

TERMS OF REFERENCE
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR AHP DEVELOPMENT CORPORATION'S
PROPOSED AMISK HYDROELECTRIC PROJECT

Approximately 28 km Southwest from Fairview, Alberta

ISSUED BY: Alberta Environment and Parks
DATE: February 3, 2016

TABLE OF CONTENTS

TABLE OF CONTENTS	2
GLOSSARY OF TERMS.....	4
PURPOSE OF THE TERMS OF REFERENCE	5
SCOPE OF THE EIA REPORT	5
CONTENT OF THE EIA REPORT	5
1 PUBLIC ENGAGEMENT AND ABORIGINAL CONSULTATION.....	5
2 PROJECT DESCRIPTION	6
2.1 OVERVIEW	6
2.2 CONSTRAINTS.....	7
2.3 REGIONAL AND COOPERATIVE EFFORTS	7
2.4 AIR EMISSIONS MANAGEMENT	7
2.5 DAM DESIGN AND CONSTRUCTION	8
2.6 DAM SAFETY.....	9
2.7 WATER MANAGEMENT	10
2.8 WASTE MANAGEMENT.....	10
2.9 CONSERVATION AND RECLAMATION.....	10
3 ENVIRONMENTAL ASSESSMENT	11
3.1 AIR QUALITY, CLIMATE AND NOISE.....	11
3.2 HYDROGEOLOGY.....	12
3.3 HYDROLOGY	13
3.4 SURFACE WATER QUALITY	14
3.5 ICE FORMATION AND BREAK-UP.....	14
3.6 FLUVIAL MORPHOLOGY AND SEDIMENT TRANSPORT	15
3.7 FISH AND FISH HABITAT	16
3.8 GEOTECHNICAL.....	18
3.9 TERRAIN AND SOILS.....	18
3.10 VEGETATION	19
3.11 WILDLIFE	19
3.12 BIODIVERSITY	20
3.13 LAND USE MANAGEMENT.....	21
3.14 BOATING AND NAVIGATION.....	21
3.15 TRANSPORTATION	22
4 HISTORIC RESOURCES	22
4.1 BASELINE INFORMATION.....	22
4.2 IMPACT ASSESSMENT	23
5 TRADITIONAL ECOLOGICAL KNOWLEDGE AND LAND USE	23
5.1 BASELINE INFORMATION.....	23
5.2 IMPACT ASSESSMENT	24
6 PUBLIC HEALTH AND SAFETY	24
6.1 PUBLIC HEALTH.....	24
6.2 PUBLIC SAFETY	24
7 SOCIO-ECONOMIC ASSESSMENT	24
7.1 BASELINE INFORMATION.....	24
7.2 IMPACT ASSESSMENT	25
8 MITIGATION MEASURES.....	25

9	CUMULATIVE EFFECTS.....	25
10	RESIDUAL IMPACTS.....	25
11	MONITORING.....	26

GLOSSARY OF TERMS

Fishway - a device, structure, or operating system that facilitates and provides for efficient fish passage upstream or downstream of any obstruction impeding the free passage of fish.

Headworks - the physical works of the Project in the river including the dam structure, powerhouse and spillway.

Headpond - a slower and deeper impoundment of water situated upstream, and created by the presence, of the hydroelectric facility.

Hydroelectric Power - electricity produced from the energy found in falling or fast-flowing water.

PURPOSE OF THE TERMS OF REFERENCE

AHP Development Corporation (the Proponent or AHP) proposes to develop the Amisk Hydroelectric Project (the Project) located on the Peace River, approximately 15 km upstream of the Dunvegan Bridge in northwestern Alberta. If approved, the Project will consist of a dam and associated headworks, a headpond, access roads, a connecting transmission line and substation and other construction related components (e.g., cofferdam, borrow pits, quarries, camp, laydown areas etc.) The current design proposal is for a 330 MW facility that would generate approximately 1,875 GWh/year.

The purpose of this document is to identify for AHP Development Corporation, Aboriginal communities and appropriate stakeholders the information required to prepare an Environmental Impact Assessment (EIA) report for the proposed Project. The EIA is to be submitted to regulatory authorities under the *Environmental Protection and Enhancement Act* (EPEA). Additional regulatory submissions will be required as part of the Project application and are not covered by the Terms of Reference.

SCOPE OF THE EIA REPORT

The Proponent shall prepare and submit an EIA report that examines the environmental and socio-economic and cultural effects of the Project.

The EIA report shall be prepared considering all applicable provincial and federal legislation, codes of practice, guidelines, standards, policies and directives.

The EIA report shall be prepared in accordance with these Terms of Reference and the environmental information requirements prescribed under EPEA and associated regulations, and the *Canadian Environmental Assessment Act* if applicable. The EIA report will form part of the Proponent's integrated application to the Alberta Utilities Commission (AUC) and the Natural Resources Conservation Board (NRCB). An EIA report summary will also be included as part of the Application.

The Proponent shall refer to the *Guide to Preparing Environmental Impact Assessment Reports in Alberta* published by Alberta Environment and Sustainable Resource Development (now Alberta Environment and Parks, AEP) (the Guide) and these Terms of Reference when preparing the Environmental Impact Assessment report. In any case where there is a difference in requirements between the Guide and these Terms of Reference, the Terms of Reference shall take precedence.

CONTENT OF THE EIA REPORT

1 PUBLIC ENGAGEMENT AND ABORIGINAL CONSULTATION

- [A] Provide a summary table of all engagement undertaken with the public, land owners and federal/territorial/municipal governments. Include a column which describes the concerns and issues expressed by the public and an outcomes column which describes the actions taken to address those concerns and issues, including how public input was incorporated into the Project development, impact mitigation and monitoring and reclamation.
- [B] Provide a summary table of all consultation undertaken with Aboriginal communities. Include a column which describes the concerns and issues expressed by Aboriginal communities and an outcomes column which describes the actions taken to address those concerns and issues. Describe how Aboriginal community input was incorporated into the

Project development, impact mitigation, monitoring and reclamation. Describe consultation undertaken with Aboriginal communities and groups with respect to traditional ecological knowledge and traditional use of land and water.

