency consultation as potentially being impacted by the development. These communities are:

- Brunswick House First Nation
- Chapleau Cree First Nation
- Chapleau Ojibwe First Nation
- Flying Post First Nation
- Mattagami First Nation
- Michipicoten First Nation
- Moose Cree First Nation
- MNO Timmins Métis Council
- Taykwa Tagamou First Nation

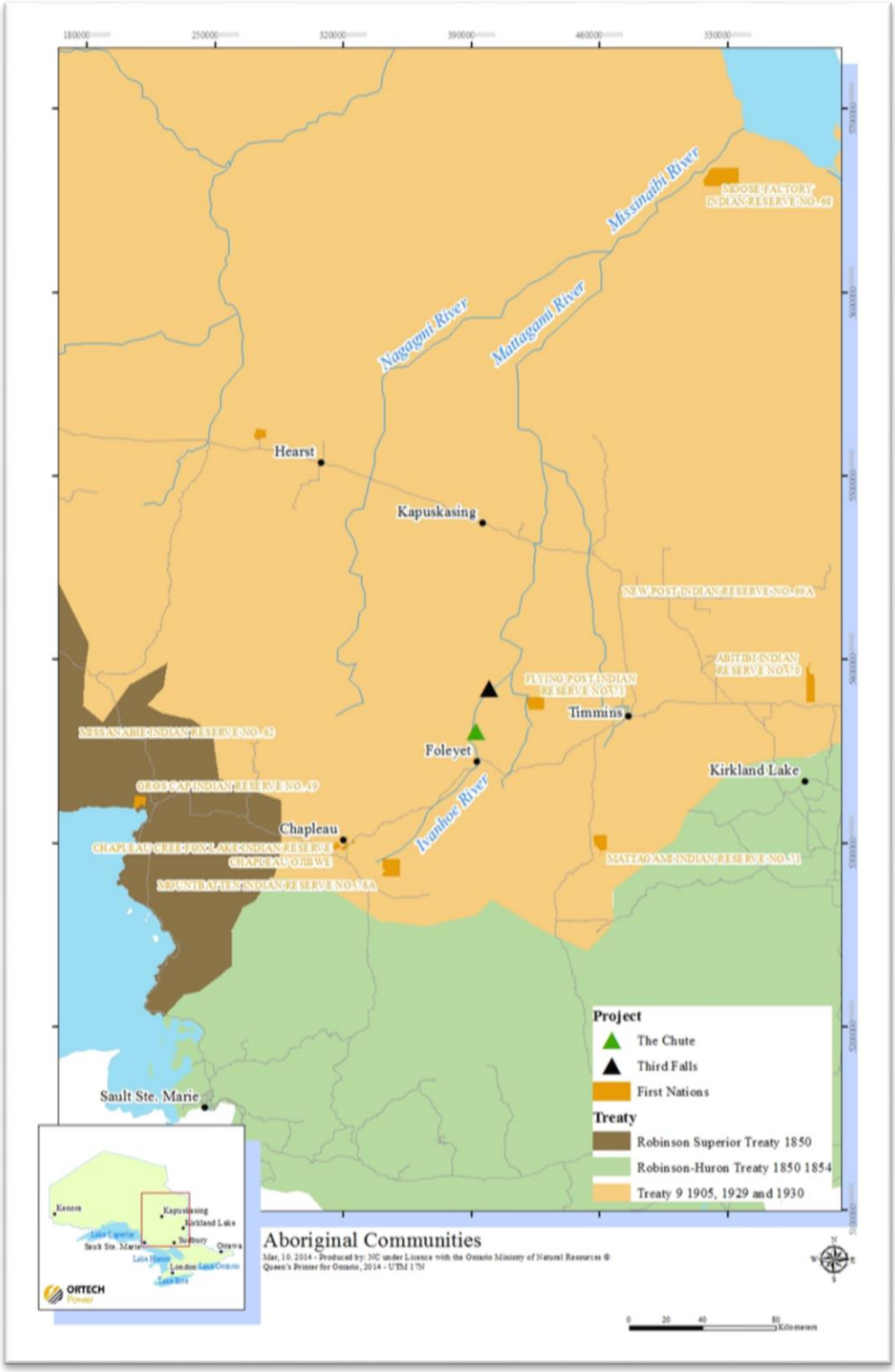
The majority of identified First Nations communities elected not to participate in consultation activities until after an economic agreement with the proponent has been finalized. While Xeneca has worked diligently towards completing these agreements as quickly as possible, they are not finalized as of the submission date of this report. However, finalized agreements are expected imminently. Xeneca has conducted community consultation sessions with the majority of these communities and to date, no requirements have been presented by these communities for additional consultation. Therefore, the proponent has both addressed the concerns and issues of the communities that have been participating, and has estimated other concerns and issues based on prior experience.

Further details on the consultation with First Nations can be found in Section 17.5.

9.9.1.1 Reserve Lands

The Project location is not located within the boundaries of any First Nation reserve lands, nor areas expressly stated as protected through Treaty 9. No rights have been asserted by First Nations through consultation to date. The Project location is assumed to be within the traditional territories and current usage areas of the aboriginal communities engaged and consulted throughout the Class EA process.

Figure I: Identified Aboriginal Reserve Lands



9.9.2 Sites of Aboriginal or Cultural Importance

As discussed in section 9.8, archaeological assessments were completed and found no items of specific value. A cultural heritage assessment checklist was completed that demonstrated that no separate cultural heritage assessment is required. However, Chapleau Cree First Nation has identified some features which are of specific value to their community, described below.

9.9.2.1 Culturally Significant White Cedars – The Chute

During consultations with Chapleau Cree First Nation, the community identified stands of white cedars that were culturally significant to their community. These stands are located in close proximity to an existing access road, a proposed access road extension, and a proposed new truck turn around at The Chute. In June and August of 2013 Northern Bioscience surveyed the stands which fringe the river along the east side of The Chute Facility location. The first stand, referred to as Stand #1, is located to the north and is dominated by White Cedar with canopy trees approximately 140 years old. Stand #2 is mixed wood dominated by White Birch with a mixture of White Cedar, popular and other species. Cedars are most common fringing the river. The White Birch are approximately 80 years old, but some of the White Cedars are estimated to be older. Both of the stands are on a steep slope along the east side of the river (Northern Bioscience 2014). Mitigations for these two stands are discussed in Section 11.9.2. Consultation with the Sustainable Forestry License holder for these trees, EACOM, is described in Section 17.2.3.

9.9.2.2 Naturally Modified Tree – The Chute

As discussed in Section 9.8.3, during the archaeological assessment a potential culturally modified tree was identified at The Chute Facility location. During this assessment it was determined that this tree was modified through natural causes and not by people. However, through consultations with Chapleau Cree First Nation, it became apparent that the modifications to this tree were culturally significant to their Community (Woodland Heritage 2012a). For details on this consultation please refer to Section 17.3.3.

9.9.2.3 Naturally Modified Trees—Third Falls

As discussed in Section 9.8.3, four potentially culturally modified trees were located at the Third Falls Facility location. During the archaeological assessment it was determined that the trees were naturally modified.

9.9.3 Traditional Lands

The Project Area is thought to fall within the Traditional Lands of all the identified aboriginal Communities. For more information on the consultation activities for this Project please refer to Section 17.3. Chapleau Cree First Nation and the Wabun Tribal Council communities are the most directly involved Communities.

9.9.4 Employment

Employment and training opportunities are an important facet of benefits that come from natural resource development on traditional lands. Xeneca and the Aboriginal communities are working together gain a better understanding of the job opportunities and capacity of the communities to participate in construction operation and maintenance of the projects. Xeneca has already developed an Aboriginal Contracting and Procurement Policy to recognize and facilitate these opportunities.

9.9.5 Land Claims

The majority of the identified communities are signatories to the James Bay Treaty 9, except Michipicoten First Nation whom are signatories of the Robison Superior Treaty of 1850, and the Métis Nation of Ontario. The Project is located wholly within the area of Treaty 9.

There is presently a Comprehensive Land Claim Agreement in Principle on file between the Canadian Federal Government and the Nishnawbe Aski Nation which is the Grand Council of Treaty 9, and represents all those communities which are signatories to Treaty 9 (refer to Table 1). At this time a final agreement has not been negotiated (Aboriginal Affairs and Northern Development Canada, 2013).

9.9.6 Economic Development

The economic development climate in Northern Ontario is in general decline, and economic issues have been a constant theme of consultation with all parties throughout the Class EA process.

Aboriginal communities, in particular, have raised the issue of economic opportunity for their communities in discussions about advancing these projects forward. Xeneca has worked with Aboriginal Communities to identify economic participation in the projects. Xeneca has developed a generous economic participation model that outlines how identified Aboriginal Communities can take a significant ownership position in the projects and how such participation will be financed. It has also demonstrated how economic benefits can be directly and indirectly derived through participation including revenue sharing amongst the participating Aboriginal Communities. Xeneca has also developed a goods and services procurement policy that specifies how contracting opportunities for Aboriginal communities' business priorities can align with building these projects.

9.9.7 Other

The EA Team has proposed additional issues and concerns which may be raised by Aboriginal Communities, based on professional experience. These are described below. In many cases, they relate to VECs already discussed and studied in detail elsewhere in this document; references will be provided in these circumstances.

9.9.7.1 Spirit/Movement of Water

Aboriginal Communities may value the current spirit or movement of the water. The site's current hydrology is described in Section 9.2; impacts and mitigations will be described in Sections 11.2 and 12.2. Consultation with First Nations about this issue is described in Section 17.3.

9.9.7.2 Culturally Significant Medicinal Plants

Plants such as sage, sweetgrass and tobacco, if they are present, may be affected by the construction or operation of the Project. However, detailed biological field inventories have not found these plants within the Project Area. Please see Section 9.3 for detailed descriptions of the terrestrial biological studies performed as part of this EA.

9.9.7.3 Culturally Significant Animal Species

Other plant species, or animals species such as bears and wolves, may have particular cultural significance to First Nations. Detailed biological field studies were undertaken for terrestrial species; please see Section 9.3.2 for a discussion of these studies and the species found.

9.9.7.4 Cedar, Ash, Birch, Tamarack and Spruce Trees

These trees may be culturally and spiritually significant to First Nations. Please see Section 9.3.1 for a description of field studies conducted and the tree communities found in the Project Area. These tree species were present on site.

9.9.7.5 Significance of Ivanhoe River

The River itself may have cultural value, particularly in terms of water quality and clarity. Please see Section 9.2 for a description of the current status of water quality in the Project Area.

9.9.7.6 Cultural Representations of Visual Landscapes

The viewscape may have cultural significance to First Nations. The current Views and Aesthetics are described in Section 9.6.6.

9.10 Energy & Electricity Considerations

Within the Project's Zone of Influence two locations are identified as having water power potential, The Chute and Third Falls. The Chute location has a gross head of 9.5 m while Third Falls has a gross head of 10m. Currently no electricity generation or water control structures exist within the Project's upstream or downstream Zone of Influence.

Beyond the upstream Zone of Influence a MNR water control structure exists at Ivanhoe Lake outlet. Beyond the downstream Zone of Influence of Third Falls a third set of water falls exists with a gross head of 2.9m located within the Northern Claybelt Forest Complex Reserve. Water power development within the reserve is currently prohibited.

10.0 METHOD TO DETERMINE SIGNIFICANCE ASSESSMENT OF RESIDUAL EFFECTS

The specific activities identified in the Potential Effects Identification Matrix (Table 12) along with concerns raised during regulatory agency and public consultations are outlined in Section 11 for construction related impacts and Section 12 for operation related impacts. Sections 11 and 12 provide information to confirm the potential effects of the activities identified, provide the appropriate avoidance strategies employed along with the prevention and/or mitigation strategies and assesses the net effects of the activity. To aid the reader, this information is summarized in Table 31 (Section 11) for Construction related impacts and Table 38 (Section 12) for Operation related impacts. Using the OWA Guide (January 2014), the following considerations were used in the assessment of the significance of residual effects after mitigation:

- The value of the resource affected,
- Geographic extent of the effect,
- Duration and frequency of the effect,
- Irreversibility of the effect, and
- Ecological / social context.

For fullness of discussion, this report also includes the following considerations in the assessment of the significance of the residual effects after mitigation:

- Magnitude of the effect, and
- Probability of the effect

These are more fully discussed in the following sections.

10.1 The Value of Resource Affected

This criterion considers the value or importance placed on the resource by stakeholders or society at large as determined through consultation and the consideration of overall environmental requirements. The value may be related to the relative abundance of the resource, the interest of participating parties, etc.

Low Value of the resource which will be affected is considered low. The resource is abundant, does not significantly contribute to the regional economy or environment, and no concerns have arisen through consultation.

Moderate	Value of the resource which will be affected is neither high nor low. The resource is acknowledged as an important part of the regional ecological and economic environment, but is not essential. Interest has arisen through consultation but has not been a focus issue.
High	Value of the resource which will be affected is considered high. The resource has some form of regulatory status or protection, generates a high level of public interest, is considered scarce or is essential to the integrity of the regional economic and/or ecological environment.

10.2 Geographic Extent of the Effect

This criterion considers the geographic area over which the effect would occur. This can relate to either a linear distance (km) or area (km^2), depending on the issue or effect being described.

Low	Effect will be limited to the Project Area (see Figure 1)
Moderate	Effect will be limited to the local area estimated as 1 km radius from the Project Area
High	Effect will be beyond the local area estimated as beyond a 1 km radius from the Project Area

10.3 Frequency and Duration

This criterion considers the frequency of when an effect might occur over a given period of time and for how long the effect lasts. Generally, events that occur less frequently or for a more limited period of time are considered less significant.

Low	The effect occurs only during construction and is infrequent.
Moderate	The effect occurs during operations but occurs infrequently or for short duration. The effect occurs during construction frequently or for a long duration.
High	The effect will occur continuously during operations.

10.4 Irreversibility of the Effect

This criteria takes into account whether or not the effect is reversible if the activity or component of the Project which is causing the effect is halted, altered or removed. Irreversible impacts are considered more significant than reversible impacts.

Reversible	Existing conditions would be re-established if the cause of the effect is halted, altered or removed.
Irreversible	Existing conditions would not be re-established if the cause of the effect is halted, altered or removed. In the event that reversibility is unknown, the effect is considered irreversible.

10.5 Ecological or Social Context

The ecological or social context refers to the level of resilience or vulnerability in the ecosystem or social system surrounding the effect. In an area of high vulnerability, a given impact may be of greater consequence. For example, mortality effects would be more significant for an endangered species, which is more vulnerable, than they would be for a common species.

Low	The value or resource being affected is common or robust enough to be able to withstand the impact in consideration.
Moderate	The value or resource being affected has already is moderately robust or resilient.
High	The value or resource being affected is highly stressed, fragmented, endangered, rare or otherwise vulnerable to the impact under consideration.

10.6 Magnitude of the Effect

The magnitude of an effect refers to the extensiveness, scale, degree, or size of that effect. As the assessment of this criterion has a high potential to be subjective/qualitative, and measures of scale vary between effects, each level of magnitude has several specific measures for the means of clear definition. When possible, pre-established quantitative scales of magnitude specific to a given effect should be used and referenced. Mitigation measures and strategies or conditions may affect the magnitude of a residual effect.

Low	Effect will only be evident at or slightly above existing conditions, will be well within the carrying capacity of the surrounding ecosystem, and will have low social impact as shown through public consultation.
Moderate	Effect will noticeably change or exceed existing conditions. The change remains within regulatory or guideline criteria, is capable of being absorbed by the surrounding ecosystem, and is not considered controversial by the majority of stakeholders.

High	Effect will exceed regulatory or guideline criteria and/or remains controversial by the majority of stakeholders and/or is deemed high by expert judgment/historic precedence, and/or exceeds the carrying capacity of the surrounding ecosystem.

10.7 Probability of the Effect

Some mitigation measures may address the potential of residual effects by reducing the likelihood or probability of their occurrence rather than or in addition to reducing the magnitude of the effect.

Low	The effect is unlikely to occur.
Moderate	The effect may occur.
High	The effect is highly likely to occur.

10.8 Overall Significance

By applying and considering all of the listed criteria, the overall significance of the residual effects can be classified as: **Negligible Effect (NE)**, **Insignificant Effect (IE)** or **Significant Effect (SE)** within the context of the Project and the environment in which it is proposed**.** The Project may also have residual effects that are considered Positive, such as economic benefits or reductions in greenhouse gas emissions, which should be considered and weighed against the potential adverse effects. These may also range in significance.

Negligible Effect (NE)	A nearly zero or hardly discernible effect. A negligible effect would touch a population or specific group of individuals at a localized area and/or over a short period in such a way as to be similar in effect to random small changes in the population (or group) due to environmental irregularities, but would have no measurable effect on the population (or group) as a whole.
Insignificant Effect (IE)	An effect that may exhibit one or more of the following characteristics: Not widespread; recurring effect lasting for short periods of time during or after Project implementation.
Significant Effect (SE)	An effect that may exhibit one or more of the following characteristics: Widespread; permanent reduction in species diversity or population of species; permanent alterations to community characteristics or services, land use or established patterns.

11.0 CONSTRUCTION IMPACTS AND MITIGATION

Using Section 4.3.1 of the OWA Guide (January 2014), any activity with the potential to cause negative effects must include the following information:

- The potential negative (or positive) effect;
- The relative level of the effect;
- The mitigation or impact management measures that will be used;
- Any individual net effects (after mitigation) and their significance; and
- The overall positive, neutral and negative effects of the Project.

The following sections describe the construction related (including the initial filling of the headponds) impacts, the associated mitigation measures and the assessment of the significance of any residual effects. The results of the technical investigations completed by the EA team members are provided in the Appendices which accompany this document. To aid the reader, the information presented in this section is summarized in Table 31.

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Table 31: Summary of Construction Related Impacts

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological/ Social	Magnitude	Probability	Overall Significance	
General Natural Environment Considerations														
11.5.1.2	**Air Quality**	Deposition of fine Particulate Matter (PM) could impact vegetation and transient users along access roads and in the vicinity of the Project Area during construction activities	IE	• Use of dust suppressant on unpaved construction and access roads (Ontario Waterpower Best Management Practice BMP037). Dust suppressants other than water may be used, subject to their described use within the guidance document referenced in this section; • Use of a hard coarse granular material on access roads (such as Granular A type material) to limit the quantities of fine particulate available for suspension from vehicle travel; • Disturbed areas will be re-vegetated as soon as practical to reduce the potential for wind erosion; • The surface of material stockpiles will be stabilized through the use of a tarp, natural cover or wetting agent to reduce the potential for wind erosion; • Avoid material handling and earth moving activities during windy conditions to minimize particulate emissions, and • Aggregate and soils delivered to and taken away from the site will employ tarps to prevent blowing particulate. • The location of any rock crushing or small concrete batch plant will be situated in an area away from waterbodies and sensitive areas of vegetation in an area partially shielded from prevailing wind direction; • During construction activities adherence to BMPs will be audited by a site inspector. The scope of the audit will also include an assessment of the effectiveness of the mitigation measures and recommendations for adaptive management if required.	Yes	High	Moderate	Low	Reversible	Low	Moderate	High	Insignificant	During construction activities adherence to Best Management Practices will be audited by a site inspector. The scope of the audit will also include an assessment of the effectiveness of the mitigation measures and recommendations for adaptive management if required.
11.5.1.2		Emissions from internal combustion engines used during construction have the potential to impact human health and vegetation	IE	• All construction equipment used on site will be inspected prior to arriving to ensure standard emission controls are properly functioning; • Routine vehicle maintenance and inspection will occur throughout the construction phase of the Project to ensure emission control equipment ins maintained;	Yes	High	Moderate	Low	Reversible	Low	Moderate	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.5.1.3		Burning cleared vegetation have the potential to impact outdoor air quality in the Project Area	SE	• Setback distances from waterbodies will be employed to prevent deposition and surface runoff from entering waterbodies; • Create a Fire Plan outlining procedures, equipment and methods used during combustion of vegetation; • Limit size and quantity of cleared vegetation to be burned at a given time and be aware of meteorological conditions. • Conduct burn operation in accordance with burn permit.	Yes	High	Moderate	Low	Reversible	Low	Moderate	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.5.2		An increase in noise and vibration due to construction activities, blasting, crushing and material handing may impact transient users in the Project Area.	SE	• To the extent practicable, schedule blasting operations during periods of lower recreational use; • Blasting operations will conform to MOE Publication NPC-119 "Blasting"; • Post signage along access routes to the Project Area, such as the portage route, informing users of activities and potential hazards; and • Ensure construction equipment is in proper working order to minimize noise emissions.	Yes	High	Moderate	Low	Reversible	Low	Moderate	High	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological/ Social	Magnitude	Probability	Overall Significance	
11.2.3.1	**Water Quality or Quantity (Surface Water)**	Erosion and sedimentation effects arising from vegetation clearing in the inundation areas, construction areas, new access roads and power line corridors	SE	To mitigate the potential increase of TSS level and turbidity arising from erosion and sedimentation during the vegetation clearing, the following measures will be implemented (CPL, 2014). Mitigation at all vegetation clearing areas: • Vegetation clearing will comply with the requirements of all applicable permits and approvals, including the Crown Forest Sustainability Act; • Vegetation clearing will be limited to the area of development set out in the project description; • Vegetation removal will only take place where absolutely required and immediately prior to construction activities to minimize soil exposure; • Tree clearing will most likely commence in the winter to minimize the disturbance to the surface soils; and • All disturbed areas will be reclaimed as soon as possible after disturbance. Additional mitigation measures at the inundation areas: • Trees cleared during headpond preparation will not be felled into the water; • During clearing, trees will be felled into the proposed site wherever possible; and • Cut materials will be removed from the riparian zone daily to ensure they do not enter the river during high flow events. Additional mitigation measures at temporary construction areas: • Stockpile, laydown, construction parking, concrete batch plant, construction camp areas will be well removed from the Ivanhoe River; • Silt/sediment control fencing will be installed between the work area and the water course(s); • Any piles of topsoil and silty material (rock and rip-rap excluded) formed due to construction will be placed a minimum of 20 m from any watercourse and in a location where erosion back into the watercourse cannot occur and the piles will not impede any drainage; and • Slash and other construction material or debris will not be disposed of in or near a watercourse. Additional mitigation measures at the access roads and power line corridors: • Vegetation clearing should include minimizing the cleared Right-of-Way width for both new access roads and power line corridors; • Cut and fill slopes along the road alignment will be constructed to stable angles for the material being used, followed by re-seeding before the end of the construction season; • Sediment control fencing will be installed 1 m beyond the intended toe of the road fill to prevent sediment from the construction area migrating beyond the grubbed area, out of the access road Right-of-Way; • Tree clearing of the power line will be limited to the 20 m Right-of-Ways, except where the power line is situated on a relatively steep side-slope which would require additional clearing on the upslope side; and • The Right-of-Way will not be grubbed in any case, and extra attention will be given to maintaining low level bushes and vegetation that will not cause a safety hazard with the line.	Yes	High	Moderate	Low	Reversible	Low	Moderate	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological/ Social	Magnitude	Probability	Overall Significance	
11.2.3.2		Erosion and sedimentation effects from in-water construction activities	SE	To mitigate the effects, the following mitigation measures are proposed in the Construction Management Plan (CPL, 2014): • The cofferdams will be constructed of clean fill with impermeable rubber liner or 1 m3 sand filled nylon mesh cargo bags (approximately 1600 kg dry) with smaller synthetic sand bags (22.5 kg dry) and a polyethylene plastic sheet liner. The smaller bags will be used to fill irregularities in the ground surface and gaps between the larger bags; • If necessary, a sump and pump will be set up immediately downstream of the cofferdams to catch seepage passing through the cofferdam before it reaches the work area; and • The installation and removal of cofferdams will be conducted in the late summer to minimize the increased level of suspended solids and minimize the risk to fish and fish habitat.	Yes	High	Moderate	Moderate	Reversible	Low	Moderate	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.2.3.3		Erosion and sedimentation effects at water crossings or bridges on the access roads and in the power line corridors	SE	Mitigation for the culvert crossings on the access roads: • Road crossing techniques and mitigation will follow standards, guidelines and best management practices; • Prior to commencing work, the contractor will review the detailed work plan with the environmental monitor and Project management; A silt/sediment control fence will be installed between the water course and the proposed works; • All loose clearing and grubbing materials will be removed from the area at the end of each work day; • Ditching will be installed to direct any surface runoff from the exposed works into a sediment trap and sediment control structures; • Earthworks will be scheduled to minimize duration of exposure; and • Required erosion protection material and/or re-seeding will be installed as soon as practical following the work. Mitigation for the bridge crossings on the access roads: • Bridge installation will be in accordance with the Navigable Water Protection Act, DFO Operational Statements and MNR requirements; Copies of these approval documents will be made available on site; • The contractor responsible will be required to submit a detailed work plan for review and approval by the proponent; • Any in-stream works will be completed within the specified in-stream work window except for clear span bridges installed according to the applicable DFO Operational Statement; • No construction material or debris will be delivered to the stream network directly or indirectly; • The work activities will be modified or stopped during severe or prolonged precipitation until ground conditions improve within the riparian zone; and • All creek banks will be restored to their original contour and the banks repaired and/or rip-rapped immediately after bridge/abutment installation. Mitigation for the water crossings in the power line corridors: • Power lines will span water crossings; and • No poles will be placed in-water.	Yes	High	Moderate	Low	Reversible	Low	Moderate	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological/ Social	Magnitude	Probability	Overall Significance	
11.2.3.4		The domestic wastewater will be generated in the construction camp during the construction phase	IE	To avoid any potential impacts from the domestic wastewater, the following measures are proposed in the Construction Management Plan (CPL, 2014). • The domestic wastewater generated from the construction camp at The Third Falls Facility will not be allowed to discharge directly into the river or any water bodies in the Project Study Area.; • The domestic wastewater will be discharged to a properly constructed and approved wastewater storage tank for temporary storage; and • Roztek Environmental, located in Timmins, will be responsible to transport the sewage to an offsite municipal wastewater treatment plant for regular treatment.	Yes	High	Low	Low	Reversible	Low	Low	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.2.3.5		The process wastewater will be generated from the production process of concrete, and equipment flushing.	IE	• The process wastewater generated from the construction batch plant at The Third Falls Facility will not be allowed to discharge directly into the river or any water bodies in the Study Area; • The process wastewater will be discharged to a properly constructed and approved sediment tank for pre-treatment; and • Roztek Environmental, located in Timmins, will be responsible to regularly transport the sewage to an offsite municipal wastewater treatment plant for treatment.	Yes	High	Low	Low	Reversible	Low	Low	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
14.1.2		Accidental spills of hazardous materials may occur during construction	IE	The following engineering and management measures will be implemented for spill prevention and control in the Construction Management Plan (Appendix C, CPL, 2014): • All hydrocarbon fuels and lubricants will be stored in a secondary containment area; • All vehicle fuelling will occur in designated areas, a minimum of 30 m from a water course and where site grading and spill response equipment will be established to contain spillage; • Drip pans will be installed on equipment to intercept minor leaks; • Locations of spill prevention and clean up materials will be made known to all workers involved in these activities; • Sumps will be installed including an oil trap to prevent contaminated water from being pumped into a water course at fuel storage and handling locations; and • Absorbent mats and other spill response equipment will be readily available for deployment.	Yes	High	Low	Low	Reversible	Low	High	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.2.5	**Water Quality or Quantity (Ground Water)**	Excavations below the groundwater table could potentially have an effect on groundwater during construction.		To mitigate the potential effect of groundwater seepage, the following measures are proposed. • If the minimal seepage is identified during the design and construction phase, it will likely be handled with a sump pump in the excavation areas, pumping water to the settling ponds for treatment prior to discharge to the river. • If seepage is higher, engineering measures are required to limit the amount of seepage into the excavations within the cofferdam areas, to minimize pumping and treatment requirements.	Yes	High	Low	Low	Reversible	Low	Low	High	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

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11.3.3.1	Species at Risk and their Habitat	Construction activities may disrupt bald eagle nesting activities	SE	• If new nests are discovered during construction, guidelines recommended in the Stand and Site Guide (MNR 2010) will be applied following consultation with MNR staff. • The power line will be routed at least 400m, from active & identified bald eagle nests, preferably 800m • 400m buffer areas (from the nest) will be established in order to minimize visual and auditory impacts associated with human activities near nest sites, and will remain for the duration of construction; • No clearing work will be conducted within 400m of bald eagle nest outside of the Critical Breeding time for this species (March 1 to August 31) • Prior to all clearing work the bald eagle nest will be clearly delineated; • No new roads, landings or aggregate pits within 400m of primary nests; • where possible construction vehicles will not stop and workers not exit vehicles within 400m of perching individuals during the breeding season (March 1 –August 31); • No construction activities will occur within 400m of active or identified bald eagle nests during the breeding season (March 1 to August 31)	Yes	High	Low	Low	Reversible	Low	Low	Low	Insignificant	Commission a third party consultant to conduct a bird survey at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird. Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.3.3.2		Road construction may impact Forest Nesting Canadian Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee and the Rusty Blackbird	SE	• No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc.) during the breeding bird period (May 15-July 31); • Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey; • No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31); • Minimize road corridor width (20 m or less); • Re-vegetate temporary roads and temporary construction areas after construction; • Where possible complete road and line construction from outside of the breeding bird period (May 15-July 31) in order to minimize noise disturbance; • Speed limits of 50 km/hour will be applied on new roads to prevent collisions with birds during the most vulnerable season (May 16 to July 31). ; • ;Modify driver behaviour (warning signs, awareness training); • Clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared; • All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife; • Vegetation clearing will be minimized wherever possible; • Restrict night use of roads during the nesting season where possible.	Yes	High	Low	Moderate	Reversible	Low	Low	High	Insignificant	Commission a third party consultant to conduct a bird survey at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird. Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

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11.3.3.3		Transmission corridor and line construction may impact Forest Nesting Canadian Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee and the Rusty Blackbird	SE	• No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc.) during the breeding bird period (May 15-July 31); • Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey; • Restrict night use of roads during the nesting season where possible; • All Facility component footprints will be flagged to prevent unnecessary over-clearing; • Minimize road corridor width where possible (20m or less); • Construction vehicles will be restricted to access routes and staging areas; • Vegetation clearing will be minimized wherever possible; • Allow for detour around sensitive habitat areas; • Re-vegetate temporary roads and construction areas after construction; • Trees will be felled into the proposed site when possible, and will not be felled into the water; • Clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared; • All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife.	Yes	High	Low	Low	Irreversible	Low	Low	High	Insignificant	Commission a third party consultant to conduct a bird survey at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird. Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.3.3.4		Construction activities may result in mortality of Common Nighthawks due to roadway collisions	SE	• A limited number of new roads are proposed to assist in construction; • Speed limits of 50 km/hour will be applied on new roads to prevent collisions with Common Nighthawks during the nesting season (May 15 to July 31);. • Modify driver behaviour (warning signs, awareness training); • Restrict night use of roads during the nesting season where possible; • New roads required for construction will be limited; • All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife; • All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife.	Yes	High	Low	Low	Reversible	Low	Low	Moderate	Insignificant	Commission a third party consultant to conduct a bird survey at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird.
11.3.3.5		Potential loss and disruption of maternity roost trees due to vegetation clearing for northern myotis, little brown myotis and eastern small-footed bat	SE	• No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31); • If tree removal must occur during this time period, potential bat maternity roost habitat (cavity trees) will be identified and exit surveys will be conducted before removal occurs to confirm no active roosts are present. Should an active maternity roost be found during previously approved construction clearing this may negate clearing during the roosting season or an appropriate buffer would need to be established. Consultation with MNR would be required to determine the appropriate course of action. • Avoid construction in portions of stands with clumps of snag trees or reduce the Right-of-Way width when snags are encountered; • If maternity colonies or other bat roosts are observed during development, operations, or decommissioning of the Project, they will be avoided or otherwise protected from disturbance; • Significant trees will be marked for protection; • Unmarked trees will only be removed if they are safety concerns that cannot be addressed in other practical ways;	Yes	High	Low	Low	Reversible	Low	Low	Moderate	Low	If vegetation clearing cannot be avoided during bat roosting season from May 1st to July31st, bat habitat surveys will be completed prior to construction to determine if headpond vegetation clearing will result in removal of these habitats. The methods and level of effort involved in these assessments would need to be determined on a case by case basis, with MNR.

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11.3.3.6		Potential loss of hibernacula due to vegetation clearing for Northern Myotis, Little Brown Myotis & Eastern Small-footed Bat	NE	There are no known hibernacula within the Study Area	No								Negligible	None
11.3.3.7		Potential disruption of Northern Myotis, Little Brown Bat and Eastern Small-footed Bat due to traffic noise and construction activities	SE	• No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31); • Speed limits of 50 km/hour will be applied on new roads to prevent collisions with bats during the season when these bats are likely to be present (May 1 to August 31). ; • Modify driver behaviour (warning signs, awareness training); • All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife; • Restrict night use of roads during the season when bats are present (May 1 – August 31) where possible.	Yes	High	Low	Low	Reversible	Low	Low	High	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.3.3.8		Potential loss of Northern Myotis, Little Brown Bat and Eastern Small-footed Bat foraging habitat due to vegetation clearing	IE	The project will result in a small increase in area of open habitat along roads and transmission lines and potentially cause an increase in foraging habitat.	No								Insignificant	None
11.3.5	**Significant Earth or Life Science Features**	Significant Earth or Life Science Features may be impacted by Project Construction or Operations	NE	None in Project Area	No								Negligible	None
11.1.1	**Geology, Topography and Terrain**	Impacts from construction activities on the terrain and topography.	IE	Mitigation for the temporary effects on terrain and topography will include: • restoring existing topography and terrain following removal of the temporary components • removing or incorporation (into existing soils) of granular fill material, addition of stockpiled topsoil (as needed) and revegetation. Stockpiled soil will be applied to the reclaimed areas post-construction to assist in rehabilitation of topography and terrain.	Yes	low	low	moderate	reversible	low	moderate	high	Insignificant	None

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11.1.3	**Land Subject to Natural or Human Made Hazards; "Landslide Hazards"**	Project construction activities such as excavation may cause increased erosion and bank slumping	Unk	• On-site excavation will be conducted using appropriate methods to control for undesirable effects in accordance with regulatory and best management practices. • All excavated materials created on site for the purpose of construction will be re-used on site, where possible. • Project personnel will review an area prior to the disturbance of a new site and that adequate resources, are available on site to implement control, mitigation and protection measures. • Reconnaissance may reveal old dumps, caches, spills, or other potential hazards that will be accommodated before the work is done. • Erosion control berms and settling basins will be constructed where required and incorporated into the natural drainage where practicable. • Restoration, including appropriate drainage and erosion control measures, will be implemented as soon as possible following excavation to prevent erosion and assist natural recovery of vegetation. • On-site excavation will be conducted using appropriate methods to control for undesirable effects in accordance with regulatory and best management practices. • All excavated materials created on site for the purpose of construction will be re-used on site, where possible.	No								Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.3.2.1	**Terrestrial Wildlife**	Vegetation clearing due to construction activities (facilities, roads, transmission line) may have an impact on nesting birds	SE	• No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc.) during the breeding bird period (May 15-July 31); • Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey; • Restrict night use of roads during the nesting season where possible; • All Facility component footprints will be flagged to prevent unnecessary over-clearing; • Minimize road corridor width where possible (20m or less); • Construction vehicles will be restricted to access routes and staging areas; • Vegetation clearing will be minimized wherever possible; • Allow for detour around sensitive habitat areas; • Re-vegetate temporary roads and construction areas after construction; • Trees will be felled into the proposed site when possible, and will not be felled into the water; • Clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared; • All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife.	Yes	High	Low	Low	Reversible/Irreversible	Low	Low	High	Insignificant	Commission a third party consultant to conduct a bird survey at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird. Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

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11.3.2.2		Construction noise, human presence and activity may displace or alter the behaviour of nesting, breeding and foraging birds in the Project Area	IE	• New roads required for construction will be limited; • Speed limits of 50 km/hour on new roads to prevent collisions with Common Nighthawks during the nesting season (May 15 to July 31); • Construction equipment will be maintained in good working order to reduce noise levels; • Modify driver behaviour (warning signs, awareness training); • All workers will be required to comply with provincial hunting regulations, which prohibit hunting, possessing a loaded firearm or discharging a firearm within eight metres from the edge of the travelled portion of a road right of way; • All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife; • All waste and foods sources are to be properly maintained so as to minimize supplemental feeding (e.g., American Crows, Common Raven, Bald Eagle, gulls); • Restrict night use of roads during the nesting season where possible.	Yes	High	Low	Low	Reversible	Low	Low	High	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.3.2.3		Vegetation clearing and construction activities may have impacts on other wildlife	IE	• New roads required for construction will be limited; • Speed limits of 50 km/hour on new roads to prevent collisions with wildlife (May 15 to July 31); • All workers will be required to comply with provincial hunting regulations, which prohibit hunting, possessing a loaded firearm or discharging a firearm within eight metres from the edge of the travelled portion of a road right of way; • All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife; • All sanitary waste and foods sources are to be properly maintained so as to reduce the incidence of wildlife feeding (e.g., black bear, red fox, striped skunk, grey wolf).	Yes	High	Low	Low	Reversible	Low	Low	High	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

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11.3.1.1	**Natural Vegetation and Terrestrial Habitat Linkages**	Vegetation clearing for the 115 kV transmission line corridor may result in a loss of 120.6 hectares of vegetation	SE	• Vegetation clearing around watercrossings will be kept to the minimum required and no grubbing will occur in riparian areas. Forest industry BMPs and MNR and DFO Guidelines for water crossings will be followed. (i.e. Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO, 2013)); • In sensitive habitats a biologist will work ahead of construction crews in order to confirm routing, and to ensure sensitive habitats and features are avoided; • Where line corridors travel along existing roadways vegetation clearing will be minimized; • Vegetation clearing will be completed during the winter on overland sections which are not constructed parallel to an access road using track mounted equipment; • Line corridors will be clearly laid out with flagging tape in advance of clearing operations • Any occurrences of sensitive wildlife habitat (such as stick nests) observed on, or adjacent to, the line during corridor layout will be flagged and immediately brought to the attention of MNR. In these instances, minor revisions to the line route may be required to protect wildlife habitat. • The Right-of-Way will be cut 20m wide in most cases except on steeper side slopes where additional up slope clearing may be required; • No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc.) during the breeding bird period (May 15-July 31); • Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey; • No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31); • Where possible construction vehicles will be restricted to access routes and staging areas; • Vegetation clearing will be minimized wherever possible; • Trees will be felled into the proposed site when possible, and will not be felled into the water; • Brush will be disposed of by piling, burning or chipping, with a preference for chipping wherever practical; • During vegetation clearing operations, the forest litter and root cover will be left in place to prevent erosion and to allow for natural regeneration of the site. • Merchantable timber will be removed from the site in accordance with agreements with the SFL holder.	Yes	Moderate	Low	Low	Irreversible	Low	Low	High	Insignificant	Commission a third party consultant to conduct a bird survey at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird. Re-vegetated areas will be visually monitored to determine the adequacy of vegetation growth of disturbed areas. Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

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General Natural Environment Considerations														
11.3.1.2		Vegetation clearing for the access roads, construction camp, stockpiles & Temporary laydown areas may result in a loss of 8ha of vegetation.	SE	• All Facility component footprints will be flagged to prevent unnecessary over-clearing; • Vegetation clearing around watercrossings will be kept to the minimum required and no grubbing will occur in riparian areas. Forest industry BMPs and MNR and DFO Guidelines for water crossings will be followed. (i.e. Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO, 2013));; • No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc.) during the breeding bird period (May 15-July 31); • Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey; • No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31); • Area for clearing and grubbing will be clearly delineated, this area will be confirmed for compliance; • Project component boundaries will be clearly marked to restrict heavy equipment traffic to the planned project area; • The Right-of-Way will be cut 20m wide in most cases except on steeper side slopes where additional up slope clearing may be required; • Construction vehicles will be restricted to access routes and staging areas; • Vegetation clearing will be minimized wherever possible; • Trees will be felled into the proposed site when possible, and will not be felled into the water; • Allow for detour around sensitive habitat areas; • Schedule construction during winter months, when possible, to minimize habitat disturbance; • Brush will be disposed of by piling, burning or chipping, with a preference for chipping wherever practical; • Travel paths, stockpile areas and staging areas will be carefully planned and followed; • Primary, secondary and tertiary roads will be used as much as possible; • Access and transportation routes will be clearly defined to minimize disturbance; • Utilize an existing turnaround area at Third Falls to reduce total tree clearing area; • Road routes will use existing trails where possible and will avoid identified values; • The temporary spur road being proposed at The Chute will be reclaimed at the end of the construction period; • All temporary laydown and stockpile areas will also be reclaimed following construction.	IE	Low	Low	Low	Irreversible	Low	Low	High	Insignificant	Commission a third party consultant to conduct a bird survey at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird. Re-vegetated areas will be visually monitored to determine the adequacy of vegetation growth of disturbed areas. Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

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11.3.1.3		Vegetation clearing for the facility components at the proposed Chute GS and in the inundation area	SE	• No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc.) during the breeding bird period (May 15-July 31); • Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey; • No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31); • Vegetation removal (grubbing) will only take place where absolutely required and immediately prior to construction activities; • Vegetation clearing in the inundation area and around the auxiliary dam will be done in accordance with Measures to Avoid Causing Harm to Fish and Fish Habitat as recommended by the DFO; • Schedule construction during winter months, when possible, to minimize habitat disturbance; • All Facility component footprints will be flagged to prevent unnecessary over-clearing; • Construction vehicles will be restricted to access routes and staging areas • Vegetation clearing will be minimized wherever possible; • Trees will be felled into the proposed site when possible, and will not be felled into the water; • Brush will be disposed of by piling, burning or chipping, with a preference for chipping wherever practical; • Following the completion of construction, the areas cleared for construction purposes will be re-vegetated. • The use of machinery will be limited in and around watercourses and sensitive terrestrial areas; • Allow for detour around sensitive habitat areas • Components and areas for clearing will be clearly laid out with flagging tape in advance of clearing operations; • Merchantable timber will be removed from the site in accordance with agreements with the SFL holder.	Yes	Low	Low	Low	Irreversible	Low	Low	High	Insignificant	Commission a third party consultant to conduct a bird survey at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird. Vegetation surveys will first be conducted one year prior to construction to establish a benchmark dataset to which operational monitoring results will be compared. Re-vegetated areas will be visually monitored to determine the adequacy of vegetation growth of disturbed areas. Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

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11.3.1.4		Vegetation clearing for facility component at the proposed Third Falls GS and in the inundation area	SE	• No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc.) during the breeding bird period (May 15-July 31); • Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey; • No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31); • Vegetation removal (grubbing) will only take place where absolutely required and immediately prior to construction activities; • Vegetation clearing in the inundation area and around the auxiliary dam will be done in accordance with Measures to Avoid Causing Harm to Fish and Fish Habitat as recommended by the DFO; • Schedule construction during winter months, when possible, to minimize habitat disturbance; • All Facility component footprints will be flagged to prevent unnecessary over-clearing; • Construction vehicles will be restricted to access routes and staging areas • Vegetation clearing will be minimized wherever possible; • Trees will be felled into the proposed site when possible, and will not be felled into the water; • Brush will be disposed of by piling, burning or chipping, with a preference for chipping wherever practical; • Following the completion of construction, the areas cleared for construction purposes will be re-vegetated. • The use of machinery will be limited in and around watercourses and sensitive terrestrial areas; • Allow for detour around sensitive habitat areas • Components and areas for clearing will be clearly laid out with flagging tape in advance of clearing operations; • Merchantable timber will be removed from the site in accordance with agreements with the SFL holder.	Yes	Low	Low	Low	Irreversible	Low	Low	High	Insignificant	Commission a third party consultant to conduct a bird survey at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird. Vegetation surveys will first be conducted one year prior to construction to establish a benchmark dataset to which operational monitoring results will be compared. Re-vegetated areas will be visually monitored to determine the adequacy of vegetation growth of disturbed areas. Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

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11.4.1.2	Soils and Sediment Quality	Sedimentation from surface runoff from the construction areas	IE	• Eliminating surface water flow and creating an effective isolation of the work area. • Silty water created in the work area will be pumped to an approved area to allow the sediment to settle without deposition to the local watercourses. • Silt control methods will be used to minimize the risk that excavation, storage and placement of cofferdam material or sediment could enter waterways. • Install mechanical erosion control measures at blast rock storage sites near the water body; • Apply water to dry soil/rock to minimize dust; • Carry out the excavation from the powerhouse working towards the water course so that flowing water does not infiltrate the cut until the final phase of excavation; • Use temporary wind control structures to avoid dust entry into watercourse; • Instruct workers and equipment operators of dust control methods; • Install mechanical barriers to prevent run-off from dust piles into water bodies; • Any piles of topsoil and silty material (rock and rip-rap excluded) formed due to construction will be placed a minimum of 20 m from any watercourse with silt fence barriers to limit the transport of sediment; • Minimize activities causing erosion; and • Employ erosion management practices	Yes	moderate	low	low	Irreversible	low	low	high	Insignificant	Water quality will be monitored on a regular basis.
11.4.1.2		Sedimentation from sediment disturbance due to in-water work construction activities	IE	• Predominantly rocky riverbed minimizes the potential for the disturbance of sediment from in water construction work and the disturbance of sediment due to water diversion • Eliminating surface water flow and creating an effective isolation of the work area. • Silty water created in the work area will be pumped to an approved area to allow the sediment to settle without deposition to the local watercourses. • The cofferdams used for water diversion work will primarily consist of earth material including blasted rock generated on-site or imported clean fill. • Instruct workers and equipment operators of dust control methods; • Develop and agree upon a water diversion and headpond filling plan with the environmental monitor prior to activities commencing; • Minimize activities causing erosion; and • Employ erosion management practices	No								Insignificant	Water quality will be monitored on a regular basis.
11.4.1.2		Sediment disturbance due to water crossing structure installation for transmission lines	IE	• Predominantly rocky riverbed minimizes the potential for the disturbance of sediment from in water construction work and the disturbance of sediment due to water diversion • Eliminating surface water flow and creating an effective isolation of the work area. • Silty water created in the work area will be pumped to an approved area to allow the sediment to settle without deposition to the local watercourses. • The cofferdams used for water diversion work will primarily consist of earth material including blasted rock generated on-site or imported clean fill. • Instruct workers and equipment operators of dust control methods; • Develop and agree upon a water diversion and headpond filling plan with the environmental monitor prior to activities commencing; • Minimize activities causing erosion; and • Employ erosion management practices	No								Insignificant	Water quality will be monitored on a regular basis.
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11.4.1.2		Sediment disturbance due to water diversion during construction	IE	• Predominantly rocky riverbed minimizes the potential for the disturbance of sediment from in water construction work and the disturbance of sediment due to water diversion • Eliminating surface water flow and creating an effective isolation of the work area. • Silty water created in the work area will be pumped to an approved area to allow the sediment to settle without deposition to the local watercourses. • The cofferdams used for water diversion work will primarily consist of earth material including blasted rock generated on-site or imported clean fill. • Silt control methods will be used to minimize the risk that excavation, storage and placement of cofferdam material or sediment could enter waterways. • Develop and agree upon a water diversion and headpond filling plan with the environmental monitor prior to activities commencing; • Minimize activities causing erosion; and • Employ erosion management practices	No								Insignificant	Water quality will be monitored on a regular basis.
11.4.1.2		Sediment disturbance due to water road crossing structure installation at Third Falls	IE	• Predominantly rocky riverbed minimizes the potential for the disturbance of sediment from in water construction work and the disturbance of sediment due to water diversion • Eliminating surface water flow and creating an effective isolation of the work area. • Silty water created in the work area will be pumped to an approved area to allow the sediment to settle without deposition to the local watercourses. • The cofferdams used for water diversion work will primarily consist of earth material including blasted rock generated on-site or imported clean fill. • Instruct workers and equipment operators of dust control methods; • Develop and agree upon a water diversion and headpond filling plan with the environmental monitor prior to activities commencing; • Minimize activities causing erosion; and • Employ erosion management practices	No								Insignificant	Water quality will be monitored on a regular basis.
11.1.4.4		Soil contamination from potential Acid Rock Drainage	Unk	• Re-use blast rock for aggregate and shoreline stabilization after it is cleaned and tested for fine sediment and acid-generating constituents; • If Acid Rock Drainage (ARD) is determined to be an issue, an ARD Management Plan will be prepared including measures for avoidance, mitigation, and treatment methods for ARD as well as long-term storage methods for acid-generating spoils which would entail isolation of spoils from water and air to prevent leaching	No								Insignificant	Water quality will be monitored during construction activities both upstream and downstream to ensure the work is not increasing the pH in the water beyond acceptable levels. If acceptable levels are close to being exceeded, the work will be suspended until levels drop.

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11.1.4.3		Soil Compaction from grading of the roads, foundations for permanent structures such as the powerhouse, and heavy machinery use especially on very moist soils	IE	• Developing shutdown protocols involving the monitoring weather forecasts and planning the work accordingly, including stabilizing work areas in anticipation of forecasted storm events. The work activities will be modified or stopped during severe or prolonged precipitation until ground conditions improve; • Constructed new roads using existing trails where possible to avoid additional soil compaction; • Limiting soil compaction to the construction areas; • Scheduling construction of ROW to minimize ground disturbance (winter) • Be prepared to alter construction activities as a result of sudden thaw conditions; • Stabilize high traffic areas with gravel surface layer or other suitable cover material; • Establish a designated construction access route to minimize area of impact; • Time construction activities to minimize effects on surface vegetation and subsurface rooting zones; • Restrict vehicles and equipment access to the minimum area necessary; and • Conduct site reclamation activities as soon as possible following the disturbance.	Yes	low	low	low	Reversible	low	low	high	Insignificant	None
14.1.1		Soil contamination through accidental spills	IE	• All hydrocarbon fuels and lubricants will be stored in a secondary containment area; • All vehicle fuelling will occur in designated areas one location, a minimum of 30 m from a water course and where site grading and spill response equipment will be established to contain spillage; • Drip pans will be installed on equipment to intercept minor leaks; • Locations of spill prevention and clean up materials will be made known to all workers involved in these activities; • Sumps will be installed including an oil trap to prevent contaminated water from being pumped into a water course; and • Absorbent mats and other spill response equipment will be readily available for deployment.	Yes	moderate	low	low	reversible	moderate	low	low	Insignificant	None
11.3.4.1	**Significant Natural Heritage Features and Areas**	Inundation at The Chute and Third Falls may have impacts to Moose Aquatic Feeding Area	SE	No construction mitigations will be possible for this effect, however post construction monitoring will be conducted	Yes	High	Low	Moderate	Reversible	Low	Low	High	Insignificant	Post construction monitoring of moose aquatic feeding habitat will coincide with aquatic vegetation surveys. Since moose aquatic feeding habitat is dependent on the presence of aquatic vegetation within the river. Observations of moose utilizing identified moose aquatic feeding habitat will be documented.
11.3.4.2		Inundation in the Third Falls headpond may impact bald eagle habitat	IE	The proposed water level increase of 20cm is not anticipated to impact bald eagle foraging and perching as the water level increase will be confined to the existing channel and will not result in the loss of any perch trees along the shoreline.	No								Negligible	None

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11.3.4.3		Inundation for Third Falls GS may impact common nighthawk habitat	IE	The proposed water level increase is unlikely to impact nesting or foraging habitat as the water level change will be restricted to the existing channel and existing high water mark.	No								Negligible	None
11.3.4.4		Inundation for Third Falls GS may impact Olive-Sided Flycatcher habitat	IE	The proposed water level increase is unlikely to impact nesting or foraging habitat as the water level change will be restricted to the existing channel and existing high water mark.	No								Negligible	None
11.3.4.5		Vegetation clearing for the inundation area at Third Falls may result in impacts to Canada warbler habitat.	IE	• No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc.) during the breeding bird period (May 15-July 31); • Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey; • Schedule construction outside of the Breeding Bird window (May 15-July 31), when possible, to minimize habitat disturbance; • Retain vegetation to the extent possible and clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared; • Trees will not be felled into the water and felling trees into the proposed site wherever possible; • Allow for detour around sensitive habitat areas • The use of machinery will be limited in and around watercourses and sensitive terrestrial areas; • Components will be clearly identified with flagging tape in advance of clearing	Yes	High	Low	Low	Irreversible	Low	Low	High	Insignificant	Commission a third party consultant to conduct a bird survey at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird.
11.3.4.6		Loss of rare treed significant wildlife habitat - Fresh Silty to Fine Loamy: Elm-Ash Hardwood (B105) through clearing of inundation area for Third Falls.	SE	• A seed harvesting and re-planting strategy will be drafted as part of the detailed construction plan and schedule which includes replanting schedules and a post construction monitoring scheduling; • Seeds from this community will be harvested prior to dam construction and inundation, in order to maintain genetic integrity of the rare-treed community. Seeds will be grown into seedlings at a local nursery within Northern Ontario which at an appropriate time of year will be planted within suitable habitat in the Project Area or adjacent lands following Construction Activities and headpond stabilization; • A suitable habit for re-establishing this community will be identified after the headpond areas are inundated. These areas will be planted once the seedlings are a minimum of 2 years old; • In order to maintain genetic diversity and reduce the magnitude of the effect, nurseries will be contracted to grow a minimum of 2-3 times more than the number of trees that would be removed and plant out as many as the available habitat would support • Post-Construction monitoring will occur to ensure the community is re-establishing.	Yes	High	Low	Low	Reversible	Low	Low	High	Insignificant	Seeds from this community will be harvested prior to dam construction and inundation, in order to maintain genetic integrity of the rare-treed community. Seeds will be grown into seedlings at a local nursery and will be planted within suitable habitat along the new shoreline within the Project Area or adjacent lands. Post-construction monitoring in year 2 and 5 of facility operations will occur to ensure the community is re-establishing.

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11.4.7.1		Marsh Breeding Bird Habitat may be impacted by construction	IE	• No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc.) during the breeding bird period (May 15-July 31); • Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey; • Restrict construction vehicles to existing access routes and staging areas; • Minimize access; • Retain vegetation to the extent possible; • During clearing, trees be felled into the proposed site wherever possible; • Clearing comply with the requirements of all applicable permits and approvals, the Crown Forest Sustainability Act, and the Forest Operations and Silviculture Manual; • Trees not be felled into the water; • Wildlife trees, culturally modified trees and other significant trees be marked for protection; marked trees will only be removed if they are safety concerns that cannot be addressed in other practical ways; • Brush should be disposed of by burning or chipping, with a preference for chipping wherever practical. When burning is carried out, it will be under permit with the MNR and according to the Forest Fires Prevention Act; • Clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared.	Yes	High	Low	Low	Reversible	Low	Low	High	Insignificant	Vegetation surveys will first be conducted one year prior to construction to establish a benchmark dataset to which operational monitoring results will be compared.
11.4.7.2		Amphibian Breeding Habitat may be impacted by construction	IE	amphibian breeding habitat is readily available outside this immediate area of habitat loss. Additionally it is predicted that over time, other wetland communities would establish and potentially provide additional open water communities with submergent wetland plants	No								Negligible	None
Aquatic and Riparian Ecosystem Considerations														
11.4.6.1	**Shoreline Dependant Species**	Otters may be impacted by headpond filling and facility construction	SE	• The area should not be initially filled during the winter or ice-over period as this could cause direct mortality by drowning mammals in their dens; • proper construction sequencing and operations; • Restrict construction vehicles to existing access routes and staging areas • Retain vegetation to the extent possible	Yes	High	Low	Low	Reversible	Low	Low	Moderate	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

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11.4.5.1	**Wetland Dependant Species**	Wetlands may be impacted by construction and inundation	SE	• Impacts to wetland habitats resulting from project footprint and headpond filling can be reduced through the following mitigation measures: • Minimize access and restrict construction vehicles to existing access routes and staging areas; • Retain vegetation to the extent possible and clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared; • Following the completion of construction, re-vegetated the areas cleared for construction purposes; • Clearly comply with the requirements of all applicable permits and approvals, the Crown Forest Sustainability Act, and the Forest Operations and Silviculture Manual; • Do not fell trees into the water and felltrees into the proposed site wherever possible; • Utilize the existing right of way, to the extent practicable for transmission lines following existing roads; • Where possible, place the power line on the side of the road opposite the wetland; • Maintain the existing ditch channels to maintain the present water movement. Avoid making the ditches any deeper or wider; • Restore and maintain low vegetation (low shrubs, graminoids) on the power line right of way; • Use passive re-vegetation through the existing seed bank where possible; • Replant trees (especially Black Spruce and Tamarack) where feasible; • The use of machinery will be limited in and around watercourses and sensitive terrestrial areas; • Use equipment and techniques to minimize compaction and rutting; • Avoiding the use of invasive plant species for rehabilitation. Reed Canary Grass (Phalaris arundinacea) in particular should be avoided since it is highly invasive in northern Ontario wetlands; and • Use Primary, secondary and tertiary roads as much as possible.	Yes	Moderate	Low	High	Irreversible	Moderate	Low	High	Insignificant	• Monitoring of vegetation will occur along the Ivanhoe River riverbanks and hydrologically connected wetlands within The Chute and Third Falls headponds. • Surveys for vegetation communities should consist of quadrat plot sampling using 1 m2 subplots located in reference to stations established using stakes. • These plots will be maintained at the same locations each survey year to assess changes in species composition, percent cover and in some instances, height. • The number of plots will vary depending on the size of the wetland and accessibility within the inundated portions of the wetland. • Monitoring of vegetation communities within the wetlands should coincide with the growing season which generally occurs within wetlands during the late spring and summer months. • It is recommended that one survey be conducted during the spring (June) and another be conducted during aquatic surveys in August. Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

11.4.5.2		Snapping Turtles may be impacted by construction activities	IE	• Employee Training; • Should Snapping Turtles be discovered in the Study Area, mitigation measures will be checked for application in specific instances with advice from biologists with experience with these species. • No water drawdowns for dust control in suitable aquatic habitat;	Yes	High	Low	Moderate	Reversible	Low	Low	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
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11.4.5.3		Wetland nesting birds may be impacted by road and powerline construction	SE	• No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc.) during the breeding bird period (May 15-July 31); • Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey; • No road construction in marsh habitat • Where possible, keep roads at least 20 m from potential habitat • Timing restrictions on road building • Complete road construction and maintenance outside of the Breeding Bird window (May 15-July 31) to minimize noise disturbance • Modify driver behaviour (warning signs, awareness training) • Restrict speed (training, signs, speed control devices) • No water drawdowns for dust control in suitable wetland habitat • Dust control using only water (no chemical agents) within 150 m of suitable habitat	Yes	High	Low	Moderate	Reversible	Low	Low	Moderate	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.4.1.1	**Fish Habitat**	Construction and dewatering for installation of cofferdams may have impacts on aquatic habitat and fish at the Project	SE	• MNR in-water timing window restrictions for construction for spring spawning fish species (typically April 1 to June 15) and fall spawning fish species (typically October 1 to May 31). Specific timing windows will be agreed to with the local MNR as part of the permitting process; • Removal of the stranded fish and standing water before construction proceeds. A scientific collector's permit is required from the MNR before a fish salvage operation can be completed; • Dewatering activities will be done in a controlled manner so as not to discharge turbid water to the receiving watercourse; • Materials such as filter bags, straw bales, filter fabric, and page-wire fencing will be on site to create a dewatering corral for waste water as a contingency plan in the event that groundwater is encountered and additional filtering properties are required; • Suitable containment/treatment areas will be identified by the Contract Administrator; • The discharge point in the receiving watercourse will be carefully chosen as an area with low scour potential (i.e. bedrock bottom); • If scour potential does exist, the contractor will use energy dissipation in the form of a splash pad or rock protection for the stream bottom; • Detailed Best Management Practices for dewatering activities, Appendix B of the Best Management Practices Guide for the Mitigation of Impacts of Waterpower Facility Construction (Genivar and NRSI 2012) will be consulted.	Yes	Moderate	Low	Low	Reversible	Low	Low	High	Insignificant	The environmental consultant will conduct a fish salvage once the coffer dams are installed. They will stay on-site and continue to salvage fish and any other wildlife as necessary during the de-watering period. This will be repeated for all in water work areas that will be isolated and drawn down.
11.4.1.2		Installation and construction of the Auxillary Dam may have impacts on the aquatic habitat at The Chute	IE	The auxiliary dam will impact a shoreline mainly comprised of bedrock which would afford negligible habitat value even during the limited periods when the channel is wetted.	No								Negligible	Construction staff will ensure BMPs for construction are employed.

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11.4.1.3		Facility construction at The Chute may impact spawning habitat and fish abundance	SE	• The area lost through the construction of the intake channel, powerhouse and tailrace will require compensation to offset impacts to spawning habitat. Xeneca has committed to creating new spawning habitat in an area downstream of the point where flows from the powerhouse and the western spillway channel recombine; • Two-dimensional modeling will be used to design habitat such that it operates within the range of velocities and depths associated with preferred Walleye spawning habitat. Please refer to the Conceptual Fish Habitat Offsetting and Monitoring Plan (NRSI 2014); • This potential degradation of macroinvertebrates and loss of fish forage habitat will be mitigated by the re-creation of appropriate riffle habitat with cobble and boulder substrates, for Walleye spawning, within the tailrace area. The Conceptual Fish Habitat Offsetting and Monitoring Plan (NRSI 2014) provides conceptual level details regarding proposed fish habitat offsetting concepts. This type of conceptual level analysis is appropriate at the EA stage of a project and provides the framework for advancing the habitat offsetting concepts during post EA design and permitting. The proposed compensation for anticipated impacts related to the spillway dam, powerhouse and tailrace will need to be developed and discussed with DFO once the engineering details for the project have been advanced during the permitting phase of the project; • Effectiveness goals will need to be discussed with MNR and DFO to ensure the compensation will be effective; • The replacement of spawning habitat will be discussed with DFO and MNR as part of the post-EA approval process required for any Fisheries Act Authorizations.	Yes	High	Low	High	Irreversible	Moderate	Moderate	High	Insignificant	Xeneca has proposed to monitor the health and population characteristics of the walleye population by completing a series of Fall Walleye Index Netting (FWIN) surveys prior to and following inundation of the headpond. It is suggested that FWIN is performed during the pre-construction period in order to fully understand and assess the current walleye population within the Ivanhoe River. Fish habitat will be constructed directly downstream of The Chute GS below the east and west channels. Spotlight visual surveys and egg mat surveys will be carried out to determine whether walleye spawning is occurring within the new spawning habitat. Sampling techniques such
11.4.1.4		Facility construction at Third Falls may impact spawning habitat and fish abundance	IE	Construction of facility components occur in areas which are not considered significant spawning habitat and do not have high value for invertebrate production, and therefore will result in minimal impacts to aquatic habitat.	No								Negligible	None

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11.4.1.5		Construction at both facilities and inundation may impact macroinvertebrates	SE	• At Third Falls: monitor the long term health of the Walleye population by conducting a series of Fall Walleye Index Netting surveys in the reservoir. If the health of the Walleye population is maintained or improved from pre development to post development then the assumption will be that the Walleye have adjusted to a change in food supply. • Should the health of the population at Third Falls be determined to decline post development then Xeneca is committed to enter into discussions with MNR about the possibility of stocking that section of the River with Walleye in order to maintain a quality fishing experience for anglers as per MNR's Fisheries Management Objectives. • At The Chute Facility Xeneca has committed to providing flows in the spillway channel that will maintain the viability of Walleye spawning habitat. As this habitat will be under the influence of the backwater effect of the Third Falls headpond it will remain wetted at all times and under the influence of the proposed minimum flow in the spillway channel. This area will provide some value in terms of invertebrate production as it remains wetted and has positive flow conditions. Effective offsetting measures will need to be developed and discussed with MNR and DFO once the engineering details for the project have been advanced during the permitting phase of the project. • Measurement of the depth and velocity conditions at the existing fastwater habitats where EPT species are being produced, prior to construction, would be an appropriate means of informing the design parameters for replacement invertebrate habitat. (NRSI 2014). • Below the confluence of the Shawmere River the opportunity to construct invertebrate offsetting habitat exists. The reader is referred to the Conceptual Fish Habitat Offsetting and Monitoring Plan (NRSI 2014) for more detail. • Xeneca has committed to providing a compensatory flow during non-spawning periods of 0.5m3/s through the spillway channel. As this habitat will be under the influence of the backwater effect of the Third Falls headpond it will remain wetted at all times and under the influence of the proposed minimum flow in the spillway channel. Therefore this area will provide some value in terms of invertebrate production as it remains wetted and has positive flow conditions.	Yes	Moderate	Low	Moderate	Irreversible	Moderate	Low	High	Moderate	The Third Falls headpond will add several meters of water depth over the 15, 000 m2 benthic invertebrate habitat located 5 km upstream of Third Falls. This means a very large volume of fill material would have to be brought in to create depths typical for riffle type invertebrate habitat. Secondly, since no gradient would remain in the river the only way to create velocity over the new habitat would be to pump water over it. Therefore, a creative way of offsetting this habitat alteration that fits within the policies and mandates of both DFO and MNR must be considered. Impacts on fish food production related to changes in invertebrate species and abundance has the potential to impact on walleye in the Third Falls headpond area. However, since the diet preferences of the walleye in the river are not known, the walleye may in fact be able to offset this loss by opportunistically feeding on food sources other than
11.4.1.6		Inundation at Third Falls GS may impact Brook Trout Habitat in upstream tributaries	IE	Only one out of eight tributaries contained suitable brook trout spawning habitat. while no spawning evidence was observed, there are deposits of sporadic gravel that may afford limited opportunities for spawning to Brook Trout. However, similar gravel deposits were noted in the area immediately upstream of the maximum backwater effect and these will remain available to Brook Trout and undisturbed by inundation. Presumably more of this habitat will be present upstream of the area surveyed; therefore the overall impact to Brook Trout spawning is anticipated to be negligible in Komak Creek.	No								Negligible	Post construction water temperature monitoring will occur in nine potential brook trout tributaries within the Third Falls headpond to verify model predictions of temperature changes within the tributaries and confirm that temperatures are within an acceptable range for brook trout. Two temperature loggers will be placed in each of the nine tributaries to record temperature

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11.4.1.7	Criterion	Aquatic habitat may be impacted as a result of the construction of new road crossings	IE	• Consideration of watercourse crossing structure design should be made in order to limit the degree of impact. • maintain the minimum crossing length possible (i.e. cutting back from grading limit to road limit and support with head wall, utilizing existing crossings, use of open bottom structures such as an open foot box culvert). • The crossing structure should be sized appropriately according to engineering standards as to not result in alterations in stream hydrology, scouring or flooding. • Crossing structure type should be determined in consultation with agency staff and be dependent on sensitivity of the water body and location. This will be completed during the permitting phase, prior to any in-stream construction activities.	Yes	Moderate	Low	Low	Reversible	Low	Loe	High	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.4.1.8		Aquatic habitat may be impacted as a result of the construction of new stream crossings for the Power Line	IE	• All work will be done in accordance with Measures to Avoid Causing Harm to Fish and Fish Habitat recommended by the DFO; • Transmission lines will span water crossings and where possible any associated water quality Areas of Concern (AOC); • No poles will be placed in-water; • Some trees may be removed in the AOCs if they would interfere with the transmission line; • Tree removal in the AOCs would be done manually using chainsaws or by feller-bunchers reaching into the AOC to minimize the presence of heavy equipment; • All other vegetation will be left remaining in the AOC to limit the potential for soil disturbance and erosion; • Erosion control measures such as straw bales or silt fencing could be used at or near AOCs if the other mitigation measures are not considered sufficient to prevent erosion and sedimentation; • Access trails may be needed for equipment to access the crossing site from the existing road systems. Trail locations will be selected so as to limit the distance to the stream of other sensitive values. Potential types of crossings for equipment could include ice bridges, fords, temporary bridges or brush mats. Each of these would need to be appropriately permitted and fitted to the subject site.	Yes	Low	Low	Low	Reversible	Low	Low	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.4.2	Fish Migration	There is a potential that upstream fish passage at the Chute GS could be impacted by facility construction	NE	The proposed Chute GS location is considered to restrict upstream fish passage due to the associated vertical drops in both the east and west channels	No								Negligible	None
11.4.2		There is a potential that upstream fish passage could be impacted at Third Falls by facility construction	NE	There are three falls at the proposed Third Falls facility location which represents the limit where upstream movement of fish species would begin into the Project Area	No								Negligible	None
11.4.2		There is a potential that downstream fish passage could be impacted by Project activities	NE	There will continue to be opportunities for fish including larvae drift to pass downstream either through the turbines or over the spillway at both	No								Negligible	None

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11.4.3	**Fisheries**	There is the potential that Project construction could impact baitfish resources	IE	These species may be temporarily displaced during construction activities however, are not expected to be impacted at a population level	No								Negligible	Construction staff will utilize DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat* for in-water work where appropriate.
11.1.4.1	**Erosion & Sedimentation**	Erosion due to installation of water crossing structures	IE	• No transmission line poles will be placed in-water; • Any trees that are required to be removed for the transmission line water crossing will be done manually using chainsaws or by feller-bunchers to minimize the presence of heavy equipment • Any piles of topsoil and silty material (rock and rip-rap excluded) formed due to construction will be placed a minimum of 20 m from any watercourse and in a location where erosion back into the watercourse cannot occur and will not impede any drainage; and, • Excavation will be stopped during intense rainfall events or whenever surface erosion occurs affecting a fish-bearing watercourse. Silt fencing and/or other erosion protection measures will be implemented, checked, and/or repaired in anticipation of intense storm events.	Yes	moderate	low	low	Irreversible	low	moderate	moderate	Insignificant	Water quality will be monitored on a regular basis. Access road inspection will include signs of soil movement and erosion. Informal inspections of access road after heavy rainfall for potential road or bridge foundation erosion, culvert blockage, or other damage from eroded materials introduced during the construction phase
11.1.4.1		Erosion due to vegetation clearing for permanent and temporary structures	IE	• Clearing will take place as close as practical prior to excavation and earthworks to minimize the length of time that soils are exposed; • Where vegetation is cleared in the year prior to excavation and earthworks, the forest litter and root cover will be left in place until the soil cover is stripped at the time of excavation; • Grubbed soil and forest litter material will be stored either in small piles or windrows next to the earthwork area or in a central soil storage pile if one is designated for the site; • Riparian areas will be cleared to the very minimum to enable work to proceed safely; • Vegetation in adjoining areas will not be disturbed; • Erosion-prone slopes will be stabilized and re-vegetated if permanent. Temporary slopes will be cordoned off with silt fencing or covered with geotextiles and/or coco mats, especially when in close proximity to fish bearing streams; • Vegetation identified for protection (e.g., mature trees and potential wildlife trees) will be left intact and root systems undisturbed wherever possible; • Reclamation work will involve reseeding and will be completed on all areas not directly in the footprint of permanent features; • All disturbed access roads and work sites will be reclaimed as soon as possible after disturbance;	Yes	moderate	low	low	Irreversible	low	moderate	moderate	Insignificant	Water quality will be monitored on a regular basis. Access road inspection will include signs of soil movement and erosion. Informal inspections of access road after heavy rainfall for potential road or bridge foundation erosion, culvert blockage, or other damage from eroded materials introduced during the construction phase

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11.1.4.1		Erosion due to grading for permanent and temporary structures and laydown areas	IE	• Clearing will take place as close as practical prior to excavation and earthworks to minimize the length of time that soils are exposed; • Where vegetation is cleared in the year prior to excavation and earthworks, the forest litter and root cover will be left in place until the soil cover is stripped at the time of excavation; • Grubbed soil and forest litter material will be stored either in small piles or windrows next to the earthwork area or in a central soil storage pile if one is designated for the site; • Erosion control berms and settling basins will be constructed where required and incorporated into the natural drainage where practicable; • Riparian areas will be cleared to the very minimum to enable work to proceed safely; • Temporary control measures such as silt fencing, drains, settling basins and pumping systems will be installed as needed; • French drains, energy dissipaters, straw mats, geotextiles, and interception ditches will be used as needed on a site-specific basis to control erosion; • Reclamation work will involve reseeding and will be completed on all areas not directly in the footprint of permanent features; • All disturbed access roads and work sites will be reclaimed as soon as possible after disturbance; • Any piles of topsoil and silty material (rock and rip-rap excluded) formed due to construction will be placed a minimum of 20 m from any watercourse and in a location where erosion back into the watercourse cannot occur and will not impede any drainage;	Yes	moderate	low	low	Irreversible	low	moderate	moderate	Insignificant	Water quality will be monitored on a regular basis. Access road inspection will include signs of soil movement and erosion. Informal inspections of access road after heavy rainfall for potential road or bridge foundation erosion, culvert blockage, or other damage from eroded materials introduced during the construction phase
11.1.4.1		Erosion due to the initial inundation of The Chute headpond	SE	• Erosion control berms and settling basins will be constructed where required and incorporated into the natural drainage where practicable; • Riparian areas will be cleared to the very minimum to enable work to proceed safely; • Temporary control measures such as silt fencing, drains, settling basins and pumping systems will be installed as needed; • French drains, energy dissipaters, straw mats, geotextiles, and interception ditches will be used as needed on a site-specific basis to control erosion; • Erosion-prone slopes will be stabilized and re-vegetated if permanent. Temporary slopes will be cordoned off with silt fencing or covered with geotextiles and/or coco mats, especially when in close proximity to fish bearing streams • Minimizing footprint impacts of The Chute headpond by constraining the headpond to the existing river channel where possible minimizing the potential for shoreline erosion • Potential for erosion from initial headpond filling for the first 5.5 km of The Chute	Yes	moderate	low	low	Irreversible	low	moderate	moderate	Insignificant	Water quality will be monitored on a regular basis. Access road inspection will include signs of soil movement and erosion. Informal inspections of access road after heavy rainfall for potential road or bridge foundation erosion, culvert blockage, or other damage from eroded materials introduced during the construction phase

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11.4.1.1		Erosion due to the initial inundation of Third Falls headpond	SE	• Erosion control berms and settling basins will be constructed where required and incorporated into the natural drainage where practicable; • Riparian areas will be cleared to the very minimum to enable work to proceed safely; • Temporary control measures such as silt fencing, drains, settling basins and pumping systems will be installed as needed; • French drains, energy dissipaters, straw mats, geotextiles, and interception ditches will be used as needed on a site-specific basis to control erosion; • Erosion-prone slopes will be stabilized and re-vegetated if permanent. Temporary slopes will be cordoned off with silt fencing or covered with geotextiles and/or coco mats, especially when in close proximity to fish bearing streams	Yes	moderate	low	low	Irreversible	low	moderate	moderate	Insignificant	Water quality will be monitored on a regular basis. Access road inspection will include signs of soil movement and erosion. Informal inspections of access road after heavy rainfall for potential road or bridge foundation erosion, culvert blockage, or other damage from eroded materials introduced during the construction phase
11.4.1.2		Erosion or sedimentation impacts from the initial inundation of The Chute on Oates Bridge	IE	The initial inundation will be a slow and at a consistent rate preventing high velocity water or large water fluctuations from transporting additional material from the inundation area. The filling will be accompanied by upstream and downstream sampling of turbidity to ensure the work is not increasing suspended solids or pH in the water beyond acceptable levels. If acceptable levels are close to being exceeded, the work will be suspended until turbidity levels drop.	No								Negligible	Water levels and erosion condition at the EACOM bridge on Oates Road will be monitored by a professional engineer during spring freshet, to ensure the bridge safety is
11.4.1.2		Erosion or sedimentation impacts from the initial inundation of Third Falls on Nova Bridge	IE	The initial inundation will be a slow and at a consistent rate preventing high velocity water or large water fluctuations from transporting additional material from the inundation area. The filling will be accompanied by upstream and downstream sampling of turbidity to ensure the work is not increasing suspended solids or pH in the water beyond acceptable levels. If acceptable levels are close to being exceeded, the work will be suspended until turbidity levels drop.	No								Negligible	Water levels and erosion condition at the Tembec bridge on Nova Road will be monitored by a professional engineer during spring freshet, to ensure the bridge safety is not impacted by the
11.1.4.1		Erosion due to: excavation for permanent and temporary structures and laydown areas	IE	• Clearing will take place as close as practical prior to excavation and earthworks to minimize the length of time that soils are exposed; • Where vegetation is cleared in the year prior to excavation and earthworks, the forest litter and root cover will be left in place until the soil cover is stripped at the time of excavation; • Grubbed soil and forest litter material will be stored either in small piles or windrows next to the earthwork area or in a central soil storage pile if one is designated for the site; • Grubbed material will be used where possible and to the extent available to restore and top dress excavated areas where desirable, including ditches and site areas that are not required for vehicle access after construction; • Erosion control berms and settling basins will be constructed where required and incorporated into the natural drainage where practicable; • Excavation will be stopped during intense rainfall events or whenever surface erosion occurs affecting a fish-bearing watercourse. Silt fencing and/or other erosion protection measures will be implemented, checked, and/or repaired in anticipation of intense storm events.	Yes	moderate	low	low	Irreversible	low	moderate	moderate	Insignificant	Water quality will be monitored on a regular basis. Access road inspection will include signs of soil movement and erosion. Informal inspections of access road after heavy rainfall for potential road or bridge foundation erosion, culvert blockage, or other damage from eroded materials introduced during the construction phase

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11.4.4	**Fish Injury or Mortality (Impingement and Entrainment)**	Fish injury or mortality during construction and blasting activities	SE	• Restriction on instantaneous pressure increases in the open water. These restrictions influence the weight of explosive and how far it needs to be buried. • At The Chute GS location only spring spawners and their habitat were identified therefore in-water works should be restricted to outside the spring spawning timing window (April 1 to June 15); • At the Third Falls GS location both spring and fall spawners and their habitat were identified therefore in-water works should be restricted to outside the spring (April 1 to June 15) and fall (October 1 to May 31) spawning timing windows; • This means that in-water works, including blasting, should be limited to between June 15 and October 1 at Third Falls; • use bubble curtains or blast mats to block shock waves and contain debris; • use of smaller charges and staggering of blasts. • Restrictions on types of explosives (e.g. no ammonium nitrate). • Confined explosives are generally required as opposed to unconfined. • MNR in-water timing window restrictions for construction for spring spawning fish species (typically April 1 to June 15) and fall spawning fish species (typically October 1 to May 31). Specific timing windows should be agreed to with the local MNR as part of the permitting process.	Yes	Moderate	Low	Low	Irreversible	Low	Low	Moderate	Insignificant	Monitoring construction works to ensure in-stream construction occur within allowable timing window. Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.2.1	**Water levels, Flows and Movement (Surface or Groundwater)**	In-water construction work may alter the water flow during construction	NE	Two stages of cofferdams will be installed in the summer low flow season during the construction phase.	No								Insignificant	None
11.2.2		In-water construction work may alter the water level and movement during construction	NE	Two stages of cofferdams will be installed in the summer low flow season during the construction phase.	No								Insignificant	None
12.2.3.3	**Drainage, Flooding and Drought Patterns**	Alteration from natural patterns as a result of construction activities	SE	Timing of coffer dam installation and construction will avoid high flow events as well as fish spawning periods. Flows will be diverted for short distances around work areas.	IE	High	Low	Moderate	Reversible	Low	Low	High	Insignificant	None
11.2.4	**Water Temperature**	Change of water temperature during construction	NE	Two separated stages of cofferdams will be used to divert the water flow from the in-water construction area for the powerhouse area or spillway dam area at each Facility. Since there is no change of water level and water flow at each Facility, it is anticipated that there is no change of water temperature during the construction phase.	No									None
Aboriginal Community Considerations														
11.9.1	**First Nation Reserves or Other Aboriginal Communities**	Project lands may impact reserve lands or aboriginal community rights	NE	Facilities are not located on any First Nations reserve lands or lands allocated to any other aboriginal community. Definitive legal agreements are being negotiated and asserted rights to traditional hunting and harvested will be maintained.	No								Negligible	None

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11.9.2.1	**Spiritual, Ceremonial, Cultural, Archaeological, or Burial Sites**	Construction activities at The Chute may lead to the removal of culturally significant White Cedar stands	SE	• Significant trees will be clearly demarcated using flag tape prior to commencement of construction activities; • Demarcations will remain in place throughout the entire construction period; • Use of heavy equipment in the area will be done with caution in order to protect the canopy; • Once required modifications to existing access road and turnaround are complete, there will be no further storage, grading or site alteration within the cedar stand without consultation with local FN; • The limits of clearing in this region will be flagged to demarcate and prohibit further vehicle access during the remainder of Project construction and commissioning; • All clearing of mature white cedar trees will take place in consultation with FN & EACOM.	Yes	High	Low	Low	Irreversible	Low	Low	High	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.9.2.2		Project construction activities may impact a naturally modified tree at The Chute	SE	• Fencing will be erected outside of the tree dripline and mechanical barriers will be installed during initial construction activities; • Protection will remain in place throughout the entire construction and commissioning period.	Yes	High	Low	Low	Irreversible	Low	Low	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.9.3.1	**Traditional Land or Resources Used for Harvesting Activities**	Hunting, harvesting, foraging and trapping activities may be disrupted by construction activities (being unable to access site areas)	IE	• Fences and gates will only be places on area where it is required for public safety; • Xeneca commits to maintaining current public access and navigation to the area;	Yes	High	Low	Low	Reversible	Low	Low	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.9.3.2		Furbearing mammals may be impacted by construction activities	NE	No impacts are anticipated to furbearing mammals as a result of construction activities (Refer to section 9.4 & 11.4 for more information)	No								Negligible	None
11.9.4	**Employment**	Employment impacts of the Ivanhoe Project for First Nations are expected to be positive, as a result of measures included in the confidential economic benefit agreements currently being finalized.	IE (Positive)	No mitigation required	No								Positive	None

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11.9.5	**Lands Subject to Land Claims**	The Project may have an impact on existing land claims on file between the Nishnawbe Aski Nation, for which no final agreement has been reached.	NE	No mitigation required	No								Negligible	None
11.9.6	**Economic Development**	Economic development impacts of the Ivanhoe Project for First Nations are expected to be positive, as a result of measures included in the confidential economic benefit agreements currently being finalized, including a generous equity participation program.	IE (Positive)	No mitigation required	No								Negligible	None
11.9.7.1	**Other (Specify)**	The construction of The Chute and Third Falls Facilities may affect the movement of the water (Spirit of Water) within the Project Area.	IE	It is anticipated that there is no change of water level and water flow in the upstream and downstream areas at each Facility. Specific impacts on water movement and flows are discussed in Section 11.2.2.	No								Insignificant	None
11.9.7.2		Vegetation removal during construction of the Project may affect any culturally significant medicinal plants, such as sage and tobacco, which may be present in the Project Area	IE	these plant species were not found during detailed field investigations. Please see Section 11.3.1 for a further description of construction impacts to flora communities in the Project Area.	No								Negligible	None
11.9.7.3		Construction activities may harass or disturb any culturally significant animal species present in the Project Area.	IE	Please see Section 11.3.2 for a complete description of construction impacts and mitigation measures for terrestrial wildlife. Transmission corridor planning was done so as to avoid important habitats and productive wetlands in order to minimize impacts on wildlife populations. As a result no population level effects are expected on wildlife as a result of any of these activities, and generally it is expected the impact to most wildlife will be low. No impacts are anticipated that would affect cultural or spiritual values within the Project Area.	No								Insignificant	None

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11.9.7.4		Vegetation clearing required during construction may require the clearing of culturally significant cedar, ash, birch, tamarack and/or spruce trees	IE	Biological field inventories did find these species within the Project Area. Please see Section 11.3.1 for a full description of vegetation to be cleared during construction, and impacts and mitigation measures related to this activity. As the area to be cleared is small relative to the total available, no impacts to cultural or spiritual use of the area due to loss of culturally significant tree species is anticipated as a result of construction activities.	No								Insignificant	None
11.9.7.5		Construction of a hydroelectric project represents a visual change to the environment, and where the environment is culturally significant, this may represent an impact to First Nations	IE	Please see Section 11.6.6 for a full description of construction impacts to Views and Aesthetics. Overall no significant impact to cultural representations of the landscape are anticipated to result from construction activities for the Ivanhoe Project.	No								Insignificant	None
Land and Resource Use Considerations														
11.6.2	**Access to Inaccessible Areas (land or water)**	Construction activities may inadvertently damage the Oates Road bridge, located approximately 1.9km upstream of the Facility location.	IE	Access will only be restricted on land or water when and where required for public safety, during construction and operations. These restrictions will be posted on signs. No mitigation is considered necessary for increase in access due to the construction of new roads.	No								Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.6.2		Construction activities may affect the function or longevity of the bridge on Nova Road, located approximately 10.9km upstream of the Facility location.	IE	Xeneca commits to maintaining the operability of the Nova Road Bridge. Consultation and negotiation is ongoing with Tembec, and an agreement acceptable to both sides will be reached prior to completion of permitting and approvals.	No								Insignificant	None
11.6.7	**Navigation**	The Ivanhoe River is a recognized canoe route, construction may impede and interfere with navigation	IE	Xeneca commits to maintaining current public access and navigation to the area; restrictions such as gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). Impacts to portage routes are not anticipated to affect navigability, so mitigation measures are not proposed. However, if impacts to portage routes affect the navigability of the river post-construction, the proponent will enter into negotiations with the MNR to reroute the portage routes.	Yes	Moderate	Low	Low	Reversible	Moderate	Low	High	Insignificant	Portage routes will be re-routed if required after construction

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11.6.3	**Riparian Rights or Privileges**	There are no riparian rights in the Project Area	NE	No mitigation required	No								Negligible	None
11.6.10.2	**Recreational Use & Tourism Values- (land or water)**	In-water construction and any terrestrial construction taking place on or adjacent to existing portage trails has the potential to affect navigation by local canoers and kayakers. An existing boat launch will be inaccessible during construction.	IE	Xeneca will to make some modest design and location improvements to the boat launch amenity, based on stakeholder input, though prior approval is required by the MNR and other regulatory agencies. Restrictions to access will only be placed where necessary to protect public health and safety.	Yes	High	Low	Low	Reversible	Low	Moderate	High	Insignificant	None
11.6.10.3		Snowmobiling may be affected by some temporary and very localized restrictions to access the Site during Project construction	IE	No mitigation required	Yes	Low	Low	Low	Reversible	Low	Low	Low	Insignificant	None
11.6.10.1		The Third Falls Facility location is infrequently used by campers currently, if at all. Impacts to site availability may occur during construction.	IE	Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.	Yes	Low	Low	Low	Reversible	Low	Low	Low	Insignificant	None

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11.6.10.1		Some impact to site availability at The Chute, a more popular camping location, may occur during construction, when areas are fenced off to protect public health and safety. The site may be considered less desirable by campers due to changes in the visual and auditory environment; however, noise from the equipment will be largely masked by the noise of the river and waterfall itself. Visual impacts are considered in the Views and Aesthetics section.	IE	Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.	Yes	High	Low	Low	Reversible	Low	Low	Moderate	Insignificant	None
11.6.10.4		During construction, access to hiking trails at The Chute may be limited to protect public health and safety.	IE	Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.	Yes	Moderate	Low	Low	Reversible	Low	Low	Moderate	Insignificant	None
11.6.10.4		During construction, access to hiking trails at Third Falls may be limited to protect public health and safety	IE	Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.										None

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11.6.4.1	**Angling and Hunting Opportunities**	Impacts to hunting of fauna.	IE	Xeneca commits to maintaining current public access and navigation to the area; restriction such as fences and gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). These minimal restrictions should ensure both that game populations do not change, and that hunters have the same number of opportunities to engage in successful hunting activities.	Yes	High	Low	Low	Reversible	Low	Low	Low	Insignificant	None
11.6.4.2		Effects on local fishing and ice-fishing opportunity due to reduced site access	IE	Xeneca has committed to operational constraints during the spring spawning period in order to ensure natural flow conditions during this period (spring and fall for Brook Trout). This will also avoid construction impacts for ice-fishing. Xeneca intends to maintain and possibly enhance public access to fishing at the Ivanhoe project sites. However, to ensure public safety, some fencing may be put in place (i.e. around electrical equipment or water intakes). This is not anticipated to seriously affect access to fishing sites. Furthermore, Xeneca will work with the recreational fishing community, tourism operators and other interested parties to ensure impacts to fisheries are kept at a minimum level, access to fishing areas is not impeded, improvements to access the fishery are facilitated and impacts to habitat are minimized. Should economic impact on commercial interests result from the project, Xeneca will enter into discussions on avoidance, mitigation and /or compensation.	Yes	High	Low	Low	Reversible	Low	Low	Low	Insignificant	None
11.6.5	**Trapping Activities**	Construction of the facility may disrupt access to trapline areas	Unk	Xeneca is committed to working with the trapline holders to create a business-to-business agreement and to ensure there are no impacts to the trapline.	No								Negligible	An agreement will be entered into with the trapline holder to ensure no negative impacts
11.6.5	**Baitfish Harvesting Activities**	Construction activities may interfere with Baitfish harvesting activities in the Project Area	IE	No impacts anticipated to baitfish populations or harvesting activities. No mitigations proposed. (Refer to Section 11.4.3 Fisheries for further information)	No								Negligible	Construction staff will utilize DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat* for in-water work where appropriate.

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11.6.6	**Views or Aesthetics**	The construction of two new hydroelectric facilities will alter the visual appearance of this part of the river, and alter the pristine character of the Third Falls Facility location. As well, inundation of upstream areas of the Ivanhoe River will change the viewscape over the longterm from a riverine to a lacustrine landscape. This impact will be perceived differently by different recreational users of the river. Construction of access roads at Third Falls may also be considered a visual intrusion into the landscape, although one that has a side effect the opening up of that landscape to additional recreational users.	IE	Xeneca has undertaken extensive planning and consultation with the local community in order to plan a project that is minimally visually intrusive and retains as many of the existing aesthetic features as possible. Renaturalization of cleared areas along roadways will be undertaken wherever possible, in consultation with the local MNR office to determine suitable species and take any fire safety concerns into account.	Yes	Moderate	Low	Low	Reversible	Low	Moderate	High	Insignificant	None
11.6.1	**An Existing Land or Resource Management Plan**	No impacts are anticipated to existing Land Use or Resource Management Plans	NE	No mitigation required	No								Negligible	None
11.6.8	**Existing Water Management Plan**	No impacts to the existing WMP will result from the Ivanhoe Project as the operations of other existing facilities in the watershed will not be modified at all.	IE	No mitigation required	No								Negligible	None

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11.6.9.1	**Protected Areas**	Construction has the potential to increase sedimentation and erosion or contamination through spills, which may cause significant negative impacts to the Northern Claybelt Forest Complex Conservation Reserve.	SE	See Sections 11.1.4 (Sedimentation and Erosion) and 14.1 (Spills)	Yes	High	Low	Low	Irreversible	High	Low	Low	Insignificant	See Sections 11.1.4 (Sedimentation and Erosion) and 14.1 (Spills)
11.6.9.2		The Nova Township Clay Plain Peatland Conservation Reserve exists 135m from a planned power line between The Chute and Third Falls. Given this distance, no impacts to the Conservation Reserve are anticipated.	NE	No mitigation required	No								Negligible	None
11.6.9.3		The Groundhog River Provincial Park would be crossed by a planned power line between The Chute and Third Falls. Construction activities to occur near or within the Park will have no impact on recreational access or use of the River, and therefore, no impacts are anticipated.	IE	Best Management Practices will be employed to prevent any potential impacts, such as erosion and root compaction, from affecting this feature.	Yes	Moderate	Low	Low	Reversible	Low	Low	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.

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11.6.9.4		The Vimy Lake Uplands Conservation Reserve is approximately 25m from a planned power line between The Chute and Third Falls. No construction activities will take place within the Conservation Reserve.	NE	No mitigation required	No								Negligible	None
Cultural Heritage Resources Considerations														
11.8.1	**Archaeological Sites**	Disturbance or destruction to significant archaeological sites associated with construction or inundation	IE	Stage 2 assessment found no items of archaeological significance requiring further study or construction mitigations	No								Negligible	None
11.8.1		Disturbance or destruction to significant archaeological sites along access roads	IE	Stage 1 assessment found no items of archaeological significance requiring further study or construction mitigations	No								Negligible	None
11.8.2	**Built Heritage Resources**	Disturbance or destruction to heritage buildings or structures	IE	Cultural Heritage self-assessment checklist indicated no items of built heritage resource in the vicinity of the Project	No								Negligible	None
11.8.2	**Cultural Heritage Landscapes**	Disturbance or destruction to prominent natural features that could have special value to people - Waterfalls	IE	Assessment found that the waterfalls at the facility locations and in the Project Area are not of any special value and do not require construction mitigation	No								Negligible	None
11.8.3		Disturbance or destruction to prominent natural features that could have special value to people - potential culturally modified cedar trees (CMT)s	IE	Assessment found all suspected CMTs were naturally modified and no construction mitigations are required	No								Negligible	None

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11.8.3		Disturbance or destruction to prominent natural features that could have special value to people - unidentified culturally modified cedar trees (CMT)s	IE	During construction workers will be trained in a *Discovery Protocol* developed by the construction contractor which will include instructions on what kinds of characteristics to look for in culturally modified trees. Should a tree with suitable characteristics be identified workers are to notify their supervisor. A Cultural Heritage Assessment may be required on newly identified potential CMTs.	Yes	High	Low	Low	Low	Low	Low	Low	Insignificant	Construction contractor will be required to monitor staff/
Social and Economic Considerations														
11.7.1	**The Location of People, Businesses, institutions, or Public Facilities**	No people, businesses, institutions or public facilities reside within or near to the Project Area nor are any anticipated to be affected by the construction of the Project.	NE	No mitigation required	No								Negligible	None
11.7.2	**Community Character, Enjoyment of Property, or Local Amenities**	No local communities or properties exist within or near to the Ivanhoe Project Area. All amenities relate to natural, recreation and tourism values, and are discussed elsewhere.	NE	No mitigation required	No								Negligible	None
11.7.3	**Employment**	Construction activities will support direct and indirect local employment. With an initial capital construction cost of $10.5 million, the project represents a significant socio-economic benefit to the local community of approximately $5.25 million at the construction phase.	IE (+ve)	Xeneca commits to hiring trades and services in the area of the project, and obtaining support services such as accommodation and construction equipment locally wherever feasible. No other mitigation is considered necessary.	Yes	High	Moderate	Low	Irreversible	High	Moderate	High	Significant (positive)	None
Report Section	**Criterion**	**Activity/Description - Potential Effect**	**Prior to Mitigation**	**Mitigation or Impact Management Measures Employed**	**Residual Effect After Mitigation?**	**Significance Assessment**								**Monitoring/Compensation Proposed**

			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological/ Social	Magnitude	Probability	Overall Significance	
11.7.5.3 & 14.1.3	Public Health and/or Safety	Forest or brush fires caused as a result of project construction	IE	A Fire Safety plan will be developed and all construction staff will be trained in it. Fire response equipment will be kept on site at all times. Flammable materials and wastes will not be kept at the construction site. A Fire Prevention and Preparedness plan will be developed annually through discussion with MNR Fire Managers. Through this annual planning process, key contacts and emergency numbers will be identified, prevention and preparedness plans will be described and include processes for how fire danger information will be communicated and used daily.	Yes	High	Low	Low	Irreversible	Low	Low	Low	Insignificant	None
11.7.5.2 & 14.1.2		Accidental spills of hazardous materials may occur during construction	SE	The following engineering and management measures will be implemented for spill prevention and control in the Construction Management Plan (Appendix C, CPL, 2014): • All hydrocarbon fuels and lubricants will be stored in a secondary containment area; • All vehicle fuelling will occur in designated areas, a minimum of 30 m from a water course and where site grading and spill response equipment will be established to contain spillage; • Drip pans will be installed on equipment to intercept minor leaks; • Locations of spill prevention and clean up materials will be made known to all workers involved in these activities; • Sumps will be installed including an oil trap to prevent contaminated water from being pumped into a water course at fuel storage and handling locations; and • Absorbent mats and other spill response equipment will be readily available for deployment.	Yes	High	Low	Low	Reversible	Low	High	Low	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.7.5.6		Worker Health and Safety concerns associated with facility construction	SE	Worker safety at the site would be ensured via strict adherence to Ministry of Labour occupational health and safety regulations pertaining to construction sites. First aid equipment will be maintained on site throughout the construction period and workers will be trained to deal with emergency situations.	Yes	High	Low	Low	Irreversible	High	Low	Low	Insignificant	None
11.7.5.4		Concerns related to production of waste in and around work site during construction	SE	Local waste management companies have been identified to deal with construction-related wastes; these are described in the CMP. They will identify waste management facilities with the capacity to accept construction wastes, and transportation of the wastes to this facility will be incorporated into the Project's transportation planning. Any hazardous wastes generated will be sent to a licensed hazardous waste facility. The Project proponent will discuss any wood waste created with the local SFL holder	Yes	Moderate	Low	Low	Reversible	Moderate	Low	Low	Insignificant	None
11.7.5.7		Construction activities may increase levels of dust locally.	IE	All stockpiled materials will be covered appropriately throughout construction, and wetted down as appropriate. Exposed soils will also be wetted down during construction prior to any revegetation. Exposed soils will be revegetated using native plants as soon as possible following construction, in consultation with the MNR and will all due consideration given to fire safety measures.	Yes	Moderate	Low	Low	Reversible	Low	Low	Low	Insignificant	None
11.7.5.5		Construction activities may affect water supplies for local communities.	NE	Distance to water intakes and water treatment plants is such that no impact is anticipated.	No								Insignificant	None
11.7.6	Local, Regional, or Provincial Economies	Project construction may have an impact on Forestry operations in the Project Area	IE	Due to ongoing consultation with the license holders for forestry operations in the area, no impact is anticipated to local logging operations. Local SFL holders will be offered first refusal on any merchantable or non-merchantable timber removed as part of Project construction.	Yes	High	Low	Low	Reversible	High	Low	Low	Insignificant	None

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11.7.6		Project Construction may have an impact on mining claims in the Project footprint	IE	The construction of a new hydro power project is not expected to have any negative effect on mining activities since mining companies are subject to a '400' surface rights reservation around all lakes and rivers (CLAIMaps). Provisions, within the *Mining Act*, like the reservation above, allow for the development of renewable energy (waterpower) on mining claims. Generally, waterpower and mining operations are compatible since they can share infrastructure (power lines/ roads) and waterpower operations provide a readily available source of reliable power. All permit holders for existing mining claims in the area have been contacted Consultation will continue with local mining and forestry operators to ensure the Project is integrated into their business models and agreements regarding access to merchantable timber, for instance, are reached.	Yes	High	Low	Low	Reversible	High	Low	Low	Insignificant	None
11.7.7	**Tourism Values**	There are no known economic impacts to tourism values in the Project Area.	NE	No mitigation required	No								Negligible	None
11.7.5.5	**Water Supply**	The operation of a hydroelectric facility has the potential to cause problems with downstream drinking water supplies, or upstream drinking water supplies where the impoundment affects the hydrology of the drinking water intake.	NE	No mitigation required	No								Negligible	None
11.7.5.5		Wastewater discharges can be affected by Project operations if the pipes are located within a hydroelectric facility's Zone of Influence (ZOI).	NE	No mitigation required	No								Negligible	None
11.6.6	**Aesthetic Image of the Surrounding Area**	Impacts to the remote aesthetic of the project area; decreased aesthetic and intrinsic value	IE	Xeneca has undertaken extensive planning and consultation with the local community in order to plan a Project that is minimally visually intrusive and retains as many of the existing aesthetic features as possible. Renaturalization of cleared areas along roadways will be undertaken wherever possible, in consultation with the local MNR office to determine suitable species and take any fire safety concerns into account.	Yes	Moderate	Low	Low	Reversible	Low	Moderate	Insignificant	Insignificant	None

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11.7.4.1	Other	Site access at the Chute Project site may become restricted during construction	IE	Access will only be restricted on land or water when and where required for public safety. These restrictions will be posted on signs.	Yes	Moderate	Low	Low	Reversible	High	Low	High	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
11.7.4.2		Some parts of the Third Falls Project site may become inaccessible during construction due to safety concerns.	IE	Access will only be restricted on land or water when and where required for public safety. These restrictions will be posted on signs.	Yes	Moderate	Low	Low	Reversible	High	Low	Moderate	Insignificant	Construction staff will monitor operations to ensure that mitigation measures are employed throughout construction.
Energy/Electricity Considerations														
11.10.1	**Reliability (e.g. Voltage Support)**	The Project may have an impact on local electricity reliability	NE	During construction of the Project portable electrical generators will be required to support construction activities. and will therefore not impact reliability	No								Negligible	None
11.10.1	**Security (e.g. Black start)**	The Project may have an impact on local electricity security	NE	During construction of the Project portable electrical generators will be required to support construction activities, and will therefore not impact security.	No								Negligible	None
11.10.2	**Electricity Flow Patterns**	The Project may have an impact on Electricity Flow	NE	During the initial construction period electricity demands will be met through use of portable electrical generators. And will therefore not impact electricity flow.	No								Negligible	None

Notes:

Negligible Effect (NE): A nearly zero or hardly discernible effect. A negligible effect would touch a population or specific group of individuals at a localized area and/or over a short period in such a way as to be similar in effect to random small changes in the population (or group) due to environmental irregularities, but would have no measurable effect on the population (or group) as a whole. (This is equivalent to a Nil effect in the OWA scale).

