

PROJECT DESCRIPTION AMISK HYDROELECTRIC PROJECT

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Canadian Environmental Assessment Agency (CEAA)

October 2015

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ABBREVIATIONS AND ACRONYMS

ACO Aboriginal Consultation Office
ACP Aboriginal Consultation Plan
AEP Alberta Environment and Parks
AHP Development Corporation

AIES Alberta Interconnected Electric System

AUC Alberta Utilities Commission
CASA Clean Air Strategic Alliance

CEAA 2012 Canadian Environmental Assessment Act 2012
CRISSP Comprehensive River Ice Simulation System Project

EIA Environmental Impact Assessment

EPEA Environmental Protection and Enhancement Act

ESRD Alberta Environment and Sustainable Resource Development

FSL Full Supply Level

HRIA Historical Resources Impact Assessment

HRV Historical Resource Value

LSA Local study area

NPA Navigation Protection Act

NRCB Natural Resources Conservation Board

NTS National Topographic System

PAD Peace-Athabasca Delta

PAZA Peace Airshed Zone Association
RCC Roller Compacted Concrete
RoC Record of Consultation
WSC Water Survey of Canada

UNITS

cm centimetre(s)
GWh gigawatt hour
ha hectare(s)
Km kilometre(s)

km² square kilometre(s)

M metre(s)

m³/s cubic metre(s) per second masl metres above sea level mg/kg milligram per kilogram mg/L milligram per litre

MW megawatt

ng/L nanogram per litre

GLOSSARY OF TERMS

Boat Locks - a device for raising and lowering boats between stretches of water of different levels e.g. on a river that has a dam.

Cofferdam – a temporary watertight enclosure from which water is pumped to expose the bottom of a body of water and permit construction (as of a dam).

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.

Gravity Dam – a concrete dam structure bound to the side of a slope where gravity holds it down preventing water in the headpond from pushing it over.

Head – the elevation difference between the headpond and the receiving water body immediately downstream of the hydroelectric facility.

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

Headpond – a slower and deeper section 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.

Impoundment—a body of water created or stored by impoundment structures such as dams, dikes, and levees.

Order in Council — Orders in Council are the instrument by which the Lieutenant Governor in Council makes its orders. These orders may or may not be a Regulation, as defined in the Regulations Act.

Powerhouse – the structures, machinery, and associated equipment needed for generating electric energy from a hydroelectric dam.

Run-of-River – a term used to describe hydroelectric facilities that do not have significantlong-term storage (i.e. less than 48 hour retention time in the headpond).

Sedimentation – occurs when particles in water settle and come to rest against a barrier.

Substation Infrastructure – a set of equipment which reduces the high voltage of electrical power transmission to that suitable for supply to consumers.

1. GENERAL INFORMATION AND CONTACTS

1.1 Nature of Project

The Amisk Hydroelectric Project (the "Project") is a run-of-river hydroelectric project proposed for the Peace River in northwestern Alberta, with an estimated generating capacity of 330 megawatts (MW). The dam headworks would be located approximately 28 kilometres (km) southwest of the Town of Fairview and 15.2 km upstream of the Dunvegan Bridge on Highway 2. The headpond created by the dam will extend approximately 50 km upstream.

The Project will generate approximately 1,875 gigawatt hour (GWh) per year, enough to power an estimated 250,000 Alberta homes. Hydroelectric power is an important renewable energy alternative to conventional fossil fueled generating facilities and provides Albertans with an energy source that has minimal comparable greenhouse gas emissions.

The Project would involve the following main components:

- A spillway and powerhouse (i.e. headworks) form the main dam structure and has its centroid located at 55°58′19.6″ North latitude and 118°48′28.8″ West longitude. The headworks have a combined length of approximately 370 m.
- The headpond will extend approximately 50 km upstream and have an estimated total surface area of 30 km². The headpond extent is based on a full supply level of 362.5 metres above sea level (masl). No significant flooding of any tributaries to the Peace River is expected.
- The spillway is sized to have a maximum capacity of approximately 12,900 m³/s at 363.5 masl elevation, in accordance with a one in one thousand year flood event. During larger flood events, all structures will be completely submerged.