- [C] Describe plans to maintain the public engagement and Aboriginal consultation process following completion of the EIA report to ensure that the public and Aboriginal peoples will have an appropriate forum for expressing their views on the ongoing development, operation and reclamation of the Project.

2 PROJECT DESCRIPTION

2.1 Overview

- [A] Provide a brief project description in sufficient detail to provide context for the EIA, including:
- a) proponent information;
 - b) the existing socio-economic conditions in the region and in the communities in the region;
 - c) the need for the Project;
 - d) an identification and analysis of Project alternatives;
 - e) proposed power generation technology;
 - f) amount and extent of water impoundment required for the Project;
 - g) proposed facilities to connect to the Alberta electricity grid;
 - h) development plan and schedule;
 - i) life expectancy of the dam; and
 - j) insurance coverage for the construction and operation of the project.
- [B] Provide maps and/or drawings of the Project components and activities including:
- a) existing infrastructure (buildings, powerlines, utilities, boat launches);
 - b) existing leases;
 - c) proposed power generation facilities and containment structures;
 - d) temporary structures (e.g. construction camps and laydown facilities);
 - e) transportation and access routes;
 - f) total areas to be flooded by the Project;
 - g) proposed transmission line and substation;
 - h) sources of aggregate resources, borrow material and other construction material and locations of any stockpiles that will be developed; and
 - i) waste storage areas and disposal sites.
- [C] Discuss the implications of a delay in proceeding with the Project, or any phase of the Project, or not going ahead with the Project.
- [D] Describe the benefits of the Project, including jobs created, local training, employment and business opportunities, and royalties and taxes generated that accrue to:
- a) the Proponent;
 - b) local and regional communities, including Aboriginal communities;
 - c) the local authority;
 - d) Alberta; and
 - e) Canada.

- [E] Provide the adaptive management approach that will be implemented throughout the life of the Project, including how monitoring, mitigation and evaluation will be incorporated and how the regulator will be informed of any changes resulting from this approach.
- [F] Provide a list of commitments AHP has made. This would include any mitigation, monitoring and operational commitments made as part of this assessment.

2.2 Constraints

- [A] Discuss the process and criteria used to identify constraints to development, and how the Project has been designed to accommodate those constraints, including the following:
 - a) any applicable *Alberta Land Stewardship Act* Regional Plan, sub-regional plan or watershed plan;
 - b) any applicable municipal plan;
 - c) land use policies and resource management initiatives that pertain to the Project;
 - d) Aboriginal traditional land and water use;
 - e) all known traplines;
 - f) the environmental setting;
 - g) cumulative environmental impacts in the region;
 - h) cumulative social impacts in the region;
 - i) regional monitoring; and
 - j) potential for changes in the regulatory regime.
- [B] Describe criteria for site selection including dam and headworks, access roads, transmission line and other facilities.
- [C] Provide a list of facilities for which locations will be determined later. Discuss the selection criteria that will be used to determine the specific location of these facilities.

2.3 Regional and Cooperative Efforts

- [A] Discuss the Proponent's involvement in regional and cooperative efforts to address environmental and socio-economic issues associated with regional development.
- [B] Describe opportunities for sharing infrastructure (e.g., access roads, utility corridors, water infrastructure) with other resource development stakeholders. Provide rationale where these opportunities will not be implemented.

2.4 Air Emissions Management

- [A] Discuss the selection criteria used, options considered, and rationale for selecting control technologies to minimize air emission and ensure air quality management.
- [B] Provide emission profiles (type, rate and source) for operating and construction emissions of all relevant Project components including point and non-point sources and fugitive emissions. Consider both normal and upset conditions. Discuss:
 - a) odorous and visible emissions from the Project;
 - b) annual and total greenhouse gas emissions during all stages of the Project. Identify the primary sources and provide detailed calculations;
 - c) the Project's contribution to total provincial and national greenhouse gas emissions on an annual basis;
 - d) the Proponent's overall greenhouse gas management plans;
 - e) amount and nature of Criteria Air Contaminants emissions; and

- f) control technologies used to reduce emissions.

2.5 Dam Design and Construction

[A] Describe:

- a) all Project components and scope including a full range of potential dam heights and potential storage levels;
- b) the overall approach for design and technical specification;
- c) any hypotheses and assumptions used;
- d) data collection methods, models and studies;
- e) the degree of uncertainty, reliability and sensitivity of models used to reach conclusion; and
- f) any gaps in knowledge and understanding related to key conclusions, including steps to address these gaps.

[B] Describe:

- a) the principal dimensions of the dam and associated structures;
- b) the anticipated quantities of material used to construct the dam and associated structures;
- c) seepage control and drainage provisions;
- d) freeboard requirements;
- e) the field and lab testing that has been performed to determine the suitability of the materials; and
- f) the characteristics/geotechnical properties of the in-situ and construction materials and their suitability for use as construction materials.

[C] Describe the physical characteristics of the headpond, including:

- a) normal operating range;
- b) spatial extent/overlap into other tributaries, if any;
- c) surface area at the maximum normal headpond level, within the area of each tributary arm, as applicable; and
- d) normal operating water volume, and the volume between the maximum normal headpond level and the minimum normal headpond level.

[D] Describe the activities for construction of the dam and other associated structures, including:

- a) site clearing and grubbing;
- b) construction and operation of the temporary works required for construction (e.g., cofferdam);
- c) excavations, slope stabilization and foundation preparation;
- d) construction of the dam and its associated structures;
- e) river water management during construction;
- f) erosion protection;
- g) installation of instrumentation, mechanical and electrical equipment;
- h) testing and commissioning the facility;
- i) access roads;
- j) camps, laydown areas and other construction related facilities;
- k) borrow pits, quarries and sources of aggregate;
- l) boat passage;

- m) fishway;
 - n) transmission line and substation; and
 - o) removal of temporary construction facilities.
- [E] Describe the construction activities for headpond filling, including:
- a) inundation zone preparation; and
 - b) methods for managing debris and shoreline stabilization.
- [F] Describe the excavation and stockpiling of suitable material, including drilling, blasting, sorting and screening in rock quarries and moisture conditioning of impervious material.
- [G] Describe the operations phase activities, including:
- a) operation and maintenance activities needed for the safe operation of the dam and to prolong its operational capacity;
 - b) water management approach (for flood, normal, drought and ice conditions), including headpond operations and resulting downstream flows and water levels; and
 - c) operation and maintenance plans.
- [H] Describe the decommissioning activities, including:
- a) decommissioning of temporary construction facilities and any associated reclamation (e.g., cofferdam); and
 - b) dam decommissioning in the future, a plan to address decommissioning and restoration in accordance with applicable regulations at that time.