Insignificant Effect (IE): An effect that may exhibit one or more of the following characteristics: Not widespread. Recurring effect lasting for short periods of time during or after project implementation. (This is equivalent to a -L effect in the OWA scale).

Significant Effect (SE): An effect that may exhibit one or more of the following characteristics: Widespread. Permanent reduction in species diversity or population of species. Permanent alterations to community characteristics or services, land use or established patterns. (This is equivalent to a -H effect in the OWA scale).

11.1 Geology, Topography and Terrain

The following sections use the existing geology, topography and terrain of the Study Area to determine construction related impacts on hazard lands and soil quality from erosion, soil compaction, sedimentation and contamination.

11.1.1 Bedrock Geology

Although there will be rock excavation mainly for the powerhouse construction, there are no anticipated impacts to Bedrock Geology as a result of Project construction activities.

11.1.2 Terrain and Topography

11.1.2.1 Potential Effect for The Chute and Third Falls

Construction will have temporary effects on the terrain and topography, typically where excavation and fill are required for construction.

11.1.2.2 Mitigation Measures for The Chute and Third Falls

Mitigation for the temporary effects on terrain and topography will include restoring existing topography and terrain to the extent possible following removal of the temporary components (e.g., staging and laydown areas, cofferdams). This will include removal or incorporation (into existing soils) of granular fill material, addition of stockpiled soil (as needed) and revegetation. Stockpiled soil will be applied to the reclaimed areas post-construction to assist in rehabilitation of topography and terrain.

No mitigation is possible for the long-term changes in topography and terrain due to permanent Project components.

11.1.2.3 Net Effects and Significance Assessment for The Chute and Third Falls

Construction of the facilities will result in a change in topography and terrain where excavation and fill are required to construct Project components.

11.1.2.3.1 Value of Resource

The existing terrain and topography that will be altered does not provide any significant value nor is it valued by stakeholders therefore the value of this resource is *low*.

11.1.2.3.2 Geographic Extent of Effect

The construction impacts to the terrain and topography will be contained with the *Project Area*, therefore it is *low*.

11.1.2.3.3 Duration and Frequency of Effect

The effects on the terrain and topography will persist consistently through the construction period, so they are considered to be *moderate*.

11.1.2.3.4 Irreversibility of Effect

The effects on terrain and topography are partially *reversible* following site restoration.

11.1.2.3.5 Ecological or Social Context

The area is determined to have *low* fragility with respect to localized effects on terrain and topography.

11.1.2.3.6 Magnitude of Effect

During construction, the terrain and topography will be somewhat different than the existing conditions therefore the magnitude is *moderate*.

11.1.2.3.7 Probability of Effect

As with almost all construction activities, there will be construction impacts to the terrain and therefore the probability of effect on terrain and topography is *high*.

11.1.2.3.8 Overall Significance

Due to the low geographic extent, low value of the resources and low ecological fragility, the impact to the terrain and topography is considered to be an *Insignificant Effect* from the Project.

11.1.3 Landslide Hazards

Construction activities, particularly excavation, could result increased erosion that could lead to slope failures.

11.1.3.1 Potential Effect for The Chute and Third Falls

Excavations conducted without proper planning or improperly executed have the potential to cause damage to the surrounding environment including slope failures and un-controlled sediment transport.

As outlined in the Construction Management Plan, excavation is restricted primarily to the following locations:

- The Chute dam axis and powerhouse
- Third falls dam axis and powerhouse

Excavation is also relevant to the auxiliary dam at The Chute, but the excavation is limited to grubbing topsoil in a relatively flat location where erosion potential is limited. No risk of slope instability exists during construction at the auxiliary dam location due to the flat grade.

At The Chute, both, the dam axis and the powerhouse are to be located on a bedrock outcrop. The baseline geomorphologic assessment revealed a limited amount of soil and overburden exists on and above the river bank at this location (i.e. typically less the 1 meter thick); however, the potential for localized sediment erosion and silt discharge into the river exists during construction of the dam axis and the powerhouse. The east and west river banks at this location are relatively steep and disturbed soil material could easily be transported into the river. This aspect requires mitigation and preventative action.

At Third Falls, the integrated dam and powerhouse are located on a bedrock outcrop; however, thick deposits (i.e. up to 5 meters thick) of silt and overburden exist on either side of the dam and powerhouse where the structure ties into grade. In addition, the construction access road on the east side has to cross the steep silty riverbank slope to access the east abutment of the dam during construction. The potential for sediment erosion and silt discharge into the river exists during construction at the following three locations:

- East abutment of dam;
- West abutment of dam; and
- Temporary east construction access

The above construction locations at The Chute and Third Falls require mitigation and preventative actions during construction to prevent silt discharge into the river as described below.

11.1.3.2 Mitigation Measures for The Chute and Third Falls

On-site excavation will be conducted using appropriate methods to control for undesirable effects in accordance with regulatory and best management practices. Project personnel will review an area prior to the disturbance of a new site to ensure that environmental concerns are addressed, that contingency plans are in place, and that adequate resources, including personnel, are available on site to implement control, mitigation and protection measures. Reconnaissance may reveal old dumps, caches, spills, or other potential hazards that will be accommodated before the work is done.

Where possible, topsoil will be placed in separate stockpiles for future use to re-contour and restore disturbed areas. Erosion control berms and settling basins will be constructed where required and incorporated into the natural drainage where practicable. Restoration, including appropriate drainage and erosion control measures, will be implemented as soon as possible following excavation to prevent erosion and assist natural recovery of vegetation. Stockpiled overburden and soils will be re-contoured prior to seed application.

Incorporating the above mitigation measures, along with the monitoring plan for erosion and sediment described below (see Appendix E for details), results in an *Insignificant Effect* from the risk of landslide hazards during construction activities.

11.1.4 Erosion, Soils & Sedimentation

Soil quality and soil quantity are important biological features that support wildlife and vegetation communities. Soil quality refers to the characteristics (physical and chemical) of the soil that support biological life while soil quantity refers to the amount of soil within a specific area. Erosion and sedimentation are processes that can impact both soil quality and soil quantity. Erosion is the removal of soil, sediment and rock fragments from the landscape. Sedimentation is the deposition of the eroded material.

The potential for erosion and sediment transport is determined by the energy level in the river and the transportability of the underlying sediment. Fine sediment is typically easier to transport than coarser sediment. An assessment of river sediments was carried out in a Geomorphic Assessment carried out in the river (*Ivanhoe River Hydroelectric Projects The Chute Hydroelectric Generating Station and Third Falls Hydroelectric Generating Station Geomorphic Assessments*, also referred to as "Geomorphic Assessment", Appendix E). Combining the field work, the energy level in the river, and the hydraulic models, the erosion and transport potential was assessed using a sediment shear stress model. In addition to inchannel erosion is potential for erosion in newly inundated areas. As the inundated area is transformed from terrestrial to aquatic habitat, there is an increased potential for that area to have increased occurrence of erosion and sediment transport. For the inundation areas, a screening level erosion potential index was created and implemented using LiDAR data. The results matched field observations and provided locations for future mitigation or monitoring.

Soil quality and soil quantity at the facilities are impacted by erosion, sedimentation, soil compaction and soil contamination. Construction activities that expose soils that have the potential to impact soil quality and soil quantity are summarized into 3 categories:

- Erosion:
    - Loss of exposed soil due to water erosion;
    - Loss of exposed soil due to wind erosion; and

  - Erosion of channel beds due to in-water construction activities.
- Sedimentation:
  - Surface runoff from the construction areas carrying construction-related sediment;
  - Sediment disturbance due to in-water work construction activities such as cofferdam construction and removal;
  - Sediment disturbance due to water diversion during construction;
  - Sediment disturbance due to water crossing structure installation for transmission lines;
  - Sediment disturbance due to water crossing structure installation for roads; and
  - Water diversion during construction.
- Soil Compaction:
  - Soil compaction from grading roads;
  - Soil compaction from the construction footprints of permanent structures; and
  - Soil compaction from temporary laydown areas.
- Contamination:
  - Impacting soil quality through acid rock drainage; and
  - Impacting soil quality through accidental spills

11.1.4.1 Erosion – Soil Quantity

11.1.4.1.1 Potential Effect for The Chute and Third Falls

When left uncontrolled, soil exposed from construction activities has the potential be transported off of the construction areas by wind or water erosion. This decreases the quantity of soil available to support wildlife and vegetation and regulating surface water runoff processes. In extreme cases, erosion can cause an increase in the overall sediment load in the river with the potential for secondary effects on water turbidity and aquatic conditions. If the eroded soil reaches the water ways, there is a potential to impact surface water quality, aquatic habitat and cause an alteration or blockage of in-stream flow.

Construction activities that expose soil include:

- Excavation for permanent and temporary structures and laydown areas;
- Installation activities related to water crossing structures for transmission lines;
- Vegetation clearing for the headpond inundation areas, temporary roads, and permanent roads; and
- Grading for construction activities and road construction.

In addition to the construction activities, the initial inundation of the headponds could cause water erosion of the soil. A screening level erosion potential index was developed using LiDAR data. The results suggest that erosion potential at The Chute generating station site is relatively low and limited to a localized slope locations in the first 2 km upstream of the proposed dam. At the Third Falls site, steep slopes near the proposed Facility have a relatively high potential for erosion, especially associated with hillslope processes, however, no flow or level alteration is proposed downstream of Third Falls as it relates to Project. As a result no Project related impact is expected downstream of Third Falls.

11.1.4.1.2 Mitigation Measures for The Chute and Third Falls

The Construction Management Plan (Appendix C) and the *Ivanhoe Baseline Environmental Conditions for Road and Transmission Line Options* (Northern Bioscience 2014) in Appendix J detail measures that will avoid, prevent, or limit the environmental effects from erosion:

- Clearing will take place as close as practical prior to excavation and earthworks to minimize the length of time that soils are exposed;
- Where vegetation is cleared in the year prior to excavation and earthworks, the forest litter and root cover will be left in place until the soil cover is stripped at the time of excavation;
- Grubbed soil and forest litter material will be stored either in small piles or windrows next to the earthwork area or in a central soil storage pile if one is designated for the site;
- Grubbed material will be used where possible and to the extent available to restore and top dress excavated areas where desirable, including ditches and site areas that are not required for vehicle access after construction;
- Erosion control berms and settling basins will be constructed where required and incorporated into the natural drainage where practicable;
- Vehicles and equipment access will be restricted to the minimum area necessary;
- Vegetation in adjoining areas will not be disturbed;
- Temporary control measures such as silt fencing, drains, settling basins and pumping systems will be installed as needed;
- French drains, energy dissipaters, straw mats, geotextiles, and interception ditches will be used as needed on a site-specific basis to control erosion;
- Erosion-prone slopes will be stabilized and re-vegetated if permanent. Temporary slopes will be cordoned off with silt fencing or covered with geotextiles and/or coco mats, especially when in close proximity to fish bearing streams;
- Vegetation identified for protection (e.g., mature trees and potential wildlife trees) will be left intact and root systems undisturbed wherever possible;

- Reclamation work will involve reseeding and will be completed on all areas not directly in the footprint of permanent features;
- If construction finishes in a cleared area, with insufficient time left in the growing season to establish vegetative cover, an overwintering treatment such as erosion control blankets, fibre matting or equivalent will be applied to contain the site over the winter period;
- Maintenance and inspection of the vegetative cover will continue until such time as the disturbed areas are sufficiently stabilized through vegetative growth to reduce overland runoff of suspended materials
- All disturbed access roads and work sites will be reclaimed as soon as possible after disturbance;
- No power line corridor poles will be placed in-water;
- Any trees that are required to be removed for the power line corridor water crossing will be done manually using chainsaws or by feller-bunchers to minimize the presence of heavy equipment;
- Vegetation clearing around new and existing water crossings will be done in accordance with *Measures to Avoid Causing Harm to Fish and Fish Habitat* recommended by the DFO;
- Project personnel will ensure that clearance techniques, silt/sediment control measures, and storm response protocols are understood and addressed;
- Any piles of topsoil and silty material (rock and rip-rap excluded) formed due to construction will be placed a minimum of 20 m from any watercourse and in a location where erosion back into the watercourse cannot occur and will not impede any drainage; and,
- Excavation will be stopped during intense rainfall events or whenever surface erosion occurs affecting a fish-bearing watercourse. Silt fencing and/or other erosion protection measures will be implemented, checked, and/or repaired in anticipation of intense storm events.

11.1.4.1.3 Net Effects and Significance Assessment for The Chute and Third Falls

Erosion impacts the quantity of soil available within an ecosystem. Minimal impacts are anticipated and will primarily occur during the initial filling of the headponds. The proper implementation of construction management plan and best management practices will mitigate impacts. Erosion control measures will be installed prior to construction and maintained diligently throughout the construction operations.

Consideration was given to minimizing footprint impacts of The Chute and the Third Falls headponds. To the extent achievable, the extent of both headponds was constrained to the existing river channel. This was done by limiting the inundation depth/elevation such that it remains below the river bank elevation for much of the headpond length. Where the headpond exists within the existing river

channel, the potential for shoreline erosion is minimal. A geomorphologic study (*Ivanhoe River Hydroelectric Projects The Chute Hydroelectric Generating Station and Third Falls Hydroelectric Generating Station Geomorphic Assessments*, also referred to as "Geomorphic Assessment", Appendix E) concluded that, although the watershed geology consists of soft silts and clays, the existing river is "in regime" with a stable channel bed. As a result, it can be concluded that there is low potential for erosion during the initial filling in the portion of the headpond within the existing channel bed (i.e. from kilometer 1.9 to kilometer 6.4 upstream of The Chute and from kilometer 5.5 to kilometer 44.2 upstream of Third Falls).

In the 1.9 km long section upstream of the proposed Chute dam site, the proposed inundation will go beyond the existing river channel and occupy the existing flood plain area on both sides of the river. In this area the geology and terrain slopes were reviewed (ORTECH 2013, Appendix E). A new shoreline will develop in this portion of the headpond. Soft sediments and moderate slopes exist in some locations along the new shoreline which represents a higher potential for erosion during the initial filling of the headpond.

In the 5.5 km long section upstream of the proposed Third Falls dam site, the proposed inundation will go beyond the existing river channel and develop a new shoreline. Geology and terrain slope were reviewed; soft sediments and moderate slopes exist in some locations which represents an increased potential for erosion during the initial filling of the headpond.

No private riparian land exists along the proposed headponds. However, two road bridges (Oates Road Bridge and Nova Road Bridge) cross the headponds and mining claims have been staked in the vicinity of Third Falls. Hydraulic analysis (CPL, 2013, Appendix F) was carried out to assess the potential inundation impact on the two bridges and the mining claims along with consultation with the owners. In addition, the initial inundation will be a slow and at a consistent rate preventing high velocity water or large water fluctuations from transporting additional material from the inundation area. The filling will be accompanied by upstream and downstream sampling of turbidity to ensure the work is not increasing suspended solids or pH in the water beyond acceptable levels. If acceptable levels are close to being exceeded, the work will be suspended until turbidity levels drop. **Consequently, there are no significant impacts on bridges and mining claims** from construction activities.

There will be a residual effect from erosion in the initial headpond filling in the portion in the first 5.5 km of The Chute headpond and the first 1.9 km in the Third Falls headpond.

Value of the Resource

Soil quantity is involved in supporting wildlife and vegetation and regulating surface water runoff processes. Although soil quantity is of high importance, the effect on the value of soil quantity is of

moderate value since there is an abundance of soil in the Project Area and the concerns regarding soil quantity from stakeholders relate to fish habitat, which is addressed in Section 11.4.1.

Geographic Extent of Effect

The erosion from the construction activities will be limited to areas of exposed soils within the Project Area therefore the geographic extent of the effect to soil quantity will be *low*. Indirect impacts from erosion such as the impacts on surface water quality (Section 11.2) and aquatic habitat (Section 11.4.1) are addressed throughout this Environmental Report (ER).

Duration and Frequency

The duration and frequency of the effect on soil quantity are anticipated to be *low* as it will be limited to the construction time frames on an infrequent basis with the effective mitigation measures regarding site remediation properly implemented.

Irreversibility of Effect

Erosion impact to soil quantity is considered *irreversible* for the construction of the headponds, since once the material is eroded it is transported downstream; however, naturally occurring processes may restore the river bed over time.

Ecological or Social Context

The implementation of the mitigation and site remediation measures will limit the amount of erosion resulting in a *low* ecological effect to soil quantity.

Probability of Effect

It is anticipated that some erosion will occur particularly with the initial headpond filling that will impact soil quantity resulting in a *moderate* likelihood of the effect occurring during the construction phase.

Magnitude of the Effect

With the effective implementation of the mitigation and monitoring procedures, the magnitude of the effect on soil quantity is anticipated to be *moderate*. There are naturally occurring erosion and sedimentation processes impacting the soil quantity. However, it is anticipated that some erosion will occur particularly with the initial headpond filling that will likely exceed existing conditions.

Overall Significance

The overall impact to soil quantity due to erosion in these areas will have an *Insignificant Effect* as concluded from the significance assessment.

11.1.4.1.4 Monitoring for The Chute and Third Falls

Since water quality in the stream is one of the major impacts from erosion accidentally introduced during the construction phase, water quality will be monitored on a regular basis as defined by the Monitoring Program in Section 16. In addition, access road inspection will include signs of soil movement and erosion. Lastly, the environmental monitor will conduct informal inspections of access road after heavy rainfall for potential road or bridge foundation erosion, culvert blockage, or other damage from eroded materials introduced during the construction phase.

11.1.4.2 Sedimentation – Soil Quality and Soil Quantity

Sedimentation and sediment transport includes both the deposition and accumulation of sediment. Sediment transport is the movement of sediment typically due to a combination of the force of gravity acting on the sediment and the movement of the fluid in the river. Occurring naturally, sedimentation is an important mechanism for the formation of rivers, channels and aquatic habitat. Soil quality is impacted by sedimentation processes. Soil quality and sediment quality are closely related. The erosion of bedrock and soils leads to suspended sediment and to the accumulation of sediments in water bodies that provide habitat for aquatic life, supporting aquatic vegetation. Soil quantity is also impacted by the deposition of sediment.

11.1.4.2.1 Potential Effect for The Chute and Third Falls

Sediment in waterbodies from construction sites can reduce the amount of sunlight reaching aquatic plants, clog fish gills, smother aquatic habitat and spawning areas, impede navigation and alter or block in-stream flow. Construction activities resulting in transporting sediment (soil quantity) from the Project Area would result in a decrease in local sediment ultimately impacting aquatic habitat (impacts discussed in Section 11.4.1) and potentially water quality (impacts discussed in Section 11.2). Sediment quality could also be impacted by accidental spills which are discussed in Section 14.1.2.

Sources of sediment during the construction phase include the following activities:

- Surface runoff from the construction areas carrying construction-related sediment;
- Sediment disturbance due to in-water work construction activities such as cofferdam installation and removal;
- Sediment disturbance due to water crossing structure installation for power line corridors;

- Sediment disturbance due to water diversion during construction; and
- Sediment disturbance due to water crossing structure installation.

11.1.4.2.2 Mitigation Measures for The Chute and Third Falls

The primary method of controlling sediment production will be through the effective isolation of the work area. Silty water created in the work area through mixing groundwater or precipitation with excavated material will be pumped to an approved vegetated bench inside forested land or a sufficiently latent pond or passive drainage channel to allow the sediment to settle without deposition to the local watercourses. The cofferdams used for water diversion work will primarily consist of earth material including blasted rock generated on-site or imported clean fill. Silt control methods will be used to minimize the risk that excavation, storage and placement of cofferdam material or sediment could enter waterways.

The following general principles will avoid, prevent, or limit the environmental effects of sedimentation:

- Install mechanical erosion control measures at blast rock storage sites near the water body;
- Re-use blast rock for aggregate and shoreline stabilization after it is cleaned and tested for fine sediment and acid-generating constituents;
    - If Acid Rock Drainage (ARD) is determined to be an issue, an ARD Management Plan will be prepared including measures for avoidance, mitigation, and treatment methods for ARD as well as long-term storage methods for acid-generating spoils which would entail isolation of spoils from water and air to prevent leaching
- Apply water to dry soil/rock to minimize dust;
- Carry out the excavation from the powerhouse working towards the water course so that flowing water does not infiltrate the cut until the final phase of excavation;
- Use temporary wind control structures to avoid dust entry into watercourse;
- Instruct workers and equipment operators on dust control methods;
- Install mechanical barriers to prevent run-off from dust piles into water bodies;
- Any piles of topsoil and silty material (rock and rip-rap excluded) formed due to construction will be placed a minimum of 20 m from any watercourse with silt fence barriers to limit the transport of sediment;
- Develop and agree upon a water diversion and headpond filling plan with the environmental monitor prior to activities commencing;
- Vegetation clearing around new and existing water crossings will be done in accordance with *Measures to Avoid Causing Harm to Fish and Fish Habitat* recommended by the DFO;

- Minimize activities causing erosion (Section 11.1.4.1); and
- Employ erosion management practices (Section 11.1.4.1).

11.1.4.2.3 Net Effects and Significance Assessment for The Chute and Third Falls

As noted in Section 9.1.1 (Bedrock Geology), the existing riverbed The Chute and Third Falls Study Area consists of sands and cobbles/boulders and bedrock. The rapids sections are primarily bedrock and boulders; the median grain size for the entire sampled area was approximately 0.5mm (medium sand). The predominantly rocky riverbed near the project sites minimizes the potential for the disturbance of sediment from in water construction work and the disturbance of sediment due to water diversion. Consequently, the installation of cofferdams for instream work including installation of water crossing structures will not disturb riverbed materials. However, equipment use around channel banks and any sediment accumulated at the upstream side of the cofferdam may mobilize and transport sediment from construction activities

During the removal of the cofferdams no riverbed material beneath the cofferdam footprint is anticipated to erode causing sediment transport downstream.

Value of the Resource

Sediment provides habitat for aquatic life and supports aquatic vegetation however there is an abundance of sediment in the Project Area therefore the value of this resource is *moderate*.

Geographic Extent of Effect

The baseline Geomorphic Assessment (Appendix E) described this section of the with slow water conditions which results in sediment settling out of the water in a relatively short distance. Therefore the geographic extent of the effect to soil quality and soil quantity will be *low*.

Duration and Frequency

The duration and frequency of the effect on soil quality and soil quantity from sediment are anticipated to be *low* as it will be limited to the construction time frames on an infrequent basis with the effective mitigation measures regarding site remediation.

Irreversibility of Effect

Sedimentation impact to soil quality is considered *irreversible,* since once the material is eroded it is transported downstream; however, naturally occurring sedimentation processes may restore the eroded material overtime.

Ecological or Social Context

The implementation of the mitigation and site remediation measures will limit the amount of sedimentation (soil quality) and sediment transport (soil quantity) resulting in a *low* ecological effect to soil quality given that the area is a predominantly rocky riverbed.

Probability of Effect

It is anticipated that equipment use around channel banks and any sediment accumulated at the upstream side of the cofferdam may mobilize and transport sediment (soil quantity) from construction activities resulting in a *high* likelihood of the effect occurring during the construction phase.

Magnitude of the Effect

Providing the effective implementation of the mitigation and monitoring procedures, the magnitude of the effect on soil quality and soil quantity from sedimentation is anticipated to be *low* as the area impacted will be restricted to permanent structures on the site.

Overall Significance

Due to the low geographic extent, low ecological context and low magnitude**,** the overall impact to soil quality from sedimentation will have an *Insignificant Effect*.

11.1.4.2.4 Monitoring for The Chute and Third Falls

To ensure these procedures are implemented and effective, water quality will be monitored on a regular basis as defined by the Monitoring Program in Section 16.

11.1.4.3 Soil Compaction – Soil Quality

Soil compaction is the result of applying stress to a soil causing increased density as air is displaced from the pores between the soil grains. Soil compaction is a part of the construction process; it is used to support structural components such as building foundations, roadways, and earth retaining structures such as the auxiliary dam at The Chute.

11.1.4.3.1 Potential Effect for The Chute and Third Falls

Soil compaction may result from grading of the roads, foundations for permanent structures such as the powerhouse, and heavy machinery use especially on very moist soils. The effects of soil compaction on plants are varied, but may limit plant growth due to a lack of water, nutrition or air at

their roots. Compact soil may also reduce the ability of water infiltration increasing the amount of surface water runoff.

11.1.4.3.2 Mitigation Measures for The Chute and Third Falls

Permanent soil compaction will be minimized by flagging foundation of permanent structures to prevent unnecessary soil compaction. Clearing, grubbing, stripping, grading and soil salvaging of the area used for permanent structures are outlined in Section 2 of the Construction Management Plan (Appendix C).

The following strategies will be employed to minimize soil compaction from construction activities:

- Developing shutdown protocols involving the monitoring weather forecasts and planning the work accordingly, including stabilizing work areas in anticipation of forecasted storm events. The work activities will be modified or stopped during severe or prolonged precipitation until ground conditions improve;
- Constructed new roads using existing trails where possible to minimize additional soil compaction;
- Limiting soil compaction to the construction areas and roads;
- Scheduling construction of the transmission Right-of-Way to minimize ground disturbance (winter);
- Be prepared to alter construction activities as a result of sudden thaw conditions;
- Stabilize high traffic areas with gravel surface layer or other suitable cover material;
- Establish a designated construction access route to minimize area of impact;
- Time construction activities to minimize effects on surface vegetation and subsurface rooting zones;
- Restrict vehicles and equipment access to the minimum area necessary; and
- Conduct site reclamation activities as soon as possible following the disturbance.

11.1.4.3.3 Net Effects and Significance Assessment for The Chute and Third Falls

The proper implementation of the construction management plan (Appendix C) and best management practices will mitigate impacts wherever possible.

Value of the Resource

Soil quality supports wildlife and vegetation. Soil quality is of *low* value since it has generally minor effects on the ecosystem and no concerns regarding soil quality from soil compaction have been raised by stakeholders.

Geographic Extent of Effect

The soil compaction from the construction activities will be limited to areas of exposed soils within the *Project Area*. In addition, existing trails where the soil is already compacted will be utilized as much as possible for road construction. Therefore the geographic extent of the effect to soil quality will be *low*.

Duration and Frequency

The duration and frequency of the effect on soil quality from soil compaction are anticipated to be *low* as it will be limited to the construction time frames provided the effective mitigation measures regarding site remediation are properly implemented.

Irreversibility of Effect

Impacts to soil quality from soil compaction during construction are considered *reversible* since soil compaction will reverse naturally over time once the construction activities cease.

Ecological or Social Context

Proper implementation of the mitigation and site remediation measures will limit the amount of soil compaction resulting in a *low* ecological effect to soil quality.

Probability of Effect

It is anticipated that some soil compaction will occur particularly with permanent structures and areas of high heavy equipment use resulting in a *high* likelihood of the effect occurring during the construction phase.

Magnitude of the Effect

Providing the effective implementation of the mitigation and monitoring procedures, the magnitude of the effect on soil quality is anticipated to be *low* as the area impacted will be restricted to permanent structures on the site.

Overall Significance

Overall, minimal impacts are anticipated particularly regarding permanent structures and areas of heavy equipment use. Soil compaction will reverse naturally over time if left undisturbed. As determined in the significance assessment, the overall impact to soil quality from soil compaction will have an *Insignificant Effect*.

11.1.4.4 Contamination – Soil Quality

This section specifically deals with the potential of Acid Rock Drainage (ARD) from the Project. Section 14 deals with accidental spills. No contaminated soils are known or anticipated in the Project Area as the Project Area has been traditionally used for recreational activities (hunting, fishing, boating) and Aboriginal traditional uses that are generally not soil contaminating activities. Therefore the transport of contaminated soils and its effect on human health during construction is not anticipated during the construction phase of this Project. The spill response procedures outlined in Section 14.1 will manage any accidental spills from construction activities that could contaminate soil.

11.1.4.4.1 Potential Effects for The Chute and Third Falls

The construction of the Project will require localized removal of bedrock material for the dam and powerhouse foundation. The bedrock will be used in embankments, riprap erosion protection, slope stabilization, cofferdam construction, fish habitat optimization, topping and rework of access roads, provided it is environmentally suitable (e.g. not acid generating and clean) and of proper grade; there will be no disposal of bedrock.

There is the potential for Acid Rock Drainage (ARD) from the bedrock to impact the soil quality.

11.1.4.4.2 Mitigation Measures for The Chute and Third Falls

The environmental risk of Acid Rock Drainage (ARD) is directly related to the degree of sulphide mineralization; rock material that is highly mineralized poses a high risk for ARD. The potential for encountering ARD issues is low because less than 1% of the landscape is underlain by rocks with a high degree of sulphide mineralization. However, the potential of encountering ARD due to rock excavation does exist and needs to be addressed.

ARD potential in rock can be readily tested by extracting and analyzing representative rock samples and this will be completed by a qualified professional in accordance with the methods and procedures from Mine Environmental Neutral Drainage (MEND) guidelines. The program described in the Construction Management Plan (Appendix C) will be carried out so that ARD testing results are available at an early enough stage to factor into final Project design and permitting.

An ARD Management Plan will be prepared including measures for avoidance, mitigation, and treatment methods for ARD as well as long-term storage methods for acid-generating spoils which would entail isolation of spoils from water and air to prevent leaching.

11.1.4.4.3 Net Effects and Significance Assessment for The Chute and Third Falls

There are **no net effects from Acid Rock Drainage anticipated** with the proper implementation of the construction management plan and best management practices.

11.1.4.4.4 Monitoring for The Chute and Third Falls

Water quality will be monitored during construction activities both upstream and downstream to ensure the work is not increasing the pH in the water beyond acceptable levels. If acceptable levels are close to being exceeded, the work will be suspended until levels drop.

11.2 Surface Water & Groundwater

11.2.1 Surface Water Hydrology

During the construction phase, 2 stages of cofferdams will be installed in the summer low flow season for each Facility to divert the water flow from the in-water construction area to the open channel. It is anticipated that there is no change of total water flow during the construction phase.

11.2.2 Water Levels, Flows & Movement

These 2 stages of cofferdams for each Facility will be installed and removed during the low flow season in late summer. The likelihood to influence the water level and flow is negligible in the low flow season. During the operation of each cofferdam, a sufficient channel is still open to divert the water flow from the cofferdam areas. It is anticipated that there is no change of water level and water flow in the upstream and downstream areas at each Facility.

11.2.3 Surface Water Quality

Surface water quality impact assessment during the construction was addressed in the Section 6.1.5 of the *Ivanhoe River Hydroelectric Development Natural Environment Characterization And Impact Assessment Report* prepared by Natural Resource Solutions Inc. (NRSI, 2014) in Appendix H, based on the construction activities introduced in the *Construction Management Plan* (CPL, 2014) in Appendix C.

The related construction impact assessment for access roads and power line corridors were addressed in the *Ivanhoe Baseline Environmental Conditions for Road and Transmission Line Options* prepared by Northern Bioscience (Bioscience, 2013) in Appendix H, based on the construction activities introduced in the *Distribution Lines and Access Road Summary Report for the Chute Hydroelectric Project* (KBM, 2013) and *Distribution Lines and Access Road Summary Report for the Chute Hydroelectric Project* (KBM, 2014) in Appendix J.

11.2.3.1 Erosion and Sedimentation Impact on Water Turbidity

11.2.3.1.1 Potential Effects

Vegetation clearing will be conducted in the following areas:

- Inundation areas for The Chute and Third Falls Facilities;
- Construction site areas at The Chute and Third Falls Facilities; and
- New access roads and power line corridors.

The vegetation clearing can lead to erosion, topsoil degradation and sediment loading into surface waters from runoff, and result in an increase of Total Suspended Solid (TSS) level and turbidity. For other erosion and sediment impacts, please refer to Section 11.1.4.

11.2.3.1.2 Mitigation Measures

To mitigate the potential increase of TSS level and turbidity arising from erosion and sedimentation during the vegetation clearing, the following measures will be implemented (CPL, 2014).

Mitigation at all vegetation clearing areas:

- Vegetation clearing will comply with the requirements of all applicable permits and approvals, including the Crown Forest Sustainability Act;
- Vegetation clearing will be limited to the area of development set out in the project description;
- Vegetation removal will only take place where absolutely required and immediately prior to construction activities to minimize soil exposure;
- Tree clearing will most likely commence in the winter to minimize the disturbance to the surface soils; and
- All disturbed areas will be reclaimed as soon as possible after disturbance.

Additional mitigation measures at the inundation areas:

- Trees cleared during headpond preparation will not be felled into the water;
- During clearing, trees will be felled into the proposed site wherever possible; and
- Cut materials will be removed from the riparian zone daily to ensure they do not enter the river during high flow events.

Additional mitigation measures at temporary construction areas:

- Stockpile, laydown, construction parking, concrete batch plant, construction camp areas will be well removed from the Ivanhoe River;
- Silt/sediment control fencing will be installed between the work area and the water course(s);
- Any piles of topsoil and silty material (rock and rip-rap excluded) formed due to construction will be placed a minimum of 20 m from any watercourse and in a location where erosion back into the watercourse cannot occur and the piles will not impede any drainage; and
- Slash and other construction material or debris will not be disposed of in or near a watercourse.

Additional mitigation measures at the access roads and power line corridors:

- Vegetation clearing should include minimizing the cleared Right-of-Way width for both new access roads and power line corridors;
- Cut and fill slopes along the road alignment will be constructed to stable angles for the material being used, followed by re-seeding before the end of the construction season;
- Sediment control fencing will be installed 1 m beyond the intended toe of the road fill to prevent sediment from the construction area migrating beyond the grubbed area, out of the access road Right-of-Way;
- Tree clearing of the power line will be limited to the 20 m Right-of-Ways, except where the power line is situated on a relatively steep side-slope which would require additional clearing on the upslope side; and
- The Right-of-Way will not be grubbed in any case, and extra attention will be given to maintaining low level bushes and vegetation that will not cause a safety hazard with the line.

11.2.3.1.3 Net Effects and Significance Assessment

Value of Resource

Surface water is not used as a source of potable water in the Study Area. Due to the water use for fish habitat in the Study Area, the value of the surface water quality resource is *high*.

Magnitude of Effect

Water turbidity could potentially be above baseline levels, but the turbidity is not anticipated to exceed the PWQO (< 10%variance from background) after mitigation measures are implemented. Therefore, the magnitude is anticipated to be *moderate*.

Geographic Extent of Effect

The erosion and sedimentation effect on water turbidity is unlikely to occur for a distance downstream greater than 1000 m, therefore the geographic extent of changes is anticipated to be *moderate*.

Duration and Frequency of Effect

The erosion and sedimentation effect on water turbidity has the potential to occur periodically during heavy rainfall event in spring and fall, therefore, the duration and frequency during construction is *low*.

Irreversibility of Effect

The erosion and sedimentation effect on water turbidity is considered to be *reversible*, since the existing conditions would be re-established when the reclamation measures are effective upon the completion of vegetation clearing.

Ecological or Social Context

The local area that will be impacted by potential minor changes of TSS level and turbidity is anticipated to have a high resilience. Therefore the area has a *low* fragility to the effect.

Probability of Effect

There is a *low* probability of the effect occurring since mitigation will be conducted and monitoring will be implemented during the construction phase.

Overall Assessment

This effect is determined to be *Insignificant*, given the assessment of moderate graphic extent, low duration and frequency, reversible effect, and low probability.

11.2.3.2 Erosion and Sedimentation Effects from In-water Construction Activities

11.2.3.2.1 Potential Effects

The in-water construction activities at the Chute Facility include:

- A 75m long temporary Type A cofferdam installed at the powerhouse area in the western channel of the river during Stage 2 construction, currently assumed to be in late-summer. The cofferdam shall divert water flow through the eastern channel, allowing construction to proceed on the spillway dam structure.

- The Stage 2 cofferdam for the construction of the spillway and dam structures which will be removed during the Stage 3 construction.
- A 110 m long Stage 3 cofferdam installed in the eastern channel of the river in late summer. The cofferdam will divert water through low level gates in the spillway, allowing construction to proceed in the headrace, powerhouse and tailrace area. This cofferdam will be removed once the powerhouse construction is completed.

The in-water construction activities at the Third Falls Facility include:

- A 200 m cofferdam installed for the powerhouse, headrace and tailrace during the stage 2 construction, currently assumed to be in late-summer.
- The Stage 2 cofferdam for the construction of the powerhouse area which will be removed and a 175 m Type A cofferdam installed in the next late summer during the stage 3 construction; This cofferdam will be removed during the stage 4 construction.

The improper installation and removal of cofferdams may result in an increase of Total Suspended Solid (TSS) level and turbidity from disturbing the bed and bank of the surface water and existing water flow.

11.2.3.2.2 Mitigation Measures

To mitigate the effects, the following mitigation measures are proposed in the Construction Management Plan (CPL, 2014):

- The cofferdams will be constructed of clean fill with impermeable rubber liner or 1 m^3 sand filled nylon mesh cargo bags (approximately 1600 kg dry) with smaller synthetic sand bags (22.5 kg dry) and a polyethylene plastic sheet liner. The smaller bags will be used to fill irregularities in the ground surface and gaps between the larger bags;
- If necessary, a sump and pump will be set up immediately downstream of the cofferdams to catch seepage passing through the cofferdam before it reaches the work area; and
- The installation and removal of cofferdams will be conducted in the late summer to minimize the increased level of suspended solids and minimize the risk to fish and fish habitat.

11.2.3.2.3 Net Effects and Significance Assessment

Value of Resource

Surface water is not used as a source of potable water in the Study Area. Due to the water use for fish habitat in the Study Area, the value of the surface water quality resource is *high*.

Magnitude of Effect

The magnitude of effect on water turbidity could potentially be above baseline levels, but the turbidity is not anticipated to exceed the PWQO (< 10%variance from background) after mitigation measures are implemented. Therefore, the magnitude is anticipated to be *moderate*.

Geographic Extent of Effect

The erosion and sedimentation effect on water turbidity is unlikely to occur for a distance downstream greater than 1000 m, therefore the geographic extent of changes is anticipated to be *moderate*.

Duration and Frequency of Effect

The effect occurs for a long duration during construction, therefore, the duration and frequency is *moderate*.

Irreversibility of Effect

The erosion and sedimentation effect on water turbidity is considered to be *reversible*, since the existing conditions would be re-established after the construction is completed and mitigation measures are effective.

Ecological or Social Context

The local area that will be impacted by potential minor changes of TSS level and turbidity is anticipated to have a high resilience. Therefore the area has a *low* fragility to the effect.

Probability of Effect

There is a *low* probability of the effect occurring since comprehensive mitigation measures and monitoring will be implemented throughout the construction period.

Overall Assessment

This effect is determined to be *Insignificant*, given the assessment of moderate duration and frequency, moderate graphic extent, reversible effect, low fragility, and low probability.

11.2.3.3 Surface Water Quality Impact from Water Crossings

11.2.3.3.1 Potential Effects

The construction activities associated with culvert crossings on the access roads include:

- A new 3.5 km access road to the Third Falls that includes a new water crossing over a stream approximately 1.8 km to the west of The Third Falls Facility that is a tributary of the Ivanhoe River.
- An existing access road to The Chute Facility that includes an existing water crossing which is located approximately 360m to the west of The Chute Facility, on an existing tertiary road.
- Since most of the water crossings and drainage culverts along the Laundry Road have failed or significantly deteriorated, this route will require the replacement of water crossings.

The construction activities associated with bridge crossings on the access roads include:

- A upgrading of the existing Nova Road Bridge, which is located approximately 10.9 km upstream of The Third Falls Facility.
- A upgrading of the existing Oats Road Bridge, which is located approximately 1.9 km upstream of The Chute Facility.

The construction activities associated with water crossings in the power line corridors include:

- 3 new water crossings in the 13.3 km new 69 kV power line corridor between the two Facilities, and 3 existing water crossings in the 13.5 km existing corridor between the two Facilities.
- 21 new water crossings in the 29.1 new 115 kV power line corridor.

The potential effects associated with the above construction activities at the water crossings include:

- The discharge of sand and silt resulting in increased suspended solids from disturbing the bed and bank of the surface water; and,
- The discharge of sand and silt from the runoff and erosion of excavated soils stockpiled adjacent to surface water bodies.

11.2.3.3.2 Mitigation Measures

To mitigate the potential effects, erosion control measures should be installed prior to construction, and maintained throughout the construction for the culvert crossings and bridge crossings.

Mitigation for the culvert crossings on the access roads:

- Road crossing techniques and mitigation will follow standards, guidelines and best management practices described in MNR's *Stand and Site Guide* and other technical requirements related to the *Navigable Waters Protection Act;*

- Prior to commencing work, the contractor will review the detailed work plan with the environmental monitor and Project management; A silt/sediment control fence will be installed between the water course and the proposed works;
- All loose clearing and grubbing materials will be removed from the area at the end of each work day;
- Ditching will be installed to direct any surface runoff from the exposed works into a sediment trap and sediment control structures;
- Earthworks will be scheduled to minimize duration of exposure; and
- Required erosion protection material and/or re-seeding will be installed as soon as practical following the work.

Mitigation for the bridge crossings on the access roads:

- Bridge installation will be in accordance with the *Navigable Water Protection Act*, DFO Operational Statements and MNR requirements; Copies of these approval documents will be made available on site;
- The contractor responsible will be required to submit a detailed work plan for review and approval by the proponent;
- Any in-stream works will be completed within the specified in-stream work window except for clear span bridges installed according to the applicable DFO Operational Statement;
- No construction material or debris will be delivered to the stream network directly or indirectly;
- The work activities will be modified or stopped during severe or prolonged precipitation until ground conditions improve within the riparian zone; and
- All creek banks will be restored to their original contour and the banks repaired and/or rip-rapped immediately after bridge/abutment installation.

Mitigation for the water crossings in the power line corridors:

- Power lines will span water crossings; and
- No poles will be placed in-water.

11.2.3.3.3 Net Effects and Significance Assessment

Value of Resource

Surface water is not used as a source of potable water in the Study Area. Due to the water use for fish habitat in the Study Area, the value of the surface water quality resource is *high*.

Magnitude of Effect

The magnitude of effect on water turbidity could potentially be above baseline levels, but the turbidity is not anticipated to exceed the PWQO (< 10%variance from background) after mitigation measures are implemented. Therefore, the magnitude is anticipated to be *moderate*.

Geographic Extent of Effect

The effect on surface water quality is unlikely to occur for a distance downstream of the Project footprint greater than 1000 m, therefore the geographic extent of changes is anticipated to be *moderate*.

Duration and Frequency of Effect

The effect has the potential to occur for a short period at each crossing during the construction phase, therefore, the duration and frequency of effect is *low*.

Irreversibility of Effect

The effect on surface water quality is considered to be *reversible*, since any changes would be anticipated to eventually settle out of suspension and normal levels will be restored.

Ecological or Social Context

The local area that will be impacted by changes in surface water quality is anticipated to have a high resilience. Therefore the area has a *low* fragility to the effect.

Probability of Effect

There is a *low* probability of the effect occurring since mitigation will be conducted and monitoring will be implemented throughout the construction period.

Overall Assessment

This effect is determined to be *Insignificant*, given the changes of turbidity and TSS will be of a low duration and frequency, moderate graphic extent, reversible effect, low fragility, and low probability.

11.2.3.4 Surface Water Quality Impact from Construction Camp

11.2.3.4.1 Potential Effects

During the construction phase, water required for the construction camp will be supplied by tanker truck from a local water source with an appropriate Permit to Take Water if required. It is estimated that maximum 40 persons work at the construction camp, which is located approximately 260 m to the west of the Ivanhoe River. Using a domestic water consumption per person as 60L/day, the maximum wastewater generate amount is approximately 2.4 m^3/day. The main pollutants in the domestic wastewater include Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), NH_3-N and Total Suspended Solids (TSS). If the wastewater is discharged directly to the environment, there could be adverse effects on surface water quality.

11.2.3.4.2 Mitigation Measures

To avoid any potential impacts from the domestic wastewater, the following measures are proposed in the Construction Management Plan (CPL, 2014).

- The domestic wastewater generated from the construction camp at The Third Falls Facility will not be allowed to discharge directly into the river or any water bodies in the Project Study Area.;
- The domestic wastewater will be discharged to a properly constructed and approved wastewater storage tank for temporary storage; and
- Roztek Environmental, located in Timmins, will be responsible to transport the sewage to an offsite municipal wastewater treatment plant for regular treatment.

In addition, considering the daily generation amount and frequency of offsite transportation, a minimum one week storage volume (20 m^3) should be provided for the temporary domestic wastewater storage in the construction camp.

11.2.3.4.3 Net Effects and Significance Assessment

Value of Resource

Surface water is not used as a source of potable water in the Study Area. Due to the water use for fish habitat in the Study Area, the value of the surface water quality resource is *high*.

Magnitude of Effect

The magnitude of effect is anticipated to be *low*, since the domestic wastewater generated in the construction camp will not be discharged in the Study Area.

Geographic Extent of Effect

The geographic extent of effect is anticipated to be *low*, since there is no discharge to the river, and a potential small amount of spill will be limited in the construction camp.

Duration and Frequency of Effect

The duration and frequency of effect is *low*, since there is no discharge and spill to the river.

Irreversibility of Effect

The potential effect is considered to be *reversible*, since there is no discharge and spill to the river.

Ecological or Social Context

There is a *low* ecological or social context, since there is no discharge and spill to the river.

Probability of Effect

The probability of the effect is *low*, since there is no discharge and spill to the river.

Overall Assessment

This effect is determined to be *Insignificant*, given the assessment above.

11.2.3.5 Surface Water Quality Impact from Concrete Batch Plant

11.2.3.5.1 Potential Effects

During the construction phase, water required for concrete production will be supplied by tanker truck from a local water source with an appropriate Permit to Take Water if required for the concrete batch plant located approximately 90m to the west of the Ivanhoe River.

The process wastewater will be generated from the production process of concrete, and equipment flushing. The main pollutant in the process wastewater is total suspended solids (TSS). If the process wastewater is discharged directly to the environment, there could be adverse effects on surface water quality.

11.2.3.5.2 Mitigation Measures

To avoid the potential impacts from the process wastewater generated in the concrete batch plant, the following measures are proposed.

- The process wastewater generated from the construction batch plant at The Third Falls Facility will not be allowed to discharge directly into the river or any water bodies in the Study Area;
- The process wastewater will be discharged to a properly constructed and approved sediment tank for pre-treatment; and
- Roztek Environmental, located in Timmins, will be responsible to regularly transport the sewage to an offsite municipal wastewater treatment plant for treatment.

11.2.3.5.3 Net Effects and Significance Assessment

Value of Resource

Surface water is not used as a source of potable water in the Study Area. Due to the water use for fish habitat in the Study Area, the value of the surface water quality resource is *high*.

Magnitude of Effect

The magnitude of effect is anticipated to be *low*, since there is no discharge of process wastewater from the concrete batch plant.

Geographic Extent of Effect

The discharge of process wastewater to any surface water bodies is not allowed. Therefore, the geographic extent of effect is anticipated to be *low*.

Duration and Frequency of Effect

The duration and frequency of effect is *low*, since the process wastewater will not be discharged to any surface water bodies in the Study Area throughout the construction.

Irreversibility of Effect

The potential effect on surface water quality is considered to be *reversible*, since there is no discharge and spill to the river.

Ecological or Social Context

There is a low ecological or social context, since there is no discharge and spill to the river.

Probability of Effect

The probability of the effect is *low*, since there is no discharge and spill to the river.

Overall Assessment

This effect is determined to be *Insignificant*, given the assessment above.

11.2.3.6 Surface Water Quality Impact from Spill and Leakage

Please see Section 14.1.2 on Spills, under Accidents and Malfunctions.

11.2.4 Water Temperature

As described in the *Ivanhoe River Hydro Projects Construction Management Plan* (CPL, 2014) in Appendix C, 2 separated stages of cofferdams will be used to divert the water flow from the in-water construction area for the powerhouse area or spillway dam area at each Facility. Since there is no change of water level and water flow at each Facility, it is anticipated that there is no change of water temperature during the construction phase.

11.2.5 Groundwater Quality and Quantity

11.2.5.1 Potential Effects

Excavations below the groundwater table could potentially have a negative effect on groundwater hydrology and hydraulics. The following construction activities have the potential groundwater effects during the construction phase:

1. Excavation and blasting within the cofferdams areas for the powerhouse, headrace and tailrace.
2. Excavation in the stockpile area for the storage of construction waste.

Sufficient information on groundwater and rock characteristics is not available to provide a quantitative assessment of groundwater seepage for the conceptual design phase. Since the excavation depth at the headrace channel ranges from 0 to 10m, and the excavation depth at the tailrace channel ranges from 0 to 7m. It is likely that some groundwater seeping into in the excavated areas in the powerhouse, headrace and tailrace areas will occur and will be removed by dewatering to facilitate the construction process under a dry condition.

As described in *Technical Memorandum - Groundwater Discharge in Tributaries – Ivanhoe River* (Appendix H), precipitation rates are typically highest in spring and fall.. As a result, groundwater levels typically rise in the spring and the fall. To minimize the impacts, the cofferdams will be installed or removed in the summer to ensure that the excavation of headrace and tailrace can be conducted during a low groundwater table season.

11.2.5.2 Mitigation Measures

To mitigate the potential effect of groundwater seepage, the following measures are proposed.

- If the minimal seepage is identified during the design and construction phase, it will likely be handled with a sump pump in the excavation areas, pumping water to the settling ponds for treatment prior to discharge to the river.
- If seepage is higher, engineering measures are required to limit the amount of seepage into the excavations within the cofferdam areas, to minimize pumping and treatment requirements.

11.2.5.3 Net Effects and Significance Assessment

11.2.5.3.1 Value of Resource

The groundwater is not used as a source of potable water in the Study Area. However, the value of the groundwater resource in the vicinity of the Study Area is *high*, considering that the groundwater is a contributing source to the downstream river and wetland in the Study Area.

11.2.5.3.2 Magnitude of Effect

The magnitude of change in the groundwater table is predicted to be *low*, considering the relatively small size of the excavations limited in the headrace, powerhouse, tailrace areas and stockpile areas.

11.2.5.3.3 Geographic Extent of Effect

The geographic extent is *low*, because the effect on the groundwater table is anticipated to be limited to the footprint areas of the headraces, powerhouses, tailraces and stockpile areas.

11.2.5.3.4 Duration and Frequency of Effect

The effect will only occur during the construction period when dewatering of seeped groundwater is necessary from the excavations. Once the excavations are sealed, dewatering will not be required. Therefore, the duration and frequency of effect are *low*.

11.2.5.3.5 Irreversibility of Effect

The effect on the groundwater table is *reversible*, because the groundwater table will rebound to normal levels after the anti-seepage measures are adopted or the excavation is completed.

11.2.5.3.6 Ecological or Social Context

The local area that will be impacted by changes in the groundwater table is anticipated to be highly resilient to the effect of local lowering of the groundwater table. The area has a *low* fragility to the effect.

11.2.5.3.7 Probability of Effect

The probability of effect at the headrace, powerhouse and tailrace area is *high*, considering the excavation depth ranges from 0 to 10m. Some seepage into the excavation will likely occur, resulting in a lowering of the local groundwater table.

11.2.5.3.8 Overall Assessment

This effect is determined to be *Insignificant*, given the assessment of low duration and frequency, low magnitude, low geographic extent of effect, and potential reversible effect.

11.3 Terrestrial Environment

Effects to terrestrial habitat will occur during various phases of the Ivanhoe River Project. Effects on terrestrial habitat types due to construction and initial inundation are discussed below. More detailed information can be found in the *Natural Environment Characterization and Impact Assessment Report* in (NRSI 2014) Appendix H and the *Ivanhoe Baseline Environmental Conditions for Road and Transmission Line Options* (Northern Bioscience 2014) in Appendix H.

11.3.1 Natural Vegetation & Terrestrial Habitat Linkages

11.3.1.1 Vegetation Clearing for the 69kV & 115 kV Power Line Corridor

11.3.1.1.1 Potential Effect

Vegetation clearing for the 69kV and 115 kV power line corridor, will result in a loss of vegetation in order to accommodate these facilities the total distance of this line is approximately 78.2km. The power line corridor will generally require a maximum corridor width of 30 meters (15m on each side of the midline) in order to accommodate its construction. Clearing will occur within this corridor to a

maximum width of 20m, except where required to remove danger trees. In some places the overall corridor width will be smaller to accommodate natural features, or where existing access roads exist.

The 69 kV power line corridor running from Third Falls south towards The Chute follows a number of secondary and tertiary forest roads. The total distance of this line is 26.8km, of which 13.5km will follow existing roadway and 13.3km will require new corridor. In addition it will require 2 new stream crossings, 1 wetland crossing and will cross 2 existing water crossings. (KBM 2014).

The total distance of the 115 kV power line corridor route is 51.35km. Of this distance 3km travels along an existing highway corridor, 18.8km travels along existing forest access roads, 29.1km will be new corridor requiring clearing, and 480m of line will cross an existing right of way at Groundhog River Provincial Park (KBM 2013a). Field studies were conducted on a broad corridor. Depending on the values being assessed, corridor widths of 100m to 600m were used during desktop or field surveys. Detailed habitat mapping was completed for a 300 m buffer on either side of the line and used for the planning and reporting of all field assessment of line and road corridors so that during construction, avoidance can be used if any values are found.

The 115kV power line will cross over a number of wetlands, permanent and intermittent streams. Clearings at these stream crossings will be required to make room for the corridor. In total there are 4 existing stream crossings and 32 new stream crossings, with the requirement for one new crossing at the Ground hog River within the provincial park as discussed above (KBM 2014).

Where the power line travels along existing roadway and highway corridors some clearing of vegetation may be required in order to accommodate the line, it is expected this vegetation clearing will be minimized wherever possible. It is possible that vegetation clearing along the existing roadway may have some general impacts on loss of habitat and sedimentation. It is anticipated that there will be a ***moderate level of impact*** as a result of this activity.

Vegetation clearing will be required at new water crossings. Some vegetation clearing may be required at existing water crossings to accommodate the line as well. This clearing has the potential to impact habitat in the area around waterbodies leading to loss of habitat and potential impact to water quality and sediment impacts. This clearing will be minimized wherever possible, and be done in accordance with *Measures to Avoid Causing Harm to Fish and Fish Habitat* recommended by the DFO. It is expected this activity will have a ***moderate level of impact*.**

The power line corridor route passes through a variety of habitat types as described in Section 9.3.1 the majority of the clearing proposed for construction will occur as described below.

Approximately 29.1km of the corridor will require clearing in order to accommodate the power line. This clearing has the potential to impact habitat and sedimentation. It is anticipated there will be a ***moderate level of impact*** as a result of this activity.

Table 32: Proposed Clearing Description 69 & 115 kV Power Line

Ecosite	Ecosite Description	Transmission
B049TlD	Dry to Fresh or Coarse: Jack Pine – Bl. Spruce Dom. (young)	6.7
B049TtD	Dry to Fresh or Coarse: Jack Pine - Black Spruce Dominated	2.1
B050TlD	Dry to Fresh or Coarse: Pine - Black Spruce Conifer (young)	6.6
B050TtD	Dry to Fresh or Coarse: Pine - Black Spruce Conifer	12.5
B051TtD	Dry to Fresh or Coarse: Hemlock - Cedar Conifer	0.5
B052TlD	Dry to Fresh or Coarse: Spruce - Fir Conifer (young)	0.6
B052TtD	Dry to Fresh or Coarse: Spruce - Fir Conifer	1.8
B055TlD	Dry to Fresh or Coarse: Aspen - Birch Hardwood (young)	7.9
B055TtD	Dry to Fresh or Coarse: Aspen - Birch Hardwood	30.0
B065TlD	Moist or Coarse: Pine - Black Spruce Conifer (young)	3.0
B065TtD	Moist or Coarse: Pine - Black Spruce Conifer	10.2
B066TtD	Moist or Coarse: Hemlock - Cedar Conifer	0.8
B067TtD	Moist or Coarse: Spruce - Fir Conifer	1.4
B127TlD	Poor Conifer Swamp (young)	0.2
B127TtD	Poor Conifer Swamp	1.8
B128TlD	Intermediate Conifer Swamp (young)	0.2
B128TtD	Intermediate Conifer Swamp	9.6
B129TlD	Rich Conifer Swamp (young)	0.1
B129TtD	Rich Conifer Swamp	0.7
B134S D	Mineral Thicket Swamp	0.0
B135S D	Organic Thicket Swamp	1.5
B136TlD	Sparse Treed Fen	0.6
B142N	Mineral Meadow Marsh	0.2
B147S	Shrub Shore Fen	0.1
	Anthropogenic	16.0
Water	Water	5.6
Total		120.6 ha
Summary	Mature Forest	71.3 ha
	Young Forest (mostly cutover)	25.2 ha
	Non-forested Wetland	2.4 ha
	Other (anthropogenic + water)	21.6 ha

(Northern Bioscience 2014)

In one instance the proposed power line corridor passes between the Groundhog River Provincial Park and the Vimy Lake Uplands Conservation Reserve as depicted in Figure 1. At this point the power line corridor will travel along an existing road, between the two protected areas. Some vegetation clearing may be required depending on the final layout and configuration of this line, as agreed to with Parks

Ontario. As well the line will cross at an existing Ministry of Transportation Ontario Right-of-Way this crossing will not require a stream crossing, construction work as described in Section 6, will be completed on both sides of the waterway. Vegetation clearing for this stream crossing will likely be required as described above. A final layout and configuration of this crossing will be dependent on MTO and Parks Ontario technical consultations.

11.3.1.1.2 Mitigation

Removal of vegetation cannot be completely mitigated, however, early on in the Project planning stage Xeneca identified and assessed conflicts. Roads and lines were re-located accordingly to avoid known values and/or mitigation measures were identified and documented to ensure minimal impact during the planning stage (Northern Bioscience 2014).

For the 32.3km of power line corridor which will be installed adjacent to existing highway, access road or forestry road the power line work can proceed during winter or summer with relatively minor impact with some exceptions (breeding birds etc.).

Mitigations will be employed to minimize the impacts described above:

- Vegetation clearing around watercrossings will be kept to the minimum required and no grubbing will occur in riparian areas. Forest industry BMPs (i.e. *Selection Guide for Water Crossings on Forest Access Roads* (FPI Innovations)), MNR Guides (i.e. *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (MNR 2010)) and DFO Guidelines for water crossings will be followed (i.e. *Measures to Avoid Causing Harm to Fish and Fish Habitat* (DFO, 2013));
- In sensitive habitats a biologist will work ahead of construction crews in order to confirm routing, and to ensure sensitive habitats and features are avoided;
- Where line corridors travel along existing roadways vegetation clearing will be minimized;
- Vegetation clearing will be completed during the winter on overland sections which are not constructed parallel to an access road using track mounted equipment;
- Line corridors will be clearly laid out with flagging tape in advance of clearing operations
- Any occurrences of sensitive wildlife habitat (such as stick nests) observed on, or adjacent to, the line during corridor layout will be flagged and immediately brought to the attention of MNR. In these instances, minor revisions to the line route may be required to protect wildlife habitat.
- The Right-of-Way will be cut 20m wide in most cases except on steeper side slopes where additional up slope clearing may be required;
- No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc) during the breeding bird period (May 15-July 31);

- Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey;
- No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31);
- Where possible construction vehicles will be restricted to access routes and staging areas;
- Vegetation clearing will be minimized wherever possible;
- Trees will be felled into the proposed site when possible, and will not be felled into the water;
- Brush will be disposed of by piling, burning or chipping, with a preference for chipping wherever practical;
- During vegetation clearing operations, the forest litter and root cover will be left in place to prevent erosion and to allow for natural regeneration of the site.
- Merchantable timber will be removed from the site in accordance with agreements with the SFL holder.

11.3.1.1.3 Net Effects and Significance Assessment

Value of the Resource Affected

The value of forest communities in this area of Ontario is *moderate.* They provide a number of important socio-economic and ecological functions, however this forest type is not unique or of particular value, and the area to be cleared is not substantial, therefore the impact is *low*.

Geographic Extent

The geographic extent of this effect is *low* as removal of vegetation will not influence areas outside of the Project Area.

Duration and Frequency

Impacts as a result of vegetation removal will be limited to the construction period and will be *low*.

Irreversibility of Effect

Impacts as a result of vegetation removal are *irreversible.* The corridor clearing is considered permanent.

Ecological or Social Context

Given the large contiguous forest surrounding the Project Area, the vulnerability of the local environment to the impact of vegetation removal is considered to be *low*.

Magnitude of Effect

The magnitude of the effect is *low*. There will be a loss of approximately 92.6 hectares of vegetation from a variety of ecosites in the Project Area as a result of the activity. This represents a small amount of the forest community available in the area.

Probability of Effect

The likelihood of this impact is *high*.

Overall Significance

The overall significance of the vegetation removal is anticipated to be *Insignificant* since the geographic extent, duration and frequency and magnitude are all considered to be low.

11.3.1.2 Vegetation Clearing - Access Roads, Construction Camp, Stockpiles & Temporary Laydown Areas

11.3.1.2.1 Potential Effect

Access to Third Falls will be primarily through existing roadways, and a number of onsite permanent and temporary roadways will be required to facility construction and operations as described in Section 5. One new access road 3.5km long will be required in order to access Third Falls GS. As well, a 40m temporary access road will be required to access the east side of the river using a temporary bridge.

Access to the Chute will be primarily through existing roadways, and a number of onsite permanent and temporary roadways will be required to facility construction and operations as described in Section 4. A 142m road extension will be required on the east side of the Ivanhoe River. A new temporary 100m spur road on the west side of the river will be required, this will be reclaimed following construction. Additionally a 174m access road will be required to access the auxiliary dam.

One water crossing will be required as described in Section 5, which will allow for a crossing on the new access road for the Third Falls GS. Some vegetation clearing will be required at this new water crossing. Clearing in this area has the potential to impact species habitat, sedimentation and water quality. This clearing will be minimized wherever possible, and be done in accordance with *Measures*

to Avoid Causing Harm to Fish and Fish Habitat recommended by the DFO. It is expected this activity will have a *moderate level of impact.*

The clearing extents for access roads, the construction camp, stockpiles, temporary laydown areas etc. are described below in Table 33. (Further descriptions on these features can be found in Sections 4 & 5):

Table 33: Vegetation Clearing Extents for Access Roads and Temporary Construction Roads

Ecosite	Ecosite Description	Roads (ha)
B049TlD	Dry to Fresh or Coarse: Jack Pine – Bl. Spruce Dom. (young)	0.1
B049TtD	Dry to Fresh or Coarse: Jack Pine - Black Spruce Dominated	0.7
B050TlD	Dry to Fresh or Coarse: Pine - Black Spruce Conifer (young)	0.7
B050TtD	Dry to Fresh or Coarse: Pine - Black Spruce Conifer	0.7
B051TtD	Dry to Fresh or Coarse: Hemlock - Cedar Conifer	0.0
B052TlD	Dry to Fresh or Coarse: Spruce - Fir Conifer (young)	0.0
B052TtD	Dry to Fresh or Coarse: Spruce - Fir Conifer	0.0
B055TlD	Dry to Fresh or Coarse: Aspen - Birch Hardwood (young)	0.0
B055TtD	Dry to Fresh or Coarse: Aspen - Birch Hardwood	1.2
B065TlD	Moist or Coarse: Pine - Black Spruce Conifer (young)	0.0
B065TtD	Moist or Coarse: Pine - Black Spruce Conifer	3.2
B066TtD	Moist or Coarse: Hemlock - Cedar Conifer	0.0
B067TtD	Moist or Coarse: Spruce - Fir Conifer	0.0
B127TlD	Poor Conifer Swamp (young)	0.5
B127TtD	Poor Conifer Swamp	0.0
B128TlD	Intermediate Conifer Swamp (young)	0.0
B128TtD	Intermediate Conifer Swamp	0.7
B129TlD	Rich Conifer Swamp (young)	0.0
B129TtD	Rich Conifer Swamp	0.0
B134S D	Mineral Thicket Swamp	0.0
B135S D	Organic Thicket Swamp	< 0.1
B136TlD	Sparse Treed Fen	0.0
B142N	Mineral Meadow Marsh	0.0
B147S	Shrub Shore Fen	0.0
	Anthropogenic	0.0
Water	Water	0.1
Total		7.9 ha
Summary	Mature Forest	6.4 ha
	Young Forest (mostly cutover)	1.3 ha
	Non-forested Wetland	< 0.1 ha
	Other (anthropogenic + water)	0.1 ha

(Northern Bioscience 2013)

Table 34: Vegetation Clearing Extents for Ivanhoe Associated Facilities

Location	Item	Clearing Extent	Features
Construction Camp	Third Falls	None, 10,000 m^2	Upland jack pine-aspen mixedwoods.
Temporary laydown Areas	The Chute (2) Third Falls (1)	1000m^2 West side of the river. 1000m^2 area on the east side of the river 750 m^2 West of the river at the Facility	the edge of an old cutover upland cedar dominated conifer stands and aspen dominated mixedwoods on deep fine texture soils
Parking Area	The Chute	250 m^2 immediately adjacent to of the East side laydown	upland cedar dominated conifer stands and aspen dominated mixedwoods
Temporary laydown	Third Falls	750m^2 on the west side of the river	Mature aspen forest
Stockpile	The Chute Third Falls	5000m^2 West side of River 5000m^2 West side of River	The Chute: Old cutover Third Falls: deep fine textured soils supporting mature aspen forests.
Concrete Batch Plant	Third Falls	3500 m^2 on west side of river along the access road to the Project site	Pit of Fine sands with abundant ground moisture

(Northern Bioscience 2013)(CPL 2014)

Vegetation clearing for the access roads upgrades, new access roads, stockpiles, construction camp, and temporary laydown areas will result in a loss of vegetation in order to accommodate these facilities. Clearing of vegetation will be required along the new access road corridor at Third Falls, additionally some clearing may be required along the existing access roads in order to accommodate road work and maintenance activities. Vegetation of these clearing areas represents many different ecosites, which are described in Section 9.3.1. This clearing activity could potentially impact species habitat and sedimentation in the area (Northern Bioscience 2014).

Clearing proposed for these activities could impact species habitat, sedimentation and water quality where the features are located in close proximity to the waterway. The clearing activities are expected to be *low* relative to the communities that they are situated in and due to the relative scale.

11.3.1.2.2 Mitigation

Removal of vegetation cannot be completely mitigated, however, identified conflicts have been assessed by Xeneca and some items such as roads were either re-located accordingly to avoid known values and/or mitigation measures were identified and documented to ensure minimal impact during the planning stage (Northern Bioscience 2014).

The area of disturbance within the overall site boundaries will be kept to a minimum and clearing will only occur where necessitated by construction. Lands within the construction zone reserved for laydown areas, stockpile areas and the temporary construction camp will be cleared of vegetation, representing a loss of wildlife habitat within those areas. However, due to the relatively small size of the areas to be cleared in relation to the large extent of similar habitat on the surrounding landscape, impacts on wildlife as a result of these habitat losses is expected to be *Insignificant* (NRSI 2014).

Mitigations will be employed to minimize this impact include:

- All Facility component footprints will be flagged to prevent unnecessary over-clearing;
- Vegetation clearing around watercrossings will be kept to the minimum required and no grubbing will occur in riparian areas. Forest industry BMPs (i.e. *Selection Guide for Water Crossings on Forest Access Roads* (FPI Innovations)), MNR Guides (i.e. *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (MNR 2010)) and DFO Guidelines for water crossings will be followed (i.e. *Measures to Avoid Causing Harm to Fish and Fish Habitat* (DFO, 2013));
- No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc) during the breeding bird period (May 15-July 31);
- Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey;
- No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31);
- Area for clearing and grubbing will be clearly delineated, this area will be confirmed for compliance;
- Project component boundaries will be clearly marked to restrict heavy equipment traffic to the planned project area;
- The Right-of-Way will be cut 20m wide in most cases except on steeper side slopes where additional up slope clearing may be required;
- Construction vehicles will be restricted to access routes and staging areas;
- Vegetation clearing will be minimized wherever possible;

- Trees will be felled into the proposed site when possible, and will not be felled into the water;
- Allow for detour around sensitive habitat areas;
- Schedule construction during winter months, when possible, to minimize habitat disturbance;
- Brush will be disposed of by piling, burning or chipping, with a preference for chipping wherever practical;
- Travel paths, stockpile areas and staging areas will be carefully planned and followed;
- Primary, secondary and tertiary roads will be used as much as possible;
- Access and transportation routes will be clearly defined to minimize disturbance;
- Utilize an existing turnaround area at Third Falls to reduce total tree clearing area;
- Road routes will use existing trails where possible and will avoid identified values;
- The temporary spur road being proposed at The Chute will be reclaimed at the end of the construction period;
- All temporary laydown and stockpile areas will also be reclaimed following construction.

11.3.1.2.3 Net Effects and Significance Assessment

Value of the Resource Affected

Forests provide a number of important socio-economic and ecological functions, however this forest type is not unique Therefore the overall value is *low*.

Geographic Extent

The geographic extent of this effect will be *low*. The loss of vegetation will not influence areas outside of the Project Area.

Duration and Frequency

Impacts as a result of vegetation removal will be limited to the construction period and will be *low.*

Irreversibility of Effect

Impacts as a result of vegetation removal are for the most part *irreversible*. The road and permanent feature clearing is considered permanent. The impacts from clearing temporary facility components is considered *reversible* following construction.

Ecological or Social Context

The forest has historically been disturbed as a result of vegetation removal. Additionally, given the large forest surrounding the Project Area, the vulnerability of the ecological context to vegetation removal is considered to be *low*.

Magnitude of Effect

The magnitude of the effect is *low*. There will be a small loss of vegetation from the Project Area as a result of these activities. This represents a small fraction of the forest community available in the area.

Probability of Effect

The likelihood of this impact is *high*.

Overall Significance

Since the value of the resource, the geographic extent and magnitude of the effect are all low; the overall significance of the residual effects is anticipated to be *Insignificant.*

11.3.1.3 Vegetation Clearing – Facility Components & Inundation at The Chute GS

11.3.1.3.1 Potential Effect

The Chute headpond will result in direct impacts to existing riparian forest within the areas proposed for inundation. The proposed inundation area for The Chute GS is 6.4km and will impact the following ELC Communities: Dry to Fresh, Coarse Sparse Shrub (B046S) which will require clearing of approximately 0.7 hectares, and Fresh, Clayey: Cedar – Conifer (B084) which will require 6.5 hectares of clearing. These areas will be cleared entirely where inundation overlaps and the habitat will be converted from terrestrial to aquatic (NRSI 2014). This clearing represents a small portion of the overall vegetation types for these communities (0.4% and 2.3% respectively), and both of these communities are abundant within the landscape beyond the Study Area. The loss of this vegetation is anticipated to affect species habitat, and water quality.

The forest communities listed above may provide maternity roosting habitat for myotis species of bats, no hibernacula were found in the Study Area and no use of maternal trees were documented. Further discussion can be found in Section 9.3.5 and Section 10.3.5. The loss of a relatively small amount of this forest is not expected to have any impact on this species' overall regional population. Detailed mitigation measures to avoid direct impacts to bat maternity roost habitat are discussed in Section 11.3.3 (NRSI 2014)

The majority of development activities for the Facility footprint occur on the west side of the river. Terrestrial vegetation will be cleared in support of the following activities (Figures 16-19):

- An auxiliary dam about 200m west of the river in a low lying draw running north-south parallel to the river, through rich cedar dominated swamps
- A powerhouse yard located on bedrock between an existing seasonal island and the east side of the river;
- Powerhouse
- Dam (including footings)
- Intake & Tailrace
- A 4/69 kV Step-up Transformer Substation
- A 4/69 kV power line connection from Third Falls
- A 69/115kV Substation

Clearing of vegetation in these areas are anticipated to result in moderate impacts to species habitat and water quality as well as some low impacts to soils and sedimentation as discussed in Section 10.3.1.

11.3.1.3.2 Mitigation

Removal of vegetation cannot be completely mitigated, however, Xeneca re-located components to avoid known values and, mitigation measures were identified and documented to ensure minimal impact where vegetation removal could not be avoided.

Mitigations will be employed in order to minimize impacts, which include:

- No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc) during the breeding bird period (May 15-July 31);
- Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey;
- No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31);
- Vegetation removal (grubbing) will only take place where absolutely required and immediately prior to construction activities;
- Vegetation clearing in the inundation area and around the auxiliary dam will be done in accordance with *Measures to Avoid Causing Harm to Fish and Fish Habitat* as recommended by the DFO;
- Schedule construction during winter months, when possible, to minimize habitat disturbance;

- All Facility component footprints will be flagged to prevent unnecessary over-clearing;
- Construction vehicles will be restricted to access routes and staging areas
- Vegetation clearing will be minimized wherever possible;
- Trees will be felled into the proposed site when possible, and will not be felled into the water;
- Brush will be disposed of by piling, burning or chipping, with a preference for chipping wherever practical;
- Following the completion of construction, the areas cleared for construction purposes will be re-vegetated.
- The use of machinery will be limited in and around watercourses and sensitive terrestrial areas;
- Allow for detour around sensitive habitat areas
- Components and areas for clearing will be clearly laid out with flagging tape in advance of clearing operations;
- Merchantable timber will be removed from the site in accordance with agreements with the SFL holder.

11.3.1.3.3 Net Effects and Significance Assessment

Value of the Resource Affected

Forests provide a number of important socio-economic and ecological functions, however this forest type is not unique or of particular value. Therefore the importance of this affected value is considered *low*.

Geographic Extent of Effect

The geographic extent of this effect will be *low*. The loss of vegetation will not influence areas outside of the Project Area.

Duration and Frequency

Impacts as a result of vegetation removal will be limited to the construction period and will be *low*.

Irreversibility of Effect

The impacts are *irreversible* following the construction period. While some vegetation will regenerate, the cleared area will be permanent.

Ecological or Social Context

Given the large contiguous forest surrounding the Project Area, the vulnerability of the ecological context to the impact of vegetation removal is considered *low*.

Magnitude of Effect

The magnitude of the effect is *low*. The loss of vegetation as a result of The Chute GS is small.

Probability of Effect

The likelihood of this impact is *high* as some vegetation will certainly be removed.

Overall Significance

Since the value of the resource, the geographic extent and magnitude of the effect are all low; the impact of vegetation removal for the Ivanhoe Project is anticipated to be *Insignificant*.

11.3.1.4 Vegetation Clearing – Facility Components & Inundation at Third Falls GS

11.3.1.4.1 Potential Effect

The proposed Third Falls headpond will stretch 44.2km and affect 13 different ELC Communities and will result in the clearing of approximately 103 hectares of vegetation. Where inundation overlaps with these communities, all vegetation will be cleared and the habitat will be converted from terrestrial to aquatic. This will result in impacts to species habitat, water quality impacts and soils and sediment impacts.

Table 35: Third Falls Inundation Area Vegetation Loss by Ecosite

Codes	ELC Description	Area Lost to Clearing (Ha)
B046S	Dry to Fresh, Coarse: Sparse Shrub	0.03
B063	Moist, Coarse: Shrub	23.5
B067	Moist, Coarse: Spruce -Fir Conifer	29.3
B084	Fresh, Clayey: Cedar – Conifer	33.2
B085	Fresh, Clayey: Spruce - Fir Conifer	0.2
B088	Fresh, Clayey: Aspen - Birch Hardwood	3.0
B102	Fresh, Silty to Fine Loamy: Conifer	0.2
B105	Fresh Silty to Fine Loamy: Elm-Ash Hardwood	0.7
B134S	Mineral Thicket Swamp	0.6
B152	Open Water Marsh: Organic	6.1
B223	Mineral Intermediate Conifer Swamp	5.9
B224	Mineral Rich Conifer Swamp	0.8

B100	Fresh, Silty to Fine Loamy: Cedar (Hemlock) Conifer	0.1
	Total	103.63 Hectares

(NRSI 2014)

Vegetation loss is an unavoidable impact. Most communities are abundant within the Project region, although community type Fresh Silty to Fine Loamy: Elm-Ash Hardwood is considered to be significant wildlife habitat. Further discussion on this habitat type can be found in Section 11.3.4

There will be a significant loss within the Moist, Coarse Shrub (B063) community (60.7% of the community within the polygon) it is anticipated the community will re-establish in proximity of the land/water interface over time (NRSI 2014). As a result it is anticipated that the impact to this habitat type is ***moderate***.

Additionally, the following habitats represent significant habitat types:

Canada Warbler Significant Wildlife Habitat: Mineral Intermediate Conifer Swamp (B223) and the Moist Coarse: Spruce-Fir Conifer (B067), clearing in these areas as described in Table 35 above will result in direct impacts to Canada warbler habitat. The area to be cleared is very small in relation to the abundance of this habitat type on the surrounding landscape outside of the Study Area. Consequently, clearing for inundation associated with the Third Falls GS will likely have a ***low to none impact*** on Canada warbler in the vicinity of the Project area. Canadian Warbler habitat is discussed further in Section 9.3.4 and 11.3.4.

Forest communities in Table 35 may also provide maternity roosting habitat for myotis species of bats, no hibernacula were found in the Study Area and no use of maternal trees were documented. The loss of a relatively small amount of this forest is not expected to have any impact on this species' overall regional population. As a result clearing for specific components at Third Falls will have ***a*** *low to nil impact* on this habitat type (NRSI 2014)(Northern Bioscience 2014). Detailed mitigation measures to avoid direct impacts to bat maternity roost habitat are discussed in Section 11.3.4

Additionally at Third Falls the following components will be constructed:

- Powerhouse
- Dam (including footings)
- Auxillary Dam
- 4/69kV Stepup Transformer
- 4/69 kV powerline
- Powerhouse yard
- Intake & Tailrace

11.3.1.4.2 Mitigation Measures

Impacts to as a result of vegetation clearing in order to construction the Project components and headpond inundation will be reduced through the following measures:

- No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc) during the breeding bird period (May 15-July 31);
- Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey;
- No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31);
- Vegetation removal (grubbing) will only take place where absolutely required and immediately prior to construction activities;
- Vegetation clearing in the inundation area will be done in accordance with *Measures to Avoid Causing Harm to Fish and Fish Habitat* as recommended by the DFO;
- Schedule construction during winter months, when possible, to minimize habitat disturbance;
- All Facility component footprints will be flagged to prevent unnecessary over-clearing;
- Construction vehicles will be restricted to access routes and staging areas
- Vegetation clearing will be minimized wherever possible;
- Trees will be felled into the proposed site when possible, and will not be felled into the water;
- Brush will be disposed of by piling, burning or chipping, with a preference for chipping wherever practical;
- Following the completion of construction, the areas cleared for construction purposes will be re-vegetated.
- The use of machinery will be limited in and around watercourses and sensitive terrestrial areas;
- Allow for detour around sensitive habitat areas
- Components and areas for clearing will be clearly laid out with flagging tape in advance of clearing operations;
- Merchantable timber will be removed from the site in accordance with agreements with the SFL holder.

11.3.1.4.3 Net Effects and Significance Assessment

Importance of Value Affected

Forests provide a number of important socio-economic and ecological functions. However with the exception of one area this forest type is not unique, and the area to be cleared is not substantial. Therefore the importance of this value is considered *low*.

Geographic Extent of Effect

The geographic extent of this effect will be *low*. The loss of vegetation will not influence areas outside of the Project Area.

Duration and Frequency of Effect

Impacts as a result of vegetation removal will be limited to the construction period and will be *low*

Irreversibility of Effect

The impacts are *irreversible* following the construction period. While some vegetation will regenerate, the cleared area will be permanent.

Ecological or Social Context

Given the large contiguous forest surrounding the Project Area, the vulnerability of the ecological context is considered *low*.

Magnitude of Effect

The magnitude of the effect is *low.*

Probability of Effect

The likelihood of this impact is *high*

Overall Significance

Since the value of the resource, the geographic extent and magnitude of the effect are all low; the impacts resulting from vegetation removal are anticipated to be *Insignificant*.

11.3.2 Terrestrial Wildlife

11.3.2.1 Vegetation Clearing Impact to Birds (Terrestrial Clearing)

11.3.2.1.1 Potential Effects

Clearing of trees for the Project activities has the potential to disrupt nesting habitat for those species that build nests in or on trees, and construction activities could potentially destroy nests of shrub or ground-nesting birds around Project facilities or within the Right-of-Way cleared for roadways and transmission facilities. In addition removal of vegetation discussed in Section 11.3.1 will result in an overall habitat loss for bird species in the area. The overall areas proposed for clearing discussed in Section 11.3.1 are moderate but compared to the diversity of habitat types in the surrounding area, it is not anticipated that Project activities will remove substantial nesting area. It is anticipated that this impact is high to moderate, and requires the following mitigation methods to be employed in order for vegetation clearing to be able to proceed with low impacts. Some sensitive bird species, and species at risk were identified within the Project Area. These are discussed further in Section 11.3.3 and 11.3.4

11.3.2.1.2 Mitigation

A number of mitigation methods can be employed in order to mitigate the impacts of vegetation clearing on nesting birds in the Study Area. The peak nesting period extends from May 15-July 31. If any clearing work is scheduled to occur within this period, the proponent will retain an avian biologist in order to determine where vegetation removal is possible during this period (NRSI 2014).

Mitigations which will be employed in order to reduce impacts on nesting birds are:

- No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc) during the breeding bird period (May 15-July 31);
- Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey;
- Restrict night use of roads during the nesting season where possible;
- All Facility component footprints will be flagged to prevent unnecessary over-clearing;
- Minimize road corridor width where possible (20m or less);
- Construction vehicles will be restricted to access routes and staging areas;
- Vegetation clearing will be minimized wherever possible;
- Allow for detour around sensitive habitat areas;
- Re-vegetate temporary roads and construction areas after construction;

- Trees will be felled into the proposed site when possible, and will not be felled into the water;
- Clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared;
- All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife.

11.3.2.1.3 Net Effects and Significance Assessment

Value of the Resource Affected

Foraging, Breeding, Nesting and Over Wintering birds are valued from a socio-economic perspective. Additionally, migratory birds are federally protected. For these reasons the value is *high.*

Geographic Extent of Effect

This effect will be limited to the Project Area; therefore, the geographic extent is considered *low*.

Duration and Frequency

Impacts as a result of vegetation removal will be limited to the construction period and is considered to be *low.*

Irreversibility of Effect

The impacts are partially *reversible*, following the construction period. Any disturbance to nesting habitat as a result of vegetation clearing will conclude following the construction period and is considered *reversible.* The effects of the vegetation clearing are considered permanent and therefore *irreversible*.

Ecological or Social Context

Nesting birds have historically been disturbed as a result of logging activity in the area. Additionally, given the availability of quality nesting habitat in the surrounding forest, the vulnerability of the ecological context to the effects of vegetation removal is considered *low*.

Magnitude of Effect

The magnitude of this effect is considered *low.* Clearing activities will not occur during nesting periods. There amount of clearing required as described in Section 11.3.1 is small compared to the overall Project Area, and a wide range of nesting habitat will continue to be available.

Probability of Effect

The likelihood of this impact is *high*

Overall Significance

Since the the geographic extent, duration and frequency and magnitude of the effect are all low; the impacts of vegetation removal on nesting bird habitat are anticipated to be *Insignificant*.

11.3.2.2 Construction Noise, Human Presence and Activity Impacts on Birds

11.3.2.2.1 Potential Effects

During construction human presence, construction noise, vehicle traffic and other construction related activities may displace or alter the behavior of birds breeding, nesting and foraging in or adjacent to the proposed Project. Additionally an increase in vehicle traffic related to construction activity could result in road kill of birds. Traffic volume and speed will be relatively low compared to local highways and the severity of this source of mortality is likely small. However, road kill can be a source of mortality for Common Nighthawks (see Section 11.3.5). Additionally, the presence of construction staff could lead to harassment, increased hunting pressure, and impaired health from alternate food sources for some bird species.

11.3.2.2.2 Mitigation

A number of mitigation methods can be employed to mitigate the impacts described above to breeding, foraging, migrating and overwintering birds in the Study Area these include:

- New roads required for construction will be limited;
- Speed limits of 50 km/hour on new roads to prevent collisions with Common Nighthawks during the nesting season (May 15 to July 31);
- Construction equipment will be maintained in good working order to reduce noise levels;
- Modify driver behaviour (warning signs, awareness training);
- All workers will be required to comply with provincial hunting regulations, which prohibit hunting, possessing a loaded firearm or discharging a firearm within eight metres from the edge of the travelled portion of a road right of way;
- All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife;
- All waste and foods sources are to be properly maintained so as to minimize supplemental feeding (e.g., American Crows, Common Raven, Bald Eagle, gulls);
- Restrict night use of roads during the nesting season where possible.

11.3.2.2.3 Net Effects and Significance Assessment

Value of the Resource Affected

Foraging, Breeding, Nesting and Over Wintering birds are valued from a socio-economic perspective. Additionally, migratory birds are federally protected. For these reasons the value is *high.*

Geographic Extent of Effect

Any disturbance to birds will be limited to the Project Area. Therefore, the geographic extent of this effect will be *low*.

Duration and Frequency

Impacts as a result of noise, human presence and construction activity on birds in the Project Area will be limited to the construction period and will be *low*.

Irreversibility of Effect

This impact is *reversible* once the construction period ends.

Ecological or Social Context

Given the forest surrounding the Project Area and the amount of quality bird habitat it provides, the vulnerability of the ecological context to disturbance to birds from construction activity is considered *low*.

Magnitude of Effect

The magnitude of this effect is considered ***low***. Birds nesting in the Project Area may be displaced into adjacent habitat as a response to construction noise and disturbance, but equivalent forest and wetland habitat is common in the surrounding landscape. Boreal bird populations are adapted to being displaced from nesting habitat by wild fires and respond by moving to alternate habitat. After construction, noise levels will return to background levels and birds are expected to return to previous nesting areas.

Probability of Effect

Some disturbance to birds is likely to occur, therefore the probability of this effect is *high.*

Overall Significance

The effects on bird species are expected to be *Insignificant* on a population level. Some bird species may leave the Project Area for adjacent areas for the duration of construction but are expected to return when noise and disturbance return to background levels.

11.3.2.3 Vegetation Clearing & Construction Activity Impacts on General Wildlife

11.3.2.3.1 Potential Effects

During construction human presence, construction noise, vehicle traffic, vegetation clearing, and other construction related activities may result in short-term disturbance of wildlife in the Project Area. Transmission corridor planning was done so as to avoid important habitats and productive wetlands in order to minimize impacts on wildlife populations. As a result no population level effects are expected on wildlife as a result of any of these activities, and generally it is expected the impact to most wildlife will be low.

11.3.2.3.2 Mitigation Measures

A number of mitigation measures are proposed to lessen the potential impacts of these activities on wildlife.

- New roads required for construction will be limited;
- Speed limits of 50 km/hour on new roads to prevent collisions with wildlife (May 15 to July 31) ;
- All workers will be required to comply with provincial hunting regulations, which prohibit hunting, possessing a loaded firearm or discharging a firearm within eight metres from the edge of the travelled portion of a road right of way;
- All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife;
- All sanitary waste and foods sources are to be properly maintained so as to reduce the incidence of wildlife feeding (e.g., black bear, red fox, striped skunk, grey wolf).

11.3.2.3.3 Net Effects and Significance Assessment

Value of the Resource Affected

Due to the importance of hunting to local residents, tourists, and the local economy, the importance of wildlife is considered *high*.

Geographic Extent of Effect

The effect will be limited to the Project Area. Therefore the geographic extent is considered *low*.

Duration and Frequency

Impacts as a result of vegetation clearing and construction disturbances will be limited to the construction period and are considered *low*.

Irreversibility of Effect

It is anticipated that wildlife will return to former ranges and behavior following the end of construction activity. Therefore, this effect is completely *reversible*.

Ecological or Social Context

Given the large forest surrounding the Project Area and the quality of habitat it offers to wildlife, the vulnerability of the ecological context to wildlife disturbance from construction activity is considered *low*.

Magnitude of Effect

Wildlife have a wide range of tolerance levels for human disturbance, and some species can be anticipated to be affected more than others. Therefore, the magnitude of this effect is considered *low*.

Probability of Effect

Some wildlife is very likely to be affected by construction activity and vegetation removal; therefore, the probability is *high*.

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low; the impacts to wildlife from vegetation removal and construction activity are anticipated to be *Insignificant*.

11.3.3 Species at Risk

11.3.3.1 Potential Disruption of Bald Eagle Nesting Due to Construction Activities

11.3.3.1.1 Potential Effects

There is a potential that bald eagle nesting habitat located between The Chute and Third Falls could be disrupted by construction of new access roads, upgrades to existing roadways, clearing for the ROW

and subsequent construction activities. Response of nesting bald eagle pairs to human activities varies widely depending on individuals. Sensitivity may depend on a number of factors including visibility, duration, noise levels, extent of the areas affected by the activity, prior experiences with humans and tolerance of the individual nesting pair. Sensitivity varies throughout the year and eagles are most sensitive during the spring during courtship and nest building. Critical breeding time for this species is March 1 to August 31. Birds disturbed early in the breeding season may desert the nest, but those disturbed after incubation is well advanced tend to finish nesting (Northern Bioscience 2014). As this species is listed as Special Concern provincially any potential impacts are considered *Significant*.

The breeding pair may build a new nest in the Project Area, or an additional pair may locate in the Project area, which may result in additional impacts as a result of construction activities due to lack of identification prior to tree clearing.

There is the potential that the breeding pair may leave the Project Area for adjacent areas during the construction period and not return due to noise and harassment.

11.3.3.1.2 Mitigation Measures

In order to move forward with construction in this area the following mitigations are required:

- If new nests are discovered during construction, guidelines recommended in the Stand and Site Guide (MNR 2010) will be applied following consultation with MNR staff.
- The power line will be routed at least 400m, from active & identified bald eagle nests, preferably 800m
- A 400m buffer areas (from the nest) will be established in order to minimize visual and auditory impacts associated with human activities near nest sites, and will remain for the duration of construction;
- No clearing work will be conducted within 400m of bald eagle nest outside of the Critical Breeding time for this species (March 1 to August 31)
- Prior to all clearing work the bald eagle nest will be clearly delineated;
- No new roads, landings or aggregate pits within 400m of primary nests;
- Where possible construction vehicles will not stop and workers not exit vehicles within 400m of perching individuals during the breeding season (March 1 –August 31);
- No construction activities will occur within 400m of active or identified bald eagle nests during the breeding season (March 1 to August 31)

11.3.3.1.3 Net Effects and Significance Assessment

Value of the Resource Affected

The value of bald eagles is *high*. They are listed as a species of Special Concern and protected by the Endangered Species Act of Ontario.

Geographic Extent of Effect

The geographic extent of this effect will be *low***.** The potential disruption to nesting will not influence areas outside the Project Area

Duration and Frequency

Impacts as a result of construction on bald eagle nesting will be limited to the construction period and will be *low***.**

Ecological or Social Context

Given the large forest surrounding the Project Area and the quality of the habitat it contains, the vulnerability of the ecological context as it pertains to the impacts of bald eagle disturbance during construction is anticipated to be *low*.

Irreversibility of Effect

This effect is likely *reversible* following the completion of construction.

Magnitude of Effect

There will be little change to the overall habitat for the Bald Eagle therefore the magnitude of this effect is *low*. Buffers will reduce construction impacts to bald eagle nesting which will ensure there is no change to the existing condition.

Probability of Effect

The probability of this impact is *low*

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low; the impacts to bald eagle nesting from construction activities are anticipated to be *Insignificant*.

11.3.3.2 Potential Impacts Due to Road construction – Forest-Nesting Birds (Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird)

11.3.3.2.1 Potential Effects

The proposed roads will result in the loss of approximately 8 hectares of forest habitat in total. The loss will be made up of primarily Black Spruce and Jack Pine dominated mixed wood stands on silty soil (ecosite B065) and aspen stands on dry to fresh coarse soils (ecosite B055) (Northern Bioscience 2014).

The impacts of the roads will vary from species to species but will likely not be significant at the population level given the small amount of habitat involved. Canada Warbler and Eastern Wood-Pewee are not highly sensitive to forest fragmentation and will inhabit small woodlots and forest edges in landscapes that are primarily forested. Similarly Common Nighthawk nests in open rock barrens, clearings and cutovers and Olive-sided Flycatcher and Rusty Blackbird nests in forested wetland edges often at beaver ponds. Birds nesting in the Project Area may be displaced into adjacent habitat as a response to loss of habitat on the roads, but equivalent forest and wetland habitat is common in the surrounding landscape. Boreal bird populations are adapted to being displaced from nesting habitat by wild fires and respond by moving to alternate habitat (Northern Bioscience 2014).

11.3.3.2.2 Mitigation Measures

In order to move forward with construction in this area the following mitigations are required:

- No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc) during the breeding bird period (May 15-July 31);
- Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey;
- No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31);
- Minimize road corridor width (20 m or less);
- Re-vegetate temporary roads and temporary construction areas after construction;
- Where possible complete road and line construction from outside of the breeding bird period (May 15-July 31) in order to minimize noise disturbance;
- Speed limits of 50 km/hour will be applied on new roads to prevent collisions with birds during the most vulnerable season (May 16 to July 31). ;
- Modify driver behaviour (warning signs, awareness training);

- Clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared;
- All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife;
- Vegetation clearing will be minimized wherever possible;
- Restrict night use of roads during the nesting season where possible.

11.3.3.2.3 Net Effects and Significance Assessment

Value of the Resource Affected

The value of these species is ***high;*** They are all listed as Species at Risk in Ontario. Their specific listings are discussed in Section 9.3.3.

Geographic Extent of Effect

The geographic extent of this effect is *low*. The potential impact as a result of road construction on these species will not influence areas outside of the Project Area.

Duration and Frequency

Some impacts as a result of road construction will continue to occur throughout operations. This effect is *moderate***.**

Ecological or Social Context

Given the large forest surrounding the Project Area and the quality of habitat it contains, the vulnerability of the ecological context to disturbance to Species at Risk from construction activities is considered *low*.

Irreversibility of Effect

This effect is *reversible* following the completion of construction.

Magnitude of Effect

There will be little change to the overall habitat therefore the magnitude of this effect is *low*.

Probability of Effect

Some effect on resident SAR species is likely to occur from construction activities; therefore, the probability is *high*.

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low; the overall impact to forest-nesting SAR species from construction activities is anticipated to be *Insignificant*.

11.3.3.3 Potential loss of Nesting Habitat Due to Transmission Corridor Construction – Forest-Nesting Birds (Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird)

Potential impacts for these significant species will be the same as for other forest nesting birds. Please refer to the Section 11.3.2.1 *Vegetation Clearing Impact to Birds (Terrestrial Clearing).*

11.3.3.4 Potential Mortality of Common Nighthawk due to Roadway Collisions During Construction

11.3.3.4.1 Potential Effects

There is a possibility that increase in traffic along existing access roads due to construction activities. Construction of new access roads, and subsequent activity on them could lead to an increase in mortality for Common Nighthawks which perch on gravel roads (Northern Bioscience 2014). Common Nighthawk were observed on the Project site north of the Nova Road Bridge, and evidence of breeding was found within the spruce-fir coniferous forest community which occurs approximately 8km upstream from the proposed Third Falls GS and continues upstream along the east shoreline of the Ivanhoe River for approximately 5.5km in the Study Area (NRSI 2014). This area will be impacted by the construction and expansion of new access roads and construction activity which could result in impacts to common nighthawks by way of collisions and increased mortality.