Other important elements of the Project under consideration include: fish and boat passage, access roads, and a transmission connector. Further details of Project components are provided in Section 2.0 and 3.0.

1.2 Proponent's Information

The Project is being developed by AHP Development Corporation ("AHP") on behalf of a number of partners, including Concord Green Energy. Concord Green Energy has invested in several renewable energy projects across Canada and is a wholly owned subsidiary of Concord Pacific, a Vancouver based company that is primarily involved in real estate development.

Information on AHP is provided in Table 1-1.

Table 1-1: Proponent Information

Category	Details
Name of Corporation:	AHP Development Corporation
Address:	50 - 805 5th Avenue SW, Calgary, AB, T2P 0N6
President and Chief Executive Officer:	Paul McKendrick
Contact:	Paul McKendrick
Principal Contact for Purposes of Project	Description for the Amisk Hydroelectric Project
Name and Title:	Paul McKendrick, President
Email Address:	pmckendrick@amiskhydro.com
Contact:	1-844-287-1529
Company Website:	http://www.amiskhydro.com/

1.3 Consultation Undertaken

AHP has initiated contact and had communications through phone, mail, email and/or face-to-face meetings with the following entities:

- Counties and Municipal Districts (Most Commonly the Chief Administrative Officer)
 - Birch Hills
 - Clear Hills
 - Fairview
 - Grande Prairie
 - Greenview
 - Northern Lights
 - Northern Sunrise County
 - Peace River
 - Saddle Hills
 - Smoky River
 - Spirit River
- Towns and Cities
 - Berwyn
 - Fairview
 - Falher
 - Grande Prairie
 - Grimshaw
 - McLennan
 - Nampa
 - Peace River
 - Rycroft

Aboriginal Groups

- Beaver First Nation
- Dene Tha' First Nation
- Duncan's First Nation
- Fairview Metis Local (Part of Metis Nation of Alberta, Zone 6)
- Fort Chipewyan Metis Local 125
- Fort Resolution Metis Council
- Fort Smith Metis Council
- Horse Lake First Nation
- Little Red River Cree Nation
- Loon River
- Metis Nation Region 6
- Mikisew Cree First Nation
- Paddle Prairie Metis Settlement
- Salt River First Nation #195
- Sturgeon Lake First Nation
- Tallcree First Nation
- Whitefish Lake First Nation
- Woodland Cree First Nation

Interest Groups

- Alberta Conservation Association
- Alberta Wilderness Association
- Canadian Parks and Wilderness Society
- Concerned Residents for Ongoing Service at Shaftsbury (CROSS)
- Grande Prairie & District Chamber of Commerce
- Mighty Peace Watershed Alliance
- Peace Country River Rats
- Peace Parkland Naturalists
- Pembina Institute
- Trout Unlimited
- River users, including outfitters and tour operators
- Landowners and occupants in close proximity to the Project
- BC Hydro

1.4 Regulatory Requirements of Other Jurisdictions

In addition to regulatory requirements under the *Canadian Environmental Assessment Act 2012* (CEAA 2012), the Project will require additional approvals and compliance, provincial and municipal authorities. The Project will require an Environmental Impact Assessment (EIA) under the Environmental Protection and Enhancement Act (EPEA) as regulated by Alberta Environment and Parks (AEP). Applications to the Natural Resources Conservation Board (NRCB) and the Alberta Utilities Commission (AUC) will also be required.

Development permits will also be required from the Alberta municipal districts of Clear Hills County, Saddle Hills County and MD of Fairview No. 136.

1.5 Environmental Studies Conducted in Project Area

In support of the Project's environmental impact assessment process, a number of environmental baseline and effects assessments will be completed including: air, fish/aquatics, terrain, vegetation, wildlife, water quality, surface water flows, sediments and ice formation. Further details regarding environmental studies are presented in Section 5.0.

There are no regional studies, as defined under CEAA 2012, being conducted in the area.

Previous environmental assessments and panel reports for Glacier Power Ltd.'s Dunvegan Hydroelectric Project will be reviewed, as will similar documents for the British Columbia Hydro and Power Authority's Site C Clean Energy Project.

Information including that from the Northern Rivers Basin Study, the Northern Rivers Ecosystem Initiative, the Mighty Peace Watershed Alliance, the Mackenzie River Basin Board, and the Peace-Athabasca Delta Ecological Monitoring Program will also be consulted.