2.6 Dam Safety

- [A] Describe all relevant dam safety design considerations, including:
- a) regulatory guidelines used;
 - b) data collection methods, models and studies; and
 - c) the degree of uncertainty, reliability and sensitivity of models used to reach conclusion.
- [B] Describe any gaps in knowledge and understanding related to key conclusions, including steps to address these gaps.
- [C] Describe the consequence classification and summarize the Emergency Preparedness Plan associated with the proposed dam and its associated structures.
- [D] Describe the expected performance of the dam and its associated structures during and after extreme events (e.g., floods, earthquakes, etc.), including potential challenges and mitigation measures.
- [E] For all stages of the Project, describe the potential challenges that could impact the safety of the proposed structure and proposed mitigation measures (e.g., during excavations, foundation/treatment, slope stabilization, materials, headpond filling, debris management, operations, maintenance and surveillance philosophy, performance under extreme events (floods, tornados, etc.), emergency preparedness and response, etc.)
- [F] For all stages of the Project, identify potential accidents and malfunctions that could occur (e.g., cofferdam leakage or failure, sediment control failure, any other Dam Safety incidents).
- [G] Describe the possibility of cascade failure and its impacts.

[H] Describe the potential challenges during decommissioning of the temporary dam works as well as for any future decommissioning.

2.7 Water Management

2.7.1 Water Supply

- [A] Describe the water supply requirements for all phases of the Project, including:
- a) the criteria used, options considered and rationale for selection of water supply sources(s);
 - b) potable and non-potable water requirements and sources for construction (including, but not limited to, road construction, site preparation and dust suppression), camp(s) and plant site, start-up and operations, decommissioning and reclamation. Identify the volume of water to be withdrawn from each source, considering plans for wastewater reuse;
 - c) the location of sources/intakes and associated infrastructure (e.g., pipelines for water supply);
 - d) the expected cumulative effects on water losses/gains resulting from the Project operations;
 - e) contingency plans in the event of restrictions on the Project's water supply source (e.g., due to license conditions, source volume limitations, climate change or cumulative impact water deficits);
 - f) potable water treatment systems for all stages of the Project; and
 - g) type and quantity of potable water treatment chemicals used.

2.7.2 Surface Water

- [A] Describe the surface water management strategy for all stages of the Project, including:
- a) design factors considered; and
 - b) permanent or temporary alterations or realignments of watercourses, wetlands and other waterbodies.
- [B] Describe and map all roads and transmission lines in relation to watercourses or waterbodies.

2.7.3 Flood Control

- [A] Describe how the Project will be utilized to manage both water and ice jam floods effectively.

2.7.4 Wastewater Management

- [A] Describe how wastewater will be managed during construction and operations including amounts and types of expected wastewater.

2.8 Waste Management

- [A] Describe how waste will be managed during construction and operations including amounts and types of expected waste.

2.9 Conservation and Reclamation

- [A] Provide a conceptual conservation and reclamation plan for the Project. Describe and map as applicable:

- a) current land use and capability and proposed post-development land use and capability;
- b) anticipated timeframes for completion of reclamation stage, including an outline of the key milestone dates for reclamation and how progress to achieve these targets will be measured;
- c) a plan for the reclamation of riparian habitat along the shoreline of the holding pond;
- d) constraints to reclamation such as timing of activities, availability of reclamation materials and influence of natural processes and cycles including natural disturbance regimes;
- e) an erosion control plan for the Project;
- f) reclamation material salvage, storage areas and handling procedures; and
- g) existing and final reclaimed site drainage plans.

[B] Discuss uncertainties related to the conceptual reclamation plan.

3 ENVIRONMENTAL ASSESSMENT

3.1 Air Quality, Climate and Noise

3.1.1 Baseline Information

[A] Discuss the baseline climatic and air quality conditions including:

- a) the type and frequency of meteorological conditions that may result in poor air quality;
- b) frequency and severity of extreme weather events and climate change literature review for the Project area;
- c) current regional air quality issues and trends (e.g. odours, exceedances of *Ambient Air Quality Objectives*); and
- d) appropriate ambient air quality parameters.

3.1.2 Impact Assessment

[A] Identify all components of the Project that will affect air quality, and:

- a) describe the potential for reduced air quality (including odours and visibility) resulting from the Project including any expected gas emissions from the headpond and discuss any implications of the expected air quality for environmental protection and public health;
- b) estimate ground-level concentrations of appropriate air quality parameters;
- c) discuss any expected changes to particulate deposition, nitrogen deposition or acidic deposition patterns;
- d) identify areas that are predicted to exceed Potential Acid Input critical loading criteria;
- e) discuss interactive effects that may occur resulting from co-exposure of a receptor to all emissions; and
- f) describe air quality impacts resulting from the Project, and their implications for other environmental resources.

[B] Identify stages or elements of the Project that are sensitive to changes or variability in climate parameters, including frequency and severity of extreme weather events and discuss the potential climate change impacts over the life of the Project.

[C] Prepare a noise assessment to:

- a) identify the nearest receptor used in the assessment; and

- b) discuss the design, construction and operational factors to be incorporated into the Project to minimize noise impacts.