11.3.3.4.2 Mitigation Measures

As a result of this potential significant impact the following mitigations are proposed:

- A limited number of new roads are proposed to assist in construction;
- Speed limits of 50 km/hour will be applied on new roads to prevent collisions with Common Nighthawks during the nesting season (May 15 to July 31);
- Modify driver behaviour (warning signs, awareness training);
- Restrict night use of roads during the nesting season where possible;
- New roads required for construction will be limited;
- All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife;

- All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife.

11.3.3.4.3 Net Effects and Significance Assessment

Value of the Resource Affected

The value of Common Nighthawk is *high*. They are listed as Special Concern under the Ontario Endangered Species Act.

Magnitude of Effect

The magnitude of this effect is *low*. The area is presently fragmented by roads and it is not anticipated that the additional 3.5 km of roadway will have a significant population impact.

Geographic Extent of Effect

The geographic extent of this effect is *low*. Effects would occur within the Project Area.

Duration and Frequency

Duration of this impact will throughout the duration of construction, therefore this effect is *low.*

Irreversibility of Effect

At the end of the construction period effect will conclude therefore the impacts are considered *reversible*.

Ecological or Social Context

Given the availability of suitable habitat surrounding the Project Area, the vulnerability of the ecological context to these construction activities is considered *low*.

Probability of Effect

There is a possibility that even though speeds have been lowered, and other mitigation measures have been employed some disturbance as a result of construction activities could still result. Therefore the probability of this impact is *moderate*.

Overall Significance

The overall significance of this effect is *Insignificant*. Mitigation including speed limits and timing restrictions for construction vehicles are expected to reduce road mortality. In addition, Common

nighthawks strikes as a result of the general public use on the approximately 3.5 km of new roadway during construction are unlikely to have population level impacts given the relatively short road lengths and expected slow traffic speeds.

11.3.3.5 Northern Myotis. Little Brown Myotis & Eastern Small-footed Bat – Potential Loss and Disruption of Maternity Roost Trees

11.3.3.5.1 Potential Effect

The proposed inundation area at Third Falls contains habitat that may provide maternity roosting habitat for Northern Myotis and Little Brown Myotis. Approximately 5.9ha and 30ha of Mineral Intermediate Conifer Swamp (B223) and the Moist, Coarse: Spruce- Fir Conifer (B067) communities will be lost due to inundation at Third Falls This represents approximately 8.7% and 2.7% of the communities, respectively (NRSI 2014).

The proposed inundation area at Third Falls contains habitat that may provide maternity roosting habitat for Northern Myotis and Little Brown Myotis. Approximately 5.9ha and 30ha of Mineral Intermediate Conifer Swamp (B223) and the Moist, Coarse: Spruce- Fir Conifer (B067) communities will be lost due to inundation at Third Falls This represents approximately 8.7% and 2.7% of the communities, respectively (NRSI 2014).

In addition, the proposed road corridors for The Chute and Third Falls also contain maternity roosting habitat. A total area of approximately 8 hectares of road corridors are proposed, which is unlikely to remove a significant number of maternity roost trees. At an average density of 5 trees/ha for the forests along the proposed roads, approximately 30 trees would be removed. The impact of removing about 30 snag trees is expected to be *Insignificant* on Myotis populations (Northern Bioscience 2014).

Much of the power line portion between Third Falls and The Chute follows old logging roads and crosses cutover landscape where potential maternity snag trees are less common than in older forest. However, large numbers of snags will be removed as mature forest is converted to open power line. The impact of removal of these snags is unknown however, bat populations in the boreal forest of northern Ontario are adapted to a fire-driven ecosystem and periodically forced to shift locations of maternity colonies due to natural factors. (Northern Bioscience 2014). Declines of *Myotis* spp. bats have been caused by white-nose syndrome during hibernation and maternal habitat is probably not limiting bat populations. Therefore, bats displaced from the cleared and inundated areas will be able to find replacement habitat in the forest surrounding the project site (Northern Bioscience 2014).

11.3.5.5.2 Mitigation Measures

In order to reduce impacts to Myotis species the following mitigations are proposed:

- No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31);
- If tree removal must occur during this time period, potential bat maternity roost habitat (cavity trees) will be identified and exit surveys will be conducted before removal occurs to confirm no active roosts are present. Should an active maternity roost be found during previously approved construction clearing this may negate clearing during the roosting season or an appropriate buffer would need to be established. Consultation with MNR would be required to determine the appropriate course of action.
- Avoid construction in portions of stands with clumps of snag trees or reduce the Right-of-Way width when snags are encountered;
- If maternity colonies or other bat roosts are observed during development or operations, they will be avoided or otherwise protected from disturbance;
- Significant trees will be marked for protection;
- Unmarked trees will only be removed if they are safety concerns that cannot be addressed in other practical ways;

11.3.5.5.3 Net Effects and Significance Assessment

Value of the Resource Affected

The importance of this value is *high*. These species are listed as endangered under the Ontario Endangered Species Act. Eastern small-footed bat is a candidate for listing under the Ontario Endangered Species Act.

Geographic Extent of Effect

As the impact is restricted to the Project Area, the geographic extent of this effect is considered *low*.

Duration and Frequency

Impacts as a result of potential loss and disruption of snag trees will be limited to the construction period and is considered to be *low*.

Ecological or Social Context

Given the large size of forest surrounding the Project Area and the availability of quality habitat, the vulnerability of the ecological context to the disturbance of bat maternity roosting habitat from construction activities is considered *low*.

Irreversibility of Effect

This impact is considered to be *reversible* following completion of construction

Probability of Effect

It may be possible to avoid removing snag trees, depending on the number encountered, their relative health, and the project layout in that area. Therefore, the probability is *moderate*.

Magnitude of Effect

There will be little change to the overall habitat therefore the magnitude of this effect is *low*.

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low; the impact to bat maternity roosting habitat from construction activities and tree removal is considered *Insignificant*.

11.3.3.6 Northern Myotis, Little Brown Myotis & Eastern Small-footed Bat – Potential Loss of Hibernacula

11.3.3.6.1 Potential Effects

These species hibernate in caves and mines from September through April and are not expected to roost in trees during the winter months. There are no known hibernacula within the Study Area (NRSI 2014).

No mitigation is required for this feature.

11.3.3.7 Northern Myotis, Little Brown Myotis & Eastern Small-footed Bat – Traffic Noise and Construction Activities

11.3.3.7.1 Potential Impacts

Activities during the construction of the Project will result in traffic noise and construction related noise and human disturbance impacts which could result in impacts to the northern myotis, little brown myotis and eastern small-footed bat. Traffic noise and forest canopy gaps created by roads sometimes cause foraging bats to alter travel routes (Northern Bioscience 2014). Given the expected low traffic noise (particularly at night) and relatively high proportion of forest cover in the surrounding landscape, the impacts of the road on bat populations will likely be *Insignificant*.

11.3.3.7.2 Mitigations Measures

The following mitigation measures are proposed:

- No clearing of forest or woodland habitats during the bat roosting period (May 1 – August 31);

- Speed limits of 50 km/hour will be applied on new roads to prevent collisions with bats during the season when these bats are likely to be present (May 1 to August 31). ;
- Modify driver behaviour (warning signs, awareness training);
- All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife;
- Restrict night use of roads during the season when bats are present (May 1 – August 31) where possible.

11.3.3.7.3 Net Effects and Significance Assessment

Value of the Resource Affected

The importance of this value is *high*. They are listed as endangered under the Ontario Endangered Species Act. Eastern small-footed bat is a candidate for listing under the Ontario Endangered Species Act.

Geographic Extent of Effect

Impacts will be restricted to the Project Area; therefore the geographic extent of this effect is *low*.

Duration and Frequency

Impacts as a result of this impact will be limited to the construction period and will be *low*.

Ecological or Social Context

Given the large size of the forest surrounding the Project Area and the amount of quality of habitat it contains, the vulnerability of the ecological context to construction activity impacts to bats is considered *low*.

Irreversibility of Effect

This impact is considered to be *reversible* following completion of construction activities.

Probability of Effect

The probability of this effect is *high*.

Magnitude of Effect

There will be little change to the overall habitat therefore the magnitude of this effect is *low*.

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low; the impacts to bats from construction noise and activity is anticipated to be *Insignificant*.

11.3.3.8 Northern Myotis. Little Brown Myotis & Eastern Small-footed Bat – Loss of Foraging Habitat

11.3.3.8.1 Potential Effects

Little brown myotis and northern myotis commonly forage over water and along roads and transmission lines, and as a result no significant negative impacts are anticipated on foraging habitat for bats in these areas. Bats were known to forage around The Chute site, and are thought to forage over the entire Project Area. The project will result in a small increase in area of open habitat along roads and transmission lines and potentially cause an increase in foraging habitat (Northern Bioscience 2014).

The fragmentation and habitat diversity that will result from the relatively localized tree removal may actually result in enhanced habitat in itself. Bat species, including little brown myotis, will often roost in areas close to foraging habitat such as woodland or riparian edges. These artificially created woodland edges may increase the preference to nearby suitable cavity trees (NRSI 2014).

No mitigation is required for this feature.

11.3.4 Significant Natural Heritage Features & Areas

11.3.4.1 Impacts to Moose Aquatic Feeding Areas due to Inundation

11.3.4.1.1 Potential Effects

The forest communities, Fresh, Clayey: Cedar – Conifer (B084), Fresh, Silty to Fine Loamy: Conifer (B102) and Moist, Coarse: Spruce – Fir Conifer (B067), are adjacent to Moose Aquatic Feeding Areas (within 120m from Open Water Marsh: Organic (B152) communities) and therefore SWH. The actual wetlands that MNR identify as Moose Aquatic Feeding Areas exist outside of the inundation areas and will not be directly affected. The adjacent forest habitats which are considered a part of the SWH are present 200m upstream of The Chute GS, as well as in the Third Falls inundation area immediately downstream of The Chute. The water level is proposed to increase by a maximum of 20cm in the river channel adjacent to Moose Aquatic Feeding Area. This increase in surface water elevation will be restricted to the existing channel within the existing high water mark and will not impact adjacent forest cover that is required by moose for shade and cover (NRSI 2014).

Loses of wetland embayment areas and riparian habitat associated with tributaries may include habitats such as Moist, Course: Shrub (B063). This habitat likely supports SWH for moose aquatic feeding areas. Approximately 23.5ha of this habitat will be lost due to inundation. This habitat is expected to experience an increase in water depth of approximately 1m, resulting in the loss of a large portion of wetland vegetation. However, it is predicted that over time, other wetland communities would establish and potentially provide additional open water communities with submergent wetland plants (NRSI 2014).

11.3.4.1.2 Mitigations

No construction mitigations will be possible for this effect, however post construction monitoring will be conducted in order to ensure that the riparian vegetation is re-establishing. This monitoring will include vegetation surveys and documenting observations of moose utilizing the habitat. Details of this monitoring plan are discussed in Section 16.

11.3.4.1.3 Net Effects and Significance Assessment

Value of the Resource Affected

This habitat value is *high* as it's a considered Significant Wildlife Habitat protected under the Provincial Policy Statement within Ontario.

Geographic Extent of Effect

The geographic extent of this effect is *low*. Impacts will occur within the inundation area and Project Area

Duration and Frequency

This impact will occur throughout the construction phase during in water works and is considered *moderate*.

Irreversibility of Effect

Impacts of this effect are considered ***reversible*** overtime as additional wetland communities in the tributaries will establish.

Ecological or Social Context

The ecological effect is *low*. There is only one location where there is expected to be a change in habitat as a result of the rise in water levels due to headpond fluctuation. Additionally communities are expected to re-establish.

Magnitude of Effect

The magnitude of this effect is *low*. The loss of this habitat type is only expected to occur in one location, where additional habitat is anticipated to be created as a consequence.

Probability of Effect

This effect is likely to occur as a result of the inundation in the tributaries therefore the effect is *high*.

Overall Significance

The impact to Moose Aquatic Feeding Areas from inundation is anticipated to be *Insignificant* since there is a low geographical extent and low ecological context.

11.3.4.2 Bald Eagle Habitat - Potential Inundation Impacts

11.3.4.2.1 Potential Effects

Bald eagle nesting and foraging habitat is present within the upstream extent of the inundation area, approximately 38km upstream from the proposed Third Falls GS. The water level is proposed to increase by a maximum of 20cm in the river channel adjacent to where the nest is located (NRSI 2014). This increase will not impact the nesting habitat as the nest is located several meters up an embankment from the shoreline. Additionally, the proposed water level increase of 20cm is not anticipated to impact bald eagle foraging and perching as the water level increase will be confined to the existing channel and will not result in the loss of any perch trees along the shoreline (NRSI 2014). It is anticipated that the impacts on this habitat as a result of inundation are *Insignificant*.

No mitigations are required for this habitat.

11.3.4.3 Common Nighthawk Habitat – Proposed Inundation Impacts

11.3.4.3.1 Potential Effects

Moist, Coarse: Spruce- Fir Conifer (B067) community is considered SWH for the common nighthawk. This habitat begins approximately 8km upstream from the proposed Third Falls GS and continues upstream along the east shoreline of the Ivanhoe River for approximately 5.5km. The water level is proposed to increase by a maximum of 20cm in the river channel adjacent to common nighthawk habitat. This increase is unlikely to impact nesting or foraging habitat as the water level change will be restricted to the existing channel and existing high water mark (NRSI 2014). It is anticipated that the impacts on this habitat as a result of inundation are *Insignificant*.

No mitigations are required for this habitat.

11.3.4.4 Olive-Sided Flycatcher Habitat – Proposed Inundation Impacts

11.3.4.4.1 Potential Effects

The Mineral Intermediate Conifer Swamp (B223) community is considered SWH for olive-sided flycatcher. Olive-sided flycatcher habitat is present within the upstream extent of the inundation area, approximately, 30km upstream from the proposed Third Falls GS. Clearing of vegetation does not pose a direct impact to olive-sided flycatcher habitat. The water level is proposed to increase by a maximum of 20cm in the river channel adjacent to olive-sided flycatcher habitat. This increase is unlikely to impact nesting or foraging habitat as the water level change will be restricted to the existing channel and existing high water mark (NRSI 2014). It is expected that the impacts on this habitat as a result of inundation are anticipated to be ***Insignificant*.**

No mitigations are required for this habitat.

11.3.4.5 Canada Warbler Habitat

11.3.4.5.1 Potential Effects

The Mineral Intermediate Conifer Swamp (B223) and the Moist, Coarse: Spruce- Fir Conifer (B067) communities are considered Significant Wildlife Habitat (SWH) for Canada warbler. Approximately 5.9ha and 30ha of B223 and B067 will be lost due to inundation at Third Falls, representing approximately 8.7% and 2.7% of the Community, respectively. The clearing of vegetation for the inundation area will result in direct loss of Canada warbler habitat. The area to be cleared is very small in relation to the abundance of this habitat type on the surrounding landscape outside of the Study Area. Additional discussion with regards to the terrestrial impacts of this clearing can be found in Section 11.3.1.3. Canada Warblers are declining in eastern Canada according to COSEWIC (2007), but northern Ontario supports an estimated 600,000 Canada Warblers (Northern Bioscience 2014). The reasons for the decline are not known with certainty, but COSEWIC (2007) concludes that “habitat loss and degradation on the wintering range are thought to be the most likely factors”. If loss of winter habitat is causing Canada Warbler declines, birds displaced from the inundation area will be able to find available nesting habitat in the landscape surrounding the project area (Northern Bioscience 2014).

11.3.4.5.2 Mitigation Measures

Mitigations to reduce the potential impacts to this habitat type include:

- No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc) during the breeding bird period (May 15-July 31);

- Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey;
- Schedule construction outside of the Breeding Bird window (May 15-July 31), when possible, to minimize habitat disturbance;
- Retain vegetation to the extent possible and clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared;
- Trees will not be felled into the water and felling trees into the proposed site wherever possible;
- Allow for detour around sensitive habitat areas
- The use of machinery will be limited in and around watercourses and sensitive terrestrial areas;
- Components will be clearly identified with flagging tape in advance of clearing

11.3.4.5.3 Net Effects and Significance Assessment

Value of Resource

The value of this resource is *high*; this habitat is SWH as it's a habitat for species of conservation concern. The Canada Warbler is listed as a special concern species in Ontario.

Geographic Extent of Effect

The geographic extent of this effect will be *low*. The loss of vegetation will not influence areas outside of the Project Area.

Duration and Frequency of Effect

This effect will occur for portions of the construction period, therefore the effect is *low*.

Irreversibility of Effect

The effect habitat loss is considered to be *irreversible*, since forest will be permanently converted to reservoir.

The population decline as a result of habitat loss is considered to be *reversible* since the small number of birds displaced from the inundation area is expected to move to equivalent habitat in the surrounding landscape.

Ecological or Social Context

Vegetation removal in the two ecosite communities that make up this SWH area represent a small portion of the total available habitat, and Canada warbler are expected to be tolerant of the level of clearing proposed. Therefore, the vulnerability of the ecological context to the impact is considered *low*.

Magnitude of Effect

There will be little change to the overall habitat therefore the magnitude of this effect is *low*.

Probability of Effect

Vegetation will be cleared during construction; the probability of some impact to Canada warblers from the clearing is *high*.

Overall Significance

As the geographical extent and duration and frequency are low, the overall significance of this effect is *Insignificant*.

11.3.4.6 Fresh Silty to Fine Loamy: Elm Ash Hardwood (B105) ecosite

11.3.4.6.1 Potential Effects

As mentioned in section 4.2.1 and 5.2, Fresh Silty to Fine Loamy: Elm-Ash Hardwood (B105) is considered a rare-treed SWH. Approximately 0.7ha of this community located downstream of The Chute GS will be inundated by the proposed completed Third Falls GS. This will result in a net loss of 35% of this habitat type within the forest cover. The loss of this amount of this habitat type is ***significant*** for this area, and could result in a loss of genetic integrity in this stand.

11.3.4.6.2 Mitigation Measures

In order for Project activities to proceed the following mitigations are required:

- A seed harvesting and re-planting strategy will be drafted as part of the detailed construction plan and schedule which includes replanting schedules and a post construction monitoring scheduling;
- Seeds from this community will be harvested prior to dam construction and inundation, in order to maintain genetic integrity of the rare-treed community. Seeds will be grown into seedlings at a local nursery within Northern Ontario which at an appropriate time of year will

be planted within suitable habitat in the Project Area or adjacent lands following Construction Activities and headpond stabilization;

- A suitable habit for re-establishing this community will be identified after the headpond areas are inundated. These areas will be planted once the seedlings are a minimum of 2 years old;
- In order to maintain genetic diversity and reduce the magnitude of the effect, nurseries will be contracted to grow a minimum of 2-3 times more than the number of trees that would be removed and plant out as many as the available habitat would support
- The community will be checked to confirm it is reestablishing.

11.3.4.6.3 Net Effects and Significance Assessment

Value of the Resource Affected

The value of this Elm Ash Hardwood ecosite type is *high*. This community type is listed as a significant wildlife habitat.

Geographic Extent of Effect

The geographic extent of this effect is *low*. Impacts to this habitat type would be constrained to the Project Area.

Duration and Frequency

This impact will last the duration of the construction period and headpond filling, this impact is *low*.

Irreversibility of Effect

This effect is likely *reversible* as replacement seedlings are planted and grow.

Ecological or Social Context

There will be a *low* effect on the ecological environment as a result of this impact. The replanting strategy will ensure that the community continues to see no significant change in integrity over time.

Magnitude of Effect

The magnitude of this effect is *low*. There will be a moderate amount of loss to this community type as a result of this impact. Inundation is unavoidable, and loss in this habitat as a result is also unavoidable, however replanting will ensure that the community is reestablished.

Probability of Effect

The probability of this impact is *high* as clearing will occur.

Overall Significance

The overall significance of this effect is *Insignificant* since the habitat will be replaced as the seedlings are replanted overtime.

11.3.5 Significant Earth or Life Science Features

As no Areas of Natural and Scientific Interest or Life Science Features were found in the Project Area, no mitigations for construction are required.

11.4 Aquatic Environment

11.4.1 Fish & Fish Habitat

11.4.1.1 Impacts due to Cofferdam Construction & Dewatering

Cofferdams are constructed to isolate any in-water work area from a water body for the purpose of enabling work under dry conditions. They are temporary structures that form an impermeable dyked enclosure which also prevent escape of debris and sediment to the exterior water body. Cofferdam material can include sandbags, sheet piling, rock fill, wood sheeting and rock filled timber cribs, depending on the size of the project and duration the cofferdam will be in place (NRSI 2014).

11.4.1.1.1Potential Effect

Temporary disturbance to additional aquatic habitat areas is anticipated during the construction of cofferdams required to complete the dams, intakes and powerhouses and tailraces construction in dry conditions. Cofferdams required for the construction of The Chute dam will result in temporary disturbance to 3400m^2 of aquatic habitat. Cofferdams required for the construction of the Third Falls dam will result in temporary disturbance to 3900m^2 of aquatic habitat. Depending on the size and type of cofferdam utilized, the structure will have direct impacts on the substrates and habitat for which it has been placed, and has potential to strand fish within the enclosure (NRSI 2014).

When cofferdams are first installed there is often a considerable amount of water retained inside of the cofferdam, in the area where work is to occur. Often fish can become stranded within the cofferdam with no access to the watercourse.

Depending on the amount of suspended sediment in the pumped water, there is the potential to impact water quality of the receiving watercourse by increasing the suspended solids loading in the watercourse above background levels. This has the potential to result in sedimentation of watercourse. The current construction management plan for The Chute and Third Falls proposes dewatering activities to complete work in the dry. Construction of The Chute dam requires temporary dewatering of approximately 5800m^2 of aquatic habitat. Construction of the Third Falls dam requires temporary dewatering of approximately 6250m^2 of aquatic habitat (NRSI 2014).

11.4.1.1.2 Mitigation

In order to deal with fish stranding and potential impacts on aquatic habitat during cofferdam construction the following mitigation methods will be employed:

- MNR in-water timing window restrictions for construction for spring spawning fish species (typically April 1 to June 15) and fall spawning fish species (typically October 1 to May 31). Specific timing windows will be agreed to with the local MNR as part of the permitting process;
- Removal of the stranded fish and standing water before construction proceeds. A scientific collector's permit is required from the MNR before a fish salvage operation can be completed;
- Dewatering activities will be done in a controlled manner so as not to discharge turbid water to the receiving watercourse;
- Materials such as filter bags, straw bales, filter fabric, and page-wire fencing will be on site to create a dewatering corral for waste water as a contingency plan in the event that groundwater is encountered and additional filtering properties are required;
- Suitable containment/treatment areas will be identified by the Contract Administrator;
- The discharge point in the receiving watercourse will be carefully chosen as an area with low scour potential (i.e. bedrock bottom);
- If scour potential does exist, the contractor will use energy dissipation in the form of a splash pad or rock protection for the stream bottom;
- Detailed Best Management Practices for dewatering activities, Appendix B of the Best Management Practices Guide for the Mitigation of Impacts of Waterpower Facility Construction (Genivar and NRSI 2012) will be consulted.

The significance of the residual impacts following implementation of the above mitigation measures are described below.

11.4.1.1.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of fish species in this area is *moderate*; they are VECs and valued socially by the local community.

Geographic Extent of Effect

The geographic extent of this effect is *low*. The effects will only occur within the Project Area.

Duration and Frequency

Impacts as a result of this effect will be limited to the construction period and will be *low*.

Irreversibility of Effect

This effect is *reversible* following the removal of the cofferdam.

Ecological or Social Context

Given the relative abundance of fish habitat in the Ivanhoe River the vulnerability of the ecological context to the impact of cofferdam construction and dewatering is considered *low*.

Magnitude of Effect

The magnitude of this effect is *low*. Dewatering for cofferdams is unlikely to produce a population level effect on fish species involved.

Probability of Effect

The probability of this effect is *high*.

Overall Significance

The overall significance of this effect is *Insignificant* as the geographical extent and duration and frequency are both low.

11.4.1.2 Impacts due to Auxiliary Dam Construction at The Chute

11.4.1.2.1 Potential Effects

An auxiliary dam is proposed to be constructed in a small overflow channel located approximately 1km upstream of the proposed Chute GS. The purpose of the dam is to prevent the headpond, during high water events, from spilling into a tributary (Tributary 34) that connects to the Ivanhoe River downstream of the proposed GS. The overflow channel is currently only connected to the river during high flow periods and minimal opportunities for use of the channel by fish exist as it contains water for only limited times during the year.

The auxiliary dam will impact a shoreline mainly comprised of bedrock which would afford negligible habitat value even during the limited periods when the channel is wetted.

No mitigation is required for this feature, it has a negligible impact.

11.4.1.3 Spawning Habitat Impacts due to The Chute Facility Construction

11.4.1.3.1 Potential Effect

Construction of The Chute GS, spillway dam, tailrace and powerhouse will involve re-structuring of the riverbed to form smooth, re-graded concrete or bedrock channels. This will result in the permanent alteration of existing natural substrates, aquatic vegetation and morphological habitat features such as riffles, chutes and pools. Furthermore, the function and productivity of these habitats will be permanently altered within these areas. The intake channel is proposed to be constructed in an area of the eastern channel which is at the downstream end of a chute habitat where velocities drop off and appropriate substrates for spawning begin to appear (NRSI 2014). As a result of this undertaking, the newly constructed intake channel will potentially alter approximately 1850m^2 of existing aquatic habitat:

Table 36: Spawning Habitat Impacts at The Chute

Activity	The Chute
Excavation for Intake at the Chute	1000m^2 of spawning habitat lost
Powerhouse Excavation	300m^2 of spawning habitat lost
Dam Footprint	No impact to walleye spawning habitat. Entire dam footprint is 1000m^2 some of which impacts on riverbed. Occurs at upstream end of western channel in an area characterized as high velocity chute with no spawning potential
Tailrace Excavation	550m^{2}of habitat lost in area considered to be prime spawning habitat

(NRSI 2014)

Although some of the habitat removed will be scoured bedrock (chute) with limited spawning potential it is anticipated that approximately 1000m2 of this excavation will occur in an area with substrates appropriate for spawning. The construction of the powerhouse and tailrace in the eastern channel will result in the permanent alteration of approximately 300m2 and 550m2 of existing channel, respectively (CPL 2014). During spring spawning surveys, Walleye and White Sucker spawning were confirmed throughout the entire lower reach of the eastern channel (NRSI 2014). Excavation of the river channel for construction of the intake channel, powerhouse and tailrace will result in the permanent alteration of approximately 1850m^2 of channel bed identified as Walleye spawning habitat (NRSI 2014).

The construction of the spillway and dam structures will result in the permanent covering of approximately 1000m2 of aquatic habitat (CPL 2014). This will occur at the upstream end of the western channel in an area characterized as high velocity chute with no spawning potential (NRSI 2014).

11.4.1.3.2 Mitigation

- The area lost through the construction of the intake channel, powerhouse and tailrace will require compensation to offset impacts to spawning habitat. Xeneca has committed to creating new spawning habitat in an area downstream of the point where flows from the powerhouse and the western spillway channel recombine;
- Two-dimensional modeling will be used to design habitat such that it operates within the range of velocities and depths associated with preferred Walleye spawning habitat. Please refer to the *Conceptual Fish Habitat Offsetting and Monitoring Plan* (NRSI 2014);
- This potential degradation of macroinvertebrates and loss of fish forage habitat will be mitigated by the re-creation of appropriate riffle habitat with cobble and boulder substrates, for Walleye spawning, within the tailrace area. The Conceptual Fish Habitat Offsetting and Monitoring Plan (NRSI 2014) provides conceptual level details regarding proposed fish habitat offsetting concepts. This type of conceptual level analysis is appropriate at the EA stage of a project and provides the framework for advancing the habitat offsetting concepts during post EA design and permitting. The proposed compensation for anticipated impacts related to the spillway dam, powerhouse and tailrace will need to be developed and discussed with DFO once the engineering details for the project have been advanced during the permitting phase of the project;
- Effectiveness goals will need to be discussed with MNR and DFO to ensure the compensation will be effective;
- The replacement of spawning habitat will be discussed with DFO and MNR as part of the post-EA approval process required for any Fisheries Act Authorizations.

The significance of the residual impacts following implementation of the above mitigation measures are described below

11.4.1.3.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of the aquatic habitat at The Chute GS is *high*, due to the amount of spawning habitat for VECs.

Geographic Extent of Effect

The geographic extent of this effect is *low*. This impact will be limited to the Project Area.

Duration and Frequency

This effect will begin in construction, but will be permanent therefore this effect is *high*.

Irreversibility of Effect

This effect is permanent and is therefore *irreversible*.

Ecological or Social Context

Given the availability of fish habitat in the Ivanhoe River and reduction of that habitat due to the construction activities the vulnerability of the ecological context due to the impact of facility construction is considered *moderate.*

Magnitude of Effect

The magnitude of this effect is *moderate* It is expected that habitat displacement at this location may produce some population disturbance.

Probability of Effect

The probability of this effect is *high*

Overall Significance

The overall significance of this effect is *Insignificant* since the geographic extent is low and the *Conceptual Fish Habitat Offsetting and Monitoring Plan* (NRSI 2014) will compensate for lost spawning habitat.

11.4.1.4 Impacts due to Third Falls Facility Construction

11.4.1.4.1 Potential Effect

Construction of the Third Falls headrace (intake channel), tailrace and spillway dam involve restructuring of the bank and riverbed. This will result in the permanent alteration or loss of existing natural substrates, aquatic vegetation and morphological habitat features such as riffles, chutes and pools. Furthermore, the function and productivity of these habitats will be permanently altered or reduced within these areas (NRSI 2014).

The intake channel is proposed to be constructed in an area of aquatic shoreline habitat with substrates composed primarily of bedrock and boulder. As a result of this undertaking the newly constructed intake channel will potentially alter approximately 650m2 of aquatic habitat (CPL 2013). This alteration of habitat will mainly involve the removal of scoured bedrock and scattered boulders along the shoreline to form a smooth channel. This excavation will occur in an area that has extreme velocities during spring flows further limiting its suitability as spawning habitat. As a result, impacts associated with the intake channel footprint are perceived to be minor since this habitat does not play a significant role in the life stages of fish species such as Walleye nor is it the type and quality of habitat that would be considered important from a benthic production standpoint (NRSI 2014).

The construction of the spillway and dam structures will result in the permanent covering of approximately 1100m2 of aquatic habitat (CPL 2014). The spillway dam crosses the river at an elevated bedrock chute feature. This scoured bedrock chute is characterized by extreme velocities during the spawning season. Given these extreme velocities and lack of appropriate substrates this area is not suitable for spawning. Based on the morphology of the location and the abundance of bedrock, this habitat is also not considered important for invertebrate production. As a result, impacts associated with the spillway dam footprint are perceived to be negligible since this habitat does not play a significant role in the life stages of VEC fish species such as Walleye or invertebrate production (NRSI 2014).

The powerhouse is proposed to be constructed on the west bank in an area of aquatic shoreline habitat comprised primarily of bedrock. As a result of this undertaking the powerhouse will potentially alter approximately 300m2 of aquatic shoreline habitat (CPL 2014). This alteration of habitat will mainly involve the removal of scoured bedrock and vegetation along the shoreline. Further, the excavation will occur upstream of a chute which is considered impassable by fish during spring flows therefore fish are not accessing this area to spawn. As a result, impacts associated with the powerhouse footprint are perceived to be minor (NRSI 2014).

The construction of the tailrace will result in the permanent alteration of approximately 500m^2 of existing riverbed (CPL 2014). This alteration will result in the removal of aquatic habitat with bedrock

as the dominant substrate. Spring spawning surveys were not conducted in this feature because the habitat and available substrates are not suitable for Walleye and White Sucker spawning. Also, the area is locked between two high velocity chutes. The habitat is not considered to afford significant spawning habitat nor does it have high value for invertebrate production therefore the construction of the tailrace will result in minimal impacts to aquatic habitat (NRSI 2014).

It is not anticipated that any spawning habitat will be impacted with the construction of the Third Falls GS and no high quality invertebrate production habitat will be impacted (NRSI 2014).

No mitigation measures are required for the Third Falls Facility, as impacts are considered negligible.

11.4.1.5 Impacts on Invertebrate Habitat due to Construction

11.4.1.5.1 Potential Effects

An analysis prepared by NRSI and summarized in Table 37 below indicates that there will be a shift in habitat conditions at six of the eleven fastwater habitats during low flow conditions during construction and inundation. At these locations, wetted widths are expected to increase by anywhere from 10m to 50m, and anywhere from 1.3m to 5.0m of additional water will cover these habitats. Velocities at these locations are predicted to drop from a range of 0.03m/s to 2.1m/s to 0.02m/s to 0.12m/s (NRSI 2014).

These habitats are predicted to lose their existing functionality as fastwater habitats and become deep water habitats with very low velocity thereby functioning as lacustrine habitat versus riverine habitat. With this change a fundamental shift in invertebrate community from a fastwater community to one more indicative of a lacustrine environment is predicted (NRSI 2014).

Table 37: Invertebrate Habitat Changes due to Inundation

Location of Invertebrate Production Habitat	Habitat Area at Low Flow (m^2)	Predicted Changes and Outcome
Approximately 6.3km upstream of the Chute GS HEC RAS Transect 6+330	1100	No change in wetted perimeter, velocity or depth from pre-project to post-construction. Habitat will continue to function and provide similar habitat conditions for invertebrates currently using the habitat.
Approximately 5.5km upstream of the Chute GS East Channel HEC RAS Transects 5+478 5+468	1500	Wetted width will increase from 16m to 46m. An additional 1m of depth will be added over habitat. Velocity predicted to decrease to 0.12 m/s from 1.36 m/s. Habitat will cease to function as fastwater invertebrate habitat during low flow condition.

Location of Invertebrate Production Habitat	Habitat Area at Low Flow (m^2)	Predicted Changes and Outcome
Approximately 5.5km upstream of the Chute GS West Channel HEC RAS Transects 5+478 5+468	800	Wetted width will increase from 16m to 46m. An additional 1m of depth will be added over habitat. Velocity predicted to decrease to 0.12m/s from 1.36m/s. Habitat will cease to function as fastwater invertebrate habitat during low flow condition.
Oates Road bridge, Approximately 2km upstream of the Chute GS HEC RAS Transect 1+875	800	Wetted width will increase from 8m to 54m. An additional 3m of depth will be added over habitat. Velocity predicted to decrease to 0.04m/s from 1.77m/s. Habitat will cease to function as fastwater invertebrate habitat during low flow condition.
Immediately (100m) upstream of the Chute GS HEC RAS Transect 0+125	1500	Wetted width will increase from 29m to 79m. An additional 5m of depth will be added over habitat. velocity predicted to decrease to 0.12m/s from 2.16m/s. Habitat will cease to function as fastwater invertebrate habitat during low flow condition.
Immediately downstream of the Chute GS West Channel	600	A reduction in functionality of the habitat during the low flow period is not anticipated. A compensatory flow of 0.5m3/s will be provided to the west spillway channel outside the spawning period which will result in the habitat remaining wetted at all times of the year. The backwater effect of the Third Falls headpond will also ensure this habitat is wetted at all times.
Immediately downstream of the Chute GS East Channel	800	During periods of low flow, when insufficient flow is available to run the turbine, there will be periods of no flow in the East Channel. This will mean that invertebrate habitat cannot be maintained because habitat will be dewatered and velocity will be reduced to zero over any habitat remaining wetted through backwater effect.
Approximately 9km Downstream of the Chute HEC RAS Transect 33+5558	1400	Wetted width will increase from 39m to 50m. An additional 1.6m of depth will be added over habitat. Velocity predicted to decrease to 0.03m/s from 0.06m/s. Habitat is currently not considered as high quality invertebrate habitat and is expected to maintain this impaired quality post development. No real reduction in functionality of the habitat anticipated.
Approximately 20km upstream of Third Falls GS HEC RAS Transect 20+784	2800	Wetted width will increase from 50m to 60m. An additional 1.6m of depth will be added over habitat. Velocity predicted to decrease to 0.02m/s from 0.03m/s. No reduction in functionality of the habitat anticipated.

Location of Invertebrate Production Habitat	Habitat Area at Low Flow (m^2)	Predicted Changes and Outcome	
At Nova Road HEC RAS Transects 10+850 10+885	5000	Wetted width will increase from 50m to 62m. An additional 1.6m of depth will be added over habitat. Velocity predicted to decrease to 0.02m/s from 0.03m/s. Habitat is currently not considered as high quality invertebrate habitat and is expected to maintain this impaired quality post development. No real reduction in functionality of the habitat anticipated.	
Approximately 5km upstream of Third falls GS HEC RAS Transects 5+487 5+410	15,000	Wetted width will increase from 30m to 70m. An additional 2.1m of depth will be added over habitat. Velocity predicted to decrease to 0.04m/s from 0.72m/s. Habitat will cease to function as fastwater invertebrate habitat during low flow condition.	
Total (m2)	**28,500**	**No longer functioning as fastwater benthic invertebrate habitat during low flow conditions (m2)**	**20,400**

(NRSI 2014)

The change in invertebrate community will impact the fish species that rely on the invertebrates produced at these fastwater habitats as a food source. At the fastwater habitats where a shift to lacustrine habitat is predicted it is anticipated that EPT species will no longer be productive. It is noted however that local species are expected to have an adequate food supply of less preferred benthic species. The newly created habitat will provide benthic production and therefore some foraging opportunities for resident fish, but impacts to fish feeding behavior is anticipated as shifts in species and abundance of invertebrates occur. Ultimately, over a period of five to ten years, a new equilibrium is predicted to establish. (NRSI 2014).

For those habitat areas upstream of The Chute where changes in fastwater habitat functionality due to habitat alteration are predicted to occur there are several areas upstream of the extent of headpond inundation and below the confluence with the Shawmere River. The predicted alteration in invertebrate habitat at the large fastwater habitat (estimated at 15,000m2) located 5km upstream of Third Falls will mean that fastwater foraging opportunities will no longer exist in that section of river during low flow conditions. Foraging opportunities will continue to exist, however, the habitat will be considered lacustrine as opposed to riverine. The need and extent of any mitigation will be discussed with DFO and MNR as part of the Fisheries Act Authorization process.

11.4.1.5.2 Mitigation

In order to proceed with the project the following mitigations need to be implemented:

- At Third Falls: monitor the long term health of the Walleye population by conducting a series of Fall Walleye Index Netting surveys in the reservoir. If the health of the Walleye population is maintained or improved from pre development to post development then the assumption will be that the Walleye have adjusted to a change in food supply.
- Should the health of the population at Third Falls be determined to decline post development then Xeneca is committed to enter into discussions with MNR about the possibility of stocking that section of the River with Walleye in order to maintain a quality fishing experience for anglers as per MNR's Fisheries Management Objectives.
- At The Chute Facility Xeneca has committed to providing flows in the spillway channel that will maintain the viability of Walleye spawning habitat. As this habitat will be under the influence of the backwater effect of the Third Falls headpond it will remain wetted at all times and under the influence of the proposed minimum flow in the spillway channel. This area will provide some value in terms of invertebrate production as it remains wetted and has positive flow conditions. Effective offsetting measures will need to be developed and discussed with MNR and DFO once the engineering details for the project have been advanced during the permitting phase of the project.
- Measurement of the depth and velocity conditions at the existing fastwater habitats where EPT species are being produced, prior to construction, would be an appropriate means of informing the design parameters for replacement invertebrate habitat. (NRSI 2014).
- Below the confluence of the Shawmere River the opportunity to construct invertebrate offsetting habitat exists. The reader is referred to the *Conceptual Fish Habitat Offsetting and Monitoring Plan* (NRSI 2014) for more detail.
- Xeneca has committed to providing a compensatory flow during non-spawning periods of 0.5m3/s through the spillway channel. As this habitat will be under the influence of the backwater effect of the Third Falls headpond it will remain wetted at all times and under the influence of the proposed minimum flow in the spillway channel. Therefore this area will provide some value in terms of invertebrate production as it remains wetted and has positive flow conditions.

The significance of the residual impacts following implementation of the above mitigation measures are described below

11.4.1.5.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of invertebrate habitat is *moderate* within the community due to its ecosystem role.

Geographic Extent of Effect

The geographic extent of this effect is *low*. This effect will occur within the Project Area.

Duration and Frequency

The duration of this effect will occur due to the initial inundation at the facilities, but will continue through operations; therefore, it is *moderate*.

Irreversibility of Effect

The impacts are *irreversible* following the construction period. While some lacustrine invertebrate habitat will continue to exist, the loss to fastwater features will be permanent.

Ecological or Social Context

The ecological effect of the impact to invertebrate habitat is *moderate*. While it is understood that fastwater features which support specific benthic communities will be lost, it is unclear how fish populations will respond to the establishment of more lacustrine benthic communities. It is possible that the effect could increase overall fisheries productivity. Impacts to fisheries productivity will be determined through post-construction monitoring. Any identified impacts to the productivity of the fishery within project area will be managed adaptively through discussions with the MNR and DFO.

Magnitude of Effect

The magnitude of the effect is *low*. The effect is not likely to result in a species level impact.

Probability of Effect

The probability of this effect is *high*.

Overall Significance

The overall significance of this effect is *Insignificant* since the geographic extent and magnitude are both considered to be low and monitoring will be conducted to confirm this assessment.

11.4.1.5.4 Monitoring

Benthic invertebrate sampling will be completed in habitats throughout the entire ZOI to compare pre and post construction benthic invertebrate communities to determine whether or not community structure has changed. Sampling for benthic invertebrates will occur on one occasion during the

monitoring year using Hester-Dendy artificial substrate samplers (H-D sampler). The H-D samplers will be installed in the river in August and retrieved after approximately 6 weeks.

Benthic invertebrate monitoring will occur at seven locations in the Ivanhoe River. Monitoring will occur upstream of the 6.4km Chute headpond within the first fast water feature downstream of the Ivanhoe/Shawmere confluence. This will be established as a reference site in order to provide information on the current invertebrate community. Within The Chute headpond, monitoring will occur at Oates Road Bridge to correspond with baseline benthic invertebrate data. Monitoring will also occur downstream of The Chute within the east and west channels following similar methods used during pre-construction surveys. Within the Third Falls headpond, monitoring will occur at the three locations where pre-construction benthic invertebrate data was collected for comparison purposes. Benthic invertebrates will be identified to the lowest practical taxonomic level by a professional taxonomist.

In addition to the sampling of benthic invertebrates, basic habitat information such as wetted width, depth and hydraulic head will be collected at the location of the H-D samplers. Sampling will also be coordinated with hydrologic monitoring to facilitate association of benthic results with the hydrology at the location of the H-D samplers. Sampling will occur once in years 1, 3, 6 and 9 of Facility operation. Should results reveal changes in the benthic community that are of concern, Xeneca will discuss appropriate mitigation strategies with MNR. Possible mitigation strategies include reducing the ratio of maximum flow to minimum flow during specific months of the year, which can be achieved by increasing the minimum flow or decreasing the maximum flow. A different approach would be to alter the riffle habitat to maintain a greater wetted area during minimum flow conditions. The density, the diversity and characteristics of the community will be statistically compared among years using Analysis of Variance (ANOVA).

The results will be submitted to MNR and DFO annually for each monitoring year.

11.4.1.6 Impacts on Tributaries & Brook Trout Habitat Impacts due to Third Falls GS Inundation

11.4.1.6.1 Potential Effect

The inundation of the headponds for the Third Falls GS will result in a backwater effect into the tributaries that flow into the headpond area. This backwater effect will be greater in lower gradient tributaries in comparison to higher gradient tributaries; it can be expected to extend only tens of meters upstream in some of the higher gradient tributaries whereas in some of the lower gradient tributaries the effect can extend for kilometers upstream (NRSI 2014).

Inundation in these tributaries may impact critical brook trout habitat, nine tributaries were identified as having potential to contain critical habitat for brook trout. An assessment prepared in 2013 and discussed in 9.4.1 concluded that only one of these tributaries contained critical habitat. For eight of these tributaries no impacts to critical brook trout habitat are anticipated to occur. In Komak Creek, while no spawning evidence was observed, there are deposits of sporadic gravel that may afford limited opportunities for spawning to Brook Trout. However, similar gravel deposits were noted in the area immediately upstream of the maximum backwater effect and these will remain available to Brook Trout and undisturbed by inundation. Presumably more of this habitat will be present upstream of the area surveyed; therefore the overall impact to Brook Trout spawning is anticipated to be negligible in Komak Creek (NRSI 2014)

No mitigations are required for Brook Trout habitat in tributaries as impacts are predicted to be negligible.

11.4.1.7 Impacts due to New Road Crossings

Impacts to watercourses resulting from the construction of access roads are associated with the location of proposed crossings as well as the design of the proposed crossing structure. Additionally, impacts can result from the use of existing roads that may require upgrades or the installation of new crossing structures. It is expected that any crossing structure upgrades required along existing roads will follow the same mitigation measures proposed for new crossing locations. The secondary and tertiary forestry roads being used to access The Chute and Third Falls will require upgrades to existing water crossing structures and potentially the construction of an appropriate crossing structure where structures currently do not exist.

11.4.1.7.1 Potential Effect

Depending on crossing structure design, some structures may result in the permanent loss and alteration of fish habitat caused by physical changes to the channel, streambed and riparian vegetation through filling, straightening and enclosing a watercourse within the crossing area. In addition to permanent loss of fish habitat, enclosure of a watercourse will result in the alteration of the feature with the loss of natural substrates, loss of in stream habitat (structure/cover), and alteration of food supply (i.e. benthos, macrophytes). Alterations to the hydrology (flow volume and dynamics) of a watercourse, is possible through the positioning and sizing of the structure. Impacts from altering hydrology are associated with the alteration of existing morphological habitats (i.e. riffles), potential for flooding and increased erosion potential. Barriers to fish passage are also possible through the improper placement of a crossing structure that results in perched conditions (elevated above the watercourse) that fish are unable to pass. Barriers to fish passage can potentially limit the normal localized movement and migration patterns of fish species. Loss of riparian habitat through the

development or alteration of an existing crossing is also possible. This would result in a change to in-stream shading and cover, furthermore reducing watercourse function (NRSI 2014).

Any loss in the productive capacity of fish habitat as a result of changes to the physical structure, substrate, type and quantity of cover, vegetation, and flow volume and dynamics that result from watercourse crossing design and construction may require compensation. The proposed offsetting for anticipated impacts related to the construction of access roads will need to be developed and discussed with DFO once the engineering details for the project have been advanced during the permitting phase of the project. Effectiveness goals will need to be discussed with MNR and DFO to ensure the offsetting habitat will be effective (NRSI 2014). It is proposed that this discussion take place during the detailed design and permitting phase.

11.4.1.7.2 Mitigation

- Consideration of watercourse crossing structure design should be made in order to limit the degree of impact.
- maintain the minimum crossing length possible (i.e. cutting back from grading limit to road limit and support with head wall, utilizing existing crossings, use of open bottom structures such as an open foot box culvert).
- The crossing structure should be sized appropriately according to engineering standards as to not result in alterations in stream hydrology, scouring or flooding.
- Crossing structure type should be determined in consultation with agency staff and be dependent on sensitivity of the water body and location. This will be completed during the permitting phase, prior to any in-stream construction activities.

The significance of the residual impacts following implementation of the above mitigation measures are described below

11.4.1.7.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of this resource is *moderate***.** This aquatic habitat is valued as habitat for some important fish species.

Geographic Extent of Effect

The geographic extent of this effect will be *low*. The disruption to aquatic habitat will not influence areas outside of the Project Area.

Duration and Frequency

Duration as a result of road crossings and construction will be limited to the construction period, and is therefore considered *low*.

Irreversibility of Effect

The impacts are *reversible*, following the construction period.

Ecological or Social Context

Given the relative abundance of fish habitat in the Ivanhoe River the vulnerability of the ecological context to the impact of water crossings is considered low

Magnitude of Effect

The magnitude of the effect is *low*. There will only be two new road crossings as a result of construction activities.

Probability of Effect

This effect is expected to be *highly* probable.

Overall Significance

As the geographic extent and duration and frequency are both low, the overall significance of this effect is *Insignificant*.

11.4.1.8 Impacts due to Power Line Corridor Stream Crossings

In order to facilitate the construction of the new power line some new stream crossings will be required, In addition the line will utilize some existing crossings as described below. The proposed power line route crosses 28 permanent streams and 20 intermittent streams. Seventeen of these crossings are along existing road right-of-ways: seven on Highway 101 and ten on forest access roads. In total there is a need for 23 new water crossings and 12 new wetlands crossings.

Table 38: Power Line Stream Crossing – Crossing Type

Route	Land Ownership	Corridor Type	Length (m)
Third Falls GS to The Chute GS (69 kv)	Crown	Existing Road	13,505
	Crown	New Corridor	13,338
		Subtotal	**26,843**
The Chute to Weston Lake Connection Point (115 kv)	Crown	Existing Hydro Corridor	3,035
	Crown	Existing Road	18,779
	Crown	New Corridor	29,056
	Provincial Park	Existing Hydro Corridor	480
		Subtotal	**51,350**
Total (Third Falls to Weston Lake Connection Point (69 kv & 115 kv))	Crown	Existing Hydro Corridor	3,035
	Crown	Existing Road	32,285
	Crown	New Corridor	42,394
	Provincial Park	Existing Hydro Corridor	480
		Total	**78,193**

(Northern Bioscience 2014)

Table 39: Power Line Stream Crossing Statistics

Route	OwnerType	RoadType	Length (m)	Summary Statistics				
				Water Crossing			Wetlands	
				Highway	Existing	New	Edge	Crossing
Third Falls to Weston Lake Connection Point (69kv & 115kv)	Crown	Existing Hydro Corridor	3,035	-	-	*2*	-	*1*
	Crown	Existing Road	32,285	*6*	*5*	-		*7*
	Crown	New Corridor	42,394	-	-	*23*		*12*
	Provincial Park	Existing Hydro Corridor	480	-	-	*1*	-	-
Total			**78,193**					

(KBM 2014)

11.4.1.8.1 Potential Effect

As discussed above there are a number of new and existing stream crossings. Work around the stream crossings has the potential to impact water quality, fish habitat and vegetation due to clearing activities and construction work. This effect has a potential *significant* effect.

11.4.1.8.2 Mitigation

The following mitigation measures are proposed:

- All work will be done in accordance with *Measures to Avoid Causing Harm to Fish and Fish Habitat* recommended by the DFO;
- Transmission lines will span water crossings and where possible any associated water quality Areas of Concern (AOC);
- No poles will be placed in-water;
- Some trees may be removed in the AOCs if they would interfere with the transmission line;
- Tree removal in the AOCs would be done manually using chainsaws or by feller-bunchers reaching into the AOC to minimize the presence of heavy equipment;
- All other vegetation will be left remaining in the AOC to limit the potential for soil disturbance and erosion;
- Erosion control measures such as straw bales or silt fencing could be used at or near AOCs if the other mitigation measures are not considered sufficient to prevent erosion and sedimentation;
- Access trails may be needed for equipment to access the crossing site from the existing road systems. Trail locations will be selected so as to limit the distance to the stream of other sensitive values. Potential types of crossings for equipment could include ice bridges, fords, temporary bridges or brush mats. Each of these would need to be appropriately permitted and fitted to the subject site.

11.4.1.8.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of this resource is *low*; the areas impacted are small and in some cases intermittent streams.

Geographic Extent of Effect

The geographic extent of this effect is *low*. The effect will only occur within the Project Area.

Duration and Frequency

Impacts as a result of this power line construction will only occur during construction, therefore this effect is *low*.

Irreversibility of Effect

This effect is considered *reversible* following the completion of the construction process.

Ecological or Social Context

Given the relative abundance of fish habitat in the Ivanhoe River the vulnerability of the ecological context to the impact of stream crossing construction is considered *low*.

Magnitude of Effect

The magnitude of the effect is *low*. The aquatic habitat is not likely to be impacted at a level to produce population scale impacts due to the stream crossings.

Probability of Effect

The probability of this effect is *low.*

Overall Significance

Since the value of the resource, the geographic extent and duration and frequency are all low, the overall significance of this effect is *Insignificant***.**

11.4.2 Fish Migration

The proposed Chute GS location is considered to restrict upstream fish passage due to the associated vertical drops in both the east and west channels (NRSI 2014).

The falls/rapids located approximately 7.5km upstream from the Groundhog River, are considered a complete barrier to upstream fish migration. Approximately 1.5km upstream of these rapids is a second significant set of falls/rapids that have also been identified to restrict upstream movement. A smaller set of rapids is situated approximately 14km upstream from this point and the base of Third Falls is located approximately 2.0km further upstream (NRSI 2014).

There are three falls at the proposed Third Falls facility location which represents the limit where upstream movement of fish species would begin into the Project Area. During the field assessment NRSI concluded that the Lower falls represents a significant barrier to upstream fish movement into the Third Falls facility area. Additionally that the middle falls represents a further barrier to upstream fish movement (NRSI 2014).

There will continue to be opportunities for fish including larvae drift to pass downstream either through the turbines or over the spillway at both locations (NRSI 2014).

No mitigations are required for fish migration as impacts are predicted to be negligible.

11.4.3 Fisheries

11.4.3.1 Impacts to Baitfish Population in the Project Area

The baitfish community within the Ivanhoe River consists of generalist species such as Longnose Dace, Blacknose Dace, Spottail Shiner and Johnny Darter that can tolerate a wide range of habitats and are common throughout Ontario. These species may be temporarily displaced during construction activities however, are not expected to be impacted at a population level (NRSI 2014).

No mitigation measures are required for the baitfish population, as impacts are considered negligible.

11.4.4 Fish Injury or Mortality

11.4.4.1 Impacts due to Blasting Activities

11.4.4.1.1 Potential Effect

Given the bedrock nature of the local topography and river bottom, in-water or near shore blasting is anticipated during construction. The use of explosives in or near water produces post detonation high-energy shock waves followed by a rapid decay to below ambient hydrostatic pressure. This pressure decay causes impacts on fish. The effects of sudden changes of hydrostatic pressure may result in trauma and death of fish (particularly those with swim bladders). Injuries sustained by fish include ruptured swim bladders and hemorrhaging in the colonic and pericardial cavities. Liver, kidney, spleen, or sinus venous injuries may also occur. Fish eggs and larvae may also be killed or damaged (NRSI 2014).

The use of explosives in and near fish habitat may also result in the physical and/or chemical alteration to that habitat such as sedimentation resulting from the explosive to cover spawning areas or reduce or eliminate bottom dwelling life forms that fish use for food (NRSI 2014). The impact to fish species as a result of blasting due to construction activities is significant.

11.4.4.1.2 Mitigation

Use of explosives will be controlled to minimize any such activity near fish habitats. Any such activity will need to follow the process outlined in the publication entitled “Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters” (Wright and Hopky 1998) (NRSI 2014). The following will also be required in accordance with DFO blasting guidelines:

- Restriction on instantaneous pressure increases in the open water. These restrictions influence the weight of explosive and how far it needs to be buried.

- Restrictions on types of explosives (e.g. no ammonium nitrate).
- Confined explosives are generally required as opposed to unconfined.
- MNR in-water timing window restrictions for construction for spring spawning fish species (typically April 1 to June 15) and fall spawning fish species (typically October 1 to May 31). Specific timing windows should be agreed to with the local MNR as part of the permitting process.

In addition the following mitigations specific to this Project will also apply:

- At The Chute GS location only spring spawners and their habitat were identified therefore in-water works should be restricted to outside the spring spawning timing window (April 1 to June 15);
- At the Third Falls GS location both spring and fall spawners and their habitat were identified therefore in-water works should be restricted to outside the spring (April 1 to June 15) and fall (October 1 to May 31) spawning timing windows;
- This means that in-water works, including blasting, should be limited to between June 15 and October 1 at Third Falls;
- use bubble curtains or blast mats to block shock waves and contain debris;
- use of smaller charges and staggering of blasts.

The significance of the residual impacts following implementation of the above mitigation measures are described below

11.4.4.1.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of fish species is *moderate* since some of these species are VECs. They also valued within the local community.

Geographic Extent of Effect

The geographic extent of this effect is *low*. Blasting will occur within the Project Area.

Duration and Frequency

The duration of this effect is *low*; blasting will only occur for a short time within the Construction period.

Irreversibility of Effect

This effect is *irreversible*.

Ecological or Social Context

Given the relative abundance of fish habitat in the Ivanhoe River the vulnerability of the ecological context to the impact of blasting is considered *low*.

Magnitude of Effect

The magnitude of this effect is *low*. Blasting activities would not likely result in a population level effect on fish species.

Probability of Effect

The probability of this effect is *moderate*.

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low; the overall significance of this effect is *Insignificant*.

11.4.5 Wetland Habitat

11.4.5.1 Impacts on Wetland Ecosites due to Inundation

Wetland communities provide several important functions including water filtration, habitat, shoreline protection, and recreational activities. Where power line or new road corridors could impact adjacent wetlands, a Rapid Assessment Technique was used to determine if the wetland is likely to be scored as a Provincially Significant Wetland (PSW). The results of the assessment are in the *Ivanhoe Baseline Environmental Conditions for Road and Transmission Line Options* in Appendix H.

11.4.5.1.1 Potential Effect for The Chute and Third Falls

Headpond creation at both facilities will transform 13.9 ha of wetland communities. The details of inundated areas can be found in the *Natural Environmental Characterization and Impact Assessment Report* (NRSI 2014) in Appendix H. Mineral Thicket Swamp and Open Water Marsh: Organic are wetland communities that will be impacted by a loss of 0.6ha and 6.1ha, respectively. Mineral Intermediate Conifer Swamp would be reduced by 5.9ha and Mineral Rich Conifer Swamp by 0.8 ha.. These habitats are represented on the landscape outside of the identified areas which means that habitat for wildlife is readily available outside this immediate area of loss. Additional loses of wetland

embayment areas and riparian habitat associated with tributaries may include habitats such as Moist, Course: Shrub (see *Natural Environmental Characterization and Impact Assessment Report* (NRSI 2014) in Appendix H).

Both the proposed access roads and the power line have been designed to avoid construction within wetland communities. In many instances, though mapping may show the power line crossing a wetland community, it will be possible to span the wetland community without any footprint within the wetland. The transmission corridor includes 22 ha of water and non-forested wetland. The new corridor section of the direct connection between the Third Falls and The Chute sites will cross one wetland area. Table 15 of the *Ivanhoe Baseline Environmental Conditions for Road and Transmission Line Options* (Northern Bioscience 2014) in Appendix H details the wetlands within or along the edge of proposed roads and transmission lines.

The potential impacts from construction activities and initial headpond filling on riverine and wetlands habitats are:

- Diversion of water into or out of the wetland;
- Loss of wetland vegetation along new road and transmission line;
- Compaction and rutting of peat during construction;
- Increases in invasive plant species; and
- Minor tree removal from wetlands.

11.4.5.1.2 Mitigation Measures for The Chute and Third Falls

- Impacts to wetland habitats resulting from project footprint and headpond filling can be reduced through the following mitigation measures:
- Minimize access and restrict construction vehicles to existing access routes and staging areas;
- Retain vegetation to the extent possible and clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared;
- Following the completion of construction, re-vegetated the areas cleared for construction purposes;
- Clearly comply with the requirements of all applicable permits and approvals, the Crown Forest Sustainability Act, and the Forest Operations and Silviculture Manual;
- Do not fell trees into the water and felltrees into the proposed site wherever possible;
- Utilize the existing right of way, to the extent practicable for transmission lines following existing roads;
- Where possible, place the power line on the side of the road opposite the wetland;
- Maintain the existing ditch channels to maintain the present water movement. Avoid making the ditches any deeper or wider;

- Restore and maintain low vegetation (low shrubs, graminoids) on the power line right of way;
- Use passive re-vegetation through the existing seed bank where possible;
- Replant trees (especially Black Spruce and Tamarack) where feasible;
- The use of machinery will be limited in and around watercourses and sensitive terrestrial areas;
- Use equipment and techniques to minimize compaction and rutting;
- Avoiding the use of invasive plant species for rehabilitation. Reed Canary Grass (*Phalaris arundinacea*) in particular should be avoided since it is highly invasive in northern Ontario wetlands; and
- Use Primary, secondary and tertiary roads as much as possible.

The significance of the residual impacts following implementation of the above mitigation measures are described below

11.4.5.1.3 Net Effects and Significance Assessment for The Chute and Third Falls

Construction activities including minor tree removal and alteration of terrestrial to aquatic environments during construction and the headpond filling will impact the riverine and wetland habitats.

Value of Resource

The value of riverine and wetland habitat in this portion of Ontario is *moderate***.** Wetland communities provide several important functions; however, wetlands are very common within this area.

Geographic Extent of Effect

The geographic extent is *low*. Construction activities such as tree removal and altering the wetland or riverine environment will only occur within the Project Area.

Duration and Frequency of Effect

Duration and frequency of effect is *high* as trees or other vegetation may need to be cleared through the operations phase to ensure no impact on the transmission line. Once the headpond is filled, that portion of the wetland will no longer function as a wetland.

Irreversibility of Effect

The effect is considered *irreversible*; however once tree removal is no longer required or the headponds are drained, the area will be able to regenerate.

Ecological or Social Context

Given the moderate amount of loss in these communities and the change in some habitat types, there is expected to be a *moderate* ecological impact on the environment as a result of this impact.

Magnitude of Effect

The magnitude of the effect is *low*. The small portions of existing wetlands will be altered into a fully aquatic environment. However, wetland communities may reemerge after the initial filling of the headpond. There will only be minor removal of trees where necessary from the wetland community, which will not reduce the overall scale of the wetland community.

Probability of Effect

The probability of tree removal within a wetland community and the inundation of wetland and riverine habitats are considered *high*.

Overall Significance

As the geographic extent and magnitude are both low, the overall significance of impacts to wetland and riverine habitats are anticipated to be *Insignificant.*

11.4.5.2 Impacts on Snapping Turtle Habitat due to Construction

No turtles were observed during 2013 surveys, although potential habitat is present in the Study Area. The Study Area is at the northern edge of the range of Snapping Turtle, a Species of Special Concern. This species habitat is therefore SWH (Northern Bioscience 2014).

11.4.5.2.1 Potential Effect

This habitat could be impacted by increased traffic on the site during the construction period, disturbance to nests along the road bed during nesting period and aquatic habitat disturbance due to water drawdowns for dust control. Traffic mortality would be the most significant impact related to turtles in the Study Area (Northern Bioscience 2014).

11.4.5.2.2 Mitigation

In order to mitigate the potential impacts to any Snapping Turtles that may be present in the Study Area the following are proposed during the active season (May 1 to Sep 30):

- Employee Training;

- Should Snapping Turtles be discovered in the Study Area, mitigation measures will be checked for application in specific instances with advice from biologists with experience with these species.
- No water drawdowns for dust control in suitable aquatic habitat;

11.4.5.2.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of Snapping Turtle is *high;* it is classified as special concern under the Ontario Endangered Species Act.

Geographic Extent of Effect

The geographic extent of this effect will be *low*. This effect will not influence areas outside of the Project Area.

Duration and Frequency

Impacts as a result of this effect will occur during construction. Some effects, particularly related to traffic impacts, have the potential to occur during operations; therefore this effect is *moderate***.**

Irreversibility of Effect

This effect is likely to be *reversible* following the completion of construction.

Ecological or Social Context

Given the relative abundance of aquatic habitat in the Project Area the vulnerability of the ecological context to turtles as a result of construction activities is considered *low*.

Magnitude of Effect

The magnitude of the effect is *low***.** The area is fragmented by roadways presently, only a small number of new roadways will be constructed. The marginal increase in traffic is not expected to produce a population level impact.

Probability of Effect

The probability of this effect is *low***.** Snapping Turtles have not been documented in the Project Area.

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low; the overall significance of this effect is *Insignificant.*

11.4.5.3 Impacts on Wetland Nesting Birds due to Road and Power Line Construction

11.4.5.3.1 Potential Effect

Several marsh and open fen nesting bird species at risk, including Black Tern, Yellow Rail, and Short-eared Owl occur in the surrounding area. Although these species were not observed in 2013, they are sparsely distributed in the boreal forest northeast of Lake Superior and suitable habitat is present in the Study Area. These birds have species-specific nesting habitat requirements, but all need relatively large marshes or graminoid fens (Northern Bioscience 2014).

The roads and power line encroaches on 27 large wetland complexes and numerous smaller wetland polygons (Northern Bioscience 2014). There is the potential that construction of the roadways and power line construction could result in loss of habitat, disturbance, disruption of breeding, and general habitat disturbance. This impact is expected to be significant.

11.4.5.3.2 Mitigation

- No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc) during the breeding bird period (May 15-July 31);
- Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey;
- No road construction in marsh habitat
- Where possible, keep roads at least 20 m from potential habitat
- Timing restrictions on road building
- Complete road construction and maintenance outside of the Breeding Bird window (May 15-July 31) to minimize noise disturbance
- Modify driver behaviour (warning signs, awareness training)
- Restrict speed (training, signs, speed control devices)
- No water drawdowns for dust control in suitable wetland habitat
- Dust control using only water (no chemical agents) within 150 m of suitable habitat

11.4.5.3.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of wetland nesting birds is *high* as they are species at risk within Ontario and have protections under the Ontario Endangered Species Act.

Geographic Extent of Effect

The geographic extent of this impact is *low*. The effect will occur within the Project Area.

Duration and Frequency

Some impacts as a result of road and power line construction will continue into operations, therefore this impact is *moderate*.

Irreversibility of Effect

This impact is considered *reversible* following the completion of construction.

Ecological or Social Context

Given the relative abundance of wetland habitat in the Project Area the vulnerability of the ecological context as a result of the construction is considered *low.*

Magnitude of Effect

The magnitude of this effect is *low*. The construction of the roads and power line is unlikely to result in a population level effect.

Probability of Effect

The probability of this effect is *moderate*.

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low; the overall significance of this effect is *Insignificant***.**

11.4.6 Shoreline Dependent Species

11.4.6.1 Impacts on Otters due to Headpond Filling and Construction

11.4.6.1.1 Potential Effects

Evidence of otters was documented at the Nova Road Bridge, 8km upstream of the proposed Third Falls GS (NRSI 2014). Impacts of hydroelectric development on otter denning are largely unknown in published literature. It is believed that if water levels change drastically during initial inundation in a short period of time, otters may be trapped or flooded out. This may force individuals to seek refuge on land where the risk of predation by species such as wolves is increased. Large drawdowns in water can leave den entrances exposed and vulnerable to predators. Additionally, it has been suggested that otters are fairly vulnerable to changes in the aquatic food base. As such, the inundation area may affect prey populations including molluscs, fish and frogs. A decrease in prey populations may result in the abandonment of their den sites or force them to travel more on land where they are further exposed to predation (NRSI 2014).

Any existing dens located within the first 5.5 km upstream of the proposed Third Falls GS would be flooded during headpond filling as the water level is proposed to increase by 1.8m to 2.8m. Upstream of the 5.5 km mark, existing dens may be sufficiently elevated to not be affected by an increase in the water level (NRSI 2014).

11.4.6.1.2 Mitigation

Impacts to terrestrial and wetland habitats and associated wildlife within the GS footprints and inundation zones can be mitigated through adherence to measures such as the following:

- The area should not be initially filled during the winter or ice-over period as this could cause direct mortality by drowning mammals in their dens;
- proper construction sequencing and operations;
- Restrict construction vehicles to existing access routes and staging areas
- Retain vegetation to the extent possible

Additionally where land becomes permanently inundated, new shoreline areas will be established that may provide denning habitat after construction of the GS.

11.4.6.1.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of Otters is *high* in the area as their habitat is SWH and protected under the PPS.

Geographic Extent of Effect

The geographic extent of the effect is *low*. The impact will be limited to the Project Area.

Duration and Frequency

The impact will be limited to the construction period and the initial filling of the headpond, therefore the impact is *low*.

Irreversibility of Effect

This effect is considered *reversible* following the completion of construction.

Ecological or Social Context

Given the relative abundance of aquatic habitat in the Ivanhoe River the vulnerability of the ecological context to construction is considered *low*.

Magnitude of Effect

There magnitude of this effect is *low*. Otters are highly mobile, and any potential effects would not likely result in a population level effect on the species.

Probability of Effect

The probability of this effect is *moderate*.

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low and reversible; the overall significance of this effect is *Insignificant*.

11.4.7 Significant Natural Heritage Features & Areas

11.4.7.1 Impacts on Marsh Breeding Bird Habitat due to Construction

11.4.7.1.1 Potential Effect

Mineral Thicket Swamp (B134S) and Open Water Marsh: Organic (B152) are two wetland communities that provide candidate SWH for Marsh Breeding Birds. These wetlands will see a total loss of 0.6ha and 6.1ha resulting in a net loss within the communities of 13% and 17% respectively. Impacts to candidate Marsh Breeding Birds are minimal and predicted to be negligible based on wetland communities present within the surrounding landscape.

Additional loses of wetland embayment areas and riparian habitat associated with tributaries may include habitats such as Moist, Course: Shrub (B063). These habitats provide potential SWH for marsh breeding birds. Approximately 23.5ha of this habitat will be lost due to inundation. This habitat is expected to experience an increase in water depth of approximately 1m, resulting in the loss of a large portion of wetland vegetation. However, it is predicted that over time, other wetland communities would establish and potentially provide additional open water communities with submergent wetland plants (NRSI 2014).

11.4.7.1.2 Mitigation

Some mitigation can be employed to reduce the impacts in these areas:

- No clearing of vegetation in complex habitats (forests, thickets, wetlands, etc) during the breeding bird period (May 15-July 31);
- Clearing work in simple habitats (hedgerows and existing structures) during breeding bird period (May 15-July 31) may occur with the provision that nest searches are conducted and any nests found are protected with suitable buffers until the young have fledged. Where no nests are found the vegetation must be removed within 48hrs of the nest survey;
- Restrict construction vehicles to existing access routes and staging areas;
- Minimize access;
- Retain vegetation to the extent possible;
- During clearing, trees be felled into the proposed site wherever possible;
- Clearing comply with the requirements of all applicable permits and approvals, the Crown Forest Sustainability Act, and the Forest Operations and Silviculture Manual;
- Trees not be felled into the water;
- Wildlife trees, culturally modified trees and other significant trees be marked for protection; marked trees will only be removed if they are safety concerns that cannot be addressed in other practical ways;
- Brush should be disposed of by burning or chipping, with a preference for chipping wherever practical. When burning is carried out, it will be under permit with the MNR and according to the Forest Fires Prevention Act;
- Clearly delineating the area for clearing/grubbing to ensure that only required areas are cleared.

11.4.7.1.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of this resource is *high* as it is a significant wildlife habitat.

Geographic Extent of Effect

The geographic extent of this effect is *low*. It will only effect areas within the Project Area.

Duration and Frequency

This effect will last the duration of the construction period, therefore the effect is *low*.

Irreversibility of Effect

This effect is considered *reversible*.

Ecological or Social Context

Given the relative abundance of habitat in the Project Area, the vulnerability of the ecological context to the impact due to construction is considered *low*.

Magnitude of Effect

There will be a *low* magnitude due to this effect. Losses in this habitat will be low.

Probability of Effect

The probability of this effect is *high*.

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low and reversible; the overall significance of this effect is *Insignificant*.

11.4.7.2 Impacts on Amphibian Breeding Habitat Due to Construction

11.4.7.2.1 Potential effect

Mineral Intermediate Conifer Swamp (B223) and Mineral Rich Conifer Swamp (B224), along with the above mentioned wetlands (B134 and B152) have been identified as candidate Amphibian Breeding Habitat. Wetland losses due to inundation upstream of the Third Falls GS for B223 and B224 are 5.9ha and 0.8ha, respectively. These losses represent a net loss of 8.7% and 20% of the ELC polygons, respectively. In addition, amphibian breeding habitat is readily available outside this immediate area of habitat loss (NRSI 2014).

Additional loses of wetland embayment areas and riparian habitat associated with tributaries may include habitats such as Moist, Course: Shrub (B063). These habitats provide potential SWH for

amphibian breeding. Approximately 23.5ha of this habitat will be lost due to inundation. This habitat is expected to experience an increase in water depth of approximately 1m, resulting in the loss of a large portion of wetland vegetation. However, it is predicted that over time, other wetland communities would establish and potentially provide additional open water communities with submergent wetland plants (NRSI 2014).

No mitigations are required for this habitat as the impact is considered *Insignificant*.

11.5 Air, Noise & Vibration

The following sections use the existing air quality and noise and vibration levels of the Study Area to determine construction related impacts on the concentration of particulate matter, combustion gases, transient users of the area, sensitive receptors such as residences and potential noise and vibration receptors.

11.5.1 Air Quality

Impacts to air quality during the construction period could result from the following operations:

- Removal of vegetation, exposing loose soils to wind erosion;
- Building of access and construction roads within and to the Project site;
- Vehicle and equipment operation and travel;
- Rock crushing, drilling or blasting activities,
- Material handling and storage activities, and
- Burning of vegetation waste.

Potential effects to air quality originating from these construction activities include:

- Increases in PM released to atmosphere due to fugitive emissions from wind erosion, material handling activities and unpaved roads,
- Increases in NO_2, SO_2, CO, TRS, and O_3 resulting from the use of internal combustion engines, and
- Increases in air pollutants from the burning of vegetation (non-merchantable timber and slash).

The following report sections provide further discussion on these effects, mitigation measures and net effects including the significance of these net effects.

11.5.1.1 Increases to Fine Particulate Matter (PM)

11.5.1.1.1 Potential Effects for The Chute and Third Falls

Deposition of Fine Particulate Matter (PM), if occurring at high concentrations could impact vegetation along access roads and the immediate Project Area Project Area by covering plant leaves, blocking photosynthesis. Similarly waterbodies in close proximity to the Project Area could become subjected to elevated concentrations of PM resulting in deposition of matter covering aquatic habitat or increasing suspended solids within the water impacting the respiration of aquatic species.

In effort to provide a wholesome discussion of the potential effects from construction related activities on the concentration of PM, the size fraction commonly used by the MOE (particulate matter with a diameter of 2.5 microns (PM2.5 µm) or less) is expanded to include larger size fractions which may become airborne and carried by air currents away from the source. Concentrations of PM2.5 are considered to be respirable particles and can travel deep into the lungs. Examples of PM2.5 may include smoke particles, fine dust or pollen. Coarser fractions of PM greater than 2.5 µm) have impacts related to deposition onto vegetation surfaces and waterbodies potentially effecting the growth and health of these systems.

The potential for increases to PM within the Project Area will be greatest during the initial site preparation phase of the Project when roads are being constructed, aggregate is being crushed, blasted or drilled and vegetation is being removed from work areas. During this period PM will be released to atmosphere through wind erosion, vehicular traffic, and material handling activities. Emissions of PM during the remaining construction phases of the Project will be less and associated with the construction of the dam site, powerhouse, operation of a concrete batch plant and equipment travelling across unpaved roads.

The nearest permanent residence to the Study Area is more than 3 km away from the Project location and is not expected to be impacted by increases in PM based upon the separation distance and scope of construction activities.

Transient users within the Study Area may include recreational activities (canoeing, hiking, etc.) or commercial activities such as trapping or mining prospecting. These users could be temporarily impacted by increases to PM primarily along the path of access roads resulting from fugitive road dust emissions. These impacts are expected to be minor due to the short-term nature of the activities which will subside with the passing of the construction vehicle and the short-term nature (travel through the area) of the recreational use in the immediate area.

11.5.1.1.2 Mitigation Measures

The potential impacts discussed above can be effectively mitigated through the use of well-established construction best management practices. The Ontario Waterpower Association document entitled "*Best Management Practices Guide for the Mitigation of Impacts of Water Power Facility Construction*" (Version 1 June 2012) will be used as a guideline during construction planning. Mitigation measures to be employed during construction will include:

- Use of dust suppressant on unpaved construction and access roads (Ontario Waterpower Best Management Practice BMP037). Dust suppressants other than water may be used, subject to their described use within the guidance document referenced in this section;
- Use of a hard coarse granular material on access roads (such as Granular A type material) to limit the quantities of fine particulate available for suspension from vehicle travel;
- Disturbed areas will be re-vegetated as soon as practical to reduce the potential for wind erosion;
- The surface of material stockpiles will be stabilized through the use of a tarp, natural cover or wetting agent to reduce the potential for wind erosion;
- Avoid material handling and earth moving activities during windy conditions to minimize particulate emissions, and
- Aggregate and soils delivered to and taken away from the site will employ tarps to prevent blowing particulate.

Mitigation of PM associated with rock crushing or the operation of a small concrete batch plant will include a combination of design and operational controls. The location of the equipment will be situated in an area away from waterbodies and sensitive areas of vegetation in an area partially shielded from the prevailing wind direction either through natural topography or barrier.

During construction activities adherence to Best Management Practices will be audited by a site inspector. The scope of the audit will also include an assessment of the effectiveness of the mitigation measures and recommendations for adaptive management if required.

11.5.1.1.3 Net Effects and Significance of Net Effects

Value of the Resource Affected

Maintaining good air quality is considered a *high* valued resource related to human and environmental health.

Geographic Extent of Effect

The geographic extent is considered to be *moderate*. Use of mitigation measures is predicted to limit the extent of impacts associated with PM to less than 1 km from the work area.

Duration and Frequency

The duration and frequency of elevated levels of PM beyond the work area are considered to be *low*. PM will be released for short durations from construction activities followed by periods of inactivity. The combined effect of several factors including multiple construction activities occurring simultaneously combined with windy conditions leading to the generation of fugitive particulate emissions, would occur on an infrequent basis during the construction period.

Irreversibility of Effect

Impacts related to PM are considered *reversible*. Upon completion of the activity the generation of PM will subside. Mitigation measures will further limit the potential for on-going emissions through the establishment of vegetation on disturbed areas and measures to prevent wind-blown fugitive emissions.

Ecological or Social Context

Excellent air quality is widely available in and near to the Project Area. Therefore, the vulnerability of the ecological context to the impact is considered *low*.

Magnitude of Effect

The magnitude of the effect is considered to be *moderate*. Increases in PM are predicted to be contained to the areas adjacent to the construction activity and are not predicted to exceed provincial air quality criteria beyond the immediate work area.

Probability of Effect

The probability of effects occurring outside of the immediate construction area is considered *high*.

Overall Significance

Overall effects related to PM are considered to be an *Insignificant Effect*. This assessment is based upon the magnitude of effect, duration and frequency as well as ecological and social context.

11.5.1.2 Increases to Air Pollutants from Internal Combustion Engines

11.5.1.2.1 Potential Effects for The Chute and Third Falls

Throughout the construction phase of the Project, vehicles and equipment will be utilized at the Project locations ranging from heavy duty diesel earth moving equipment to portable gasoline powered electric generators. The primary emissions from the equipment will consist of NO_2 and CO. Emissions of SO_2, TRS, O_3 and PM will also occur but at quantities and concentrations less than the primary contaminants and are not predicted to impact air quality in the Study Area.(ORTECH, 2012) For this reason the remaining discussion focuses on impacts associated with the primary contaminants, specifically NO_2 and CO.

Impacts to air quality from internal combustion engines are predicted to be relatively constant throughout the construction period. Initially site preparation activities will generate emissions from earth moving and haul equipment as roads are being constructed and vegetation is being removed. Emissions from internal combustion engines for the remaining construction phase of the Project will be originate from equipment used for construction of the dam site and powerhouse. Personal light duty construction vehicles and portable generators will also be present and operating throughout the construction period.

Emissions from internal combustion engines consisting of NO_2 and CO can have negative impacts on human health and vegetation if not properly maintained.

11.5.1.2.2 Mitigation Measures

All construction equipment used on site will be inspected prior to arriving on site to ensure standard emission controls are properly functioning. Routine vehicle maintenance and inspection will occur throughout the construction phase of the Project to ensure emission control equipment is maintained. Employment of these mitigation measures is expected to effectively prevent adverse impacts related to emissions from internal combustion engines.

11.5.1.2.3 Net Effects and Significance of Net Effects

Value of the Resource Affected

Maintaining good air quality is considered a *high* valued resource related to human and environmental health.

Geographic Extent of Effect

The geographic extent is considered to be *moderate*. Use of mitigation measures is expected to limit the extent of impacts associated with emissions to less than 1 km from the work area.

Duration and Frequency

The duration and frequency of elevated levels of emissions beyond the work area are considered to be *low*. Combustion emissions from equipment will conform to US EPA Tier 4 vehicle emission standards. The combined effect of several pieces of equipment operating simultaneously within a small area combined with stagnant meteorological conditions leading to elevated concentrations of emissions, would occur on an infrequent basis during the construction period.

Irreversibility of Effect

Impacts related to emissions are considered *reversible*. Upon completion of the activity the generation of the emissions will be sporadic and minimal consisting of a few light duty vehicles at any given time.

Ecological or Social Context

Excellent air quality is widely available in and near to the Project Area. Therefore, the vulnerability of the ecological context to the impact is considered *low*.

Magnitude of Effect

The magnitude of the effect is considered to be *moderate*. Increases in emissions are anticipated to be contained to the areas adjacent to the construction activity and are not expected to exceed provincial air quality criteria (MOE, 2011) beyond the work area.

Probability of Effect

The probability of effect occurring during construction area is considered *low* due to the size and nature of equipment being employed. The probability of increased emissions is considered high, although emissions of this magnitude are not expected to result in negative effects.

Overall Significance

Overall effects related to emissions are considered to be an *Insignificant Effect*. This assessment is based upon the magnitude of effect, duration and frequency as well as ecological and social context.

11.5.1.3 Increases to Air Pollutants from Burning of Vegetation

11.5.1.3.1 Potential Effects for The Chute and Third Falls

During the construction phase of the headponds, vegetation will be removed from areas to be inundated. Non-merchantable timber and slash will be chipped on site and removed. A portion of this material is expected not to be suitable for chipping and will be arranged into temporary piles for controlled burn. Burning of vegetation piles will be conducted in accordance with an MNR burn permit. No other wastes including municipal, domestic or construction wastes will be burned.

Impacts to the air quality index rating from vegetation burning could occur in the adjacent areas to the construction site based upon the size of the pile to be burnt and meteorological conditions at the time.

11.5.1.3.2 Mitigation Measures

In accordance with the burn permit, setback distances from waterbodies will be employed to prevent deposition and surface runoff from entering waterbodies. A Fire Plan will be created outlining the procedures, equipment and methods used during the combustion of vegetation. Impacts to air quality can be further mitigated by controlling the size of vegetation material burnt at one time as well as the meteorological conditions under which the activity is conducted.

11.5.1.3.3 Net Effects and Significance of Net Effects

Value of the Resource Affected

Maintaining good air quality is considered a *high* valued resource related to human and environmental health.

Geographic Extent of Effect

The geographic extent is considered to be *moderate*. Use of mitigation measures is expected to limit the extent of impacts associated with emissions to less than 1 km.

Duration and Frequency

The duration and frequency of elevated levels of emissions beyond the work area are considered to be *low*. The activity would occur only infrequently lasting several hours.

Irreversibility of Effect

Impacts related to emissions are considered *reversible*. Upon completion of the activity the generation of the emissions from burning will be minimal.

Ecological or Social Context

Excellent air quality is widely available in and near to the Project Area. Therefore, the vulnerability of the ecological context to the impact is considered *low*.

Magnitude of Effect

The magnitude of the effect is considered to be *moderate*. Increases in emissions are anticipated to be contained to the areas adjacent to the construction activity and are not expected to exceed provincial air quality criteria (MOE, 2011) beyond the work area.

Probability of Effect

The probability of effects occurring outside of the immediate construction area is considered *low*.

Overall Significance

Overall effects related to emissions are considered to be an *Insignificant Effect*. This assessment is based upon the magnitude of effect, duration and frequency as well as ecological and social context.

11.5.2 Noise & Vibration

11.5.2.1 Increases to the Existing Acoustic Environment Within the Study Area

11.5.2.1.1 Potential Effects for The Chute and Third Falls

An increase to the existing acoustic environment within the Study Area is anticipated to occur during the construction period resulting from operation of construction equipment, blasting, crushing and material handling activities. Personal protective hearing equipment may be required by on-site personnel during specific construction activities.

Increases in vibration within the Project are anticipated to occur during blasting operations with limited potential for impacts to civil structures in the area.

The nearest permanent residence to the Study Area is more than 3 km away from the Project location and is not expected to be adversely impacted by increases in sound levels originating from the Project. The MOE primary noise screening for stationary sources of sound provides for a 1 km setback distance beyond which adverse impacts are not predicted to occur. Similarly vibration impacts are not expected to occur at this distance from the Project Area.

Transient users within the Study Area may include recreational activities (canoeing, hiking, etc.) or commercial activities such as trapping or mining prospecting. These users could be temporarily

impacted by increases in sound levels, through the loss of enjoyment while in adjacent areas to the construction activity. Restriction of recreational use may be required during such operations as blasting of rock as an added measure of safety.

11.5.2.1.2 Mitigation Measures

Mitigation measures to protect permanent residents of the area are not required based upon the above discussion.

Mitigation measures to protect transient users within adjacent areas to the construction site will include:

- To the extent practicable, schedule blasting operations during periods of lower recreational use;
- Blasting operations will conform to MOE Publication NPC-119 "Blasting";
- Post signage along access routes to the Project Area, such as the portage route, informing users of activities and potential hazards; and
- Ensure construction equipment is in proper working order to minimize noise emissions.

11.5.2.1.3 Net Effects and Significance of Net Effects

Value of the Resource Affected

Maintaining desirable sound levels is considered a *high* valued resource related to provincial guidelines for noise and vibration.

Magnitude of Effect

The magnitude of the effect is considered to be *moderate*. Increases in sound emissions are expected to be contained to the areas adjacent to the construction activity and are not expected to exceed provincial noise guidelines 1 km beyond the work area.

Geographic Extent of Effect

The geographic extent is considered to be *moderate*. Use of mitigation measures is anticipated to limit the extent of impacts associated with emissions to less than 1 km from the work area.

Duration and Frequency

The duration and frequency of elevated levels of sound emissions beyond 500m of the work area are considered to be *low*. The timing of activities will be limited to daytime hours and no impacts to evening or nighttime hours are expected.

Irreversibility of Effect

Impacts related to sound emissions are considered *reversible*. Upon completion of the activity the generation of the sound level emissions will resemble ambient conditions.

Ecological or Social Context

Given the large contiguous natural area surrounding Project construction activities and the low number of receptors at the site at any one time, the vulnerability of the local context to noise impacts is considered *low*.

Probability of Effect

The probability of effects occurring are *high* for the construction area and *low* beyond 1 km of the construction area.

Overall Significance

Overall effects related to noise and vibration is considered to be an *Insignificant Effect*. This assessment is based upon the magnitude of effect, reversibility as well as ecological and social context.

11.6 Land

11.6.1 Existing Land Use or Resource Management Plans

No impacts are anticipated to existing Land Use or Resource Management Plans. No construction impacts are anticipated to existing mining or aggregate extraction activities; potential construction impacts to forestry activities in relation to vegetation clearing have been addressed through consultation with the SFL holders, EACOM and Tembec (see Section 17.2.3).

11.6.2 Site Access

11.6.2.1 Existing Bridges

11.6.2.1.1 Oates Bridge

Western site access to The Chute Facility is off the Oates Roads just past the Oates Bridge**.** The Oates Bridge on the Oates Roads is located approximately 1.9 km upstream of The Chute Facility. The location is presented in Figure 3.

Potential Effects

Construction activities may inadvertently damage the Oates Road bridge, located approximately 1.9km upstream of the Facility location.

Mitigation

Xeneca commits to maintaining the operability of the Oates Road Bridge. Consultation and negotiation is ongoing with EACOM, and an agreement acceptable to both sides will be reached prior to completion of permitting and approvals.

11.6.2.1.2 Nova Bridge

Potential Effects

Construction activities may affect the function or longevity of the bridge on Nova Road, located approximately 10.9km upstream of the Facility location.

Mitigation

Xeneca commits to maintaining the operability of the Nova Road Bridge. Consultation and negotiation is ongoing with Tembec, and an agreement acceptable to both sides will be reached prior to completion of permitting and approvals.

11.6.3 Riparian Rights & Privileges

There are no riparian rights or private landowners within the Project Area. Therefore, there are no impacts to consider.

11.6.4 Angling & Hunting

11.6.4.1 Hunting

11.6.4.1.1 Potential Effects

Game species have large territorial ranges and though they do have regular interaction with aquatic habitats (for water, consumption of aquatic species, and cooling), they tend to use different habitats at different times of the year and move around to find the best food and cover available to them. Xeneca's construction activities are not expected to have a significant impact on hunting activities, since hunters are able to target these species in other locations near the Project Area. Furthermore, the surrounding forest is large (>100ha in size) and contiguous, which signifies that similar habitat is abundant in the surrounding area (Source: NRSI Environmental Baseline report). Thus, it is anticipated that there will be minimal impacts to hunting as a result of the Ivanhoe Project.

11.6.4.1.2 Mitigation

Xeneca commits to maintaining current public access and navigation to the area; restriction such as fences and gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). These minimal restrictions should ensure both that game populations do not change, and that hunters have the same number of opportunities to engage in successful hunting activities.

Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Hunting is an important activity that is highly valued, both among local residents and tourists to the area. The importance of this resource is *high*.

Geographic Extent of Effect

The geographic extent is anticipated to be very *low*, as it will be limited to the areas immediately surrounding construction areas.

Duration and Frequency

Any impact during construction due to construction activities will be restricted to the construction period, and therefore *low*.

Irreversibility of Effect

Construction impacts to hunting are *reversible* following the construction period.

Ecological or Social Context

As there exist many hunting opportunities in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on hunting from the Ivanhoe Project is anticipated to be *low*.

Probability of Effect

The likelihood of a detectible impact is very *low*.

Magnitude of the Effect

The magnitude of the effect is anticipated to be very *low*.

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low; the impacts of these residual effects are anticipated to be *Insignificant*.

11.6.4.2 Fishing

11.6.4.2.1 Potential Effects

Waterpower facilities have the potential affect either the ability of anglers to access fishing sites, through reduced waterway access, or reduce the success of fishing through affecting the local populations of popular fish species. Reduced access in the winter may affect ice-fishing. Potential impacts to fish from the Project are addressed elsewhere (see Sections 11.4 and 12.4). Here we will consider potential impacts to fishing as a result of reduced access to fishing sites.

Access may be affected during construction through restrictions placed on land or water around construction areas.

11.6.4.2.2 Mitigation

Xeneca has committed to operational constraints during the spring spawning period in order to ensure natural flow conditions during this period (spring and fall for Brook Trout). This will also avoid construction impacts for ice-fishing.

Furthermore, Xeneca will work with the recreational fishing community, tourism operators and other interested parties to ensure impacts to fisheries are kept at a minimum level, access to fishing areas is not impeded, improvements to access the fishery are facilitated and impacts to habitat are minimized. Should economic impact on commercial interests result from the Project, Xeneca will enter into discussions on avoidance, mitigation and /or compensation.

Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Fishing is important both to the local community, and to tourists to the area, and is considered *high*.

Geographic Extent of Effect

The geographic extent of any impact to local fish populations may extend beyond the direct Project Area, and could be considered moderate. However, restrictions on construction timing to accommodate local fish species' life cycles and operational mitigations to ensure low fish mortality should ensure that the geographic extent of any impact is *low*, and restricted to the immediate area surrounding the Project facilities.

Duration and Frequency

Construction impacts, where they occur, will be limited to the duration of construction, and will be *low*.

Irreversibility of Effect

Construction impacts are *reversible* following the construction period.

Ecological or Social Context

As there exist many fishing opportunities in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on fishing from the Ivanhoe Project is anticipated to be *low*.

Probability of Effect

Impacts to fishing access or impacts to local fish populations at The Chute and Third Falls are considered to be very unlikely or *low*.

Magnitude of the Effect

The magnitude of the impact is anticipated to be very *low*, as mitigation measures as described above should ensure that impacts to local fish species and access are kept minimal.

Overall Significance

Since the duration and frequency, ecological context and magnitude of the effect are all low and reversible; the construction impacts to fishing are anticipated to be *Insignificant*.

11.6.5 Trapping & Baitfishing

11.6.5.1 Potential Impacts

Construction may reduce access to trapline or baitfishing sites, through restrictions placed around active construction areas. This impact will be geographically and temporally quite limited. One trapline holder operates near the Third Falls location, on the east side of the river. Xeneca is consulting with this trapline holder to create a business-to-business agreement at their request. The primary value identified by the trapline license holder is access to Third Falls and the use of the Ivanhoe River downstream from Third Falls for transportation and access. Since access to Third Falls won't be restricted and downstream flows will be run-of-river, no impact to these values and activities are expected.

11.6.6 Views and Aesthetics

11.6.6.1 Potential Effects for The Chute and Third Falls

The construction of two new hydroelectric facilities will alter the visual appearance of this part of the river, and alter the pristine character of the Third Falls Facility location. As well, inundation of upstream areas of the Ivanhoe River will change the viewscape over the longterm from a riverine to a lacustrine landscape. This impact will be perceived differently by different recreational users of the river. Construction of access roads at Third Falls may also be considered a visual intrusion into the landscape, although one that has a side effect the opening up of that landscape to additional recreational users.

11.6.6.2 Mitigation

Xeneca has undertaken extensive planning and consultation with the local community in order to plan a Project that is minimally visually intrusive and retains as many of the existing aesthetic features as possible. Renaturalization of cleared areas along roadways will be undertaken wherever possible, in consultation with the local MNR office to determine suitable species and take any fire safety concerns into account.

11.6.6.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The value of the current appearance of The Chute and Third Falls locations to local residents is *moderate*.

Geographic Extent of Effect

The geographic extent of the construction impacts to aesthetics will be *low*, as it is limited to the immediate area surrounding construction activities.

Duration and Frequency

The duration of the impact is *low*, and will be limited to the construction period

Ecological or Social Context

As there exist large tracts of undisturbed views in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on views and aesthetics from the Ivanhoe Project is anticipated to be *low*.

Irreversibility of Effect

Construction impacts are *reversible* following the construction period.

Magnitude of the Effect

The magnitude of construction impacts on the existing environment is *moderate*

Probability of Effect

The likelihood of the impact is *high*; visual alteration as a result of the Project is unavoidable.

Overall Significance

Since the geographic extent, ecological context and duration and frequency of the effect are all low and reversible; the impacts of these residual effects are anticipated to be *Insignificant*.

11.6.7 Navigation

11.6.7.1 Potential Impacts

As the Ivanhoe River is a recognized canoe route, the construction of a hydroelectric Facility may impede the movement of canoes, kayaks, and other small craft on the waterway.

11.6.7.2 Mitigation

Xeneca commits to maintaining current public access and navigation to the area; restrictions such as gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). Some portion of the river will remain navigable through construction.

Impacts to portage routes are not anticipated to affect navigability, so mitigation measures are not proposed. However, if impacts to portage routes affect the navigability of the river post-construction, the proponent will enter into negotiations with the MNR to reroute the portage routes.

11.6.7.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The navigability of this route is considered to be of *moderate* importance.

Geographic Extent of Effect

The geographic extent of the construction impact is *low*.

Duration and Frequency

The duration of construction impacts is limited to the construction period, and is *low.*

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period.

Ecological or Social Context

As the Ivanhoe River is broad, and portage routes already exist where required, vulnerability to impacts to navigation from the Ivanhoe Project are anticipated to be *moderate*.

Probability of Effect

The likelihood of impact is *high*.

Magnitude of the Effect

The magnitude of the impact will be *low*.

Overall Significance

Since the geographic extent, duration and frequency and magnitude of the effect are all low and reversible; the residual impacts of construction on navigation are anticipated to be *Insignificant*.

11.6.8 Existing Water Management Plans

Alterations to the existing Water Management Plan, if required, will be carried out under a separate process through the MNR. No impacts to the existing WMP will result from the Ivanhoe Project as the operations of other existing facilities in the watershed will not be modified at all.

11.6.9 Protected Areas

Please refer to Figure 1 for a map showing the protected areas in relation to the Ivanhoe Project Area.

11.6.9.1 Northern Claybelt Forest Complex Conservation Reserve

11.6.9.1.1 Potential Effects

The Conservation Reserve is less than 100m downstream of proposed construction activities. Construction has the potential to increase sedimentation and erosion (see Section 11.1.4) or contamination through spills (see Section 14), which may cause significant negative impacts to the Northern Claybelt Forest Complex Conservation Reserve.

11.6.9.1.2 Mitigation

See Section 11.1.4 on Sedimentation and Erosion and Section 14.1 on Spills for a full description of mitigation measures to be taken for these potential impacts.

11.6.9.1.3 Net Effects and Significance of Net Effects

Value/Importance of the Resource Affected

The Northern Claybelt Forest Complex Conservation Reserve is considered very important to the local community and agencies. Its value is therefore *high*.

Geographic Extent of Effect

The geographic extent will be *low*, and limited to the area immediately surrounding and downstream of construction activities.

Duration and Frequency

The duration of construction impacts will be very *low*.

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period

Ecological or Social Context

Given the rarity of the features being preserved in Northern Claybelt Forest Complex Conservation Reserve, the vulnerability to impacts is considered *high*.

Magnitude of the Effect

The magnitude of the impact is considered to be *low*, with the application of all mitigation measures.

Probability of Effect

The likelihood of impacts is *low*, given that operations will be modified to eliminate impacts.

Overall Significance

Since the geographic extent, duration and frequency, and magnitude of the effect are all low and reversible; the construction impacts to the Conservation Reserve are anticipated to be *Insignificant.*

11.6.9.2 Nova Township Clay Plain Peatland Conservation Reserve

11.6.9.2.1 Potential Effects

The Nova Township Clay Plain Peatland Conservation Reserve exists 135m from a planned power line between The Chute and Third Falls. Given this distance, no impacts to the Conservation Reserve are anticipated.

11.6.9.3 Groundhog River Provincial Park

11.6.9.3.1 Potential Effects

The Groundhog River Provincial Park would be crossed by a planned power line between The Chute and Third Falls.