Under the Government of Alberta Land-Use Framework, the Lower and Upper Peace regional plans have yet to be completed. The Lower Athabasca Regional Plan, which was approved in August 2012, will be reviewed.

2. PROJECT INFORMATION

2.1 General Description, Context and Objectives

2.1.1 Project Context and Objectives

The Project is being proposed to provide Alberta electricity consumers with a long-term, reliable, cost effective supply of renewable electricity.

The electricity market in Alberta is deregulated and therefore left to market participants to add additional electrical generating capacity when supply and demand fundamentals suggest that additional generation capacity is warranted. In Alberta, the majority of electricity generated is currently from coal-fired generation, which contributed approximately 68% of the electricity supplied to the Alberta Interconnected Electric System (AIES) in 2014. In comparison, hydroelectric generation supplied approximately 3%¹.

A significant amount of the coal-fired generation in Alberta is approaching retirement, with 3,760 MW mandated to be retired by 2029 at the latest under the federal government's *Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations*. In addition to the federal regulations, the province has rules regarding other emissions, including NO_x and SO_x, which were previously agreed to by the Clean Air Strategic Alliance (CASA). The requirements under CASA could accelerate the retirement of all coal-fired units, including 2,460 MW of coal-fired generation slated for retirement after 2029 based on federal regulations.

Sufficient generating capacity must also be added to the AIES to address increasing demand for electricity in Alberta. Over the last ten years, electricity demand in Alberta has grown by approximately 170 MW per year².

The Project represents an attractive replacement for a portion of the coal-fired fleet slated for retirement and/or to address electricity demand growth as it will provide a long-term, reliable and cost-effective source of renewable electricity.

The Project provides the following benefits to Albertans:

- Generates 1,875 GWh per year of electricity, which is the equivalent to supplying roughly 250,000 average Alberta homes;
- Supplies renewable electricity that will displace approximately 1.1 million tonnes per year of CO₂ equivalent emissions, which is equivalent to removing over 210,000 cars from the road³;

¹ Alberta Electric System Operator, 2014 Annual Market Statistics Data File

² Ibid

³ Based on current Grid Displacement Factor of 0.59 tonnes of CO2e/MWh under Alberta's Specified Gas Emitters Regulation.

- Provides a firm and reliable source of renewable electricity throughout the year;
- Be a cost-effective source of renewable electricity; and
- Supports regional and provincial economic development.

2.1.2 General Description of Project Components

The Project is independent and not a component of a larger project. It is a described physical activity under Schedule 2(c) of the *Regulations Designating Physical Activities (SOR/2012-147)* as a new hydroelectric generating facility with a production capacity of 200 MW or more. The Project will generate 330 MW.

Project engineering is currently at the prefeasibility level. Major Project components consist of an east and west powerhouse, a spillway, a substation, a transmission line, and access roads. Additional incidental components under consideration include fish and boat passage. A Project schematic is shown in Figure 2-1.

The following sections provide additional information on each of the main project components, including:

- Dam;
- Powerhouses;
- Spillway;
- Headpond;
- Substation and Transmission Line;
- Access Roads;
- Fish Passage Facility; and
- Boat Passage Facility.

Project dimensions and levels are conceptual in nature and subject to change, based on the results of the ongoing preliminary engineering design.

Dam

The east and west powerhouses and the spillway will act collectively as the main dam and have a combined length of approximately 370 m. The main dam will be constructed across the Peace River, which is approximately 360 m wide at the proposed facility location⁴. The total height of the dam from the existing river bed will be approximately 24 m and water levels immediately upstream from the dam are expected to increase by about 17 m over average water levels. The main dam structure will consist of reinforced concrete; various steel gates which will control headpond levels and water passage. A cut-off wall will be constructed directly beneath the structures at the upstream side to reduce the uplift pressure and permeability of the foundation. Two additional gravity dams are anticipated between the