3.2 Hydrogeology

3.2.1 Baseline Information

[A] Provide an overview of the existing geologic and hydrogeologic setting from the ground surface down to, and including, the Base of Groundwater Protection for the Project area, and:

- a) present regional and Project Area geology to illustrate depth, thickness and spatial extent of lithology, stratigraphic units and structural features; and
- b) present regional and Project Area hydrogeology describing:
 - i) the major aquifers, aquitards and aquicludes (Quaternary and bedrock), their spatial distribution, properties, hydraulic connections between aquifers, hydraulic heads, gradients, groundwater flow directions and velocities, including maps and cross sections,
 - ii) the chemistry of groundwater aquifers including baseline concentrations of major ions, metals and hydrocarbon indicators,
 - iii) the potential discharge zones, potential recharge zones and sources, areas of groundwater-surface water interaction and areas of Quaternary aquifer-bedrock groundwater interaction,
 - iv) any groundwater users,
 - v) the recharge potential for Quaternary aquifers,
 - vi) potential hydraulic connection between the aquifers and the Project (i.e. groundwater mounding), and
 - vii) the locations of major structures associated with the Project, including the headpond and dam. Describe site-specific aquifer and shallow groundwater conditions beneath these proposed structures. Provide supporting geological information.

3.2.2 Impact Assessment

[A] Describe Project components and activities that have the potential to affect groundwater resource quantity and quality at all stages of the Project.

[B] Describe the nature and significance of the potential project impacts on groundwater with respect to:

- a) inter-relationship between groundwater and surface water in terms of both groundwater and surface water quantity and quality;
- b) implications for terrestrial or riparian vegetation, wildlife and aquatic resources including wetlands;
- c) changes in groundwater quality, quantity and flow;
- d) groundwater level fluctuation and seepage underneath the dam and in the reservoir slope area, and its impact on dam and slope stability and erosion;
- e) its effect on other groundwater users and how these effects will be mitigated; and
- f) potential implications of seasonal variations;

3.3 Hydrology

3.3.1 Baseline Information

- [A] Describe the baseline hydrologic regime which is regulated by BC Hydro's W.A.C. Bennett Dam, the Peace Canyon Dam and Site C Dam currently under construction.
- [B] Describe in detail the hydraulic models that will be used to predict potential changes to the hydrological regime as a result of the Project, at all stages, including the following information:
 - a) basis of model methodology;
 - b) purpose for the model;
 - c) input parameters and assumptions;
 - d) model outputs; and
 - e) level of confidence.
- [C] For the local and regional study area:
 - a) describe the rationale used to define the local and regional study areas considering the location and range of potential project and cumulative effects;
 - b) provide maps illustrating boundaries of the local and regional study areas;
 - c) describe and map the surface hydrology;
 - d) describe meteorological conditions; and
 - e) describe sediment yield.
- [D] Describe the existing flow regime, including:
 - a) seasonal variation, low, average and peak flows for watercourses;
 - b) low, average and peak levels for waterbodies; and
 - c) natural flow contribution of tributaries to the Peace River.

3.3.2 Impact Assessment

- [A] Describe anticipated changes to the topography, elevation, and drainage patterns resulting from the construction and operation of the Project.
- [B] Identify any changes to the river regime and surface water hydrology including flood discharges and flood stages, water levels, flow velocities and flow patterns (thalweg), expected as a result of the Project in both the near- and long-term. Consider potential effects upstream and downstream of the Project, including tributaries to the Peace River and potential effects to the Slave River basin and Peace Athabasca Delta.
- [C] Discuss the anticipated storage volume of the headpond and the mean residence time under a variety of flow conditions, including mean annual discharges and flood events.
- [D] Describe and map where turbulent water will be located (relative to the dam structure) as it flows through the spillway and the powerhouse. Show the water levels immediately upstream and downstream of the dam structure under normal operation and during flood events.
- [E] Describe Project impacts on surface water users who have existing approvals, permits or licenses in the local and regional study areas.

3.4 Surface Water Quality

3.4.1 Baseline Information

- [A] Describe the baseline water quality of the Peace River accounting for seasonal variations. Consider appropriate water quality parameters (e.g., metals, nutrients, pesticides, temperature, TOC, bacteria, dissolved oxygen, etc.) Provide:
- a) a summary of existing information available from literature review(s) and provide results from any site specific sampling; and
 - b) a comparison of the results to the *Environmental Quality Guidelines for Alberta Surface Waters (2014)* or the *Canadian Water Quality Guidelines for the Protection of Aquatic Life*.
- [B] Describe sediment quality in the area affected by the Project considering the following parameters: particle size, nutrients and metals (total). Results should be compared to relevant provincial and federal guidelines.
- [C] Measure temperature across the Project affected area during the open water season.

3.4.2 Impact Assessment

- [A] Identify impacts of the Project on water quality parameters that may exceed *Environmental Quality Guidelines for Alberta Surface Waters (2014)* or the *Canadian Water Quality Guidelines for the Protection of Aquatic Life*. Discuss potential changes to physical and chemical water quality characteristics resulting from sedimentation, inundation of soils and slumping.
- [B] Discuss the potential for increased methyl mercury levels in the water due to Project-related inundation of soils and vegetation.
- [C] Describe the downstream impacts of the Project to water quality processes.
- [D] Describe Project impacts on downstream water users including water users on the Slave River and in the Northwest Territories.
- [E] Describe proposed monitoring and mitigation measures during the construction and operation phases of the Project.
- [F] Discuss contingency plans and company policy regarding remedial measures should downstream river water quality be adversely affected.

3.5 Ice Formation and Break-Up

3.5.1 Baseline Information

- [A] Describe ice formation and break-up processes, and the modelling that is used to simulate these processes. Clearly identify the limitations of the model(s) including sources of error, simplifying assumptions and relative accuracy. Provide example figures or maps showing estimated ice fronts with appropriate confidence intervals.

3.5.2 Impact Assessment

- [A] Discuss and assess the effects of the proposed dam with one ice front moving from downstream and approaching the structure, and a second ice front starting at the headpond and moving upstream towards British Columbia during construction and operation.