The Park's Management Plan states that the purpose of this waterway park is to protect access to high-quality recreational activities on the Groundhog River. Construction activities to occur near or within the Park will have no impact on recreational access or use of the River, and therefore, no impacts are anticipated.

11.6.9.3.2 Mitigation

Best Management Practices will be employed to prevent any potential impacts, such as erosion and root compaction, from affecting this feature.

11.6.9.3.3 Net Effects and Significance of Net Effects

Value/Importance of the Resource Affected

The Groundhog River Provincial Park is considered moderately important to the local community and agencies. Its value is therefore *moderate*.

Geographic Extent of Effect

The geographic extent will be *low*, as only the power corridor will be affected.

Duration and Frequency

The duration of impacts will be very *low*.

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period

Ecological or Social Context

The Groundhog River Provincial Park exists primarily to protect water-based recreational experiences, which the construction activities for the Ivanhoe Project are anticipated to have no impacts on. Therefore, the fragility of this park to expected impacts is *low*.

Probability of Effect

The likelihood of impacts is *low*, given park's purpose of protecting water-based recreational activities and the construction activities to actually take place at the park.

Magnitude of the Effect

The magnitude of the impact is considered to be *low*, given that the Park's purpose is to protect recreational activities on the Groundhog River, and the construction activities to take place at the Park are not anticipated to affect recreational access or use in any way.

Overall Significance

Since the geographic extent, ecological context and magnitude of the effect are all low; the construction impacts to the Groundhog River Provincial Park are anticipated to be *Insignificant*.

11.6.9.4 Vimy Lake Uplands Conservation Reserve

11.6.9.4.1 Potential Effects

The Vimy Lake Uplands Conservation Reserve is approximately 25m from a planned power line between The Chute and Third Falls. No construction activities will take place within the Conservation Reserve. Given the nature of the construction activities (installing poles and stringing lines between them), no impacts are anticipated to occur to the Conservation Reserve

11.6.10 Recreational Land Use

11.6.10.1 Camping

Crown land camping is allowed throughout Northern Ontario, although non-residents do require a permit.

11.6.10.1.1 The Chute

Potential Effects

Some impact to site availability at this more popular camping location may occur during construction, when areas are fenced off to protect public health and safety. The site may be considered less desirable by campers due to changes in the visual and auditory environment; however, noise from the equipment will be largely masked by the noise of the river and waterfall itself. Visual impacts are considered in the Views and Aesthetics section.

Mitigation

Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.

Net Effects and Significance of Net Effects

Value/Importance of the Resource Affected

The Chute is a popular local camping spot, and is considered important to the local community. Its value is therefore *high*.

Geographic Extent of Effect

The geographic extent will be restricted to the areas immediately surrounding construction activities or any Project infrastructure with the potential to harm human health or safety, and is therefore *low*.

Duration and Frequency

The duration of construction impacts will be very *low*, and limited to the construction period. These will not recur.

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period

Ecological or Social Context

Many camping spots exist in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on camping from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of the impact is considered to be very *low*, as only limited portions of the site will be restricted.

Probability of Effect

During construction, the likelihood of such impacts is considered *moderate*.

Overall Significance

Since the geographic extent, ecological or social context and magnitude of the effect are all low; the impacts of these residual construction impacts to camping are anticipated to be *Insignificant.*

11.6.10.1.2 Third Falls

Potential Effects

The Third Falls Facility location is infrequently used by campers currently, if at all. Impacts to site availability may occur during construction, and some potential sites may be permanently restricted for health and safety reasons.

Mitigation

Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.

Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The value of the resource as it currently exists, given low use levels, is considered *low*.

Geographic Extent of Effect

The geographic extent of impacts will be restricted to the area immediately surrounding construction and Project infrastructure, and is considered *low*.

Duration and Frequency

Construction impacts will be short-term and will not recur, and would be *low*.

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period.

Ecological or Social Context

As there exist many camping spots in natural areas in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on camping from the Ivanhoe Project is anticipated to be *low*.

Probability of Effect

The likelihood of impacts is anticipated to be *low*.

Magnitude of the Effect

The magnitude of all impacts is anticipated to be *low*, as the site is so infrequently used at present that any further restriction would be difficult to detect against background levels.

Overall Significance

Since the geographic extent, ecological or social context and magnitude of the effect are all low; the impacts of these residual construction impacts to camping are anticipated to be *Insignificant.*

11.6.10.2 Canoeing/Kayaking/Boating

11.6.10.2.1 The Chute

Potential Effects

In-water construction and any terrestrial construction taking place on or adjacent to existing portage trails has the potential to affect enjoyment and use of this amenity by local canoers and kayakers.

An existing boat launch will be inaccessible during construction.

Mitigation

Xeneca will to make some modest design and location improvements to the boat launch amenity, based on stakeholder input, though prior approval is required by the MNR and other regulatory agencies. Restrictions to access will only be placed where necessary to protect public health and safety.

Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Both the boat launch and the navigability of the river for local canoers and kayakers have *high* value for the local community and tourists to the area.

Geographic Extent of Effect

The geographic extent of the impacts will be limited to the areas immediately surrounding construction, and is therefore *low*.

Duration and Frequency

Construction impacts will be limited to the construction period, and will not recur, and are therefore *low*.

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period

Ecological or Social Context

As many navigable water bodies exist in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on canoeing and kayaking from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of the impacts is anticipated to be *moderate*, as no impacts are anticipated to occur which would preclude canoeing or kayaking on any stretch of the river that is currently navigable.

Probability of Effect

Some impact to the boat launch and local portage routes is considered to be very likely or *high*.

Overall Significance

Since the geographic extent, and ecological or social context of the effect are all low and reversible; the impacts of these residual construction impacts to Canoeing/Kayaking/Boating are anticipated to be *Insignificant*.

11.6.10.2.2 Third Falls

Potential Effects

In-water construction and any terrestrial construction taking place on or adjacent to existing portage trails has the potential to affect enjoyment and use of this amenity by local canoers and kayakers.

Mitigation

If any launching areas or portage routes are impacted by the Ivanhoe Project, new landing areas or docking facilities may be built. No mitigation is considered necessary for portage routes at this time; however, they will be re-routed should this become necessary during operations.

Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Access to the canoe and portage routes is important to the local community, and is considered *moderate*.

Geographic Extent of Effect

The geographic extent of construction impacts is considered *low*.

Duration and Frequency

Construction impacts to access will be restricted to the construction period, and is considered *low*.

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period

Ecological or Social Context

As there exist many navigable water bodies in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on canoeing and kayaking from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The impact the navigability of this portion of the Ivanhoe river due to the Ivanhoe Project is considered *low*; some access will be restricted during construction, but the site is anticipated to be fully accessible throughout operations.

Probability of Effect

The likelihood of impacts restricting the accessibility of the site to canoes and kayaks is *low*.

Overall Significance

Since the geographic extent, and ecological or social context of the effect are all low and reversible; the impacts of these residual construction impacts to Canoeing/Kayaking/Boating are anticipated to be *Insignificant*.

11.6.10.3 Snowmobiling Trails

Potential Effects

Some temporary and very localized restrictions to access may result during Project construction.

Mitigation

None proposed.

Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Snowmobiling and snowmobiling trails are of *low* importance.

Geographic Extent of Effect

The geographic extent of the impact is anticipated to be highly localized, and therefore *low*.

Duration and Frequency

The duration of the impact is considered to be very *low*, as it would only occur during winter at active construction sites.

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period

Ecological or Social Context

As there exists an extensive natural area to enjoy snowmobiling in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on snowmobiling from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of any impact is anticipated to be *negligible*.

Probability of Effect

The impact is considered to be very unlikely or *low*.

Overall Significance

Since the geographic extent, and ecological or social context of the effect are all low and reversible; the impacts of these residual construction impacts to snowmobiling trails anticipated to be *Insignificant.*

11.6.10.4 Hiking and ATV Trails

11.6.10.4.1 The Chute

Potential Effects

During construction, access to hiking trails may be limited to protect public health and safety.

Mitigation

Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.

Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The trails are of *moderate* importance to the local community and tourists to the area.

Geographic Extent of Effect

The geographic extent will be limited to the area immediately surrounding construction activities and Project infrastructure, and is considered to be *low*.

Duration and Frequency

Construction impacts will be limited to the construction period and will not recur, and is considered *low*.

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period.

Ecological or Social Context

As there exists a large, natural geographic area appropriate for hiking surrounding the Project, the vulnerability of the social context to impacts on hiking from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of the impact is anticipated to be *low*.

Probability of Effect

There is a *moderate* likelihood of some disruption to trail access during construction.

Overall Significance

Since the geographic extent, and ecological or social context of the effect are all low and reversible; the impacts of these residual effects are anticipated to be *Insignificant* during construction.

11.6.10.4.2 Third Falls

Potential Effects

During construction, access to hiking trails may be limited to protect public health and safety.

Mitigation

Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.

Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The value of this resource to the local community and tourists, given the inaccessibility of the site currently, is considered *low*.

Geographic Extent of Effect

The geographic extent of impacts will be limited to the area immediately surrounding construction activities, or operational areas restricted permanently to protect public health and safety, and is therefore considered *low.*

Duration and Frequency

The duration of construction impacts will be limited to the construction period and will not recur, and would be considered very *low*.

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period.

Ecological or Social Context

As there exists a large, natural geographic area appropriate for hiking surrounding the Project, the vulnerability of the social context to impacts on hiking from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of impacts will be *negligible*.

Probability of Effect

The likelihood of impacts is anticipated to be *low*.

Overall Significance

Since the geographic extent, and ecological or social context of the effect are all low and reversible; the impacts of these residual effects are anticipated to be *negligible* during construction.

11.6.10.5 Traffic

Chapleau MNR deployed Trafx units near the Ivanhoe Project sites to monitor vehicle traffic along road and trails between May 5th 2012 and August 19th 2012. It was found that, on average, The Chute Project site was visited by two (2) to three (3) vehicles per day along the roads and trails through May and August 2012. In contrast, the Third Falls site was used heavily, with an average of 35 vehicles per day, during the 12th May to 21st May 2012 with low to no usage through to August.

Potential Effects

Due to construction vehicle traffic, access to roads by local residents or recreational users may be affected. However, given the low volume of construction vehicles and the relatively short construction period at each site, these impacts are considered to be very limited in duration and geographic extent, and not significant.

Mitigation Measures

Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.

Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The importance of road access in the vicinity of the Project location is considered *moderate*.

Geographic Extent of Effect

The geographic extent of impacts will be *moderate*, extending somewhat into areas surrounding the Project location.

Duration and Frequency

Duration of impacts is limited to the construction period, and will not recur. It therefore is considered *low*.

Irreversibility of Effect

The impacts are completely *reversible*.

Ecological or Social Context

As there are few roads already in existence in the surrounding vicinity, vulnerability to the impacts to traffic from the Ivanhoe Project is anticipated to be *high*.

Magnitude of the Effect

The magnitude of impacts is anticipated to be *low*, given the low volume of construction traffic expected.

Probability of Effect

The likelihood of some impacts is *moderate*.

Overall Significance

Since the duration and frequency and magnitude of the effect are low and reversible; the impacts of these residual effects to traffic during construction are anticipated to be *Insignificant*.

11.7 Social & Economic

11.7.1 Locations of People, Businesses, Institutions & Public Facilities

No people, businesses, institutions or public facilities reside within or near to the Project Area, nor are any anticipated to be affected by the Project.

11.7.2 Community Character, Enjoyment of Property and Amenities

No local communities or properties exist within or near to the Ivanhoe Project Area. All amenities relate to natural, recreation and tourism values, and are discussed elsewhere.

11.7.3 Employment

As described above, Foleyet and Chapleau are small communities that have experienced significant population and economic decline along with the decline of the mining and forestry industries in Northern Ontario. The City of Timmins has a more diversified economic base that supports a more stable population than Foleyet, although it too has struggled in recent times. Employment and economic stability are major concerns for the local community (see Section 9.7).

11.7.3.1 Potential Impacts

The economic impact of the Ivanhoe Project is expected to be positive. With an initial capital construction cost of $10.5 million, the project represents a significant socio-economic benefit to the local community of approximately $5.25 million at the construction phase. However, there is the possibility that this potential will not be realized if employees or services are hired from outside of the local area.

11.7.3.2 Mitigation

Xeneca commits to hiring trades and services in the area of the Project, and obtaining support services such as accommodation and construction equipment locally wherever feasible. No other mitigation is considered necessary.

11.7.3.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The economy is considered very important to the local community, and therefore has *high* value.

Geographical Extent

The geographical extent may include nearby communities, and is therefore considered *moderate*.

11.7.3.3.2 Duration and Frequency

The positive economic impact of additional construction employment will be restricted to the construction period, and is therefore *low*.

11.7.3.3.3 Irreversibility of Effect

The impact is *irreversible*.

11.7.3.3.4 Ecological or Social Context

Given the condition of the local economy and employment market, the vulnerability of the system to changes in employment levels is considered *high*.

11.7.3.3.5 Magnitude of the Effect

The magnitude of the impact is *moderate* during construction.

11.7.3.3.6 Probability of Effect

The impact is highly likely or *high*.

11.7.3.3.7 Overall Significance

The Project is anticipated to result in a *moderately significant, positive* residual impact.

11.7.4 Access

11.7.4.1 The Chute

11.7.4.1.1 Potential Effects

As The Chute is already largely accessible due to an existing logging road, the construction of the Ivanhoe Project is not anticipated to either increase or decrease access to the site significantly.

11.7.4.1.2 Mitigation

Access will only be restricted on land or water when and where required for public safety. These restrictions will be posted on signs.

11.7.4.1.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The value of the resource is considered *moderate* to local recreational users.

Geographic Extent of Effect

The geographic extent is very localized, constrained to the immediately surrounding area of the access road extension and any in-water hydro works. The impact is therefore considered *low*.

Duration and Frequency

The impact during construction will be very brief and will not recur, so is *low*.

Irreversibility of Effect

Construction impacts are *reversible* following the construction period.

Ecological or Social Context

As there are few roads already in existence in the surrounding vicinity, vulnerability to the impacts to traffic from the Ivanhoe Project is anticipated to be *high*.

Magnitude of the Effect

The impact to access during construction will be *low*, as users will be warned of any access restrictions through the use of signage, and construction areas will generally be easy to avoid or move around.

Probability of Effect

The likelihood of the impact is *high*, during both construction, as areas will definitely be restricted from time to time in order to protect human health and safety.

Overall Significance

Since the geographic extent, and duration and frequency of the effect are all low and reversible; the impacts of these residual effects are anticipated to be *Insignificant*.

11.7.4.2 Third Falls

11.7.4.2.1 Potential Effects

Some parts of the site may be inaccessible during construction due to safety concerns. The construction of a new access road to the Third Falls will increase recreational access to the site for more users. However, water access immediately around the dam and powerhouse will be limited for public safety. As well, increased road traffic, particularly construction vehicles, may disrupt remote areas.

11.7.4.2.2 Mitigation

Access will only be restricted on land or water when and where required for public safety. These restrictions will be posted on signs. No mitigation is considered necessary for increase in access due to the construction of new roads.

11.7.4.2.3 Net Effects and Significance of Net Effects

Value/Importance of the Resource Affected

Current use is fairly low so the value of the access to the Third Falls location is *moderate*.

Geographic Extent of Effect

The geographic extent of all impacts is *low*, as it is limited to the immediately surrounding area of the new access road and hydro Facility.

Duration and Frequency

The duration of any limitation to access at the Third Falls site during construction is very *low*, and will not recur.

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period

Ecological or Social Context

As there are few roads already in existence in the surrounding vicinity, vulnerability to the impacts to traffic from the Ivanhoe Project is anticipated to be *high*.

Magnitude of the Effect

The magnitude of limited access is *low*, as only limited portions of the waterway or nearby areas will be restricted.

The positive impact of increased access to the Third Falls location is considered *moderate*.

Probability of Effect

The likelihood of access impacts during construction is *high*, as it is certain that some areas will be restricted for health and safety reasons, and equally certain that the road will be constructed.

Overall Significance

Since the geographic extent, and duration and frequency of the effect are all low and reversible; the impacts of these residual effects are anticipated to be *Insignificant*.

11.7.5 Public Health and Safety

Construction of the proposed The Chute and Third Falls facilities on Ivanhoe River poses potential public health and safety concerns related to accidents, dam failure, worker health and safety, and dust.

11.7.5.1 Accidents

Please see Section 14.1.1, Accidents and Malfunctions.

11.7.5.2 Spills

Please see Section 14.1.2, Accidents and Malfunctions.

11.7.5.3 Fires and Fire Safety

Please see Section 14.1.3, Accidents and Malfunctions.

11.7.5.4 Waste and Waste Management

11.7.5.4.1 Potential Effects

Construction of the Ivanhoe Project will general wastes, including wood, concrete, brush and petroleum hydrocarbons.

11.7.5.4.2 Mitigation

Local waste management companies have been identified to deal with construction-related wastes; these are described in the CMP. They will identify waste management facilities with the capacity to accept construction wastes, and transportation of the wastes to this facility will be incorporated into the Project's transportation planning. Any hazardous wastes generated will be sent to a licensed hazardous waste facility. The Project proponent will discuss any wood waste created with the local SFL holder.

11.7.5.4.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Given the plentiful availability of clean soils, surface waters and groundwater in the Project Study Area, the value of soils, surface waters and groundwater present on-site is *moderate*.

Geographic Extent of Effect

The geographic extent of the impact would be limited to the immediate vicinity of the construction activity generating the waste, and so is very *low*.

Duration and Frequency

The duration and frequency of any impact resulting from waste management for the Ivanhoe Project, following the application of mitigation measures and best management practices, is anticipated to be very *low*.

Irreversibility of Effect

Such impacts would be *reversible*, but may require rehabilitation of the ecosystem in questions (for example, removing affected soils).

Ecological or Social Context

Given the rarity of appropriate waste management facilities in this part of the province, the fragility of the resource to potential construction impacts is anticipated to be *moderate*.

Magnitude of the Effect

With the application of all mitigation measures and best management practices, the magnitude of any impact from wastes generated by construction of the Ivanhoe Project is anticipated to be *low*.

Probability of Effect

The likelihood of impacts to soils, surface water or groundwater from waste generation is *low*.

Overall Significance

Since the geographic extent, magnitude, and duration and frequency of the effect are all low and reversible; the impacts of these residual effects are anticipated to be *Insignificant*.

11.7.5.5 Water Supply

11.7.5.5.1 Potential Effects

The operation of a hydroelectric facility has the potential to cause problems with downstream drinking water supplies, or upstream drinking water supplies where the impoundment affects the hydrology of the drinking water intake. In the case of the Ivanhoe project, the nearest drinking water intake is 6.4 km upstream of the maximum inundation extent. No impact is expected.

As well, wastewater discharges can be affected if the pipes are located within a hydroelectric facility's Zone of Influence (ZOI). The nearest wastewater treatment plant is located approximately 20 km upstream of the project; no impact is expected.

11.7.5.6 Worker Safety

11.7.5.6.1 Potential Effects

Equipment malfunctions or other adverse events during construction may affect worker health and safety.

11.7.5.6.2 Mitigation

Worker safety at the site would be ensured via strict adherence to Ministry of Labour occupational health and safety regulations pertaining to construction sites. First aid equipment will be maintained on site throughout the construction period and workers will be trained to deal with emergency situations.

11.7.5.6.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Worker safety is of very *high* importance.

Geographic Extent of Effect

The geographic extent is very localized, as it is restricted to the immediate vicinity of construction activities. The extent is therefore *low*.

Duration and Frequency

The duration is *low*, as it is restricted to the construction period; and the frequency of accidents affecting worker health or safety following the application of mitigation measures is anticipated to be very *low*.

Irreversibility of Effect

Any impact to worker health or safety has the potential to be *irreversible*.

Ecological or Social Context

Vulnerability to the impacts on worker safety from the Ivanhoe Project is anticipated to be *high*.

Magnitude of the Effect

The magnitude of an impact to worker health or safety has the potential to be high to the individual worker(s) in question; however, the broader magnitude of such impacts would be *low*.

Probability of Effect

The likelihood of such an accident, following the application of all mitigation measures and best management practices for worksite safety, is *low*.

Overall Significance

Since the geographic extent, magnitude, and duration and frequency of the effect are all low; the impacts of these residual impacts to workers during construction are anticipated to be *Insignificant*.

A more comprehensive public health and safety assessment will occur during the detailed design stage and will address all further concerns and issues.

11.7.5.7 Dust

11.7.5.7.1 Potential Effects

Dust can result during construction activities, particularly from vegetation removal, grading, or stockpiling of soils and fill. This has the potential to affect air quality in the vicinity of construction activities.

11.7.5.7.2 Mitigation

All stockpiled materials will be covered appropriately throughout construction, and wetted down as appropriate. Exposed soils will also be wetted down during construction prior to any revegetation. Exposed soils will be revegetated using native plants as soon as possible following construction, in consultation with the MNR and will all due consideration given to fire safety measures.

11.7.5.7.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Given the very high quality of air present at this location currently, and the absence of any persistent pollution sources nearby, high air quality is considered to be abundant in this location and able to tolerate a fair amount of dust and minor localized air pollution before the quality becomes compromised enough to affect the health of any nearby receptors. Air quality is therefore of *moderate* importance.

Geographic Extent of Effect

The geographic extent of air quality impacts from dust would be limited to the immediate vicinity of active construction sites, or sites with soil stockpiles. The extent therefore is very *low*.

Duration and Frequency

The duration of impact would be limited to the construction period, and is *low*.

Irreversibility of Effect

All such impacts would be *reversible*, and would naturally attenuate in a short period of time.

Ecological or Social Context

Given the pristine quality of air existing in the vicinity of the Project, vulnerability to the impacts from dust resulting from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of any impact would be *low*.

Probability of Effect

Following the application of mitigation measures and best management practices, the likelihood of air quality issues resulting from construction of the Ivanhoe Project is very *low*.

Overall Significance

Since the geographic extent, magnitude, and duration and frequency of the effect are all low and reversible; the impacts of these residual effects during construction are anticipated to be *Insignificant*.

11.7.6 Local, Regional and Provincial Economies

11.7.6.1 Potential Impacts

The construction of a new hydro power project is not expected to have any negative effect on mining activities since mining companies are subject to a '400' surface rights reservation around all lakes and rivers (CLAIMaps). Provisions, within the *Mining Act*, like the reservation above, allow for the development of renewable energy (waterpower) on mining claims. Generally, waterpower and mining operations are compatible since they can share infrastructure (power lines/ roads) and waterpower operations provide a readily available source of reliable power. All permit holders for existing mining claims in the area have been contacted; to date, none have responded.

Similarly, due to ongoing consultation with the license holders for forestry operations in the area, no impact is anticipated to local logging operations.

Some temporary workers will move to the area during construction, which would increase demand for housing, food, and other local services. Additionally, the increased access to the Third Falls Facility site through the construction of new access roads may decrease business for local remote tourism

operators. However, as few such operators are present in this area, this impact is not expected to be significant.

11.7.6.2 Mitigation

Consultation will continue with local mining and forestry operators to ensure the Project is integrated into their business models and agreements regarding access to merchantable timber, for instance, are reached.

No mitigation is considered necessary for temporary workers nor for impacts to local remote tourism operators.

11.7.6.3 Net Effects and Significance of Net Effects

11.7.6.3.1 Value/Importance of the Resource Affected

The value of the economy to the local community is *high*.

11.7.6.3.2 Geographic Extent of Effect

Both effects are anticipated to be highly localized, and therefore a *low* impact.

11.7.6.3.3 Duration and Frequency

The positive economic effect of increased demand for local services during construction will be brief and will not recur, and is therefore *low*.

11.7.6.3.4 Irreversibility of Effect

The positive economic effect is *reversible*, and will return to normal or near-normal following construction.

11.7.6.3.5 Ecological or Social Context

Given the existing condition of the local economy and employment market, vulnerability to the impacts to the economy from the Ivanhoe Project is anticipated to be *high*.

11.7.6.3.6 Magnitude of Effect

The positive effect of the increase to demands and services for local businesses is anticipated to be *moderate*.

The negative impact to local remote tourism operators from increasing access to Third Falls is anticipated to be *low*.

11.7.6.3.7 Probability of Effect

The positive economic effect from greater demand for local services is highly likely or *high*.

11.7.6.3.8 Overall Significance

The overall significance of the residual effects is anticipated to be *Insignificant, but positive*.

11.7.7 Tourism Values

Impacts to existing tourist activities are described under Section 11.6, as all local tourism revolves around recreational use of the natural amenities there described.

Impacts to economic considerations of tourist activities are described in Section 11.7.

11.8 Heritage & Culture

11.8.1 Archaeological Sites

There are no known archaeological values requiring mitigation during construction.

11.8.2 Built Heritage

There are no known built heritage values requiring mitigation during construction.

11.8.3 Cultural Heritage Landscapes

11.8.3.1 Potential Impacts

11.8.3.1.1 Culturally Modified Trees

There is a concern that there may be culturally modified cedar trees present in the landscape that have not been identified and assessed during field work. Though this impact is anticipated to be low the proponent has made allowances for identification of CMTs during the clearing phases of construction. These trees may be encountered during clearing for Facility footprints, access road construction, or power line installation.

11.8.3.2 Mitigation

During construction workers will be trained in a *Discovery Protocol* developed by the construction contractor which will include instructions on what kinds of characteristics to look for in culturally modified trees. Should a tree with suitable characteristics be identified workers are to notify their supervisor and all reasonable efforts will be made to not disturb the tree. Identification and preservation of potential CMTs would be done in accordance with the MNRs publication *Forest Management Guide for Cultural Heritage Values (*CPL 2014).

It is understood that a cultural heritage assessment may be required prior to the removal of any suspected culturally modified tree.

11.8.3.3 Net Effects and Significance of Net Effects

11.8.3.3.1 Value of the Resource Affected

The importance of this resource is significant to the local aboriginal community.

11.8.3.3.2 Magnitude of Effect

Magnitude of effect due to un-surveyed culturally modified trees is considered to be *low*.

11.8.3.3.3 Geographic Extent of Effect

The geographic extent will be limited to only those areas that require clearing in the Project Area, largely the access roads and power line corridors therefore the effect is *low*.

11.8.3.3.4 Duration and Frequency

This impact will occur during the construction period, over a short period of time. The duration therefore is *low*.

11.8.3.3.5 Irreversibility of Effect

Accidental removal of a CMT is an *irreversible* effect. However, successfully implementing the mitigation methods described above would prevent CMTs from being accidentally removed.

11.8.3.3.6 Ecological or Social Context

Due to the rarity of Culturally Modified Trees and their importance to local Aboriginal Communities, the vulnerability of the ecological/social context to the impact is considered *high*.

11.8.3.3.7 Probability of Effect

There is a *low* probability of this effect occurring.

11.8.8.3.7 Overall Significance

There are no anticipated residual effects. It is anticipated that should the above mitigation method be employed the impact of this activity will be *Insignificant*.

11.8.8.4 The Chute

The Proponent has opted to employ mitigations for the naturally modified cedar tree located at The Chute due to its significance to Chapleau Cree First Nation; however the assessment discussed in section 9.8.3 found this feature to not be culturally modified. For details on these mitigations refer to Section 11.9

11.9 Aboriginal

Issues identified during Aboriginal Consultation are described in Section 17.4 (and summarized in Section 17.4.9). Many First Nation communities identified during the Class EA have elected not to participate in the consultation process until after the economic benefit agreements have been finalized. Where agreements are finalized or nearly so and consultation is underway, the discussion below reflects their communicated concerns. However, while Xeneca has worked hard to achieve this as quickly as possible and believes it to be imminent, in many cases, aboriginal communities have not yet communicated their issues or concerns. In this case, based on previous experience, issues and concerns were anticipated and included in the Potential Effects Identification Matrix, included in Section 7. How these issues and concerns have been addressed through the consultation process and future actions taken to resolve remaining issues are also described in the Matrix.

11.9.1 Aboriginal Communities and First Nation Reserves

11.9.1.1 Potential Impact

The Ivanhoe Project is located within an area covered under Treaty 9; however, the Facilities are not located on any First Nations reserve lands or lands allocated to any other aboriginal community. Definitive legal agreements are being negotiated and asserted rights to traditional hunting and harvesting will be maintained in treaty areas. Therefore, no impacts to aboriginal communities or First Nation reserves are anticipated to result from the Ivanhoe Project.

11.9.2 Sites of Aboriginal or Cultural Importance

Xeneca met with Chapleau Cree First Nation representatives on site in October 2012 to investigate the potential for Culturally Modified Trees (CMT). A potential CMT was identified on an island downstream of the proposed The Chute Facility. This tree is located outside of clearing areas, but will be clearly marked and shielded from flyrock during construction.

Four potential CMTs were also located in the Third Falls Facility area. These were determined not to be CMTs through field investigations, but they will be treated as significant due to Community Concerns.

A culturally significant stand of mature Eastern White Cedar was also identified by Chapleau Cree First Nation in the vicinity of the truck turnaround. Prior to commencement of construction activities, a registered professional forester will delineate the mature trees. The truck turnaround area may shift slightly to avoid removal of these mature cedars. The significant trees will be protected by fencing and barriers which will remain in place throughout the entire construction period. Use of heavy equipment in the area and the backing up of any heavy equipment will be done with caution in order to protect the canopy. In addition, areas to be cleared during construction will be minimized and clearly demarcated, and construction staff will be provided with training on identifying culturally modified trees.

Project construction may result in the removal of culturally significant eastern white cedar trees during clearing for the inundation area. An estimate of the number of mature cedar trees that may be removed was undertaken and reported to the CCFN during a community meeting. A protocol for their removal of cedar trees will be developed on consultation with the applicable SFL holder and interested Aboriginal Communities.

11.9.2.1 Culturally Significant White Cedars – The Chute

11.9.2.1.1 Potential Effects

First Nations are concerned that the construction of a new access road, upgrades to the existing access road and the construction of a new truck turn-around at The Chute could lead to the removal of the culturally significant White Cedars stands.

11.9.2.1.2 Mitigation

In order to minimize loss of the culturally significant white cedar in these stands, the proponent has opted to utilize the existing infrastructure on the site to the greatest extent possible, instead of constructing new facilities as originally intended. The existing road to the boat launch on the east side of the river, as well as the existing turning loop, will be upgraded and used for construction and

permanent site access. This will minimize the need to clear cedar trees, particularly in Stand 1, which contains older trees and is more densely populated with Cedars.

From Stand #1 and the turnaround area a new proposed spur road will extend south for approximately 142 m to the southern limit of Stand #2, and to the location of The Chute powerhouse. In order to minimize clearing in Stand #2, this road will be set back as far from the river edge as side slopes allow; however, site access will require a more clearing in this area. A clearing plan will be provided to the local First Nations prior to site construction (Appendix C, CPL 2014).

Significant trees will be clearly demarcated using flag tape for protection prior to commencement of construction activities. Demarcations will remain in place throughout the entire construction period. Use of heavy equipment in the area will be done with caution in order to protect the canopy. Once the required modifications to the existing access road and turnaround are complete, there will be no further storage, grading or site alteration within the cedar stand without consultation with local First Nations. The limits of clearing in this region will be flagged to demarcate and prohibit further vehicle access during the remainder of Project construction and commissioning (Appendix C, CPL 2014).

In stand #2, significant trees will also be clearly identified using flagging tape. Once construction areas are cleared and demarcated, tape will also be used on the northern section of the new 135 m access road to limit down slope access into the more mature stands of trees along the water's edge (except as necessary for cofferdam construction and tailrace access). This flagging will also prevent any unplanned use of this area for storage and prevent any site alteration during the remainder of the Project construction and commissioning periods (Appendix C, CPL 2014). At stand #2 young cedars will be planted, where possible, in order to mitigate the loss of those cedars removed during clearing activities (Appendix J, Northern Bioscience 2014).

All clearing of mature white cedar trees will take place in consultation with First Nations and EACOM, the SFL holder in this area.

11.9.2.1.3 Net Effects and Significance of Net Effects

Value of the Resource Affected

Due to its significance to the Chapleau Cree, the importance of the mature cedar trees is *high*.

Geographic Extent of Effect

Clearing and tree removal will be limited to only two locations in the Project Area; therefore, the geographic extent is considered *low*.

Duration and Frequency

The frequency and duration are *low*, as clearing will only occur for a short time during Project construction.

Ecological or Social Context

Given the size of the forest in which the clearing occurs, the vulnerability of the local environment to the impact of clearing the mature white cedars is considered *low*.

Irreversibility of Effect

The removal of the existing mature white cedars is *irreversible*.

Probability of Effect

The probability of clearing of some mature white cedar trees is *high*.

Magnitude of Effect

Due to the small number of trees being removed relative to the size of the stands, the magnitude of this effect is considered *low*.

Overall Significance

The geographic extent will be limited to only those areas that require clearing in the Project Area, largely the access roads and power line corridors and the magnitude is low therefore the overall significance of this effect is *Insignificant*.

11.9.2.2 Naturally Modified Tree – The Chute

11.9.2.2.1 Potential Effects

This naturally modified tree was originally thought to be a culturally modified tree, and is located in the vicinity of the tailrace on the island at The Chute Facility. There are concerns that construction activities could damage the tree.

11.9.2.2.2 Mitigation

Fencing will be erected outside of the tree dripline and with mechanical barriers which will be installed during initial construction activities, as access to the area allows. This protection will remain in place throughout the entire construction and commissioning period.

11.9.2.2.3 Net Effects and Significance of Net Effects

Value of the Resource Affected

Due to its significance to the Chapleau Cree First Nation, the importance of this feature is considered *high*.

Geographic Extent of Effect

The impact would be limited to one tree; therefore, the geographic extent is considered *low*.

Duration and Frequency

Construction impacts would be limited to the construction period; therefore, duration and frequency of the impact is considered *low*.

Ecological or Social Context

Given the size of the contiguous forest existing in and surrounding the Project Area, the vulnerability of the ecological context is considered *low*.

Irreversibility of Effect

If damage were to occur to the tree, it would be *irreversible*; however, no damage is anticipated to occur.

Magnitude of Effect

As the tree will be protected during construction, the magnitude of this effect is considered *low*.

Probability of Effect

The probability of impact is very *low*.

Overall Significance

Since the geographic extent, magnitude, and duration and frequency of the effect are all low; the impacts of these residual effects during construction are anticipated to be *Insignificant*.

11.9.3 Traditional Lands

11.9.3.1 Hunting, Harvesting and Foraging

11.9.3.1.1 Potential Effects

Hunting, harvesting, foraging and trapping activities may be disrupted by construction activities as access will be restricted around the Facility and associated infrastructure to address security and public safety. This access restriction is limited and there is abundant similar area available both upstream and downstream of the Project for these activities. Access will be maintained to the waterway and around the Facility (boat launch and portages).

Particular concerns may relate to impacts to waterfowl habitats; however, detailed biological field studies found no waterfowl habitats within the Project Area.

11.9.3.1.2 Mitigation

Xeneca commits to maintaining current public access and navigation to the area; restriction such as fences and gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). These minimal restrictions should ensure both that game and flora populations do not change, and that hunters have the same number of opportunities to engage in successful hunting, harvesting and foraging activities.

11.9.3.1.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Hunting, harvesting and foraging are important activities, therefore, the importance of this resource is *high*.

Geographic Extent of Effect

The geographic extent is anticipated to be very *low*, as it will be limited to the areas immediately surrounding construction areas.

Duration and Frequency

Any impact during construction due to construction activities will be restricted to the construction period, and therefore *low*.

Ecological or Social Context

As there exist many hunting opportunities in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on hunting from the Ivanhoe Project is anticipated to be *low*.

Irreversibility of Effect

Construction impacts are *reversible*, following the construction period

Magnitude of the Effect

The magnitude of the effect is anticipated to be very *low*.

Probability of Effect

The likelihood of a detectible impact is very *low*.

Overall Significance

Since the geographic extent, magnitude, and duration and frequency of the effect are all low and reversible; the impacts of these residual effects during construction are anticipated to be *Insignificant*.

11.9.3.2 Furbearing Mammals

11.9.3.2.1 Potential Effects

No impacts are anticipated to furbearing mammals from construction activities.

11.9.4 Employment

11.9.4.1 Potential Impacts

Employment impacts of the Ivanhoe Project for First Nations are expected to be positive, as a result of measures included in the confidential economic benefit agreements currently being finalized. Therefore, no mitigation measures are considered necessary.

11.9.5 Land Claims

11.9.5.1 Potential Impacts

The Project location is in an area where a land claim is on file between the Federal Crown and Nishnawbe Aski Nation which is the Grand Council of Treaty 9. An Agreement in Principle has been

reached but no final agreement has been settled. The Ivanhoe Project is not anticipated to have any impact on this process.

11.9.6 Economic Development

11.9.6.1 Potential Impacts

Economic development impacts of the Ivanhoe Project for First Nations are expected to be positive, as a result of measures included in the confidential economic benefit agreements currently being finalized, including a generous equity participation program. Therefore, no additional mitigation measures are considered necessary.

11.9.7 Other

11.9.7.1 Spirit/Movement of Water

11.9.7.1.1 Potential Effects

The construction of The Chute and Third Falls Facilities may affect the movement of the water within the Project Area. Specific impacts on water movement and flows are discussed in Section 11.2.2. It is anticipated that there is no change of water level and water flow in the upstream and downstream areas at each Facility.

11.9.7.2 Culturally Significant Medicinal Plants

Vegetation removal during construction of the Project may affect any culturally significant medicinal plants, such as sage and tobacco, which may be present in the Project Area. However, these plant species were not found during detailed field investigations. Please see Section 11.3.1 for a further description of construction impacts to flora communities in the Project Area.

11.9.7.3 Culturally Significant Animal Species

Construction activities may harass or disturb any culturally significant animal species present in the Project Area. Please see Section 11.3.2 for a complete description of construction impacts and mitigation measures for terrestrial wildlife. Transmission corridor planning was done so as to avoid important habitats and productive wetlands in order to minimize impacts on wildlife populations. As a result no population level effects are expected on wildlife as a result of any of these activities, and generally it is expected the impact to most wildlife will be low. No impacts are anticipated that would affect cultural or spiritual values within the Project Area.

11.9.7.4 Cedar, Ash, Birch, Tamarack and Spruce Trees

Vegetation clearing required during construction may require the clearing of culturally significant cedar, ash, birch, tamarack and/or spruce trees. Biological field inventories did find these species within the Project Area. Please see Section 11.3.1 for a full description of vegetation to be cleared during construction, and impacts and mitigation measures related to this activity. As the area to be cleared is small relative to the total available, no impacts to cultural or spiritual use of the area due to loss of culturally significant tree species is anticipated as a result of construction activities.

11.9.7.5 Significance of the Ivanhoe River

Some communities prefer natural to manmade materials in hydroelectric projects, and object to the use of concrete in water. Some concrete will need to be used in order to meet safety requirements; please see the Aboriginal Consultation Section 17.3 for a full description of communication with First Nations on this issue. The proponent has expressed a willingness to use natural materials where doing so is feasible.

11.9.7.6 Cultural Representations of Visual Landscapes

Construction of a hydroelectric project represents a visual change to the environment, and where the environment is culturally significant, this may represent an impact to First Nations. Please see Section 11.6.6 for a full description of construction impacts to Views and Aesthetics. Overall no significant impact to cultural representations of the landscape are anticipated to result from construction activities for the Ivanhoe Project.

11.10 Energy & Electricity Considerations

Construction of the Project will not impact existing or future waterpower facilities. Within the zone of influence there are neither existing waterpower facilities nor potential waterpower locations suitable for development.

11.10.1 Reliability and Security (Black Start)

During construction of the Project portable electrical generators will be required to support construction activities. The Project will not have black start capabilities.

11.10.2 Electricity Flow Patterns

During the initial construction period electricity demands will be met through use of portable electrical generators. After completion of the electrical distribution line site electrical needs for construction will be met through the distribution line system fed from the 115 kV substation..

As described in Section 4, 5 & 6 the project will be connected to Weston Lake TS via a 51km, 115kV power line which will connect to a 115kV substation located in the vicinity of The Chute GS (Figures 10-12). The Chute and Third Falls facility will connect to the 115kV substation via 69kV power lines. The connection line for The Chute will be very short, running from a 69kV step-up substation at the powerhouse, within the existing footprint to the 115kV substation. The Third Falls connection line will run from a step-up substation, approximately 26.9km to the 115kV substation.

12.0 OPERATIONAL IMPACTS AND MITIGATION

As described in Section 10, any activity with the potential to cause an effect must include the following information:

- The potential effect;
- The relative level of the effect;
- The mitigation or impact management measures that will be used;
- Any individual net effects (after mitigation) and their significance; and
- The overall positive, neutral and negative effects of the Project.

The following sections describe the operational impacts, the associated mitigation measures and the assessment of significance. The results of the technical investigations completed by the EA team members are provided in the Appendices which accompany this document. To aid the reader, the information presented in this section is summarized in Table 40.

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	

Table 40: Operational Impacts Summary Table

General Natural Environment Considerations														
12.5.2	Air Quality (including GHG Offsets)	Green house gas, specifically methane, could potentially be released by the facility due to decomposing organic material in the headponds	IE	• Reduce the amount of organic material available to decompose ; • Removal of trees with diameters of 0.05m and greater.	Yes	High	Low	Low	Irreversible	Low	Low	High	Insignificant (Positive)	None
12.5.3		Exhaust from onsite standby generator during operations has the potential to impact local air quality at the Project Site	IE	• Diesel back-up generators will be operated and maintained in conformance with manufacturers requirements; • Operator will be responsible for maintaining log of all maintenance activities and operation of equipment.	Yes	High	Low	Low	Reversible	Low	Low	Low	Insignificant	Routine equipment inspection and periodic maintenance.
12.5.4		Operational noise from turbine and associated equipment and operations may result in impacts to transient users in the Project Area	IE	• Securing the Facility powerhouse within a fenced area including locked doors and signage indicating potential for noise exposure hazards within the building;	Yes	High	Low	Low	Irreversible	Low	Low	Moderate	Insignificant	Routine equipment inspection and periodic maintenance.
12.2.3.1	Water Quality or Quantity (Surface Water)	Suspended solids could increase above baseline values resulting from shoreline erosion created by variability of flow and water levels within the zone of influence during operations	IE	Discussed as part of Section 12.1.4 Erosion, Soils and Sedimentation.	Yes	Moderate	Low	Moderate	Irreversible	Low	Moderate	Moderate	Insignificant	Refer to Section 12.1.4
12.2.3.2		Reduced dissolved oxygen levels in the headpond due to stratification, increased water temperature, altered flows and mixing downstream of the facilities during operations	SE	Water depths within the headponds generally preclude the formation of stratified flow. The establishment of stratified flow can lead to low dissolved oxygen concentrations in the lower portion of the water column.	Yes	High	Low	High	Irreversible	Low	Low	Low	Insignificant	A temperature profile with measurements taken every meter of depth will be conducted at the impoundment.
12.2.4		The potential increase of mercury and methyl mercury levels can be generated when the mercury contained soil is flooded into the river, and the increased water depth in the inundation area can enhance the methylation of mercury in surface water.	SE	• Rehabilitation at all construction areas will be monitored and maintained properly to minimize the potential soil erosion; • Removal of woody vegetation from the head ponds to decrease the amount of organic matter/carbon within the headpond areas which will decrease the import of potential mercury contained materials; and • Run-of-river operation for both facilities will occur when the natural river flow is greater than the maximum turbine capacity during spring thaw run-off conditions and during major storm events in the spring, summer and fall. It will also occur when natural flows are so low that any available water must be released downstream to protect the environment in late summer and late winter. The run-of-river operations reduce the	Yes	High	High	High	Reversible	Moderate	Moderate	Moderate	Insignificant	None

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	
				residence time within each head pond, and decrease the possibility of conversion of inorganic mercury.										
14.2.2		Accidental spill of lubricant oil, transformer oil and other hazardous substances may result in soil, surface and/or groundwater contamination during operations and maintenance	IE	• Secondary containment areas should be monitored throughout the operational period to ensure their integrity. • An oil-water separator should be installed in each powerhouse to contain oil in the event of an accidental spill within the powerhouse. • Only machinery/equipment that is clean and well maintained (e.g., no leaks) should operate in or near watercourses or drainage areas. No washing of equipment is to take place within or near watercourses. • Proper spill response equipment will be kept at the Facilities through operations, and all workers trained in their use. . • All workers will be trained in the Emergency Response Plan • Significant quantities of hazardous materials will not be stored on site. Any hazardous materials such as petroleum hydrocarbons or lubricants which must be stored on site, will be stored and managed in accordance with all applicable legislation and guidelines.	Yes	High	Low	Low	Reversible	Low	Low	Low	Insignificant	None
12.2.5.1	**Water Quality or Quantity (Ground Water)**	Elevated water levels in headponds may impact the groundwater table in the vicinity of headponds.	IE	Groundwater recharge areas originate from elevations significantly higher than the operating range of the headponds. Low heads (<10 m) of spillway dams and proper operating parameters selected to minimize the increased water level and daily fluctuation level in the headponds.	Yes	High	Moderate	High	Irreversible	Moderate	Low	High	Insignificant	None

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	
12.2.5.2		A potential groundwater quality effects will be generated from an accidental spill or leakage from the use of hydraulic fluids and cleaning detergent and the transfer and removal of transformer oils.	IE	• A spill control plan will include required secondary containment areas for any storage and use of the hydraulic fluid drums and cleaning detergent containers, adequate spill clean-up materials within the powerhouses, and spill control training to all staff. • The transformers will be enclosed by a secondary containment structure capable of holding the entire volume of transformer oil, as well as some additional volume. Secondary containment areas will be monitored throughout the operational phase to ensure the integrity.	Yes	High	Low	Low	Irreversible	Low	Low	Low	Insignificant	None
14.2.2		Accidental spill of lubricant oil, transformer oil and other hazardous substances may result in soil, surface and/or groundwater contamination during operations and maintenance	IE	• Secondary containment areas should be monitored throughout the operational period to ensure their integrity. • An oil-water separator should be installed in each powerhouse to contain oil in the event of an accidental spill within the powerhouse. • Only machinery/equipment that is clean and well maintained (e.g., no leaks) should operate in or near watercourses or drainage areas. No washing of equipment is to take place within or near watercourses. • Proper spill response equipment will be kept at the Facilities through operations, and all workers trained in their use. . • All workers will be trained in the Emergency Response Plan • Significant quantities of hazardous materials will not be stored on site. Any hazardous materials such as petroleum hydrocarbons or lubricants which must be stored on site, will be stored and managed in accordance with all applicable legislation and guidelines.	Yes	High	Low	Low	Reversible	Low	Low	Low	Insignificant	Secondary containment areas should be inspected regularly.
12.3.3.1	**Species at Risk and their Habitat**	Road and Power Line maintenance may impact Forest Nesting Canadian Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee and the Rusty Blackbird	IE	• Complete road and line maintenance outside of the breeding bird season (May 15-July 31) where possible to minimize noise disturbance; • Modify driver behavior (warning signs, awareness training); • Restrict speed (training, signs, speed control devices); and, • Restrict night use of roads, by staff and equipment, during the nesting season where possible	Yes	Moderate	Low	Moderate	Irreversible	Low	Low	Moderate	Insignificant	Workplace training should be completed annually

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	
12.3.3.2		Potential Mortality of Common Nighthawk due to Roadway Collisions	SE	• Speed limits of 50 km/hour will be applied on new roads to prevent collisions with Common Nighthawks during the nesting season (May 15 to July 31); • Warning signs; • All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife; • Limit night time use of road by staff and equipment.	Yes	High	Low	Moderate	Irreversible	Low	Low	High	Insignificant	Workplace training should be completed annually
12.3.5	**Significant Earth or Life Science Features**	No areas of significant Earth or Life Science Features were identified in the study area	NE	No mitigation required	No								Negligible	None
12.1.1	**Land Subject to Natural or Human Made Hazards**	Effect to bedrock geology as a result of Project operations	Unk	No mitigation required	No								Insignificant	None
12.1.2		Effect to terrain and topography as a result of Project operations	Unk	No mitigation required	No								Insignificant	None
12.1.3		The proposed headpond inundation and water level fluctuations during operations pose a potential risk for slope stability effects and soil erosion.	Low	• Operating levels were designed such that much of the shoreline for both headponds falls within the existing channel bed • Hydraulic modeling was carried out to demonstrate how water velocities will be decreased during operations decreasing erosion potential • Maximum daily operating fluctuations in The Chute headpond have been limited to 1 meter and within the stable channel bed for much of the headpond length. • Maximum daily operating fluctuations in Third Falls headpond have been limited to 0.25 meters and within the stable channel bed for much of the headpond length.	Yes	Moderate	Low	Moderate	Irreversible	Low	Moderate	Low	Insignificant	The Geomorphic Assessment (Appendix E) concluded that the Ivanhoe River channel is stable but there may be some bank locations the may become destabilized from operational activities. These banks are not anticipated to cause any net effects on erosion but should be monitored. In order to confirm the predictions made in the geomorphic assessment, erosion and sedimentation monitoring has been planned for 5 years and again in years 7 and 10 following the start of operations.

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	
12.3.2.1	**Terrestrial Wildlife**	Potential that large birds may be impacted by the operating 115kV transmission line	SE	• Use wooden poles instead of steel towers (which some species nest in) to reduce risk of electrocution;• Route selection to twin with existing corridors and avoid waterbodies and open wetlands that are attractive to waterfowl, eagles, ospreys, herons, and other large waterbirds;• Markers (e.g., marker cones and coloured spiral markers) will be used where appropriate to increase the visibility of the power lines where they cross the Ivanhoe River and other major rivers and other potential high bird traffic corridors (e.g. adjacent to wetlands) to reduce potential collisions by large birds flying along the rivers; • Suggested Practices outlined in APLIC (2006) will be used on the towers and lines near major rivers (or the whole power line if practical) to reduce the risk of electrocution of bald eagles and other birds, include a 150 cm (60 inch) standard of horizontal and vertical separation between energized and/or grounded parts on power line; and• Best management practices (e.g., avoiding use of shield wires, minimizing guy wires) will be used where possible to minimize the potential for collisions and electrocution.	Yes	Moderate/High	Low	Moderate	Irreversible	Low	Low	Low	Insignificant	Periodic inspection of line, inspection and as needed replacement of line markers.
12.3.2.2		Vegetation clearing during operations for the ROW may impact small mammals	IE	Direct effects from vegetation management using herbicides are expected to be negligible since mammals do not metabolize triclopyr and if ingested it is rapidly (e.g., 3 days) excreted unchanged	No								Insignificant	None
12.3.2.3		Breeding birds may be impacted by facility operations	IE	• Complete road and line maintenance outside of the breeding bird season (May 15-July 31) where possible to minimize noise disturbance; • Modify driver behavior (warning signs, awareness training); • Restrict speed (training, signs, speed control devices); and, • Restrict night use of roads, by staff and equipment, during the nesting season where possible	Yes	Moderate	Low	Moderate	Irreversible	Irreversible	Low	Moderate	Insignificant	Workplace training should be completed annually

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	
12.3.1	**Natural Vegetation and Terrestrial Habitat Linkages**	Terrestrial Vegetation may be impacted due to operations at The Chute and Third Falls	IE	Mitigation is not possible.	Yes	Moderate	Low	High	Irreversible	Low	Low	High	Insignificant	• Monitoring of vegetation will occur along the Ivanhoe River riverbanks and hydrologically connected wetlands within The Chute and Third Falls headponds. • Surveys for vegetation communities should consist of quadrat plot sampling using 1 m2 subplots located in reference to stations established using stakes. • These plots will be maintained at the same locations each survey year to assess changes in species composition, percent cover and in some instances, height. • The number of plots will vary depending on the size of the wetland and accessibility within the inundated portions of the wetland. • Monitoring of vegetation communities within the wetlands should coincide with the growing season which generally occurs within wetlands during the late spring and summer months. • It is recommended that one survey be conducted during the spring (June) and another be conducted during aquatic surveys in August.
12.1.4.3	**Soils and Sediment Quality**	Impacts on Sedimentation and Sediment Transport due to operations.	Low	The measures to minimize erosion include limiting the maximum daily fluctuations of upstream water levels and maintain daily water level fluctuations in the headponds to 1.0m at The Chute and 0.25 at Third Falls will limit the potential for sedimentation and sediment transport.	Yes	Moderate	Low	Moderate	Irreversible	Low	Moderate	Moderate	Insignificant	The Geomorphic Assessment (Appendix E) concluded that the Ivanhoe River channel is stable but there may be some bank locations the may become destabilized from operational activities. These banks are not anticipated to cause any net effects on erosion but should be monitored. In order to confirm the predictions made in the geomorphic assessment, erosion and sedimentation monitoring has been planned for 5 years and again in years 7 and 10 following the start of operations. Details of the monitoring plan can be found in Ivanhoe River Hydroelectric Projects The Chute and Third Falls Geomorphic Assessment, Addendum #1 – Monitoring Program, Appendix E.
12.3.4.1	**Significant Natural Heritage Features & Areas**	Moose Aquatic Feeding Area may be impacted due to inundation and headpond fluctuations during operations	IE	This impact to the adjacent upland forest communities is unavoidable, and mitigation is not expected to be required.	Yes	High	Low	High	Irreversible	Low	Low	High	Insignificant	Post construction monitoring will be planned in order to confirm that aquatic vegetation communities have re-established and that moose are continuing to use the area for feeding.
Aquatic and Riparian Ecosystem Considerations														

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	
12.4.6.1	**Shoreline Dependent Species**	Otters may be impacted by daily operations	IE	With the water level fluctuation restricted to 25cm in the Third Falls headpond, no impacts to otters or otter denning are anticipated	No								Negligible	Monitoring of river otter denning habitat will include presence/absence surveys in conjunction with all other field investigations. Extensive surveys for denning sites is not recommended as locating them can be very challenging (MNR 2012), however, any observed individuals will be followed, if possible, to their den site to confirm the location of river otter denning Significant Wildlife Habitat
12.4.5.1	**Wetland Dependent Species**	Wetland and Riverine habitats may be impacted during operations	SE	Re-naturalizing the water flows and levels results in no effect on the downstream terrestrial habitat.	No								Negligible	• Monitoring of vegetation will occur along the Ivanhoe River riverbanks and hydrologically connected wetlands within The Chute and Third Falls headponds. • Surveys for vegetation communities should consist of quadrat plot sampling using 1 m2 subplots located in reference to stations established using stakes. • These plots will be maintained at the same locations each survey year to assess changes in species composition, percent cover and in some instances, height. • The number of plots will vary depending on the size of the wetland and accessibility within the inundated portions of the wetland. • Monitoring of vegetation communities within the wetlands should coincide with the growing season which generally occurs within wetlands during the late spring and summer months. • It is recommended that one survey be conducted during the spring (June) and another be conducted during aquatic surveys in August.
12.4.5.2		Snapping turtles may be impacted by operational activities	IE	• Modify driver behaviour (warning signs, awareness training); • Employee Training; • Should Snapping Turtles be discovered in the Study Area, mitigation measures will be checked for application in specific instances with advice from biologists with experience with these species.	High	Low	Moderate	Irreversible	Low	Low	Low	Insignificant	Insignificant	Workplace training should be completed annually
12.4.5.3		Wetland nesting birds may be impacted by road maintenance	IE	• Complete road maintenance during non-breeding season (mid-August to early-May to minimize noise disturbance • Modify driver behaviour (warning signs, awareness training) • Restrict speed (training, signs, speed control devices • No water drawdowns for dust control in suitable wetland habitat • Dust control using only water (no chemical	High	Low	Low	Irreversible	Low	Low	Low	Moderate	Insignificant	Workplace training should be completed annually

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			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	
				agents) within 150 m of suitable habitat										
12.4.1.1	**Fish Habitat**	Northern Pike Spawning Habitat may be impacted by inundation at The Chute GS	SE	• The Facility will operate in run-of-river mode when temperatures reach 4oC in the spring and remain in this mode for thirty three days (following the end of Walleye spawning) to protect incubating eggs until fry are free swimming. This strategy for Walleye encompasses the period of Northern Pike spawning, and during these operations daily fluctuations in headpond water level would not occur. This strategy would also protect Northern Pike eggs from exposure and mitigate any effects.	Yes	Moderate	Low	Moderate	Irreversible	Low	Low	Moderate	Insignificant	Fish community sampling to obtain post construction CPUE and relative abundance to compare to pre-construction conditions and determine whether fish community and abundance have changed.Fish community sampling will be conducted in August following the RIN protocol with large RIN nets. A total of 61 nets will be set in the Ivanhoe River between 6.4km upstream of The Chutes to the crest of Third Falls. Eleven nets will be set upstream of The Chute, 40 nets will be set between The Chute and Third Falls and 10 nets will be set below Third Falls. This is to coincide with the number and locations of surveys completed during the pre-construction phase.(This sampling will provide specimens for analysis of fish tissue mercury concentration and structures for aging analysis.)
12.4.1.2		Northern Pike Spawning Habitat may be impacted by inundation at Third Falls GS	SE	As the limited daily fluctuation of 25cm is not anticipated to result in the elimination of emergent vegetation in the nearshore area it is not anticipated that Northern Pike spawning habitat will be impacted by water level fluctuation.	No								Negligible	Fish community sampling to obtain post construction CPUE and relative abundance to compare to pre-construction conditions and determine whether fish community and abundance have changed. Fish community sampling will be conducted in August following the RIN protocol with large RIN nets. A total of 61 nets will be set in the Ivanhoe River between 6.4km upstream of The Chutes to the crest of Third Falls. Eleven nets will be set upstream of The Chute, 40 nets will be set between The Chute and Third Falls and 10 nets will be set below Third Falls. This is to coincide with the number and locations of surveys completed during the pre-construction phase. (This sampling will provide specimens for analysis of fish tissue mercury concentration and structures for aging analysis.)

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12.4.1.3		Walleye Spawning habitat may be impacted at The Chute	SE	• The Facility will operate in run-of-river mode during the Walleye spawning, egg incubation and fry dispersal periods. If insufficient natural flow is available, the generating station will run continuously at maximum turbine flow throughout the duration of Walleye spawning, egg incubation and fry dispersal period; • No rapid fluctuations in flow are anticipated in the east channel and the Walleye spawning habitat in that channel will benefit from consistent flow over the habitat; • Walleye spawning offsetting habitat will be placed in the east channel, and will be designed to ensure that it functions hydraulically within the preferred range of velocity and depth for Walleye spawning under conditions of maximum turbine flow from the generating station; • Minimum compensatory flow of 5 m3/s be made available in the west spillway channel at all times during the Walleye spawning, egg incubation and fry dispersal period; • Water levels will be kept high enough in the Third Falls headpond (downstream from The Chute) in order to keep the lower portion of the west channel adequately wetted.	Yes	High	Low	Moderate	Irreversible	Low	Low	Moderate	Insignificant	Monitoring of walleye/white sucker spawning habitats where velocity and depth have been predicted to remain within the preferred range for walleye spawning. Required to ensure that predictions with respect to post development depth and velocity at these habitats were accurate and that the habitat continues to function within the preferred depth and velocity ranges for walleye spawning. Water depths and water velocities will be measured when water temperatures are suitable for walleye spawning. This will require that measurements are taken on one occasion during the spawning season in order to describe the depths and velocities available for walleye. Spotlight visual surveys and egg mat surveys will be carried out to determine whether walleye spawning is occurring within the existing spawning habitats. Sampling techniques such as angling, trap netting and gill netting will also be used, as appropriate, to determine presence of adults during the spawning season.
12.4.2.1	**Fish Migration**	There is a potential for Fish Stranding at The Chute due to Operations	SE	• Habitat adjustments at key areas to provide a pathway for stranded fish to retreat with water levels; and • Restrictions on down ramping that would reduce the rate of water level change allowing more time for fish to escape exposed areas.	Yes	Moderate	Low	Low	Reversible	Low	Low	Moderate	Insignificant	Fish stranding will be monitored in the constructed habitat in the tailrace area (east channel) downstream of The Chute GS. A camera will be installed directed downstream of the proposed GS to observe any stranding of fish during incidental or emergency shutdown of flows. The areas downstream will be visually assessed for stranding of all fish species. Stranding will also be monitored during all operating regimes. Onsite staff will be trained in the identification of stranding and will be required to notify a biologist of any occurrences for further observation and reporting.

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12.4.3.1	**Fisheries**	There is potential that Project operation could impact baitfish resources	IE	Water level fluctuations are not expected to impact these species and mitigations provided for the protection of Walleye and Northern Pike will also benefit other baitfish species. These species are not expected to be impacted at a population level	No								Negligible	Fish community sampling to obtain post construction CPUE and relative abundance to compare to pre-construction conditions and determine whether fish community and abundance have changed. Fish community sampling will be conducted in August following the RIN protocol with large RIN nets. A total of 61 nets will be set in the Ivanhoe River between 6.4km upstream of The Chutes to the crest of Third Falls. Eleven nets will be set upstream of The Chute, 40 nets will be set between The Chute and Third Falls and 10 nets will be set below Third Falls. This is to coincide with the number and locations of surveys completed during the pre-construction phase.
12.1.4.1	**Erosion & Sedimentation**	Erosion potential from headpond fluctuations at The Chute	SE	In order to minimize erosion effects, the maximum daily fluctuations of upstream water levels will not exceed 1 m. These maximum daily fluctuations were selected to minimize the magnitude of pore pressure changes of the soil along the shoreline, and by extension reducing the amount of shoreline erosion in the headpond. By limiting the daily fluctuation, vegetation will be able to naturally re-establish along the shoreline, thereby limiting the erosion potential.	No								Insignificant	The Geomorphic Assessment (Appendix E) concluded that the Ivanhoe River channel is stable but there may be some bank locations the may become destabilized from operational activities. These banks are not anticipated to cause any net effects on erosion but should be monitored. In order to confirm the predictions made in the geomorphic assessment, erosion and sedimentation monitoring has been planned for 5 years and again in years 7 and 10 following the start of operations.
12.1.4.1		Erosion potential from downstream water fluctuations from The Chute	SE	In order to minimize erosion effects, the maximum daily fluctuations will not exceed 0.25 m.	No								Insignificant	None
12.1.4.1		Erosion potential from headpond fluctuations at Third Falls	SE	In order to minimize erosion effects, the maximum daily fluctuations of upstream water levels will not exceed 0.25 m. This maximum daily fluctuation was selected to minimize the magnitude of pore pressure changes of the soil along the shoreline, and by extension reducing the amount of shoreline erosion in the headpond. By limiting the daily fluctuation to 0.25 m, vegetation will be able to naturally re-establish along the shoreline, thereby limiting the erosion potential.	No								Insignificant	None
12.1.4.1		Erosion potential from downstream water fluctuations from Third Falls	SE	Third Falls will be operated to re-naturalize the flows in the river resulting in flows that would exist under existing conditions. The presence of The Chute and Third Falls will not affect the erosion potential downstream of the Third Falls tailrace.	No								Insignificant	None

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12.1.4.1		Erosion potential on the Oates Bridge upstream of The Chute	Unk	In order to minimize erosion effects, the maximum daily fluctuations of upstream water levels will not exceed 1 m. The Oates Bridge is 1.9 km upstream of The Chute where the maximum daily water fluctuation will be 1 m.	No								Insignificant	Water levels and erosion condition at the EACOM bridge on Oates Road will be monitored by a professional engineer during spring freshet, to ensure the bridge safety is not impacted by the inundation of the facility during the first three years of operation. Should impacts occur to the bridge due to The Chute facility inundation, an adaptive management plan will be discussed with EACOM. Possible measures will include adjusting the operational levels of the facility or upgrading the bridge.
12.1.4.1		Erosion potential on Nova Bridge upstream of Third Falls	Unk	In order to minimize erosion effects, the maximum daily fluctuations of upstream water levels will not exceed 0.25 m. The Nova Bridge is 10.9 km upstream of Third Falls where the maximum daily water fluctuation will be less than 0.25 m.	No								Insignificant	Water levels and erosion condition at the Tembec bridge on Nova Road will be monitored by a professional engineer during spring freshet, to ensure the bridge safety is not impacted by the inundation of the facility during the first three years of operation. Should impacts occur to the bridge due to the Third Falls facility inundation, an adaptive management plan will be discussed with Tembec. Possible measures will include adjusting the operational levels of the facility or upgrading the bridge.
12.1.4.2		Erosion potential from ice scour from the daily lowering of the water levels in the headpond at The Chute	SE	The maximum daily fluctuations of upstream water levels will not exceed 1 m. These maximum daily fluctuations were selected to minimize the magnitude of pore pressure changes of the soil along the shoreline, and by extension reducing the amount of shoreline erosion in the headpond. By limiting the daily fluctuation, vegetation will be able to naturally re-establish along the shoreline, thereby limiting the erosion potential.	Yes	Moderate	Low	Moderate	Irreversible	Low	Moderate	Moderate	Insignificant	The Geomorphic Assessment (Appendix E) concluded that the Ivanhoe River channel is stable but there may be some bank locations the may become destabilized from operational activities. These banks are not anticipated to cause any net effects on erosion but should be monitored. In order to confirm the predictions made in the geomorphic assessment, erosion and sedimentation monitoring has been planned for 5 years and again in years 7 and 10 following the start of operations.
12.1.4.2		Erosion potential from ice scour from the daily lowering of the water levels in the headpond at Third Falls	SE	The maximum daily fluctuations of upstream water levels will not exceed 0.25 m. This maximum daily fluctuation was selected to minimize the magnitude of pore pressure changes of the soil along the shoreline, and by extension reducing the amount of shoreline erosion in the headpond. By limiting the daily fluctuation to 0.25 m, vegetation will be able to naturally re-establish along the shoreline, thereby limiting the erosion potential.	Yes	Moderate	Low	Moderate	Irreversible	Low	Moderate	Moderate	Insignificant	A monitoring location with soft sediments and potential for ice scour will be established prior to construction in an accessible area within the Chute and Third Falls headponds, respectively. The monitoring locations will be documented with photographs taken and be assessed for visible effects of ice scour after year 1 and year 5 of operation (i.e. during low flows in late summer). The monitoring locations will be assessed in the winter while modified run of river operation is ongoing to determine if and how much ice breakage and wedging occurs. (See Operating Plan Section 5.4 Ice Scour in Appendix E)

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12.4.4.1	**Fish Injury or Mortality (Impingement and Entrainment)**	Fish impingement on trash racks may occur during operations	SE	• Trash racks will be installed at each turbine entrance with a spacing of 48mm; • Entrance velocities are proposed to be a maximum of 0.75m/s at each Facility. This entrance velocity is lower than the burst swimming capabilities of adult Northern Pike and Walleye and within the range of burst swimming capabilities for Brook Trout which will help to mitigate impingement of these species on the trash racks; • Should impingement prove to be a threat to VEC fish species, there are numerous other modifications may be considered such as lighting, electrical barriers, air bubbling and sound barriers.	Yes	Moderate	Low	Moderate	Irreversible	Low	Low	Moderate	Insignificant	Fish mortality from entrainment and impingement will be monitored to determine whether entrance velocity and trash rack spacing is adequate to mitigate fish mortality from entrainment and impingement. Entrainment and impingement will be monitored on a regular basis by onsite staff through visual surveys of fish mortality within and below the tailrace area.
12.4.4.2		Fish Entrainment in the Turbine may occur during operations	SE	• Trash racks will be installed at each turbine entrance with a spacing of 48mm; • Entrance velocities of 75m/s to prevent larger fish from entering the turbine; • Use of Kaplan turbines to decrease impacts of cavitation; • Maintain low rotational speeds in order to increase fish survival rate.	Yes	Moderate	Low	Moderate	Irreversible	Low	Low	Moderate	Insignificant	Fish mortality from entrainment and impingement will be monitored to determine whether entrance velocity and trash rack spacing is adequate to mitigate fish mortality from entrainment and impingement. Entrainment and impingement will be monitored on a regular basis by onsite staff through visual surveys of fish mortality within and below the tailrace area.
12.2.1	**Waterlevels Flows & Movements (Surface & Groundwater)**	The existing hydrogeological conditions may be influenced during operations	NE	The water flow from the Project is re-naturalized at Third Falls.	No								Negligible	None
12.2.1.1		During modified run-of-river operations at The Chute, hourly hydrology will be altered from existing conditions. It may impact aquatic habitats.	IE	Operating parameters were established to ensure that ecological flow requirements identified as part of the environmental assessment process are met.	Yes	High	Low	High	Reversible	High	Low	High	Insignificant	None
12.2.2		Operation of the Project will impact water levels, flows and movement within the zone of influence on an hourly basis during certain times.	IE	The quantity of water released from the Facilities over a 24 hour period will equal the total quantity of water into the headpond. On an hourly basis the quantity of water will be reduced or increased above natural conditions. Flow variability is the topic of extensive discussions with stakeholders. The facility will operate as run of river during key ecological periods. Significant downstream flow will occur under most operating scenarios with the exception of periods of very low flow.	Yes	High	Low	High	Reversible	Moderate	Moderate	High	Insignificant	Discharge from the facilities will be continuously monitored.

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14.2.5	**Drainage, Flooding and Drought Patterns**	Increased impacts related to flood events.	Low	Facilities are designed to pass 1:100 year flows. The extend of additional flooding will be contained within the headpond extend. (upstream zone of influence)	Yes	High	Low	Low	Irreversible	Low	Low	Low	Insignificant	None
14.2.5		Increased impacts during severe drought events.	Unk	Both facilities will operate as run of river when province declares a Level 3 drought.	No								Negligible	None
12.2.3.3	**Water Temperature**	Inundation may result in the increase of water temperature in the river and tributaries within the Zone of Influence during operations	IE	Volume and depth of headpond is limited to provide a maximum of 24 hours of storage. Long term storage of water will not occur. Low heads (<10 m) of spillway dams and proper operating parameters selected to minimize the increased water level and daily fluctuation level in the headponds. In addition, water flow through the powerhouse intakes will be withdrawn from the full height of the water column in the headponds.	Yes	High	Moderate	Low	Reversible	Moderate	Moderate	Moderate	Insignificant	Monitoring of headpond temperatures
Aboriginal Community Considerations														
12.9.1.1	**First Nation Reserves or Other Aboriginal Communities**	Project lands may impact reserve lands or aboriginal community rights	NE	No impacts are anticipated; however, if any should occur during operations, they will be resolved in consultation with the affected First Community	No								Insignificant	None
12.9.2.1	**Spiritual, Ceremonial, Cultural, Archaeological, or Burial Sites**	Inundation may result in the removal of mature white cedars in the inundation zone.	IE	All clearing of mature white cedar trees will take place in consultation with First Nations and EACOM, the SFL holder in this area.	Yes	High	Low	Low	Irreversible	Low	Low	High	Insignificant	An estimate of the number of mature cedar trees that may be removed will be undertaken and a protocol for their removal will be developed with the communities.
12.9.2.2		Project operations may affect CMT downstream of The Chute.	IE	Based on studies completed at the site, the tree's roots are above the waterline, and no impacts will occur with the CMTs during operations. Tree was determined to be a naturally modified tree during field investigations.	No								Negligible	None
12.9.3.1	**Traditional Land or Resources Used for Harvesting Activities**	Hunting, harvesting, foraging and trapping activities may be disrupted when inundation makes previously accessible areas inaccessible. Access will be maintained to the waterway and around the Facility (boat launch and portages).	IE	Xeneca commits to maintaining current public access and navigation to the area; restriction such as fences and gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). The headponds for both facilities are relatively small; inundation will affect a small proportion of the total area, and impacts to hunting and foraging due to inundation are anticipated to be minimal. These minimal restrictions should ensure both that game and flora populations do not change, and	Yes	High	Low	High	Irreversible	Low	Low	Low	Insignificant	None

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				that hunters have the same number of opportunities to engage in successful hunting, harvesting and foraging activities.										
12.9.3.2		Furbearing mammals may be impacted by an increase in headpond levels and alteration of habitat resulting in a change in trapping which may impact traditional lifeways and economic resources of aboriginal peoples.	IE	In order to mitigate effects such as direct mortality, inundation will not occur during the winter or ice-over period in order to ensure no mortality due to individuals become trapped. Following inundation, operational water fluctuations will be within 0.25 m, which should not affect den entrances. Following construction, monitoring will occur to ensure that otters continue to populate this area.	Yes	High	Low	Low	Irreversible	Low	Low	Low	Insignificant	Monitoring of river otter denning habitat will include presence/absence surveys in conjunction with all other field investigations. Extensive surveys for denning sites is not recommended as locating them can be very challenging (MNR 2012), however, any observed individuals will be followed, if possible, to their den site to confirm the location of river otter denning Significant Wildlife Habitat
12.9.4	**Employment**	Employment impacts of the Ivanhoe Project for First Nations are expected to be positive, as a result of measures included in the confidential economic benefit agreements currently being finalized. Therefore, no mitigation measures are considered necessary.	IE (+ve)	No mitigation required	No								Positive	None
12.9.5	**Lands Subject to Land Claims**	The Project may have an impact on existing land claims on file between the Nishnawbe Aski Nation, for which no final agreement has been reached.	NE	No mitigation required	No								Negligible	None
12.9.6	**Economic Development**	Economic development impacts of the Ivanhoe Project for First Nations are expected to be positive, as a result of measures included in the confidential economic benefit agreements currently being finalized, including a generous equity participation program. Therefore, no additional mitigation measures are considered necessary.	NE	No mitigation required	No								Negligible	None
12.9.7.1	**Other**	Spirit (movement) of the water to be impeded by operation of the Facilities	IE	Both facilities are small, with small headponds; the Third Falls facility has been designed as run-of-river and will re-naturalize flows downstream of the dam. Refer to Section 12.2.2. for further information.	No								Insignificant	Discharge from the facilities will be continuously monitored.
12.9.7.2		Operations may affect culturally significant medicinal plants, such as sage and tobacco, which may be present in the Project Area	IE	No mitigation required as these species were not found in the Project Area	No								Insignificant	None

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12.9.7.3		Development may animal species of cultural or spiritual significance to communities (bears, wolves etc.)	IE	No impacts to these species are anticipated from operation of the project.	No								Insignificant	None
12.9.7.4		The loss of culturally used Cedar, Ash, birch, tamarack, and spruce trees surrounding the Project site as a result of project activities and flooding may impact community cultural and spiritual activities as well as production of traditional tools and traditional lifeways	IE	No further impacts to vegetation are anticipated once operations begin	No								Negligible	None
12.9.7.5		The use of concrete for the in-water components of the Facilities is a concern for some Communities	IE	Some concrete will need to be used in order to meet safety requirements; please see the Aboriginal Consultation Section 17.3 for a full description of communication with First Nations on this issue. The proponent has expressed a willingness to use natural materials where doing so is feasible.	No								Insignificant	None
12.9.7.6		Visual impacts of the facility could interfere with cultural representations of the landscape	SE	Xeneca has undertaken extensive planning and consultation with the local community in order to plan a Project that is minimally visually intrusive and retains as many of the existing aesthetic features as possible. Re-naturalization of cleared areas along roadways will be undertaken wherever possible, in consultation with the local MNR office to determine suitable species and take any fire safety concerns into account.	Yes	Moderate	High	High	Irreversible	Low	Moderate	High	Insignificant	None

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12.6.7		Development of the dam will present a barrier to navigation and may conflict with traditional lifeways of communities	SE	See Section 12.6.7 for mitigation measures for navigation. Within the Third Falls headpond water level variations will be kept within 0.25 m. Downstream of Third Falls flows and levels will be re-naturalized to run of river conditions. The Chute headpond may experience water level fluctuations up to 1 m. This impact is offset through the creation and operation of the headpond which will see water levels increase over those experienced under the existing long term average flow. Xeneca commits to maintaining current public access and navigation to the area; restrictions such as gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). Impacts to portage routes are not anticipated to affect navigability, so mitigation measures are not proposed. However, if impacts to portage routes affect the navigability of the river post-construction, the proponent will enter into negotiations with the MNR to reroute the portage routes.	Yes	Moderate	Low	Low	Irreversible	Moderate	Low	High	Insignificant	Portage routes will be changed if required to maintain access and navigability in the Ivanhoe River in the project area
Land and Resource Use Considerations														
12.6.2.1	**Access to Inaccessible Areas (land or water)**	The operation of the dam at The Chute Facility may cause increased water levels that affect the function or longevity of the bridge on the Oates Road, located approximately 1.9km upstream of the Facility location.	SE	Xeneca commits to maintaining the operability of the Oates Road bridge. Consultation and negotiation is ongoing with EACOM, which has reviewed the CPL report, and a solution acceptable to both sides will be reached prior to completion of permitting and approvals. This negotiation will include discussions over the form of weir to be used at the hydroelectric facility and, if required, may also involve elevating the bridge deck.	Yes	High	Low	Low	Reversible	High	Low	Low	Insignificant	None
12.6.2.2		The operation of the dam at the Third Falls Facility may cause increased water levels that affect the function or longevity of the bridge on Nova Road, located approximately 10.9km upstream of the Facility location.	SE	Xeneca commits to maintaining the operability of the Nova Road bridge. Consultation and negotiation is ongoing with EACOM, which has reviewed the CPL report, and a solution acceptable to both sides will be reached prior to completion of permitting and approvals. This negotiation will include discussions over the form of weir to be used at the hydroelectric facility and, if required, may also involve elevating the bridge deck.	Yes	High	Low	Low	Reversible	High	Low	Low	Insignificant	None

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12.6.7	**Navigation**	Ivanhoe River is a recognized canoe route, the operation of the facility may impede and interfere with navigation	SE	Xeneca commits to maintaining current public access and navigation to the area; restrictions such as gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). Impacts to portage routes are not anticipated to affect navigability, so mitigation measures are not proposed.	Yes	Moderate	Low	High	Irreversible	Moderate	Low	High	Insignificant	Portage routes will be changed if required to maintain access and navigability in the Ivanhoe River in the project area
12.6.3	**Riparian Rights or Privileges**	There are no riparian rights or privileges affected by the Ivanhoe project.	NE	No mitigation required	No								Negligible	None
12.6.10.1	**Recreational Use & Tourism Values (land or water)**	Operations may result in reduced enjoyment of campsites in the Chute area	IE	The noise of the waterfall will mask any noise from the operations from The Chute. Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.	Yes	High	Low	High	Irreversible	Low	Low	Low	Insignificant	None
12.6.10.1		Operations may result in reduced enjoyment of campsites in the Third Falls area	IE	Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.	Yes	Low	Low	High	Irreversible	Low	Low	Low	Insignificant	None
12.6.10.2		Fluctuating water levels during Project operations could affect users' abilities to launch boats at the existing boat launch at The Chute	SE	Xeneca will to make some modest design and location improvements to the boat launch amenity, based on stakeholder input, though prior approval is required by the MNR and other regulatory agencies. Xeneca commits to ensuring that portage routes remain available after construction. The location of the portage route entrance close to the safety boom will be relocated closer to the termination of the safety boom as a safety precaution. Overall, the portage route will still be present and accessible, but shorter.	Yes	Moderate	Low	Low	Reversible	High	Low	Low	Low	A new boat launch will be constructed
12.6.10.2		Fluctuating water levels during Project operations could affect portage routes at Third Falls	IE	If any launching areas or portage routes are impacted by the Ivanhoe Project, new landing areas or docking facilities may be built. No mitigation is considered necessary for portage routes at this time; however, they will be re-routed should this become necessary during operations.	Yes	Moderate	Moderate	Low	Irreversible	Low	Low	Low	Insignificant	None
12.6.10.3		No potential impacts to local snowmobiling are anticipated to result during operations	NE	No mitigations required	No								Negligible	None

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12.6.10.4		Operations may result in reduced access to a public hiking trail near the Chute	IE	Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.	Yes	Moderate	Low	High	Irreversible	Low	Low	Moderate	Insignificant	None
12.6.10.4		No impact to access to hiking trails is anticipated during the operation of the Third Falls Facility.	NE	No mitigations required	No								Negligible	None
12.6.4.1	**Angling and Hunting Opportunities**	Effects on hunting fauna, including bear and moose during operations	IE	Xeneca commits to maintaining current public access and navigation to the area; restriction such as fences and gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). These minimal restrictions should ensure both that game populations do not change, and that hunters have the same number of opportunities to engage in successful hunting activities.	Yes	High	Low	High	Irreversible	Low	Low	Low	Insignificant	None
12.6.4.2		Effects on local fishing and ice-fishing opportunity due to reduced site access during operations	IE	Xeneca has committed to operational constraints during the spring spawning period in order to ensure natural flow conditions during this period (spring and fall for Brook Trout). Xeneca intends to maintain and possibly enhance public access to fishing at the Ivanhoe Project sites. However, to ensure public safety, some fencing may be put in place (i.e. around electrical equipment or water intakes). This is not anticipated to seriously affect access to fishing sites. Furthermore, Xeneca will work with the recreational fishing community, tourism operators and other interested parties to ensure impacts to fisheries are kept at a minimum level, access to fishing areas is not impeded, improvements to access the fishery are facilitated and impacts to habitat are minimized. Should economic impact on commercial interests result from the Project, Xeneca will enter into discussions on avoidance, mitigation and /or compensation.	Yes	High	Low	High	Irreversible	Low	Low	Low	Insignificant	None
12.6.5	**Trapping Activities**	Operations may affect trapline if they are contiguous with specific Project facilities restricted to public access for health and safety reasons.	IE	Xeneca is consulting with the trapline holder to create a business-to-business agreement at their request; however, given the extent of the trapline area and the habitat it is within, there are no impacts anticipated to this trapline.	Yes	Low	Low	High	Irreversible	Low	Low	Low	Insignificant	None

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12.6.5	**Baitfish Harvesting Activities**	Operations may affect baitfishing sites if they are contiguous with specific Project facilities restricted to public access for health and safety reasons	NE	No interference with baitfish harvesting opportunities is anticipated	No								No	None
12.6.6	**Views or Aesthetics**	The construction of two new hydroelectric facilities will alter the visual appearance of this part of the river, and alter the pristine character of the Third Falls Facility location. As well, inundation of upstream areas of the Ivanhoe River will change the viewscape over the longterm from a riverine to a lacustrine landscape.	SE	Xeneca has undertaken extensive planning and consultation with the local community in order to plan a Project that is minimally visually intrusive and retains as many of the existing aesthetic features as possible. Re-naturalization of cleared areas along roadways will be undertaken wherever possible, in consultation with the local MNR office to determine suitable species and take any fire safety concerns into account.	Yes	Moderate	High	High	Irreversible	Low	Moderate	High	Insignificant	None
12.6.1	**An Existing Land or Resource Management Plan**	No impacts to Land Use or Resource Management Plans are anticipated from Project operations	NE	No mitigation required	No								Negligible	None
12.6.8	**An Existing Water Management Plan**	No impacts are anticipated; however, the proponent is working with the Steering Committee of the Mattagami River Water Management Plan to integrate the new facilities into the plan and ensure no impacts.	IE	No mitigation required	No								Negligible	None
12.6.9.1	**Protected Areas**	Effects of operation of the Third Falls Facility the on Northern Claybelt Forest Complex Conservation Reserve	IE	The Third Falls facility will be operated in such a way as to re-naturalize the flows of the Ivanhoe river downstream from the Chute, so as to entirely prevent impacts to the Conservation Reserve	No								Insignificant	None
12.6.9.2		The Nova Township Clay Plain Peatland Conservation Reserve exists 135m from a planned power line between The Chute and Third Falls and may be impacted by operations	NE	No mitigation required	No								Negligible	None
12.6.9.3		The Groundhog River Provincial Park would be crossed by a planned power line between The Chute and Third Falls	IE	No mitigation required	No								Insignificant	None
Cultural Heritage Resources Considerations														
12.8.1	**Archaeological Sites**	Disturbance or destruction to significant archaeological sites associated with construction or inundation	IE	Stage 2 assessment found no items of archaeological significance requiring further study or operational mitigations	No								Negligible	None

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	
12.8.1		Disturbance or destruction to significant archaeological sites along access roads	IE	Stage 1 assessment found no items of archaeological significance requiring further study or operational mitigations	No								Negligible	None
12.8.2	**Built Heritage Resources**	Disturbance or destruction to heritage buildings or structures	IE	Cultural Heritage self-assessment checklist indicated no items of built heritage resource in the vicinity of the Project	No								Negligible	None
12.8.3	**Cultural Heritage Landscapes**	Disturbance or destruction to prominent natural features that could have special value to people - Waterfalls	IE	Assessment found that the waterfalls at the facility locations and in the Project Area are not of any special value and do not require operational mitigation	No								Negligible	None
12.8.3		Disturbance or destruction to prominent natural features that could have special value to people - potential culturally modified cedar trees (CMT)s	IE	Assessment found all suspected CMTs were naturally modified and no operational mitigations are required	No								Negligible	None
12.8.3		Disturbance or destruction to prominent natural features that could have special value to people - unidentified culturally modified cedar trees (CMT)s	IE	Unidentified CMTs located during construction are not expected to require operational mitigations	No								Negligible	None
Social and Economic Considerations														
12.7.1	**The Location of People, Businesses, institutions, or Public Facilities**	No people, businesses, institutions or public facilities reside within or near to the Project Area nor are any anticipated to be affected by the operation of the Project.	NE	No mitigation required	No								Negligible	None
12.7.2	**Community Character, Enjoyment of Property, or Local Amenities**	No local communities or properties exist within or near to the Ivanhoe Project Area	NE	No mitigation required	No								Negligible	None
12.7.3	**Employment**	Operation and management of project facilities will lead to one to two full-time positions	IE (+ve)	Xeneca commits to hiring locally wherever feasible.	Yes	High	Moderate	High	Irreversible	High	Low	High	Insignificant (positive)	None
12.7.5.1 & 14.2.1	**Public Health and/or Safety**	As maintenance vehicle traffic during operations will be infrequent, elevated risks of accidents during operation are not expected; however, the risk cannot be entirely eliminated.	IE	Xeneca is committed to maintaining public health and safety at all of its sites and operational facilities. An emergency response plan will be developed, and workers trained in its use. No additional mitigation measures are considered necessary for operational accidents,	Yes	High	Low	Low	Irreversible	Low	Low	Low	Insignificant	Employees will receive annual health and safety training.

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	
				as the risk is very low.										
12.7.5.2 & 14.2.2		Accidental spill of lubricant oil, transformer oil and other hazardous substances may result in soil, surface and/or groundwater contamination during operations and maintenance	IE	• Secondary containment areas should be monitored throughout the operational period to ensure their integrity.• An oil-water separator should be installed in each powerhouse to contain oil in the event of an accidental spill within the powerhouse.• Only machinery/equipment that is clean and well maintained (e.g., no leaks) should operate in or near watercourses or drainage areas. No washing of equipment is to take place within or near watercourses.• Proper spill response equipment will be kept at the Facilities through operations, and all workers trained in their use. .• All workers will be trained in the Emergency Response Plan• Significant quantities of hazardous materials will not be stored on site. Any hazardous materials such as petroleum hydrocarbons or lubricants which must be stored on site, will be stored and managed in accordance with all applicable legislation and guidelines.	Yes	High	Low	Low	Reversible	Low	Low	Low	Insignificant	Employees will receive annual health and safety training.
12.7.5.3 & 14.2.3		Fires can occur during operation and maintenance activities when a flame is required (i.e. welding) and could potentially result in loss of vegetation and wildlife, adverse effects on surface water quality due to ash-laden runoff and corresponding effects on aquatic biota.	IE	An Emergency Response Plan will be developed to document the procedures to be followed at the facilities in response to a fire. This plan will outline responsibilities and procedures to be followed by the observer, immediate supervisor, operator, and incident coordinator. The Emergency Response Plan will also identify personal protective equipment that should be worn when dealing with clean-up/ decontamination following fires. The power line Right-of-Way (ROW) will be maintained to minimize the potential for damage to the power line due to vegetation, which will also minimize the fire risk due to the power line.	Yes	High	Low	Low	Irreversible	Low	Low	Low	Insignificant	Employees will receive annual health and safety training.
12.7.5.4		Operations of the dams will create small quantities of hydrocarbon wastes. These wastes, if not properly handled, have the potential to affect soils, surface waters and groundwater.	IE	Local waste management companies have been identified for removal of wastes during operations. They will identify a waste management facility with the capacity to accept operation related wastes, and transportation of the wastes to this facility will be incorporated into the Project's transportation planning.. Any hazardous wastes generated will be sent to a licensed hazardous waste facility. The Project proponent will discuss any wood waste created with the local SFL holder.	Yes	Moderate	Low	Low	Reversible	Moderate	Low	Low	Insignificant	Employees will receive annual health and safety training.

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	
12.7.5.6 & 14.2.6		Damage to and safety of Foleyet in the case of dam failure or flood	SE	The primary protective measure is the safe design, construction, operation and maintenance of the Ivanhoe projects and ancillary facilities. Following the approval of the Ivanhoe Class EA, a full Dam Safety Study will be commissioned and incorporated into the overall safety plan. The mitigation measures and recommendations in the Dam Safety Plan will be incorporated into the Project's final design in order to reduce the risk to public health and safety from dam failure to near zero.	Yes	High	High	Low	Irreversible	High	High	Low	Insignificant	None
12.7.5.7		Equipment malfunctions or other adverse events during operations may affect worker health and safety.	IE	Worker safety at the site would be ensured via strict adherence to Ministry of Labour occupational health and safety regulations. First aid equipment will be maintained on site throughout the Project lifespan and workers will be trained to deal with emergency situations (see Section 14, Accidents and Malfunctions).	Yes	high	low	Low	Irreversible	High	Low	Low	Insignificant	Employees will receive annual health and safety training.
12.7.5.8		Methyl Mercury and Fish Consumption - Increase in mercury concentration in fish tissue as a result of inundation	Unk	• Minimize organic material • Minimize anoxic potential • Minimize new inundation • Promote flushing to decrease concentrations • Extensive monitoring is proposed to identify potential increases in fish tissue methyl mercury levels • Monitoring will be reported such that agencies can issue consumption advisories through the existing consumption advisory program should this become necessary. This will minimize the potential for a human health risk to arise.	Yes	high	low	high	Reversible	low	moderate	low	Insignificant	The pre- and post-construction water quality and mercury-in-fish monitoring programs for the Project will provide information to warn and safeguard the public from possible mercury increases and provide data to inform future mercury models. Conditions after construction will be regularly compared to pre-development conditions to measure change. The water quality in the Project area will also be compared to upstream reference conditions to differentiate natural variation from project-related changes. The monitoring program includes an early warning component that identifies if forage fish low in the food chain are showing signs of increasing or decreasing mercury, providing information on the trend(s) of the change so that mitigating action such as changes to fish consumption guidelines can be implement in a timely fashion.
12.7.6	**Local, Regional, or Provincial Economies**	Project operations may have an impact on mining activities or forestry operations in the project area.	IE	No mitigation required	Yes	High	Low	High	Reversible	High	Low	Low	Insignificant	None
12.7.7	**Tourism Values**	Impacts to existing tourist activities are described under Section 12.6, as all local tourism revolves around recreational use of the natural amenities there described.	IE	No mitigation required	No								Insignificant	None

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	
12.7.5.5	**Water Supply**	The operation of a hydroelectric facility has the potential to cause problems with downstream drinking water supplies, or upstream drinking water supplies where the impoundment affects the hydrology of the drinking water intake.	NE	No mitigation required	No								Negligible	None
12.7.5.5		Wastewater discharges can be affected by Project operations if the pipes are located within a hydroelectric facility's Zone of Influence (ZOI).	NE	No mitigation required	No								Negligible	None
12.6.6	**Aesthetic Image of the Surrounding Area**	The construction of two new hydroelectric facilities will alter the visual appearance of this part of the river, and alter the pristine character of the Third Falls Facility location. As well, inundation of upstream areas of the Ivanhoe River will change the viewscape over the longterm from a riverine to a lacustrine landscape.	SE	Xeneca has undertaken extensive planning and consultation with the local community in order to plan a Project that is minimally visually intrusive and retains as many of the existing aesthetic features as possible. Re-naturalization of cleared areas along roadways will be undertaken wherever possible, in consultation with the local MNR office to determine suitable species and take any fire safety concerns into account.	Yes	Moderate	High	High	Irreversible	Low	Moderate	High	Insignificant	None
12.7.4	**Other**	Site access to the area around The Chute may be impacted by Project operations	IE	Access will only be restricted on land or water when and where required for public safety. These restrictions will be posted on signs.	Yes	Moderate	Low	High	Irreversible	High	Low	High	Insignificant	None
12.7.4		Site access to the area around Third Falls may be impacted by Project operations	IE	Access will only be restricted on land or water when and where required for public safety. These restrictions will be posted on signs.	Yes	Moderate	Low	High	Irreversible	High	Low	High	Insignificant	None
Energy /Electricity Considerations														
12.10.1	**Reliability (e.g. Voltage Support)**	Operation of the Project in parallel with current electricity generating systems tied into the electrical grid will have a positive impact on overall grid reliability and availability of power especially during peak hours when consumption is highest	IE (+ve)	No mitigation required	No								Positive	None
12.10.1	**Security**	The Project will not have black start capabilities.	NE	No mitigation required	No								Negligible	None
12.10.2	**Electricity Flow Patterns**	The Project will not be equipped with island mode capability and all power generated will be distributed externally to the electrical grid for consumption.	IE	No mitigation required	No								Insignificant	None

ORTECH

Report Section	Criterion	Activity/Description - Potential Effect	Prior to Mitigation	Mitigation or Impact Management Measures Employed	Residual Effect After Mitigation?	Significance Assessment of Net Effects (After Mitigation)								Monitoring/Compensation Proposed
			Significance (Relative Level of the Effect)	Mitigation measures can include:• reducing the magnitude, duration etc. of the impact; • repairing the situation post-impact to achieve (more of a) pre-impact state;• offsetting the impact through other means, not necessarily directly related to that impact; and • enhancing positive effects where possible		Value of Resource Affected	Geographic Extent	Duration/ Frequency	Irreversibility	Ecological / Social	Magnitude	Probability	Overall Significance	

Negligible Effect (NE): A nearly zero or hardly discernible effect. A negligible effect would touch a population or specific group of individuals at a localized area and/or over a short period in such a way as to be similar in effect to random small changes in the population (or group) due to environmental irregularities, but would have no measurable effect on the population (or group) as a whole. (This is equivalent to a Nil effect in the OWA scale).

Insignificant Effect (IE): An effect that may exhibit one or more of the following characteristics: Not widespread. Recurring effect lasting for short periods of time during or after project implementation. (This is equivalent to a -L effect in the OWA scale).

Significant Effect (SE): An effect that may exhibit one or more of the following characteristics: Widespread. Permanent reduction in species diversity or population of species. Permanent alterations to community characteristics or services, land use or established patterns. (This is equivalent to a -H effect in the OWA scale).

12.1 Geology, Topography and Terrain

The following subsections use the existing geology, topography and terrain of the *Project Area* to determine operational related impacts on terrestrial and wetland/riverine habitats, hazard lands, and soil quantity and soil quality from erosion, and sedimentation. Soil contamination is included in the Accidents and Malfunctions in Section 14.

12.1.1 Bedrock Geology

There are no anticipated impacts to Bedrock Geology as a result of Project operations.

12.1.2 Terrain and Topography

There are no additional excavation activities beyond the construction phase therefore there are no anticipated impacts to Terrain and Topography as a result of Project operations.

12.1.3 Landslide Hazards

The proposed headpond inundation and water level fluctuations during operations pose a potential risk for slope stability effects and soil erosion. Variable downstream flow conditions can also affect slope stability and erosion; however, as described in Section 3, flows will be re-naturalized at Third Falls, such that no flow alteration occurs beyond that point. As such, no effects assessment on slope stability and erosion is required downstream of Third Falls. The following effects assessment addresses the headpond inundation and operation related effects.

12.1.3.1 Potential Effects

Erosion effects related to headpond inundation can occur where the new shoreline abuts steep slopes and soft soil conditions. Specific areas were identified in the baseline assessment (see Section 9.1.3) where such conditions could occur:

- **The Chute**: Two outer bend locations in the proposed headpond within 2 km upstream of the dam. The slopes in these two locations are moderate. A limited amount of soil material overlies bedrock and the locations were previously eroded during glacial times. The headpond in these two locations is relatively wide and water velocities are expected to be low. However, a limited risk of outer bank erosion is possible on a localized scale. Long term monitoring of these locations has been proposed.
- **Third Falls**: The shoreline of the pool between the first and second falls has relatively steep. Gradual slumping and re-adjustment of the shoreline slope may occur over time. The headpond is relatively wide at this location and flow directions are not oriented towards the shoreline. Post-construction, the water velocities in this area are expected to be very slow. In

combination, these factors could result in a gradual shoreline adjustment. Due to the gradual nature of the process, the impact on sediment load and water quality in the river should be limited. Long term monitoring of this the shoreline in the pool has been proposed.

Shoreline formation can erode sediment into the river and, under extreme conditions; shoreline formation can undercut steep slopes and cause localized slumping and landslides.

Ongoing operation of the Project will result in daily level changes in both headponds at certain times of the year and under certain hydrologic conditions. These level changes may have the propensity to accelerate any shoreline or channel erosion processes that are occurring. Potential effects include:

- Acceleration of shoreline erosion effects outlined above.
- Acceleration of natural channel forming processes.

Both of the above effects have been considered in the geomorphic assessment of the river (Parish 2013, Appendix E). The assessment concluded that except for localized issues, the river channel and the banks appeared to be stable, but there may be some bank locations the may become destabilized from operational activities. It was further concluded that **these banks are not anticipated to cause any net effects on erosion** but should be monitored.

12.1.3.2 Mitigation for The Chute and Third Falls

To minimize the potential for erosion, slumping and landslide conditions, several mitigation steps were adopted in the project design:

- Operating levels were designed such that much of the shoreline for both headponds falls within the existing channel bed, thereby limiting the extent of new shoreline development.
- Hydraulic modeling was carried out that demonstrates how water velocities will be decreased post-construction within the headpond areas, thereby decreasing the potential for erosion from acceleration of natural channel processes.
- Maximum daily operating fluctuations in The Chute headpond have been limited to 1 meter and carefully set such that the operating water level changes occur within the existing and stable channel bed for much of the headpond length.
- Maximum daily operating fluctuations in Third Falls headpond have been limited to 0.25 meters and carefully set such that of the operating water level changes occur within the existing and stable channel bed for much of the headpond length.