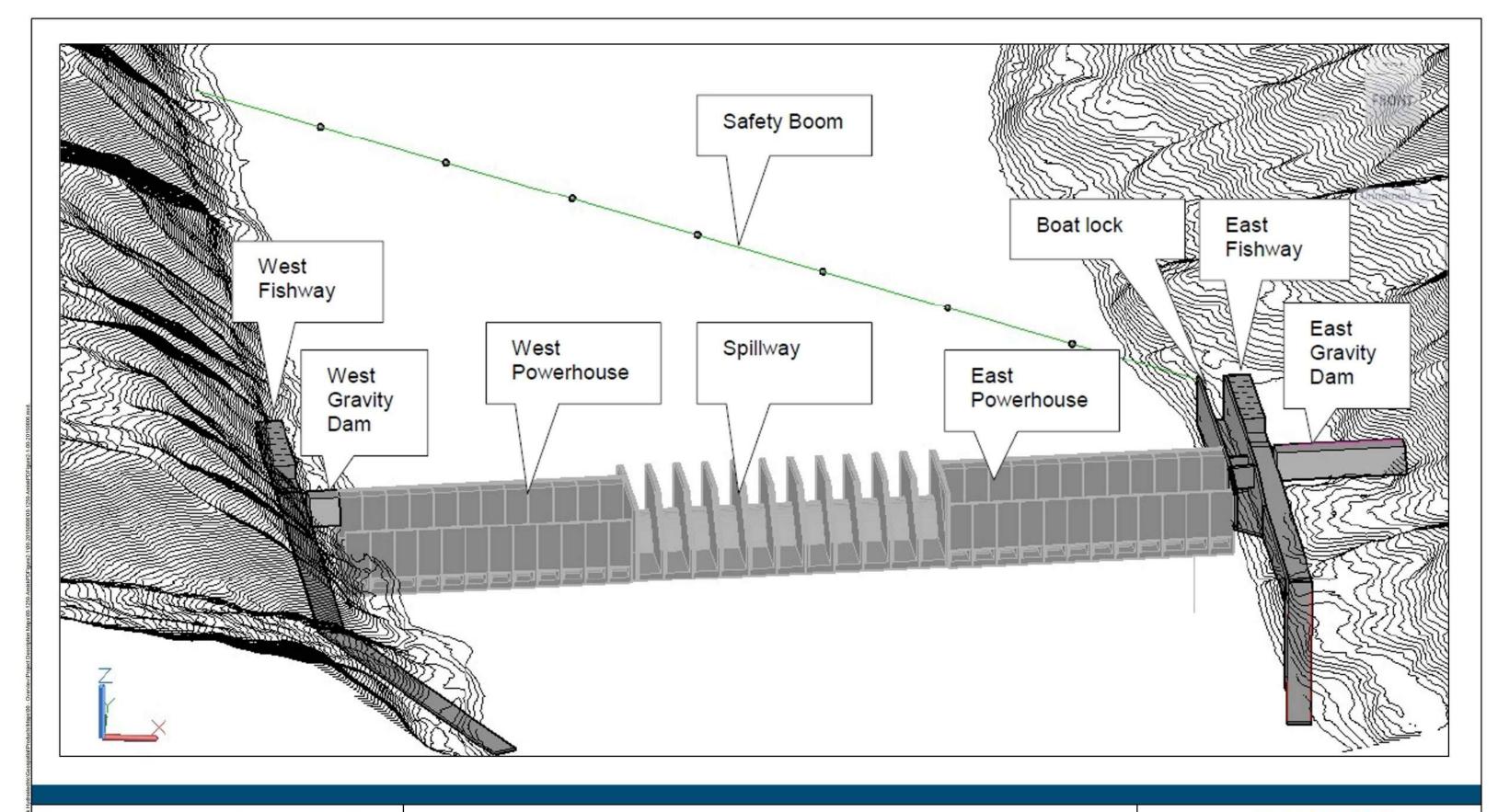
⁴ As currently planned, the centroid of the dam headworks is located at 55°58′19.6" North latitude and 118°48′28.8" West longitude

powerhouse and abutments on both sides of the river. These dams may be constructed of concrete, earthfill or roller compacted concrete (RCC).