- [B] Describe any changes to flood potential at communities and properties upstream and downstream of the Project during construction and operation. Describe any change in the frequency of flooding due to ice-jams and break-up.
- [C] Assess the potential effects of the current operating regime at the BC Hydro's W.A.C. Bennett Dam, the Peace Canyon Dam and Site C Dam currently under construction on the freeze-up process.
- [D] Assess the overall change in ice cover thickness and ice strength during freeze-up as a result of the Project and discuss the implications of these changes for other ice processes and affected Valued Ecosystem Components (VECs).
- [E] Assess the effect of the change of thickness and strength on the local and regional flooding regimes, at Dunvegan and in the vicinity of the Town of Peace River, and downstream beyond Fort Vermillion. Include both freeze-up and break-up scenarios, and the occurrence of secondary consolidations in the assessment.
- [F] Discuss the potential for additional ice generation as a result of the Project and evaluate:
 - a) the effects of any additional ice on upstream and downstream structures; and
 - b) the effect of additional ice cover on the typical spring break-up processes for the Peace and Smoky Rivers.
- [G] Discuss the potential increase in frazil ice formation and its effects on downstream overwintering fish habitat. Describe the potential for frazil ice dam build-up in the headpond created by the Project.
- [H] Discuss and evaluate the impacts of possibly changed freeze-up processes on ice bridges across the Peace River. Include the ice bridges at the Shaftesbury Ferry crossing site upstream of the Town of Peace River and the Tompkin's Landing and Sunny Valley sites downstream of the Town of Peace River in the discussion and evaluation. Describe:
 - a) potential changes to downstream water temperatures; and
 - b) the impact of the Project on the thermal characteristics of the river and the resultant effect on freeze and thaw timing for ferry operations.

3.6 Fluvial Morphology and Sediment Transport

3.6.1 Baseline Information

- [A] Describe baseline conditions of fluvial geomorphology and sediment transport parameters upstream and downstream of the Project including:
 - a) suspended sediment characteristics and transport rates;
 - b) bed material characteristics and bedload transport rates; and
 - c) historical locations, patterns and rates of channel deposition and erosion downstream of the Project.
- [B] Utilize predictive models to describe potential changes in fluvial morphology and sediment transport downstream of the Project.

3.6.2 Impact Assessment

- [A] Assess potential upstream impacts and propose mitigation strategies as a result of the Project including:
 - a) deposition pattern and rate of infilling;

- b) sedimentation patterns at the upstream end of the headpond;
 - c) changes to slope stability, bank erosion and riparian vegetation;
 - d) changes in sediment size; and
 - e) changes in hydraulic characteristics of the headpond and upstream over time.
- [B] Assess potential downstream impacts as a result of the Project including:
- a) degradation along the main channel and tributaries due to reduced sediment supply; and
 - b) morphological changes to the channel pattern, bar and island characteristics, channel width and vegetation.
- [C] Address anticipated downstream effects on bridge piers, pipeline crossings, water intakes, and other riverine structures. Define the extent of anticipated Project effects.
- [D] Assess impacts of climate change on fluvial morphology and sediment transport.
- [E] Discuss expected changes in sediment transport and deposition in the headpond and downstream of the dam structure.
- [F] Discuss impacts of sediment transport on the Slave River basin, including downstream users.
- [G] Discuss how sediment will be managed. Include an evaluation of expected Project impacts that would result from maintenance procedures.
- [H] Discuss operating scenarios for W.A.C. Bennett Dam, the Peace Canyon Dam and Site C Dam currently under construction and the resultant impacts on the Project and the hydrologic regime.

3.7 Fish and Fish Habitat

3.7.1 Baseline Information

- [A] Describe and map the fish, fish habitat and aquatic resources (e.g., aquatic and benthic invertebrates) of the lakes, rivers, ephemeral water bodies and other waters in the Project affected area. Describe the species composition, distribution, relative abundance, movements and general life history parameters of fish resources. Also identify any species that are:
- a) listed as “at Risk, May be at Risk and Sensitive” in the *General Status of Alberta Wild Species* (Alberta Environment and Sustainable Resource Development, now Environment and Parks);
 - b) listed in Schedule 1 of the federal *Species at Risk Act*;
 - c) listed as “at risk” by Committee on the Status of Endangered Wildlife in Canada (COSEWIC); and
 - d) traditionally used species.
- [B] Describe and map existing critical or sensitive areas such as spawning, rearing, and overwintering habitats, seasonal habitat use including migration and spawning routes.
- [C] Describe the current and potential use of the fish resources by Aboriginal, sport or commercial fisheries.

3.7.2 Impact Assessment

- [A] Describe and assess the potential impacts of the Project to fish and fish habitats in the Peace River system, including but not limited to the following:
- a) fish habitat loss and alteration:
 - i) during construction and operation of the headpond, dam and associated infrastructure footprint, and
 - ii) changes to hydrology of the Peace River and the Slave River;
 - b) entrainment and entrapment of fish at the dam, including:
 - i) measures to prevent fish entrainment,
 - ii) ability for entrained fish to return to the Peace River system,
 - iii) population level impacts from added mortality or loss from the Peace River system, including other cumulative effects (e.g., fish mortality, habitat loss, competition with non-native species),
 - iv) effects of headpond design (e.g., shape, depth) on fish stranding and mortality with respect to drawdown,
 - v) effects of the proposed boat passage, and
 - vi) mitigation measures to return fish to the Peace River system in the event of stranding due to drawdown;
 - c) fish passage at the dam throughout the year and across years, considering all species and life stages;
 - d) impacts on fish spawning and reproductive processes;
 - e) impacts on fish biodiversity;
 - f) a description of maintenance requirements to maintain fish passage at all times of year;
 - g) effects on water quality including, but not limited to:
 - i) changes to water temperature and dissolved oxygen in the Peace River system and headpond and potential effects of these changes on fish, and
 - ii) contaminants (e.g., methylmercury) and bioaccumulation in fish;
 - h) the current use of local, regional and Aboriginal fisheries resources to assess potential changes in angling pressure;
 - i) increased fish habitat fragmentation; and
 - j) groundwater-surface water interactions.
- [B] Identify the key aquatic indicators that will be used to assess Project impacts and discuss the rationale for their selection.
- [C] Identify all aspects of potential serious harm to fish and fish habitat resulting from the construction and ongoing operation of all Project components (i.e. operation of dam, fish entrainment, fish kills due to passage through turbines and thermal increases in water temperature, frazil ice formation, etc.)
- [D] Identify plans proposed to offset any loss in the productivity of fish habitat. Indicate how environmental protection plans address applicable provincial and federal policies on fish habitat.
- [E] Describe measures to ensure aquatic invasive species do not occupy, or establish in the Project area; describe measures to remove aquatic invasive species, should they be found.
- [F] Identify and describe monitoring plans/strategies that can be implemented to evaluate potential Project impacts to fisheries resources in the Peace River system.