12.1.3.2.1 Net Effects and Significance Assessment for The Chute and Third Falls

There will be a residual effect from the operations of the risk of erosion, slumping and landslide conditions.

Value of the Resource

The proposed headpond inundation and water level fluctuations during operations pose a potential risk for slope stability effects and soil erosion which could ultimately reduce soil quantity. Soil is involved in supporting wildlife and vegetation and regulating surface water runoff processes. Although soil quantity is of high importance, the effect on the value of soil quantity from the risk of erosion, slumping and landslide conditions is of *moderate* value since there is an abundance of soil in the Project Area.

Geographic Extent of Effect

The risk of erosion, slumping and landslide conditions from the operations will be limited to areas already identified as being susceptible to erosion within the Zone of Influence therefore the geographic extent of the effect to soil quantity will be *low*. Indirect impacts from erosion such as the impact surface water quality and aquatic habitat will be addressed in the relevant sections through the report.

Duration and Frequency

The duration and frequency of the risk of erosion, slumping and landslide conditions are anticipated to be *moderate* as the potential for this risk will persist through the life of the facilities but the risk of the frequency will be lowered due to the limited number of fluctuations and the run-of-river operations for Third Falls.

Irreversibility of Effect

The risk of erosion, slumping and landslide conditions impact to soil quantity is considered *irreversible* during the operations of the Project; once the material is eroded, it is transported downstream.

Ecological or Social Context

Minimizing the number of daily fluctuations and limiting the rate of change of upstream water levels will limit the amount of erosion resulting in a *low* ecological effect to soil quantity.

Magnitude of the Effect

Providing the effective implementation of the mitigation and monitoring procedures, the magnitude of the effect on soil quantity is anticipated to be *moderate*.

Probability of Effect

The mitigation measures along with the operating restrictions will lower the probability of the risk of erosion, slumping and landslide conditions resulting in a *low* probability.

Overall Significance

Given the low geographic extent and low probability of the effect along with the mitigation measures and the monitoring plan (below), there is an *Insignificant Effect* to the risk of landslide hazards during operations.

12.1.3.3 Monitoring for The Chute and Third Falls

In order to assess the effectiveness of the mitigation efforts and to confirm the predictions made in the geomorphic assessment, erosion and sedimentation monitoring has been planned for 5 years and again in years 7 and 10 following the start of operations. Details of the monitoring plan can be found in *Ivanhoe River Hydroelectric Projects The Chute and Third Falls Geomorphic Assessment, Addendum #1 – Monitoring Program, Appendix E.* This comprehensive monitoring plan has been developed focusing primarily on channel adjustments and sediment movement within the zone of influence in order to detect any accelerated erosion that may potentially occur due to dam operations. Ten stations, including both control and impact stations, will be established within the Study Area in order to follow a Before, After, Control, Impact method.

At each station, a benchmarked channel section will be set-up and surveyed to provide a direct measure of changes in channel dimensions as well as changes in substrate, based on results of a pebble-count method. Additionally, a series erosion pins will be installed in the banks at each station. Total Suspended Solids (TSS) will be measured as well for direct measure of suspended sediment movement (See Geomorphology Report in Appendix E). Should the monitoring program identify that significant erosion or sedimentation is occurring, a detailed study will be carried out to determine the cause. If it is due to Facility operation, an adaptive management plan will be developed with agencies to modify operations or provide physical shoreline protection measures.

12.1.4 Erosion, Soils & Sedimentation

Soil quality and soil quantity are important biological features that support wildlife and vegetation communities. Soil quality refers to the characteristics (physical and chemical) of the soil that support

biological life while soil quantity refers to the amount of soil within a specific area. Erosion and sedimentation are processes that can impact both soil quality and soil quantity. Erosion is the removal of soil, sediment and rock fragments from the landscape. Sedimentation is the deposition of the eroded material.

The potential for erosion and sediment transport is determined by the energy level in the river and the transportability of the underlying sediment. Fine sediment is typically easier to transport than coarser sediment. An assessment of river sediments was carried out in a Geomorphic Assessment carried out in the river (*Ivanhoe River Hydroelectric Projects The Chute Hydroelectric Generating Station and Third Falls Hydroelectric Generating Station Geomorphic Assessments*, Appendix E). The assessment combined field work, existing and predicted river energy levels, and hydraulic models, to determine the potential of erosion and sediment transport from operational activities.

Operational activities potential to impact soil quality and soil quantity are summarized as follows:

- Erosion:
  - Loss of soil due to erosion from headpond fluctuations;
  - Loss of soil due to erosion from downstream water fluctuations;
  - Impacts on civil structures upstream of the facilities; and
  - Ice Scour.
- Sedimentation and Sediment Transport:
  - Infilling due to inundation of rapids in the headponds;
  - Increased suspended sediment due to intermittent operations
  - Auxiliary dam sediment transport (**The Chute Auxiliary Dam only**)

12.1.4.1 Erosion – Soil Quantity

12.1.4.1.1 Potential Effect for The Chute and Third Falls

Rapid changes in shoreline water levels have the potential to increase erosion. Where pore water in the soil dissipates too quickly, pore pressure can loosen soil grains and cause loss of stability in the soil structure, thereby enhancing erosion. A small amount of shoreline erosion occurs naturally in the river; however, accelerated shoreline erosion from daily water level changes can effect natural shoreline vegetation that cannot establish itself, shoreline aquatic habitat, and in extreme cases, erosion can cause an increase in the overall sediment load in the river effecting water turbidity and aquatic conditions (extreme erosion is assessed in Section 12.1.3).

The Geomorphic Assessment (*Ivanhoe River Hydroelectric Projects The Chute Hydroelectric Generating Station and Third Falls Hydroelectric Generating Station Geomorphic Assessments*, Appendix E) is designed to determine the channel form and function under existing conditions (Section 9.1.5 and

9.1.6) and how they may change once the facilities are operational. The erosion threshold analysis determines the hydraulics to:

i. initiate the mobilization of soil particles; and
ii. evaluate a reach's erosion sensitivity.

The erosion threshold analysis in Geomorphic Assessments (Parish Geomorphic and ORTECH, Appendix E) was completed using both detailed cross-section data and HEC-RAS model results. The geomorphic studies (Parish Geomorphic and ORTECH, Appendix E) have shown very few signs of channel instability.

The Chute – Headpond Fluctuations

The proposed Chute dam site is located within a rapid cut into bedrock and the proposed dam will sit within the rapid, with the upstream end of the bedrock section, and the existing backwater will form the headpond area extending approximately 6.4km upstream and cover approximately 59 ha (at long-term average flow). The Hydraulic Analysis (Appendix F) concluded that fluctuations from The Chute headpond beyond 1.9 km upstream of the dam will operate largely in the existing shoreline due to the small change in inundation depths and the potential for erosion from the headpond fluctuations is unlikely. From the dam to 1.9 km upstream, a new shoreline will develop in the prevailing silt and clay material. It is this area that the following erosion potential discussion is focused.

The two elements required for erosion to occur from headpond fluctuations are

i) the slope of the ground must be steep at the location of the water level fluctuations; and
ii) the soil must be susceptible to erosion.

The slope of the banks at The Chute headpond are 3.3:1(Parish Geomorphic, Appendix E) and the susceptibility of the soil, using the erosion threshold analysis, indicates that it is unlikely that gravel and cobbles will be transported under bankfull flows (Parish Geomorphic, Appendix E). The additional water in the headpond will further reduce the energy of the water, reducing the potential for sand and gravel to be entrained. Due to the slope and soil substrate at The Chute there is a low potential for erosion from the operations of The Chute once a new shoreline has been established, however monitoring is required to confirm this conclusion.

In addition, EACOM's Oates Bridge is located 1.9 km upstream from The Chute Facility. Using the same analysis, the potential from erosion impacting the bridge are also anticipated to be low. The additional flooding created by The Chute near the Oates bridge is estimated at 1 meter which is not significant enough to cause bank slumping. There will be a reduction in flow velocity from pre-project conditions including flood flow conditions, so there is less energy in the river for bank erosion. A hydraulic analysis

on the Oates Bridge can be found in Appendix F. Consultation with EACOM regarding Oates Bridge can be found in Appendix L. Monitoring will confirm this conclusion.

Third Falls– Headpond Fluctuations

The Hydraulic Analysis (Appendix F) concluded that fluctuations from Third Falls headpond beyond 5.5 km upstream of the dam will operate largely in the existing shoreline due to the small change in inundation depths, therefore the potential for erosion from the headpond fluctuations is unlikely. From the dam to 5.5 km upstream, a new shoreline will develop in the prevailing silt and clay material. It is this area that the following erosion potential discussion is focused.

As outlined above, the two elements required for erosion to occur from headpond fluctuations are i) the slope of the ground must be steep at the location of the water level fluctuations and ii) the soil must be susceptible to erosion. The slope of the banks at Third Falls headpond is 2:1(Parish Geomorphic, Appendix E) and the susceptibility of the soil, using the erosion threshold analysis, indicates that small gravel may be entrained along the channel under existing and proposed operating bankfull conditions, except for immediately below the rapids (Parish Geomorphic, Appendix E). At flows close to the maximum modified operations, gravel is too large to move under both the existing and operating scenarios. Due to the slope and soil substrate at Third Falls there is a low potential for erosion from the operations of Third Falls once a new shoreline has been established however monitoring is required to confirm this conclusion.

In addition, Tembec's Nova Bridge is located 10.9 km upstream from the Third Falls Facility. Since the bridge is located in the portion of the headpond that will be largely operated within the existing shoreline, the likelihood of erosion impacts on the bridge from the headpond fluctuations is unlikely. A hydraulic analysis on the Nova Bridge can be found in Appendix E. Consultation with Tembec regarding the Nova Bridge can be found in Appendix L. Monitoring will confirm this conclusion.

The Chute and Third Falls – Downstream Water Fluctuations

Similar to the headpond fluctuation discuss above, changes in water levels downstream of the facilities from operational activities could also result in the potential for erosion. Downstream water fluctuations from the tailrace of The Chute are attenuated by the headpond of Third Falls resulting in no net effect on downstream erosion potential. A screening level erosion potential index was developed using LiDAR data suggest that steep slopes near the Third Falls have a relatively high potential for erosion, especially associated with hillslope processes, however, no flow or level alteration is proposed downstream of Third Falls as it relates to Project. Third Falls will be operated to re-naturalize the flows in the river resulting in flows that would exist under existing conditions. As a result no Project related impact is expected downstream of Third Falls. The presence of The Chute and Third Falls will not affect the erosion potential downstream of the Third Falls tailrace. Monitoring will

be conducted downstream of Third Falls to confirm this conclusion. **Erosion impacts on soil quantity are not anticipated downstream due to operational activities.**

12.1.4.1.2 Monitoring for The Chute and Third Falls

In order to confirm the predictions made in the geomorphic assessment, erosion and sedimentation monitoring has been planned for the first 5 years and again in years 7 and 10 following the start of operations. Details of the monitoring plan can be found in *Ivanhoe River Hydroelectric Projects The Chute and Third Falls Geomorphic Assessment, Addendum #1 – Monitoring Program, Appendix E.* This comprehensive monitoring plan has been developed focusing primarily on channel adjustments and sediment movement within the zone of influence in order to detect any accelerated erosion that may potentially occur due to dam operations. Ten stations, including both control and impact stations, will be established within the Study Area in order to follow a Before, After, Control, Impact method.

At each station, a benchmarked channel section will be set-up and surveyed to provide a direct measure of changes in channel dimensions as well as changes in substrate, based on results of a pebble-count method. Additionally, a series erosion pins will be installed in the banks at each station. Total Suspended Solids (TSS) will be measured as well for direct measure of suspended sediment movement (See Geomorphology Report in Appendix E). Should the monitoring program identify that significant erosion or sedimentation is occurring, a detailed study will be carried out to determine the cause. If it is due to Facility operation, an adaptive management plan will be developed with agencies to modify operations or provide physical shoreline protection measures.

Erosion Impacts on EACOM Bridge on Oates Road

The EACOM Bridge on Oates Road is located within the inundation area of the proposed The Chute Facility.

Water levels and erosion condition at the EACOM bridge on Oates Road will be monitored by a professional engineer during spring freshet, to ensure the bridge safety is not impacted by the inundation of the Facility during the first three years of operation. Should impacts occur to the bridge due to The Chute Facility inundation, an adaptive management plan will be discussed with EACOM. Possible measures will include adjusting the operational levels of the Facility or upgrading the bridge.

Erosion Impacts on Tembec Bridge on Nova Road

The Tembec Bridge on Nova Road is located within the inundation area of the proposed Third Falls Facility.

Water levels and erosion condition at the Tembec bridge on Nova Road will be monitored by a professional engineer during spring freshet, to ensure the bridge safety is not impacted by the

inundation of the Facility during the first three years of operation. Should impacts occur to the bridge due to the Third Falls Facility inundation, an adaptive management plan will be discussed with Tembec. Possible measures will include adjusting the operational levels of the Facility or upgrading the bridge.

12.1.4.2 The Chute and Third Falls - Ice Scour

12.1.4.2.1 Potential Effects

Daily operation in the winter may cause ice instability within the headponds. The impact from the daily lowering of water levels in the winter cause breaking of the ice along the shoreline and ice scour can erode soft river bottom sediment. The action of broken ice wedging into the river sediments and moving up and down with repeated water level fluctuations can disturb certain shoreline habitat such as benthic organisms or winter spawned fish eggs.

The greatest potential for ice breakage and ice scour exists when the difference in daytime and nighttime flow is the greatest. This situation occurs when natural river flows are low during the winter. At these low flows, the higher lying river bank sections, where soft sediment is primarily found are not affected. This limits the areas of interest to locations where soft sediments occur in the primarily rocky river bed.

12.1.4.2.2 Mitigation Measures for The Chute and Third Falls

The geomorphic studies (Parish Geomorphic and ORTECH, Appendix E) have shown very few signs of channel instability within the Zone of Influence however a low potential for erosion still exists. In order to minimize erosion effects, the maximum daily fluctuations of upstream water levels will be limited. The daily fluctuation of water levels in the headponds of The Chute and the Third Falls will not exceed 1 m and 0.25 m, respectively. These maximum daily fluctuations were selected to minimize the magnitude of pore pressure changes of the soil along the shoreline, and by extension reducing the amount of shoreline erosion in the headpond. By limiting the daily fluctuation, vegetation will be able to naturally re-establish along the shoreline, thereby limiting the erosion potential.

There are no mitigation measures for potential ice scour impacts however a monitoring plan is described below.

12.1.4.2.3 Net Effects and Significance Assessment for The Chute and Third Falls

There will be a residual effect from the operations of both headponds and ice scour on the potential for erosion

Value of the Resource

Soil quantity is involved in supporting wildlife and vegetation and regulating surface water runoff processes. Although soil quantity is of high importance, the effect on the value of soil quantity is of *moderate* value since there is an abundance of soil in the Project Area and the concerns regarding soil quantity (sediment) from stakeholders relate to fish habitat which is addressed in Section 12.4.1

Geographic Extent of Effect

The erosion from the operations will be limited to areas already identified as being susceptible to erosion within the Zone of Influence therefore the geographic extent of the effect to soil quantity will be *low*. Indirect impacts from erosion such as the impact surface water quality and aquatic habitat will be addressed in the relevant sections through the report.

Duration and Frequency

The duration and frequency of the effect on soil quantity are anticipated to be *moderate* as the potential for erosion will persist through the life of the facilities but the frequency will be lowered due to the limited number of fluctuations and the run-of-river operations for Third Falls.

Irreversibility of Effect

Erosion impact to soil quantity is considered *irreversible* during the operations of the Project since once the material is eroded it is transported downstream; however naturally occurring erosion processes may restore the eroded material overtime.

Ecological or Social Context

Minimizing the number of daily fluctuations and limiting the rate of change of upstream water levels will limit the amount of erosion resulting in a *low* ecological effect to soil quantity.

Probability of Effect

It is anticipated that some erosion will occur particularly with the new shoreline development that will impact soil quantity resulting in a *moderate* likelihood of the effect occurring during operations phase.

Magnitude of the Effect

Providing the effective implementation of the mitigation and monitoring procedures, the magnitude of the effect on soil quantity is anticipated to be *moderate*. There are naturally occurring erosion processes impacting the soil quantity. However, it is anticipated that some erosion will occur from the

headpond fluctuations particularly while the new shorelines are being established that will likely exceed existing conditions.

Probability of Effect

The mitigation measures along with the operating restrictions will lower the impact to soil quantity resulting in a *low* probability of impact.

Overall Significance

The overall impact to soil quantity due to erosion from operations will be an *Insignificant Effect* as the geographic extent, ecological context and probability of the effect are low. The following monitoring plan will confirm the assumptions in the assessment.

12.1.4.2.4 Monitoring for The Chute and Third Falls

A monitoring location with soft sediments and potential for ice scour will be established prior to construction in an accessible area within The Chute and Third Falls headponds, respectively. The monitoring locations will be documented with photographs taken and be assessed for visible effects of ice scour after year 1 and year 5 of operation (i.e. during low flows in late summer).

The monitoring locations will be assessed in the winter while modified run-of-river operation is ongoing to determine if and how much ice breakage and wedging occurs. (See *Proposed Operating Plan & Water Management Plan Amendment*, Section 5.4 Ice Scour in Appendix D).

12.1.4.3 Sedimentation – Soil Quality

Occurring naturally, sedimentation is an important mechanism for the formation of rivers, channels and aquatic habitat. Soil quality is impacted by sedimentation processes. The erosion of bedrock and soils leads to the accumulation of sediments in water bodies providing habitat for aquatic life, supporting aquatic vegetation and impacting suspended sediment element of water quality. Soil quantity is impacted by the deposition of sediment in new locations.

12.1.4.3.1 Potential Effect for The Chute and Third Falls

Sediment in waterbodies from erosion processes due to operations can reduce the amount of sunlight reaching aquatic plants, clog fish gills, smother aquatic habitat and spawning areas, impede navigation and alter or block in-stream flow. Transporting sediment (soil quantity) from the Project site due to operations would result in a decrease in local sediment impacting aquatic habitat (impacts discussed in Section 12.4.1) and potentially water quality (impacts discussed in Section 12.2). Sediment quality could also be impacted by accidental spills which are discussed in Section 14.2.

Parish Geomorphic conducted a Sediment Impact Analysis Methods (SIAM) compares sediment transport capacities to estimated sediment supplies and indicates if there is an overall sediment surplus or deficit. The assessment can be found in the *Ivanhoe River Hydroelectric Projects The Chute Hydroelectric Generating Station and Third Falls Hydroelectric Generating Station Geomorphic Assessments* ("Geomorphic Assessment") included in Appendix E, and the results of the assessment are summarized below.

It was determined that operations at the two generating stations will likely only accentuate existing channel processes in the Study Area. The inundation of smaller rapids in headponds will likely result in the gradual deposition of sediment at the dam sites. The deposition of sediment will also likely occur at the upstream ends of each headpond, as well as in the areas immediately upstream of the dams. Though limited scouring may occur in the upstream portions of the headponds and slowwater areas, the eroded sediment would be deposited within a relatively short distance downstream, thus making the impact local in nature.

Although the rate of sediment infilling could not be predicted, it was concluded that infilling of the two headponds should be relatively slow, as fine sediment will generally be transported past both generating stations by the current.

Similar to the main dam at The Chute, the gradual deposition of sediment at the auxiliary dam at The Chute will likely result from the inundation of smaller rapids in the headpond.

12.1.4.3.2 Mitigation Measures for The Chute and Third Falls

Minimizing erosion effects (Section 12.1.4.1) will also minimize sedimentation since some of the eroded sediment would be deposited within a relatively short distance downstream. The measures to minimize erosion include limiting the maximum daily fluctuations of upstream water levels and maintain daily water level fluctuations in the headponds to 1.0m at The Chute and 0.25 at Third Falls.

12.1.4.3.3 Net Effects and Significance Assessment for The Chute and Third Falls

The variable operations at The Chute may result in a residual effect of increased suspended sediment in the Project Area. The significance of this impact is kept low by monitoring potential erosion areas that may contribute to increased sedimentation and using mechanical and vegetative controls where necessary. Studies based on hydraulic modelling show that impact from sedimentation (soil quality) and sediment transport (soil quantity) is predicted to be low. Monitoring will be initiated for the first 5 years and again in years 7 and 10 following the start of operations in order to confirm these predictions.

Value of the Resource

Sediment provides habitat for aquatic life and supports aquatic vegetation however there is an abundance of sediment in the Project Area therefore the value of this resource is *moderate*.

Geographic Extent of Effect

The baseline Geomorphic Assessment (Appendix E) described this section of the with slow water conditions which results in sediment settling out of the water in a relatively short distance. Therefore the geographic extent of the effect to soil quality and soil quantity will be *low*.

Duration and Frequency

The duration and frequency of the effect on soil quality and soil quantity from sedimentation are anticipated to be *moderate* as the potential for erosion will persist through the life of the facilities but the frequency will be lowered due to the limited number of fluctuations and the run-of-river operations for Third Falls.

Irreversibility of Effect

Sedimentation impact to soil quality is considered *irreversible* since once the material is eroded it is transported downstream; however, naturally occurring sedimentation processes may restore the eroded material overtime.

Ecological or Social Context

Minimizing the number of daily fluctuations and limiting the rate of change of upstream water levels will limit the amount of sedimentation (soil quality) and sediment transport (soil quantity) resulting in a *low* ecological effect to soil quality given that the area is a predominantly rocky riverbed.

Probability of Effect

The inundation of smaller rapids will likely lead to the gradual deposition of sediment resulting in a *moderate* likelihood of the effect occurring during operations.

Magnitude of the Effect

Predicted changes to the sediment transport regime will exceed existing conditions, but are anticipated to be *moderate* in magnitude.

Overall Significance

As the geographic extent and ecological context are low, the overall impact to soil quality and quantity from sedimentation during operations is anticipated to be an *Insignificant Effect*. The following monitoring plan will be confirm the assumptions used in this assessment.

12.1.4.3.4 Monitoring for The Chute and Third Falls

In order to confirm the predictions made in the geomorphic assessment, erosion and sedimentation monitoring has been planned for the first 5 years and again in years 7 and 10 following the start of operations. Details of the monitoring plan can be found in *Ivanhoe River Hydroelectric Projects The Chute and Third Falls Geomorphic Assessment, Addendum #1 – Monitoring Program* ("Geomorphic Assessment") in Appendix E. This comprehensive monitoring plan has been developed focusing primarily on channel adjustments and sediment movement within the zone of influence in order to detect any accelerated erosion that may potentially occur due to dam operations. Ten stations, including both control and impact stations, will be established within the Study Area in order to follow a Before, After, Control, Impact method.

At each station, a benchmarked channel section will be set-up and surveyed to provide a direct measure of changes in channel dimensions as well as changes in substrate, based on results of a pebble-count method. Additionally, a series erosion pins will be installed in the banks at each station. TSS will be measured as well for direct measure of suspended sediment movement (See Geomorphic Assessment in Appendix E). Should the monitoring program identify that significant erosion or sedimentation is occurring, a detailed study will be carried out to determine the cause. If it is due to Facility operation, an adaptive management plan will be developed with agencies to modify operations or provide physical shoreline protection measures.

12.2 Surface & Ground Water

12.2.1 Hydrology

Surface water hydrology outside of the zone of influence will not be altered from existing conditions. Upstream of the zone of influence water flows and levels are influenced by the Ivanhoe Lake dam. Downstream of the zone of influence, less than 100 m downstream of Third Falls tailrace flows and levels will be re-naturalized to run-of-river conditions.

The Project is designed to limit environmental impacts, including alternations to existing hydrology. On this basis operation of the Project will not alter annual, seasonal or daily hydrological parameters. Specifically the quantity of water entering the upstream zone of influence location over a 24 hour

period will be equal to the quantity of water leaving the downstream zone of influence location, with the addition of tributary and groundwater sources as at present.

Surface water hydrology will remain unchanged during run-of-river operations This mode of operation will occur 20% of the year.

During modified run-of-river operations hourly hydrology will be altered from existing conditions. The degree of alteration is a function of headpond storage capacity, headpond water level restrictions, inflow rates into the Chute headpond and turbinable flow parameters. The flow from the Project is re-naturalized at Third Falls; therefore the variable flow effect only occurs in Third Falls headpond. In this mode, the variability can affect:

1. Aquatic Habitat (Section 11.4 & 12.4)
2. Navigation (Impact Assessment in Sections 11.6.7 & 12.6.7)
3. Public Safety & Civil Structures (see Sections 11.7 and 12.7)
4. Ice Scour (Sedimentation Impact Assessment in Section 12.1.4.2)

A detailed discussion on flow and level alterations are provided in the Proposed Operating Plan & *Water Management Plan Amendment* (also referred to as an "Operating Plan") included as Appendix D.

12.2.1.2 Changes to Flows and Levels Impacting Aquatic Habitat

12.2.1.2.1 Potential Effect for The Chute and Third Falls

The daily variability in flow during modified run-of-river operation at The Chute may impact certain sensitive aquatic habitat in the Variable Flow Reach downstream of the Facility. Examples of possible concerns include:

1. Effects on fish spawning and foraging.
2. Effects on benthic organisms in the river sediment.

The significant aquatic habitat issues that were identified in the field studies were reviewed and considered in developing the Operating Plan.

12.2.1.2.2 Mitigation Measures

To reduce the potential for impact in the Variable Flow Reach during intermittent operations, the following operating parameters were established within the Environmental Screening Report:

1. Time of Event

2. Size of bypass flows
3. Controlled ramping of flows
4. Limit of maximum turbine flow

The objective of the downstream flow and level parameters is to ensure that ecological flow requirements identified as part of the environmental assessment process are met.

12.2.1.2.3 Net Effects and Significance Assessment

Value of the Resource

Aquatic habitat, including fish spawning and foraging habitat is considered to have a *high* value.

Geographic Extent of Effect

Since the effect is limited to the Project Area, the geographic extent is *low*.

Duration and Frequency of Effect

The effect will result in increased flow variability during periods of modified operations. The duration and frequency of this effect is considered *high* as both hourly low and high flow conditions will represent variability in the Zone of Influence.

Irreversibility of the Effect

The effect of flow variability is considered *reversible* as the frequency, duration and magnitude of flow variability can be adjusted as environmental conditions dictate.

Ecological or Social Context

The ecological context of flow variability is considered *high*. Aquatic habitat immediately downstream of the Chute and Third Falls GS has been identified as fish spawning and / or fish foraging habitat with limited habitat of similar quality found elsewhere within the river system.

Magnitude of Effect

The magnitude of change in hydrology is considered *low*. The long term synthesized flow record indicates operations are constrained within the existing seasonal patterns although hourly hydrological parameters will, at times fall outside of the existing pattern.

Probability of Effect

The probability of effect is *high*, considering modified flows will occur on a regular and recurring basis.

Overall Assessment

This effect is determined to be significant, based upon the value of the resource, frequency and ecological context. The proponent has engaged in a fish habitat offsetting, two-dimensional modelling and monitoring program resulting in an overall net benefit to impacted resources resulting in an overall impact of *Insignificant Effect*.

12.2.2 Water Levels, Flows & Movement

Operation of the Project will impact water levels, flows and movement within the zone of influence on an hourly basis. During certain times, both facilities would operate at the same rate as the natural flow in the river (i.e. "run-of-river") with no variation in upstream water levels due to operation and no man-made variation in downstream flows from those experienced naturally. At other times the first Facility in series, The Chute, would "modify" the natural flow in the river by storing some of the natural river flow during night time hours to be used during daytime hours (i.e. on business days from 11:00 a.m. to 7:00 p.m.) when the need for electricity in the Province is greater. During these periods, the second Facility in series, Third Falls, would re-naturalize river flows by storing and releasing water at a rate consistent with inflow rates prior to the Chute (natural rate). **It should be noted that over any 24 hour period the same volume of water would pass down the river as would occur under run-of-river operation.**

Modified run-of-river operation at the Chute would occur during moderate and low flows when the natural flow in the river is below the maximum turbine flow capacity (Q_{Tmax}) but above the minimum flow required to protect the environment (Q_{EA}). During these flow conditions, some of the natural river flow during night-time hours can be stored and used to produce electricity during daytime hours.

An important factor in modified run-of-river operation is the availability of storage upstream of the Facility. As described in the project description section, the amount of storage created as part of the Project is very limited. To achieve the objective of building a Project with limited environmental impact, the conceptual design of the Facility limits the height of structure, the depth and the area of inundation upstream. Consequently, the amount of storage available for operation is inherently limited in relation to the natural flow in the river, thereby limiting the storage to a few hours during moderate and low flows. The ability to use this storage is further constrained by environmental constraints outlined in other parts of the environmental assessment document. It is the limited storage that differentiates modified run-of-river projects from hydroelectric projects that create large storage reservoirs with the ability to store water for weeks or seasons to "peak" when seasonal periods

of hot or cold spells raise the need for extra electricity production. Typically, modified run-of-river projects have significantly less environmental impact than peaking hydroelectric projects. Run-of-river operations at Third Falls will have no effects past the Northern Claybelt Forest Complex Conservation Reserve boundary.

Further discussion on the Operating Plan objectives is provided in Sections 4.3 and 5.3 in *Proposed Operating Plan & Water Management Plan Amendment* in Appendix D.

A discussion of potential effects associated with water levels, flows and movement is provide in Section 11.2.1 "Surface Water Hydrology".

12.2.3 Water Quality & Quantity

Operation of the Project may result in changes to the following water quality parameters:

- Suspended and Dissolved Solids
- Dissolved Oxygen
- Water Temperature

Potential effects to water quality are discussed in the following section. The remaining water quality parameters are not expected to be directly affected by operations. A water quality monitoring plan will include these other parameters for comparison to baseline values and PWQO.

12.2.3.1 Suspended Solids

Suspended solids cold increase above baseline values resulting from shoreline erosion created by variability of flow and water levels within the zone of influence. Increases suspended solids can impact aquatic habitat such as silting of spawning areas. Over an extended period of time increased suspended solids falling out of the water column and settling within the headpond area can decrease headpond storage capacity.

Potential effects due to increased suspended solids are discussed Section 11.1.4 Erosion, Soils and Sediment.

12.2.3.2 Dissolved Oxygen

12.2.3.2.1 Potential Effect for The Chute and Third Falls

Changes to dissolved oxygen concentrations could occur within the deepest sections of the headpond if the water column becomes stratified. Low dissolved oxygen concentrations can occur within the bottom layer of a poorly mixed water column and lead to anaerobic conditions which are detrimental

to fish and fish habitat. In addition, increases in water temperature can result in reduction in dissolved oxygen concentration. However, the inundation depth for this project is shallow. Lack of mixing and aeration is not expected given the relatively shallow depth and the long channel like geometry of the headpond. In addition, temperature modeling (Screening Assessment - Water Temperature - Ivanhoe (The Chute / Third Falls) prepared by ORTECH on April 12, 2013 (Appendix G) has shown no significant difference in pre and post development water temperatures.

12.2.3.2.2 Mitigation Measures

A temperature profile with measurements taken every meter of depth will be conducted at the impoundment to determine if thermal stratification is occurring in the headpond
(See Surface Water Quality Report Section 4.2, Appendix G). Should stratification effects occur, the results will be reviewed with MOE/MNR to develop an adaptive management plan.

12.2.3.2.3 Net Effects and Significance Assessment

Value of the Resource

Dissolved oxygen concentrations, linked to aquatic ecosystem health and function is considered to have a *high* value.

Geographic Extent of Effect

The effect the geographic extent is considered *low* due to the limited area and volume which could be impacted. Areas most susceptible to stratification are identified as those areas within the first 500m upstream of the dam sites (i.e., within the Project Area).

Duration and Frequency of Effect

The duration and frequency of the effect is considered *high*. Once stratification is established within the water column it is expected to remain in this state until seasonal weather pattern cause the water column to “turn over” and mix thoroughly. This effect could occur on an annual basis during summer and winter.

Irreversibility of Effect

The effect of stratification is considered *irreversible*. Water depths susceptible to stratification due to a combination of water depth and low mixing flows will have a tendency to reform during each season. Adjustments to operations, such as managing headpond water levels and thus water depths within the headpond could be incorporated into operations to reduce the overall effect but may not necessarily prevent stratification from occurring.

Ecological or Social Context

The ecological context of reduced dissolved oxygen concentrations is considered *low* based upon the area and water volume which may be impacted.

Probability of Effect

The probability of effect is *low*, based upon the maximum water depths and flow velocities which will remain in the river system.

Magnitude of Effect

The magnitude of the effect is considered *low* resulting from the limited area and volume within the headponds where this effect could occur.

Overall Assessment

This effect is determined to be *Insignificant*, based upon the magnitude of the effect, geographic extent and ecological context.

12.2.3.3 Water Temperature

12.2.3.3.1 Potential Effect

The new headponds result in an increased area of surface water in the inundation areas. The residence time of water flow will be also increased. Temperature stratification can occur in deep reservoirs whereby the water at depth remains cooler than the water at the surface (Miller 2004). The changes of open water area, residence time and stratification arising from the new headpond areas could generate potential water temperature effect to the river, and could affect the water temperature of cold-water tributaries within the *Zone of Influence*.

The pre-project and project temperature assessments along the Ivanhoe River channel for both the Chute and Third Falls headponds are addressed in the *Screening Assessment - Water Temperature - Ivanhoe (The Chute / Third Falls)* prepared by ORTECH on April 12, 2013 (ORTECH, 2013 a) in Appendix G.

The calculation of the area ratio between the proposed inundation and the existing open water area in the watershed is introduced below.

- The Chute area ratio (ha/ha): 20 / 12661 = 0.2%
- Third Falls & The Chute area ratio (ha/ha): 61 / 17833 = 0.3%

The resulting change in areas due to the new inundation of The Chute and Third Falls is less than 1% of the total open water area of the watershed. The calculation results suggest that the contribution to the overall summer temperature baseline in the watershed at the macro scale is likely insignificant (ORTECH, 2013a).

The other main effect factor is residence time. Residence time was calculated by dividing headpond volume by various summer low flows. The average increase in residence time for the combined inundation for the sample data is approximately 1 to 2 days. The worst case increase in residence time and considering the combined effect of The Chute and Third Falls, results in an additional residence time of 5 days during a severe drought event.

The average new inundation depth values were calculated by dividing the proposed inundation volume by the inundation area (ORTECH, 2013a).

- The Chute average new inundation depth (m): 1.0
- Third Falls average new inundation depth (m): 1.8

Due to the shallow depth of the inundation, The Chute and Third Falls Facilities are not likely to result in temperature stratification.

Based on the above assessment, the predicted water temperature changes in the Ivanhoe River is low.

To predict the potential water temperature to the tributaries within the *Zone of Influence*, an assessment of pre-project and project tributary stream temperatures within the extend of the Third Falls headpond was prepared and provided in the *Ivanhoe River Predicted Temperature Impacts to Tributary Streams* prepared by ORTECH on November 27, 2013 (ORTECH, 2013b) in Appendix G.

The impact assessment to tributary temperature (NRSI, 2014) notes a water temperature tolerance limit for Brook Trout growth of 23.3°C for the 7-day mean temperature, and 25.3°C for the 1-day mean temperature.

The predicted increases of tributary temperature ranged from 0.1^{o}C to 4.4^{o}C, which was given in Table 2 (ORTECH, 2013b) in Appendix G. The predicted maximum mean daily water temperature is 21.1^{o}C, which is below the 1-day mean temperature and the 7-day mean temperature.

12.2.3.3.2 Mitigation Measures

To minimize the increase of water temperature in the river and tributaries within the *Zone of Influence*, the following mitigation measures are proposed.

- The installed capacities have been reduced from 3.6 MW to 2.9 MW for The Chute, and from 5.1 MW to 3.8 MW for Third Falls, to reduce the heights of spillway dams, and areas of the head ponds.
- Low heads of 9.5m and 10m will be implemented for The Chute and Third Falls respectively.
- The depth of The Chute's headpond will be increased from 6m at the spillway dam to 1m at 2.7 km upstream. The area of inundation between 2.7 km and 6.4 km upstream of The Chute is predicted to rise less than 1m and is expected to be confined to the existing channel below the existing high water mark for the majority of the river length.
- The depth of Third Fall's headpond will be increased from 3 m at the spillway dam to 1 m at 6.3 km upstream of the spillway dam. The depth of headpond between 6.3 km and 44 km upstream of Third Falls is predicted to rise less than 1m and is expected to be confined to the existing channel below the existing high water mark.
- Water flow through the powerhouse intakes will be withdrawn from the full height of the water column in the headpond. It will ensure that the warmer surface water is mixed with the colder deep water to minimize the potential for changes in water temperature in downstream water flow.

12.2.3.3.3 Net Effects and Significance Assessment

Value of Resource

Since the surface water quality, including the water temperature parameter, is an important resource for cold water fish species, such as Brook Trout, the value of the surface water quality resource in the Study Area is *high*.

Magnitude of Effect

The magnitude of effect is anticipated to be *moderate*, since the predicted maximum daily and weekly tributary temperatures are well below the tolerance limits.

Geographic Extent of Effect

The impact tributary length is less than 1000 m (ORTECH, 2013d), therefore, the geographic extent of effect is anticipated to be *moderate*.

Duration and Frequency of Effect

The effect has the potential to occur for short intervals during the summer period when river flows are the lowest. No changes during colder seasons are anticipated. Therefore, the duration and frequency is *low*.

Irreversibility of Effect

The effect on water temperature is *reversible*, as the air temperature is decreased.

Ecological or Social Context

The ecological context of increased water temperatures is considered *moderate*, since water temperatures are not predicted to increase significantly within the Zone of Influence and remain within the temperature range tolerated by Brook Trout.

Probability of Effect

There is a *moderate* probability of the effect occurring in the summer.

Overall Assessment

This effect is determined to be *Insignificant*, given that the duration and frequency is low and the effect is reversible.

12.2.4 Mercury

12.2.4.1 Potential Effect

The presence of mercury in water has become a source of concern because the methyl mercury is bio-concentrated by fish in water (see Section 12.7.5 Public Health for discussion relating to mercury levels in fish). Methyl mercury (MeHg) conversion can occur in the headponds, and is enhanced by shallow water depth, low pH, warm temperatures and the presence of abundant organic matter (Environment Canada, 2003).

As described in Section 9, the mercury and methyl mercury levels in the river are well below PWQO standards, accounting for 2.7% and 4.3% of PWQO standards. Methyl mercury levels were slightly higher in the summer than in the spring and fall, which is the inverse of the total mercury trend. The methyl mercury trend may be a result of increased methylating bacteria activity, which are stimulated when dissolved oxygen is low, a condition that may exist at night in the summer when aquatic plants are respiring (NRSI, 2014).

The potential increase of mercury and methyl mercury levels can be generated from the following activities.

- Mercury contained soil can be flooded into the river.
- The headponds increase the water depth in the inundation area, and can enhance the methylation of mercury in surface water through flooding of mercury containing soils, and microbial conversion of inorganic mercury to the more toxic form of methyl mercury during warm seasons.

12.2.4.2 Mitigation Measures

To mitigation the effects, the following measures are proposed.

- Rehabilitation at all construction areas will be monitored and maintained properly to minimize the potential soil erosion;
- Removal of woody vegetation from the head ponds to decrease the amount of organic matter/carbon within the headpond areas which will decrease the import of potential mercury contained materials; and
- Run-of-river operation for both facilities will occur when the natural river flow is greater than the maximum turbine capacity during spring thaw run-off conditions and during major storm events in the spring, summer and fall. It will also occur when natural flows are so low that any available water must be released downstream to protect the environment in late summer and late winter. The run-of-river operations reduce the residence time within each head pond, and decrease the possibility of conversion of inorganic mercury.

12.2.4.3 Net Effects and Significance Assessment

Value of Resource

Surface water is not used as a source of potable water in the Study Area. Due to the water use for fish habitat in the Study Area, the value of the surface water quality resource is *high*.

Geographic Extent of Effect

The effect on water quality could potentially occur for a distance downstream of the Project footprint greater than 1000 m. Therefore the geographic extend of changes is anticipated to be *high*.

Duration and Frequency of Effect

The effect has the potential to occur in a medium term to long term of operations. Therefore, the duration and frequency is *high*.

Ecological or Social Context

The local area that will be impacted by changes in water quality is anticipated to have a moderate resilience. Therefore the area has a *moderate* fragility to the effect.

Irreversibility of Effect

The scientific literature suggests that the increase in mercury levels will attenuate back to baseline conditions over time. Hence the effect is *reversible.*

Magnitude of Effect

The magnitude of change in mercury and methyl mercury due to headpond inundation is anticipated to exceed the low baseline levels, but it is unlikely to exceed PWQO standards. Therefore, the magnitude is anticipated to be *moderate*.

Probability of Effect

The probability of effect on water quality is *moderate*.

Overall Assessment

This effect is determined to be *Insignificant*, given that the effect is reversible and it is anticipated that the PWQO will continue to be met.

12.2.5 Ground Water Resources

12.2.5.1 Groundwater Flow and Level

12.2.5.1.1 Potential Effect

The increase of surface water level in the headpond areas is addressed in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* (NRSI, 2014) in Appendix H, with reference to the *Proposed Operating Plan & Water Management Plan Amendment Ivanhoe River Hydro Projects: The Chute, Third Falls* (ORTECH 2014) in Appendix D. The operation of elevated water level in the headpond areas will elevate the groundwater table in the area

immediately adjacent to the headponds. The potential elevated groundwater table may generate potential effects to the groundwater flow discharged to the tributaries in the *Zone of Influence*.

The surface water level in The Chute's headpond will be increased from 6m at the spillway dam to 1m at 2.7 km upstream. The area of inundation between 2.7 km and 6.4 km upstream of The Chute is predicted to rise less than 1m and is expected to be confined to the existing channel. The surface water level in Third Fall's headpond will be increased from 3 m at the spillway dam to 1 m at 6.3 km upstream of the spillway dam. The area of headpond between 6.3 km and 44 km upstream of Third Falls is predicted to rise less than 1m and is expected to be confined to the existing channel. Therefore, the increase of surface water level in the headpond areas is minor.

The regional groundwater movement is expected to follow the prevailing relief of the watershed. Topographic relief, from the top of the prevailing glaciofluvial eskers down to the river exceeds 60 meters (Xeneca, 2013b) which is much greater than the average increase of surface water level.

Based on the analysis of geological settings, regional groundwater flow, the consistency of groundwater flow to the tributaries is not anticipated to change throughout the year as this is primarily driven by precipitation which will not be affected by the Project (NRSI, 2014).

In addition, the regional groundwater flow patterns are not expected to change as they are driven by geologic conditions that will not change as a result of this project (NRSI, 2014).

12.2.5.1.2 Mitigation Measures

To minimize the potential effect on the groundwater flow and level, the following mitigation measures are proposed to minimize the changes of surface water levels and water flow in the headpond areas:

- Low heads of 9.5m and 10m will be implemented for The Chute and Third Falls respectively.
- The operating plan parameters proposed in Table 4a and Table 4b in the *Proposed Operating Plan & Water Management Plan Amendment* (Appendix D) have been chosen to be less than the amount of seasonal and inter-annual fluctuation that has been occurring naturally over time in the upstream river.
- During spring run-off conditions, major storm events in the spring, summer and fall, and during very low flow in late summer and late winter, both facilities would operate at the same rate as the natural flow in the river (i.e. "run-of-river").
- At other times the first project in series, The Chute, would "modify" the natural flow in the river by storing some of the natural river flow during night time hours to be used during business daytime hours. The second project in series, Third Falls, would re-naturalize river flows at a rate consistent with inflow rates prior to the Chute (natural rate).

12.2.5.1.3 Net Effects and Significance Assessment

Value of Resource

Groundwater is not used as a source of potable water in the Study Area. However, the value of the groundwater flow and level is *high*, because the groundwater provides a source of water flow in watercourses, including the Ivanhoe River and tributaries.

Magnitude of Effect

The magnitude of change in groundwater table is anticipated to be *low*, since the minor increase of surface water level is approximately less than 1 m in the majority area of the headponds.

Geographic Extent of Effect

The geographic extent of effect is anticipated to be *moderate*, since it is not anticipated to extend beyond 1000 m from the headponds.

Duration and Frequency of Effect

The duration and frequency of effect is *high*, since the effect will occur during the operational phase.

Irreversibility of Effect

The effect on groundwater table is considered to be *irreversible*; however, the groundwater table will be restored to the original natural level once the Project ceases the operations.

Ecological or Social Context

The local area that will be impacted by changes in groundwater table is anticipated to have a moderate resilience. Therefore the area has a *moderate* fragility to the effect.

Probability of Effect

There is a *high* probability of the effect occurring.

Overall Assessment

This effect is determined to be *Insignificant*, given the assessment of low magnitude, moderate graphic extend and reversible effect.

12.2.5.2 Groundwater Quality

12.2.5.2.1 Potential Effect

The major potential groundwater quality effects during the operational phase will be generated from an accidental spill or leakage from the following operation and maintenance activities:

- The use of hydraulic fluids and cleaning detergent within the powerhouses;
- The transfer and removal of transformer oils in the substations.

12.2.5.2.2 Mitigation Measures

To mitigate the potential effects, the following mitigation measures are proposed.

- A spill control plan will include required secondary containment areas for any storage and use of the hydraulic fluid drums and cleaning detergent containers, adequate spill clean-up materials within the powerhouses, and spill control training to all staff.
- The transformers will be enclosed by a secondary containment structure capable of holding the entire volume of transformer oil, as well as some additional volume. Secondary containment areas will be monitored throughout the operational phase to ensure the integrity.

12.2.5.2.3 Net Effects and Significance Assessment

Value of Resource

Groundwater is not used as a source of potable water in the Study Area. However, the value of the groundwater quality is *high*, because the groundwater provides a source of water flow in watercourses, including the Ivanhoe River and tributaries.

Geographic Extent of Effect

The geographic extent of effect is anticipated to be *low*, considering that the likelihood of groundwater contamination is low, with the implementation of secondary containment and spill control measures.

Duration and Frequency of Effect

The effect is unlikely to occur, with the implementation of secondary containment and spill control measures, therefore, the duration and frequency during operation is *low*.

Irreversibility of Effect

The potential effect on groundwater quality is considered to be *reversible*, since it is anticipated that the existing conditions will not be changed with the implementation of secondary containment and spill control measures.

Ecological or Social Context

There is no potential effect to the ecological or social context, since the potential spill and leakage will be avoided, with the implementation of secondary containment and spill control measures.

Magnitude of Effect

The magnitude of effect in groundwater quality is anticipated to be *low*, considering that the likelihood of groundwater contamination is low, with the implementation of secondary containment and spill control measures.

Probability of Effect

The probability of effect is *low*, since it is predicted that the likelihood to contaminate the groundwater is low with the implementation of secondary containment and spill control measures.

Overall Assessment

This effect is determined to be *Insignificant*, given that the geographic extent, duration and frequency, magnitude and probability are low.

12.3 Terrestrial Environment

12.3.1 Natural Vegetation & Terrestrial Habitat Linkages

The long-term operation of the Project will prevent regeneration of limited vegetation communities. Following effective use of mitigation measures, it is not anticipated that there will be any net effects on terrestrial vegetation communities as a result of fugitive dust generation. The following identifies the significance of these net negative effects. As the effect is localized, eventually reversible, and the resource is abundance in the area, this effect is considered to be *Insignificant*.

12.3.1.1 Potential Impacts on Terrestrial Vegetation due to Inundation at The Chute & Third Falls

12.3.1.1.1 Potential Effects

Terrestrial habitat is important to support terrestrial wildlife. More detailed information on the effect on the terrestrial habitat can be found in the *Natural Environment Characterization and Impact Assessment Report* (NRSI 2014) in Appendix H and the *Ivanhoe Baseline Environmental Conditions for Road and Transmission Line Options* (Northern Bioscience 2014) *i*n Appendix J.

During the operations phase, impacts to terrestrial habitat are due to the headponds, potential fugitive dust from the access roads and fluctuating water levels. Section 11.3.1 assessed the impacts to terrestrial habitat from vegetation clearing for the access roads, power lines, temporary laydown areas, head ponds, and permanent structures. During the operations phase, neither additional clearing nor any further earth moving activities are required. **No additional effects on the terrestrial habitat from tree clearing activities are anticipated from operational activities.**

When the facilities are operating as run-of-river facilities, the operations will not vary upstream or downstream water levels and no effects from operations on terrestrial habitat from water fluctuations are anticipated.

When The Chute is operating as a modified run-of-river Facility and Third Falls is acting to re-naturalize the flows, there will be a variation in water levels. The downstream water fluctuations from The Chute are attenuated by the headpond of Third Falls. The operations of Third Falls will re-naturalize the water flows and levels by storing and releasing water at a rate consistent with natural inflows coming into The Chute headpond. Re-naturalizing the water flows and levels results in no discernable effect on the downstream terrestrial habitat. However, the facilities will vary upstream water levels; therefore there is a potential effect to terrestrial habitat from headpond water fluctuations which are assessed below.

12.3.1.1.2 The Chute

The *Proposed Operating Plan & Water Management Plan Amendment* (also referred to as an "Operating Plan") (ORTECH 2014, Appendix D) outlines the maximum headpond water level fluctuations from the daily operation of The Chute. Water levels are proposed to fluctuate, on a daily basis, within the upstream zone of inundation to a maximum of 1m. Most riparian and emergent plants will not tolerate daily water level fluctuations of more than 25cm, therefore the daily operation of The Chute could result in the loss of emergent and shoreline vegetation. The two ELC community types impacted by inundation in The Chute headpond area are: Dry to Fresh, Coarse: Sparse Shrub (B046S) and Fresh, Clayey: Cedar – Conifer (B084). The estimated change in these habitat types is estimated to

be small, approximately 0.4% and 2.4% will be lost respectively, and both of these habitat types are abundant within the Project Area. The actual transitional area or riparian zone will be impacted based on the extent of daily water level fluctuations as described above. Where the fluctuations exceed 25cm daily, it is anticipated that the shoreline will be characterized as bare substrates.

An alteration to the composition of the terrestrial habitat along The Chute headpond is anticipated, some emergent or wetland species may establish along the shoreline immediately below the high water mark in areas that will be exposed for part of the day and submerged (in areas where the fluctuations are less than 25cm) for part of the day.

12.3.1.1.3 Third Falls

The proposed Operating Plan (Appendix D) outlines the maximum headpond water level fluctuations from the daily operation of Third Falls. Water levels are proposed to fluctuate, on a daily basis, within the upstream zone of inundation to a maximum of 0.25m. Under these conditions it is expected that emergent and shoreline vegetation will persist. The maximum daily water level fluctuation of 25cm is not anticipated to effect terrestrial habitat. Terrestrial habitat impacts are considered to be ***Insignificant*.**

12.3.1.1.4 Mitigation Measures for The Chute and Third Falls

It is not possible to mitigate this effect.

12.3.1.1.5 Net Effects and Significance Assessment for The Chute and Third Falls

The net effect to terrestrial habitat is the loss of emergent and shoreline vegetation from the headpond area during operations at The Chute which may not reestablish along the new shoreline.

Value of the Resource

The value of terrestrial habitat in this portion of Ontario is *moderate.* The terrestrial habitat in this region provides several important ecological and socio-economic functions. However, forests are very common within Northern Ontario.

Geographic Extent of Effect

The geographic extent is *low* as the impacts to of terrestrial habitat will only occur in The Chute headpond area.

Duration and Frequency of Effect

Duration and frequency of effect is *high*. Some emergent or wetland species may establish along the shoreline however, the impact will be for the life of the Project.

Irreversibility of Effect

The effect is considered *irreversible* during operations of the Project.

Ecological or Social Context

The headpond shoreline is resilient as emergent or wetland species may establish along the new shoreline. Therefore, the vulnerability of the ecological context to this impact is considered *low*.

Probability of Effect

The probability of the effect is high; terrestrial habitat will be impacted by the headpond fluctuations.

Magnitude of Effect

Some alteration in the habitat will occur but it is expected that re-establishment will occur such that this change is small, therefore the magnitude of the effect is *low*.

Overall Significance

As the effect is localized to The Chute headpond only, and the resource is abundant in the area, this effect to terrestrial habitat is considered to be *Insignificant*.

12.3.2 Terrestrial Wildlife

12.3.2.1 Operational effects of the 115kV Power Line on Large Birds

12.3.2.1.1 Potential Effect

During the operation of the 115kV power line it is possible that large bird species such as bald eagles may collide with the line or be electrocuted. This risk is higher for waterfowl and large waterbirds due to their large size and lower maneuverability, and lower for raptors who are stronger fliers with keen eyesight who become familiar with powerlines in their territory. Overall, incidence rates of raptor collisions are very low and collision fatalities are generally not a population decline factors and have little population-level significance. Collision with shield (grounding) wires has been reported as a primary cause of avian fatality from wire collisions due to their location and since they are difficult to see. Electrocution of raptors such as bald eagles may occur more frequently than collisions, particularly

if they fly into lines mid-span and bridge two conductors or when landing on wires or towers. Additionally bald eagles, ravens, osprey and red-tailed hawks will nest on transmission structures increasing their risk of electrocution (Northern Bioscience 2014).

12.3.2.1.2 Mitigation Measures

In order to mitigate impacts of electrocution and collision on large birds from the electrical line the following mitigations are proposed:

- Use wooden poles instead of steel towers (which some species nest in) to reduce risk of electrocution;
- Route selection to twin with existing corridors and avoid waterbodies and open wetlands that are attractive to waterfowl, eagles, ospreys, herons, and other large waterbirds;
- Markers (e.g., marker cones and coloured spiral markers) will be used where appropriate to increase the visibility of the power lines where they cross the Ivanhoe River and other major rivers and other potential high bird traffic corridors (e.g. adjacent to wetlands) to reduce potential collisions by large birds flying along the rivers;
- Suggested Practices outlined in APLIC (2006) will be used on the towers and lines near major rivers (or the whole power line if practical) to reduce the risk of electrocution of bald eagles and other birds, include a 150 cm (60 inch) standard of horizontal and vertical separation between energized and/or grounded parts on power line; and
- Best management practices (e.g., avoiding use of shield wires, minimizing guy wires) will be used where possible to minimize the potential for collisions and electrocution.

12.3.2.1.3 Net Effects and Significance Assessment

Value of the Resource

The value of large bird species in this area of Ontario is *moderate***.** Some of the species potentially impacted by this effect are Species at Risk in Ontario, particularly bald eagles which are known to occur in the Project Area. For those species this impact would be *high*.

Geographic Extent of Effect

The geographic extent of this effect will be *low*. It is not anticipated that this effect will have impacts outside of the Project Area.

Duration and Frequency

Impacts as a result of this effect will occur throughout the life of the power line, however they will likely occur infrequently, therefore the impact is *moderate*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

Given the considerable amount of quality habitat surrounding the Project Location, the vulnerability of the ecological context to this impact is considered to be *low*.

Magnitude of Effect

The magnitude of the effect is *low*.

Probability of Effect

The likelihood of this impact is *low*.

Overall Significance

Due to the low ecological context, magnitude and probability of the effect, the overall significance is *Insignificant*.

12.3.2.2 Vegetation Clearing Impacts on General Wildlife

12.3.2.2.1 Potential Effect

The most significant potential effects on terrestrial wildlife during operation and maintenance are from vegetation management in the ROW in order to suppress woody vegetation which can affect facility components. For the Ivanhoe power line, the effects of repeated vegetation management will likely affect habitat suitability for forest-dependent small mammals such as red squirrels, Eastern chipmunks, and red-backed voles compared to those species with preference for more open habitats early successional stages. Effects of vegetation management will vary depending on the ecological context in which the ROW is located and the relative abundance of the original forested and ROW habitat. Direct effects from vegetation management using herbicides are expected to be negligible since mammals do not metabolize triclopyr and if ingested it is rapidly (e.g., 3 days) excreted unchanged (Northern Bioscience 2014). Herbicides used in vegetation management have met all regulatory requirements and are widely used throughout Ontario and Canada. As graminoid-dominated open areas are

generally limited in the Study Area this will result in the promotion of certain species that may be currently limited by habitat area (Northern Bioscience 2014).

No mitigations measures are required for this effect, as the overall significance of this effect is *Insignificant*.

12.3.2.3 Disruption to Breeding Birds during Facility Operations

12.3.2.3.1 Potential Effect

Ongoing Facility operations, and access to previously inaccessible areas by the public may displace or alter the behavior of birds nesting in or adjacent to the Project. Additionally vehicle traffic on site may result in road kill of ground nesting birds.

12.3.2.3.2 Mitigation Measures

The following mitigations are proposed:

- Complete road and line maintenance outside of the breeding bird season (May 15-July 31) where possible to minimize noise disturbance;
- Modify driver behavior (warning signs, awareness training);
- Restrict speed (training, signs, speed control devices); and,
- Restrict night use of roads, by staff and equipment, during the nesting season where possible

12.3.2.3.3 Net Effects and Significance Assessment

Importance of the Value Affected

The value of birds in this area is ***moderate.*** In addition to protected species, some hunting, camping and nature activities occur in the area adding to the value of song birds and other species.

Geographic Extent of Effect

The geographic extent of this effect is *low*. Effects are expected to occur within the Project Area.

Duration and Frequency

The duration of this impact is expected to occur over the life of the roadways, with *moderate* frequency.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

The adjacent habitat is fragmented by roads, and the existing bird population tolerates this activity presently. There is some indication that the activity along the proposed roadways for operations would have a similar impact. Given the considerable amount of habitat near to the Project Area, the vulnerability of the ecological context to this impact is considered *low*.

Probability of Effect

The probability of this effect occurring is *moderate* depending on species type and nest location. Some species are more tolerant of disturbance than others.

Magnitude of Effect

The magnitude of this effect is *low*. Road collisions and disturbance are not anticipated to be extensive.

Overall Significance

As the geographic extent, ecological context and magnitude are low, the overall significance of this effect is *Insignificant*.

12.3.3 Species at Risk

12.3.3.1 Potential Disruption of Breeding and Nesting Due to Operations and Maintenance of Road and Power Line – Foresting Nesting Birds (Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird)

Potential impacts for these significant species will be the same as for other forest nesting birds. Please refer to the Section 12.3.2.3 *Disruption to Breeding Birds During Facility Operations.*

12.3.3.2 Potential Mortality of Common Nighthawk due to Roadway Collisions During Operations

12.3.3.2.1 Potential Effects

Common Nighthawk were observed on the Project site north of the Nova Road Bridge, and evidence of breeding was found within the spruce-fir coniferous forest community which occurs approximately 8km upstream from the proposed Third Falls GS and continues upstream along the east shoreline of the Ivanhoe River for approximately 5.5km in the Study Area (NRSI 2014). There is potential that expanded access into the Third Falls area for operations, maintenance, and the public may result in

mortality for common nighthawks which like to site their nests on gravel roads (Northern Bioscience 2014).

12.3.3.2.2 Mitigation Measures

- Speed limits of 50 km/hour will be applied on new roads to prevent collisions with Common Nighthawks during the nesting season (May 15 to July 31);
- Warning signs;
- All workers will be given an orientation on environmental management including a focus on non-harassment of wildlife;
- Limit night time use of road by staff and equipment.

12.3.3.2.3 Net Effects and Significance Assessment for The Chute and Third Falls

Value of the Resource Affected

The value of this species is *high*; the Common nighthawk is listed as Special Concern under the Ontario Endangered Species Act.

Geographic Extent of Effect

The geographic extent of this effect is *low*. Effects are anticipated to occur within the Project Area.

Duration and Frequency

The duration of this impact is expected to occur over the life of the roadways, with *moderate* frequency.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

The adjacent habitat is fragmented by roads, and the existing population tolerates this activity presently. There is some indication that the activity along the proposed roadways for operations would have a similar impact. Given the amount of quality of habitat surrounding the Project Area, the ecological context of the impact is considered to be *low*.

Magnitude of Effect

The magnitude of this effect is *low*. Road strikes can be a significant source of mortality for this species, however, strikes are not expected to occur in numbers which would have a population effect given the relatively short length of new road, small increase in expected traffic, and low traffic speed.

Probability of Effect

This impact is likely and is therefore *high*.

Overall Significance

As the geographic extent, ecological context and magnitude are low, the overall significance of this effect is *Insignificant*.

12.3.4 Significant Natural Heritage Features & Areas

12.3.4.1 Potential Impact to Moose Aquatic Feeding Area Due to Inundation and Headpond Fluctuation

12.3.4.1.1 Potential Effects

The forest communities, Fresh, Clayey: Cedar – Conifer (B084), Fresh, Silty to Fine Loamy: Conifer (B102) and Moist, Coarse: Spruce – Fir Conifer (B067), are adjacent to Moose Aquatic Feeding Areas (within 120m from Open Water Marsh: Organic (B152) communities) and therefore SWH. The actual wetlands that MNR identify as Moose Aquatic Feeding Areas exist outside of the inundation areas and will not be directly affected. The adjacent forest habitats which are considered a part of the SWH are present 200m upstream of The Chute GS, as well as in the Third Falls inundation area immediately downstream of The Chute. The water level is proposed to increase between 20cm – 1m depending on location in the river channel adjacent to Moose Aquatic Feeding Area. In the upstream location a 20cm increase in surface water elevation will be restricted to the existing channel within the existing high water mark and will not impact adjacent forest cover that is required by moose for shade and cover (NRSI 2014).

In the downstream location a 1m increase may result in the loss of a large portion of wetland vegetation. However, it is predicted that over time, other wetland communities would establish and potentially provide additional open water communities with submergent wetland plants (NRSI 2014).

12.3.4.1.2 Mitigation Measures

This impact to the adjacent upland forest communities is unavoidable, and mitigation is not expected to be required. Post construction monitoring will be planned in order to confirm that aquatic vegetation communities have re-established and that moose are continuing to use the area for feeding.

12.3.4.1.3 Net Effects and Significance Assessment

Value of the Resource Affected

This habitat value is *high* as it's a Significant Wildlife Habitat within protected within Ontario.

Geographic Extent of Effect

The geographic extent of this effect is *low*. Impacts will occur within the Project Area.

Duration and Frequency

This impact will occur throughout the life of the Project, and will therefore be *high.*

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

The ecological effect is *low*. There is only one location where there is expected to be a change in habitat as a result of the rise in water levels due to headpond fluctuation. Additionally communities are expected to re-establish.

Magnitude of Effect

The magnitude of this effect is *low***.** The loss of this habitat type is only expected to occur in one location, where additional habitat is anticipated to be created as a consequence.

Probability of Effect

This effect is likely to occur and the probability is therefore *high*

Overall Significance

As the geographic extent, ecological context and magnitude of the effect are low, the overall significance is *Insignificant*

12.3.5 Significant Earth or Life Science Features

As no Areas of Natural and Scientific Interest or Life Science Features were found in the Project Area, no mitigations for operations are required.

12.4 Aquatic Environment

12.4.1 Fish & Fish Habitat

12.4.1.1 Impacts on Northern Pike Spawning Habitat in The Chute inundation Area

12.4.1.1.1 Potential Effects

Northern Pike spawn in the spring, over aquatic and seasonally inundated vegetation such as in the marshes, wetlands and margins of lakes found throughout the Project Area. The water temperature range for Northern Pike spawning, is 4 to 12°C (NRSI 2014). Emergent aquatic vegetation is considered the preferred vegetation for Northern Pike spawning (NRSI 2014).

Habitat areas with aquatic vegetation, representing potential Northern Pike spawning habitat, have been identified in the area of inundation upstream of The Chute. Four tributaries (Tributaries 1 - 4) located between 300m and 3.5km upstream from the proposed Chute Facility have vegetated margins ideal for Northern Pike spawning. The herbaceous riparian vegetation along the shorelines of tributaries is expected to be impacted by water level fluctuations and comprises the most likely locations to be used for spawning. The loss of emergent vegetation due to daily water level fluctuations in the headpond would have a direct impact on Northern Pike spawning habitat (NRSI 2014). As noted above, some emergent or wetland species may establish along the shoreline immediately below the high water mark in areas that will be exposed for part of the day and submerged (less than 25cm) for part of the day (NRSI 2014) However daily fluctuations in the headpond still pose a significant risk to eggs.

12.4.1.1.2 Mitigation Measures

In order to ensure that Northern Pike eggs are protected during the Facility operations the following mitigation will be employed:

- The Facility will operate in run-of-river mode when temperatures reach 4°C in the spring and remain in this mode for thirty three days (following the end of Walleye spawning) to protect incubating eggs until fry are free swimming. This strategy for Walleye encompasses the period of Northern Pike spawning, and during these operations daily fluctuations in headpond water level would not occur. This strategy would also protect Northern Pike eggs from exposure and mitigate any effects.

The significance of the residual impacts following implementation of the above mitigation measure is described below

12.4.1.1.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of Northern Pike is *moderate;* this fish species is considered a valued ecosystem component by the MNR and is a common sport fish.

Geographic Extent of Effect

The geographic extent of this effect is *low;* this effect will be limited to the Project Area.

Duration and Frequency

Duration of the effect is *moderate*, it occurs infrequently during operations.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

The impact is *low*. With the re-establishment of emergent vegetation along the shoreline, which would provide suitable spawning habitat and the run-of-river operating mode during spawning, it is not anticipated that a significant impact to the local ecological context would occur.

Magnitude of Effect

This impact is *low.* Overall numbers of northern pike are stable, and anticipated effects would not adversely impact the population.

Probability of Effect

The probability of this effect is *moderate*. Monitoring will be required to ensure that sufficient vegetation remains.

Overall Significance

As the geographic extent and magnitude of the effect are low, the operational impacts to Northern Pike spawning habitat are anticipated to be *Insignificant*.

12.4.1.2 Impacts on Northern Pike Spawning Habitat Upstream of Third Falls

12.4.1.2.1 Potential Effect

Several areas representing potential Northern Pike spawning habitat, have been identified in the area upstream of Third Falls. Nineteen tributaries (Tributaries 5 – 23) were located between 5.5km and 30.8km upstream from the proposed Third Falls Facility location. These tributaries represent potential Northern Pike spawning habitat with an abundance of aquatic vegetation present. There are also two connected lakes with vegetated margins also representing potential Northern Pike spawning habitat. As the limited daily fluctuation of 25cm is not anticipated to result in the elimination of emergent vegetation in the nearshore area it is not anticipated that Northern Pike spawning habitat will be impacted by water level fluctuation (NRSI 2014).

This impact is expected to be negligible and no mitigation is required.

12.4.1.3 Impacts on Walleye Spawning Habitat at The Chute

12.4.1.3.1 Potential Effect

A modified run-of-river operation is currently proposed for The Chute Facility. During periods of modified run-of-river operations, the flows downstream of The Chute will vary throughout the day. At night, flows may be substantially lower than natural river flows; and during the day flows may be higher. This can result in flow fluctuations which are characterized by relatively rapid increases and decreases. Associated with these changes in flows are changes in the wetted width, water depths, and velocities in downstream habitat areas (NRSI 2014)

Rapidly fluctuating water levels are of concern due to the potential impacts of these fluctuations on Walleye spawning and egg incubation at The Chute. Spawning habitat has been confirmed in both the east (powerhouse) and west (spillway) channels at The Chute (NRSI 2014).

12.4.1.3.2 Mitigation

- The Facility will operate in run-of-river mode during the Walleye spawning, egg incubation and fry dispersal periods. If insufficient natural flow is available, the generating station will run continuously at maximum turbine flow throughout the duration of Walleye spawning, egg incubation and fry dispersal period;
- No rapid fluctuations in flow are anticipated in the east channel and the Walleye spawning habitat in that channel will benefit from consistent flow over the habitat;
- Walleye spawning offsetting habitat will be placed in the east channel, and will be designed to ensure that it functions hydraulically within the preferred range of velocity and depth for Walleye spawning under conditions of maximum turbine flow from the generating station;
- Minimum compensatory flow of 5 m3/s be made available in the west spillway channel at all times during the Walleye spawning, egg incubation and fry dispersal period;
- Water levels will be kept high enough in the Third Falls headpond (downstream from The Chute) in order to keep the lower portion of the west channel adequately wetted.

12.4.1.3.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of the resource is *high* as walleye is a VEC and valued by the local community as a sport and recreation fish.

Geographic Extent of Effect

The geographic extent of this impact is *low*. The impacts will occur within the Project Area.

Duration and Frequency

This impact will occur during operations of the Facility, therefore this impact is *moderate*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

Given the relative abundance of fish habitat in the Ivanhoe River, the vulnerability of the ecological context due to operation is considered *low*.

Magnitude of Effect

There magnitude of the effect is *low*. It is not anticipated that this impact will have an effect on population numbers.

Probability of Effect

The probability of this effect is *moderate*

Overall Significance

As the geographic extent, magnitude, and ecological context of this effect are low; the overall significance of this effect is *Insignificant*.

12.4.2 Fish Migration

12.4.2.1 Impacts on Potential Effects of Fish Stranding at The Chute GS

12.4.2.1.1 Potential Effect

Fish stranding is a potential impact that may occur in the fastwater habitats downstream of The Chute GS. In the new habitat areas that are constructed as Walleye spawning habitats in the east channel, rapidly decreasing flows during the modified run-of-river operation have the potential to result in the stranding of fish in the shallower, nearshore margins. When the Third Falls headpond downstream of the Chute GS is at full supply level, these impacts may be mitigated to some extent through the backwater effect of the headpond (NRSI 2014). This effect is considered significant as fish stranding can lead to mortality.

12.4.2.1.2 Mitigation

Due to the potential for fish stranding in the headpond area, the following mitigations include:

- Habitat adjustments at key areas to provide a pathway for stranded fish to retreat with water levels; and
- Restrictions on down ramping that would reduce the rate of water level change allowing more time for fish to escape exposed areas.

The significance of the residual impacts following implementation of the above mitigation measures are described below.

12.4.2.1.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of the resource is *moderate* as some fish in this system are valuable ecologically and to local residents.

Geographic Extent of Effect

The geographic extent of this effect is *low*. This effect would occur within the Project Area.

Duration and Frequency

This effect would only occur during operations infrequently, therefore the effect is *low*.

Irreversibility of Effect

This effect is considered *reversible*, provided the project operations change if stranding is observed.

Ecological or Social Context

This ecological significance of this effect is considered *low*. Most of these populations are considered stable within the area.

Magnitude of Effect

The magnitude of this effect is considered *low*. This effect is not anticipated to create population level effect.

Probability of Effect

This probability of this effect is *moderate*.

Overall Significance

As the geographic extent, duration and frequency, ecological context and magnitude of the effect are all low, the overall significance is *Insignificant.*

12.4.3 Fisheries

12.4.3.1 Impacts to Baitfish Population

The baitfish community within the Ivanhoe River consists of generalist species such as Longnose Dace, Blacknose Dace, Spottail Shiner and Johnny Darter that can tolerate a wide range of habitats and are common throughout Ontario. Water level fluctuations are not expected to impact these species and mitigations provided for the protection of Walleye and Northern Pike will also benefit other baitfish species. These species are not expected to be impacted at a population level (NRSI 2014).

No mitigation measures are required for the baitfish population, as impacts are considered negligible

12.4.4 Fish Injury or Mortality

12.4.4.1 Impacts of Fish Impingement on Trash Racks

12.4.4.1.1 Potential Effect

It is important that the proposed intake structure be intentionally designed for low intake velocities in order to avoid and mitigate the risk of entrainment and impingement. The installation of trash racks or louvers will act as both a visual and physical deterrent for fish becoming entrained. However, if entrance velocities are higher than burst swimming capabilities shown in Table 41: Burst Swimming Velocities of VEC Species in the Project Area and fish are too large to pass between the trash racks, they can become impinged (NRSI 2014).

Table 41: Burst Swimming Velocities of VEC Species in the Project Area

Species	Burst Speed Range	Juvenile Burst Speed Range
Walleye	1.60– 2.6 m/s	1.60m/s
Brook Trout	0.60 – 2.8 m/s	0.48 - 0.76m/s
Northern Pike	1.1 -2.2m/s	0.20 – 0.50m/s

(NRSI 2014)

12.4.4.1.2 Mitigation

Impingement is almost entirely a result of flow velocity in the area of the trash racks. Where velocities are kept low, fish benefit by being able to swim away from the intake flows, thereby avoiding impingement. Intake velocities should be lower than burst swimming capabilities of Walleye, Northern Pike and Brook Trout in order to avoid impingement of these species (NRSI 2014). The following will be required in order to avoid impingement of adult fish. Juveniles and small bodied fish will most likely continue to pass through the trash racks (See Section on Potential Effects of Turbine Entrainment).

- Trash racks will be installed at each turbine entrance with a spacing of 48mm;
- Entrance velocities are proposed to be a maximum of 0.75m/s at each Facility. This entrance velocity is lower than the burst swimming capabilities of adult Northern Pike and Walleye and within the range of burst swimming capabilities for Brook Trout which will help to mitigate impingement of these species on the trash racks;
- Should impingement prove to be a threat to VEC fish species, there are numerous other modifications may be considered such as lighting, electrical barriers, air bubbling and sound barriers.

12.4.4.1.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of fish species in this area is *moderate*; they are VECs and valued socially by the local community.

Geographic Extent of Effect

This geographic extent of this effect is *low*. Effects will only occur within the Project Area.

Duration and Frequency

This effect has the potential to occur somewhat frequently during operations therefore it is *moderate*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

Given the relative abundance of fish habitat in the Ivanhoe River the vulnerability of the ecological context to the impact due to operation is considered *low*.

Magnitude of Effect

The magnitude of this effect is *low*. Potential impingement would not likely result in a population level effect of the fish species involved.

Probability of Effect

This probability of this effect is *moderate*.

Overall Significance

As the geographic extent, ecological context and magnitude of the effect are low, the overall significance is *Insignificant*.

12.4.4.2 Impacts of Fish Entrainment in the Turbine (Turbine Mortality)

Discussions related to turbine mortality of entrained fish will primarily be focused on those individuals that do not have the ability to escape (i.e. larval fish, juvenile fish) or fish that are in a weakened state (i.e. wounded or diseased fish). In these cases, some small fish (larval fish and some juveniles) as well as adults (diseased or in weakened state) will enter the intake channel and become entrained, passing through the turbines and into the tailrace channel (NRSI 2014).

12.4.4.2.1 Potential Effects

There is the potential that small fish, juvenile fish, weak or wounded fish or other marine animals may pass through the turbine and become entrained, passing through the turbines and into the tailrace channel. This can be a significant cause of injury and mortality due to pressure, shear and turbulence, cavitation and mechanical causes (direct strike of turbine blades, abrasion or grinding of species, and stress of passage) (NRSI 2014).

It is considered unlikely that pressure related injury or mortality of fish will occur at the proposed Chute and Third Falls facilities, which have proposed heads of 9.5m and 10m respectively. High velocity gradients have been minimized within the turbines at The Chute and Third Falls generating stations (entrance velocities of 0.75m/s), therefore, injuries and mortality of fish related to shear and turbulence will likely be minimal. Impacts related to cavitation at proposed facilities are also anticipated to be minimal because of the selection of Kaplan turbines which can operate at a high rate of generation efficiency under a wide variety of flows. Cavitation is minimized through operations by running at peak efficiency, and concerns regarding fish injury and mortality related to cavitation will be minimized through turbine design and operation (NRSI 2014).

The turbine proposed for The Chute GS consists of four blades with a rotational speed of 225 RPM. The estimated turbine survival for a 100mm fish is 92.2%, for a 200mm fish is 89.5%, for a 300mm fish is 86.8%, for a 400mm fish is 84.1% and for a 500mm fish is 81.4%. It is evident that as the size of the fish increases the percentage of survival decreases, however, it is less likely for larger fish to pass through the trash racks which minimizes the chance of turbine mortality. Further details on this can be found in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* (NRSI 2014) in Appendix H.

The turbine proposed for the Third Falls GS consist of four blades (b) with a rotational speed of 211 RPM. The estimated turbine survival for a 100mm fish is 92.9%, for a 200mm fish is 90.2%, for a 300mm fish is 87.5%, for a 400mm fish is 84.8% and for a 500mm fish is 82.1%. Again, there is a trend of decreasing survival success as fish size increases. There is also a slightly higher chance of survival at the Third Falls turbine compared to The Chutes turbine as the proposed rotational speed is lower(NRSI 2014).

Smaller and juvenile fish are more likely to be entrained through the turbine because trash rack spacing is relatively small (48mm) and their burst swimming capabilities are much lower than those of adult fish. However, their chances of survival through the turbine are very high. Although larger fish have a lower chance of survival compared to smaller and juvenile fish, they are more likely to escape entrainment as entrance velocities are lower or within their range of burst swimming capabilities. At this time, entrainment does not pose a significant threat to fish as the percentages of survival for all five lengths are greater than 80%(NRSI 2014).

12.4.4.2.2 Mitigation

- Trash racks will be installed at each turbine entrance with a spacing of 48mm;
- Entrance velocities of 75m/s to prevent larger fish from entering the turbine;
- Use of Kaplan turbines to decrease impacts of cavitation;
- Maintain low rotational speeds in order to increase fish survival rate.

The significance of the residual impacts following implementation of the above mitigation measures are described below

12.4.4.2.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of fish species in this area is *moderate*; they are VECs and valued socially by the local community.

Geographic Extent of Effect

The geographic extent of this effect is *low*. This effect will only occur within the Project Area.

Duration and Frequency

Impacts as a result of turbine entrainment will occur during operations, and are therefore *moderate*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

Given the relative abundance of fish habitat in the Ivanhoe River the vulnerability of the ecological context to the impact due to operations is considered *low.*

Magnitude of Effect

The magnitude of this effect is *low***.** Potential entrainment would not likely result in a population level effect of the fish species involved.

Probability of Effect

The probability of this effect is *moderate***.**

Overall Significance

As the geographic extent, ecological context and magnitude of the effect are low; the overall significance of this effect is *Insignificant*

12.4.5 Wetland Habitat

12.4.5.1 Impacts to Riverine/Wetland Habitat due to Operations

Wetland communities provide several important functions including water filtration, habitat, shoreline protection, and recreational activities. Where power line or new road corridors could impact adjacent wetlands, a Rapid Assessment Technique was used to determine if the wetland is likely to be scored as a Provincially Significant Wetland (PSW). The results of the assessment are located in the *Ivanhoe Baseline Environmental Conditions for Road and Transmission Line Options* (Northern Bioscience 2014) in Appendix H.

12.4.5.1.1 Potential Effects of The Chute and Third Falls

When the facilities are operating as run-of-river facilities, the operations will not vary upstream or downstream water levels and no effects from operations on riverine or wetland habitat from water fluctuations are anticipated.

When The Chute is operating as a modified run-of-river Facility and Third Falls is acting to re-naturalize the flows, there will be a variation in water levels. The downstream water fluctuations from The Chute

are attenuated by the headpond of Third Falls. The operations of Third Falls will re-naturalize the water flows and levels by storing and releasing water at a rate consistent with natural inflows coming into The Chute headpond. **Re-naturalizing the water flows and levels results in no effect on the downstream terrestrial habitat.**

12.4.5.1.2 The Chute

The proposed *Proposed Operating Plan &Water Management Plan Amendment Ivanhoe River Hydro Projects* ("Operating Plan") in Appendix D, outlines the maximum headpond water level fluctuations from the daily operation of The Chute. Water levels are proposed to fluctuate, on a daily basis, within the upstream zone of inundation to a maximum of 1m. The two ELC community types in The Chute headpond area are: Dry to Fresh, Coarse: Sparse Shrub and Fresh, Clayey: Cedar – Conifer neither of which are wetlands therefore there are **no impacts anticipated from the water fluctuations in The Chute headpond.**

12.4.5.1.3 Third Falls

The proposed Operating Plan (Appendix D) outlines the maximum headpond water level fluctuations from the daily operation of Third Falls. Water levels are proposed to fluctuate, on a daily basis, within the upstream zone of inundation to a maximum of 0.25m. Under these conditions it is expected that emergent and shoreline vegetation will persist. **The maximum daily water level fluctuation of 25cm is not anticipated to effect riverine and wetland habitat** (NRSI 2014).

12.4.5.2 Impacts on Snapping Turtle Habitat Due to Traffic

No turtles were observed during 2013 surveys, although potential habitat is present in the Study Area. The Study Area is at the northern edge of the range of Snapping Turtle, a Species of Special Concern. This species habitat is therefore considered SWH (Northern Bioscience 2014).

12.4.5.2.1 Potential Effect

This habitat could be impacted by increased traffic on the site during the construction period, disturbance to nests along the road bed during nesting period and aquatic habitat disturbance due to water drawdowns for dust control. Traffic mortality would the most significant impact related to turtles in the Study Area (Northern Bioscience 2014). It is expected that the potential impacts during operations will be considerably less than during construction due to reduced traffic volume.

12.4.5.2.2 Mitigation

In order to mitigate the potential impacts to any turtles that may be present in the Study Area the following activities are proposed during the active season (May 1 to Sep 30):

- Modify driver behaviour (warning signs, awareness training);
- Employee Training;
- Should Snapping Turtles be discovered in the Study Area, mitigation measures will be checked for application in specific instances with advice from biologists with experience with these species.

The significance of the residual impacts following implementation of the above mitigation measures are described below.

12.4.5.2.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of Snapping Turtle is *high*; it is classified as special concern under the Ontario Endangered Species Act.

Geographic Extent of Effect

The geographic extent of this effect will be *low*. This effect will not influence areas outside of the Project Area.

Duration and Frequency

Impacts as a result of this effect will occur during operations therefore this effect is *moderate*.

Irreversibility of Effect

This effect is *irreversible* during Project operations however it would be reversible should the Project cease operations.

Ecological or Social Context

Given the relative abundance of fish habitat in the Ivanhoe River the vulnerability of the ecological context to due to operations is considered *low*.

Magnitude of Effect

The magnitude of the effect is *low*. The area is fragmented by roadways presently, only a small number of new roadways will be constructed. The marginal increase in traffic is not expected to produce a population level impact.

Probability of Effect

The probability of this effect is *low*. Snapping Turtles have not been documented in the Project Area.

Overall Significance

As the geographic extent, ecological context, magnitude and probability of the effect are low; the overall significance of this effect is *Insignificant*

12.4.5.3 Impacts on Wetland Nesting Birds due to Road Maintenance

12.4.5.3.1 Potential Effect

Several marsh and open fen nesting bird species at risk, including Black Tern, Yellow Rail, and Short-eared Owl occur in the surrounding area. Although these species were not observed in 2013, they are sparsely distributed in the boreal forest northeast of Lake Superior and suitable habitat is present in the Study Area. These birds have species-specific nesting habitat requirements, but all need relatively large marshes or graminoid fens (Northern Bioscience 2014).

The roads and power line encroaches on 27 large wetland complexes and numerous smaller wetland polygons (Northern Bioscience 2014). There is the potential that maintenance of the roadways could result in species disturbance, disruption of breeding, and general habitat disturbance. This impact is expected to be moderately significant.

12.4.5.3.2 Mitigation

- Complete road maintenance during non-breeding season (mid-August to early-May to minimize noise disturbance
- Modify driver behaviour (warning signs, awareness training)
- Restrict speed (training, signs, speed control devices
- No water drawdowns for dust control in suitable wetland habitat
- Dust control using only water (no chemical agents) within 150 m of suitable habitat

12.4.5.3.3 Net Effects and Significance Assessment

Value of Resource Affected

The value of wetland nesting birds is *high* as they are species at risk within Ontario and have protections under the Ontario Endangered Species Act.

Geographic Extent of Effect

The geographic extent of this impact is *low*. The effect will occur within the Project Area.

Duration and Frequency

Impacts as a result of road maintenance will occur throughout the operations period, infrequently. This impact is *low*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

Given the relative abundance of habitat in the Project Area, the vulnerability of the ecological context to the impact due to operations is considered *low*.

Magnitude of Effect

The magnitude of this effect is *low*. The maintenance of the roads is unlikely to result in a population level effect.

Probability of Effect

The probability of this effect is *moderate*.

Overall Significance

As the geographic extent, duration and frequency, ecological context and magnitude of the effect are low; the overall significance of this effect is *Insignificant*.

12.4.6 Shoreline Dependent Species

12.4.6.1 Impacts to Otters in the Third Falls Inundation Area

Evidence of otters was documented at the Nova Road Bridge, 8km upstream of the proposed Third Falls GS. With the water level fluctuation restricted to 25cm in the Third Falls headpond, no impacts to otters or otter denning are anticipated (NRSI 2014). **As a result this impact is expected to be negligible and no mitigation is required.**

12.4.7 Significant Natural Heritage Features and Areas

There are no operational impacts to significant or natural heritage features or areas.

12.5 Air, Noise & Vibration

12.5.1 Air Quality

12.5.1.1 Potential Effects

Impacts to air quality during the operation of the Facility could result from the following activities:

- Off gassing from decaying organic matter within the newly created headpond;
- Emissions from a back-up diesel generator.

Potential effects to air quality originating from these operations include:

- Increases in greenhouse gas emissions originating from the headponds created during the decomposition of organic matter, and
- Short-term and localized increases in emission of nitrogen oxides and carbon monoxide from operation of the back-up generator.

During the operations of the facilities there is a potential for fugitive dust from travel along access roads to impact terrestrial habitats, however, the anticipated infrequent nature of such travel will result in negligible impacts.

The following report sections provide further discussion on these effects, mitigation measures and net effects including the significance of these net effects.

Emissions from vehicles accessing the site include PM from road dust and combustion engine emissions are not anticipated to create adverse impacts based upon the scope and infrequent nature of these activities.

12.5.2 Green House Gas Emissions

12.5.2.1 Potential Effect

Increases in Greenhouse Gas (GHG) emissions globally are linked with climate change and has gathered the attention of nations to enact measures to reduce GHG emissions. GHGs including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are emitted from both the existing waterbody and adjacent terrestrial lands. The GHG that could potentially be released by the Facility are related to the decomposing organic material releasing methane (CH_4) into the atmosphere. Published literature and scientific studies on hydroelectric reservoirs (headponds) in Canada indicates that increases in GHGs are likely to peak during the first three years of operation and reach levels similar to natural lakes after ten years. (Tremblay, 2010) This increase of GHG emissions in reservoirs shortly after flooding is related to the release of nutrients, enhanced bacterial activity and decomposition of available carbon.(Tremblay, 2010)

GHG emission factors from waterpower facilities with operating headponds are significantly lower than corresponding emission factors from thermal power plant alternatives by at least one order of magnitude.(Tremblay, 2010) Over an extended period of time GHG emissions (CO_2 equivalent) for one Canadian reservoir was estimated to be 16% of that produced by a combined cycle natural gas fired generating station.(Tremblay, 2010) This reduced GHG generation factor is supportive of Canada's objectives of reducing GHG emissions.

12.5.2.2 Mitigation Measures

Reducing the amount of organic material available to decompose generating GHGs are partially mitigated through the design of the Facility which limits the extent of newly inundated area, with most of the headpond contained within the existing river channel. Additional mitigation measures, to be employed around significant areas of inundation adjacent to the dam site, includes the removal of trees with diameters of 0.05m and greater. This measure will reduce the quantity of organic matter below the newly established water surface available for decomposition.

12.5.2.3 Net Effects and Significance of Net Effects

12.5.2.3.1 Value of Resource

Maintaining good air quality is considered a *high* valued resource related to human and environmental health.

12.5.2.3.2 Geographic Extent of Effect

The geographic extent is considered to be *low*. Increases in GHG emissions are assessed on a global scale with an overall net benefit realized through reduced levels of GHG emissions over the life of the Project.

12.5.2.3.3 Duration and Frequency of Effect

The duration of elevated levels of emissions are considered to be *low*. GHG emissions are predicted to peak during the first three years of operation and then subside. During the initial three years elevated emission will occur on a relatively constant basis, with the exception of winter months. Beyond year ten of operations elevated emissions of GHG are not predicted.

12.5.2.3.4 Reversibility of Effect

Impacts related to emissions are considered *irreversible*. Construction of the Project will create a permanent headpond and aquatic areas

12.5.2.3.5 Ecological or Social Context

The vulnerability of the ecological/social context to reductions in GHG emissions is considered *low*.

12.5.2.3.6 Magnitude of Effect

The magnitude of the effect is considered to be *low*. Increases in GHG emissions are assessed on a global scale with an overall net positive benefit realized through reduced levels of GHG emissions over the life of the Project.

12.5.2.3.7 Probability of Effect

The probability of the effect is considered *high*. Recent studies have confirmed elevated GHG emission during the initial years of operation followed by significantly reduced levels in the following years. The overall net benefit to reducing GHG emissions employs a conservative approach which may underestimate total GHG reductions from waterpower facilities.

12.5.2.3.8 Overall Assessment

Overall effects related to GHG emissions are considered to be *Insignificant but positive* in support of Canada's GHG reduction targets. This assessment is based upon the magnitude of effect, duration and frequency as well as ecological and social context.

12.5.3 Increases to Air Pollutants from the Back-up Generator

12.5.3.1 Potential Effects

During the operational phase of the Facility, a back-up diesel powered generator will be required on occasion to provide a source of emergency power during periods when the generator is shut down and the local electrical supply is unavailable. To ensure reliability of the back-up system periodic testing and operation of the equipment will be required.

The primary emissions from the equipment will consist of NO_x and CO. Emissions of SO_2, TRS, O_3 and PM will also occur but at quantities and concentrations significantly less than the primary contaminants and are not predicted to impact air quality in the Study Area. (ORTECH, 2012) For this reason the remaining discussion focuses on impacts associated with the primary contaminants NO_2 and CO.

Localized impacts to air quality from the back-up generator are unlikely to occur based upon current engine performance standards (US EPA Tier 4 Standards) enacted for new equipment.

12.5.3.2 Mitigation Measures

Mitigation measures for the diesel back-up generator include operating and maintaining the equipment in conformance with the manufacturer's requirements. The operator will be responsible for maintaining a log of all maintenance activities and operation of the equipment.

12.5.3.3 Net Effects and Significance of Net Effects

12.5.3.3.1 Value of Resource

Maintaining good air quality is considered a *high* valued resource related to human and environmental health.

12.5.3.3.2 Geographic Extent of Effect

The geographic extent is considered to be *low*. Use of mitigation measures is predicted to limit the extent of impacts associated with emissions to the powerhouse site.

12.5.3.3.3 Duration and Frequency of Effect

The duration and frequency of elevated levels of emissions are considered to be *low*. Combustion emissions from the equipment will conform to emission standards. The duration of emissions will be limited to periodic testing and infrequent use during power outages.

12.5.3.3.4 Reversibility of Effect

Impacts related to emissions are considered *reversible*. Upon completion of the activity the generation of the emissions will approach zero.

12.5.3.3.5 Ecological or Social Context

Due to the abundance of excellent air quality in the Project Area, the vulnerability of the ecological/social context to operational increases to air emissions is considered *low*.

12.5.3.3.6 Magnitude of Effect

The magnitude of the effect is considered to be *low*. Increases in emissions are predicted to be contained to the areas adjacent to the powerhouse and are not predicted to exceed provincial air quality criteria beyond the site.

12.5.3.3.7 Probability of Effect

The probability of effects occurring outside of the immediate powerhouse area is considered *low*.

12.5.3.3.8 Overall Assessment

Overall effects related to emissions are considered to be an *Insignificant Effect*. This assessment is based upon the magnitude of effect, duration and frequency as well as ecological and social context.

12.5.4 Noise and Vibration

Operation of the Project will result in increased sound levels impacting areas adjacent to the powerhouse. The MOE has developed a series of Noise Pollution Control (NPC) guidelines and two noise screening documents (primary and secondary) that provide a framework to determine if noise emissions from a Facility are causing, or are likely to cause, an adverse effect. For the Ivanhoe River Hydro Project, the primary screening methodology provides a 1,000 m setback beyond which adverse impacts are not predicted to occur from defined facilities including Electric Power Generation facilities (NAICS Code 22111).

Through a process of stakeholder consultation including public postings in local newspapers, public information sessions and a review of aerial imagery no Points of Reception, as defined in the NPC documents, are identified within 3,000 meters of the Project. Based upon this information the Project will be compliant with the MOE's NPC guidelines and no further assessment is required.(ORTECH, 2013)

Transient users adjacent to the facilities may include recreational activities (canoeing, hiking, etc.) or commercial activities such as trapping or mining prospecting. These users could be temporarily impacted by nuisance levels of sound above the MOE guideline values when travelling within 100 m of the Facility based upon information provided in the noise assessment report.(HGC, 2013) These sound levels are significantly lower than levels where hearing protection would be required.

12.5.4.1 Mitigation Measures

Mitigation measures to prevent exposure to high levels of sound include securing the powerhouse Facility within fenced areas including locked doors to the powerhouse Facility and signage indicating the potential for noise exposure hazards within the powerhouse building.

12.5.4.2 Net Effects and Significance of Net Effects

12.5.4.2.1 Value of Resource

Maintaining desirable sound levels is considered a *high* valued resource related to the establishment of provincial noise guidelines.

12.5.4.2.2 Geographic Extent of Effect

The geographic extent is considered to be *low*. Use of mitigation measures is predicted to limit the extent of impacts associated with emissions to less than 100 m from the powerhouse.

12.5.4.2.3 Duration and Frequency of Effect

The duration and frequency of elevated levels of sound emissions beyond 100m of the powerhouse are considered to be *low*.

12.5.4.2.4 Reversibility of Effect

This effect is *irreversible* during Project operations.

12.5.4.2.5 Ecological or Social Context

Due to the absence of permanent users of the area and the ability of wildlife to migrate within the large contiguous forest surrounding the Project Area, the vulnerability of the social/ecological context to operational increases to noise and vibration is considered *low*.

12.5.4.2.6 Magnitude of Effect

The magnitude of the effect is considered to be *low*. Increases in sound emissions are predicted to be contained to the areas adjacent to the powerhouse and are not predicted to exceed provincial guidelines beyond 100m (HGC, 2013).

12.5.4.2.7 Probability of Effect

The probability of effects occurring is high in the immediate area and low beyond 100 m of the powerhouse giving an overall ranking of *moderate*.

12.5.4.2.8 Overall Assessment

Overall effects related to noise and vibration is considered to be an *Insignificant Effect*. This assessment is based upon the magnitude of effect, reversibility as well as ecological and social context.

12.6 Land

12.6.1 Existing Land Use or Resource Management Plans

No impacts are anticipated to existing Land Use or Resource Management Plans. No construction impacts are anticipated to existing mining or aggregate extraction activities; potential construction impacts to forestry activities in relation to vegetation clearing have been addressed through consultation with the SFL holders, EACOM and Tembec (see Section 17.2.3).

12.6.2 Site Access

12.6.2.1 Oates Bridge

Western site access to The Chute Facility is off the Oates Roads just past the Oates Bridge**.** The Oates Bridge on the Oates Roads is located approximately 1.9 km upstream of The Chute Facility.

12.6.2.1.1 Potential Effects

The operation of the dam at The Chute Facility may cause increased water levels that affect the function or longevity of the bridge on the Oates Road, located approximately 1.9km upstream of the Facility location. At the request of the bridge owner, EACOM, Xeneca commissioned a study from Canadian Project Limited to model how increased water levels from the impoundment might affect it. The analysis concluded that the Project will reduce the freeboard from 2.08m to 1.7m during a 1:100 year storm event if a gated overflow weir is used in the Project design. If a fixed weir design is used

instead, the bottom of the bridge girders would be submerged during the 1:100 year storm, and an increase in bridge elevation of 0.65m would be required.

12.6.2.1.2 Mitigation

Xeneca commits to maintaining the operability of the Oates Road bridge. Consultation and negotiation is ongoing with EACOM, which has reviewed the CPL report, and a solution acceptable to both sides will be reached prior to completion of permitting and approvals. This negotiation will include discussions over the form of weir to be used at the hydroelectric facility and, if required, may also involve elevating the bridge deck.

12.6.2.1.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The bridge is of *high* value to EACOM, the bridge owner, as it supports their forestry operations.

Geographic Extent of Effect

The geographic extent will be limited to the bridge itself, and is *low*.

Duration and Frequency

As impacts were assessed for a 1:100 year storm event, the frequency of any impact to the Oates bridge is anticipated to be very infrequent or *low*.

Irreversibility of Effect

Such damage, if it were to occur, would be *reversible*, but it would require repair and rehabilitation of the bridge structure.

Ecological or Social Context

Given the low number of roads and bridges in the area, it is anticipated to have *high* vulnerability to impacts to the Oates Bridge structure.

Magnitude of the Effect

If a 1:100 year storm event occurs and a fixed weir design is used, the magnitude of impacts could be high, as this could damage or destroy the bridge, and this may affect EACOM's ability to carry out their forestry activities until the bridge is repaired. However, with the application of mitigation measures to

be determined in consultation with EACOM, any damage resulting to the bridge structure post-mitigation is anticipated to be *low*.

Probability of Effect

The likelihood of impact is *low*, as Xeneca will raise the bridge deck if required to avoid anticipated impacts from the 1:100 year storm event.

Overall Significance

As the geographic extent, duration and frequency, reversibility, probability and magnitude of the effect are low; the residual impacts to the Oates Bridge are anticipated to be *Insignificant.*

12.6.2.2 Nova Bridge

12.6.2.2.1 Potential Effects

The operation of the dam at the Third Falls Facility may cause increased water levels that affect the function or longevity of the bridge on Nova Road, located approximately 10.9km upstream of the Facility location. At the request of the bridge owner, Tembec, Xeneca commissioned a study from Canadian Project Limited to model how increased water levels from the impoundment might affect it. The analysis concluded that the Project will reduce the freeboard from 0.48m to 0.45m during a 1:100 year storm event if a gated overflow weir is used in the Project design. If a fixed weir design is used instead, the bottom of the bridge girders would be submerged during the 1:100 year storm, and an increase in bridge elevation of 0.67m would be required.

12.6.2.2.2 Mitigation

Xeneca commits to maintaining the operability of the Nova Road bridge. Consultation and negotiation is ongoing with EACOM, which has reviewed the CPL report, and a solution acceptable to both sides will be reached prior to completion of permitting and approvals. This negotiation will include discussions over the form of weir to be used at the hydroelectric facility and, if required, may also involve elevating the bridge deck.

12.6.2.2.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The bridge is of *high* value to Tembec, the bridge owner, as it supports their forestry operations.