Spillway

The spillway will be located at the approximate mid-point of the dam structure in the centre of the river, between the east and west powerhouses, as shown on Figure 2-1. The spillway will pass all Peace River flow not directed through the powerhouses and the fish and boat passage facilities. The spillway is divided into 11 spillway bays, separated by 2 m wide piers. Each spillway bay will be 10 m long, resulting in a total length of about 130 m. Flow through each bay will be controlled by adjustable gates. The type of gates to be used will be determined as the engineering design progresses, although vertical lift gates are currently contemplated.

The preliminary inflow design flood for the Project is based on a one in 1,000 year flood event, or approximately 12,300 m³/s. The current configuration of the spillway can pass a flood event of 12,900 m³/s at the proposed headpond Full Supply Level (FSL) of 362.5 masl. The top of the spillway structure is 363.5 masl which provides additional capacity for the spillway. For the larger events, the powerhouse will be designed to overtop, if river flows exceed the spillway capacity.



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PROJECT CONCEPTUAL LAYOUT



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Powerhouses

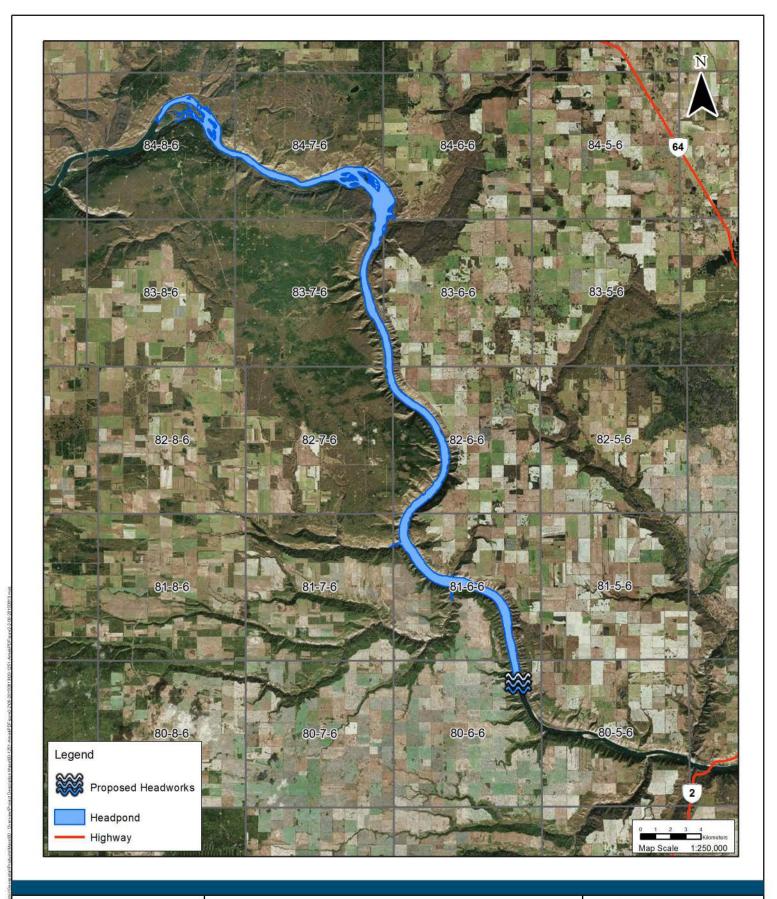
The facility will consist of two powerhouses; one on the east bank and one on the west bank of the Peace River. Each powerhouse unit is close-coupled where the intake, turbine passageway, and draft tube form a single structural element. The current facility design is configured to have a total of 22 turbines (11 per powerhouse) with a maximum generating capacity of 15 MW each, for an overall facility capacity of 330 MW. Currently, each powerhouse will be approximately 120 m long, including a repair and maintenance bay, for a combined powerhouse length of 240 m. The number of turbines at each side of the spillway may be altered in the final design. The upstream side of each powerhouse will have a foundation (or bottom) elevation of about 336.5 masl and a top elevation of 363.5 masl. Ongoing geotechnical investigation and additional engineering design will confirm these elevations and finalize turbine generator orientation (i.e. whether vertical or horizontal). The rated discharge capacity of each turbine is anticipated to be approximately 80 m³/s, resulting in an overall capacity of approximately 1,760 m³/s combined for the two powerhouses. The turbines are currently anticipated to be propeller turbines installed in an "S" configuration, although this will be confirmed during future design phases.