3.8 Geotechnical

3.8.1 Baseline Information

- [A] Describe the surficial and bedrock geology of the Project site, headpond, and adjoining areas to address the site suitability for the proposed Project.
- [B] Describe relevant geologic structures such as lineaments, faults and joints.
- [C] Discuss seismicity, slope stability, hydraulic conductivity and erosion potential. Include downstream reaches and upstream tributaries that may be affected in the discussion. Provide maps which identify areas with high potential for slope instability.
- [D] Describe geotechnical conditions in the area of each component of the project, including access road(s) and power transmission structures.

3.8.2 Impact Assessment

- [A] Describe the likelihood of slumping of the headpond banks and, if it is likely, address how slumping could affect Project operations, water quality, sedimentation and fish habitat.
- [B] Describe changes to slope stability along the headpond extent.
- [C] Identify potential slope stability conditions that may affect the construction and operation of the access roads. Describe measures that will be taken to avoid or minimize loss of land due to slope instability.
- [D] Describe how the design and construction of the project components are appropriate for the geotechnical conditions.

3.9 Terrain and Soils

3.9.1 Baseline Information

- [A] Describe and map the pre-disturbance terrain and soils conditions including soil types and distribution in the Project Area.

3.9.2 Impact Assessment

- [A] Describe Project activities that could affect soil quality (e.g., salinity, erosion/loss, stability, compaction, admixing, contaminants) and:
 - a) indicate the extent (ha) of surface disturbance, aggregate and borrow pits, access roads, transmission lines and other infrastructure-related construction and operational activities;
 - b) provide an inventory of the pre- and post-disturbance land capability classes for soils in the Project area;
 - c) discuss the relevance of any changes for the local and regional landscapes, biodiversity, productivity, ecological integrity, aesthetics and future use;
 - d) evaluate reclamation suitability and approximate volumes of suitable soil materials available for reclamation;
 - e) evaluate current and future soil erosion potentials for the Project; and
 - f) describe potential sources of soil contamination (e.g., industry infrastructure and activities, agricultural infrastructure and activities, contaminated sites, etc.)

- [B] Discuss:
- a) the environmental effects of proposed development methods on the landscape;
 - b) actions to minimize soil erosion and stability potentials; and
 - c) possible actions to minimize impacts to land capability and reclamation suitability.

3.10 Vegetation

3.10.1 Baseline Information

- [A] Describe and map the vegetation communities, wetlands, rare plants, old growth forests, riparian communities and communities of limited distribution. Identify the occurrence, relative abundance and distribution and identify any species that are:
- a) listed as “at Risk, May be at Risk and Sensitive” in the *General Status of Alberta Wild Species* (Alberta Environment and Sustainable Resource Development, now Environment and Parks);
 - b) listed in Schedule 1 of the federal *Species at Risk Act*;
 - c) listed as “at risk” by COSEWIC;
 - d) tracked and watched in the Alberta Conservation Information Management System (CIMS) database; and
 - e) important for traditional food, medicine and cultural uses.
- [B] Identify key vegetation indicators used to assess Project impacts and the rationale for their selection.
- [C] Describe and quantify the current extent of habitat fragmentation.
- [D] Provide a timber productivity rating for the Project area, including the identification of productive forested, non-productive forested and non-forested lands. Describe the status of timber harvesting arrangements, including species and timing.

3.10.2 Impact Assessment

- [A] Describe and assess the potential impacts of the Project on vegetation communities, considering:
- a) both temporary (include timeframe) and permanent impacts;
 - b) the introduction and colonization of weeds and non-native invasive species;
 - c) increased fragmentation and loss of rare plants, upland, riparian and wetland habitats; and
 - d) the changes to vegetation communities within and along the margins of the headpond that may result from fluctuating water level.
- [B] Assess the impact of the project on the availability of and access to traditional, medicinal and culturally important species.
- [C] Discuss Project impacts on forest resources.

3.11 Wildlife

3.11.1 Baseline Information

- [A] Describe and map the wildlife resources (i.e. amphibians, reptiles, birds, and terrestrial and aquatic mammals). Describe species relative abundance, distribution and their use and potential use of habitats. Also identify any species that are:

- a) listed as “at Risk, May be at Risk and Sensitive” in the *General Status of Alberta Wild Species* (Alberta Environment and Sustainable Resource Development, now Environment and Parks);
 - b) listed in Schedule 1 of the federal *Species at Risk Act*;
 - c) listed as “at risk” by COSEWIC; and
 - d) traditionally used species.
- [B] Identify the key wildlife and habitat indicators used to assess project impacts. Discuss the rationale for their selection.
- [C] Describe and map existing wildlife habitat and habitat disturbance including Project construction and operation activities. Identify habitat disturbances that are related to existing and approved projects.
- [D] Discuss significant habitat, habitat use patterns, extent or range in both summer and winter, and seasonal movement corridors.

3.11.2 Impact Assessment

- [A] Describe and assess the potential impacts of the Project to wildlife and wildlife habitats, considering:
- a) how the Project will affect wildlife relative abundance, habitat availability, habitat fragmentation, mortality, movement patterns, and distribution for all stages of the Project, including a prediction of future use due to habitat alteration;
 - b) how improved or altered access may affect wildlife, including future prediction of wildlife use and movements;
 - c) how the presence of the headpond may affect wildlife movements and distribution, particularly during winter months;
 - d) how altered habitat conditions (loss, change, fragmentation) may affect wildlife values. Consider habitat change (e.g., riparian), the availability of habitat and the influence of anthropogenic features and infrastructure on wildlife movements and predator-prey relationships; the contribution of the Project to changes in regional wildlife populations and the impact to local and regional ecosystems;
 - e) potential effects on wildlife resulting from changes to air and water quality, including both acute and chronic effects to animal health;
 - f) abundance of, and access to, traditionally used species; and
 - g) how the risk to wildlife and habitat will be managed.