Geographic Extent of Effect

The geographic extent will be limited to the bridge itself, and is *low*.

Duration and Frequency

As impacts were assessed for a 1:100 year storm event, the frequency of any impact to the Nova bridge is anticipated to be very infrequent or *low*.

Irreversibility of Effect

Such damage, if it were to occur, would be *reversible*, but it would require repair and rehabilitation of the bridge structure.

Ecological or Social Context

Given the low number of roads and bridges in the area, it is anticipated to have *high* vulnerability to impacts to the Nova Bridge structure.

Magnitude of the Effect

If a 1:100 year storm event occurs and a fixed weir design is used, the magnitude of impacts could be high, as this could damage or destroy the bridge, and this may affect Tembec's ability to carry out their forestry activities until the bridge is repaired. However, with the application of mitigation measures to be determined in consultation with Tembec, any damage resulting to the bridge structure post-mitigation is anticipated to be *low*.

Probability of Effect

The likelihood of impact is *low*, as Xeneca will ensure that the bridge deck is raised if necessary to avoid anticipated impacts from the 1:100 year storm event.

Overall Significance

As the geographic extent, duration and frequency, reversibility, probability and magnitude of the effect are low; the residual impacts to the Nova Road bridge from Project operations is anticipated to be *Insignificant*.

12.6.3 Riparian Rights & Privileges

There are no riparian rights or private landowners within the Project Area. Therefore, there are no impacts to consider.

12.6.4 Angling & Hunting

12.6.4.1 Hunting

12.6.4.1.1 Potential Effects

Game species have large territorial ranges and though they do have regular interaction with aquatic habitats (for water, consumption of aquatic species, and cooling), they tend to use different habitats at different times of the year and move around to find the best food and cover available to them. Xeneca's operations are not expected to have a significant impact on hunting activities, since hunters are able to target these species in other locations near the Project site. Furthermore, the surrounding forest is large (>100ha in size) and contiguous, which signifies that similar habitat is abundant in the surrounding area (Source: NRSI Environmental Baseline report). Thus, it is anticipated that there will be minimal impacts to hunting as a result of the Ivanhoe Project.

12.6.4.1.2 Mitigation

Xeneca commits to maintaining current public access and navigation to the area; restriction such as fences and gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). These minimal restrictions should ensure both that game populations do not change, and that hunters have the same number of opportunities to engage in successful hunting activities.

12.6.4.1.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Hunting is an important activity that is highly valued, both among local residents and tourists to the area. The importance of this resource is *high*.

Geographic Extent of Effect

The geographic extent is anticipated to be very *low*, as it will be limited to the areas immediately surrounding high-voltage equipment during operations.

Duration and Frequency

The duration of any operational impact to hunting would recur for the lifetime of the Project, and therefore *high*, but is anticipated to be non-detectible above baseline levels during that time period.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

As there exist many hunting opportunities in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on hunting from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of the effect is anticipated to be very *low*.

Probability of Effect

The likelihood of a detectible impact is very *low*.

Overall Significance

As the geographic extent, probability and magnitude of the effect are low; the residual effects are anticipated to be *Insignificant*.

12.6.4.2 Fishing

12.6.4.2.1 Potential Effects

Hydroelectric facilities have the potential to affect either the ability of anglers to access fishing sites, through reduced waterway access, or reduce the success of fishing through affecting the local populations of popular fish species. Reduced access in the winter may affect ice-fishing. Potential impacts to fish from the Project are addressed elsewhere (see Sections 11.4 and 12.4). Here we will consider potential impacts to fishing as a result of reduced access to fishing sites.

Access may be affected during operations, around areas permanently restricted for public health and safety reasons.

12.6.4.2.2 Mitigation

Xeneca has committed to operational constraints during the spring spawning period in order to ensure natural flow conditions during this period (spring and fall for Brook Trout). Xeneca intends to maintain and possibly enhance public access to fishing at the Ivanhoe Project sites. However, to ensure public

safety, some fencing may be put in place (i.e. around electrical equipment or water intakes). This is not anticipated to seriously affect access to fishing sites.

Furthermore, Xeneca will work with the recreational fishing community, tourism operators and other interested parties to ensure impacts to fisheries are kept at a minimum level, access to fishing areas is not impeded, improvements to access the fishery are facilitated and impacts to habitat are minimized. Should economic impact on commercial interests result from the Project, Xeneca will enter into discussions on avoidance, mitigation and /or compensation.

12.6.4.2.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Fishing is important both to the local community, and to tourists to the area, and is considered *high*.

Geographic Extent of Effect

The geographic extent of any impact to local fish populations may extend beyond the direct Project Area, and could be considered moderate. However, with appropriate mitigation measures, such impacts are anticipated to be insignificant, and this will not affect access to fishing opportunities. Therefore, the geographic extent is considered *low*.

Duration and Frequency

Operational impacts, should any occur, would continue throughout Project operations and be considered *high*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

As there exist many fishing opportunities in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on fishing from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of the impact is anticipated to be very *low*, as mitigation measures as described above should ensure that impacts to local fish species and access are kept minimal.

Probability of Effect

Impacts to fishing access or impacts to local fish populations at The Chute and Third Falls are considered to be very unlikely or *low*.

Overall Significance

As the geographic extent, ecological context, probability and magnitude of the effect are low; the residual effects are anticipated to be *Insignificant*.

12.6.5 Trapping & Baitfishing

12.6.5.1 Impacts

Operations may affect trapline or baitfishing sites if they are contiguous with specific Project facilities restricted to public access for health and safety reasons; however, this is considered to be very unlikely. One trapline holder operates near the Third Falls location, on the east side of the river. Xeneca is consulting with this trapline holder to create a business-to-business agreement at their request; however, given the extent of the trapline area and the habitat it is within, there are no impacts anticipated to this trapline.

12.6.5.2 Mitigation

Xeneca is committed to working with this trapline holder to create a business-to-business agreement and ensure no impacts to the trapline.

12.6.5.3 Net Effects and Significance of Net Effects

12.6.5.3.1 Value/Importance of the Resource Affected

The importance of the resource is very *high* to the trapline holder, but *low* to the local community as a whole.

12.6.5.3.2 Geographic Extent of Effect

The geographic extent of the impact will be highly localized around Project infrastructure, and therefore *low*.

12.6.5.3.3 Duration and Frequency

The impact is anticipated not to occur at all; to the extent that it does, it may persist throughout Project operations, and would be *high*.

12.6.5.3.4 Irreversibility of Effect

This effect is *irreversible* during Project operations.

12.6.5.3.5 Ecological or Social Context

As there exist many trapping & baitfishing opportunities in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on trapping & baitfishing from the Ivanhoe Project is anticipated to be *low*.

12.6.5.3.6 Magnitude of the Effect

The magnitude of the impact is anticipated to be non-detectible above baseline levels, and therefore *low*.

12.6.5.3.7 Probability of Effect

The impact is very unlikely or *low*.

12.6.5.3.8 Overall Significance

As the geographic extent, ecological or social context, probability and magnitude of the effect are low; the he overall significance of the residual effects are anticipated to be *Insignificant*.

12.6.6 Views and Aesthetics

12.6.6.1 Potential Impacts

The construction of two new hydroelectric facilities will alter the visual appearance of this part of the river, and alter the pristine character of the Third Falls Facility location. As well, inundation of upstream areas of the Ivanhoe River will change the viewscape over the longterm from a riverine to a lacustrine landscape. This impact will be perceived differently by different recreational users of the river. Construction of permanent access roads at Third Falls may also be considered a visual intrusion into the landscape, although one that has a side effect the opening up of that landscape to additional recreational users.

As a result of public concerns relating to alteration of the aesthetic values in the area, artist's renderings of the hydro facilities post-construction were commissioned and shared with the attendees of the October 16, 2013 Public Information Centre.

12.6.6.2 Mitigation

Xeneca has undertaken extensive planning and consultation with the local community in order to plan a Project that is minimally visually intrusive and retains as many of the existing aesthetic features as possible. Re-naturalization of cleared areas along roadways will be undertaken wherever possible, in consultation with the local MNR office to determine suitable species and take any fire safety concerns into account.

12.6.6.3 Net Effects and Significance of Net Effects

Value of Resource Affected

The value of the current appearance of The Chute and Third Falls locations to local residents is *moderate*.

Geographic Extent of Effect

The geographic extent of the alteration in aesthetics will be *high*, as it will extend beyond the Project Area.

Duration and Frequency

The duration of the impact is *high*, and will continue over the Project's lifespan.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

As there exist large tracts of undisturbed views in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on views and aesthetics from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of the impact is *moderate* (see artist's renderings in Appendix L, Oct 16, 2013 PIC panels); however, whether it will be perceived as positive or negative will depend on the perspective of the viewer.

Probability of Effect

The likelihood of the impact is *high*; visual alteration as a result of the Project is unavoidable.

Overall Significance

As the ecological or social context is low and the magnitude and value of the resource are moderate, the residual impacts are anticipated to be *Insignificant*.

12.6.7 Navigation

12.6.7.1 Potential Effects

As the Ivanhoe River is a recognized canoe route, the operation of a hydroelectric facility may impede the movement of canoes, kayaks, and other small craft on the waterway.

During operations, one portage route at Third Falls will be completely inundated. However, the inundation will mean that the portage route is no longer required. Therefore, this is not considered to be a navigability impact.

At The Chute, one portage route entrance will be relocated away from its current location, towards the proposed safety boom termination point, to address potential safety concerns. It will remain accessible, so this is not considered to be a navigability impact.

As well, a portage route will be eliminated as it is the location of the proposed powerhouse. However, an alternative portage route exists on the other side of the river, so this is not considered to be an impact to navigability.

Navigation impacts could result during times of modified run-of-river operation in the Variable Flow Reach. During certain hours, the flows and water depths would be lower than normal and during certain other hours, the flows and water depth would be greater than normal.

The river is not used for commercial navigation but sporadically for recreational canoeing or boating. This matter is further addressed as part of the Water Management Plan. Where navigation concerns have been or are identified, the objective of the operating parameters is to ensure that downstream navigation constraints are considered.

12.6.7.2 Mitigation

Within the Third Falls headpond water level variations will be kept within 0.25 m. Downstream of Third Falls flows and levels will be re-naturalized to run-of-river conditions. The Chute headpond may experience water level fluctuations up to 1 m. This impact is offset through the creation and operation

of the headpond which will see water levels increase over those experienced under the existing long term average flow.

Xeneca commits to maintaining current public access and navigation to the area; restrictions such as gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake).

Impacts to portage routes are not anticipated to affect navigability, so mitigation measures are not proposed. However, if impacts to portage routes affect the navigability of the river post-construction, the proponent will enter into negotiations with the MNR to reroute the portage routes.

12.6.7.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The navigability of this route is considered to be of *moderate* importance.

Geographic Extent of Effect

The geographic extent of the impact, if all of the inundations are included, will include the entire Zone of Influence. However, if only the activities which might affect navigability are considered, the geographic extent of the impact of in-water works and safety restrictions will be *low*.

Duration and Frequency

The duration of impacts will continue throughout the lifetime of the Project, and is *high*

Ecological or Social Context

As the Ivanhoe River is broad, and portage routes already exist where required, vulnerability to impacts to navigation from the Ivanhoe Project are anticipated to be *moderate*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Probability of Effect

The likelihood of impact is *high*.

Magnitude of the Effect

The magnitude of the impact will be *low*.

Overall Significance

As the geographic extent and magnitude of the effect are low; the residual impacts are anticipated to be *Insignificant*.

12.6.8 Existing Water Management Plans

Alterations to the existing Water Management Plan, if required, will be carried out under a separate process through the MNR. No impacts to the existing WMP will result from the Ivanhoe Project as the operations of other existing facilities in the watershed will not be modified at all.

12.6.9 Protected Areas

12.6.9.1 Northern Claybelt Forest Complex Conservation Reserve

12.6.9.1.1 Potential Effects

The Northern Claybelt Forest Complex Conservation Reserve, due to its near proximity to the Project, has been subject of extensive consultation both with the public and with the Ministry of Natural Resources throughout the Class EA process. As a result of this consultation, Xeneca committed to fully re-naturalizing flows downstream of the Third Falls Facility in order to ensure no impacts to the Conservation Reserve.

12.6.9.1.2 Mitigation

The flows downstream of Third Falls will be fully re-naturalized, thus assuring no impacts to the Conservation Reserve.

12.6.9.2 Nova Township Clay Plain Peatland Conservation Reserve

12.6.9.2.1 Potential Effects

The Nova Township Clay Plain Peatland Conservation Reserve exists 135m from a planned power line between The Chute and Third Falls. Given this distance, *no* impacts to the Conservation Reserve are anticipated.

12.6.9.3 Groundhog River Provincial Park

12.6.9.3.1 Potential Effects

The Groundhog River Provincial Park would be crossed by a planned power line between The Chute and Third Falls. However, power lines cause no impacts during the operational phase.

The Park's Management Plan states that the purpose of this waterway park is to protect access to high-quality recreational activities on the Groundhog River. The power line will be completely passive after installation; therefore, no impacts are anticipated.

12.6.9.4 Vimy Lake Uplands Conservation Reserve

12.6.9.4.1 Potential Effects

A planned power line runs approximately 25m from the border of the Vimy Lake Uplands Conservation Reserve. Power lines cause no impacts during the operational phase. Therefore, no impacts are anticipated to this feature as a result of the Ivanhoe project operations.

12.6.10 Recreational Land Use

12.6.10.1 Camping

Crown land camping is allowed throughout Northern Ontario, although non-residents do require a permit.

12.6.10.1.1 The Chute

Potential Effects

Some areas may be permanently restricted for health and safety reasons, such as around high-voltage electrical equipment. The site may be considered less desirable by campers due to changes in the visual and auditory environment; however, noise from the equipment will be largely masked by the noise of the river and waterfall itself. Visual impacts are considered in the Views and Aesthetics section.

Mitigation

Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.

Net Effects and Significance of Net Effects

Value/Importance of the Resource Affected

The Chute is a popular local camping spot, and is considered important to the local community. Its value is therefore *high*.

Geographic Extent of Effect

The geographic extent will be restricted to the areas immediately surrounding Project infrastructure with the potential to harm human health or safety, and is therefore *low*.

Duration and Frequency

Any impacts to site access or noise levels during operation will continue for the lifetime of the Project, and would be *high*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

As there exist many camping spots in natural areas in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on camping from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of the impact is considered to be very *low*, as only limited portions of the site will be restricted.

Probability of Effect

The likelihood of impacts to campsite access or site enjoyability during operations are *low*.

Overall Significance

As the geographic extent, ecological or social context, probability and magnitude of the effect are low; the overall significance of residual affects during operations is anticipated to be *Insignificant.*

12.6.10.1.2 Third Falls

Potential Effects

The Third Falls Facility location is infrequently used by campers currently, if at all. Some potential sites may be permanently restricted during operations for health and safety reasons. However, increased site access during operations due to the construction of new access roads may increase the use of this location by campers over the long term.

Mitigation

Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.

Net Effects and Significance of Net Effects

Value of Resource Affected

The value of the resource as it currently exists, given low use levels, is considered *low*.

Geographic Extent of Effect

The geographic extent of impacts will be restricted to the area immediately surrounding Project infrastructure, and is considered *low*.

Duration and Frequency

Impacts during operations will continue for the lifetime of the Project, and would be *high*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

As there exist many camping spots in natural areas in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on camping from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of all impacts is anticipated to be *low*, as the site is so infrequently used at present that any further restriction would be difficult to detect against background levels.

Probability of Effect

The likelihood of impacts is anticipated to be *low*.

Overall Significance

As the value of the resource, geographic extent, ecological or social context, probability and magnitude of the effect are low; the residual effects are anticipated to be *Insignificant*.

12.6.10.2 Canoeing/Kayaking/Boating

12.6.10.2.1 The Chute

Potential Effects

Fluctuating water levels during Project operations could affect users' abilities to launch boats at the existing boat launch. As well, the existing entrance to the portage route is in a potentially unsafe location, as it will be near the dam and safety boom. The upstream branch of this portage route will not be affected.

Mitigation

Xeneca will to make some modest design and location improvements to the boat launch amenity, based on stakeholder input, though prior approval is required by the MNR and other regulatory agencies. Additionally, Xeneca commits to ensuring that portage routes remain available after construction. The location of the portage route entrance close to the safety boom will be relocated closer to the termination of the safety boom as a safety precaution. Overall, the portage route will still be present and accessible, but shorter.

Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Both the boat launch and the navigability of the river for local canoers and kayakers have *high* value for the local community and tourists to the area.

Magnitude of the Effect

The magnitude of the impacts is anticipated to be *moderate*, as no impacts are anticipated to occur which would preclude canoeing or kayaking on any stretch of the river that is currently navigable.

Geographic Extent of Effect

The geographic extent of the impacts will be limited to the areas immediately surrounding Project infrastructure during operations, and is therefore *low*.

Duration and Frequency

Operational impacts would exist throughout the lifetime of the Project, and would therefore be *high*.

Ecological or Social Context

As many navigable water bodies exist in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on canoeing and kayaking from the Ivanhoe Project is anticipated to be *low*.

Probability of Effect

Some impact to the boat launch and local portage routes is considered to be very likely or *high*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Overall Significance

As the geographic extent and ecological or social context of the effect are low; the residual effects are anticipated to be *Insignificant*.

12.6.10.2.2 Third Falls

Potential Effects

During operations, the upper rapid portage routes will be inundated completely; however, the inundation will also mean that they are no longer required, so this will not be an impact to navigability at the site. One portage route will be eliminated as it is the proposed location of the powerhouse, but the alternate portage route on the other side of the river will remain functional and accessible.

Mitigation

If any launching areas or portage routes are impacted by the Ivanhoe Project, new landing areas or docking facilities may be built. No mitigation is considered necessary for portage routes at this time; however, they will be re-routed should this become necessary during operations.

Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Access to the canoe and portage routes is important to the local community, and is considered *moderate*.

Geographic Extent of Effect

The geographic extent is *moderate*, and extends over the Zone of Influence.

Duration and Frequency

Impacts to portage routes will continue over the lifespan of the Project, but will not affect the ability of canoers or kayakers to enjoy this resource, and are considered *low*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

As there exist many navigable water bodies in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on canoeing and kayaking from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The impact the navigability of this portion of the Ivanhoe river due to the Ivanhoe Project is considered *low*; the site is anticipated to be fully accessible throughout operations.

Probability of Effect

The likelihood of impacts restricting the accessibility of the site to canoes and kayaks is *low*.

Overall Significance

As the duration and frequency, ecological or social context, probability and magnitude of the effect are low; the residual effects are anticipated to be *Insignificant*.

12.6.10.3 Snowmobiling Trails

Potential Effects

No impacts to local snowmobiling are anticipated to result during operations.

12.6.10.4 Hiking and ATV Trails

12.6.10.4.1 The Chute

Potential Effects

Project operations may result in reduced public access to a hiking trail on the eastern shore of the Ivanhoe River.

Mitigation

Any restriction to access of the site for any reason will be communicated through signage to the public and to site users. Every effort will be made to keep the site accessible as much as possible, without compromising health or safety requirements.

Net Effects and Significance of Net Effects

Value of Resource Affected

The trails are of *moderate* importance to the local community and tourists to the area.

Geographic Extent of Effect

The geographic extent will be limited to the area immediately surrounding Project infrastructure, and is considered to be *low*.

Duration and Frequency

Any access restriction during operations will continue throughout the lifetime of the Project, and would be *high*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

As there exists a large, natural geographic area appropriate for hiking surrounding the Project, the vulnerability of the social context to impacts on hiking from the Ivanhoe Project is anticipated to be *low*.

Magnitude of the Effect

The magnitude of the impact is anticipated to be *low*.

Probability of Effect

There is a *moderate* likelihood of some disruption to trail access during operations.

Overall Significance

As the geographic extent, ecological or social context and magnitude of the effect are low; the residual effects are anticipated to be *Insignificant*.

12.6.10.4.2 Third Falls

Potential Effects

No impact to access to hiking trails is anticipated during the operation of the Third Falls Facility.

12.7 Social & Economic

12.7.1 Locations of People, Businesses, Institutions & Public Facilities

No people, businesses, institutions or public facilities reside within or near to the Project Area nor are any anticipated to be affected by the operation of the Project.

12.7.2 Community Character, Enjoyment of Property and Amenities

No local communities or properties exist within or near to the Ivanhoe Project Area. All amenities relate to natural, recreation and tourism values, and are discussed elsewhere.

12.7.3 Employment

Foleyet and Chapleau are small communities that have experienced significant population and economic decline along with the decline of the mining and forestry industries in Northern Ontario. The City of Timmins has a more diversified economic base that supports a more stable population than

Foleyet, although it too has struggled in recent times. Employment and economic stability are major concerns for the local community (see Section 9.7).

12.7.3.1 Impacts

The economic impact of the Ivanhoe Project is expected to be positive. One to two permanent full-time positions will be created for maintenance and operations of the Project. However, there is the possibility that this potential will only be partly realized if employees or services are hired from outside of the local area.

12.7.3.2 Mitigation

Xeneca commits to hiring locally wherever feasible. No other mitigation is considered necessary.

12.7.3.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The economy is considered very important to the local community, and therefore has *high* value.

12.7.3.3.1 Geographical Extent

The geographical extent may include nearby communities, and is therefore considered *moderate*.

12.7.3.3.2 Duration and Frequency

The positive economic impact will continue at a low level throughout operations, and is therefore *high*.

12.7.3.3.3 Irreversibility of Effect

This effect is *irreversible* during Project operations.

12.7.3.3.4 Ecological or Social Context

Given the condition of the local economy and employment market, the fragility of the system to changes in employment levels is considered *high*.

12.7.3.3.5 Magnitude of the Effect

The magnitude of the impact is *low* during operations.

12.7.3.3.6 Probability of Effect

The impact is highly likely or *high*.

12.7.3.3.7 Overall Significance

As the effect has high value of the resource, high duration and frequency, and highly probable, the Project is anticipated to result in a *moderately significant*, *positive* residual impact.

12.7.4 Access

12.7.4.1 The Chute

12.7.4.1.1 Potential Effects

As The Chute is already largely accessible due to an existing logging road, the operation of the Ivanhoe Project is not anticipated to either increase or decrease access to the site significantly. Access to the water immediately surrounding the dam and powerhouse, however, will be restricted through operations.

12.7.4.1.2 Mitigation

Access will only be restricted on land or water when and where required for public safety. These restrictions will be posted on signs.

12.7.4.1.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

The value of the resource is considered *moderate* to local recreational users.

Geographic Extent of Effect

The geographic extent is very localized, constrained to the immediately surrounding area of the access road extension and any in-water hydro works. The impact is therefore considered *low*.

Duration and Frequency

The impact during operations will persist throughout the lifetime of the Project, so is *high*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

As there are few roads already in existence in the surrounding vicinity, vulnerability to the impacts to traffic from the Ivanhoe Project is anticipated to be *high*.

Magnitude of the Effect

The magnitude of the impact to access during operations will be very *low*, as restricted areas will be few, small, and easy to navigate around.

Probability of Effect

The likelihood of the impact is *high*, as areas will definitely be restricted from time to time in order to protect human health and safety.

Overall Significance

As the geographic extent and magnitude of the effect are low; the residual effects are anticipated to be *Insignificant*.

12.7.4.2 Third Falls

12.7.4.2.1 Potential Effects

The construction of a new access road to the Third Falls will increase recreational access to the site for more users. However, water access immediately around the dam and powerhouse will be limited for public safety. As well, increased road traffic may disrupt remote areas.

12.7.4.2.2 Mitigation

Access will only be restricted on land or water when and where required for public safety. These restrictions will be posted on signs. No mitigation is considered necessary for increase in access due to the construction of new roads, as this will be both insignificant and slightly positive.

12.7.4.2.3 Net Effects and Significance of Net Effects

Value/Importance of the Resource Affected

Current use is fairly low so the value of the access to the Third Falls location is *moderate*.

Geographic Extent of Effect

The geographic extent of all impacts both during operations is *low*, as it is limited to the immediately surrounding area of the new access road and hydro Facility.

Duration and Frequency

The duration of the impact to access to the water immediately surrounding the new hydro Facility during operations, and the increased access to the site as a result of the construction of the access road, is *high*, as both will continue throughout the lifetime of the Project.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

As there are few roads already in existence in the surrounding vicinity, vulnerability to the impacts to traffic from the Ivanhoe Project is anticipated to be *high*.

Magnitude of the Effect

The magnitude of limited access is *low*, as only limited portions of the waterway or nearby areas will be restricted during operations.

The positive impact of increased access to the Third Falls location is considered *moderate*.

Probability of Effect

The likelihood of access impacts is *high*, as it is certain that some areas will be restricted for health and safety reasons.

Overall Significance

The significance of residual effects is anticipated to be *Insignificant*, but *positive* overall.

12.7.5 Public Health and Safety

Operation of the proposed The Chute and Third Falls facilities on Ivanhoe River poses potential public health and safety concerns related to accidents, dam failure, worker health and safety, and dust.

12.7.5.1 Accidents

Please see Section 14.2.1, Accidents and Malfunctions.

12.7.5.2 Spills

Please see Section 14.2.3, Accidents and Malfunctions.

12.7.5.3 Fires and Fire Safety

Please see Section 14.2.4, Accidents and Malfunctions.

12.7.5.4 Waste and Waste Management

12.7.5.4.1 Potential Effects

Operations of the dams will create small quantities of hydrocarbon wastes. These wastes, if not properly handled, have the potential to affect soils, surface waters and groundwater.

12.7.5.4.2 Mitigation

Local waste management companies have been identified for removal of wastes during operations. They will identify a waste management facility with the capacity to accept operation related wastes, and transportation of the wastes to this facility will be incorporated into the Project's transportation planning.. Any hazardous wastes generated will be sent to a licensed hazardous waste facility. The Project proponent will discuss any wood waste created with the local SFL holder.

12.7.5.4.3 Net Effects and Significance of Net Effects

Value of Resource Affected

Given the plentiful availability of clean soils, surface waters and groundwater in the Project Study Area, the value of soils, surface waters and groundwater present on-site is *moderate*.

Geographic Extent of Effect

The geographic extent of the impact would be limited to the immediate vicinity of the hydro facility generating the waste, and so is very *low*.

Duration and Frequency

The duration and frequency of any impact resulting from waste management for the Ivanhoe Project, following the application of mitigation measures and best management practices, is anticipated to be very *low*.

Irreversibility of Effect

Such impacts would be *reversible*, but may require rehabilitation of the ecosystem in questions (for example, removing affected soils).

Ecological or Social Context

Given the rarity of appropriate waste management facilities in this part of the province, the fragility of the resource to potential operation impacts is anticipated to be *moderate*. However, very few wastes will be produced by project operation.

Magnitude of the Effect

With the application of all mitigation measures and best management practices, the magnitude of any impact from wastes generated by operations of the Ivanhoe Project is anticipated to be *low*.

Probability of Effect

The likelihood of impacts to soils, surface water or groundwater from waste generation is *low*.

Overall Significance

As the geographic extent, duration and frequency, reversibility and magnitude of the effect are low; the residual effects are anticipated to be *Insignificant.*

12.7.5.5 Water Supply

12.7.5.5.1 Potential Effects

The operation of a hydroelectric facility has the potential to cause problems with downstream drinking water supplies, or upstream drinking water supplies where the impoundment affects the hydrology of the drinking water intake. In the case of the Ivanhoe Project, the nearest drinking water intake is 6.4 km upstream of the maximum inundation extent. No impact is expected.

As well, wastewater discharges can be affected if the pipes are located within a hydroelectric facility's Zone of Influence (ZOI). The nearest wasteweater treatment plant is located approximately 20 km upstream of the Project; no impact is expected.

12.7.5.6 Dam Failure

Please see Section 14.2.6

12.7.5.7 Worker Safety

12.7.5.7.1 Potential Effects

Equipment malfunctions or other adverse events during operations may affect worker health and safety.

12.7.5.7.2 Mitigation

Worker safety at the site would be ensured via strict adherence to Ministry of Labour occupational health and safety regulations. First aid equipment will be maintained on site throughout the Project lifespan and workers will be trained to deal with emergency situations (see Section 14, Accidents and Malfunctions).

12.7.5.7.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Worker safety is of very *high* importance.

Geographic Extent of Effect

The geographic extent is very localized, as it is restricted to the immediate vicinity of maintenance activities. The extent is therefore *low*.

Duration and Frequency

Given the minimal amount of maintenance required during Project operations, and the mitigation measures to be applies, the duration and frequency of any event affecting worker health or safety is anticipated to be very *low*.

Irreversibility of Effect

Any impact to worker health or safety has the potential to be *irreversible*.

Ecological or Social Context

Vulnerability to the impacts on worker safety from the Ivanhoe Project is anticipated to be *high*.

Magnitude of the Effect

The magnitude of an impact to worker health or safety has the potential to be high to the individual worker(s) in question; however, the broader magnitude of such impacts would be *low*.

Probability of Effect

The likelihood of such an accident, following the application of all mitigation measures and best management practices for worksite safety, is *low*.

Overall Significance

As the geographic extent, duration and frequency, ecological or social context, probability and magnitude of the effect are low; the residual impacts to workers during operations are anticipated to be *Insignificant*.

A more comprehensive public health and safety assessment will occur during the detailed design stage and will address all further concerns and issues.

12.7.5.8 Mercury and Fish Consumption

Mercury is naturally present in soils and rocks in Ontario and is enhanced by atmospheric deposition from human sources such as the combustion of coal and some mining related operations. Inundating land with water results in the partial release of inorganic mercury accumulated in the vegetation and soils. Decomposition of flooded organic matter in soils and vegetation enhances the methylation of mercury to the bioavailable and toxic form of methyl mercury. Mercury and methyl mercury may biomagnify within the food chain and can pose a health concern to humans. Mercury concentrations in fish may increase rapidly after impoundment and will decrease and stabilize in subsequent years. This cycle has been observed in experimental inundation in northern Ontario and in large-scale hydroelectric projects in Quebec and Northern Manitoba over the last 30 years, where mercury is also present in the soils and vegetation of impounded areas from natural and anthropogenic sources.

12.7.5.8.1 Potential Effect

The operation of the Project has the potential to increase mercury concentrations in the Project Area. Any flooding of land has the potential to effect the concentrations of available mercury in surface water, including the bioavailable form – methyl mercury.

The headpond inundation of the Project can lead to increases in bioaccumulation of methyl mercury in fish tissue for resident sport fish. The MOE's fish consumption advisories for Ontario water bodies ("Guide to Eating Ontario Sport Fish," 2013) recommend monthly consumption limits for sport fish. The suggested consumption limits are categorized by fish species, length and receptor sensitivity (i.e. 'general population', or 'sensitive population' such as children or women of child bearing age). The suggested consumption limits are based on fish tissue concentrations for various substances with methyl mercury being the predominant substance of interest due to its pervasive occurrence in the natural environment. Methyl mercury in fish tissue is the primary factor in most consumption advisories in northern areas. The methyl mercury threshold limits underlying the suggested consumption advisories are described in Section 9.7.3 but are repeated here again:

- 0.26 ug/g– for Sensitive Populations monthly consumption restrictions suggested above this value.
- 0.52 ug/g – for Sensitive Populations no consumption suggested above this value.
- 0.61 ug/g – for the General Population, suggested consumption restriction above this value.
- 1.84 ug/g – for the General Population, no consumption suggested above this value.

The median mercury concentrations in the existing Walleye populations in the Project Area chosen to represent commonly consumed sport fish are near or above the 'no consumption' restriction for Sensitive Population. The median values are near the lower threshold value for General Population but well below the 'no consumption' restriction for General Population.

Headpond inundation is expected to result in an increase in methyl mercury concentrations in fish tissue with a gradual return to baseline levels over a period of 5 – 20 years. 0 shows measured pre-construction and operational values from four headponds in northern Ontario referenced as headpond "A", "B", "C" and "D" (confidential agency source, February 19, 2014). Information for The Chute and Third Falls has been included for comparison.

Table 42: Fish Tissue Methyl Mercury Reference Data

Headpond or Facility	Units	Site A	Site B	Site C	Site D	*The Chute*	*Third Falls*
Headpond Size	ha	65	401	1769	519	*59*	*265*
New Inundation	ha	39	172	1380	176	*20*	*41*
New Inundation	%	60%	43%	78%	34%	*34%*	*15%*
Flow	km^3/yr	1.0	4.4	1.0	1.2	*1.0*	*1.1*
40 cm Walleye– Pre	ug/g	0.7	0.8	0.5	0.4	*0.7*	*0.6*
40 cm Walleye – Post	ug/g	1.5	1.5	2.2	0.3	***1. 5****	***1.3****
Walleye Increase	%	114%	85%	320%	-25%		
55 cm Pike – Pre	ug/g	0.6	0.7	0.1	0.3		
55 cm Pike – Post	ug/g	0.9	0.4	1.5	0.3		

Pike Increase	%	50%	-40%	1400%	0%		
Time Inundated	Yrs.	17	7	4	5		

Note * denotes values that are projected based on a straight line extrapolation of mercury values from site A. Of sites A, B and D, all which have similar new headpond inundation size or new inundation percentage to the Project, site A has the largest percentage mercury increase and thus was chosen as the basis for the extrapolation. Site C has a far larger headpond size, far larger new inundation size and far larger new inundation percentage then either The Chute or Third Falls and was therefore left out of the projection calculation.

As shown, the measured pre-construction and operational values from the reference sites range widely, from a decrease in methyl mercury to a multifold increase. The variances are consistent with significant differences in baseline values and headpond parameters. Literature sources (eg. Ullrich, S.M. et al, 2001) suggest a complex relationship among various factors such as availability of organic material to stimulate methylation, concentration of mercury in the system, anoxic conditions to allow methylation to occur, the portion of watershed and food chain affected by new inundation and the ongoing flushing and attrition of methylated mercury from the system.

The Project headponds were compared to the reference sites in the Table 42 to project the potential increase in fish tissue in sport fish as follows:

- Headpond Size: the proposed headponds are at the lower size range of the references sites (i.e. small portion of watershed);
- New Inundation: the proposed new inundation (34% for The Chute and 15% for Third Falls) is less than the reference sites (i.e. small portion of food chain affected);
- Flushing: the Ivanhoe river has a flushing flow rate that is similar to the reference projects but in relation to smaller amount of new inundation (i.e. greater flushing and attenuation of methyl mercury from the system over time);
- Length of Exposure: The Chute headpond extends 6.4 km and then there is 40 km until the next impassable barrier which is the Ivanhoe Lake Dam as well as the Shawmere River resulting in the possibility that fish will only spend a relatively small portion of time in The Chute headpond. The Third Falls headpond extends for 44 km and only 15% of the total area is new inundation that may cause the potential for methyl mercury generation resulting in less exposure to methyl mercury.

Based on the percent of new inundation, the proposed headponds compare closely to reference sites “A”, “B” and “D”. As a result, the increase in methyl mercury in fish tissue is projected to range from -25% to 114%. Based on the scientific literature (St. Louis et al. 2004), any increases in fish tissue concentrations are expected to subside over a number of years.

The potential effect of increased methyl mercury concentrations in fish tissue relates to the impact on fish consumption advisories. If the maximum projected increase in fish tissue concentrations were to occur, the fish consumption advisories would be affected as follows:

- Baseline levels for Third Falls exceed the recommended lower and upper consumption advisory levels for Sensitive Population (i.e. children and women of child bearing age). The projected increase would not significantly affect the consumption advisory level for the Sensitive Population receptor group compared to the existing baseline condition.
- Baseline levels for The Chute are currently above the lower consumption advisory level of 0.61 ug/g for the General Population. With the maximum projected increase, the consumption advisory level would remain between the lower (0.61 ug/g) and upper (1.84 ug/g) consumption advisory level. There would be no resulting change to the consumption advisory level at The Chute due to the Project where most of the recreational catch of fish occurs.
- Baseline levels for Third Falls are currently slightly below the lower consumption advisory level of 0.61 ug/g for the General Population. The projected increase could exceed the lower consumption advisory level for this General Population receptor group; however, the projected increase is below the upper advisory threshold of 1.84 ug/g (i.e. reduced but continued consumption of fish).

Consultation over the past 4 years did not identify a population group that relies on fish consumption from the Ivanhoe River as the primary dietary source. Fish consumption appears to be largely recreational and supplemental reducing the potential effect directly related to human health.

12.7.5.8.2 Mitigation Measures

Extensive mitigation has been incorporated in the project design to minimize the potential for increased methyl mercury in fish tissue. Specific aspects include:

- Minimize Organic Material: Tree and shrub vegetation will be removed prior to inundation to minimize the introduction of additional organic for methylation.
- Minimize Anoxic Potential: The two headponds are designed to be long and narrow to ensure water circulation and minimize stagnant areas. Water depth has been limited to ensure vertical circulation and minimize oxygen stratification. The Facility operations (Appendix D) have been designed to release all water each day to avoid stagnation and related anoxic conditions. Water temperature modeling (Appendix G) has been carried out to ensure that future headpond water temperatures will not increase such that dissolved oxygen levels are decreased.
- Minimize New Inundation: The area of new inundation has been minimized to limit the percentage of watershed forage area potentially affected by increased methylation.To the extent possible, the headpond uses the existing riverbed and un-vegetated channel bank areas.
- Promote Flushing to Decrease Concentrations: Total headpond size has been kept small in relation to average annual flow rate such any free floating or dissolved methyl mercury is adequately flushed. The Facility operations (Appendix D) have been designed such that all

water is released every day to ensure continual flushing and minimize settling of particles with methyl mercury.

- Monitoring: Extensive monitoring is proposed to identify potential increases in fish tissue methyl mercury levels (see Section 16).
- Reporting: Monitoring will be reported such that agencies can issue consumption advisories through the existing consumption advisory program should this become necessary. This will minimize the potential for a human health risk to arise.

12.7.5.8.3 Net Effects and Significance Assessment

Value of Resource

Sport fish consumption in the Ivanhoe River is primarily related to recreational purposes and not commercial fishing or primary sustenance. The direct value of the sport fish resource is moderate, but this generates a high level of public interest. As a result the value of the resource is *high*.

Magnitude of Effect

The maximum projected change in fish tissue mercury concentrations is less than the range interval between the lower and upper consumption advisory level. The maximum projected change would result in only one change in advisory level if it does occur.Hence the projected change is not large in relation to the human health effect impacts. The actual magnitude of the effect is likely to be smaller than the maximum. The magnitude of effect is *moderate.*

Geographic Extent of Effect

The effect on fish will be restricted to the Project Area resulting in a *low* geographic extent.

Duration and Frequency of Effect

The effect of an increase in the fish consumption advisory level would likely occur only once but persist for multiple years at a time. Therefore, the frequency is low and the duration is high, with an overall rating of *high.*

Irreversibility of Effect

The scientific literature suggests that the increase in methyl mercury levels in fish tissue will attenuate back to baseline conditions over time. Hence the effect is *reversible.*

Ecological and Social Context

Consumption of local fish does not constitute a significant part of the local diet. Therefore, it is anticipated that the ecological and social vulnerability of minor elevations in mercury levels in sports fish would be *low*.

Probability of Effect

The fish advisory level for only one receptor group is likely to change from the baseline condition (i.e. for General Population). In this receptor group only the Third Falls headpond is likely to require a change in advisory level and only if an increase in methyl mercury in fish tissue does occur. In the context of only one of two headponds requiring a change in advisory level and only if the levels increase sufficiently, the probability of an effect is *low.*

Overall Assessment

The overall effect is determined to be *Insignificant,* given the geographic extent and reversible nature of the effect.

12.7.5.8.4 Monitoring

The pre- and post-construction water quality and mercury-in-fish monitoring programs (see Section 16) for the Project will provide information to warn and safeguard the public from possible mercury increases and provide data to inform future mercury models. The cycle of mercury increase, stabilization and decrease in surface water and fish in the area of the Projects will be monitored as described by Hutchinson Environmental Sciences Ltd. (Appendix G). Conditions after development will be regularly compared to pre-development conditions to measure change. The water quality in the Project area will also be compared to upstream reference conditions to differentiate natural variation from project-related changes. The monitoring program includes an early warning component that identifies if forage fish low in the food chain are showing signs of increasing or decreasing mercury, providing information on the trend(s) of the change so that mitigating action such as changes to fish consumption guidelines can be implement in a timely fashion.

12.7.6 Local, Regional and Provincial Economies

12.7.6.1 Potential Effect

The construction of a new hydro power project is not expected to have any negative effect on mining activities since mining companies are subject to a '400' surface rights reservation around all lakes and rivers (CLAIMaps). Provisions, within the *Mining Act*, like the reservation above, allow for the development of renewable energy (waterpower) on mining claims. Generally, waterpower and mining

operations are compatible since they can share infrastructure (power lines/ roads) and waterpower operations provide a readily available source of reliable power. Attempts have been made to contact all permit holders for existing mining claims in the area; to date, none have responded.

Similarly, due to ongoing consultation with the license holders for forestry operations in the area, no impact is anticipated to local logging operations.

12.7.6.2 Mitigation

Appropriate agreements will be in place before construction and operations; therefore, further mitigation measures will not be required by this stage.

12.7.6.3 Net Effects and Significance of Net Effects

12.7.6.3.1 Value/Importance of the Resource Affected

The value of the economy to the local community is *high*.

12.7.6.3.2 Geographic Extent of Effect

Both effects are anticipated to be highly localized, and therefore a *low* impact.

12.7.6.3.3 Duration and Frequency

The negative impact to local remote tourism operators, if it occurs, would be long-lasting, and is therefore *high*.

12.7.6.3.4 Irreversibility of Effect

The negative impact to local tourism operators, if it occurs, would only be *reversible* over the long term as operators move their efforts to more remote areas.

12.7.6.3.5 Ecological or Social Context

Given the existing condition of the local economy and employment market, vulnerability to the impacts is anticipated to be *high*.

12.7.6.3.6 Magnitude of Effect

The negative impact to local remote tourism operators from increasing access to Third Falls is anticipated to be *low*.

12.7.6.3.7 Probability of Effect

The negative economic effect from reduced demand for remote tourism in the Third Falls area is unlikely or *low*.

12.7.6.3.8 Overall Significance

As the geographic extent, reversibility, probability and magnitude of the effect are low; the residual impact is anticipated to be *Insignificant*.

12.7.7 Tourism Values

Impacts to existing tourist activities are described under Section 12.6, as all local tourism revolves around recreational use of the natural amenities there described.

Impacts to economic considerations of tourist activities are described in Section 12.7.

12.8 Heritage & Culture

12.8.1 Archaeological Sites

There are no known archaeological values requiring mitigation during operations

12.8.2 Built Heritage

There are no known built heritage values requiring mitigation during operations.

12.8.3 Cultural Heritage Landscapes

There are no known cultural heritage landscapes requiring mitigation during operations

12.9 Aboriginal

Issues identified during Aboriginal Consultation are described in Section 17.3. Many First Nation communities identified during the Class EA have elected not to participate in the consultation process until after the economic benefit agreements have been finalized. While Xeneca has worked hard to achieve this as quickly as possible and believes it to be imminent, in many cases, aboriginal communities have not yet communicated their issues or concerns. In this case, based on previous experience, issues and concerns were anticipated and included in the Potential Effects Identification Matrix, included in Section 8. How these issues and concerns have been addressed through the consultation process and future actions taken to resolve remaining issues are also described in the Matrix.

12.9.1 Aboriginal Communities and First Nation Reserves

12.9.1.1 Potential Effect

The Ivanhoe Project is located within an area covered under Treaty 9; however, the Facilities are not located on any First Nations reserve lands or lands allocated to any other aboriginal community. Definitive business agreements are being negotiated and asserted rights to traditional hunting and harvesting will be maintained in treaty areas. Therefore, no impacts to aboriginal communities or First Nation reserves are anticipated to result from the Ivanhoe Project.

12.9.2 Sites of Aboriginal or Cultural Importance

Xeneca met with Chapleau Cree First Nation representatives on site in October 2012 to investigate the potential for Culturally Modified Trees (CMT). A potential CMT was identified on an island downstream of the proposed The Chute Facility. A culturally significant stand of mature Eastern White Cedar was also identified by Chapleau Cree First Nation in the vicinity of the truck turnaround. Project construction may result in the removal of culturally significant eastern white cedar trees during clearing for the inundation area. An estimate of the number of mature cedar trees that may be removed will be undertaken and a protocol for their removal will be developed with the communities.

12.9.2.1 Culturally Significant White Cedars – The Chute

12.9.2.1.1 Potential Effects

Mature White Cedars may be removed in the inundation area.

12.9.2.1.2 Mitigation

All clearing of mature white cedar trees will take place in consultation with First Nations and EACOM, the SFL holder in this area.

12.9.2.1.3 Net Effects and Significance of Net Effects

Value of the Resource Affected

Due to its significance to the Chapleau Cree, the importance of the mature cedar trees is *high*.

Geographic Extent of Effect

Clearing and tree removal will be limited to only two locations in the Project Area; therefore, the geographic extent is considered *low*.

Duration and Frequency

The frequency and duration are *low*, as clearing will only occur once.

Irreversibility of Effect

The removal of the existing mature white cedars is *irreversible*.

Ecological or Social Context

Given the size of the forest in which the clearing occurs, the vulnerability of the local environment to the impact of clearing the mature white cedars is considered *low*.

Magnitude of Effect

Due to the small number of trees being removed relative to the size of the stands, the magnitude of this effect is considered *low*.

Probability of Effect

The probability of clearing of some mature white cedar trees is *high*.

Overall Significance

It is anticipated that with the application of the above mitigation methods, as well as the low geographic extent, duration and frequency, ecological or social context and magnitude of the effect; the residual impact of the removal of these trees is anticipated to be *Insignificant*.

12.9.2.2 Naturally Modified Tree – The Chute

12.9.2.2.1 Potential Effects

This naturally modified tree was originally thought to be a culturally modified tree, and is located in the vicinity of the tailrace on the island at The Chute Facility. There are concerns that inundation or changes to water levels during Facility operations could harm the tree through submerging its roots.

12.9.2.2.2 Mitigation

Xeneca commissioned a study by a consultant to examine the impacts of changes to water levels on the tree. Modeling determined that the tree is above the level at which water level changes could damage its roots. Therefore, no such impact is anticipated.

12.9.3 Traditional Lands

12.9.3.1 Hunting, Harvesting and Foraging

12.9.3.1.1 Potential Effects

Hunting, harvesting, foraging and trapping activities may be disrupted when inundation makes previously accessible areas inaccessible. Access will be maintained to the waterway and around the Facility (boat launch and portages).

12.9.3.1.2 Mitigation

Xeneca commits to maintaining current public access and navigation to the area; restriction such as fences and gates will only be placed on areas where it is required for public safety (i.e. powerhouse and water intake). The headponds for both facilities are relatively small; inundation will affect a small proportion of the total area, and impacts to hunting and foraging due to inundation are anticipated to be minimal. These minimal restrictions should ensure both that game and flora populations do not change, and that hunters have the same number of opportunities to engage in successful hunting, harvesting and foraging activities.

12.9.3.1.3 Net Effects and Significance of Net Effects

Value/Importance of Resource Affected

Hunting, harvesting and foraging are important activities, therefore, the importance of this resource is *high*.

Magnitude of the Effect

The magnitude of the effect is anticipated to be very *low*.

Geographic Extent of Effect

The geographic extent is anticipated to be very *low*, as it will be limited to inundated areas or high-voltage equipment during operations.

Duration and Frequency

The duration of any operational impact to these activities would recur for the lifetime of the Project, and therefore *high*, but is anticipated to be non-detectible above baseline levels during that time period.

Ecological or Social Context

As there exist many hunting opportunities in a large geographic area surrounding the Project, the vulnerability of the social context to impacts on hunting and foraging from the Ivanhoe Project is anticipated to be *low*.

Probability of Effect

The likelihood of a detectible impact is very *low*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Overall Significance

As the geographic extent, ecological or social context, probability and magnitude of the effect are low; the significance of residual effects is anticipated to be *Insignificant*.

12.9.3.2 Furbearing Mammals

12.9.3.2.1 Potential Effects

Concerns about impacts to furbearing mammals were raised by First Nation communities. Otter denning was documented 8 km upstream of the Third Falls Facility. Dens may be impacted by an increase in water levels, however the most significant level changes occur within the first 6 km of the Third Falls headpond.

12.9.3.2.2 Mitigation

In order to mitigate effects such as direct mortality, inundation will not occur during the winter or ice-over period in order to ensure no mortality due to individuals become trapped. Following inundation, operational water fluctuations will be within 0.25 m, which should not affect den entrances. Following construction, monitoring will occur to ensure that otters continue to populate this area.

12.9.3.2.3 Net Effects and Significance of Net Effects

Value of the Resource Affected

Due to its significance to the First Nations, the importance of this feature is considered *high*.

Geographic Extent of Effect

With the application of the mitigation measures described above, the geographic extent is considered *low*.

Duration and Frequency

Duration and frequency of the impact is considered *low*.

Irreversibility of Effect

This effect is *irreversible* during Project operations.

Ecological or Social Context

Given the size of the contiguous forest existing in and surrounding the Project Area, the vulnerability of the ecological context is considered *low*.

Magnitude of Effect

With the application of the mitigation measures described above, the magnitude of this effect is considered *low*.

Probability of Effect

The probability of impact is very *low*.

Overall Significance

As the geographic extent, duration and frequency, ecological or social context, probability and magnitude of the effect are low; the residual impacts are anticipated to be *Insignificant*.

12.9.4 Employment

12.9.4.1 Potential Effects

Employment impacts of the Ivanhoe Project for First Nations are expected to be positive, as a result of measures included in the confidential economic benefit agreements currently being finalized. Therefore, no mitigation measures are considered necessary.

12.9.5 Land Claims

12.9.5.1 Potential Effects

The Project location is in an area where a land claim is on file between the Federal Crown and Nishnawbe Aski Nation which is the Grand Council of Treaty 9. An Agreement in Principle has been reached but no final agreement has been settled. The Ivanhoe Project is not anticipated to have any impact on this process.

12.9.6 Economic Development

12.9.6.1 Potential Effects

Economic development impacts of the Ivanhoe Project for First Nations are expected to be positive, as a result of measures included in the confidential economic benefit agreements currently being finalized, including a generous equity participation program. Therefore, no additional mitigation measures are considered necessary.

12.9.7 Other

12.9.7.1 Spirit/Movement of Water

The operation of The Chute and Third Falls Facilities may affect the movement of the water within the Project Area. Specific impacts on water movement and flows are discussed in Section 12.2.2. Operation of the Project will impact water levels, flows and movement within the zone of influence on an hourly basis. During certain times, both facilities would operate at the same rate as the natural flow in the river (i.e. "run-of-river") with no variation in upstream water levels due to operation and no man-made variation in downstream flows from those experienced naturally. At other times the first Facility in series, The Chute, would "modify" the natural flow in the river by storing some of the natural river flow during night time hours to be used during daytime hours (i.e. on business days from 11:00 a.m. to 7:00 p.m.) when the need for electricity in the Province is greater. During these periods, the second Facility in series, Third Falls, would re-naturalize river flows by storing and releasing water at a rate consistent with inflow rates prior to the Chute (natural rate). It should be noted that over any 24 hour period the same volume of water would pass down the river as would occur under run-of-river operation.

Therefore, the impact to the movement of water in the Project Area is considered *Insignificant*.

12.9.7.2 Culturally Significant Medicinal Plants

Culturally significant medicinal plant species were not found during detailed biological field studies, and no further impacts are expected to vegetation during operation of the Project.

12.9.7.3 Culturally Significant Animal Species

Operation of the Project is not anticipated to disturb any culturally significant animal species who may be present within the Project Area.

12.9.7.4 Cedar, Ash, Birch, Tamarack and Spruce Trees

Operation of the Project is not anticipated to affect any culturally significant tree species that may be present within the Project Area.

12.9.7.5 Significance of the Ivanhoe River

Some communities prefer natural to manmade materials in hydroelectric projects, and object to the use of concrete in water. Some concrete will need to be used in order to meet safety requirements; please see the Aboriginal Consultation Section 17.3 for a full description of communication with First Nations on this issue. The proponent has expressed a willingness to use natural materials where doing so is feasible.

12.9.7.6 Cultural Representations of Visual Landscapes

A hydroelectric project represents a visual change to the environment, and where the environment is culturally significant, this may represent an impact to First Nations. Please see Section 12.6.6 for a full description of construction impacts to Views and Aesthetics. Overall no significant impact to cultural representations of the landscape are anticipated to result from construction activities for the Ivanhoe Project.

12.10 Energy & Electricity Considerations

Operation of the Project will not impact existing or future waterpower facilities. Within the zone of influence there are neither existing waterpower facilities nor potential waterpower locations suitable for development.

12.10.1 Reliability and Security

Operation of the Project in parallel with current electricity generating systems tied into the electrical grid will have a positive impact on overall grid reliability and availability of power especially during peak hours when consumption is highest. Electrical safeguards installed at the substations of each Facility will include isolation measures providing a safeguard to the electrical grid in the event of a malfunction. The Project will not have black start capabilities.

12.10.2 Electricity Flow Patterns

The generating stations will not be equipped with black start capabilities and will require an external source of electricity during restarts. In addition the Project will not be equipped with island mode capability and all power generated will be distributed externally to the electrical grid for consumption.

13.0 CUMULATIVE EFFECTS ASSESSMENT

A Cumulative Effects Assessment (CEA) was initially required as part of the federal Environmental Assessment screening process; however, as a federal Environmental Screening is no longer required due to 2012 changes to the Canadian Environmental Assessment Act, a CEA is no longer a required part of this process but has been included for information purposes.

As a result of substantial concern on the part of public and agencies regarding impacts to the upstream Ivanhoe Lake Dam and the downstream Northern Claybelt Forest Complex Conservation Reserve, the Project has been re-designed to eliminate upstream and downstream impacts. As well, the Project's Environmental Assessment is itself a Cumulative Effects Assessment of the previously-separate The Chute and Third Falls projects. Therefore, the vast majority of potential cumulative impacts have already been addressed through the process to date.

Forestry is a local industry that together with this Project, has potential to cumulatively impact local vegetation, particularly during the construction phase of the Project and related vegetation removal and clearing. However, as Xeneca is working with the local SFL holders to ensure that vegetation removal is coordinated with and included in their activities, no cumulative impacts are anticipated. Further details of this consultation on this can be seen in Section 17.2.3.

It is anticipated that remaining potential Cumulative Effects will be addressed through the Water Management Planning process, initiated by Xeneca, and discussed in Sections 9.6.8, 11.6.8, and 12.6.8. Please see also Section 17.2 for efforts to include the public in Water Management Planning activities.

14.0 ACCIDENTS AND MALFUNCTIONS

This section provides a summary of potential accidents and malfunctions that could occur at the Project Area, and potential environmental effects generated by accidents and malfunctions, and mitigation measures that will be implemented as part of the Project design. The following potential scenarios were assessed for the construction and operation:

- Accidental spill;
- Accidental fire;
- Emergency shut-down (**operations only**);
- Flood; and
- Earthquake.

14.1 Construction Phase

14.1.1 Accidents

14.1.1.1 Potential Effects

Increased construction traffic may result in a slightly increased risk of traffic accidents, affecting the health and safety of local residents or recreational users of the sites.

14.1.1.2 Mitigation

Xeneca is committed to maintaining public health and safety at all of its construction sites and operational facilities. Public access to the Facility will be controlled by use of temporary fencing to isolate active construction areas from available recreational areas. Similarly, signage alerting the recreational users of the roads and river about the dangers of construction areas will also be used. An emergency response plan will be developed, and workers trained in its use.

14.1.1.3 Net Effects and Significance of Net Effects

14.1.1.3.1 Value/Importance of Resource Affected

Public health and safety are of very *high* importance, and avoidance of accidents is critical.

14.1.1.3.2 Geographic Extent of Effect

The geographic extent of increased risk of accidents would be limited to the area immediately surrounding construction activities or construction traffic, and so is *low*.

14.1.1.3.3 Duration and Frequency

The duration of this increased risk is limited to the construction period, which is *low*.

14.1.1.3.4 Irreversibility of Effect

The impact of an accident, if it were to affect a person's health or safety, is potentially *irreversible*.

14.1.1.3.5 Ecological or Social Context

Vulnerability to the impacts of accidents from the Ivanhoe Project is anticipated to be *high*.

14.1.1.3.6 Magnitude of the Effect

The magnitude of an impact, if it were to occur, would be high. However, with the application of mitigation measures, any accidents likely to occur would have a *low* magnitude.

14.1.1.3.7 Probability of Effect

The likelihood of an accident is *low*, particularly following safety-enhancing mitigation measures.

14.1.1.3.8 Overall Significance

Given the low geographic extent, low duration and frequency, low magnitude and low probability of the effect, the residual effects are anticipated to be *Insignificant*.

14.1.2 Accidental Spill

14.1.2.1 Potential Effects

Hazardous materials that will be normally used and transported to both Facilities during the construction phase may include:

- Fuels and lubricants;
- Degreasers; and
- Paints, primers, thinners, coatings.

A 5,000-10,000L on-site fuel tank will be stored in a safe, designated fuelling location at least 30m from any water body. This fuel tank will be refilled on an approximately weekly basis throughout construction by a 300-500L tanker truck.

Accidental spills have the potential to be generated from the following construction activities:

- Vehicle accidents, including mechanical breakdowns, involving fuels, lubricants and chemicals on access roads or the Project Area,
- Improper loading and unloading, storage and handling of fuels, lubricants and chemicals at the construction sites;
- Improper refueling and maintenance of vehicles at the construction parking area and construction sites.

Accidental spills may result in soil, surface and/or groundwater contamination, and potentially generate adverse effects to the terrestrial and aquatic ecology.

14.1.2.2 Mitigation Measures

Refilling the fuelling tanks and transportation of tanker trucks to the fuelling sites will follow strict protocols designed to ensure that tanks will safely carry all fuels to the site without spills or leaks. To mitigate the potential environmental effects, the following engineering and management measures will be implemented for spill prevention and control in the Construction Management Plan (Appendix C, CPL, 2014):

- All hydrocarbon fuels and lubricants will be stored in a secondary containment area;
- All vehicle fuelling will occur in designated areas, a minimum of 30 m from a water course and where site grading and spill response equipment will be established to contain spillage;
- Drip pans will be installed on equipment to intercept minor leaks;
- Locations of spill prevention and clean up materials will be made known to all workers involved in these activities;
- Sumps will be installed including an oil trap to prevent contaminated water from being pumped into a water course at fuel storage and handling locations; and
- Absorbent mats and other spill response equipment will be readily available for deployment.

14.1.2.3 Net Effects and Significance Assessment

14.1.2.3.1 Value of Resource

The value of the forest resource and of human health and safety is *high*.

14.1.2.3.2 Geographic Extent of Effect

The geographic extent is determined by the nature, magnitude and location of a spill. The geographic extent of a fuel tanker spill in a water crossing is *high*. However, the geographic extent of a small spill at the construction sites is *low*.

14.1.2.3.3 Duration and Frequency of Effect

The duration and frequency of spills is *low* using the appropriate mitigation measures.

14.1.2.3.4 Irreversibility of Effect

The effect is considered to be *reversible*, through clean-up and restoration activities..

14.1.2.3.5 Ecological or Social Context

The Project Study Area is identified to have *low* fragility with respect to the environmental effects of a spill.

14.1.2.3.6 Magnitude of Effect

Under the worst case scenario of a spill from a fuel tanker in a water crossing, the magnitude of effect is *high*. However, the magnitude of effect of a small spill (as per at construction sites) is *low*.

14.1.2.3.7 Probability of Effect

The probability of a high magnitude spill or a low magnitude spill is *low*, upon adoption of the above engineering and management measures.

14.1.2.3.8 Overall Significance

Because the probability of high magnitude effects associated with a large spill is *low*, the net effect of accidental spills is considered to be an *Insignificant Effect*.

14.1.3 Accidental Fire

14.1.3.1 Potential Effects

An accidental fire may be generated from the following activities in the Study Area:

- Burning of slash and debris associated with vegetation clearing;
- Careless smoking;
- Sparks from construction equipment and electrical faults; and
- Lightning strikes.

The potential effects associated with an accidental fire in the *Project Area* depend on the nature and ultimate size of the fire. The effects of small, controllable fires in the work area would tend to be local in extent, minor in magnitude and short-term in duration. However, there is the potential for an event

that could result in effects that are very large in magnitude, particularly if a large fire were to start in the surrounding forest during dry periods. Such a large fire may be hard to control and have the potential to spread into a large forest fire.

The accidental fire may generate potential negative effects on public health and safety, wildlife and wildlife habitat, aquatic biota and habitat, air quality and surface water quality.

14.1.3.2 Mitigation Measures

A Fire Prevention and Preparedness plan will be developed annually through discussion with MNR Fire Managers. Through this annual planning process, key contacts and emergency numbers will be identified, prevention and preparedness plans will be described and included processes for how fire danger information will be communicated and used daily.

To mitigate the environmental effects due to an accidental fire, the following measures in the Construction Management Plan will be implemented (Appendix C, CPL, 2014):

- Project personnel will prepare and be familiar with the site *Fire Preparedness Plan*.
- Firefighting equipment will be available to all workers and the location of such equipment will be outlined in the *Fire Preparedness Plan*.
- Locations of equipment and muster points in case of fire will be advertised as necessary around the site.
- Project personnel will also be familiar with firefighting techniques and the use of the supplied equipment.
- Smoking will only be permitted in designated smoking areas and disposal of all waste will be into proper waste containers to prevent fires. Fire extinguishers will be available at designated smoking areas and will be inspected on a regular basis.
- Un-controlled fires will be immediately reported to the nearest fire emergency service and to the MNR in the case of an un-controlled fire on Crown Land.
- When burning is carried out, it will be under permit with the MNR and according to the *Forest Fires Prevention Act*.

Additional mitigation measures are proposed to mitigate the effects of an accidental fire:

- All construction contractors must prepare a *Fire Prevention and Preparedness Plan*, and have fire suppression equipment in accordance with the *Forest Fires Prevention Act*.
- All mechanical equipment will be equipped with a fire cache as required by MNR and be kept free of any accumulation of flammable materials.

14.1.3.3 Net Effects and Significance Assessment

14.1.3.3.1 Value of Resource

The value of the forest resource and of human health and safety are *high*.

14.1.3.3.2 Geographic Extent of Effect

The geographic extent of a forest fire has the potential to be very high. However, following the implementation of mitigation measures, the extent of any fire at the Ivanhoe Project is anticipated to be *low*.

14.1.3.3.3 Duration and Frequency of Effect

Following the application of the fire safety and preparedness plan, the duration and frequency of any forest fire is anticipated to be *low*.

14.1.3.3.4 Irreversibility of Effect

Impacts to the forest would be *reversible* over time. Any human health impacts have the potential to be *irreversible*.

14.1.3.3.5 Ecological or Social Context

Given the large size of the contiguous forest in and surrounding the Project Area, the fragility of the local ecological context to any forest that might result from project construction is anticipated to be *low*.

14.1.3.3.6 Magnitude of Effect

The magnitude of a forest fire has the potential to be very high. However, following the implementation of mitigation measures, the magnitude of any impact resulting from a forest fire at the Ivanhoe Project is anticipated to be *low*.

14.1.3.3.7 Probability of Effects

The probability of a high magnitude fire is *low*, upon adoption of the above measures.

14.1.3.3.8 Overall Significance

Because the probability of effects is *low*, the net effect of accidental fire is considered to be an *Insignificant Effect*.

14.1.4 Flooding

14.1.4.1 Potential Effects

The major construction activities that will occur in and around the water course, are the construction of the headpond, powerhouse tailrace and possibly bridges for Facility access. Temporary cofferdams will be installed in the river during the construction process. At this time, cofferdams are contemplated to be built to manage the 1:20 year flow rate. A potential flood beyond the 1:20 year flow rate may generate potential adverse effects on water quality, aquatic biota and habitat, and public health and safety.

14.1.4.2 Mitigation Measures

To mitigate the environmental effects due to flooding, the following engineering and management measures in the Construction Management Plan will be implemented (Appendix C, CPL, 2014):

- Installation and use of coffer dams will occur outside of the spring freshet period when flows in the range of the 1:20 year rates are unlikely.
- Project personnel will check weather forecasts and endeavor to anticipate approaching storms that may affect the Project.
- Should it become obvious that a storm is approaching, immediate plans should be made to adjust work schedules to protect personnel, re-schedule vulnerable tasks and facilities, manage adverse effects on the Project and the environment, and prepare for excess runoff.
- During storms, sedimentation, debris, and in-stream flows will be naturally high in the watershed. Personnel, tools, equipment, and supplies will be made as safe and secure as possible before the storm arrives.
- Following every flood event, a complete inspection of all structures and headworks equipment should be performed. All major damage would be repaired without delay.
- Conduct informal inspections of access road after heavy rainfall for potential road or bridge foundation erosion, culvert blockage, or other damage from water.
- The power line should be inspected after major storms for potential trees falling on the power line and to ensure proper condition of the power line, poles, and support structures.

14.1.4.3 Net Effects and Significance Assessment

14.1.4.3.1 Value of Resource

The value of water quality, aquatic biota and habitat, and public health and safety are *high*.

14.1.4.3.2 Geographic Extent of Effect

The geographic extent of flooding has the potential to be beyond the Project site, however, following the implementation of mitigation measures, the extent of the impacts related flooding over the cofferdams is anticipated to be *low*.

14.1.4.3.3 Duration and Frequency of Effect

As the cofferdams are designed to a 1 in 20 year storm, the frequency of experiencing a 1 in 20 year storm more than once is unlikely or *low*.

14.1.4.3.4 Irreversibility of Effect

Impacts of flooding to water quality, aquatic biota and habitat would be *reversible* over time. Any human health impacts have the potential to be *irreversible*.

14.1.4.3.5 Ecological or Social Context

Given that spring freshset flows are very high, the fragility of the local ecological context to flood flows are anticipated to be *low*.

14.1.4.3.6 Magnitude of Effect

The magnitude of a flooding has the potential to be very high. However, given that spring freshet flows are very high, the magnitude of any impact resulting from a flooding event at the Project is anticipated to be *low*.

14.1.4.3.7 Probability of Effects

The probability of a1 in 20 year flood event is *low*.

14.1.4.3.8 Overall Significance

Given the above mitigation measures and considering the probability of a flood beyond 1:20 flow rate at the time of installation and operation of the coffer dams is *low*, and potential environmental effects are limited in the Study Area, the net effect of the flood is considered to be an *Insignificant Effect*.

14.1.5 Earthquake

14.1.5.1 Potential Effects

The *Project Area* is located in the Northeastern Ontario Seismic Zone. According to Natural Resources Canada (http://earthquakescanada.nrcan.gc.ca), this zone experiences a very low level of seismic zone activity. Natural Resources Canada reports that from 1970 to 1999, on average, only one or two magnitude 2.5 earthquakes were recorded in the Northeastern Ontario Seismic Zone. The *Project Area* is located in this low seismic activity area presents a low potential for the facilities to be affected by this type of geological event.

The potential effects from an earthquake are mainly associated with the potential damage to the structural integrity of cofferdams in the river. A potential cofferdam failure could generate a temporary flood and generate short term adverse effects on surface water quality, aquatic biota and habitat, and the workplace safety.

14.1.5.2 Overall Significance

Considering the probability of an earthquake during construction phase is low, and potential environmental effects are limited in the Study Area, the net effect of seismic activity is considered to be *an Insignificant Effect*.

14.1.5.3 Monitoring

Dam Safety Inspections (DSI) will be conducted as recommended by the MNR in the Dam Safety Reviews Best Management Practices. It is recommended that a dam safety inspection occur after any significant change that may affect the dam (Appendix C, CPL, 2014).

14.2 Operational Phase

14.2.1 Accidents

14.2.1.1 Potential Effects

As maintenance vehicle traffic during operations will be infrequent, elevated risks of accidents during operation are not expected; however, the risk cannot be entirely eliminated.

14.2.1.2 Mitigation

Xeneca is committed to maintaining public health and safety at all of its construction sites and operational facilities. An emergency response plan will be developed, and workers trained in its use.

No additional mitigation measures are considered necessary for operational accidents, as the risk is very low.

14.2.1.3 Net Effects and Significance of Net Effects

14.2.1.3.1 Value/Importance of Resource Affected

Public health and safety are of very *high* importance, and avoidance of accidents is critical.

14.2.1.3.2 Geographic Extent of Effect

The geographic extent of increased risk of accidents would be limited to the area immediately surrounding Project facilities, and so is *low*.

14.2.1.3.3 Duration and Frequency

No elevated risk is anticipated; therefore, duration and frequency are *low*.

14.2.1.3.4 Irreversibility of Effect

The impact of an accident, if it were to affect a person's health or safety, is potentially *irreversible*.

14.2.1.3.5 Ecological or Social Context

Resilience to the impacts of accidents from the Ivanhoe Project is anticipated to be *low*.

14.2.1.3.6 Magnitude of the Effect

The magnitude of an impact, if it were to occur, would be high. However, with the application of mitigation measures, any accidents likely to occur would have a *low* magnitude.

14.2.1.3.7 Probability of Effect

The likelihood of an accident is *low*, particularly following safety-enhancing mitigation measures.

14.2.1.3.8 Overall Significance

Given the low geographic extent, low duration and frequency, low magnitude and low probability of the effect, the residual effects are anticipated to be *Insignificant*.

14.2.2 Accidental Spill

14.2.2.1 Potential Effects

Accidental spills have the potential to be generated from the following activities during the operational phase:

- Improper use, transportation, storage and disposal of transformer oils within the substations;
- Improper use, transportation, storage and disposal of hydraulic fluids and cooling oils within the powerhouses and substation areas;
- Improper use, storage and transfer of cleaning detergent for maintenance activities.

The accidental spill may result in soil, surface and/or groundwater contamination.

14.2.2.2 Mitigation Measures

Mitigation measures to prevent accidental spills during operations include the following:

Substation transformers should be enclosed by an impervious secondary containment structure (e.g., berm or container) capable of holding a minimum volume equal to the volume of transformer oil and lubricants plus the volume equivalent to providing a minimum 24-hour duration, 50-year return storm capacity for the stormwater drainage area around the transformer under normal operating conditions. The area should be equipped with a drain so that it can be cleared of any spilled material, which would be disposed of in a suitable manner.

- Secondary containment areas should be monitored throughout the operational period to ensure their integrity.
- An oil-water separator should be installed in each powerhouse to contain oil in the event of an accidental spill within the powerhouse.
- Only machinery/equipment that is clean and well maintained (e.g., no leaks) should operate in or near watercourses or drainage areas. No washing of equipment is to take place within or near watercourses.
- Proper spill response equipment will be kept at the Facilities through operations, and all workers trained in their use. .
- All workers will be trained in the Emergency Response Plan
- Significant quantities of hazardous materials will not be stored on site. Any hazardous materials such as petroleum hydrocarbons or lubricants which must be stored on site, will be stored and managed in accordance with all applicable legislation and guidelines.

14.2.2.3 Net Effects and Significance Assessment

14.2.2.2.1 Value of Resource

The value of the forest and of human health and safety is *high*.

14.2.2.2.2 Geographic Extent of Effect

The geographic extent of any spill during the operational phase of the Project would be limited to the Project Area, and therefore *low*.

14.2.2.2.3 Duration and Frequency of Effect

The duration and frequency of spills is *low* using the appropriate mitigation measures.

14.2.2.2.4 Irreversibility of Effect

The effect is considered to be *reversible*, through clean-up and restoration activities.

14.2.2.2.5 Ecological or Social Context

The Project Study Area is identified to have *low* fragility with respect to the environmental effects of a spill.

14.2.2.2.6 Magnitude of Effect

As quantities of hazardous materials are quite low during the operational phase, the magnitude of any spill during the operational phase is anticipated to be *low*.

14.2.2.2.7 Probability of Effect

The probability of a spill is *low*, upon adoption of the above engineering and management measures.

14.2.2.2.8 Overall Assessment

Given the low geographic extent, low duration and frequency, low magnitude and low probability of the effect, the residual effects of accidental spills during operations are considered to be *Insignificant*.

14.2.3 Accidental Fire

14.2.3.1 Potential Effects

Fires can occur during operation and maintenance activities when a flame is required, for example, when welding, or develops as a spark on mechanical equipment. Electrical fires could also occur within the powerhouses or at the switchyards or associated with the power lines. Fires could potentially result in loss of vegetation and wildlife, adverse effects on surface water quality due to ash-laden runoff and corresponding effects on aquatic biota. Large fires, although not anticipated to occur, could also present a human health and safety risk.

14.2.3.2 Mitigation Measures

The *Forest Fires Prevention Act* will apply to the operations of the Project. Fire protection equipment will be installed in each of the powerhouses. An *Emergency Response Plan* will be developed to document the procedures to be followed at the facilities in response to a fire. This plan will outline responsibilities and procedures to be followed by the observer, immediate supervisor, operator, and incident coordinator. The *Emergency Response Plan* will also identify personal protective equipment that should be worn when dealing with clean-up/ decontamination following fires.

The power line Right-of-Way (ROW) will be maintained to minimize the potential for damage to the power line due to vegetation, which will also minimize the fire risk due to the power line.

A Fire Prevention and Preparedness Plan will be developed annually through discussion with MNR Fire Managers. Through this annual planning process, key contacts and emergency numbers will be identified, prevention and preparedness plans will be described and include processes for how fire danger information will be communicated and used daily. Fire response equipment will be kept on site. All staff will be trained to deal with fire prevention and response.

14.2.3.3 Net Effects and Significance Assessment

14.2.3.3.1 Value of Resource

The value of the forest resource and of human health and safety are *high*.

14.2.3.3.2 Geographic Extent of Effect

The geographic extent of a forest fire has the potential to be very high. However, following the implementation of mitigation measures, the extent of any fire at the Ivanhoe Project is anticipated to be *low*.

14.2.3.3.3 Duration and Frequency of Effect

Following the application of the fire safety and preparedness plan, the duration and frequency of any forest fire is anticipated to be *low*.

14.2.3.3.4 Irreversibility of Effect

Impacts to the forest would be reversible over time. Any human health impacts have the potential to be *irreversible*.

14.2.3.3.5 Ecological or Social Context

Given the large size of the contiguous forest in and surrounding the Project Area, the fragility of the local ecological context to any forest fire that might result from project operations is anticipated to be *low*.

14.2.3.3.6 Magnitude of Effect

The magnitude of a forest fire has the potential to be very high. However, following the implementation of mitigation measures, the magnitude of any impact resulting from a forest fire at the Ivanhoe Project is anticipated to be *low*.

14.2.3.3.7 Probability of Effects

The probability of a high magnitude fire is *low*, upon adoption of the above measures.

14.2.3.3.8 Overall Significance

Because the probability of effects is *low*, the net effect of accidental fire is considered to be an *Insignificant Effect*.

14.2.4 Emergency Shut Down

In the event of an emergency, abrupt or unplanned shut down of one or both facilities, a bypass valve in the powerhouse has been incorporated into the Facility designs. The purpose of the valve is to avoid temporary interruption of flow downstream of the powerhouse.

14.2.4.1 Potential Effects

During normal operation, the river flow will overtop the weir when the powerhouse is shut down so that downstream flow is not inadvertently interrupted. However, during an unexpected shut-down, headpond water levels could be below the crest of the weir and the headpond would have to fill to the

weir crest before downstream flow resumes. This interruption of flow can last several minutes to several hours, depending on the prevailing inflow conditions. This would cause a disruption to the downstream ecosystem.

14.2.4.2 Mitigation Measures

To avoid a temporary interruption of flow from an unplanned shut down of one or both of the facilities, a bypass valve in the powerhouse is automatically activated to provide a minimum flow of 2 m^3/s. Normal flow resumes when the headpond has reached the weir crest and overflows at the prevailing river flow rate.

14.2.4.3 Overall Significance

The probability of an unplanned shutdown and the frequency and duration of this shutdown is *low*. With the provision of an emergency bypass valve providing a continued supply of water downstream until the water overflows the weir and the potential environmental effects are limited in the Project Study Area, the net effect of the flood is considered to be an *Insignificant Effect*.

14.2.5 Flooding

14.2.5.1 Potential Effects

According to the *Hydraulic Engineering Centre River Analysis System (HEC-RAS) Modeling Hydraulic Report* prepared by Canadian Projects Limited (CPL) in 2013 (Appendix F), the water levels upstream of the proposed structure post-construction during the Long Term Annual Flow (LTAF 30.2 m^3/s) will generally be lower than those reached by 1:100 year flood (506.0 m^3/s) pre-project.

According to the *Proposed Operating Plan & Water Management Plan Amendment* (referred to as an "Operating Plan", Appendix D), normal flood events are defined as event flows that exceed the maximum throughput capacity of the plant up to and including the one in two year flood event level. Flood events of this magnitude are normal occurrences in the river and present little concern for safety or environmental impacts. During these periods, the Facility is operated to manage water levels upstream below the maximum upstream operating water level where possible. This is achieved by allowing any water that is in excess of the maximum turbine capacity to bypass the Facility through the spillway and by operating the spillway and the power generation in a manner that achieves this objective.

High flood events are defined as events that exceed the one in two year flood event level but are within the safe design level of the Facility. Flood events of this level are expected to only occur infrequently over the life of the Facility. The emphasis on operation is on ensuring public safety. This is typically achieved by allowing any water that is in excess of the maximum turbine capacity to bypass

the Facility through the spillway and by operating the spillway and the power generation in a manner that achieves this objective.

Extreme flood events are defined as events at which the Facility cannot be attended safely by operators and where the risk of flooding of the generation equipment is possible. The emphasis on operation is on ensuring public and operator safety. Where advance warning is received that an extreme event may occur, the Facility will be prepared in advance of the flood peak to maximize the ability to pass water and provide minimal obstruction to the passing flood waters.

It should be recognized that the Facility is not designed to mitigate the effects of naturally occurring events such as floods and droughts. However, there are circumstances where the existence of the Facility can either aid in managing a special event or pose an additional risk. The flood risk aspects are managed, in part, through the government approval under the Lakes and Rivers Improvement Act which guide the engineering plans and specifications for the design of the Facility. The purpose of this process is to ensure that the flood passage capacity of the Facility is adequate and that the risk to property and public safety is duly considered.

14.2.5.2 Mitigation Measures

The following measures are proposed to mitigate the potential effects to the public.

- Where advance warning is received that an extreme event may occur, the Facility will be prepared in advance of the flood peak to maximize the ability to pass water and provide minimal obstruction to the passing flood waters.

14.2.5.3 Net Effects and Significance Assessment

14.2.5.3.1 Value of Resource

The value of the river and of human health and safety are *high*.

14.2.5.3.2 Geographic Extent of Effect

The geographic extent of a flood has the potential to be high. However, following the implementation of mitigation measures, the extent of any flood at the Ivanhoe Project is anticipated to be *low*.

14.2.5.3.3 Duration and Frequency of Effect

The frequency of 1:100 year storm events is 1 in 100 years, and therefore *low*.

14.2.5.3.4 Irreversibility of Effect

Impacts to the forest would be reversible over time. Any human health impacts have the potential to be *irreversible*.

14.2.5.3.5 Ecological or Social Context

Given the large size of the watershed and surrounding healthy natural ecosystems, the fragility of the local ecological context to floods is anticipated to be *low*.

14.2.5.3.6 Magnitude of Effect

The magnitude of a flood has the potential to be very high. However, following the implementation of mitigation measures, the magnitude of any impact is anticipated to be *low*.

14.2.5.3.7 Probability of Effects

The probability of a serious flood is *low*, upon adoption of the above measures.

14.2.5.3.8 Overall Significance

Because the probability of the effect is *low*, the net effect of flooding is considered to be an *Insignificant Effect*.

14.2.6 Earthquake

14.2.6.1 Potential Effects

The Study Area is located in the Northeastern Ontario Seismic Zone, a low seismic activity area. The potential effects from an earthquake are mainly associated with spillway and dam structures in the river. A spillway dam failure could generate a temporary flood and short term adverse effects on surface water quality, aquatic biota and habitat, and workplace safety.

14.2.6.2 Mitigation and Monitoring Measures

During the operational phase the following inspections will be adopted to mitigate the potential effects generated by a seismic accident during operations (Appendix C, CPL, 2014):

- Dam Safety Inspections (DSI) will be conducted as recommended by the Ontario Ministry of Natural Resources (MNR) in the Dam Safety Reviews Best Management Practices, and
- Annual Inspection and Dam Safety Review should be conducted during the low-flow period.

To mitigate the potential effects from a seismic accident, a dam safety assessment will be required according to the Ontario Dam Safety Guidelines. The engineering measures and management measures addressed in the dam safety assessment will be incorporated into the final design.

14.2.6.3 Overall Significance

Considering the probability of an earthquake in the Study Area is low, and potential effects are limited in the Project Study Area, the net effect of seismic is considered to be an *Insignificant Effect*.

14.2.7 Dam Safety

14.2.7.1 Potential Effects

Dam failure during operation can cause the sudden release of water to the watershed, potentially causing serious and sudden flooding downstream, with the possibility of impacts to human health and safety.

14.2.7.2 Mitigation

The primary protective measure is the safe design, construction, operation and maintenance of the Ivanhoe projects and ancillary facilities. Following the approval of the Ivanhoe Class EA, a full Dam Safety Study will be commissioned and incorporated into the overall safety plan. The mitigation measures and recommendations in the Dam Safety Plan will be incorporated into the Project's final design in order to reduce the risk to public health and safety from dam failure to near zero.

14.2.7.3 Net Effects and Significance of Net Effects

14.2.7.3.1 Value/Importance of Resource Affected

Public health and safety are of very *high* importance.

14.2.7.3.2 Geographic Extent of Effect

The geographic extent of impact from a dam failure could be very *high*, as it could affect users and residents far downstream.

14.2.7.3.3 Duration and Frequency

The duration of impact from such an event could be high; however, the frequency is anticipated to be very *low* with the application of mitigation measures as determined by the Dam Safety study.

14.2.7.3.4 Irreversibility of Effect

Impacts resulting from a dam failure, particularly where impacts to human health or safety are concerned, have the potential to be *irreversible*.

14.2.7.3.5 Ecological or Social Context

Vulnerability to the impacts of dam failure on the surrounding communities is anticipated to be *high*.

14.2.7.3.6 Magnitude of the Effect

The magnitude of impact in the case of dam failure would be *high*.

14.2.7.3.7 Probability of Effect

Following the implementation of mitigation measures, the likelihood of such an event would be very *low*.

14.2.7.3.8 Overall Significance

Given that the duration and frequency along with the probability of the effect is low, the residual effects are anticipated to be *Insignificant*.

15.0 CLIMATE CHANGE

Climate change is a variation in the long-term weather patterns of temperature and precipitation. The Intergovernmental Panel on Climate Change (IPCC) declared that "warming of the climate's system is unequivocal" and that there is a "very high confidence" that human activity since 1750 has played a significant role in overloading the atmosphere with carbon dioxide (CO_2) (IPCC Fourth Assessment Report: Climate Change 2007).

Ontario's climate change adaptation plan, Climate Ready: Ontario's Adaptation Strategy and Action Plan 2011-2014, states "We know that extreme weather is becoming more frequent. Across the Province we have seen an increase in prolonged heat waves, torrential rainstorms, windstorms, even drought." (MOE, 2011).

Climate change projections for Ontario suggest that average annual air temperatures will increase by 3 to 8°C by the end of the century and precipitation is projected to become more variable (MNR, 2013). It is projected that overall Ontario will experience milder, shorter winters with earlier snowmelt, less ice cover on lakes, changing rainfall patterns and increased evapotranspiration. All of these factors impact the normal precipitation patterns which affect future water availability for waterpower generation, transportation, and recreation as well as changes to water supply which impact Ontario's biodiversity, wetlands, shorelines and forests.

Chapleau District will experience the impacts of a changing climate in the next 50 years. It is projected that using a baseline of the years 1971 to 2000, over the next 50 years the Chapleau District will experience a temperature increase between 0 and 3 oC in the summer and 3 to 4 oC in the winter and an increase in precipitation between 0 to 10% in the summer. Winter precipitation is projected to range between a 10% increase and a 30% decrease in the next 50 years compared to a 1971 – 2000 year baseline (Colombo et al., 2007).

15.1 Potential Effects

Extreme weather events such as intense precipitation have the potential to impact waterpower generation in Ontario by increasing the frequency of high water flow events, increasing the likelihood of flooding. To determine the impacts of these high water flow events, the HEC-RAS model was run at three different flows: long term average flow, 1:2 year flood flow, and 1:100 year flood flow for both pre and post construction (HEC RAS reports in Appendix I). In addition, as per the current MNR Dam Safety Guidelines, the facilities will be designed to withstand a 1:100 year flood therefore a gradual increase in magnitude or frequency of flooding events will not affect the facilities within its regulatory requirement for passing the Inflow Design Flood (IDF) determined using MNR Guidelines.

In addition to extreme weather events, gradual climatic changes have the potential to impact the waterpower generation industry. Warmer winter temperatures are already being experienced in Ontario with lakes and rivers generally freezing later and thawing earlier than they used to (MNR, 2013). Warmer average air and water temperatures in the summer may result in lower water levels in Ontario's lakes and rivers (MNR, 2013).

The operation of the facilities may have the potential to exacerbate the impacts of climate change. A shorter winter ice season may have positive impacts such as less potential for ice scour and negative impacts such as increasing the susceptibility of the river to higher evaporation rates. In the winter, the warming temperatures and changes in precipitation will affect both snowfall amounts and the rate at which snowpack melts. Significant volumes of water are stored the winter snow pack and released in spring. An earlier and/or reduced freshet may be impacted by water levels and flows.

The higher evaporation rates caused by a shorter winter ice season as well as warmer air temperatures would occur throughout the Ivanhoe watershed; the incremental effect caused by the increased surface area of the headponds is negligible compared to the overall surface area of the river subject to increased evaporation. The *Proposed Operating Plan & Water Management Plan Amendment* (or "Operating Plan") prepared by ORTECH in 2013 (Appendix D) addresses the operations under different water levels and flows, covering operations for high flood, low flood, extreme flood and droughts conditions. **The operation of the facilities is not anticipated to worsen any of these potential effects of climate change.**

Anticipating the increased frequency of extreme precipitation events, the HEC-RAS model was run at three different flows: long term average flow, 1:2 year flood flow, and 1:100 year flood flow for both pre and post construction. Using this analysis, both The Chute and Third Falls facilities have been designed to withstand a 1:100 year flood. When a level 3 drought for the effected watershed is declared by the Province, the facilities will go into run-of-river operation (Operating Plan, Appendix D),

16.0 MONITORING PROGRAMS

In accordance with Section 4.5.3 of the OWA Guide (January 2014), the following three phases of monitoring are relevant to the Project, to verify the extent of effects, effectiveness of mitigation measures and whether additional measures are warranted, and are introduced in this section.

- Pre-construction monitoring
- Construction monitoring
- Operation monitoring

16.1 Pre-Construction Monitoring Program

A pre-construction monitoring introduces the monitoring requirements immediately prior to construction. The environmental baseline monitoring completed by the proponent and is described in Section 9 of this report. The pre-construction monitoring program described in this section will focus on the monitoring immediately prior to construction.

To identify and mitigate the construction effects, general construction related impacts and associated best management practices were introduced in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* (NRSI, 2014) in Appendix H. To verify the construction effects and identify any further remedial actions, a general construction monitoring program was given in the Construction Management Plan (Appendix C, CPL, 2014). Based on these reports, the pre-construction monitoring program is prepared to verify that the required permits and approvals, site environmental and social management system and procedures are in place, and related environmental emergency response and training are well implemented. The construction monitoring tasks are summarized in 0 below.

Table 43: Pre-construction Monitoring Tasks

Item	Description
Environmental Permits and Approvals	The required federal and provincial permits and approvals must be obtained prior to construction. (Refer to Section 7).
Tender Specifications	The conditions of permits and approvals, applicable best management practices, and mitigation measures addressed in the Class EA, Construction Management Plan and associated assessment reports must be introduced in the tender document.
Contractor Obligations	Construction contractors must comply with the obligations introduced in the tender document, including the implementation of engineering and management mitigation measures, monitoring, and emergency response plan
Culturally Modified Tree (CMT)	The Culturally Modified Trees (CMTs) located at The Chute on the east side of

Item	Description
	the river must be shielded prior to construction.
Sediment and Erosion Control Plan	To be prepared by construction contractors for DFO, MNR and MOE's review, prior to construction.
Process Wastewater Management Plan	To be prepared by the contractor of the concrete batch plant, including a wastewater transportation and offsite treatment agreement with local municipal wastewater treatment plant and transportation company, prior to construction.
Domestic Wastewater Management Plan	To be prepared by the contractor of the construction camp, including a wastewater transportation and offsite treatment agreement with local municipal wastewater treatment plant and transportation company, prior to construction.
Water Quality MonitoringPlan	To be prepared by contractors of in-water works, including daily monitoring and weekly audit reports, prior to construction.
Waste Management Plan	To be prepared by contractors to manage the construction waste and hazardous waste prior to construction.
Emergency Response Plan	To be prepared by contractors prior to construction, including the accidental spill, fire, flooding, and earthquake.
Surface Water Quality Monitoring	Surface water quality monitoring at 5 locations (upstream background, one upstream and one downstream at each facility) to monitor the pH, water temperature, dissolved oxygen, total suspended solid and NH3-N.
Bird Survey	Commission a third party consultant to conduct a bird survey at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird.
Bat Habitat Survey	If vegetation clearing cannot be avoided during bat roosting season from May 1st to July31st, bat habitat surveys will be completed prior to construction to determine if headpond vegetation clearing will result in removal of these habitats. The methods and level of effort involved in these assessments would need to be determined on a case by case basis, with MNR.
Fall Walleye Index Netting (FWIN)	Xeneca has proposed to monitor the health and population characteristics of the walleye population by completing a series of Fall Walleye Index Netting (FWIN) surveys prior to and following inundation of the headpond. It is suggested that FWIN is performed during the pre-construction period in order to fully understand and assess the current walleye population within the Ivanhoe River.
Aquatic Vegetation Surveys	Vegetation surveys will first be conducted one year prior to construction to establish a benchmark dataset to which operational monitoring results will be compared.
Moose Aquatic Feeding Habitat	Monitoring of moose aquatic feeding habitat will coincide with aquatic vegetation surveys. Since moose aquatic feeding habitat is dependent on the presence of aquatic vegetation within the river. Vegetation surveys will be completed following the methods described above.

Item	Description
	Observations of moose utilizing identified moose aquatic feeding habitat will be documented.

16.2 Construction Monitoring Program

A construction monitoring program will be implemented during the construction phase, considering the following purposes:

- To verify the predicted construction effects;
- To monitor the performance of the Project and the effectiveness of mitigation measures;
- To determine project compliance with regulatory requirements, standards, permits and approval conditions;
- To provide an early indication should any of the environmental control measures or practices fail to achieve acceptable standards;
- To take remedial action if unexpected problems or unacceptable impacts arise; and
- To provide data to enable an environmental audit.

The construction monitoring program will be implemented by various construction contractors and/or the project proponent during the construction phase. The proposed mitigation measures will be built and operated by construction contractors during the construction phase. A dedicated contractor's environmental representative should be commissioned by each construction contractor to conduct routine site survey to record the mitigation measures addressed in the ER.

Based on the construction effects in the *Ivanhoe River Hydroelectric Development Natural Environment Characterization and Impact Assessment Report* (Appendix H, NRSI, 2014), and general construction monitoring program in the *Construction Management Plan* (Appendix C, CPL, 2014), and further evaluation of construction effects in the Class EA, the proposed construction monitoring program is summarized in 0 below.

Table 44: Construction Monitoring Program

Environmental and Social Components	Rationale (Potential Effects associated with construction activities)	Methods	Timing and Duration	Monitoring Responsibility	Reporting
Compliance with Plans	Compliance with approved drawings, protocols, tender, ER/ES and permit and approval specifications.	All site activities will be reviewed with contractors on a weekly basis to ensure that the contractor is in compliance with requirements.	Weekly	Construction Supervisor and/or Environmental Inspector	Weekly report to the project component
Erosion and sediment	Vegetation clearance, temporary or permanent stockpiling from earth-moving activities can change the topographic surface, increase runoff and sedimentation, and result in the water erosion from the inundation area, construction areas, water crossings for the access roads and power line corridors.	Site inspection of water erosion control measures in the inundation area, construction areas, and water crossings on the access roads and in the power line corridors. Visual inspection of all silt fences to ensure they are properly constructed. River banks in immediate vicinity of each site will be inspected for stability.	Weekly and after each heavy rainfall and snowmelt event	Site EHS Supervisor	Weekly report to the project proponent

Environmental and Social Components	Rationale (Potential Effects associated with construction activities)	Methods	Timing and Duration	Monitoring Responsibility	Reporting
Surface water quality	Surface water quality may be affected by sediment introduced from the dewatering water collected and treated in a settlement pond.	Water quality will be monitored daily at the settlement pond discharge for pH, temperature, turbidity and TSS. TSS can be monitored weekly once a correlation is established between TSS and turbidity, and is reviewed by the MNR.	Daily or Weekly	Site EHS Supervisor	Weekly report to the project proponent
Wastewater	Improper collection, storage, transportation and offsite treatment of domestic wastewater in the construction camp may generate impact to the surface water quality.	Site inspection of the onsite domestic wastewater storage tank, offsite transportation and treatment records.	Monthly	Site EHS Supervisor	Monthly report to the project proponent
	Improper collection, storage, transportation and offsite treatment of process wastewater in the concrete batch plant may generate impacts to the surface water quality.	Site inspection of the onsite process wastewater storage tank, offsite transportation and treatment records.	Monthly	Site EHS Supervisor	Monthly report to the project proponent

Environmental and Social Components	Rationale (Potential Effects associated with construction activities)	Methods	Timing and Duration	Monitoring Responsibility	Reporting
Construction waste	Improper transportation, storage and disposal of excavated construction wastes at the construction areas and stockpile areas can generate impacts to soil, surface water and groundwater quality.	Site inspection of excavated construction material stockpiles at construction sites and the stockpile area at each facility.	Monthly	Site EHS Supervisor	Monthly report to the project proponent
Hazardous waste	Improper transportation, storage and disposal of hazardous wastes at the fuel and chemical storage and handling locations can generate impacts to soil, surface water and groundwater quality.	Site inspection of hazardous wastes transportation, storage and offsite disposal records with a licensed hazardous waste hauler and facility.	Weekly	Site EHS Supervisor	Weekly report to the project proponent
Soil and groundwater	A spill or leakage of fuels or chemicals due to improper handling or storage may cause soil, surface water or groundwater contamination.	Site inspection of the secondary containment areas, spill control plan and materials at fuel and chemical storage and handling locations.	Weekly	Site EHS Supervisor	Weekly report to the project proponent

Environmental and Social Components	Rationale (Potential Effects associated with construction activities)	Methods	Timing and Duration	Monitoring Responsibility	Reporting
Natural Vegetation and Terrestrial wildlife	The plant communities at the footprint areas, temporary construction areas, access roads, power line corridors may provide nesting, foraging, breeding and wintering grounds for wildlife and bird species including bats, bald eagle and forest-nesting birds (Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird). Vegetation clearing in complex habitats (forest) during bird breeding season must be avoided (May 16 to August8 in Bird Conservation Region 8, Timmins area). If limited vegetation clearing in simple habitats has to occur during birds breeding season, bird nests may be affected. If nests are identified, a certain	If limited vegetation clearing in simple habitats has to occur during birds breeding season, commission a third party consultant to conduct a bird survey prior to construction at the proposed vegetation clearing areas, covering Bald Eagle Nesting, Canada Warbler, Olive-Sided Fly Catcher, Common Nighthawk, Eastern Wood-Pewee & Rusty Blackbird. If tree removal must occur during the period of April 30 to September 1, exit surveys will be conducted before removal occurs to confirm no active roosts are present. Exit surveys will follow the Bats and Bat Habitats guidelines authored by the OMNR (2012), which stipulate that a 1.5hr visual survey should be conducted to confirm use. This survey will be completed within 24hrs of the tree being removed to limit the possibility of a roost	prior to clearing of construction areas Spring and summer twice a year	Bird and bat survey consultant	Bird and bat survey report to the project proponent

Environmental and Social Components	Rationale (Potential Effects associated with construction activities)	Methods	Timing and Duration	Monitoring Responsibility	Reporting
	buffer zone from construction will be provided to protect the nests. Wherever possible, no tree removal will occur during the peak roosting period for bats. This will include the period of April 30 to September 1. If tree removal must occur during this time period, potential bat maternity roost habitat (cavity trees) will be affected.	establishing after the survey has been completed. Re-vegetation areas will be visually monitored to determine the adequacy of vegetation growth of disturbed areas.			
Aquatic biota	Improper in-stream construction may generate impacts to the aquatic biota.	Monitoring construction works to ensure in-stream construction occur within allowable timing window. The environmental consultant will conduct a fish salvage process once the coffer dams are installed. They will stay on-site and continue to salvage fish and any other wildlife as necessary during the de-watering period. This will be	Continually through in-stream construction; prior to dewatering;	Aquatic biology survey consultant	Aquatic biology survey report to the project proponent

Environmental and Social Components	Rationale (Potential Effects associated with construction activities)	Methods	Timing and Duration	Monitoring Responsibility	Reporting
		repeated for all in water work areas that will be isolated and drawn down.			
Aquatic Habitat	The temporary construction and operation of cofferdams in the river may generate impacts to fish spawning habitat	All aquatic habitat mitigation measures will be monitored during and immediately following their installation to ensure they have been constructed in accordance with DFO/MNR requirements.	Once following construction of the mitigation measures.	Environmental consultant	Aquatic biology survey report to the project proponent
Water flow	Hydraulic and hydrology change may occur due to the construction and operation of cofferdams in the river during or after heavy rainfall events, which may generate impacts to the water flow in the river.	Water flow will be monitored at one just outside the upstream extent of The Chute headpond and the other just downstream of Third Falls ZOI. The level meter installed downstream of Third Falls ZOI will be a real-time level logger and directly connected to the SCADA.	Instantaneous flows at these locations will be monitored at 15 minute intervals.	Site EHS Supervisor	Monthly report to the project proponent

Environmental and Social Components	Rationale (Potential Effects associated with construction activities)	Methods	Timing and Duration	Monitoring Responsibility	Reporting
Air	Construction dust will be generated from the land-clearing, earth works, site preparation and formation, construction activities and the movement of construction vehicles on unpaved construction sites, access roads power corridors, cement transportation, storage and handling in the cement batch plant.	Dust will be visually monitored to assess if excessively dusty conditions are present and dust suppression will be applied.	No specific monitoring frequency – continuous monitoring by the environmental inspector and construction supervisors.	Site EHS Supervisor	Monthly report to the project proponent
Noise	The blasting activities can generate high level noise impacts to the people on the portage trail, the birds and moose in the vicinity of facilities.	Noise monitoring at one closest location at each portage trail for each facility and the moose aquatic feeding locations within 1000 m to the blasting area	Quarterly during blasting periods	Site EHS Supervisor	Monthly report to the project proponent
Access to the river	In-water construction and any terrestrial construction taking place on or adjacent to existing portage trails has the potential to affect enjoyment and use of this amenity by local people.	Site inspection of the access to existing and temporary new portage trails.	Monthly	Site EHS Supervisor	Monthly report to the project proponent

16.3 Operation Monitoring Program

The operation monitoring will be implemented by the project proponent after the facilities and associated mitigation measures are built and put into operation, due to the following objectives:

- To verify the predicted operational effects;
- To confirm the effectiveness of mitigation measures;
- To determine project compliance with regulatory requirements, standards, permits and approval conditions;
- To identify any further remedial actions in the event that related mitigation measures are not effective.
- To provide an early indication should any of the environmental control measures or practices fail to achieve acceptable standards;
- To provide data to enable an environmental audit.