3.12 Biodiversity

3.12.1 Baseline Information

- [A] Describe and map existing biodiversity.
- [B] Identify the biodiversity metrics, biotic and abiotic indicators that are used to characterize baseline biodiversity. Discuss the rationale for their selection.

3.12.2 Impact Assessment

- [A] Describe and assess the potential impacts of the Project to biodiversity considering:
- a) the biodiversity metrics, biotic and abiotic indicators selected;
 - b) the effects of fragmentation on biodiversity potential;

- c) the contribution of the Project to any anticipated changes in regional biodiversity and the potential impact to local and regional ecosystems; and
- d) effects of the Project on biodiversity throughout all phases, including the significance of these changes in a local and regional context.

3.13 Land Use Management

3.13.1 Baseline Information

- [A] Describe and map the current land in the Project Area, including all Crown land dispositions, resource and commercial industry and recreational uses.
- [B] Identify and map unique sites or special features such as Parks and Protected Areas, Heritage Rivers, Historic Sites, Environmentally Significant Areas, culturally significant sites and other designations (e.g., World Heritage Sites, Ramsar Sites, Internationally Important Bird Areas). Specifically include sites of local significance such as Cotillion Park, Carters Camp, Pratts Landing and Many Islands Park.

3.13.2 Impact Assessment

- [A] Identify the potential impacts of the Project on land uses, including:
 - a) private land;
 - b) unique sites or special features;
 - c) Dunvegan West Wildland Provincial Park including an assessment of the original reason(s) for inclusion of these lands in the Park;
 - d) aggregate reserves required for the Project;
 - e) forested land;
 - f) the operations of any agricultural crown leases and provincial grazing reserves; and
 - g) access for public, regional recreational activities, Aboriginal land use and other land uses during and after development activities.
- [B] Describe how Integrated Land Management has been used (e.g., sharing of infrastructure, access requirements).
- [C] Summarize the status of securing consent from landowners and leaseholders for various components of the project.

3.14 Boating and Navigation

3.14.1 Baseline Information

- [A] Describe existing boat use on the Peace River including information on types of use and patterns of use.

3.14.2 Impact Assessment

- [A] Describe the impact of the project on projected boat use.
- [B] Discuss the ownership of the boat lock and boat launch and who will be responsible for operating the facilities.
- [C] Describe and provide diagrams for boat passage over and around the Project structure under the full range of flow scenarios.
- [D] Describe all proposed safety, signage and awareness strategies associated with navigation including travel during dark and foggy conditions. Address the safety precautions which

will prevent a boat floating over the structure. Use a worst-case scenario such as a loss of power or visibility. Discuss how accidents will be avoided in river navigation and transfer of vessels past the structure.

3.15 Transportation

3.15.1 Baseline Information

- [A] Describe existing traffic infrastructure, including bridges, ferries, ice bridges and the local, regional and provincial road system.
- [B] Discuss how Project materials will be moved onto site.

3.15.2 Impact Assessment

- [A] Prepare a Traffic Impact Assessment as per Alberta Transportation's *Traffic Impact Assessment Guideline* (<http://www.transportation.alberta.ca/613.htm>) and summarize the results in relation to the Project and associated components.
- [B] Describe and map the locations of any proposed new road or intersection construction and improvements to existing roads or intersections that are related to the development of the Project, from the boundary of the Project Area, up to and including the highway access points, and
 - a) discuss the alternatives and the rationale for selection of the preferred alternative;
 - b) discuss compatibility of the preferred alternative with Alberta Transportation's immediate and future plans;
 - c) describe the impacts to local communities of the changes in transportation and infrastructure; and
 - d) provide a proposed schedule for the work.
- [C] Discuss the potential for increased bridge deck icing and fog downstream of the Project at the Dunvegan Bridge due to winter open-water conditions and describe how necessary mitigating measures will be undertaken.
- [D] Discuss the potential impacts to both existing and future bridge crossings on the Peace River and tributaries arising from any possible changes to the river regime. Include potential hydrological and hydraulic impacts on the existing Highway 2 bridge structures at Dunvegan and the Town of Peace River with respect to issues such as water levels, flow velocities, sediment discharge, ice-jam formation, erosion and scour.
- [E] Describe the possible Project effects on the operation of the Shaftesbury Ferry and the ice bridge, Tompkin's Landing and Sunny Valley and the resulting impact on traffic along Secondary Highway 740 during the construction and operation phases of the Project. Assess potential downstream effects on other ferries and ice bridges as affected by the Project.
- [F] Identify and discuss the possible alternatives to mitigate the impacts of the Project on users of the ferries and ice bridges downstream of the Project.

4 HISTORIC RESOURCES

4.1 Baseline Information

- [A] Provide an overview of the regional historical resources setting including a discussion of the relevant archaeological, historic and paleontological records.

- [B] Describe and map known historic resources in the Project Area, considering:
 - a) site type and assigned Historic Resource Values; and
 - b) existing site specific *Historical Resources Act* requirements.
- [C] Provide an overview of previous Historic Resources Impact Assessments that have been conducted within the Project Area, including:
 - a) a description of the spatial extent of previous assessments relative to the Project Area, noting any assessment gap areas; and
 - b) a summary of *Historical Resources Act* requirements and/or approvals that have been issued for the Project to date.
- [D] Identify locations within the Project Area that are likely to contain previously unrecorded historic resources. Describe the methods used to identify these areas.

4.2 Impact Assessment

- [A] Describe Project components and activities that have the potential to affect historic resources at all stages of the Project.
- [B] Describe the nature and magnitude of the potential project impacts on historical resources, considering:
 - a) effects on historic resources site integrity; and
 - b) implications for the interpretation of the archaeological, historic and paleontological records.
- [C] Provide recommendations for the management of all historic resources within the Project area.

5 TRADITIONAL ECOLOGICAL KNOWLEDGE AND LAND USE

5.1 Baseline Information

- [A] Provide:
 - a) a map and description of traditional land use areas including fishing, hunting, trapping and nutritional, medicinal or cultural plant harvesting by affected Aboriginal peoples (if the Aboriginal community or group is willing to have these locations disclosed);
 - b) a map of cabin sites, spiritual sites, cultural sites, graves and other traditional use sites considered historic resources under the *Historical Resources Act* (if the Aboriginal community or group is willing to have these locations disclosed), as well as traditional trails and resource activity patterns; and
 - c) a discussion of:
 - i) the availability of vegetation, fish and wildlife species for food, traditional, medicinal and cultural purposes in the identified traditional land use areas considering all Project related impacts,
 - ii) access to traditional lands in the Project Area during all stages of the Project, and
 - iii) Aboriginal views on land reclamation.
- [B] Describe how Traditional Ecological Knowledge and Traditional Land Use information was incorporated into the Project, EIA development, the conservation and reclamation plan, monitoring and mitigation.

5.2 Impact Assessment

- [A] Determine the impacts of the Project on traditional, medicinal and cultural practises and identify possible mitigation strategies.

6 PUBLIC HEALTH AND SAFETY

6.1 Public Health

- [A] Describe aspects of the Project that may have implications for public health or the delivery of regional health services. Determine quantitatively whether there may be implications for public health arising from the Project.
- [B] Document any health concerns raised by stakeholders during consultation on the Project.
- [C] Document any health concerns identified by Aboriginal communities or groups resulting from impacts of existing development and of the Project, specifically on their traditional lifestyle. Include an Aboriginal receptor type in the assessment.
- [D] Document all hazardous goods associated with the project operation.
- [E] Describe the potential health impacts resulting from higher traffic volumes and the increased risk or accidental spills or leaks.

6.2 Public Safety

- [A] Describe aspects of the Project that may have implications for public safety. Specifically:
 - a) describe the emergency response plan including public notification protocol and safety procedures to minimize adverse environmental effects, including emergency reporting procedures and notification of a dam breach or release;
 - b) document any safety concerns raised by stakeholders during consultation on the Project;
 - c) describe how local residents, Aboriginal communities and land users will be contacted during an emergency and the type of information that will be communicated to them;
 - d) describe the existing agreements with area municipalities or industry groups such as safety cooperatives, emergency response associations, regional mutual aid programs and municipal emergency response agencies;
 - e) describe the potential safety impacts resulting from higher regional traffic volumes during construction; and
 - f) describe how hazardous good associated with the project will be transported and stored.

7 SOCIO-ECONOMIC ASSESSMENT

7.1 Baseline Information

- [A] Explain how hydroelectric power generation aligns with the current Government of Alberta policy for non-fossil fuel energy development. Provide a cost/benefit analysis for generating 330 MW power generation using run-of-river hydro vis a vis alternative power generation feedstocks including wind and fossil fuels (natural gas, coal).
- [B] Provide supply and demand analysis for Alberta's electricity needs. Include projections for total project electricity supply to domestic and export markets.

- [C] Describe factors that may affect existing socio-economic conditions including:
- a) population changes;
 - b) workforce requirements for all stages of the Project, including a description of when peak activity periods will occur;
 - c) planned accommodations for the workforce for all stages of the Project. Discuss the rationale for their selection;
 - d) the Proponent's policies and programs regarding the use of local, regional and Alberta goods and services;
 - e) the Project schedule; and
 - f) the overall engineering and contracting plan for the Project.

7.2 Impact Assessment

- [A] Describe the social and economic effects on local and regional population groups of construction and operation of the Project with respect to:
- a) changes in local and regional infrastructure such as ferries and ice bridges;
 - b) tourism and recreational activities;
 - c) hunting, fishing, trapping and gathering; and
 - d) Aboriginal communities and groups (e.g., traditional land use and social and cultural implications).
- [B] Discuss opportunities to work with Aboriginal communities and groups, other local residents and businesses regarding employment, training needs and other economic development opportunities arising from the Project.
- [C] Provide the economic impacts of the project on the study areas and on Alberta for the construction phase and on-going operations. Provide the estimated total Project cost, including a breakdown for engineering and project management, equipment and materials, and labour for both construction and operation stages. Indicate the percentage of expenditures expected to occur in the region, Alberta, Canada outside of Alberta, and outside of Canada.

8 MITIGATION MEASURES

- [A] For each component discussed in Section 3 to 7 above:
- a) discuss mitigation measures planned to avoid, minimize or eliminate the potential impacts for all stages of the Project; and
 - b) identify the mitigation objectives for each associated impact and describe the mitigation measures that will be implemented. Provide rationale for their selection, including a discussion on the effectiveness of the proposed mitigation.

9 CUMULATIVE EFFECTS

- [A] Discuss the contribution of the Project to cumulative effects in the Peace River and the Slave River basin on valued environmental and social components in relation to other projects and activities and how cumulative effects should be managed.

10 RESIDUAL IMPACTS

- [A] Describe the residual impacts of the Project following implementation of the Proponent's mitigation measures and the Proponent's plans to manage those residual impacts.

11 MONITORING

- [A] Describe the Proponent's current and proposed monitoring programs during construction and operation, including:
- a) how the monitoring programs will assess any Project impacts and measure the effectiveness of mitigation plans. Discuss how the Proponent will address any Project impacts identified through the monitoring program;
 - b) how the Proponent will contribute to current and proposed regional monitoring programs;
 - c) monitoring performed in conjunction with other stakeholders, including Aboriginal communities and groups;
 - d) new monitoring initiatives that may be required as a result of the Project;
 - e) regional monitoring that will be undertaken to assist in managing environmental effects and improve environmental protection strategies;
 - f) how monitoring data will be disseminated to the public, Aboriginal communities and groups and other interested parties; and
 - g) how the results of monitoring programs and publicly available monitoring information will be integrated with the Proponent's environmental management system.