The proposed operation monitoring program is summarized in **Error! Reference source not found.**.

Table 45: Operation Monitoring Program

Environmental Component Parameter		Monitoring Methodology	Monitoring Frequency and Timing	Trigger for Action	Reporting
Aquatic Biota and Habitat	Fish Communities	Fish community sampling to obtain post construction CPUE and relative abundance to compare to pre-construction conditions and determine whether fish community and abundance have changed. Fish community sampling will be conducted in August following the RIN protocol with large RIN nets. A total of 61 nets will be set in the Ivanhoe River between 6.4km upstream of The Chutes to the crest of Third Falls. Eleven nets will be set upstream of The Chute, 40 nets will be set between The Chute and Third Falls and 10 nets will be set below Third Falls. This is to coincide with the number and locations of surveys completed during the pre-construction phase. (This sampling will provide specimens for analysis of fish tissue mercury concentration and structures for aging analysis.)	Fish community sampling will occur in years 3, 6 and 9 of Facility operation.	Should the fish community monitoring results reveal substantial changes in the fish community that are of concern, Xeneca will discuss the matter with MNR. Appropriate mitigation strategies will be developed as appropriate in the context of the various aspects of resource use that affect the fish community in the Ivanhoe River. Possible mitigation strategies include reducing the ratio of maximum flow to minimum flow during specific months of the year, which can be achieved by increasing the minimum flow or decreasing the maximum flow. Another consideration would be whether changes to the fish community are caused by impacts on recruitment. In this case, modification to the compensation fish habitat may be an option. Fish stocking could also be a viable management option for a valued species such as walleye.	The results will be submitted to MNR annually for each monitoring year.
	Benthic Invertebrates	Benthic invertebrate sampling will be completed in habitats throughout the entire ZOI to compare pre and post construction benthic invertebrate communities to determine whether or not community structure has changed. Sampling for benthic invertebrates will occur on one occasion during the monitoring year using Hester-Dendy artificial substrate samplers (H-D sampler). The H-D samplers will be installed in the river in August and retrieved after approximately 6 weeks. Benthic invertebrate monitoring will occur at seven locations in the Ivanhoe River. Monitoring will occur upstream of the 6.4km Chute headpond within the first fast water feature downstream of the Ivanhoe/Shawmere confluence. This will be established as a reference site in order to provide information on the current invertebrate community. Within The Chute headpond, monitoring will occur at Oates Road Bridge to correspond with baseline benthic invertebrate data. Monitoring will also occur downstream of The Chute within the east and west channels following similar methods used during pre-construction surveys. Within the Third Falls headpond, monitoring will occur at the three locations where pre-construction benthic invertebrate data was collected for comparison purposes. Benthic invertebrates will be identified to the lowest practical taxonomic level by a professional taxonomist. In addition to the sampling of benthic invertebrates, basic habitat information such as wetted width,	Sampling will occur once in years 1, 3, 6 and 9 of Facility operation.	Should results reveal changes in the benthic community that are of concern, Xeneca will discuss appropriate mitigation strategies with MNR. Possible mitigation strategies include reducing the ratio of maximum flow to minimum flow during specific months of the year, which can be achieved by increasing the minimum flow or decreasing the maximum flow. A different approach would be to alter the riffle habitat to maintain a greater wetted area during minimum flow conditions.	The density, the diversity and characteristics of the community will be statistically compared among years using Analysis of Variance (ANOVA). The results will be submitted to MNR and DFO annually for each monitoring year.

Environmental Component Parameter		Monitoring Methodology	Monitoring Frequency and Timing	Trigger for Action	Reporting
		depth and hydraulic head will be collected at the location of the H-D samplers. Sampling will also be coordinated with hydrologic monitoring to facilitate association of benthic results with the hydrology at the location of the H-D samplers.			
	Compensation Benthic Invertebrate Habitat	Approximately 800 m^2 of the walleye spawning habitat below The Chute and 4600 m^2 upstream of the influence of The Chute headpond will be created in such a way as to provide invertebrate production during low flow periods. Xeneca proposes to monitor the invertebrate population using methods identical to those described above (also used for baseline sampling for the EA).	First five years of Facility operation.	Should invertebrate sampling and analysis at the constructed invertebrate habitats reveal that invertebrate abundance, species composition and diversity are substantially altered compared to the pre development baseline condition, Xeneca is prepared to enter into discussions with MNR and DFO to determine what might be done to modify the constructed habitat to improve benthic production. Consideration may need to be given to providing additional benthic invertebrate habitat elsewhere to improve production.	The results will be submitted to MNR and DFO annually for each monitoring year.
	Compensation Fish Habitat	Monitoring the effectiveness of all aquatic compensation habitats constructed as part of Federal Fisheries Act Authorization will occur in order to ensure that habitat is functioning as intended and that the objectives related to each compensation habitat area have been achieved. Fish habitat will be constructed directly downstream of The Chute GS below the east and west channels. Spotlight visual surveys and egg mat surveys will be carried out to determine whether walleye spawning is occurring within the new spawning habitat. Sampling techniques such as angling, trap netting and gill netting will also be used, as appropriate, to determine presence of adults during the spawning season. Water depths and water velocities will be measured when water temperatures are suitable for walleye spawning. This will require that measurements are taken on one occasion during the spawning season in order to describe the depths and velocities available for walleye. If it is found that the fish are not using the compensation habitat, the habitat measurements will be used to verify the predicted conditions from the 2-dimensional model used to design the spawning habitat. The 2-dimensional modeling may then be used to analyze the habitat parameters at a variety of flow conditions. However, this will only be done if there is clearly a need to analyze the habitats beyond the observation of use by walleye.	First five years of Facility operation.	Should results reveal that habitat is not functioning as intended or that identified objectives are not being realized Xeneca will discuss strategies with DFO and MNR to ensure that the desired habitat function is achieved and objectives are met. There would be a variety of options to modify the habitat. For example, additional large boulders could be placed in order to provide more resting areas for spawning fish and/or to provide greater variety of water velocities. Similarly, additional large or small substrate material could be placed in order to change the substrate composition, initially in a portion of the spawning bed in order to test success.	The results will be submitted to MNR and DFO annually for each monitoring year.

Environmental Component Parameter		Monitoring Methodology	Monitoring Frequency and Timing	Trigger for Action	Reporting
	Fall Walleye Index Netting (FWIN)	The Third Falls headpond will add several meters of water depth over the 15, 000 m^2 benthic invertebrate habitat located 5 km upstream of Third Falls. This means a very large volume of fill material would have to be brought in to create depths typical for riffle type invertebrate habitat. Secondly, since no gradient would remain in the river the only way to create velocity over the new habitat would be to pump water over it. Therefore, a creative way of offsetting this habitat alteration that fits within the policies and mandates of both DFO and MNR must be considered. Impacts on fish food production related to changes in invertebrate species and abundance has the potential to impact on walleye in the Third Falls headpond area. However, since the diet preferences of the walleye in the river are not known, the walleye may in fact be able to offset this loss by opportunistically feeding on food sources other than the invertebrates presently generated at this location. This may even lead to a more productive ecosystem thereby increasing foraging opportunities for other food sources that benefit from this increased productivity. FWIN should be conducted during the post-construction period in order to monitor the walleye population for potential change.	FWIN will be completed yearly for the first five years of Facility operation.	If the FWIN monitoring determines that there is a significant decrease in the overall health of the walleye population in the Third Falls headpond area then Xeneca is prepared to enter into discussions with MNR about the possibility of stocking that section of the river with walleye in order to maintain a quality fishing experience for anglers as per MNR's Fisheries Management objectives.	The results will be submitted to MNR and DFO annually for each monitoring year.
	Walleye/ white sucker spawning Habitats	Monitoring of walleye/white sucker spawning habitats where velocity and depth have been predicted to remain within the preferred range for walleye spawning. Required to ensure that predictions with respect to post development depth and velocity at these habitats were accurate and that the habitat continues to function within the preferred depth and velocity ranges for walleye spawning. Water depths and water velocities will be measured when water temperatures are suitable for walleye spawning. This will require that measurements are taken on one occasion during the spawning season in order to describe the depths and velocities available for walleye. Spotlight visual surveys and egg mat surveys will be carried out to determine whether walleye spawning is occurring within the existing spawning habitats. Sampling techniques such as angling, trap netting and gill netting will also be used, as appropriate, to determine presence of adults during the spawning season.	The first five years of Facility operation.	Should post development monitoring reveal that the habitats are not functioning within the preferred ranges for walleye/white sucker spawning discussions with DFO will ensue and the construction of additional compensation habitat will be considered.	The results will be submitted to MNR and DFO annually for each monitoring year.
	Brook Trout and Tributaries	Water temperature monitoring will occur in nine potential brook trout tributaries within the Third Falls headpond to verify model predictions of temperature changes within the tributaries and confirm that temperatures are within an acceptable range for brook trout. Two temperature loggers will be placed in each of the nine tributaries to record temperature continuously at one hour intervals. One temperature logger will be placed at a location within the backwater influence of the proposed inundation and one upstream of this point. The loggers will be left in place for an entire year and downloaded periodically throughout the year. Data will be analyzed and summarized annually for comparison to pre-construction baseline conditions as well as to the model predictions for verification.	The first five years of Facility operation.	Should post development monitoring reveal that the habitats are not functioning within the preferred ranges for brook trout discussions with MNR and DFO will ensue to determine an appropriate method of action.	The results will be submitted to MNR and DFO annually for each monitoring year.

Environmental Component Parameter		Monitoring Methodology	Monitoring Frequency and Timing	Trigger for Action	Reporting
	Fish Stranding	Fish stranding will be monitored in the constructed habitat in the tailrace area (east channel) downstream of The Chute GS. A camera will be installed directed downstream of the proposed GS to observe any stranding of fish during incidental or emergency shutdown of flows. The areas downstream will be visually assessed for stranding of all fish species. Stranding will also be monitored during all operating regimes. Onsite staff will be trained in the identification of stranding and will be required to notify a biologist of any occurrences for further observation and reporting.	Should occur in spring summer and fall to account for seasonal variation in habitat usage by fish. Should occur for three years following construction.	Should fish stranding be identified as an issue, possible mitigation measures include habitat adjustments at problem areas to provide a pathway for stranded fish to reach the flowing water. Another option would be to adjust the operations such that flow is reduced at a slower rate to provide more time for fish to escape areas being dewatered.	All occurrences of fish stranding will be reported to MNR annually for each monitoring year.
	Fish Entrainment and Impingement	Fish mortality from entrainment and impingement will be monitored to determine whether entrance velocity and trash rack spacing is adequate to mitigate fish mortality from entrainment and impingement. Entrainment and impingement will be monitored on a regular basis by onsite staff through visual surveys of fish mortality within and below the tailrace area.	Should occur in the first year following construction.	Should a significant number of dead or injured fish be observed, operations should be ceased immediately and both MNR and DFO notified. This will ensure that no further mortality or injury occurs while a thorough investigation is conducted by the proponent in cooperation with MNR and DFO. Once the cause of injury or death is determined an appropriate response can then be determined in consultation with the agencies. Should entrainment or impingement prove to be a threat to VEC species such as walleye, northern pike or brook trout, potential modifications such as lighting, electrical barriers, air bubbling and sound barriers can be made.	The results will be submitted to MNR and DFO when fish mortality is observed.
Vegetation and Significant Wildlife Habitat	Aquatic Vegetation Surveys	Monitoring of vegetation will occur along the Ivanhoe River riverbanks and hydrologically connected wetlands within The Chute and Third Falls headponds. Surveys for vegetation communities should consist of quadrat plot sampling using 1 m^2 subplots located in reference to stations established using stakes. These plots will be maintained at the same locations each survey year to assess changes in species composition, percent cover and in some instances, height. The number of plots will vary depending on the size of the wetland and accessibility within the inundated portions of the wetland. Monitoring of vegetation communities within the wetlands should coincide with the growing season which generally occurs within wetlands during the late spring and summer months. It is recommended that one survey be conducted during the spring (June) and another be conducted during aquatic surveys in August.	Subsequent monitoring will occur during years 1, 3 and 6 of operations.	Should surveys identify that wetland communities are being adversely impacted and an erosion issue is occurring along the inundation area shoreline then Xeneca will discuss the matter with the MNR and develop appropriate mitigation strategies. Possible strategies include re-planting vegetation cover using local resilient species, or reducing the rate of headpond level changes to minimise erosion during the growing season. Monitoring should continue after mitigations are put into place to ensure that the strategies employed have the desired effect.	The results should be submitted to MNR annually for each monitoring year.

Environmental Component Parameter		Monitoring Methodology	Monitoring Frequency and Timing	Trigger for Action	Reporting
	Moose Aquatic Feeding Habitat	Monitoring of moose aquatic feeding habitat will coincide with aquatic vegetation surveys. Since moose aquatic feeding habitat is dependent on the presence of aquatic vegetation within the river. Vegetation surveys will be completed following the methods described above. Observations of moose utilizing identified moose aquatic feeding habitat will be documented.	Subsequent monitoring will occur during years 1, 3 and 6.	Should surveys identify that wetland communities, and in turn moose aquatic feeding habitat, are being adversely impacted, Xeneca will discuss the matter with the MNRand develop appropriate mitigation strategies. Possible strategies include reducing the maximum daytime flow for some or all of the months of June through October, and further constraining the daily water level fluctuations during the growing season. Monitoring should continue after mitigations are put into place to ensure that the strategies employed have the desired effect.	The results will be submitted to MNR annually for each monitoring year.
	Otter Denning Habitat	Monitoring of river otter denning habitat will include presence/absence surveys in conjunction with all other field investigations. Extensive surveys for denning sites is not recommended as locating them can be very challenging (MNR 2012), however, any observed individuals will be followed, if possible, to their den site to confirm the location of river otter denning Significant Wildlife Habitat.	Initial five years of Facility operation in conjunction with other monitoring field investigations. In the absence of any river otter observations in years 1 through 5, the MNR and local trappers will be contacted to confirm the lack of otter observations in the vicinity of the Facility. Targeted river otter surveys may be recommended for years 6, 7, 8 and 9, or until river otter individuals are observed. Each year, one targeted survey would occur between April and June when juveniles are known to emerge from their dens.	Should surveys identify that river otter denning habitats are being adversely impacted, Xeneca will discuss appropriate mitigation strategies with the MNR. Possible strategies include reducing the ratio of maximum flow to minimum flow which can be achieved through increasing minimum flow or decreasing maximum flow. Monitoring should continue after any mitigation is put into place to ensure that the strategies employed have the desired effect.	The results will be submitted to MNR annually for each monitoring year.
Oper ation	Water Levels	The headpond water level will be monitored from a water level gauge located on the upstream side of	At 15 minute intervals for duration of Facility	An operating system will be designed to include an alarm to notify the operator when water level deviates	The results will be submitted

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Environmental Component Parameter		Monitoring Methodology	Monitoring Frequency and Timing	Trigger for Action	Reporting
		each powerhouse. Two additional monitoring stations will be established, one just outside the upstream extent of The Chute headpond and the other just downstream of Third Falls ZOI. The level meter installed downstream of Third Falls ZOI will be a real-time level logger and directly connected to the SCADA. Instantaneous flows at these locations will be monitored at 15 minute intervals. (See ER document Section 5.7 Compliance Considerations)	lifetime.	outside the target operating range. The Facility inflow and outflow will be adjusted until the level returns to the target operating range. An Incident Report following standard compliance procedures outlined by MNR will be submitted. If operations at Third Falls prove incapable of effectively re-naturalizing downstream flows consistent with the above approach, consideration will be given to changing the operations at both The Chute and Third Falls to true run-of-river during periods of concern.	to MOE and MNR annually
		Daily water level fluctuation at The Chute headpond will be monitored not to exceed 1 m and at Third Falls headpond will not exceed 25 cm due to operations.	At 15 minute intervals for duration of Facility lifetime.	An operating system will be designed to include an alarm to notify the operator when water level fluctuations deviate outside the target operating range. The Facility inflow and outflow will be adjusted until the level returns to the target operating range. An Incident Report following standard compliance procedures outlined by MNR will be submitted.	The results will be submitted to MOE and MNR annually
	Flow Rates	Total instantaneous discharge readings would be a combination of gauged/measured flows through each Facility and calculated discharge from the spillway. (See ER document Section 5.7 Compliance Considerations)	At 15 minute intervals for duration of Facility lifetime.	An operating system will be designed to include an alarm to notify the operator when flow rate deviates outside the target operating range. The Facility inflow and outflow will be adjusted until the flow rate returns to the target operating range. An Incident Report following standard compliance procedures outlined by MNR will be submitted.	The results will be submitted to MOE and MNR annually
	Ice Scour	Ice scour can occur where water levels fluctuate during the winter months and where soft river bottom sediments exist. The action of broken ice wedging into the river sediments and moving up and down with repeated water level fluctuations within The Chute and Third Falls headponds can disturb certain shoreline habitat such as benthic organisms or winter spawned fish eggs. A monitoring location with soft sediments and potential for ice scour will be established prior to construction in an accessible area within The Chute and Third Falls headponds, respectively. The monitoring locations will be documented with photographs taken and be assessed for visible effects of ice scour after year 1 and year 5 of operation (i.e. during low flows in late summer). The monitoring locations will be assessed in the winter while modified run-of-river operation is ongoing to determine if and how much ice breakage and wedging occurs.	Year 1 and year 5 of operation.	Based on the results of the assessment, the Operating Plan (Appendix D) will be adjusted to mitigate where a significant adverse effect is determined to occur as a result of modified operation.	The results will be submitted to MOE annually for each monitoring year.

Environmental Component Parameter		Monitoring Methodology	Monitoring Frequency and Timing	Trigger for Action	Reporting
		(See Operating Plan Section 5.4 Ice Scour in Appendix D)			
Surface Water	Water temperature and dissolved oxygen	Thermal loggers have been installed in the Ivanhoe River two headponds. One thermal logger will be placed at the boundary of the Conservation Reserve (crest or just below the last fall at Third Falls) to document pre and post development thermal conditions. Water temperature in these locations will be monitored on an hourly basis. (See ER document Section 5.7 Compliance Considerations)	Hourly data will be monitored for duration of Facility lifetime.	If thermal condition changes, the results will be reviewed with MOE/MNR to develop an adaptive management plan.	The results will be submitted to MOE and MNR annually for each monitoring year.
		A temperature and dissolved oxygen profile with measurements taken every meter of depth will be conducted three times a year at the impoundment to identify if thermal stratification and decreased dissolved oxygen is occurring in the impoundment if sufficient water depths permit such an assessment. (See Surface Water Quality Report Section 4.2 in Appendix G)	First three years of operation.	If thermal stratification and decreased dissolved oxygen occurs as a result of the facilities, an adaptive management plan will be discussed with MOE and MNR where mitigation measures could include bottom drawer from multi-level draw systems or increased headpond flushing rates. Facility affected vs. natural changes in water quality will be assessed with upstream reference water quality samples during Facility operation.	The results will be submitted to MOE and MNR annually for each monitoring year.
	Surface Water Quality	Samples will be collected from five locations including the upstream reference, impoundment of The Chute, downstream of The Chute, impoundment of Third Falls, and downstream of Third Falls respectively. Parameters below will be measured: pH, conductivity, alkalinity; Total Suspended Solids (TSS) and Total Dissolved Solids (TDS); Cations (Mg, Na, Ca, K); Anions (Cl, SO_4); Dissolved Organic Carbon (DOC); Total phosphorus; Nitrate, nitrite, ammonia and total Kjeldahl nitrogen (TKN);	Post-development water quality samples will be collected three times a year during the spring freshet, the summer low-flow period and the fall mid-flow periods in years 1, 2 and 3 following development, as recommended by MOE 2012.	Should monitoring identify that water quality including dissolved oxygen is impacted, Xeneca will discuss the matter with MOE to determine if additional sampling or investigation into the source of the changes is necessary and develop appropriate mitigation strategies.	The results of the post-development monitoring will be compared to pre-construction condition and reported to MOE annually for each monitoring year.

Environmental Component Parameter		Monitoring Methodology	Monitoring Frequency and Timing	Trigger for Action	Reporting
		Total metals; Low level total mercury (0.1 ng/L detection limit); and, Low level methyl mercury (0.02 ng/L detection limit). Water temperature, dissolved oxygen, pH and conductivity and turbidity will be measured in the field using YSI model 650 TDS multi-meter. (See Surface Water Quality Report Section 4.2 Water Sampling in Appendix G)			
Mercury	Fish Tissue Mercury Concentrations	Fish sampling will be conducted according to the MNR RIN protocol and recommendations of MOE Permit To Take Water Guideline 2012. Large fish: total mercury – 10 samples; methyl mercury – 5 samples, of at least 25 to 55 cm length; Forage fish: total mercury and methyl mercury – 5 composite samples, of 5 to 10 individuals of yearling perch or other cyprinid species. Fish will be sampled from The Chute impoundment, Third Falls impoundment, and Downstream of Third Falls to assess project impacts. (See Surface Water Quality Report Section 4.3 Fish Sampling in Appendix G)	Sampling will be conducted in years 1, 2, 3, 6 and 9 of Facility operation (forage fish) and 3, 6 and 9 (large fish) to assess mercury accumulation in fish tissue.	Fish tissue mercury may potentially increase for a number of years post-development. Xeneca will remove trees and large vegetation from the inundation rea to help control possible increases in mercury. Mercury levels in the Northern rivers are governed largely by anthropogenic airborne sources and past mining operations. The monitored results will be provided to the MOE mercury consumption advising program. If the mercury level is not attenuated to background levels after 9 years, the monitoring program will be extended in co-operation with MOE as part of a program to resolve sources of mercury increases, if any, from air, mining or other sources.	The results of the post-development sampling will be compared to baseline results and reported to MOE annually for each monitoring year. Discussions will be needed with all users of the river or sources of airborne deposition on this matter.
Erosion and Sedimentation Control		A comprehensive monitoring plan has been developed focusing primarily on channel adjustments and sediment movement within the zone of influence in order to detect any accelerated erosion that may potentially occur due to dam operations. Ten stations, including both control and impact stations, will be established within the Study Area in order to follow a Before, After, Control, Impact method. At each station, a benchmarked channel section will be set-up and surveyed to provide a direct measure of changes in channel dimensions as well as changes in substrate, based on results of a pebble-count method. Additionally, a series erosion pins will be installed in the banks at each station. TSS will be measured as well for direct measure of suspended sediment movement. (See Geomorphology Report in Appendix E)	First 5 years of operation, and then year 7 and year 10.	Should the monitoring program identify that significant erosion or sedimentation is occurring, a detailed study will be carried out to determine the cause. If it is due to Facility operation, an adaptive management plan will be developed with agencies to modify operations or provide physical shoreline protection measures.	The results of the post-development monitoring will be compared to pre-construction condition and reported to MOE and MNR annually for each monitoring year.

Environmental Component Parameter	Monitoring Methodology	Monitoring Frequency and Timing	Trigger for Action	Reporting
Recovery of Forest loss	Elm-Ash Hardwood is considered a rare-treed SWH. Approximately 0.7ha of this community located downstream of The Chute GS will be inundated by the proposed completed Third Falls GS. Seeds from this community will be harvested prior to dam construction and inundation, in order to maintain genetic integrity of the rare-treed community. Seeds will be grown into seedlings at a local nursery and will be planted within suitable habitat along the new shoreline within the Project Area or adjacent lands. Post-construction monitoring will occur to ensure the community is re-establishing.	Year 2 of facility operation and Year 5 if necessary.	If the survival percentage of the seedlings is not adequate, more seeds will be grown and those dead seedlings will be replaced.	The results will be submitted to OMNR annually for each monitoring year.
EACOM Bridge on Oates Road	The EACOM Bridge on Oates Road is located within the inundation area of the proposed The Chute Facility. Water levels and erosion condition at the EACOM bridge on Oates Road will be monitored by a professional engineer during spring freshet, to ensure the bridge safety is not impacted by the inundation of the Facility.	First three years of operation.	Should impacts occur to the bridge due to The Chute Facility inundation, an adaptive management plan will be discussed with EACOM. Possible measures will include adjusting the operational levels of the Facility or upgrading the bridge.	The results will be submitted to MOE and EACOM annually for each monitoring year.
Nova Road Bridge	The Nova Road Bridge, owned by Tembec, is located within the inundation area of the proposed Third Falls Facility. Water levels and erosion condition at the Nova Road Bridge will be monitored by a professional engineer during spring freshet, to ensure the bridge safety is not impacted by the inundation of the Facility.	First three years of operation.	Should impacts occur to the bridge due to Third Falls Facility inundation, an adaptive management plan will be discussed with Tembec. Possible measures will include adjusting the operational levels of the Facility or upgrading the bridge.	The results will be submitted to MOE and Tembec annually for each monitoring year.

17.0 PUBLIC, ABORIGINAL & AGENCY CONSULTATIONS

The consultation and engagement initiatives were designed to co-ordinate all applicable requirements for the regulatory, public and Aboriginal community notification, engagement and consultation. Xeneca is committed to carrying out effective and responsive consultation activities with all local stakeholders, and to achieve this goal, adhered to the following regulations and guidance documents in designing their consultation program:

17.1 Consultation and Engagement Initiatives

17.1.1 Federal:

- Aboriginal Consultation and Accommodation: Updated Guidelines for Federal Officials to Fulfill the Duty to Consult Guide *(AAND 2011)*.

17.1.2 Provincial:

- OWA Class EA for Waterpower Projects (OWA, 2011)

In addition, the proponent referred to Ontario Regulation 359/09 in designing consultation programs for elements such as notification provisions and publications.

This Section of the Environmental Report provides a complete description of all consultation activities carried out in support of the Ivanhoe Project, issues raised by stakeholders, and their resolution.

17.1.3 Stakeholder List

At the beginning of the EA process, a list of stakeholders that could be affected by or have an interest in the Project was developed. The original list was developed through a desk-top review of organizations, businesses and agencies active in the vicinity of the Project location; this list was added to as additional stakeholders came forward during the EA process and asked to be included in consultation activities. All required correspondence and notifications were sent to everyone on the Stakeholder List. In addition, other correspondence and notifications were sent based on interest and developments.

The Stakeholder List is included in Appendix L. Each portion of the Stakeholder List has been included in the relevant subsections of this section.

17.1.4 Project Consultation Background

The Ivanhoe Project was initially conceived of and evaluated as two separate hydroelectric projects: The Chute and Third Falls. A Notice of Completion for The Chute GS as an individual project was issued on July 14, 2011. In September of 2011, seven Part II Order requests were submitted to Xeneca and the Ministry of the Environment. After consultation, it was mutually agreed in March 2012 that the Notice of Completion and ER would be withdrawn and the EA planning process for the project would continue as a planning process that would consider The Chute GS and Third Falls GS as a combined project with one Class Environmental Assessment. This Environmental Report concludes that process by presenting the former The Chute and Third Falls projects as one, combined, Ivanhoe project.

Consultation activities completed before the combination of The Chute and Third Falls are also included in this report for the sake of completeness.

17.1.5 Consultation Records

Written (including email, post, and comment form) and verbal (including phone calls and conversations at PICs and other meetings) feedback was recorded in a comprehensive Consultation Log that included the stakeholder, date, medium, comment, and Xeneca's response. The full Log can be found in Appendix L.

For the reader's convenience, a summary of the issues identified during the regulatory agency and public consultation process is provided in tabular format. These tables also identify whether and how resolution of the issue has been or may be addressed.

The Final Environmental Report will be provided electronically to regulatory agencies, First Nations, Aboriginal groups and made available to local stakeholders identified during the EA process. Hard copies of the Final Environmental Report have been placed in the Timmins Public Library, Township of Chapleau offices, and the Northern Lights Restaurant in Foleyet for a 30-day formal review period as per the Class EA for Waterpower Projects.

The ER will be available for a 36-calendar day review period from April 9th through to May 14, 2014. Xeneca must receive all comments in writing regarding the proposed project and/or the ER no later than 11:59 pm on May 14, 2014.

The review will follow the steps below:

- A Notice of Completion will be issued for publication in local media on April 5 & 7, 2014, emailed to stakeholders and posted on the Xeneca website.

- Formal review of the Environmental Report and submission of reviewer comments (both regulatory and public) identifying outstanding issues and any requests to meet with Xeneca.
- During the formal review period Xeneca and stakeholders will attempt to resolve any issues that have been brought forward.
- Once outstanding issues have been resolved within the formal review period or within any subsequent periods required for third party resolution, Xeneca will submit the Statement of Completion.
- If, at the end of the formal review period, a stakeholder is not satisfied with Xeneca's proposed resolution, the stakeholder may make a written request to MOE for a Part II Order.

The consultation programs undertaken by Xeneca were intended to meet all mandatory consultation requirements as well as to assist in the identification and resolution of environmental concerns relating to the Project. Xeneca was responsible for notification, engagement, and consultation with First Nations and Aboriginal communities. All public consultation events, communications, and advertising with the public at large were coordinated and executed by Xeneca staff. Public and Aboriginal Community Consultation Plans for the proposed developments were prepared by Xeneca and are presented in Appendices L and M, respectively. Key components of the consultation plans including the specific tools and approaches to consultation are described below.

17.2 Main Communication Channels

17.2.1 General Print and Mailing

General mailing of reports, notices and letters through postal, courier and electronic methods were used. To promote environmental sustainability, the EA team did attempt to minimize printed media; however, hard copy print was used where electronic formats were not guaranteed to reach the intended target audience and where specifically requested.

17.2.2 Print Media

Both the Timmins Daily Press and the Chapleau Express were used for notice publications to ensure broad formal notification of key project milestones and key meeting dates to members of the public. Advertisements for public meetings were circulated in advance of all meeting dates. Table 46, below, summarizes the dates and newspapers for each notice publication. The dates, locations, and issues raised at each meeting are summarized in Section 17.3.4.

17.2.3 Web Media

Throughout the planning process Xeneca has provided regular project status updates and key documents (PIC slides, project updates, etc.) through emailing and on its website (www.Xeneca.com) to complement the consultation and engagement program for the projects. Project Descriptions were initially distributed on www.wesa.ca.

ORTECH

Table 46: Newspaper Publication Table

Event	NOC July 2010	NOC Nov 2010	NOC Dec 2010	Jan 13 2011 PIC	Jan 27 2011 PIC	February 5 2011 updated NOC	July 6 2011 PIM	July 7 2011 PIC	Notice of Completion	July 26 2012 PIC	October 2013 PIC
Newspaper											
The Daily Press (english)	July 28 & 31, 2010	Nov 10 & 13, 2010	Dec 22 & 24, 2010	Dec 31 2010 & Jan 7 2011	Jan 19 & 21, 2010		Jun 25, 2011	June 25 & 29, 2011	July 16 & 23, 2011	July 13 & 21, 2012	October 10 & 12, 2013
The Daily Press (french)	Aug 21 & 25, 2010	Nov 10 & 13, 2010	Dec 22 & 24, 2010	Dec 31 2010 & Jan 7 2011	Jan 19 & 21, 2010		Jun 25, 2011	June 25 & 29, 2011	July 16 & 23, 2011	July 13 & 21, 2012	October 10 & 12, 2013
Chapleau Express (english)						February 5, 2011		June 25 & July 2, 2011	July 13 & 16, 2011	July 21, 2012	October 12, 2013
Chapleau Express (french)						February 5, 2011		June 25 & July 2, 2011	July 14 & 16, 2011	July 21, 2012	October 12, 2013

17.2.4 Meetings

Direct and/or teleconference meetings with various stakeholders, such as municipalities and public interest groups, were a component of the consultation initiative intended to assist in the identification and resolution of environmental concerns. A summary of these events is presented in Sections 17.2.5, and 17.3.

Meetings were specifically held with identified Aboriginal communities as part of the aboriginal consultation initiative. As part of these meetings, consideration of the concerns of Aboriginal communities located in the vicinity of, and/or having a potential interest in the Project was afforded. To help facilitate these activities, Xeneca assisted interested Aboriginal communities in accessing government programs and funding. A summary of Aboriginal Engagement for the proposed Ivanhoe River projects is presented in Section 17.4 of this report.

The EA team engaged federal, provincial and municipal agencies during an EA Coordination meeting on April 19th, 2011 to introduce the projects and collect feedback for regulatory approvals, permitting and requirements and Project scoping.

17.2.5 Public Information Centres (PICs)

In addition to direct correspondence, Public Information Centres (PICs) were held in order to inform the public on Project details and studies, and to gather feedback on the proposed undertakings. The dates and times for the Public Information Centres were advertised in local publications (see Table 46 for details), and notification was sent either by electronic mail or direct mail to participating members of stakeholder groups and government agencies well in advance of the scheduled date. Members of Xeneca staff as well as other key experts from the EA team were on hand to answer public questions and to address concerns related to the development. The PICs featured posters and maps with information about the Project, copies of which are provided in Appendix L. Attendees of the meeting were asked to provide their name and contact information, to identify whether they wished to be provided with Project updates, and to provide feedback on the Project. A summary of these events is presented in Section 17.3.4.

17.3 Public Consultation

Public Consultation under the OWA Class EA for Waterpower Projects includes four required elements:

1. Notice of Project Commencement
2. Notice of Inspection (only for projects on rivers designated as unmanaged)
3. Notice of Completion
4. Statement of Completion

In addition to these required notifications, the proponent undertook several additional consultation efforts, including direct communications, advertising, Public Information Centres (PICs) and focus group meetings where requested by industry or community groups. The following section describes in detail all of the consultation efforts taken with the public over the course of the Ivanhoe Class EA.

Over the course of the EA, two options were presented to the public as potential locations for the Third Falls GS structure. One was located inside the boundary of the Northern Claybelt Forest Complex Conservation Reserve, and the other was outside the reserve. In order for the option inside the conservation area to be considered, an amendment that de-regulates the land being used for the Project was required from the MNR. As the amendment was not approved; therefore, only the option outside the reserve is now being considered, and this is the only option included in this EA report.

17.3.1 Public Consultation Strategy

Xeneca is committed to taking all reasonable action to ensure positive and productive relationships with the neighbours of its waterpower projects. A public consultation process document was created and is included in Appendix L of this report, in order to help facilitate responsive and timely public consultation.

During the Class EA process, Xeneca became aware that members of the local community were boycotting the Xeneca Public Information Centres and Public Information Meeting. In order to help resolve community issues, Xeneca offered to meet directly with any local community members at their request, at a time and location of their choosing. These offers were not accepted. Please see the Consultation Log in Appendix L for details of offers made and responses.

17.3.2 Public Consultation Participating Stakeholders

The list of public stakeholders began with a desktop review of sources detailing local environmental groups, businesses and business associations, residents, agencies and clubs. As the Class EA progressed and more organizations or individuals came forward to participate, they were added to the stakeholder list and included in future distributions of printed or electronic materials, as desired.

Participating Stakeholders included:

- Air Ivanhoe
- Borden Lake Campers Association
- Chapleau Anglers Hunters Club
- Chapleau Arctic Watershed Snowmobile Club
- Chapleau ATV Club
- Chapleau Centennial Museum

- Chapleau Fur Council
- Chapleau Tourist Association
- D'Amour Contracting Limited
- Do Little Inn
- Gosenda Lodge
- Ivanhoe Lake Cottager's Association
- Kinniwabi Long Rifles Club
- Northern Wilderness Cottages
- Ontario Rivers Alliance
- Red Pine Lodge
- Timmins Chamber of Commerce
- Utor Gold Construction
- Whitepine Lodge
- Individual local residents and community members

17.3.3 Public Notifications

17.3.3.1 Notices of Commencement

A Notice of Commencement (NOC) and three subsequent revisions to the Notice were issued by Xeneca. The NOCs were advertised in the Daily Press, with the exception of the last revision, which was published in the Chapleau Express (see Table 46, above). The first NOC was issued on July 28, 2010. The NOC was revised and re-issued on November 10, 2010, on December 22, 2010, and again on February 5, 2011. All notices identified both The Chute and Third Falls facilities.

17.3.3.2 Notice of Public Information Centre—December 31, 2010 & January 7, 2011

The January 13, 2011 PIC was advertised in the Daily Press on December 31, 2010 and January 7, 2011 in both French and English. A copy is included in Appendix L of this report.

17.3.3.3 Notice of Public Information Centre—January 19 & 21, 2011

The January 27, 2011 PIC was advertised in the Daily Press on January 19 and 21, 2011 in both French and English. A copy is included in Appendix L of this report.

17.3.3.4 Notice of Public Information Meeting—June 25, 2011

A presentation was given on July 6, 2011, at the Foleyet Community Centre. This was hosted by the Foleyet Local Services Board (FLSB) and both the ILCA and local business community were invited. The

July 6, 2011 PIM was advertised in the Daily Press on June 25th, in both French and English. It was also distributed by the Foleyet Local Services Board (FLSB). A copy is included in Appendix L of this report.

17.3.3.5 Notice of Public Information Centre—June 25, 29 & July 2, 2011

The July 7, 2011 PIC was advertised in the Chapleau Express on June 25th and July 2nd, and in the Timmins Daily Press on June 25th and 29th, in both French and English. A copy is included in Appendix L of this report.

17.3.3.6 Notice of Completion (The Chute GS)—July 14, 16 & 23, 2011

A Notice of Completion for The Chute GS as an independent project was circulated in July 2011. It was published in The Daily Press on July 16 & 23, 2011, and in the Chapleau Express on July 14 & 16, 2011, in both French and English. Copies are attached in Appendix L.

In September of 2011, seven Part II Order requests were submitted to Xeneca and the Ministry of the Environment. Following consultation with the Ministry, Xeneca agreed to withdraw the Notice of Completion and The Chute GS Environmental Report, and that The Chute and Third Falls would be combined into one Class EA and Report.

17.3.3.7 Notice of Public Information Centre—July 13 & 21, 2012

The July 26, 2012 PIC was advertised in the The Daily Press on July 13 & 21, 2012, and in the Chapleau Express on July 21, 2012, in both French and English. A copy is included in Appendix L of this report.

17.3.3.8 Notice of Public Information Centre—October 10 & 12, 2013

The October 16, 2013 PIC was advertised in The Daily Press on October 10 and 12, 2013, and in the Chapleau Express on October 12, 2013, in both French and English. A copy is included in Appendix L of this report.

17.3.3.9 Notice of Completion—April 5 & 7, 2014

The final Notice of Commencement for this Report will be published in the Chapleau Express on April 5, 2014, and in the Daily Press on April 7, 2014, in both French and English. A copy of these publications will be available on request following the publication dates.

17.3.4 Public Information Centres and Focus Group Meetings

Five Public Information Centres (PICs) and one Public Information Meeting (PIM) were held between 2011 and 2013 in Foleyet and Chapleau. Focus group meetings were also held with any local group expressing interest in exploring the Project with the proponent in more depth. All of these meetings are described in detail below.

The MNR recommended a PIC also be held in the city of Timmins, where several users of the Ivanhoe River reside. However, Xeneca determined that public interest was concentrated primarily in Foleyet, with very little interest among Timmins residents (3-4 individuals). Xeneca offered to meet directly with members of the interest group in Timmins, but the meeting was declined. The dates and locations of the meetings are described below and in Table 47.

During the Class EA process, Xeneca became aware that members of the local community were boycotting the Xeneca Public Information Centres and Public Information Meetings. In order to help resolve community issues, Xeneca offered to meet directly with any local community members at their request, at a time and location of their choosing. These offers were not accepted. Please see the Consultation Log in Appendix L for details of offers made and responses.

To ensure PICs and the PIM were as close to the Project Area as possible, venues in Chapleau and Foleyet were selected. As both communities are relatively small, a small number of venues are available; however, in each town, there is a public Facility suitable for hosting public meetings. The final selection of venue for a particular meeting depended on the availability of each at a particular date and time. Where stakeholder groups indicated that this distance was too great to travel, private meetings the day before/after the PIC were offered.

Table 47: Public Information Centres/Meetings for The Proposed Ivanhoe River Project

Meeting type [1]	Date	Subject of Meeting	Location
PIC	January 13, 2011	The Chute and Third Falls	Foleyet Community Hall, Foleyet
PIC	January 27, 2011	Third Falls	Foleyet Community Hall, Foleyet
PIM	July 6, 2011	The Chute	Foleyet Community Hall, Foleyet
PIC	July 7, 2011	The Chute	Royal Canadian Legion, Chapleau
PIC	July 26, 2012	The Chute and Third Falls	Foleyet Community Hall, Foleyet
PIC	October 16, 2013	The Chute and Third Falls	Royal Canadian Legion, Chapleau

[1] PIC: Public Information Centre; PIM: Public Information Meeting

17.3.4.1 Focus Group Meeting (Air Ivanhoe)--November 2, 2010

Xeneca met with Air Ivanhoe, a local remote tourism outfitter. Gosenda Lodge and Red Pine Lodge (also operating as outfitters) were invited, but were unable to attend. Xeneca presented draft versions

of the information panels to be finalized for public information centres (PICs) in Foleyet in January 2011 (Appendix L). Xeneca outlined its corporate profile, the Waterpower Class EA process, and presented conceptual project designs and development timelines. The outfitter was primarily concerned with the proponent's other proposed projects. The issue of the proposed connection lines intersecting forestry land was also raised by Air Ivanhoe. The proponent confirmed that discussions were underway with SFL holders. The meeting notes can be found in Appendix L.

17.3.4.2 PIC (The Chute and Third Falls) – January 13, 2011

The first public information centre (PIC) for The Chute GS and Third Falls GS was held at the Foleyet Community Hall, Foleyet, Ontario on January 13, 2011. A notice of PIC was advertised on the Daily Express on December 31, 2010. A total of 45 people signed in to the PIC. Representatives from Xeneca and the EA team members attended the meeting to provide information and answer questions.

The PIC was designed to:

- Introduce the Ivanhoe River Project & facilities
- Share preliminary design concepts
- Provide an understanding of the Environmental Assessment and Approvals Process
- Provide an opportunity to discuss the Project with Xeneca representatives

A poster display was set up to inform the public about the proponent and the proposed facilities. Posters included:

- The Chute GS Concept, Inundation Area, Access and Power Lines
- Third Falls GS Concept, Inundation Area, Access and Power Lines
- Project Benefits
- Environmental and Engineering Investigations

Hand-out materials, including comment forms, were available to those in attendance. An overview of the information provided and collected at each PIC event is attached in Appendix L.

15 comment forms were completed during and following the PIC (refer to Appendix L). A summary of the responses to the questions asked in the comment forms is provided in Table 48.

Table 48: Summary of Responses to Comment Forms (January 13, 2011 PIC)

Question	Response			Total
	Yes	No	Not Specified	

1 What is your interest in this project?	-	-	-	-
• Affected Landowner	9	0	0	9
• Interested Community Member	11	0	0	11
• Interest Group Member	4	0	0	4
• Government Representative	0	0	0	0
• Aboriginal Community Member	0	0	0	0
• Other (please specify) *	2	0	0	2

Question	Response			Total
	Yes	No	Not Specified	
2 Please specify how you heard about this Public Information Centre:	-	-	-	-
• Newspaper Ad	6	0	0	6
• Xeneca Website	0	0	0	0
• Other Media	0	0	0	0
• Other (please specify)	9	0	0	9
3 Did you find the information display panels and maps helpful in explaining the project?	8	5	2	15
4 Were Xeneca staff members able to adequately answer your questions?	6	5	4	15

* specifics can be found in Appendix L

Issues raised through discussions at the PIC and on submitted comment forms are summarized in Table 49.

Table 49: Issues Raised by Community and Responses (January 13, 2011 PIC)

Issue	Response on Record*
Concern regarding the access to The Chute site for fishing	With respect to site access and use, Xeneca has committed to tourism operators and recreational users to: • Make road improvements thereby improving access to the site • Improve the existing boat launch at The Chute Create a parking/rest area • Create a portage route around both The Chute and Third Fall sites • Ensure that access to the recreational angling, canoeing and other activities is not fenced off or otherwise lost. • Only where public safety is at issue (i.e. high voltage equipment, water intakes, etc.) will fencing or access restricting devices (i.e. safety booms) be put in place.
Concern regarding disturbance to	Xeneca has demonstrated that walleye spawning/rearing habitat will be

Issue	Response on Record*
fish habitats and spawning areas, including a spawning bed for Walleye at The Chute	maintained below The Chute. They have identified that, at the cross sections overlapping with known walleye spawning habitat, the velocities remain within the range for walleye spawning. The area below The Chute is also the proposed location for habitat offsetting measures. The newly constructed habitat, as well as the existing habitats expected to continue functioning, will be monitored extensively for depths and velocities (to ensure they are suitable for walleye spawning) and for habitat use. More details on proposed monitoring can be found in the Conceptual Fish Habitat Offsetting Plan and the Proposed Monitoring Plan appended to the ER. Xeneca has committed to maintaining these habitats and will ensure adequate depths and velocities are provided.
Concern regarding changes to the aesthetics of the river	As a result of public concerns relating to alteration of the aesthetic values in the area, artist's renderings (included in Appendix L; September 2013 PIC) of the Facilities post-construction were commissioned and shared with the attendees at the October 16, 2013 Public Information Centre. Xeneca has undertaken extensive planning and consultation with the local community in order to plan a project that is minimally visually intrusive and retains as many of the existing aesthetic features as possible. Renaturalization of cleared areas along roadways will be undertaken wherever possible, in consultation with the local MNR office to determine suitable species and take any fire safety concerns into account.
Concern regarding maintaining natural water levels	Xeneca undertook an options analysis to determine how much water level fluctuation could be reduced by managing turbine output. Five options were put forward to the MNR and had options reducing fluctuations to about 20 cm during a worst case scenario. An effects report for downstream of Third Fall is being prepared. Sturgeon studies to confluence with the Groundhog R. have been done. Reports will speak to change in benthic community and fast water features, VECs and risks of fish stranding. The proponent acknowledged there may be some subtle changes to the benthic community.
Concern regarding the low water level in a dry season	Extensive modelling and assessment was undertaken in consultation with the Ministry of Natural Resources and Ministry of Environment. Consensus was reached on minimum flows, water level fluctuations and commitments to maintain flows optimal to aquatic species during critical life stages such as spawning.
Concern regarding floods and flooding	A dam safety study for the proposed new dams would be completed by a competent engineering design firm, which would address the design in accordance with the known flow history for the site. This study will be completed during the permitting phase.
Concern regarding the alteration of water level in Ivanhoe Lake	There are no effects on Ivanhoe Lake as a result of The Chute or Third Fall projects as the lake is several kilometers upstream of the Zone of

Issue	Response on Record*
	Influence and is separated from the project sites by an MNR control dam. The dam at Ivanhoe Lake will not alter its operations to support the Ivanhoe Project, and the MNR is not selling the dam to Xeneca.
Concern regarding the impact to the existing bridge over the Ivanhoe River	Studies on the predicted impacts to the Oates Road and Nova Road bridges have been completed by a specialist engineering firm, and consultation with the bridge owners is underway to ensure no negative impacts to these structures.
Concern regarding the disturbance to wildlife due to more transportation activities on access roads	Impacts to wildlife from increases in traffic during both construction and operations are anticipated to be negligible. See Sections 11.3.2 and 12.3.2 for more information.

Issue	Response on Record*
Concern regarding the potential change of owner and related responsibilities	The commitments in the Class EA and related documents are binding on the project owner, regardless of who the project owner will be, and will form part of the approvals granted by the Ministries.
Concern regarding the power line route from The Third Falls to Montcalm Mine	Please see the "Lines and Roads" report in Appendix J
Concern regarding the construction contractor for the tree clearing in the inundation area and power line Right-of-Way	Consultation is underway with the license holder regarding any clearing of merchantable timber.
Concern regarding the employment benefits to Foleyet	According to research undertaken by the Ontario Waterpower Association, the construction of a hydro Facility of the size of the Ivanhoe Project can be anticipated to create about 65,000 person-hours of labour. A further one or two additional full-time positions will be created for the operation and maintenance of the facilities.
What is the proposed height of each dam on the Ivanhoe River?	Third Falls is proposed to be a rock and clay filled dam structure with a 10.5 m concrete overflow weir; it is also proposed that this structure has concrete footings. The Chute has the same design parameters, however is planned to have a 9.5 m concrete overflow weir structure.
What is the area of forest being removed from the *Pineland Forest Management Plan*?	The total area of forest to be removed cannot be fully determined at this point as final numbers will be dependent on detailed design. However, Xeneca has endeavoured to site Project components so as to minimize required clearing.

* Note these are the responses that are on record, some of these responses no longer apply to the Project or with new information and further studies are now out of date. Please refer to appropriate section of this Report or Appendices to find the most up to date information.

17.3.4.3 PIC (Third Falls) – January 27, 2011

This PIC focused on the Third Falls GS. A notice of PIC was advertised on the Daily Press on January 19 and 21, 2011. Approximately 23 people attended this meeting, including representatives of the MNR, OPP, White Pine Lodge, Chapleau Fur Council, and D'Amour Contracting Ltd. Representatives from Xeneca were on hand to answer questions. The PIC was designed to:

- Further introduce the Third Falls Facility
- Share preliminary design concepts
- Provide an understanding of the Environmental Assessment and Approvals Process
- Provide an opportunity to discuss the Project with Xeneca representatives

A poster display was set up to inform the public about the proponent and the proposed facilities. Posters included:

- Third Falls GS Concept, Inundation Area, Access and Power Lines
- Project Benefits
- Environmental and Engineering Investigations

Information provided to attendees at this PIC included:

- Ivanhoe River—Project Information for PIC

Five comment forms were completed during and following the PIC (refer to Appendix L). A summary of the responses to the questions asked in the comment forms is provided in Table 50.

Table 50: Summary of Responses to Comment Forms (January 27, 2011 PIC)

Question	Response			Total
	Yes	No	Not Specified	
1 What is your interest in this project?	-	-	-	-
• Affected Landowner	1	0	0	1
• Interested Community Member	3	0	0	3
• Interest Group Member	1	0	0	1
• Government Representative	0	0	0	0
• Aboriginal Community Member	0	0	0	0
• Other (please specify)	1	0	0	1
2 Please specify how you heard about this Public Information Centre:	-	-	-	-
• Newspaper Ad	3	0	0	3

• Xeneca Website • Other Media • Other (please specify)	0 0 2	0 0 0	0 0 0	0 0 2
3 Did you find the information display panels and maps helpful in explaining the project?	4	0	1	5
4 Were Xeneca staff members able to adequately answer your questions?	4	0	1	5

Issues raised on submitted comment forms and through discussions at the PIC are presented in Table 51.

Table 51 : Issues Raised by Community and Responses (January 27, 2011 PIC)

Issue	Response
Will the two projects –namely "The Chute & Third Falls", be evaluated simultaneously?	This Class EA evaluates the impacts of The Chute and Third Falls as one Ivanhoe project.
Concern regarding the goods and services to the construction contractors	A Procurement Policy will be put in place favouring local providers of goods and services.
Concern regarding the tree clearing opportunity generated by the project for the local logging company	Consultation is underway with the license holder regarding any clearing of merchantable timber.
Concern regarding the potential effect to aquatic fur animals and any compensation to the trappers due to the loss of aquatic fur animals	No impacts to the population of furbearing mammals are anticipated from the Ivanhoe Project. Separate consultations with trapline holders have been ongoing to ensure no impacts to trapping activities.
Concern regarding the effects to cold water fisheries, warm water fisheries and special fisheries	All impacts to fish habitats are detailed in Sections 11.4.1 and 12.4.1. Water temperature is expected to remain constant over project construction and operations, with no impacts to existing cold-water systems from the Ivanhoe Project.
Concern regarding the public access to the river	Xeneca indicated that they were committed to maintaining river access except as required for public and worker health and safety (i.e.; fencing for security and in hazardous areas).

Sign-in sheets and comment cards are included in Appendix L of this report.

In order to address some of the concerns raised during the public consultation process to date, Xeneca scheduled additional public consultation events with local stakeholders, including a meeting with the Ivanhoe Lake Cottagers Association Executive on Wednesday, July 6, 2011 in Foleyet and a PIC in Chapleau on July 7, 2011 (see additional details below).

17.3.4.4 Public Information Meeting (The Chute) – July 6, 2011

The July 6, 2011 Public Information Meeting (PIM) was scheduled from 4 to 6 p.m. at the Foleyet Community Centre, Foleyet, Ontario. The meeting location, date and time was also posted at the Community Centre and distributed by the Local Service Board to community members. The meeting was designed to:

- Introduce elements of the Draft Environmental Assessment Report
- Provide responses and updates to the comments and questions previously received
- Provide an understanding of the next stages of the Class EA process and the next steps towards approvals and permitting
- Provide an opportunity to further discuss the Project with Xeneca representatives

This meeting focused on the proposed The Chute GS; there were a total of 21 people in attendance representing community interests from Timmins, Ivanhoe Lake Cottagers' Association, Foleyet, a local tourism outfitter and lodge owner. The proponent gave a PowerPoint presentation describing the proposed Project, the studies conducted and the EA process (Appendix L).

Four comment forms were completed during the PIC (refer to Appendix L). A summary of the responses to the questions asked in the comment forms is provided in Table 52.

Table 52: Summary of Responses to Comment Forms (July 6, 2011 PIC)

Question	Response			Total
	Yes	No	Not Specified	
1 What is your interest in this project?				
Affected Landowner	1	0	0	1
Interested Community Member	0	0	0	0
Interest Group Member	2	0	0	2
Government Representative	0	0	0	0
Aboriginal Community Member	1	0	0	1
Other (please specify)	1	0	1	2
2 Please specify how you heard about this Public Information Centre:				
Newspaper Ad	0	0	0	0
Xeneca Website	1	0	0	1
Other Media	1	0	0	1
Other (please specify)	1	0	1	2

Question	Response			Total
	Yes	No	Not Specified	
3 Did you find the information display panels and maps helpful in explaining the project?	2	0	2	4
4 Were Xeneca staff members able to adequately answer your questions?	2	1	1	4
5 Have you previously submitted questions/comments been adequately addressed in the revised project proposal presented today? (If no-please specify your issue on the back of the form and submit it to Xeneca staff)	0	3	1	4

Issues raised through discussions at the PIC and on submitted comment forms are presented in Table 53.

Table 53: Issues Raised by Community and Responses (July 6, 2011 PIC)

Issue	Response
Concern regarding the potential effect to camping in Foleyet	No significant negative impact to camping is anticipated as a result of the Ivanhoe project. Please see Sections 11.6.10 and 12.6.10.
Concern regarding the potential effect to fishing in Groundhog River	No impacts are anticipated to fishing in the Groundhog River, due to its distance from the Ivanhoe project site.
Concern regarding Xeneca's budget for the restoration of the river for the future decommissioning	Decommissioning is not part of the Project. FIT contracts are 40 years in duration. Waterpower facilities have a lifespan of 80+ years and can be retro-fitted to last decades longer.
Concern regarding fish spawning at The Chute	The proponent explained that extensive biological studies of the area have been undertaken and are ongoing. Spawning sites have been identified as well as year-round habitat. The proponent commits to maintaining ecological flows in the river at all times. During spawning seasons, water levels will be maintained at seasonal averages. It was further explained that the proponent aims to avoid impacts to spawning areas and that possible enhancements to spawning sites will be explored in consultation with the MNR.
Concern regarding changes to the river aesthetics	Artists' renderings of the two facilities have been completed and shared with the public. They are

Issue	Response
	reproduced in Section x. Overall, the aesthetic impact of the Project is anticipated to be minimal. Please see Sections 11.6.6 and 12.6.6 for a discussion of the predicted impacts to views and aesthetics from the Ivanhoe project.
Concern regarding fishing in the river	Xeneca intends to maintain and possibly enhance public access to fishing at The Chute site, although some fencing may be put in place to ensure public safety. There will be improvements to road access and boat launching in addition to the creation of parking and rest areas.
Concern regarding low water levels	Extensive modelling and assessment was undertaken in consultation with the Ministry of Natural Resources and Ministry of Environment. Consensus was reached on minimum flows, water level fluctuations and commitments to maintain flows optimal to aquatic species during critical life stages such as spawning.

Comments from Verbal Discussions	
Environmental concerns over the spawning areas and fish habitat in proximity to the Project (i.e. residual water flows, water level fluctuations):	The proponent explained that extensive biological studies of the area have been undertaken and are ongoing. Spawning sites have been identified as well as year-round habitat. The proponent commits to maintaining ecological flows in the river at all times. During spawning seasons, water levels will be maintained at seasonal averages. It was further explained that the proponent aims to avoid impacts to spawning areas and that possible enhancements to spawning sites will be explored in consultation with the MNR.
Access to fishing areas in proximity to the Project.	The proponent responded that it intends to maintain and possibly enhance public access to fishing at The Chute site, although some fencing may be put in place to ensure public safety. There will be improvements to road access and boat launching in addition to the creation of parking and rest areas.
Impact on Ivanhoe Lake levels	The proponent explained that the Ivanhoe Lake Dam is owned and operated by the MNR whose primary objective is to maintain Ivanhoe Lake levels. The proponent will not require or request water to be released from Ivanhoe Lake for its operations. The dam at Ivanhoe Lake will not alter its operations to support the Ivanhoe Project, and the MNR is not selling the dam to Xeneca.
Impact on Foleyet water treatment facilities	The proponent noted that the Zone of Influence (ZOI) of The Chute Facility and its inundation area is over 7 km downstream from Foleyet and, as a result, there will be no impacts to water treatment facilities.
Decommissioning plans should the Facility permanently cease operations	The proponent explained that there are no plans to decommission the Project. FIT contracts are 40 years in duration. Waterpower facilities have a lifespan of 80+ years and can be retro-fitted to last decades longer. However, should decommissioning be identified as necessary, a reserve will be established to accumulate funds to a level required to meet the decommissioning standards of the day

17.3.4.5 Focus Group (Ivanhoe Lake Cottager's Association)—July 6, 2011

At the July 6, 2011 meeting, Xeneca presented an overview of the most recent Project design, operating plans, and findings from environmental studies. The meeting focused on the proposed The Chute GS (located closer to Ivanhoe Lake than the proposed Third Falls GS).

The major concerns expressed by the Association and the responses at the meeting were summarized in Table 54.

Table 54: Issues Raised by Ivanhoe Lake Cottager's Association and Responses (July 6, 2011 PIC)

Issue	Response
Potential impacts on water levels at Ivanhoe Lake	Xeneca explained that the Ivanhoe Lake Dam is owned and operated by the MNR, and that Xeneca will not require or request that the MNR modify operations at the Ivanhoe Lake Dam to benefit electricity production at the proposed Chute and Third Falls facilities. The dam at Ivanhoe Lake will not alter its operations to support the Ivanhoe Project, and the MNR is not selling the dam to Xeneca.
Plans for decommissioning	There are no plans to decommission the proposed The Chute GS due to the anticipated long life span of the Facility.
Potential impacts on fish habitat and spawning	The biological studies conducted to date, as well as the mitigation strategies for minimizing impacts to fish and their habitat, were explained.
Access to fishing areas	The proponent responded that it intends to maintain and possibly enhance public access to fishing at The Chute site, although some fencing may be put in place to ensure public safety. There will be improvements to road access and boat launching in addition to the creation of parking and rest areas.
General inquiries about the EA process	The EA process and Notice of Completion review period were also explained to the meeting attendees.

17.3.4.6 PIC (The Chute) – July 7, 2011

The July 7, 2011 PIC in Chapleau was scheduled from 4 to 6 p.m. at the Chapleau Branch of the Royal Canadian Legion.

Two members of the public attended the PIC.

A number of poster panels were presented, copies of which are presented in Appendix L, including:

- The Chute GS Concept
- The Chute physical footprint
- The Chute proposed access and powerlines
- The Chute inundation
- Kapuskasing Ivanhoe proposed access and powerlines

- Project Benefits
- Environmental and Engineering investigations
- Biology Study Area
- Aquatic Survey Locations
- Results of Fish Studies
- Terrestrial Biology Results
- 2010 Biology Summary
- Proposed 2011 Biology Work
- Class EA Requirements and Next Steps

The MNR also attended this PIC. Discussions were held regarding connection lines and connection points; the proponent committed to providing copies of lines and roads maps by July 11, 2011. A summary of the discussions that were held during this PIC is provided in the meeting notes in Appendix L of this report.

No comment forms were filled and provided by the attendees during and following the PIC.

Issues raised through discussions at the PIC are presented in Table 55.

Table 55: Issues Raised by Community and Responses (July 7, 2011 PIC)

Issue	Response
Effects of low flows and turbine design on the river and the drying out of the opposite channel	Extensive modelling and assessment was undertaken in consultation with the Ministry of Natural Resources and Ministry of Environment. Consensus was reached on minimum flows, water level fluctuations and commitments to maintain flows optimal to aquatic species during critical life stages such as spawning.
Changes in water levels at Ivanhoe Lake as a result of operational changes at the Ivanhoe Lake Dam upstream in support of the proposed Project.	The proponent confirmed that the Ivanhoe Lake Dam is operated by the MNR and that no water would be released by MNR to accommodate the proposed power Facility. Any restrictions and environmental flows agreed upon in the ER for the proposed Facility would be part of the operational requirements for The Chute site. The dam at Ivanhoe Lake will not alter its operations to support the Ivanhoe Project, and the MNR is not selling the dam to Xeneca.
Conceptual drawings were requested showing the location of promised boat ramps and docks.	The proponent stated that this would be provided during the development process.

Issue	Response
Effects of sedimentation on upstream spawning sites.	It was noted that a sedimentation study was not completed. The EA team (biologist) further explained that large scale sedimentation usually only occurred at large dams and that this was a relatively small structure.
Clarification was requested in relation to the EA process and future studies proposed before and after submission of the ER document.	This Final ER represents the last stage of the Class EA process. Comments can be made to the proponent and to the MOE following the Notice of Completion; the proponent will work to address all comments receiving during the review period. Following approval of the EA and construction of the facilities, the post-construction monitoring work will be undertaken, including monitoring of impacts to methyl mercury levels and other issues of concern. Please see the Post-Construction Monitoring Plan in Section 7.
Concerns were raised about dam safety and design as the Ivanhoe Lake Dam has experienced breaches on more than one occasion.	The proponent advised that a dam safety study for the proposed new dams would be completed by a competent engineering design firm, which would address the design in accordance with the known flow history for the site. This study will be completed during the permitting phase.

17.3.4.7 Focus Group Meeting (Mattagami WMP)—November 22, 2011

The proponent attended a meeting of the Mattagami Water Management Planning Committee, where Xeneca committed to providing Project information to the Standing Advisory Committee (SAC).

17.3.4.8 PIC (The Chute and Third Falls) – July 26, 2012

On July 26, 2012, Xeneca held a PIC at the Foleyet Community Hall for both proposed Ivanhoe River facilities. The PIC was advertised in the Daily Press 5 and 13 days in advance of the event. Approximately 26 people attended, including representatives from the MNR, MOE, Michipicoten First Nation, EACOM, Nitah Aboriginal Enterprises, and a local outfitter. The PIC was designed to:

- Introduce the combined Ivanhoe Project
- Present preliminary design concepts
- Provide an understanding of the environmental assessment and approvals process
- Provide an opportunity to discuss the Project with Xeneca representatives

Poster panels were presented at the PIC on topics including:

- Information on Xeneca and the Project Team
- How Hydroelectric Power Works
- Benefits of Water Power
- Class EA Process
- Aboriginal Relations
- Next Steps
- The Chute GS Concept, Inundation, Access and Power Lines
- Third Falls Concept, Inundation, Access and Power Lines
- Project Benefits
- Environmental and Engineering Investigations

Six comment forms were completed during the PIC (refer to Appendix L). A summary of the responses to the questions asked in the comment forms is provided in Table 56.

Table 56: Summary of Responses to Comment Forms (July 26, 2012 PIC)

Question	Response			Total
	Yes	No	Not Specified	
1 What is your interest in this project?				
Affected Landowner	2	0	0	2
Interested Community Member	1	0	0	1
Interest Group Member	1	0	0	1
Government Representative	0	0	0	0
Aboriginal Community Member	2	0	0	2
Other (please specify)	2	0	0	2
2 Please specify how you heard about this Public Information Centre:				
Newspaper Ad	4	0	0	4
Xeneca Website	0	0	0	0
Other Media	0	0	0	0
Other (please specify)	3	0	0	3
3 Did you find the information display panels and maps helpful in explaining the project?	5	1	0	6
4 Were Xeneca staff members able to adequately answer your questions?	4	1	1	6

Issues raised through discussions at the PIC and on submitted comment forms are presented in Table 57.

Table 57: Issues Raised by Community and Responses (July 26, 2012 PIC)

Issue	Response
Concern regarding the road maintenance and management for the existing Oates and Laundry Roads with EACOM Timber	Consultation with EACOM is underway.
Concern regarding the water flow effect to the existing bridge on the Oates Road over the Ivanhoe River	Studies on the predicted impacts to the Oates Road and Nova Road bridges have been completed by a specialist engineering firm, and consultation with the bridge owners is underway to ensure no negative impacts to these structures.
Concern regarding gravel sources	All aggregate will be sourced from permitted aggregate facilities near to the Project Area.
Concern regarding the tree clearing in the inundation area by a license holder	The proponent explained that it was Xeneca's policy to give some preference to local contractors and service providers during construction.
Concern regarding benefits to the local employment, including the tree clearing in the inundation area by the local license holder	According to research undertaken by the Ontario Waterpower Association, the construction of a hydro Facility of the size of the Ivanhoe Project can be anticipated to create about 65,000 person-hours of labour. A further one or two additional full-time positions will be created for the operation and maintenance of the facilities.
Concern regarding the public access to the new access road	The proponent explained that the public access to the site except in areas where safety requirements preclude public use (i.e. water intake channels and powerhouse).
Concern regarding the public access to trapping and fishing	Xeneca made commitments to ensure flows required for spawning downstream of the facilities, to upgrade roads and access to the fishing site, and construction of a better boat launch and parking areas.

17.3.4.9 PIC (The Chute and Third Falls)—October 16, 2013

A fourth public information centre (PIC) for The Chute GS and Third Falls GS was held in Chapleau, Ontario on October 16, 2013. A notice of PIC was advertised on Chapleau Express on October 12, 2013. A total of 7 people signed in to the PIC. Representatives from Xeneca were on hand to provide information and answer questions.

The PIC was designed to:

- Provide up-to-date information on the Class Environmental Assessment (Class EA) process
- Provide an opportunity to learn more about the Water Management Planning (WMP) process
- Provide results from new field studies and consultation efforts
- Provide an opportunity to ask questions and/or identify any additional concerns related to the Project development

A poster display was set up to inform the public about the proponent and the proposed facilities. Posters included:

- Company and Project Team
- Project Benefits
- Water Management Planning Process at Ivanhoe
- Zone of Influence
- Project Updates
- Project Construction Monitoring
- Changes to the River and Operational Effects
- Operational Effects
- Access and Power Line
- Conceptual Design
- 2010 -2013 Biology Summary

One comment form was completed during the PIC (refer to Appendix L). A summary of the responses to the questions asked in the comment form is provided in Table 58.

Table 58: Summary of Responses to Comment Forms (October 16, 2013 PIC)

Question	Response			Total
	Yes	No	Not Specified	
1 What is your interest in this project?				
Affected Landowner	1	0	0	1
Interested Community Member	1	0	0	1
Interest Group Member	1	0	0	1
Government Representative	0	0	0	0
Aboriginal Community Member	0	0	0	0
Other (please specify)	0	0	0	0

Question	Response			Total
	Yes	No	Not Specified	
2 Please specify how you heard about this Public Information Centre:				
Newspaper Ad	1	0	0	1
Xeneca Website	0	0	0	0
Other Media	0	0	0	0
Other (please specify)	0	0	0	0
3 Did you find the information display panels and maps helpful in explaining the project?	1	0	0	1
4 Were Xeneca staff members able to adequately answer your questions?	1	0	0	1

No concerns were raised in the comment form.

17.3.4.10 Public Correspondence

Throughout the EA planning and public consultation process, Xeneca has been contacted by various public interest groups and individual members of the public regarding the proposed development. For general inquiries (e.g. project location, general impacts), the public contacts were referred to the company website (www.xeneca.com) for available Project information. Specific and/or extensive lists of concerns were sometimes sent to Xeneca from public interest groups. Records of these communications are included in Appendix L of this report.

17.3.5 Consultation with Industry Groups

17.3.5.1 EACOM

The proponent and its consultants has consulted extensively with EACOM throughout the Class EA on the design of access roads and connection lines for The Chute Facility site, concerns over impacts to the Oates Bridge, road sharing agreements, and handling of any merchantable timber resulting from Project construction activities such as clearing for road allowances.

EACOM states that any work to complete required improvements to the existing Oates bridge over Ivanhoe River should be borne by the proponent, and that timber harvesting in the zone of inundation should be conducted by the license holder. It was suggested that the connection line follow existing roads and that ROW width be increased, that timber removal should be conducted by a local contractor and merchantable wood be sold to EACOM. Detailed maps and aerial photos were requested along with a plan for long term road maintenance. Further consultation with EACOM on March 9th, 2011 indicated that existing Pineland Forest roads and bridges could provide access to the

site but a roads sharing agreement is required. The proponent commits to developing this agreement with EACOM and to working with traditional forest license holders in the area for the removal and utilization of merchantable wood from Crown land.

17.3.5.2 Niska North

The proponent is undertook consultations with Niska North regarding any required removals of mature white cedar trees due to the Ivanhoe Project. However, it has recently come to light that Niska North is not currently operating. Therefore, EACOM is the relevant SFL holder, and any mature white cedar trees removed will be dealt with through EACOM. Xeneca commits to taking all reasonable measures to prevent the removal of mature white cedar trees within the Project Area, in consultation with EACOM and interested First Nation communities. Please see Appendix L for the full correspondence with Niska North on this issue.

17.3.5.3 Tembec

The proponent and its consultants has consulted extensively with Tembec throughout the Class EA on the design of access roads and connection lines for the Third Falls Facility site, concerns over impacts to the Nova Bridge, road sharing agreements, and handling of any merchantable timber resulting from Project construction activities such as clearing for road allowances.

Xeneca stated their willingness to raise the bridge if required by final design and predicted impacts under the 1:100 year storm condition, and also offered to provide an indemnity such that any costs resulting from damage to the Nova bridge that would not have occurred but for the Ivanhoe Project would be borne by the proponent. Tembec was satisfied by this offer. Negotiation is continuing on legal language.

17.4 Aboriginal Consultation

Developing positive relationships with affected Aboriginal communities is a high priority for the Xeneca team. An Aboriginal Consultation Plan was developed early in the process, using the following documents as a guide:

- the Ontario Waterpower Association Class EA process and best practices adopted from the Ontario Power Authority (OPA) *Consulting with First Nations and Métis Communities: Best Practices, Good Business* (Ontario Power Authority, July 2008) document; and
- The Government of Canada's Aboriginal Consultation and Accommodation: Updated Guidelines for Federal Officials to Fulfill the Duty to Consult Guide (AAND 2011).

These Plans were shared in draft format with the Aboriginal groups consulted with for the Ivanhoe Project, and their feedback incorporated into the final version, attached in Appendix M.

Xeneca has created an Aboriginal Relations Liaison position within Xeneca to manage Aboriginal Relations Policy and Guiding Principles, and ensure that the consultation requirements of the Class EA are satisfied.

To support the Crown's Duty to Consult, Xeneca:

- Provided Project information to potentially affected communities and responded to questions, concerns and input in a timely manner;
- Through the environmental assessment planning process, provided all available information and accepted from Aboriginal communities all information they wish to share regarding existing and traditional use for those resources and environmental components that might be impacted by the Project;
- Ensured that any traditional knowledge shared by a Community is presented in an agreed-upon manner to ensure that it remains the property of the Community;
- Afforded consideration to any potential adverse impacts to treaty rights in the Class EA planning process;
- Clearly outlined the EA consultation and engagement process, and potential Project related issues to the Communities;
- Maintained records of correspondence and engagement;
- Reflected on input questions and responses in the EA Report and subsequent processes accurately, respectfully and in a timely manner;
- Sought to have Aboriginal Communities obtain benefits from the projects where reasonably possible;
- Respected an Aboriginal Community's right not to engage; and
- Provided the Crown with requested information concerning the proponent's Aboriginal consultation and engagement activities.

Xeneca committed to carrying out engagement with identified Aboriginal Communities & Métis Chapters through written correspondence and direct telephone communications, including follow-up on numerous occasions if communities were non-responsive. Upon appropriate direct contact, Xeneca sought meetings with community leaders or designated lead person(s) in order to introduce Xeneca and the Project. Upon receiving an invitation from the host Aboriginal Community, Xeneca conducted and sponsored community engagement sessions. Xeneca also provided, when requested, access to its professional staff and consultants to answer technical questions. Finally, where a request was made, Xeneca provided necessary resources to support meaningful engagement including the retention of external consultants to peer review material presented to the communities.

By meeting these objectives and following the above-noted processes, Xeneca hopes to foster and sustain a mutually respectful relationship with its aboriginal neighbors beyond the requirement to provide consultation support to the Crown.

The following methods of communication and engagement were employed to seek input from the Aboriginal communities involved with the Ivanhoe Project:

- Providing Project information to potentially affected communities and being responsive to questions, concerns and formal engagement letters;
- Follow-up Email(s) and phone call(s);
- Formal invitations to participate in Public Information Centres (PICs)
- Offer to host information sessions in individual Communities;
- Extend invitations and offer financial assistance to participate in Stage II Archaeological field work program;
- Provide financial resources, technical staff and consultants to assist in the review of the Draft Environmental Report and supporting documents;
- In certain circumstances, Xeneca has supported community initiatives, such as Pow-Wow's when a request has been brought forward by the community; and
- Where Xeneca has received a protocol from the Aboriginal community that provides details on how the communities are to be consulted with, Xeneca has collaborated with the community to create a mutual understanding on a process to proceed.

It is anticipated that issues may continue to arise throughout the lifetime of the Project. Xeneca is committed to adaptive management and establishing protocols within each community for continuing consultation and negotiation for newly identified issues.

Consultation Requirements

The Class EA requires that aboriginal communities be consulted with regards to their rights within treaty and traditional lands and how they may be impacted by Project activities. This consultation and engagement is designed to help determine whether the Crown has a legal duty to consult under the Constitution Act of 1982, and is not intended to replace that duty. The Class EA requires that aboriginal engagement includes consultation as required for the general public, as well as recommending active engagement to determine if the Project activities will impact aboriginal uses and values within the area.

What follows below is a description of the major highlights of engagement and consultation as it relates to the Class EA. A full description of all consultation activities, copies of major correspondence and a log of all correspondence can be found in Appendix E.

Consultation through Site Release

The aboriginal consultation and engagement process began as a component of the Crown Land Site Release Process, and has included components of the Class EA planning process in parallel. An application was made for this site through the Crown Land Site Release process in 2007 for The Chute site and in 2008 for Third Falls. The engagement progress as required by the Site Release Process and the Consultation Process as required by the Class EA process, were connected and where possible completed in parallel. This parallel process was confirmed by the MNR as an acceptable approach in a letter dated May 17, 2011.

While Site Release and the consultation process required by the Class EA were connected and completed in parallel, a separate report updating the MNR on the status of the consultation process for the Site Release process will be completed separately.

Areas under Land Claim

The majority of the identified communities are signatories to the James Bay Treaty 9, except Michipicoten First Nation whom are signatories of the Robison Superior Treaty of 1850, and the Métis Nation of Ontario. The Project is located wholly within the area of Treaty 9.

There is presently a Comprehensive Land Claim Agreement in Principle on file between the Canadian Federal Government and the Nishnawbe Aski Nation which is the Grand Council of Treaty 9, and represents all those communities which are signatories to Treaty 9 (refer to Table 59). At this time a final agreement has not been negotiated.

The Project location is not located within the boundaries of any First Nation reserve lands, nor areas expressly stated as protected through Treaty 9. Communities may assert protections to activities and rights under this treaty which are not explicitly stated within the treaty text. Where those rights are asserted they have been documented as impacts. The Project area is assumed to be within the traditional territories and current usage areas of the aboriginal communities engaged and consulted throughout the Class EA process.

17.4.1 First Nations Stakeholder List

An initial list of likely affected First Nations was developed early in the process based on a review of existing electronic resources and atlases, to determine which had treaty and traditional rights in the vicinity of the Ivanhoe Project. Through the Crown Site Release Process, further communities were identified in a letter provided on May 17, 2011 (see Appendix M).

Further direction was provided by Transport Canada, with assistance from Fisheries and Oceans Canada, National Defence and Aboriginal Affairs and Northern Development Canada, to define communities which may have treaty rights, traditional territories or interests within the Project Area. By way of correspondence dated October 28, 2011, the federal regulating agencies mentioned communities which had already been identified through consultation with the MNR. A copy of this letter can be found in Appendix N.

Consulted communities include:

- Brunswick House First Nation (Wabun Tribal Council)
- Chapleau Cree First Nation
- Chapleau Ojibwe First Nation (Wabun Tribal Council)
- Flying Post First Nation (Wabun Tribal Council)
- Mattagami First Nation (Wabun Tribal Council)
- Métis Nation Ontario
- Michipicoten First Nation
- Timmins Métis Council
- Moose Cree First Nation
- Taykwa Tagamou First Nation

Information was also provided to:

- Constance Lake First Nation
- Missanabie Cree First Nation
- North Channel Métis Council
- Northern Lights Métis Council
- Sudbury Métis Council

Below is a table of each community identified and their organizational structure. Wabun Tribal Council has been engaged on behalf of its member communities, as has the Métis Nation of Ontario. Further information on the Wabun Tribal Council engagement can be found in Section 17.4.12, and the Métis Nation of Ontario in Section 17.4.7.

Table 59: Community Organization

Community/Community Council	Tribal Council/Region	Grand Council/ Nation
Brunswick House First Nation	Wabun Tribal Council	Nishnawbe Aski Nation
Chapleau Cree First Nation	Mushkegowuk Tribal Council	Nishnawbe Aski Nation
Chapleau Objiwe First Nation	Wabun Tribal Council	Nishnawbe Aski Nation
Flying Post First Nation	Wabun Tribal Council	Nishnawbe Aski Nation
Mattagami Frst Nation	Wabun Tribal Council	Nishnawbe Aski Nation
Michipicoten First Nation	None	Union of Ontario Indians
Moose Cree First Nation	Mushkegowuk Tribal Council	Nishnawbe Aski Nation
MNO Timmins Métis Council	Region 3	Métis Nation of Ontario
Taykwa Tagamou First Nation	Mushkegowuk Tribal Council	Nishnawbe Aski Nation

17.4.2 Brunswick House First Nation Consultation

17.4.2.1 Background

Brunswick House First Nation is a member of Wabun Tribal Council and a signatory to Treaty 9. They have traditionally engaged in hunting and gathering activities on their lands. The presently hold two reserves in the Sudbury area, Mountbatten 76A Indian Reserve and Duck Lake 76B Indian Reserve (Aboriginal Affairs and Northern Development Canada, 2008a).

Brunswick House First Nation has delegated the accommodation aspects to Wabun Tribal Council. Through Wabun Tribal Council, Brunswick House First Nation indicated that until acceptable economic accommodation has been arrived at with Xeneca, it would not acknowledge any consultation efforts. Xeneca continued to engage the community by providing updates and documents on an ongoing basis as required for the EA process, while negotiating towards a definitive legal agreement with Wabun Tribal Council. In the summer of 2013, the Letters of Intent and Term Sheets were signed by the Brunswick House First Nation and returned to the proponent, and discussions and meetings began, as described below.

17.4.2.2 Summary of Engagement

The Project proponent made frequent and regular contact in writing to the Brunswick House First Nation, as documented in Table 60, below. All outgoing correspondence can be found in Appendix M.

Table 60: Brunswick House First Nation Consultation

Date	Content
June 2010	Introductory letter: project commencement, Class EA and Site Release process, contact information
September 2010	Archaeological field work invitation
October 2010	Invitation for November 3, 2010 PIC
October 25, 2010	Notification of rescheduling of November PIC
December 20, 2010	Letter: Class EA update, Draft Project Description for The Chute and Third Falls
April 2011	Letter: update on Third Falls, Draft Project Description for Third Falls
May 13, 2011	Notices of Commencement (3), past communications, draft Aboriginal Consultation Plan, information on archaeological work
May 17, 2011	MNR letter re: Site Release Process notification
June 18, 2011	NOC and Environmental Report for The Chute Generating Station Project
June 29, 2011	Summary reports for Stage 1 archaeological work for Third Falls and The Chute; invitation to participate in Stage 2 field studies
August 2011	Revised Aboriginal Consultation Plan, update on Class EA status
March 1, 2012	Updated Project Description for The Chute
July 12, 2012	Invitation for July 26, 2012 PIC, and for local in-person meeting if desired
April 11, 2013	Copies of Stage 2 Archaeology reports for The Chute and Third Falls
May 15, 2013	Clarification of Letters of Intent and Term Agreements process
July 24, 2013	Draft Environmental Report for Ivanhoe Project
October 18, 2013	Invitation to attend field visit to investigate potential Culturally Modified Trees (CMTs)
	Invitation to attend an in-person meeting in November, 2013

In the summer of 2011, the community held an election, during which documents were often returned. The documents were re-sent to a new contact until a new Chief was elected.

17.4.2.3 Meeting—August 8, 2012

This meeting, held with a representative from Brunswick House, the Wabun Tribal Council, and Xeneca, began to explore the basis for partnerships and Aboriginal participation in the Ivanhoe Project.

17.4.2.4 Conference—September 16 & 17, 2013

Xeneca arranged a meeting for seven First Nations interested in various proposed Xeneca waterpower projects at the Mnjikaning Arena Sports Ki on September 16 & 17, 2013, to discuss the projects and the proposed financial models and legal agreements that had been negotiated to that point. Brunswick House First Nation was one of the attendees.

17.4.2.5 Meeting—November 25, 2013

A presentation was made on the environment and cultural heritage of the Project Study Area, including Culturally Modified Trees (CMTs), and details of the economic partnerships being developed. Please see Appendix M for the meeting minutes.

Throughout this period Xeneca has continued to engage Brunswick House First Nation individually and through Wabun Tribal Council. This engagement and consultation process is progressing towards a definitive legal agreement on their behalf through Wabun Tribal Council. Please refer to Section 17.4.12 for further discussion on the status of the Wabun Tribal Council engagement. Consultation beyond economic issues is still on-going with this community. Based on a general understanding of the community's traditional and current use of the area, additional potential concerns for the community are listed in the Potential Effects Identification Matrix, in Table 12. These concerns have been reproduced in Section 17.4.19, below, for the reader's convenience. Consultation and engagement with this community will continue throughout the Class EA process, Site Release Process, construction, and into the lifecycle operations of the Project.

17.4.3 Chapleau Cree First Nation Consultation

17.4.3.1 Background

Chapleau Cree First Nation is a member of Mushkegowuk Tribal Council and a signatory to Treaty 9. This community is located approximately 5km southwest of the Town of Chapleau. An original settlement was connected to the Chapleau and Nebskwashi Rivers east of the town of Chapleau, but it was found to be of poor quality and residents instead chose to settle near the Town of Chapleau (Wakenagun Community Futures Development Corporation, 1999).

17.4.3.2 Summary of Engagement

The project proponent made frequent and regular contact in writing to the Chapleau Cree First Nation, as documented in Table 61, below. All outgoing correspondence can be found in Appendix M.

A detailed Consultation Log of all issues and concerns expressed by the Chapleau Cree First Nation is in Table 62, below.

Table 61: Correspondence to Date

Date	Content
June 16, 2010	Introductory letter: Project commencement, Class EA and Site Release process,
January 9, 2011	Invitation sent to attend PIC
May 13, 2011	Notices of Commencement (3), past communications, draft Aboriginal Consultation Plan, information on archaeological work
May 17, 2011	MNR letter re: Site Release Process notification
June 2011	Invitation to attend July 7, 2011 PIC
June 9, 2011	Invitation to participate in archaeological field work.
June 18, 2011	NOC and Environmental Report for The Chute Generating Station Project
July 15, 2011	Summary reports for Stage 1 archaeological work for Third Falls and The Chute; invitation to participate in Stage 2 field studies
August 2011	Revised Aboriginal Consultation Plan, update on Class EA status
February 13, 2012	Updated Project Description for The Chute and Third Falls
March 6, 2012	Baseline reports provided, per request made at November 2011 meeting
July 12, 2012	Invitation for July 26, 2012 PIC, and for local in-person meeting if desired
February 23, 2013	Letter outlining responses to CCFN concerns received to date
April 11, 2013	Copies of Stage 2 Archaeology reports for The Chute and Third Falls
July 24, 2013	Draft Environmental Report for Ivanhoe Project
September 5, 2013	Term Sheet
September 19, 2013	Limited Partnership Agreement and Procurement Policy

Meeting—July 12, 2010

The informal introductory meeting was held on July 12, 2010.

Meeting—August 10, 2010

On August 10, 2010 the community hosted a meeting with Xeneca to discuss the projects and the Class EA process. They discussed a wide range of topics, including other Xeneca projects and identified concerns including the use of concrete and the preference to have a run-of-river Facility. Xeneca committed to work with them on these items, and hosted a booth at their two day Cree Fest event to raise awareness of the company and Project within the local community. Dam materials and operations are addressed within Table 62, below.

Meeting—January 27, 2011

On January 27, 2011 a formal meeting was held between the community and Xeneca to update the community on the projects and the proposed conceptual design. During this meeting a draft copy of the Project Description was provided for review by the community. Discussions regarding treaty rights and issues related to conceptual design were continued from the August 2010 meeting. In this meeting, the community indicated that they were interested in economic development, particularly those that come from clean, renewable sources. However, they noted that it was also important to be responsible to the environment, and that they would not accept development at any cost. This issue is addressed within Table 62, below. A follow up letter sent on February 2, 2012 is provided in the Appendix M.

Meeting—November 28, 2011

A meeting was held on November 28, 2011 between Xeneca and the community to discuss the ongoing EA process, issues with the ongoing review and consultation processes and to flush out issues related to culturally modified trees identified in the area. This issue is addressed within Table 60, below.

Meeting—August 7, 2012

Another meeting was held between the community and Xeneca on August 7, 2012 in which Xeneca provided updated information on the Project and information on the archaeology and the environmental field work. The community identified many issues with the Project and the process including: the appearance of the Project, Methyl mercury contamination, water quality and water temperature, the Facility design (run-of-river being the preference), health of the fish population, a request to continue fish studies if Project is constructed, and a request for a visual representation of the Project to gain a better understanding of what it would look like. These issues are addressed within Table 62, below. This meeting also included some components of the business-to-business relationship building required for the site release process. Issues identified during this process are outlined in Table 62.

Meeting—September 25, 2012

A further meeting was held between the community and Xeneca on September 25, 2012, in which the community expressed several concerns regarding the Ivanhoe projects, including: Culturally Modified Trees (CMTs), the development of a new consultation process for the Chapleau Cree, and the potential presence of sacred medicines in the Project Area. Botanical surveys were conducted in the Project Area, and no sacred medicines were found. Xeneca has undertaken to adhere to the community's consultation process. Regarding the CMTs, the community's main request was a site visit to see the CMTs, and this was undertaken in October 2012.

Site Visit—Culturally Modified Trees, October 17, 2012

Beginning on September 25, 2012, Xeneca established a process to support consultation and create a framework for a site visit to The Chute in order to address concerns related to culturally modified cedar trees. Chief Keeter Corston suggested that a tour of the Project site be conducted by the Regional Elders Group and Xeneca staff along with a Board member of Xeneca. Chief Corston also proposed that a larger meeting be held with members of the Chapleau Cree and that Xeneca's non-disclosure agreement be shared with the First Nation.

On October 17, 2012 a site visit occurred which included Xeneca, Chief and Council, members of the community, Regional Elders, Regional Women Water Keepers, as well as members from the Ministry of Natural Resources. The purpose of this site visit was to discuss issues related to the culturally modified trees and the community had identified at the site and to discuss the significance of cedar trees to the community, as well as to discuss ongoing procedural aspects of the consultation between Chapleau Cree and Xeneca. This is summarized in Table 62, below.

Conference—September 16 & 17, 2013

Xeneca arranged a meeting for seven First Nations interested in various proposed Xeneca waterpower projects at the Mnjikaning Arena Sports Ki on September 16 & 17, 2013, to discuss the projects and the proposed financial models and legal agreements that had been negotiated to that point. Chapleau Cree First Nation was one of the attendees.

Meeting—October 17, 2013

Xeneca and the Chapleau Cree discussed their concerns on the Ivanhoe Project, including Culturally Modified Trees, environmental impacts, when the detailed design would be ready for review, water temperature, methyl mercury, and the economic structure of the legal agreement being developed. These issues are addressed within Table 62, below.

Throughout this period Xeneca has continued to engage Chapleau Cree individually; Mushkegowuk Tribal Council has not been involved on their behalf. This engagement and consultation process is progressing towards a definitive legal agreement. To date the community has tabled several specific concerns related to aboriginal treaty rights, traditional lands and specific community issues, as summarized below. Consultation and engagement with this community will continue throughout the Class EA process, construction, and into the lifecycle operations of the Project.

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Table 62: Chapleau Cree First Nation Consultation Log

Issue / Concern Raised	Response on Record	Comments
Design		
Concrete style dams would be opposed, inflatable (obermeyer dams) may present a problem. Would only support run-of-river dams that captured current water flow and had as little impact as possible. Knowing what style of structure will be constructed is important for decision making.	Third Falls was originally planned as a Modified run-of- river Facility that would, for brief periods, alter water flow through temporary storage in the Facility headpond. Xeneca has now committed to straight run- of river-operations. Run-of-river requires that all inflowing water be released and flows downstream are not significantly altered from the natural conditions occurring at the site. Third Falls is proposed to be a rock and clay filled dam structure with a 10.5 m concrete overflow weir; it is also proposed that this structure has concrete footings. The Chute has the same design parameters, however is planned to have a 9.5 m concrete overflow weir structure.	Xeneca respects that the community is concerned with the use of concrete in the waterway, and has attempted to minimize the use of concrete in the conceptual design of the Facility where possible.
Any project that has smaller footprint is better	Third Falls was originally planned as a modified run-of- river Facility that would, for brief periods, alter water flow through temporary storage in the Facility headpond. Xeneca has now committed to straight run- of river-operations. Run-of-river requires that all inflowing water be released and flows downstream are not significantly altered from the natural conditions occurring at the site. This change results in a smaller area of impact for the Project.	None
Run-of-river		
Do not like projects that take away the spirit (movement) of the water	At all times there will be a minimum flow provided downstream for The Chute. This minimum value will vary monthly based upon base flow conditions and will range from 20 cms during the spring (freschet) and a minimum of 3 cms (during the dry summer months). Third Falls will operate as a run-of-river Facility. Downstream of Third Falls the river flow will be the same as the pre-Project condition.	
Council supports run-of-river projects in principle but they need to be backed up by good environmental science and supported by our traditional teachings. We could also consider other project options, but the science and traditional integrity would need to be very sound (and the trade-offs acceptable).	Class Environmental Assessment for Waterpower Report ("EA Report") has been submitted for review and past community input as per my last correspondence was incorporated into the document. Class Environmental Assessment for Waterpower does not issue any approvals or permits and Xeneca informed the community that it was taking this step at several junctures in our discussions.	

Issue / Concern Raised	Response on Record	Comments
Will the generating station be run-of-river, as there are concerns for water quality and temperature	The operations of the Facility have been decided through deliberations with the Timmins district of the Ministry of the Environment and Ministry of Natural Resources, through these discussions a "Proposed Operating Plan & Water Management Plan Amendment Ivanhoe River Hydro Projects: The Chute, Third Falls" (2013) has been prepared by ORTECH Environmental. This document is still in draft. It outlines how the project will operate. Operations for The Chute will operate as modified Run-of-river, meaning that water will be stored during night time hours in order to be used during day time hours. Third Falls will operate as a run-of-river Facility at all times. Water sampling was started in 2012 and continued in 2013; details of this sampling program can be found in the Ivanhoe River Hydroelectric Generating Facilities Third Falls and The Chute: 2012 Baseline Water Quality and Fish Tissue Mercury Report (2013). Three years of post-development water samples will be required by the Ministry of the Environment in order to assess water quality of the waterway post development. Construction-phase water quality monitoring will be determined during the design and construction phase of the project.	Water temperature monitors have been installed on the Ivanhoe river as part of the Water Quality assessment. This monitoring program will continue on the river post construction. The Third Falls Facility will be operated as run-of-river and all downstream flows will be renaturalized.
Culturally modified trees		
The recent discovery of culturally modified trees in the Project Area raises a flag for even a run-of-river proposal and would need to be thoroughly investigated. It is for this reason that a ground level cultural assessment is recommended.	A Stage 1 archaeological assessment was completed in the area of both Project Sites in December 2010. Stage 2 assessments were completed in October 2012. These assessments concluded that there were no sites of archaeological significance within the project footprint or inundation area. The Stage 2 Assessment did look at the Culturally Modified Trees and found that at that they did not meet the definition of culturally modified in the opinion of Xeneca's Archaeologist. Despite not meeting this classification, Xeneca recognizes that these trees hold significance to the community and they are prepared to protect them. The construction management plan contains mitigation plans for the Culturally Modified Trees (CMT), which includes identification of the culturally modified trees that have been identified on the island located near the proposed location for the tailrace. These trees will be protected by fencing. Further information can be found in the *Ivanhoe River Hydro Projects Construction Management Plan* (2013) prepared by Canadian Projects Limited.	There have been several meetings with the community including November 28, 2011 during which the Xeneca's contracted archaeologist met with community elders. Further meetings were held on August 7, 2012 and October 17, 2012. The October 2012 field visit included Chapleau Cree's advocational archaeologist Bill Allen. The gathering was an opportunity to raise concerns about the culturally modified cedar trees which had not been classified as such by the archaeological study, and to discuss environmental responsibilities. Further meetings are planned with this community in late May/early June 2013, for which cultural assessment has been added to the agenda as a topic for discussion.
Community indicated that there were cultural issues in the form of culturally significant trees. The location indicated was downstream of the proposed Chute project based on the mapping provided by the community.	Xeneca's archaeologist indicates that he has identified no such heritage/cultural issues. Moreover if the location of the trees is where indicated on the map provided by the community the project poses no impacts because it's downstream.	

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Issue / Concern Raised	Response on Record	Comments
Culturally modified trees are a result of ancestors and symbolic of our ancestors still being with us, they need to be protected. The trees are near where the truck turnaround is proposed for the project. Where you find one of these trees you will usually find more in the same area and they need to be respected	The construction management plan discusses mitigation plans for this stand of trees which includes identification of the culturally significant stand of Eastern White Cedars near the truck turn around, and contracting a registered professional forester to delineate the mature trees. These trees will be protected using fencing. Should the truck turn around area overlap with a significant tree, the truck turn around will be relocated slightly to avoid having to remove any of the significant trees. Further information can be found in the "Ivanhoe River Hydro Projects Construction Management Plan"(2013) prepared by Canadian Projects Limited. Please note that field investigations showed these were not culturally modified trees, but had been modified through natural processes.	None
Chapleau Cree has their own process to natural resource development and could have implications to include Natural Law and provided the example of how the Culturally Modified Tree issue needs to be dealt with	Noted	
Type of materials for the project site and construction	Both sites will use general construction materials which include objects such as gravel, concrete, wire, metal sheeting, clay and rebar. In addition the project will use wooden telephone poles, and require blasting materials such as explosives.	
Cedar trees are highly regarded as one of the sacred medicines that have healing properties for both physical and mental areas	February 22, 2013 letter from Uwe Roeper, Xeneca CEO, to Chief Keith Corsten: "I very much appreciated learning about the traditional significance of cedar trees during the visit to the site. I have asked our consultant to estimate the number of mature cedar trees that might have to be removed for the project. Do you think it would be of interest to use the resulting logs for a special community structure or project?" In addition to the above response Xeneca commissioned a report from KBM Resources Group in April 2013 which assessed presence of cedars in the inundation area titled "*Presence of Cedar in Proposed Inundation Area for Ivanhoe (Third Falls and The Chute): A Summary Report for : Xeneca Power Development Inc.*" (2013). The report estimates that 6,336 cedars are within the proposed inundation area.	Details regarding removal and disposal of cedars in the impoundment area, which are considered sacred species to the community, are considered ongoing.

Misc.		
Desire to have all information on projects issued in project description format	At this time there is not an updated project description for this Project, however the Environmental Report will contain a section which summarizes the Project. Following review of the report with the community Xeneca will assess whether this meets the needs of the community or if an updated Project Description is still required.	Draft ER provided to community on July 24, 2013

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Issue / Concern Raised	Response on Record	Comments
Community desired their community experts to be engaged with Xeneca consultants after review of the documents submitted	February 22, 2013 letter: We will be issuing the Draft Environmental Report in the coming weeks. The report provides information on both Ivanhoe The Chute and Ivanhoe: Third Falls. The report explains the operation and flows in detail. It also explains the steps we have taken to ensure minimal environmental impact on fish and land. We will share the draft with you and would be pleased to send someone to present report findings and answer questions.	Draft ER provided to community on July 24, 2013
Community requested information session and question and answer session on all projects in the winter of 2012.	Meeting Postponed until late Spring / early summer 2013	
Would like to see all the information about the project identified at the community meeting in May 2012 so they can provide feedback to Xeneca	Meeting postponed until late Spring / early summer 2013	
Requested that Xeneca share all that is available on: project location, surrounding impacts to water levels, where the structure will be built, type of construction, how will the environment be impacted/protected. Overview of the project	Xeneca has now prepared a revised draft ER for The Chute which also includes details on how the project will incorporate operations at Third Falls into the design for the project. This Environmental Report document contains information related to impacts on water levels, where the structures at both locations will be located, and the type of construction expected, how the environment is expected to be impacted and a general overview of the Projects. Xeneca would very much like to hear your comments on any aspect in this Draft Report.	Xeneca is available to meet with you in order to discuss this report, or to discuss providing resources to assist you in reviewing this report
Methyl mercury is a concern for the community	Levels will be kept low by water circulation and be checked through a monitoring program for mercury. Vegetation is also removed from the inundation areas which will minimize the amount of mercury entering the river system from decaying vegetation.	The final methyl mercury post-construction monitoring plan is included in Section 16.
Community requested a visual to gain a better understanding of what the project would look like	Artist rendering and physical model provided to community in letter on February 22, 2013	None
Mushkegowuk Tribal Council is developing an EA process, inside this process there will be sites that are off limits for development and other site locations that are ok but will be protected by minimizing impacts from development.	Noted	
Equity in project is in the resources, the environment is a priority for protection from impacts and money is not the top priority in any project within their territory	Noted	
Four most sacred medicines are: sweet grass, cedar, tobacco, sage	Natural Resource Solutions Inc. (NRSI) completed a Baseline report for the Third Falls in February 2013 *"The Chute and Third Falls Hydroelectric Developments Natural Environment Characterization and Impact Assessment Report"* (2013). During this field assessment the biologists on site did not find any occurrences of sweet grass, tobacco or sage in the areas of proposed development. It is therefore not expected that these species will be impacted by development. The Project will require removal of some cedar trees in the impoundment and construction areas. Significant cedars and Culturally Modified Cedar trees will be protected as described, and other cedars will be removed and disposed of in ways agreed to in consultation with the community.	Consultation with regards to removal and disposal of cedars in construction and impoundment areas is ongoing

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Issue / Concern Raised	Response on Record	Comments
First Nations should be at the top end of the communication for consultations	Addressed in response on September 12, 2011 Xeneca recognized that First Nation and Aboriginal Communities would want to engage in the decisions made after the EA Report and the Aboriginal Consultation Plan (draft for Community consideration) outlines that engagement continues until at least project commissioning.	None
Fish		
What happens if there are high levels of mercury in fish?	The MNR will be notified of the elevated levels of mercury, consumption levels of fish need to be adjusted (MOE develops consumption guide for fish) a proactive measure would be set up a model to predict mercury and other water contaminants effects. The model could provide better reaction time and predict after effects. Current studies establish baseline of information that could be used for comparison to future levels and to anticipate and mitigate post construction monitoring. Contingencies can be developed if mitigation measures need to be altered. The baseline data will also provide a level of naturally occurring mercury already in the river.	The final methyl mercury post-construction monitoring plan is included in Section 16
Health of the fish population	Tissue samples were taken from fish in 2012 to assess the baseline methyl mercury existing in the population prior to development of the Ivanhoe facilities. Details on how this was carried out can be found in the *Ivanhoe River Hydroelectric Generating Facilities Third Falls and The Chute : 2012 Baseline Water Quality and Fish Tissue Mercury Report* (2013) Prepared by Hutchison Environmental Services Ltd. The results of this assessment found that median mercury concentrations in large fish were higher upstream of the proposed Facility than downstream. Presently mercury concentrations in most large fish in the vicinity of the Project exceed the Ministry of the Environment fish consumption guidelines for women of child bearing age and children under 15, as well as exceeding general population partial and Complete Restrictions and Canadian Council of Ministers of the Environment (CCME) guidelines for protection of wildlife consumers of aquatic biota. Based on this finding Xeneca will be monitoring the mercury concentration in fish at the site following the development.	The final methyl mercury post-construction monitoring plan is included in Section 16

17.4.4 Chapleau Ojibwe First Nation Consultation

17.4.4.1 Background

This community is a member of Wabun Tribal Council and is a signatory of treaty number 9 (First Nations Communities, 2009).This community has three reserve areas: Chapleau 61A Chapleau 74 and Chapleau 74A_(Aboriginal Affairs and Northern Development Canada, 2013). Traditional activities for this community are hunting, gathering, fishing and trapping (Wabun Tribal Council, 2013).

Chapleau Ojibwe First Nation has delegated the accommodation aspects to Wabun Tribal Council. Through Wabun Tribal Council, Chapleau Ojibwe First Nation has indicated that until acceptable accommodation has been arrived at with Xeneca, it will not acknowledge any consultation efforts. While Xeneca respects the approach taken by the community and wishes to work collaboratively, Xeneca continues to engage the community by providing updates and documents on an ongoing basis as required for the EA process.

17.4.4.2 Summary of Engagement

The project proponent made frequent and regular contact in writing to the Chapleau Ojibwe First Nation, as documented in Table 63, below. All outgoing correspondence can be found in Appendix M.

Table 63: Chapleau Ojibwe Main Correspondence

Date	Content
June 2010	Introductory letter: project commencement, Class EA and Site Release process, contact information
September 2010	Archaeological field work invitation
October 2010	Invitation for November 3, 2010 PIC
October 25, 2010	Notification of rescheduling of November PIC
December 20, 2010	Letter: Class EA update, Draft Project Description for The Chute and Third Falls
April 2011	Letter: update on Third Falls, Draft Project Description for Third Falls
May 13, 2011	Notices of Commencement (3), past communications, draft Aboriginal Consultation Plan, information on archaeological work
May 17, 2011	MNR letter re: Site Release Process notification
June 18, 2011	NOC and Environmental Report for The Chute Generating Station Project
July 15, 2011	Summary reports for Stage 1 archaeological work for Third Falls and The Chute; invitation to participate in Stage 2 field studies
August 2011	Revised Aboriginal Consultation Plan, update on Class EA status
March 1, 2012	Updated Project Description for The Chute
July 12, 2012	Invitation for July 26, 2012 PIC, and for local in-person meeting if desired

Date	Content
April 11, 2013	Copies of Stage 2 Archaeology reports for The Chute and Third Falls
May 15, 2013	Clarification of Letters of Intent and Term Agreements process (confidential)
July 24, 2013	Draft Environmental Report for Ivanhoe Project
October 18, 2013	Invitation to attend field visit to investigate potential Culturally Modified Trees (CMTs)

17.4.4.3 Conference—September 16 & 17, 2013

Xeneca arranged a meeting for seven First Nations interested in various proposed Xeneca waterpower projects at the Mnjikaning Arena Sports Ki on September 16 & 17, 2013, to discuss the projects and the proposed financial models and legal agreements that had been negotiated to that point. Chapleau Ojibwe First Nation was one of the attendees.

17.4.4.4 Meeting—November 25, 2013

Xeneca traveled to the First Nation community to make a presentation on the environmental, archaeological and cultural heritage studies performed to date on the Ivanhoe Project, including information on the issue of culturally modified trees. No particular issues were raised at this time. Xeneca and the Chapleau Ojibwe also discussed making arrangements for an independent consultant to perform a peer review on the reports, when ready.

Throughout this period Xeneca has continued to engage Chapleau Ojibwe First Nation individually and through Wabun Tribal Council. This engagement and consultation process is progressing towards a definitive legal agreement on their behalf through Wabun Tribal Council. Please refer to section 6.5.2.11 for further discussion on the status of the Wabun Tribal Council engagement. To date the community has not tabled any specific concerns related to aboriginal treaty rights, traditional lands or specific community issues. Based on a general understanding of the community's traditional and current use of the area, potential concerns are summarized in the Potential Effects Identification Matrix, in Section 8. These concerns have been reproduced in Section 17.4.19, below, for the reader's convenience. Consultation and engagement with this community will continue throughout the Class EA process, Site Release Process, construction, and into the lifecycle operations of the project.

17.4.5 Flying Post First Nation Consultation

17.4.5.1 Background

Flying Post First Nation is a member of Wabun Tribal Council and a signatory to Treaty 9. They presently hold a reserve in the Smooth Rock Falls Area, Flying Post 73 (Aboriginal Affairs and Northern Development Canada, 2008b)

Flying Post First Nation has delegated the accommodation aspects to Wabun Tribal Council. Through Wabun Tribal Council, Flying Post First Nation has indicated that until an acceptable accommodation has been arrived at with Xeneca, it will not acknowledge any consultation efforts. While Xeneca respects the approach taken by the community and wishes to work collaboratively, Xeneca continues to provide updates and documents to the community on an ongoing basis as required for the EA process.

17.4.5.2 Summary of Engagement

The project proponent made frequent and regular contact in writing to the Flying Post First Nation, as documented in Table 64, below. All outgoing correspondence can be found in Appendix M.

Table 64: Flying Post First Nation Main Correspondence

Date	Content
June 2010	Introductory letter: project commencement, Class EA and Site Release process, contact information
September 2010	Archaeological field work invitation
October 2010	Invitation for November 3, 2010 PIC
October 25, 2010	Notification of rescheduling of November PIC
December 20, 2010	Letter: Class EA update, Draft Project Description for The Chute and Third Falls
May 9 2011	Letter: update on Third Falls, Draft Project Description for Third Falls
May 13, 2011	Notices of Commencement (3), past communications, draft Aboriginal Consultation Plan, information on archaeological work
May 17, 2011	MNR letter re: Site Release Process notification
June 18, 2011	NOC and Environmental Report for The Chute Generating Station Project
June 13, 2011	Summary reports for Stage 1 archaeological work for Third Falls and The Chute; invitation to participate in Stage 2 field studies
August 2011	Revised Aboriginal Consultation Plan, update on Class EA status
March 1, 2012	Updated Project Description for The Chute
July 12, 2012	Invitation for July 26, 2012 PIC, and for local in-person meeting if desired
April 11, 2013	Copies of Stage 2 Archaeology reports for The Chute and Third Falls
May 15, 2013	Clarification of Letters of Intent and Term Agreements process (confidential)
July 24, 2013	Draft Environmental Report for Ivanhoe Project

17.4.5.3 Conference—September 16 & 17, 2013

Xeneca arranged a meeting for seven First Nations interested in various proposed Xeneca waterpower projects at the Mnjikaning Arena Sports Ki on September 16 & 17, 2013, to discuss the projects and the

proposed financial models and legal agreements that had been negotiated to that point. Flying Post First Nation was one of the attendees.

Throughout this period Xeneca has continued to engage Flying Post First Nation individually and through Wabun Tribal Council. This engagement and consultation process is progressing towards a definitive legal agreement on their behalf through Wabun Tribal Council. Please refer to section 17.3.12 for further discussion on the status of the Wabun Tribal Council engagement. To date the community has not tabled any specific concerns related to aboriginal treaty rights, traditional lands or specific community issues. Based on a general understanding of the community's traditional and current use of the area, potential concerns are summarized in the Potential Effects Identification Matrix in Section 8. These concerns have been reproduced in Section 17.4.19, below, for the reader's convenience. Consultation and engagement with this community will continue throughout the Class EA process, Site Release Process, construction, and into the lifecycle operations of the project.

17.4.6 Mattagami First Nation Consultation

17.4.6.1 Background

Mattagami First Nation is a member of Wabun Tribal Council and a Signatory of Treaty 9. They presently engage in a wide variety of activities in their traditional lands including hunting, fishing, snowmobiling, ATVing, and promoting ecotourism (Mattagami First Nation, 2013). They reside on one reserve Mattagami 71 (Aboriginal Affairs and Northern Development Canada, 2008c).

Mattagami First Nation has delegated the accommodation aspects to Wabun Tribal Council. Through Wabun Tribal Council, Mattagami First Nation has indicated that until acceptable accommodation has been arrived at with Xeneca, it will not acknowledge any consultation efforts. While Xeneca respects the approach taken by the community and wishes to work collaboratively, Xeneca continues engage the community by providing updates and documents on an ongoing basis as required for the EA process.

17.4.6.2 Summary of Engagement

The project proponent made frequent and regular contact in writing to the Mattagami First Nation, as documented in Table 65, below. All outgoing correspondence can be found in Appendix M.

Table 65: Mattagami First Nation Main Correspondence

Date	Content
June 2010	Introductory letter: project commencement, Class EA and Site Release process, contact information
September 2010	Archaeological field work invitation
October 2010	Invitation for November 3, 2010 PIC
October 25, 2010	Notification of rescheduling of November PIC
December 20, 2010	Letter: Class EA update, Draft Project Description for The Chute and Third Falls
May 9, 2011	Draft Project Description
May 13, 2011	Notices of Commencement (3), past communications, draft Aboriginal Consultation Plan, information on archaeological work
May 17, 2011	MNR letter re: Site Release Process notification
June 18, 2011	NOC and Environmental Report for The Chute Generating Station Project
June 13, 2011	Summary reports for Stage 1 archaeological work for Third Falls and The Chute; invitation to participate in Stage 2 field studies
August 2011	Revised Aboriginal Consultation Plan, update on Class EA status
March 1, 2012	Updated Project Description for The Chute
July 12, 2012	Invitation for July 26, 2012 PIC, and for local in-person meeting if desired
April 11, 2013	Copies of Stage 2 Archaeology reports for The Chute and Third Falls
May 15, 2013	Clarification of Letters of Intent and Term Agreements process (confidential)
July 24, 2013	Draft Environmental Report for Ivanhoe Project

17.4.6.3 Conference—September 16 & 17, 2013

Xeneca arranged a meeting for seven First Nations interested in various proposed Xeneca waterpower projects at the Mnjikaning Arena Sports Ki on September 16 & 17, 2013, to discuss the projects and the proposed financial models and legal agreements that had been negotiated to that point. Mattagami First Nation was one of the attendees.

17.4.6.4 Meeting—February 20, 2014

Xeneca presented information on the project to the First Nation. Representatives of Mattagami First Nation expressed concerns about fish spawning habitat, habitat compensation, archaeology and cultural heritage. The proponent provided information on how the Facility operation had been modified to protect spawning habitat, details of construction schedule timing to avoid sensitive periods, coffer dams, and details on the Fish Habitat Offsetting Plan. Xeneca also presented

information on the archaeology consultant hired and the issue of culturally modified trees in the Ivanhoe Project Area.

Throughout this period Xeneca has continued to engage Mattagami First Nation individually and through Wabun Tribal Council. This engagement and consultation process is progressing towards a definitive legal agreement on their behalf through Wabun Tribal Council. Please refer to section 17.4.12 for further discussion on the status of the Wabun Tribal Council engagement. The community has only recently begun to share specific concerns about the Project and the Environmental Assessment, concerning fish habitat and spawning, as discussed in the section above. This concern was addressed at the meeting, and is reproduced in Section 17.4.19, below, for the reader's convenience. Consultation and engagement with this community will continue throughout the Class EA process, Site Release Process, construction, and into the lifecycle operations of the project.

17.4.7 Metis Nation of Ontario Consultation

17.4.7.1 Background

The Métis Nation of Ontario (MNO) provides a host of services to all Métis individuals in Métis Nation communities and Regions in Ontario.

Xeneca is working with the MNO through their Lands, Resources and Consultation Branch collaboratively in order to establish a consultation protocol that will involve regional meetings and will include opportunities for review and input on project developments by representatives from the Timmins Community Council, and any other interested Community Councils. The MNO has provided their consultation protocol to Xeneca with the intent that it be used as a model to develop a consultation process and aid in the implementation of an MOU that addresses capacity and accommodation requirements between the two parties.

As part of the consultation strategy, any written correspondence materials provided to Community Councils were also copied to the MNO for their information purposes.

Specific Metis communities included within the consultation process with the Metis Nation of Ontario include Northern Channel Metis, Northern Lights Metis and the Sudbury Metis Council. More information on efforts with these specific communities can be found in Section 17.4.13, below.

17.4.7.2 Summary of Engagement

The project proponent made frequent and regular contact in writing to the Metis Nation of Ontario, as documented in Table 66. All outgoing correspondence can be found in Appendix M.

Table 66: Metis Nation of Ontario Main Correspondence

Date	Content
June 2010	Introductory letter: project commencement, Class EA and Site Release process, contact information (The MNO issued a letter of support to Xeneca, which described the conditions under which the MNO would support the development of the proposed project and process and would be willing to engage with Xeneca on the permitting processes as required.)
October 2010	Invitation for November 3, 2010 PIC
October 25, 2010	Notification of rescheduling of November PIC
January 7, 2011	Invitation to PIC
May 13, 2011	Notices of Commencement (3), past communications, draft Aboriginal Consultation Plan, information on archaeological work
June 18, 2011	NOC and Environmental Report for The Chute Generating Station Project
June 18, 2011	Summary reports for Stage 1 archaeological work for Third Falls and The Chute; invitation to participate in Stage 2 field studies
June, 2011	Invited to July 7, 2011 PIC
August 2011	Revised Aboriginal Consultation Plan, update on Class EA status
March 1, 2012	Updated Project Description for The Chute
July 12, 2012	Invitation for July 26, 2012 PIC, and for local in-person meeting if desired
December 17, 2012	Xeneca provided the community with copies of all the updated draft information available for the revised Draft of the Ivanhoe The Chute and Third Falls ER for their review and comment.
April 11, 2013	Copies of Stage 2 Archaeology reports for The Chute and Third Falls
May 15, 2013	Clarification of Letters of Intent and Term Agreements process
July 24, 2013	Draft Environmental Report for Ivanhoe Project
October 18, 2013	Invitation to attend field visit to investigate potential Culturally Modified Trees (CMTs)
	Invitation to attend an in-person meeting in November, 2013

Presently Xeneca is still in negotiations with the Métis Nation of Ontario, progressing towards a memorandum of understanding leading to an impact benefit agreement in the future. To date the Nation has not tabled any specific concerns related to aboriginal treaty rights, traditional lands or specific community issues. Based on a general understanding of the community's traditional and current use of the area, potential concerns are summarized in the Potential Effects Identification Matrix in Section 8. These concerns have been reproduced in Section 17.4.19, below, for the reader's convenience. Consultation and engagement with this community will continue throughout the Class EA process, Site Release Process, construction, and into the lifecycle operations of the project.

17.4.8 Michipicoten First Nation Consultation

17.4.8.1 Background

Michipicoten First Nation is not a member of a Tribal Council; however, they are a member of the Union of Ontario Indians. They are signatories to the Robinson Superior Treaty of 1850 and may have traditional territory in the Treaty 9 area. The land base for this community is highly disrupted as the community was subjected to several forced moves. This community engages in fishing, hunting and trapping activities (Michipicoten First Nation, 2013). As a result there are several reserve lands, the largest of which is the Gros Cap Indian Village 49A. A listed reserve for this community, Chapleau 61 is within Sudbury District (Aboriginal Affairs and Northern Development Canada, 2008d).

17.4.8.2 Summary of Engagement

The project proponent made frequent and regular contact in writing to the Michipicoten First Nation, as documented in Table 67, below. All outgoing correspondence can be found in Appendix M.

Table 67: Michipicoten First Nation Main Correspondence

Date	Content
June 2010	Introductory letter: project commencement, Class EA and Site Release process, contact information
September 2010	Archaeological field work invitation
October 2010	Invitation for November 3, 2010 PIC
October 25, 2010	Notification of rescheduling of November PIC
December 20, 2010	Letter: Class EA update, Draft Project Description for The Chute and Third Falls
May 9, 2011	Letter: update on Third Falls, Draft Project Description for Third Falls
May 13, 2011	Notices of Commencement (3), past communications, draft Aboriginal Consultation Plan, information on archaeological work
June 18, 2011	NOC and Environmental Report for The Chute Generating Station Project
June 13, 2011	Summary reports for Stage 1 archaeological work for Third Falls and The Chute; invitation to participate in Stage 2 field studies
June 2011	Invitation to attend Ivanhoe PIC on July 7, 2011
August 2011	Revised Aboriginal Consultation Plan, update on Class EA status
March 1, 2012	Updated Project Description for The Chute
July 12, 2012	Invitation for July 26, 2012 PIC, and for local in-person meeting if desired
December 17, 2012	Xeneca provided the community with copies of all the updated draft information available for the revised Draft of the Ivanhoe The Chute and Third Falls ER for their review and comment.
March 7, 2014	Copies of Stage 2 Archaeology reports for The Chute and Third Falls

Date	Content
July 24, 2013	Draft Environmental Report for Ivanhoe Project
October 24, 2013	Provided information to FN in accordance with Michipicoten's Consultation Protocol, including draft ER and Archaeology Reports, in response to August 9, 2013 email

17.4.8.3 Meeting—May 9, 2013

Xeneca had a brief meeting with Chief Joseph Buckell to introduce the project. Discussion focused on renewable energy in general, and the Michipicoten Consultation Protocol, which the Chief indicated he would send to Xeneca.

Throughout this period Xeneca has continued to engage Michipicoten First Nation. To date the Nation has not tabled any specific concerns related to aboriginal treaty rights, traditional lands or specific community issues. Based on a general understanding of the community's traditional and current use of the area, potential concerns are summarized in the Potential Effects Identification Matrix in Section 8. These concerns have been reproduced in Section 17.4, below, for the reader's convenience. Consultation and engagement with this community will continue throughout the Class EA process, Site Release Process, construction, and into the lifecycle operations of the project.

17.3.9 MNO Timmins Metis Council

17.3.9.1 Background

The MNO Timmins Métis Council is a member of Region 3 of the MNO. They have traditional territories in the lands surrounding the Projects however are not signatories to Treaty 9. They presently engage in hunting, fishing, trapping and harvesting activities in their traditional areas (Métis Nation of Ontario, 2013)

Xeneca initially worked primarily through the MNO's central office in Toronto to funnel information to MNO Timmins Métis Council including the draft Class EA report and all associated background reports. With the guidance and direction of MNO Central Office, a meeting was established in January 2013 with MNO Timmins and other local councils in Region 3, this meeting is discussed in the summary below.

17.3.9.2 Summary of Engagement

The project proponent made frequent and regular contact in writing to the MNO Timmins Metis Council, as documented in Table 68, below. All outgoing correspondence can be found in Appendix M.

Table 68: MNO Timmins Metis Council Main Correspondence

Date	Content
February 2011	Project Notification, including Draft Project Description
May 9, 2011	Letter: update on Third Falls, Draft Project Description for Third Falls
May 13, 2011	Notices of Commencement (3), past communications, draft Aboriginal Consultation Plan, information on archaeological work
May 17, 2011	MNR letter re: Site Release Process notification
June 18, 2011	NOC and Environmental Report for The Chute Generating Station Project
June 18, 2011	Summary reports for Stage 1 archaeological work for Third Falls and The Chute; invitation to participate in Stage 2 field studies
August 2011	Revised Aboriginal Consultation Plan, update on Class EA status
March 1, 2012	Updated Project Description for The Chute
July 12, 2012	Invitation for July 26, 2012 PIC, and for local in-person meeting if desired
December 17, 2012	Xeneca provided the community with copies of all the updated draft information available for the revised Draft of the Ivanhoe The Chute and Third Falls ER for their review and comment.
April 11, 2013	Copies of Stage 2 Archaeology reports for The Chute and Third Falls
July 24, 2013	Draft Environmental Report for Ivanhoe Project

Meeting—January 23, 2013

On January 23, 2013 with the assistance of the MNO Central Office, a meeting was arranged with MNO Timmins along with other local councils within Abitibi Temiscamingue/James Bay Consultation Committee (Region 3) in Timmins. At this meeting, a project overview along with the environmental and archaeological work that had been completed on these projects was presented.

Throughout this period, Xeneca has continued to engage MNO Timmins Métis Council individually and through Region 3 of the Métis Nation of Ontario. This engagement and consultation process is progressing towards a memorandum of understanding, nearly complete, on their behalf. Please refer to section 17.3.7 for further discussion on the status of the Métis Nation of Ontario engagement. To date the community has not tabled any specific concerns related to aboriginal treaty rights, traditional lands or specific community issues. Based on a general understanding of the community's traditional and current use of the area, potential concerns are summarized in the Potential Effects Identification Matrix in Section 8. These concerns have been reproduced in Section 17.4, below, for the reader's convenience. Consultation and engagement with this community will continue throughout the Class EA process, Site Release Process, construction, and into the lifecycle operations of the project.

17.3.10 Moose Cree First Nation

17.3.10.1 Background

The Moose Cree First nation is a member of the Mushkegowuk Tribal Council, and a signatory to Treaty 9. They have a reserve located on Moose Factory Island, however their traditional territory extends south towards Kapuskasing. The community engages in traditional harvesting, fishing and hunting activities within their lands. They are also extensively engaged in resource management and infrastructure development projects in their traditional territories (Canadian Business Ethics Research Network).

Xeneca engages with the Moose Cree regularly through quarterly teleconferences set up by the MNR Hearst Aboriginal Resource Liaison Officer (RLO). These calls provide an avenue for Xeneca to update the community on the status for all projects that are within the traditional territories of the Moose Cree and also provide an opportunity for the community to ask questions. To date the community has expressed minimal interest in The Chute and Third Falls; however, they continue to be updated.

17.3.10.2 Summary of Engagement

The project proponent made frequent and regular contact in writing to the Moose Cree First Nation, as documented in Table 69, below. All outgoing correspondence can be found in Appendix M.

Table 69: Moose Cree First Nation Main Correspondence

Date	Content
June 2010	Introductory letter: project commencement, Class EA and Site Release process, contact information
September 2010	Archaeological field work invitation
October 2010	Invitation for November 3, 2010 PIC
October 25, 2010	Notification of rescheduling of November PIC
December 20, 2010	Letter: Class EA update, Draft Project Description for The Chute and Third Falls
May 9, 2011	Letter: update on Third Falls, Draft Project Description for Third Falls
May 13, 2011	Notices of Commencement (3), past communications, draft Aboriginal Consultation Plan, information on archaeological work
June 18, 2011	NOC and Environmental Report for The Chute Generating Station Project
June 13, 2011	Summary reports for Stage 1 archaeological work for Third Falls and The Chute; invitation to participate in Stage 2 field studies
June, 2011	Invitation to July 7, 2011 PIC
August 10, 2011	Revised Aboriginal Consultation Plan, update on Class EA status
March 1, 2012	Updated Project Description for The Chute

Date	Content
July 12, 2012	Invitation for July 26, 2012 PIC, and for local in-person meeting if desired
December 17, 2012	Xeneca provided the community with copies of all the updated draft information available for the revised Draft of the Ivanhoe The Chute and Third Falls ER for their review and comment.
March 7, 2014	Copies of Stage 2 Archaeology reports for The Chute and Third Falls
July 24, 2013	Draft Environmental Report for Ivanhoe Project
October 18, 2013	Invitation to attend field visit to investigate potential Culturally Modified Trees (CMTs)

Meeting—June 2, 2011

On June 2, 2011 a meeting was held with the Community where Xeneca presented the project and provided information on environmental impacts and cumulative effects. The discussion centered around the impacts of multiple generating stations on the river. A draft copy of the Ivanhoe Aboriginal Consultation Plan was distributed and the community was asked to provide input and comment.

Meeting—August 26, 2013

Xeneca met with several representatives of the Moose Cree First Nation to introduce the Ivanhoe project. Discussion included harvesting plans, minimum flows, and environmental studies along the river.

Throughout this period Xeneca has continued to engage Moose Cree First Nation individually. This engagement and consultation process is progressing towards an Impact Benefit Agreement (IBA) with regards to any impacts that can be demonstrated to affect the treaty or traditional territorial rights of the Moose Cree. The Moose Cree First Nation has to date shared primarily environmental concerns with the proponent, including cumulative impacts, harvesting plans, minimum flows and aquatic and environmental studies in the Ivanhoe River.

The concern regarding cumulative impacts has been addressed through combining the Third Falls and The Chute facilities into one Class EA process, and assessing them as one project. Minimum flows and the impact of flow alterations to the Ivanhoe river and its aquatic communities is described in Section 11.2 and 12.2. Flows maintained during dam operations will be sufficient to maintain ecological function of these features. All aquatic and environmental studies completed to date are included with this Final ER, and will be shared with all First Nation communities. Harvesting plans for all species of interest will also be discussed with First Nations throughout construction to arrive at a fair and mutually agreeable solution.

Consultation and engagement with this community will continue throughout the Class EA process, Site Release Process, construction, and into the lifecycle operations of the project.

17.4.11 Taykwa Tagamou Nation

Background

Taykwa Tagamou Nation (TTN) is a member of Mushkegowuk Tribal Council and is a signatory to Treaty Number 9. This community holds two reserves in the Cochrane area, Newpost 69 and Newpost 69A (Aboriginal Affairs and Northern Development Canada, 2008e).

Summary of Engagement

The project proponent made frequent and regular contact in writing to the Taykwa Tagamou Nation, as documented in Table 70, below. All outgoing correspondence can be found in Appendix M.

Table 70: Taykwa Tagamou Nation Main Correspondence

Date	Content
May 9, 2011	Notified about Ivanhoe project, and sent copy of Draft Project Description
May 13, 2011	Notices of Commencement (3), past communications, draft Aboriginal Consultation Plan, information on archaeological work
May 17, 2011	MNR letter re: Site Release Process notification
June 18, 2011	NOC and Environmental Report for The Chute Generating Station Project
June 13, 2011	Summary reports for Stage 1 archaeological work for Third Falls and The Chute; invitation to participate in Stage 2 field studies
August 8, 2011	Revised Aboriginal Consultation Plan, update on Class EA status
March 1, 2012	Updated Project Description for The Chute
July 12, 2012	Invitation for July 26, 2012 PIC, and for local in-person meeting if desired
December 17, 2012	Xeneca provided the community with copies of all the updated draft information available for the revised Draft of the Ivanhoe The Chute and Third Falls ER for their review and comment.
April 11, 2013	Copies of Stage 2 Archaeology reports for The Chute and Third Falls
July 24, 2013	Draft Environmental Report for Ivanhoe Project

Teleconference, May 10 2012

Xeneca introduced the project to the TTN Councilors. TTN indicated that they do not feel that the Ivanhoe project falls within the scope of their traditional territories, but are watching how Xeneca manages and works with other neighbouring communities.

To date the community has not tabled any specific concerns related to aboriginal treaty rights, traditional lands or specific community issues as it relates to the Ivanhoe project. Based on a general understanding of the communities traditional and current use of the area potential concerns are summarized in the Potential Effects Identification Matrix in Section 8. These concerns have been reproduced in Section 17.4.19, below, for the reader's convenience. Consultation and engagement with this community will continue throughout the Class EA process, Site Release Process, construction, and into the lifecycle operations of the project.

17.4.12 Wabun Tribal Council

Background

Wabun Tribal Council provides a host of services to its member communities including health, employment and technical services. Among First Nations participating in the Ivanhoe Aboriginal Consultation process, the Wabun Tribal Council represents Brunswick House First Nation, Chapleau Objiwe First Nation, Flying Post First Nation, and Mattagami First Nation. During an initial teleconference call in 2010 with the member communities and Wabun Tribal Council, the participating Chiefs and Councilors stated that they were delegating their authority to Wabun Tribal Council to negotiate an appropriate economic arrangement prior to moving forward on the consultation process for other issues relating to the project. This approach was then reiterated by email on January 7, 2011, from Jason Batise of the Wabun Tribal Council to Xeneca (see Appendix M).

Xeneca acknowledges this approach. Notwithstanding their position, Xeneca has been sharing, and will continue to share, all of the relevant project information with each First Nation as required for the Class EA process. As part of the consultation strategy, any written correspondence materials provided to each represented community were also copied to Wabun Tribal Council.

Summary of Engagement

The project proponent made frequent and regular contact in writing to the Wabun Tribal Council, as documented in Table 71, below. All outgoing correspondence can be found in Appendix M. Please note that the Wabun Tribal Council frequently received correspondence via cc from other First Nation communities.

Table 71: Wabun Tribal Council Main Correspondence

Date	Content
June 2010	Introductory letter: project commencement, Class EA and Site Release process, contact information
September 2010	Archaeological field work invitation
October 2010	Invitation for November 3, 2010 PIC
October 25, 2010	Notification of rescheduling of November PIC
December 20, 2010	Letter: Class EA update, Draft Project Description for The Chute and Third Falls
January 7, 2011	PIC Invitations
May 9 2011	Letter: update on Third Falls, Draft Project Description for Third Falls
May 13, 2011	Notices of Commencement (3), past communications, draft Aboriginal Consultation Plan, information on archaeological work
May 17, 2011	MNR letter re: Site Release Process notification
June 18, 2011	NOC and Environmental Report for The Chute Generating Station Project
June 13, 2011	Summary reports for Stage 1 archaeological work for Third Falls and The Chute; invitation to participate in Stage 2 field studies
August 2011	Revised Aboriginal Consultation Plan, update on Class EA status
March 1, 2012	Updated Project Description for The Chute
July 12, 2012	Invitation for July 26, 2012 PIC, and for local in-person meeting if desired
April 11, 2013	Copies of Stage 2 Archaeology reports for The Chute and Third Falls
May 15, 2013	Clarification of Letters of Intent and Term Agreements process (confidential)
July 24, 2013	Draft Environmental Report for Ivanhoe Project

Teleconference—September 2, 2010

On September 2, 2010 an introductory teleconference was held between Wabun Tribal Council and Xeneca to discuss protocol and process.

Meeting—October 14, 2010

In response to the September teleconference an in person meeting was held with representatives from member communities, Wabun Tribal Council and Xeneca on October 14, 2010. The purpose of this meeting was to discuss the relationship between Xeneca and the communities, as well as to introduce the projects and to develop an ongoing consultation and engagement protocol.

Shortly after the October 14, 2010 meeting, Xeneca and Wabun Tribal Council began to work on drafting a definitive legal agreement. Xeneca continued to keep Wabun Tribal Council apprised of the consultation activities, notifying them of a mail-out to communities by email prior to the information being released.

Meeting—February 17, 2011

The discussion continued in another face to face meeting February 17, 2011 where further issues related to relationship building, trust and communications were discussed. Legal agreement discussions continued on into October 2011 when conditions of an agreement were presented and an agreement in principle was struck.

Teleconference—August 22, 2011

Further discussions relating to the legal agreement were held.

Teleconference—April 2, 2012

This teleconference furthered the discussion regarding the economic basis for the definitive legal agreement.

Meeting—June 26, 2012

At this meeting, it was agreed that a draft agreement would be arrived at by July 2012.

Teleconference—August 8, 2012

Further discussion regarding the economic model was held.

Meeting—July 15, 2013

A meeting between Xeneca, the Wabun Tribal Council and the provincial Ministry of Finance was held to discuss the Aboriginal Loan Guarantee Program.

Conference—September 16 & 17, 2013

Xeneca arranged a meeting for seven First Nations interested in various proposed Xeneca waterpower projects at the Mnjikaning Arena Sports Ki on September 16 & 17, 2013, to discuss the projects and the proposed financial models and legal agreements that had been negotiated to that point. Wabun Tribal Council was one of the attendees.

Presently Xeneca is still in negotiations with Wabun Tribal Council towards a definitive legal agreement agreement, which is anticipated imminently.

17.4.13 Communities with Minor Consultation

Some communities were consulted in minor ways to gauge their interest prior to the 2011 MNR letter that identified which communities may have interests in the Project. The consultation for these communities is not extensive and as such no attachments are included in the appendices.

17.4.14 Constance Lake First Nation

Constance Lake First Nation was notified about the project in June 2010 when a formal letter was sent introducing the company, notifying the community of the project, the need for a Class EA process, and providing information related to the Site Release. This letter provided contact information for Xeneca and contact information for the MNR if any further information was required.

Correspondence to the Constance Lake First Nation included the following:

1. A September 2010 letter inviting the community to participate in in archaeological studies
2. An October 2010 letter advising of an upcoming PIC on November 23, 2010; and a later update advising of the PIC's postponement
3. A December 2010 update on the Class EA process, including the Draft Project Descriptions
4. A May 13, 2011 package including the Notices of Commencement, a draft Aboriginal Consultation Plan, and information regarding upcoming archaeological work

Consultation with this community was discontinued in May of 2011 as they were not on the identified communities list provided by Federal or Provincial Agencies, and they had not indicated an interest in participating in the process.

17.4.15 Missinabie Cree First Nation

Missinabie Cree First Nation was notified about the project in June 2010 when a formal letter was sent introducing the company, notifying the community of the project, the need for a Class EA process, and providing information related to the Site Release. This letter provided contact information for Xeneca and contact information for the MNR if any further information was required.

Correspondence to the Missinabie Cree First Nation included the following:

1. A September 2010 letter inviting the community to participate in in archaeological studies
2. An October 2010 letter advising of an upcoming PIC on November 23, 2010; and a later update advising of the PIC's postponement
3. A December 2010 update on the Class EA process, including the Draft Project Descriptions
4. A May 13, 2011 package including the Notices of Commencement, a draft Aboriginal Consultation Plan, and information regarding upcoming archaeological work

Consultation with this community was discontinued in May of 2011 as they were not on the identified communities list provided by Federal or Provincial Agencies, and the Chief stated during a phone conversation that the project was outside their traditional territories.

17.4.16 North Channel Metis Council Consultation

On July 12, 2012 an email invitation was sent to the North Channel Métis Council inviting them to a Public Information Centre being held for The Chute and Third Falls on July 26, 2012. This email also extended an invitation to host and participate in a meeting within their local community if it was favourable. Given the distance between their territory and the Project, no further communication took place.

17.4.17 Northern Lights Metis Council Consultation

Although the Metis Nation of Ontario is consulting with Xeneca on behalf of this Council, on July 23, 2012 a letter was provided to the Northern Lights Métis Council notifying them that Xeneca was applying for a work permit application for geotechnical investigations in the Project area. This letter was provided to the other major communities identified, and is included as an item in the logs in Appendix M.

17.4.18 Sudbury Metis Council Consultation

Although the Metis Nation of Ontario is consulting with Xeneca on behalf of this Council, on July 12, 2012 an email invitation was sent to the Sudbury Métis Council inviting them to a Public Information

Centre being held for The Chute and Third Falls on July 26, 2012. This email also extended an invitation to host and participate in a meeting within their local community if it was favourable. Given the distance between their territory and the Project, no further communication took place.

17.4.19 Potential Effects Identification Matrix Summary for First Nations

As mentioned in several of the above sections on aboriginal consultation, several First Nations are delaying their consultation on non-economic issues until economic legal agreements are signed with the proponent. In the meantime, Xeneca ensured that all First Nations receive all information on all studies, processes, consultation activities, and anticipated impacts and mitigation measures, throughout the Class EA process. In addition, the proponent anticipated what likely concerns and issues from First Nations might be, based on previous waterpower projects and FN Consultation processes. These were included in the Potential Effects Identification Matrix in Table 12, and are included here (Table 72) as well for the reader's convenience.

Table 72: Aboriginal Concerns from Potential Effects Identification Matrix

Aboriginal Community Considerations		
Criterion	**Potential Effect**	**Reasoning**
First Nation Reserves or Other Aboriginal Communities	Project lands may impact reserve lands or aboriginal community rights	No reserve lands exist within the Project Area. Xeneca commits to ensuring that no existing aboriginal community rights in the area will be affected by the project's construction or operations.
Spiritual, Ceremonial, Cultural, Archaeological, or Burial Sites	Project construction may result in impacts to culturally modified trees (CMTs) on an island downstream of the proposed Chute project site.	Two consultants were hired to complete studies on CMTs; all CMTs in the area are above expected inundation levels and will not be affected by the Ivanhoe project.
	Project Inundation may result in removal of four potential CMTs at Third Falls Facility	Two consultants were hired to complete studies on CMTs; all CMTs in the area are above expected inundation levels and will not be affected by the Ivanhoe project.
	Project construction may result in impacts to a stand of culturally significant eastern white cedar trees near the truck turn around area	Negotiations are underway both with First Nations and with EACOM, the forest license holder. All steps will be taken to avoid any negative impact to the mature cedar trees. Any mature cedar trees requiring removal will be dealt with through EACOM in consultation with interested Aboriginal Communities.
	Project construction may result in the removal of culturally significant	Negotiations are underway both with First Nations and with EACOM, the forest license holder. All steps

	cedar trees in the inundation area	will be taken to avoid any negative impact to the mature cedar trees. Any mature cedar trees requiring removal will be dealt with through EACOM in consultation with interested Aboriginal Communities.
	Spirit, (movement) of the water to be impeded by construction of the dam.	At all times there will be a minimum flow provided downstream for The Chute. This minimum value will vary monthly based upon base flow conditions and will range from 20 cms during the spring (freshet) and a minimum of 3 cms (during the dry summer months). Third Falls will operate as a run-of-river Facility. Downstream of Third Falls the river flow will be the same as the pre-project condition.
	Project construction may result in the removal of culturally significant medicinal plants (such as sage, sweetgrass, tobacco etc.)	Biological studies found no evidence of these species within the Project Area.
	Development may impact plant or animal species of cultural or spiritual significance to communities (bears, wolves etc.)	No impact is anticipated to any terrestrial mammals from the Ivanhoe project.
	Development of the dam will present a barrier to navigation and may conflict with traditional lifeways of communities	No barrier to navigation is anticipated from the complete Ivanhoe project. Minor impacts to navigation may occur during construction, but these will be limited geographically and temporally.
	Quality and Clarity of water may be affected by development, which would impact an important cultural and spiritual value for many communities	No impacts to water quality or clarity are anticipated as a result of dam operations.
	The loss of culturally used Cedar, Ash, birch, tamarack, and spruce trees surrounding the Project site as a result of project activities and flooding may impact community cultural and spiritual activities as well as production of traditional tools and traditional lifeways	Some of these species will be cleared for Project construction or inundation areas. Overall, the impact is not anticipated to be significant due to the large contiguous forest and the preponderance of many tree species within and near to the Project Area. However, where significant numbers of trees are to be removed from significant habitats or community types, seed harvesting and re-planting will take place. Please see Sections 11.3 and 12.3 for more information on the community populations and mitigation efforts proposed.

Traditional Land or Resources Used for Harvesting Activities	Furbearing mammals may be impacted by fluctuating water levels in the headpond during the winter months and alteration of habitat resulting in a change in trapping which may impact traditional lifeways and economic resources of aboriginal peoples.	Impacts to furbearing mammals from Project construction and operations are anticipated to be negligible. See Sections 11.4.6 and 12.4.6 for more information.
	Development activities may impact use of the area by waterfowl for foraging and nesting activities which could impact subsistence, harvesting, hunting and cultural activities of communities	No waterfowl habitats were found within the Project Area.
	Hunting, harvesting, foraging and trapping activities may be disrupted by construction activities (being unable to access site areas)	Access to Third Falls will be enhanced as a result of the Ivanhoe project. While some small areas may be restricted for public health and safety reasons (eg. High voltage electrical equipment), Xeneca has committed to maintaining post-construction access for hunting, harvesting, foraging and trapping activities.
	Development activities may impact food bearing plants and impact foraging and harvesting activities of some communities	No impact is anticipated to food-bearing plants or foraging or harvesting activities as a result of the Ivanhoe project.
	Fish species health and abundance may be impacted by activities related to development, thus impacting harvesting and subsistence activities of certain communities during specific times of the year	No significant impacts are anticipated for fish species health or abundance as a result of the Ivanhoe Project. Please see Sections 11.4 and 12.4 for further detail.
	Habitat changes as a result of development may result in changes in populations of large game such as moose and caribou which communities rely on for food and other products	No impact to moose or caribou is expected as a result of the Ivanhoe project.
Employment	Impacts to aboriginal-run tourism operators on the waterway	No aboriginal-run tourism operators were identified, and none came forward during the consultation process.

Lands Subject to Land Claims	The Project may have an impact on existing land claims on file between the Nishnawbe Aski Nation, for which no final agreement has been reached.	No impacts to land claims are anticipated from the Ivanhoe Project
Economic Development	The Project will have a significant impact on the economic development prospects for participating Aboriginal Communities both from an equity ownership perspective as well as potentially in the participation on the construction of the project.	Xeneca has tabled what it considers a generous equity participation model with interested identified Aboriginal Communities, along with contracting and employment opportunities. Non-binding term sheets have been signed with the Wabun participating communities and Xeneca is working towards finalization on definitive legal agreements.
Other (Specify)	Culturally significant waterway, some local communities opposed to use of concrete in waterways	Xeneca respects that the communities are concerned with the use of concrete in the waterway, and has attempted to minimize the use of concrete in the conceptual design of the Facility where possible.
	Increase in methyl mercury concentrations in waterway and increase in mercury contamination in the local fish population impact community health.	Due to the small size of the facilities, no impact is anticipated. Further detail on methyl mercury, including the post-construction monitoring program, can be found in Section 12.7.5.
	Increase in temperature and water quality impacts could adversely impact local communities	Water temperature monitors have been installed on the Ivanhoe river as part of the Water Quality assessment. This monitoring program will continue on the river post construction. The Third Falls Facility will be operated as run-of-river and all downstream flows will be renaturalized.
	Visual impacts of the Facility could interfere with cultural representations of the landscape	Artists' renderings of the project completed and shared with the communities

17.5 Agency Consultation

This section describes all activities undertaken to consult with federal, provincial, and municipal/local agencies. Agency consultation materials are reproduced in Appendix N.

17.5.1 Federal Agency Consultation Summary

Federal agency stakeholders for the Ivanhoe Project included:

- The Canadian Environmental Assessment Agency (CEAA)

- The Department of Fisheries and Oceans (DFO)
- Transport Canada (TC)
- Natural Resources Canada (NRCan)
- Environment Canada (EC)
- Aboriginal Affairs and Northern Development Canada (AANDC, formerly known as Indian and Northern Affairs Canada (INAC))
- Health Canada (HC)

The proponent initially approached the EA process with a view to presenting one harmonized environmental assessment report document to meet the requirements of both provincial and federal processes. Since the enactment of the new *Canadian Environmental Assessment Act* (CEAA, 2012) a federal environmental assessment is no longer required for this project. The following section spans both the preliminary project approach and that undertaken after the passage of the new law, and should be considered in that light. The entire federal consultation record is included in order to provide a comprehensive account. Additional consultation with federal regulators may be required subsequent to the release of this document and prior to authorizations or approvals required under applicable federal legislation.

17.5.1.1 Project Introduction

The Canadian Environmental Assessment Agency (CEAA) was provided with an introductory letter and project overview by Xeneca in June 2010. The proponent was advised that the CEAA would be acting at the Federal Environmental Assessment Coordinator (FEAC) for any proposed project subject to the then-applicable Canadian Environmental Assessment Act (1992).

17.5.1.2 Project Descriptions

A copy of the Project Description for The Chute and Third Falls was provided to CEAA, EC, DFO, HC, INAC, NRCan and TC in November 2010 and February 2011.

17.5.1.3 Surface Water Monitoring Program Results—March 22, 2011

A surface water monitoring program was conducted during the 2010 field season at the proposed Facility sites. The results of the program were summarized in baseline surface water quality investigation reports (Appendix G) which Environment Canada (EC) received on March 22, 2011. EC was also informed of the proponent's timeline for releasing additional supporting documentation, including planned reports on hydrology, operations, existing conditions and archaeology.

Acting as an expert Federal Authority for the EA, EC reviewed the surface water quality monitoring reports and provided feedback to the federal agencies, the proponent and its consultants on April 15,

2011. Comments and recommendations were made regarding the collection and reporting of data for the Fish Species Inventory, the identification of potential environmental effects during the construction and operation phases of the project, and ongoing monitoring of surface water chemistry, the details of which are provided below.

EC requested maps of the sampling areas and stations for the fish species inventory survey and as part of the Walleye Spawning Survey along with the water quality sampling stations. Clarification as to the location of the reference sampling area prior to headpond creation to ensure appropriate sampling had been undertaken is required. This information is presented in the EA team's technical report titled Natural Environment Characterization and Impact Assessment Report provided in Appendix H.

The 2010 habitat investigations identified Walleye and Pike as the primary species targeted by anglers within the Ivanhoe River in the area of The Chute (Appendix H). EC sought clarification as to why the proponent targeted only Walleye in its spawning survey.

The Agency recommended that baseline studies be continued to determine mercury concentrations in sport fish and in the Study Areas, detailing specific parameters to which the proponent has committed to in future work plans. It was noted that further consideration was required since the undertakings would result in the creation of upstream headponds, presenting the potential of an increase in methylized mercury levels in both surface water and fish tissue.

EC requested an estimate of the expected temperature and volume of the thermal discharge from either of the facilities' powerhouse and clarification as to whether this discharge would be released into the Ivanhoe River in order to quantify the potential change in surface water temperature in the headpond due to increased surface area and slower flow velocity. EC noted that there was mention of small areas of wetland in the proposed The Chute development area and requested results of the study conducted which are provided in Appendix H. Additional information and measurements were requested in relation to hardness of water, water levels and currents by EC; a copy of the correspondence is provided in Appendix C.

In response to EC's requests, the proponent committed to consultation with EC in 2011 in order to scope and undertake a surface water quality characterization study and impact assessment during subsequent field seasons leading up to the construction phase, in order to determine any potential negative effects of the proposed project on this regime. Subsequently, surface water characterization and monitoring has been developed with MOE and is included in Appendix G.

Baseline levels have been established through testing protocols developed with MOE. Xeneca commitments to post construction monitoring programs are included in Section 16 of the ER.

17.5.1.4 Federal EA Coordination Meeting—April 19, 2011

An EA Coordination meeting for the proposed project was held in Timmins on April 19, 2011. The CEAA was unable to participate in the meeting and requested a copy of the meeting minutes; the Agency was provided with the final meeting minutes on June 13, 2011.

17.5.1.5 Department of Fisheries and Oceans

Fisheries and Oceans Canada (DFO) was identified as a Responsible Authority for the project. DFO outlined their concerns and responsibilities including impacts to fisheries and fish habitat around the project sites and at any proposed water crossings, as well as provisions for fish migration and passage, and the requirement for detailed information.

Federal scoping documents for the two proposed Ivanhoe River facilities was issued by DFO in the months following the EA Coordination meeting in April 2011. The scoping documents outlined the federal review team and the environmental and project components that must be assessed.

17.5.1.6 Transport Canada

Transport Canada (TC) confirmed that based on the Project Description, approvals under the *NWPA* will be required. The agency confirmed it would provide a comprehensive list of requirements which would need to be addressed prior to accepting the outcomes of the EA and ultimately make a determination under the *Navigable Waters Protection Act*.

On September 9, 2011, TC issued their review comments on the July 2011 Environmental Report for the proposed The Chute project. The report was reviewed and evaluated within the context of the then-applicable CEAA (1992), and outlined the Department's responsibilities under the Act.

17.5.1.7 Revisions to Canadian Environmental Assessment Act—2012

In a July 12, 2012 letter (sent by DFO), Xeneca was informed that a federal EA was no longer required for the proposed Chute GS and Third Falls GS. On August 10, 2012, CEAA confirmed that it would no longer be involved with the proposed project as a federal EA was no longer required.

17.5.1.8 Future Federal Agency Consultation

Future consultation will be required with federal agencies during permitting as follows:

- DFO : The new *Fisheries Act* came into force in November 2013. As no serious harm to fish is anticipated as a result of the Ivanhoe project, it is anticipated that an authorization under the *Fisheries Act* will not be required.

- TC : given the federal government's passage of the new *Navigation Protection Act* to replace the original *Navigable Waters Protection Act* (NWPA), and the current plan not to include the Ivanhoe River in the Schedule of protected waterways, it is anticipated that an approval from TC will no longer be required. However, if the original NWPA is still in force at the time of the approval of this Class EA document, final detailed engineering drawings for each proposed Facility will be submitted to TC for a determination.
- **EC:** On March 22, 2011, Environment Canada was invited to attend the upcoming EA coordination meetings and an invitation to form part of the technical review team. They were also provided information on the release dates of upcoming supporting studies. No further communications were received from Environment Canada. No further consultation with them is planned.
- NRCan: Electronic correspondence was received from Natural Resources Canada on August 13, 2012, confirming that the Agency is no longer involved in the proposed undertaking as a result of the enactment of *CEAA 2012.* No further consultation with them is planned.

17.5.2 Provincial Agency Consultation

Provincial Ministries and Agencies consulted with during the Ivanhoe Class EA include:

- The Ministry of Natural Resources (MNR)
- The Ministry of Environment (MOE)
- The Ministry of Toursim, Culture and Sport (MTCS)
- The Ministry of Municipal Affairs and Housing (MMAH advised the proponent on July 20, 2010 (Appendix N) that their Ministry did not intend to comment as it was understood that consultation efforts with potentially affected communities was being undertaken by the proponent)
- The Ministry of Transportation (MTO)
- The Ministry of Energy (ME)
- Ontario Parks
- Ontario Clean Water Agency
- Ontario Ministry of Aboriginal Affairs
- Ontario Ministry of Northern Development and Mines (MNDM)

This section contains a detailed description of all consultation activities carried out with provincial authorities in the course of the Ivanhoe Class EA.

17.5.2.1 Ministry of Natural Resources Teleconference—March 3, 2010

The proponent and Ministry of Natural Resources (MNR) discussed information requirements for the work plan and Scientific Collectors Permits requirements for aquatic investigations in advance of the 2010 field season.

17.5.2.2 Project Introduction and Draft Notice of Commencement—June 10, 2010

These documents were provided to all provincial agencies.

17.5.2.3 Project Descriptions

A copy of the Project Description for The Chute and Third Falls was provided to all provincial agencies in November 2010 and February 2011.

17.5.2.4 MNR Meeting—September 2010

Species at Risk discussion with the Chapleau District Office to determine the applicability of the *Endangered Species Act* to the project. One species at risk, Lake Sturgeon, has been observed in the Ivanhoe River. MNR recommended that field work be conducted to determine if sturgeon spawning areas exist within the Study Area; studies were carried out in the fall of 2011.

17.5.2.5 Ministry of the Environment Letter—August 12, 2010

A response to the project introduction was received from the Ministry of the Environment (MOE)'s Regional Environmental Assessment Coordinator - Northern Region. The MOE cautioned the proponent that by proceeding with the Class EA for Waterpower Projects prior to having secured Applicant of Record status from the Ministry of Natural Resources, Xeneca was facing possible risks by not having the same level of information that is provided once Applicant of Record is awarded. The proponent was urged to discuss the classification of the waterway as unmanaged with both the MOE and MNR. Additionally, the proponent was advised that in the MOE's opinion the Draft Notice of Commencement (NOC) provided in the project information package failed to meet the minimum requirements for such a Notice. Detailed comments for the NOC were provided along with a request for a copy of the Final NOC and confirmation of advertising for the Notice. The NOC was subsequently revised and re-released to meet MOE suggestions. Discussions on the classification of the waterway have been ongoing with agencies since 2010, as can be seen in the Consultation Log in Appendix N.

The Ministry recommended that the proponent host an Agency coordination meeting prior to the release of the NOC. This was held on April 19, 2011.

The Ministry referred the proponent to various resources aimed at ensuring that Aboriginal communities that should be consulted regarding the undertaking were identified. The MOE recommended that the proponent provide information directly to the Aboriginal communities that may be directly affected by or have an interest in the undertaking as early as possible. Details on aboriginal consultation can be found in Section 17.3.

The MOE also provided comment on the Project Description, consultation and issue resolution requirements, permits and approvals and federal triggers for waterpower projects. A copy of the letter issued to the proponent by the MOE is provided in Appendix N.

17.5.2.6 MNR Site Information Packages (SIPs)—October 19, 2010

Prior to the EA planning phase of the projects, the Ministry of Natural Resources, Chapleau District office, provided instructions specific to site release issues, including MNR's requirements for Aboriginal consultation, the procedures associated with the Site Release Policy, and the provision of a Waterpower Declaration Form. Site Information Packages (SIPs) for The Chute and Third Falls Facility locations were received from the MNR on October 19, 2010.

17.5.2.7 Ministry of Energy Email—December 21, 2010

The Ministry of Energy (ME) requested additional information on Xeneca's proposed approach to fostering Aboriginal and First Nation partnerships within the development proposal via an e-mail on December 21, 2010 (Appendix N). ME noted that although the Ministry might not participate in all planning meetings, the ME would like to be kept abreast of the planning process developments. Additionally, ME confirmed on January 5, 2011 (Appendix N) that they wanted to be included in the distribution of all technical documents and the ER in order to provide comment where appropriate. However, subsequent communications have not been responded to.

17.5.2.8 MNR Meeting—January 26, 2011

A meeting on January 26th, 2011 was held to discuss the following issues:

- Only one season of biological data, with historically low water levels. It was suggested that additional data collection in the 2011 field season would be required to augment the baseline studies (Appendix H). Date collection continued over 2012 and 2013 to meet agency requests and requirements.

- The importance of Aboriginal and local community consultation for the project as they might have extensive local knowledge of the river and surrounding area. Regular updates to MNR on Aboriginal community consultation were expected, and that a formal public and Aboriginal

engagement and consultation plan was required. A subsequent letter from the MNR to Xeneca dated May 17, 2011, outlined the next steps in Aboriginal engagement and consultation for the site release and environmental assessment processes and provided a clarification of responsibilities. A list of Local Aboriginal Communities and Identified Aboriginal Communities was provided. Public and Aboriginal Consultation Plans are located in Appendices L and M respectively.

- Sharing of information in regards to the operation of the Ivanhoe Lake Dam (rule curve) and other hydrological data for the river available currently, from the water level monitoring station and, in the future from the Facility once built. All required information was shared with the MNR.

- The preservation and protection of the Northern Claybelt Conservation Reserve located immediately downstream of the Third Falls project site. In 2013, Xeneca committed to operating Third Falls purely as a run-of-river Facility in order to fully re-naturalize downstream flows and ensure that the Conservation Reserve is not negatively affected.

- Water management planning requirements for the proposed facilities (i.e. dam operating plan and flood flow management plan) which can be found in Appendix D (*Proposed Operating Plan & Water Management Plan Amendment)*.

17.5.2.9 Ministry of Transportation Communication—February 18, 2011

The Ministry of Transportation (MTO) provided a response to several of Xeneca's proposed undertakings on February 18th, 2011. Information was provided as per the *Public Transportation and Highway Improvement Act* and applicable permits (Appendix N). MTO identified the requirements for any project that requires modification to a highway entrance. The Ministry identified that all connection lines must be placed outside of existing MTO Right-of-Way (ROW), and that permits will be required for all proposed ROW crossings or for lines located within 45 metres of MTO ROW limits. No further communications from MTO were received on this project.

17.5.2.10 MNR & MOE Meeting—April 15, 2011

The proponent met with a task team of MNR and MOE hydrologists to discuss the hydrologic modeling methodology undertaken to develop the Operational Plan for the sites. Modeling and analysis was conducted as per advice of MOE/MNR and can be found in Appendix F of the ER.

17.5.2.11 EA Agency Coordination Meeting—April 19, 2011

Meeting minutes are provided in Appendix N. The following key considerations were discussed:

- The project planning will be undertaken as a harmonized environmental assessment in order to integrate federal and provincial EA planning requirements. The proponent will follow the Waterpower Class EA process as approved under the Ontario *Environmental Assessment Act*, and incorporate additional information necessary to satisfy the requirements of the *Canadian Environmental Assessment Act*. In keeping with this agreement which encourages efficient and comprehensive planning, the proponent decided to incorporate the connection line ROW for the proposed The Chute GS into the environmental assessment of the undertaking even though under the provincial process, a <115 KV line is a Category A undertaking and is exempt from an EA. The MNR agreed that dispositions that may be required under the MNR-RSFDP Class EA may be embedded into the Waterpower Class EA if the proponent can demonstrate they have adhered to MNR-RSFDP Class EA planning principles.
- It was determined that discussion and decisions surrounding the classification of the project as being on a "managed waterway" would be deferred to the Operation Plans Meeting to be held April 28th, 2011. Subsequently a clarification on managed/unmanaged waterways was submitted by Ontario Waterpower Association to MOE. MOE accepted the clarification and Ivanhoe River was declared a managed waterway.
- Public Information Centres (PICs) were requested for Timmins, Chapleau and Foleyet. Public Information Centres are described above in Section 17.2.2. Consultation requirements include the need to present the findings of any investigations within the course of the environmental assessment process.
- Documentation identifying which First Nations had agreed to representation by the Wabun Tribal Council was requested by MNR to be included in the ER. This is discussed in Section 17.3, above.
- A detailed Construction Management Plan and Sediment and Erosion Control Plan are required at the permitting and approvals stage of the projects. These can be found in Sections N and M.
- Proposed access road and connection line corridor route maps will be required (found in Appendix C of this report) along with *Public Lands Act* permit applications.
- MNR stated that operations of the Ivanhoe Lake Dam will most likely not be altered in support of the nearby The Chute GS.
- It was agreed between the proponent and the MNR that the Zone of Influence of the project would be clearly identified in the *Proposed Operating Plan & Water Management Plan Amendment* (Appendix D) and through HEC-RAS modeling as part of the environmental report (Appendix F).
- MNR cautioned the proponent about proceeding with EA planning as site release approval had not yet been provided for the projects. It was recommended that the proponent initiate conversations with the Mattagami WMP Standing Advisory Committee to facilitate approval and incorporation into the Water Management Plan. The proponent must ultimately

demonstrate that water management planning was incorporated into all notification and display material either through the EA or through a separate water management plan amendment process. Further information on the Mattagami WMP can be found in Section 9.6.8. The proponent met with the Standing Advisory Committee in November 2011 (Section 17.2), and a PIC was held on the Mattagami WMP Amendment Process in October 2013 (see Section 17.2.2).

- All maps provided in the ER should show all protected area boundaries.
- the MOE stated that the Potential Regulatory Permits and Approvals List provided in the Project Description was insufficient and requested an expanded list of all activities that will occur during construction and operation, so as to provide the Ministry with sufficient detail to identify all applicable permits and approvals. This request was supported by MNR. This list is included in Section 7 of this Final ER.
- MOE stated that there is a concern with waste disposal for the undertaking since the local landfill does not have the capacity to accept the project's construction waste, noting an alternative for waste disposal will be required. The MOE stated the burning of waste on site would not be permitted. Three local waste disposal companies have been identified for all construction and operational waste. It will be their responsibility to identify appropriate waste disposal facilities.
- Concerns were expressed with the proposed timing for the completion of the EA since investigations planned to be completed subsequent to the date of the submission of the Environmental Report would not be addressed in the document. Additionally, they noted that there would remain the requirement for public consultation to present the findings of these post EA investigations. The EA team explained that the proponent's approach would be to identify clear commitments in the Final ER to complete any outstanding studies thereafter, and to develop impact management strategies that would have to be agreed by the various agencies and honoured by the proponent moving forward, otherwise an amendment to the EA would be required.

17.5.2.12 MNR, MOE & DFO Meeting—April 28th & 29th, 2011

Attendees discussed the proposed operational strategy for The Chute Facility. The proponent presented the conceptual engineering design for The Chute site, and the proposed Operation Plan, which included maps of the upstream inundation zone of influence. Discussion included the following:

- The Agencies requested more details on the modeling parameters and methods in order to confirm the information. This additional information has been provided in the revised *Proposed Operating Plan & Water Management Plan Amendment* provided in Appendix D.

- Topics such as potential impacts to riparian land and civil structures were preliminarily discussed. The proponent advised that standard engineering design work such as a downstream dam break analysis would not be conducted until the detailed design stage of the project. The proponent considered that only a conceptual design was required for the EA planning stage and the legislative approvals stage would be where more detailed information was provided. MNR cautioned that it would be best to consider all potential impacts at the EA stage to avoid opening the addendum provision of the Waterpower Class EA at a later date.
- The erosion potential downstream in the variable flow reach was also identified as a potential information gap. The proponent committed to addressing this issue by providing an erosion potential assessment. An Erosion Potential Assessment (2011) and Geomorphic Assessments are provided in Appendix E.

17.5.2.13 Project Description Review—May 30, 2011

Comments on the Project Descriptions for both The Chute and Third Falls were received on May 30th, 2011 (see Appendix N). The MNR review comments on the Project Description document did not indicate any errors, but it was noted that the Document was deficient of some information which has since been addressed in this ER. Please see the Consultation Log in Appendix N for a full description of this correspondence and the resolution of issues identified. An addendum to the Project Description was therefore not prepared.

17.5.2.14 MNR Teleconferences—May 31 & June 15, 2011

Additional discussions were held on the subject of operations and potential ecological effects between the MNR, proponent and the EA team. The outcomes are summarized in a letter from Xeneca to the MNR dated July 4th, 2011 included in Appendix N.

17.5.2.15 Fish Management Objectives—June 1 & 9, 2011

The MNR provided Xeneca with draft Fish Management Objectives documents for the Ivanhoe River. The Fish Management Objectives noted that fish habitat upstream and downstream of the proposed project sites may be impacted by the inundation area and manipulation of flows downstream due to Facility operations. In the outlined objectives, the MNR advised Xeneca to maintain productivity of the river in the vicinity of, and downstream of the project sites for fish species targeted by recreational and commercial anglers. Additionally, Xeneca was advised that populations of sturgeon in the downstream reaches of the Ivanhoe River, as well as the Groundhog River, should be maintained. The MNR noted that due to the large drop in elevation at both the Third Falls and Chute sites, the falls are likely acting as a barrier to upstream fish movement so upstream fish passage won't be a project requirement.

However, given that downstream movement of larvae and adult fish is likely, operations at the facilities should allow for downstream fish passage to occur.

These comments and suggestions have been incorporated into Sections. 11.4 and 12.4 of this ER.

17.5.2.16 MNR Ivanhoe River Usage Survey—initiated June 6, 2011

The Ministry launched the Survey with the approval of the proponent in order to assist all parties in gaining a better understanding of the use of the area by recreational anglers and commercial outfitters. Details of this survey can be found in Appendix N, and the results of this survey are included in the socio-economic analysis provided in Section 9.7.

A public usage survey was drafted by the Ministry of Natural Resources (MNR) to solicit public input on the proposed undertaking. Prior to the opening of Walleye season, the Chapleau District MNR distributed log sheets to local outfitters known to frequent The Chute/Third Falls sites, asking that they record catch/keep data from their clientele. The Ministry also launched an Ivanhoe River Usage Survey on June 6, 2011 with the approval of the proponent in order to assist all parties in gaining a better understanding of usage by recreational anglers and commercial outfitters. Notices and comment boxes were installed at both the Third Falls site and The Chute site (see picture provided in Appendix N). This study assisted with the identification of the proposed developments' potential impacts on the fisheries and recreational enjoyment of the Ivanhoe River. A copy of the survey is provided in Appendix N. Ministry staff returned to the sites on June 17th, 2011, to collect the comment cards and stopped by one of the outfitters to collect any information recorded to date. There were no comment cards submitted at either site. However, the outfitter provided a number of catch/keep records of angling activities. Most of the angling activity was focused around The Chute site, directly below the rapids from either the shore or from boats, with a total of sixty-five (65) Walleye harvested. Additional visits to the site boxes and to other outfitter operators by the Chapleau District MNR staff was planned throughout the remainder of the summer and fall seasons; the resulting information was provided to the proponent and is included in Appendix N.

17.5.2.17 Notice of Completion for The Chute—July 14, 2011

On July 14, 2011, Xeneca published its Notice of Completion for the proposed The Chute GS and provided a 60-day review period which ended September 12, 2011. A total of seven Part II order requests were submitted to the MOE and to Xeneca between August 9th and September 12th, 2011.

17.5.2.18 Environmental Report for The Chute—July 15, 2011

A draft Environmental Report was submitted to all agencies for review and comment.

17.5.2.19 MNR Letter—July 22, 2011

The MNR sent Xeneca a letter outlining some concerns. These concerns included inadequate information being provided on the increased dynamic inundation zone, the need to address variable flows upstream and downstream of The Chute through modelling, the need to analyze base and peak flows, ramping rates, frequency of peaking, and the impacts of these flows relative to the natural flow regime. MNR also expressed concerns regarding erosion of the inundation zone and downstream areas because of the fine substrate materials in the Project Area. MNR also indicated that the riverine index netting program for 2011 would need to include fish ageing data to provide adequate baseline information that could be used as a target during the post-construction phase.

Concerns relating to hydrological modelling and inundation have been addressed in Section 11.2.1 and 12.2.1 of this report. Erosion is addressed in Section 11.1.4 and 12.1.4. Baseline conditions for fish populations and impacts of the project on fish, including post-construction monitoring, are included in Section 9.4.

17.5.2.20 MTCS Letter—August 2011

In August 2011, the MTCS informed the project team of the registration of a site on the island at The Chute due to the reported presence of culturally modified trees. Field visits in September 2011 yielded no evidence of the presence of such trees (see Appendix K), and the proponent subsequently sent a request to the MTCS on October 5, 2011, to have the site registration cancelled. The MTCS declined to cancel the site registration, but did put a note on the file stating that the site was no longer of concern.

17.5.2.21 MNR Letter—September 2011

Key concerns were identified with the July 15 draft ER, as follows:

- Zone of influence and assessment of potential impacts: information and analysis were missing from the potential effects identification matrix, especially in light of the expanded zone of influence downstream of The Chute to the junction with the Groundhog River. This concern has been addressed in Section 3.4 of this report.
- The document was missing a preliminary dam operating plan which would clearly outline the environmental effects expected from the operation of the Facility and the resulting requirement for mitigative and/or monitoring strategies. The dam Operating Plan has been included in Appendix D.
- Inadequate hydrological monitoring was available to identify the flows needed at The Chute to provide a Q80 baseflow at the crest of Third Falls. Hydrological monitoring is discussed and addressed in Appendix F.

- The procedural aspects of aboriginal consultation had not yet been completed. Aboriginal consultation is included in Section 17.3 of this report.
- Post-construction monitoring had not been included in the Environmental Report. Post-construction monitoring has been described in detail in Section 16 of this Report.

17.5.2.22 MTCS Letter—September 12, 2011

On September 12, 2011, Xeneca received a letter from the Ontario Ministry of Tourism and Culture (now the Ministry of Tourism, Culture and Sport) advising the proponent that the information relating to identifying all known and potential cultural heritage resources was inconsistent within the initial The Chute EA Report submitted. The letter indicated that The Chute may be considered a cultural heritage landscape because of the request made by the Chapleau Cree to consider a modified dam structure for aesthetic reasons at this location. The Ministry also commented that not enough information had been gathered on the known and potential cultural heritage resources to be able to evaluate the potential project impacts. The MTCS also recommended that Xeneca conduct a marine archaeological assessment at the project site as a best practice, because of the potential impact on marine archaeological sites.

Xeneca sent a comprehensive response on November 7, 2013 that can be found in Appendix N. It included a completed Cultural Heritage Checklist to substantiate the claim that a Cultural Heritage study was not warranted at the site, and that there were no characteristics leading to the necessity of a marine archaeological assessment.

17.5.2.23 MOE The Chute Letter—October 6, 2011

In a response to The Chute Environmental Report and NOC, MOE suggested that additional public, agency and aboriginal consultation opportunities be provided following the completion of the 2011 field season (Appendix N). Based on the information provided, the MOE was not able to determine whether sufficient consultation was provided to Aboriginal groups for the EA process, and was also unable to determine what level of aboriginal consultation would be required for the permitting and approval process to follow.

The MOE also indicated that there were a number of studies and potential effects that were not fully assessed in the initial The Chute ER. Studies which had been initiated but were not yet complete included those relating to the thermal regime, water quality, general field studies and archaeological Stage 1 and 2 assessments. There were a number of outstanding technical issues that had not been adequately addressed in the report. These included issues related to the consideration of different options, zone of influence, hydrology and hydraulics, water quality, benthic invertebrates, mercury, economic and socio-economic effects, cumulative impacts and archaeological effects, waste, and permitting issues.

Xeneca responded in a letter dated October 14, 2011, indicating that the comments received would be incorporated into the process moving forward, and that Xeneca's immediate concern was to address the Part II Order requests to support the MOE's processes.

17.5.2.24 MOE Letter—March 2, 2012

MOE advised that the July 2011 Environmental Report for the proposed The Chute GS be revised and that Xeneca should re-issue a new Notice of Completion. MOE instructed Xeneca to consult with potentially affected or interested Aboriginal communities to gain information related to traditional land and water use and potential impacts to aboriginal or treaty rights and incorporate this information into the Environmental Report. It was suggested that further consultation with both MNR and MOE would be required to clarify the zone of influence and to determine what additional studies would need to be completed to adequately assess potential effects of the project. It was also suggested that a revised version of the report be provided to all regulatory agencies for comment prior to re-issuance, and that following the Notice of Completion re-issuance, the MOE would further investigate the Part II Order requests received between August 12 and September 9, 2011, as well as any additional requests received after the re-issuance of the new Notice of Completion.

At this point it was decided that Xeneca would combine both The Chute and Third Falls proposed projects into one comprehensive Environmental Report.

17.5.2.25 MNR, MOE & DFO Meeting—August 16, 2012

In advance of the meeting between Xeneca, the MNR, MOE and DFO, these regulators were provided with a draft operating plan for the two proposed Ivanhoe River developments; the 2012 version also presented both options for the location of the Third Falls powerhouse (inside and outside of the conservation reserve).

At the meeting, Xeneca updated the agencies on the status of studies completed, identified key issues, and discussed potential mitigation options and approaches. Highlights include:

- Route planning for the proposed power lines.
- MNR requested an updated Notice of Commencement for the combined EA process.
- Hydrological modelling was discussed. Xeneca proposed that modified run-of-river operations will be conducted at The Chute and Third Falls. Two hydrology reports were completed by two different consulting firms. The fast water features downstream of Third Falls and the impact of these features on the hydrological modelling required were discussed. Xeneca was to ensure its consultants include within their reports a discussion of the uncertainties and limitations of the modelling used, and to suggest that a model verification exercise be completed at project commissioning. These requests were incorporated into subsequent reports.

- Modelling at the Third Falls site and Conservation Reserve (CR). MNR shared a concern regarding erosion when the Ivanhoe River is at low flows, and the need to ensure that the Northern Claybelt Forest Complex Conservation Reserve will not experience erosion as a result of the project. Xeneca committed to retaining a geomorphology consultant to address the potential for erosion with MNR, which was subsequently done.
- The potential impacts on area tributaries.
- Brook trout and the required potential mitigation if they were found to be present, and where lake sturgeon may be present.
- Xeneca discussed plans to initiate a deregulation of a portion of the CR to continue further analysis of an in-CR option with respect to the Third Falls project. The need to potentially utilize the CR lands for road access to the Third Falls site was also discussed; Xeneca was later informed that a deregulation of this portion of the CR would be required for access road construction. Ultimately, Xeneca committed to alter operations of the facilities to ensure no impacts to the CR, and no infrastructure is planned within the CR borders.
- The preferred option for best placement of the dam structure at the two channels of The Chute was discussed. The eastern channel was selected as being the most suitable for minimizing the impact to spawning habitat, which is dominant in the western channel.

17.5.2.26 MNR, MOE & DFO Meeting—March 1, 2013

Facility operations, the downstream Zone of Influence, sediment and erosion, assessment of lines and roads, and Brook trout were discussed. During this meeting, the MNR noted their concern about the loss of fast water features as a result of inundation created by Third Falls, and stated that a habitat compensation plan and a description of mitigation efforts must be included in the EA for the proposed Ivanhoe River projects. The habitat compensation plan and mitigation measures can be found in Section 11.4 and Section 12.4 of this report.

The need to assess tributaries within the headpond of Third Falls was also discussed, due to the potential for suitable Brook trout habitat to be impacted by inundation. MNR noted that there did not appear to be sufficient information at the time on impacts in the tributaries, and that should impacts occur, compensation would be required. Impacts on tributaries have been assessed in Section 11.4 and 12.4 of this report.

MNR also expressed concern regarding the then-proposed operations for Third Falls, which at the time of the meeting, was to vary outflows from the Third Falls GS while ensuring a minimum flow is supplied to the downstream reaches of the river at all times. The MNR explained that impacts to natural flows in the nearby conservation reserve would be subject to a much higher standard of ecological study and restraint.

Following the March 1, 2013 meeting with the MNR, MOE and DFO, Xeneca made a formal commitment to the MNR to operate the Third Falls GS under a run-of-river regime in order to avoid or mitigate downstream environmental effects within the Conservation Reserve (see the March 13, 2013 letter in Appendix N of this report). Xeneca noted, though, that they would be completing additional environmental studies inside and outside of the nearby Northern Claybelt Forest Complex Conservation Reserve to assess the potential impacts of using an alternate operating regime at Third Falls. Xeneca stated that, should the results indicate that the effects are within acceptable ranges, they will undertake the steps required to amend permits to ease restrictions on that Facility's operations.

17.5.2.27 Ontario Clean Water Agency

OCWA was contacted by the EA team to verify the water intake location for Foleyet and to identify any outstanding issues. OCWA identified high and low water levels as being a concern for the operation of the water treatment plant, citing past issues with seasonal runoff and drought conditions.

17.5.2.28 Ontario Ministry of Natural Resources

The Ontario Ministry of Natural Resources (MNR), based on its mandate to manage natural resources and to promote renewable energy in the province, has legislative as well as natural heritage and water management planning policy roles in these projects.

The proponent's notification and consultation with the Ministry includes the provision of early notices of the projects, requests for background/baseline information on Natural Heritage information in the vicinity of the project sites, scoping consultation, and requests for Scientific Collectors Permits to undertake terrestrial and aquatic baselines surveys within the anticipated project zones of influence.

As the MNR is a key agency in the development process for waterpower, Xeneca is committed to ongoing consultation throughout the permitting and approvals stage following the Environmental Assessment.

17.5.3 Municipal Consultation

The project sites are located in the geographic townships of Oates and Bedford, west of the City of Timmins. No incorporated municipalities exist within or adjacent to the proposed Project Area. Throughout the Class EA, the proponent consulted with the City of Timmins, Chapleau and the Foleyet Local Services Board (FLSB).

17.5.3.1 Project Description Reports and Notices of Commencement—November 19, 2010 and February 2, 2011

The Project Description document for the proposed Chute GS and Third Falls GS were provided on November 19th, 2010, and February 2nd, 2011, respectively, to the City of Timmins.

17.5.3.2 FLSB Meeting—November 1, 2010

Draft versions of the information panels for upcoming public information centres (PICs) in Foleyet were presented and can be found in Appendix N. Xeneca outlined its corporate profile, the Class EA for Waterpower process, and presented conceptual project designs and development timelines.

At the November 1, 2010 meeting, Foleyet LSB expressed concerns about the potential for the project to impact the town water supply and water intake, and the sewage treatment plant. Xeneca replied that the upper limit of the proposed Chute project zone of influence would be located approximately 14 km downstream from the water intake, and that the project's anticipated upstream zone of influence would not extend beyond 3 km upstream of the proposed dam, adding that there would be minor, if any, impact to the river in the vicinity of Foleyet. The LSB noted a previous dam failure at Ivanhoe Lake Dam which resulted in significant damage within the town. Xeneca responded that water control at The Chute would be automated and that the Facility design is based on extreme flood conditions.

LSB members identified that the community's drinking water and sewage treatment is managed by the Ontario Clean Water Agency (OCWA) and that OCWA should be included in the planning process (meeting notes in Appendix N). The proponent followed up and met with OCWA, as seen above. The economic cost and benefits to Foleyet were discussed, and it was noted that Xeneca will endeavour to procure goods and services locally where possible.

Members enquired as to Xeneca's expertise and experience in building and operating waterpower plants and they were directed to the Misema GS near Englehart, Ontario. The executive team at Xeneca Power Inc. was part of the team that developed the Misema GS.

Questions were raised as to the impact to terrestrial wildlife (particularly the rare white moose population). The proponent advised that more definitive answers would be provided in the Waterpower Class EA technical reports (see Appendix H). The report does not specifically address the rare white moose population, but encompasses moose populations as a whole.

17.5.3.3 Revised Notice of Commencement—November 10, 2010 and December 22, 2010

A revised Notice of Commencement was issued on November 10th, 2010, with a third NOC revision issued on December 22, 2010. A copy of each NOC is provided in Appendix L. A revised Notice of Commencement was issued on November 10th, 2010, with a third NOC revision issued on December 22, 2010.

17.5.3.4 EA Coordination Meeting—April 19, 2011

The Foleyet Local services Board (LSB) attended the EA Coordination meeting. The LSB requested an additional PIC in Foleyet in May. The LSB re-iterated its concerns about water levels since Foleyet's sewage treatment Facility (two lagoons - alternate discharge to river) may be impacted by loading rates which in turn could affect water quality.

A guarantee was sought from the proponent that there would be no impacts to the community's potable water supply as a result of this undertaking.

FLSB sought clarification as to whether Xeneca would provide notification prior to operating its Facility, and whether the project would have an effect on operations at the Ivanhoe Lake Dam. A letter to the proponent was circulated by the LSB at the meeting (Appendix N).

17.5.3.5 FLSB Communication—May 5, 2011

The Local Services Board of Foleyet was contacted by the EA team on May 5th, 2011 to determine the location of the sewage treatment plant and the information was referenced to aerial photography for confirmation.

Given that the water supply intake and sewage treatment Facility outflow are both located well upstream of the 6.4 km inundation area, it is not anticipated that the project will result in impacts to the Town's potable water supply or wastewater treatment Facility. In an August 15, 2012 letter to the board, Xeneca made a formal commitment that the proposed Chute and Third Falls projects would have no impact on Foleyet's water supply or sewage treatment facilities. Xeneca committed to ensuring that clean water would be brought in, in the unlikely event that Xeneca's construction or operational activities could ever affect water for Foleyet.

17.5.3.6 FLSB Letter—May 13, 2011

In a May 13, 2011 letter to Xeneca, the Local Services Board expressed concerns regarding the potential for The Chute GS and Third Falls GS to exacerbate problems with flooding and low water levels and questioned how they would be notified of water level changes. In June of 2011, Xeneca

committed to meet with the Board prior to the PIC being organized on July 7th in Chapleau for further discussion on these topics; this Public Information Meeting was held on July 6, 2011, in Foleyet, and is summarized in Section 17.2.2 above.

In a January 24, 2012 letter to the FLSB, Xeneca committed to maintaining public access to the proposed Chute project site, and that restrictions would only be implemented where required to ensure public safety. Additionally, Xeneca expressed willingness to collaborate in the development of a small parking and rest area, and the improvement of an existing boat launch, with input from the town. These concerns were raised previously in several venues, as described above.

18.0 PROJECT SUMMARY & CONCLUSIONS

18.1 Consultation Activities Resulting in Changes to the Project

The substantial consultation activities undertaken by Xeneca over the course of the assessment has altered the Project design in important ways, including but not limited to the following:

1. Impacts to the Northern Forest Claybelt Complex Forest Conservation Reserve: The original modified run-of-river operating plan for the Third Falls Facility had the potential to affect the Conservation Reserve. Due to the importance of the Reserve to agencies and the public, Xeneca committed to making Third Falls fully run-of-river. Additionally, the original Project plan had components placed within the Conservation Reserve. These have been moved fully outside of the Conservation Reserve in order to ensure no impacts to this important ecological feature.
2. Impacts to Mature White Cedars at Third Falls: Due to Aboriginal concerns regarding culturally important mature White Cedar trees within the planned access road route at Third Falls, the access road was re-routed to align with an existing turning loop and minimize the removal of these significant trees. Where the mature White Cedars will still need to be removed, the Aboriginal communities will be consulted and removal efforts will be coordinated between them and the Sustainable Forest License holder.
3. Impacts to existing portage routes and an existing boat launch: The Ivanhoe River is an official canoe route, and access to navigation is a concern of the public and of Aboriginal communities. Xeneca has committed to retaining access at current levels post-construction. Some portage routes may be affected, but not in any way that will alter their usability; in the event that portage routes are no longer usable after construction, Xeneca has committed to reconstructing them in consultation with the MNR. The boat launch, which may be inundated by Project operations, will be reconstructed and improved.
4. Economic Benefit Agreements: Economic Benefit Agreements have been negotiated with all interested Aboriginal communities, in order to ensure that their economic needs and priorities are reflected in the Project.

18.2 Commitments

The following sections outline commitments made by the proponent in order to ensure the development of a sustainable waterpower project.

18.2.1 General

- The proponent is committed to ensuring compliance with the ER as a contract with the people of Ontario.

- The proponent is committed to the adoption and application of the mitigation measures outlined within this document for both the construction and operation of the proposed undertakings according to applicable legislation (i.e. adherence to Construction Management Plan and best management practices, such as applicable DFO Ontario Operational Statements as listed at http://www.dfo-mpo.gc.ca/regions/central/habitat/os-eo/provinces-territories-territoires/on/index-eng.htm). This may be achieved through the hiring of an environmental monitor for the duration of the construction program and through operator training on environmental issues within the operational phase of the projects.
- The proponent will implement the monitoring measures for pre-construction, construction and operations as outlined in Section 16.
- The proponent will apply the mitigation measures for erosion and sedimentation presented in the Preliminary Erosion and Sediment Control Plan (see Appendix E). Such mitigation measures include phasing construction to minimize the duration of soil exposure, maximizing the retention of existing vegetation cover, installing silt fences around stockpiles of erodible material, and monitoring the effectiveness of the mitigation measures throughout the construction period. The proponent will further develop the Erosion and Sediment Control Plan (Appendix E) before the start of the construction phase for the proposed undertakings.
- The proponent will monitor incoming flows to the headpond of The Chute and outflows from the Third Falls tailrace to ensure that natural flows continue to pass into the Northern Forest Claybelt Complex Forest Conservation Reserve (i.e., to confirm that the Ivanhoe River is renaturalized downstream of Third Falls).
- The proponent is committed to the development and implementation of a regular reporting process including a Project Implementation Report. The format and content of this report will be discussed with local stakeholders and agencies to meet their needs.
- The proponent is committed to the protection and conservation of culturally modified trees (CMTs) and culturally significant trees in proximity to the project sites. Through consultation with First Nations communities, the proponent has developed an understanding for the cultural significance of these trees, and has discussed their location and protection with First Nations communities
- In the unlikely event that bridges within the project`s headpond are affected, the proponent is committed to indemnifying the bridge owners for damages and repairs.

18.2.2 Facility Operations

- The proponent is committed to verifying the specific operational parameters as identified in the Operations Monitoring Program (Section 16) and in consultation with regulators and to documenting any updates in the operational plan for the Facility.

- During intermittent operations, The Chute Facility will continue to pass the volume of water which would pass the Facility naturally over the same 24 hour period.
- The operation of the Facility will be aligned with the existing Mattagami River Water Management Plan (WMP) during a comprehensive review in 2014. The Chute and Third Falls Operating Plan will be made available to all identified stakeholders (please see the *Proposed Operating Plan & Water Management Plan Amendment* in Appendix D and reference to stakeholder list) for consideration during the EA review process and for discussion in subsequent stages of the development. The approved *Proposed Operating Plan & Water Management Plan Amendment* in Appendix D will become part of the Mattagami River WMP through a *Lakes and Rivers Improvement Act*, Section 23.1, Water Management Plan amendment. After the approval of the amendment, Xeneca will participate in the Mattagami River WMP process.
- To ensure that the Project will not have any deleterious effect on the Northern Forest Claybelt Complex Forest Conservation Reserve located downstream of the project zone of influence the Third Falls project will re-naturalize the flows.
- Xeneca is committed to operating within the existing flows provided by the upstream Ivanhoe Lake Dam without causing any change to the Ivanhoe Lake Dam operations.

18.2.3 Consultation

- The proponent is committed to realizing a signed Memorandum of Understanding with the Wabun Tribal Council.
- The proponent is committed to continuing to engage specific community and Aboriginal stakeholders on relevant issues after the issuance of the Notice of Completion and Statement of Completion.
- The proponent is committed to sharing all information from studies as well as the operational strategy proposed for the site with the interested First Nation, Aboriginal and other communities.
- Xeneca will apply the mitigation measures outlined in 12.6 to minimize impacts to the remote aesthetic image of the general area and to remote tourism operators.

18.2.4 Further Investigations

- The proponent will update the Construction Management Plan based on advanced project design to include instructions and protocols for minimizing the disturbance to valued ecosystem components.
- Based on First Nation input, alternative materials other than concrete will be considered in construction pending approval by the MNR.

- The proponent will document and verify impacts associated with inundation and flow effects within the zone of influence upstream (inundation area) and downstream (variable flow reach) of the Facility.
- The proponent will continue to actively solicit the involvement of participating Aboriginal communities in any cultural heritage assessment activities to be undertaken for the project.

18.3 Conclusion

The Project Proponent, Xeneca, has undertaken this Class Environmental Assessment in support of the Ivanhoe Project. Assessment work has included several years of field studies on ecology, archaeology and cultural heritage, extensive consultation activities with public and agency stakeholders and Aboriginal communities, several revisions of the Project design, and the submission of this Environmental Assessment Report with detailed and extensive mitigation measures, commitments and monitoring from pre-construction to operations.

Hydroelectricity generating projects such as the Ivanhoe Project are an important component of the Government of Ontario's commitment to greenhouse gas emission reductions and improvements to air quality, through reducing the demand for electricity generated from fossil fuels. The Ivanhoe River has been designated as "general use," and therefore appropriate for such hydroelectric projects. Xeneca is excited about contributing to a clean energy future for Ontario through developing hydroelectric projects such as the Ivanhoe Project.

Previously, the Ivanhoe Project was two separate hydro projects, The Chute project and Third Falls project. However, public and agency concerns relating to the cumulative interactions between the two projects led Xeneca to combine the separate projects and conduct an assessment as one Project.

Aboriginal and First Nation engagement was undertaken with each community's leadership as part of the business to business Aboriginal consultation initiative by the proponent. A comprehensive engagement initiative with each community located within, or having traditionally used the Project Area has been underway since issue of the Notice of Commencement and will continue beyond Notice of Completion and into project implementation. Additionally, the Stage 1 and Stage 2 archaeological assessments of the project determined that there were no cultural resources which would be impacted by the project.

Throughout this document, management strategies have been developed and applied to known impacts in order to avoid, prevent or minimize any identified adverse environmental effects of the Project. It is the conclusion of this Environmental Assessment that the planned undertaking will result in residual effects after mitigation measures are employed. An analysis of the identified residual environmental effects was undertaken to determine their significance, and commitments for any

required additional measures for the further management of these potential residual effects, including monitoring have been made. The majority of the identified residual effects were determined to be "*Insignificant*", meaning that they are not likely to cause unacceptable harm to environmental quality, productive capacity of the effected environment, or the socio-economic and cultural attributes of the area. Compensation such as Habitat Offsetting and monitoring are included in the determination of the significance of the residual effect.

There are also many positive environmental effects associated with the Project, including:

- Tangible Economic Outcomes for the Local Communities and the Regional / Provincial Economy:
  - Benefit to the local SFL holder by sale/processing of merchantable timber along the connection line and access road ROWs, and the merchantable timber to be harvested from the area of inundation.
  - Direct economic activity to build a waterpower project in Ontario is approximately $5 million per megawatt. Generally, about half of this amount is spent locally (approximately $9 million in the case of this project), in procuring construction labour & materials, consulting and legal services, trucking and other services such as accommodation, food and fuel.
  - Employment and training opportunities (planning, construction and operation phases of the project);
  - A significant return to the people of Ontario paid through Gross Revenue Charges (GRC) and provincial and federal income taxes. Return to the people of Ontario will continue past the 40 year contract, likely as long as the Facility is in operation.
- Creation of reliable and secure green energy for the province and reduced Greenhouse Gas emissions:
  - The project will reduce CO_2 emissions by eliminating the need for an equivalent amount of electricity to be produced through the combustion of fossil fuels.
  - Benefits to the population, commerce and industries of Ontario by providing more reliable and consistent renewable power to the provincial grid for many years to come. Many power plants built in the early 1900s are still in operation and with regular maintenance and upgrades can last for generations to come.

- The operation of the Facility in the existing power grid will be compatible with the overall power system reliability and power quality (voltage and frequency) objectives while improving distribution customer service reliability in this area, from a sustainable and consistent power source.

- The generation of electricity through a renewable energy supply in support of the province's *Green Energy Act*.

Preliminary planning discussions towards the development of various management strategies are outlined in this document, and the proponent will continue to work with the regulators and other interested parties in support of securing approvals for this undertaking. The application of the recommended management strategies and adherence to the identified commitments by the proponent will help to realize a sustainable renewable energy development project.

Xeneca is committed to ensuring that the Project contributes positively to the Province and the Region in which it is proposed.

19.0 ACKNOWLEDGEMENTS

The proponent necessarily reserves the right to variances between the conceptual design presented herein and the final detailed engineering design, provided that such variances do not materially and negatively impact the environment beyond the scope of the impacts described herein. The proponent recognizes that any changes to the project that are determined to be significant and which may result in new negative effects to the environment will require an addendum to the Final ER as per the Waterpower Class EA.

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The environmental assessment team included internal departments within Xeneca as listed above, as well as, technical consultant firms retained by Xeneca for the proposed undertaking as such:

- Canadian Projects Limited
- Hatch
- Hutchison Environmental Sciences Ltd.
- KBM Resources Group
- Natural Resource Solutions Inc. (NRSI)
- Northern Bioscience
- OEL-HydroSys and WESA, divisions of BluMetric Environmental Inc.
- ORTECH Consulting Inc.
- Parish Geomorphic Ltd.

- R.J. Burnside and Associates Limited
- Woodland Heritage Services
- Thomson Environmental
- Archaeological Services Inc.

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GLOSSARY, DEFINITIONS & ACRONYMS

AAND	Aboriginal Affairs and Northern Development (formerly Indian and Northern Affairs Canada)
ANOVA	Analysis of Variance
APLIC	Avian Power Line Interaction Committee
ARD	Acid Rock Drainage
ARA	Aggregate Resources Act
AOC	Area of Concern
AQI	Air Quality Index
BOD	Biological Oxygen Demand
BMP	Best Management Practice
CALA	Canadian Association for Laboratory Accreditation
CEAA	Canadian Environmental Assessment Act
CEA Agency	Canadian Environmental Assessment Agency
CCFN	Chapleau Cree First Nation
CCME	Canadian Council of Ministers of the Environment
CH_4	Methane
CLUPA	Crown Land Use Policy Atlas
CMS	Cubic metres per second (m^3/s)
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
CR	Conservation Reserve
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EC	Environment Canada
US EPA	United States Environmental Protection Act
ESA	Endangered Species Act
ER	Environmental Report
FEAC	Federal Environmental Assessment Coordinator
FIT	Feed-In Tariff
GEEA	Green Energy and Economy Act
GHG	Greenhouse gas
GS	Generating Station
HC	Health Canada
HEC-RAS	Hydraulic Engineering Center River Analysis System
IBA	Impact Benefit Agreement

INAC	Indian and Northern Affairs Canada (this is the former name of Aboriginal Affairs and Northern Development Canada
IPCC	Intergovernmental Panel on Climate Change
LiDAR	Light Detection and Ranging (a remote sensing method)
LRIA	Lakes and Rivers Improvement Act
LTAF	Long term annual flow, average annual mean
ME	Ministry of Energy
ML	Metal leaching
MNDM	Ministry of Northern Development and Mines
MNR	Ministry of Natural Resources
MOE	Ministry of the Environment
MMAH	Ministry of Municipal Affairs and Housing
MTCS	Ministry of Tourism, Culture and Sport
MTO	Ministry of Transportation
NOC	Notice of Commencement
NO_2	Nitrogen Dioxide
N_2O	Nitrous Oxide
NPC	Environmental Noise Guideline, Stationary and Transportation Sources - Approval and Planning
NRCan	Natural Resources Canada
NRSI	Natural Resource Solution Inc.
NWPA	Navigable Waters Protection Act
O_3	Ozone
OBBA	Ontario Breeding Bird Atlas
OCWA	Ontario Clean Water Agency
OFAH	Ontario Federation of Anglers and Hunters
OPA	Ontario Power Authority
OWA	Ontario Waterpower Association
PIC	Public Information Centre
PLA	Public Lands Act
PM	Fine Particulate Matter
QP	Qualified Person
Q_{99}	Streamflow exceeded 99% of time
Q_{95}	Streamflow exceeded 95% of time
Q_{80}	Streamflow exceeded 80% of time
Q_{50}	Streamflow exceeded 50% of time
Q_{20}	Streamflow exceeded 20% of time
Q_{EA}	Downstream environmental flow target
Q_{COMP}	Compensatory flow (between dam and tailrace)
Q_{MED}	Median streamflow value

Q_{TMAX}	Maximum turbine capacity
Q_{Tmin}	Minimum turbine flow
Q_{TL}	Limited turbine flow – modified ROR
Q_{HWM}	Streamflow corresponding to high water mark
7Q2	2 year return period 7-day-average-low flow
7Q10	10 year return period 7-day-average-low flow
7Q20	20 year return period 7-day-average-low flow
Q1:2	High streamflow event; occurrence of 1 in 2 yrs.
Q1:100	High streamflow event; occurrence of 1 in 100 yrs.
RA	Responsible Authority
ROR	Run-of-river
ROW	Right-of-Way
SAAS	Streamflow Analysis and Assessment Software
SAR	Species at Risk
SARA	Species at Risk Act
SCADA	Supervisory Control And Data Acquisition
SIAM	Sediment Impact Analysis Methods
SO_2	Sulphur dioxide
TC	Transport Canada
TRS	Total Reduced Sulphur compounds
TS	Transformer Station
TSS	Total Suspended Solids
UTM	Universal Transverse Mercator Units

Units

kW	kilowatt
kWh	kilowatt hour
m	metres
m^2	square metres
masl	metres above sea level
m/s	metres per second
m^3/s	cubic metres per second
MW	megawatt
MWh	megawatt hour
r/min	revolutions per minute
µg	microgram
umho/cm	micromhos per centimetre