The powerhouses will consist of an excavated intake channel to transition from the existing river bed to the base of the powerhouse, with an intake structure consisting of trashracks to prevent passage of debris through the turbines and fixed wheel vertical lift maintenance gates to facilitate dewatering of turbines.

A tailrace will be excavated downstream from the powerhouse to transition from the draft tube level back up the existing river bed. Provisions will be made in the intake and or draft tubes to allow for dewatering of individual turbine units. A riprap apron will be installed, extending approximately 40 m downstream from the powerhouse to prevent riverbed scour.

Headpond

The anticipated FSL of 362.5 masl is anticipated to increase the water level of the Peace River immediately upstream from the dam by approximately 17 m during average flow conditions. The existing Peace River channel at the dam location is approximately 4-5 m deep during average flow conditions. This will create a headpond that will extend approximately 50 km upstream and will inundate approximately 800 hectares (ha) (8 km²) of the Peace River valley walls. The headpond (including the existing river channel and incremental inundated area) will have an overall surface area of approximately 30 km² (Figure 2-2). The existing river channel averages 350-400 m wide but is up to approximately 1 km wide in some locations within the proposed headpond. The average width of the headpond is anticipated to be 400 m. The headpond is anticipated to be contained within the existing Peace River valley, without resulting in extensive inundation of the existing riparian parts of the valley or adjacent tablelands. No significant inundation of existing tributaries of the Peace River is expected. The longitudinal and lateral extent of the headpond will be confirmed after initial survey completion.



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APPROXIMATE HEADPOND EXTENT

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Bathymetric Data: Natural Waterway versus Headpond

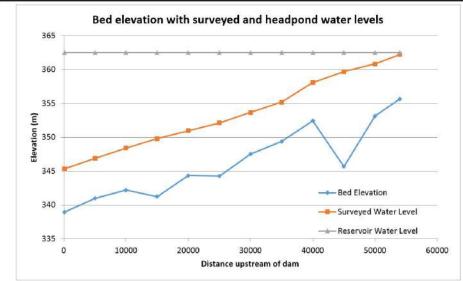
A bathymetric survey was conducted from May 21 to 31, 2015. Table 2-1 provides data of the bed elevation with distance upstream of the headworks along with surveyed versus headpond water level, maximum depth and top width. Figure 2-3 shows graphical representations of the information presented in Table 2-1 with maximum width of the Peace River occurring at approximately 40 km upstream of the headworks and maximum depth between Montagneuse Islands and Many Islands (approximately 45 km upstream from the headworks).

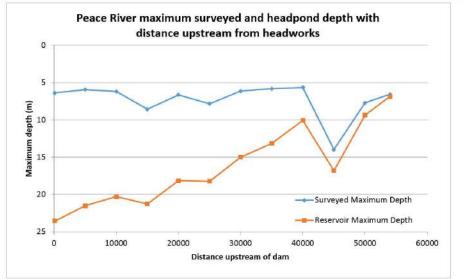
Table 2-1: Summary of widths and depths in Amisk headpond reach of the Peace River

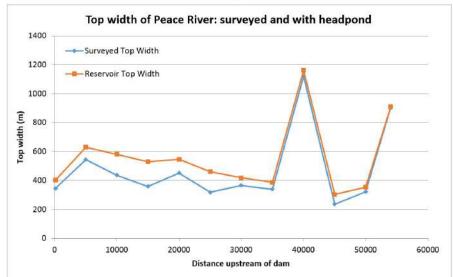
Distance Upstream of Dam	Bed Elevation	Surveyed Water Level	Headpond Water Level	Surveyed Maximum Depth	Headpond Maximum Depth	Surveyed Top Width	Headpond Top Width
(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)
150	338.93	345.32	362.50	6.39	23.57	345	402
5000	340.95	346.88	362.50	5.93	21.55	544	630
10000	342.19	348.39	362.50	6.20	20.31	436	581
15000	341.21	349.79	362.50	8.57	21.29	359	530
20000	344.33	350.97	362.50	6.63	18.17	451	545
25000	344.27	352.11	362.50	7.84	18.23	318	461
30000	347.50	353.65	362.50	6.15	15.00	365	418
35000	349.36	355.18	362.50	5.82	13.14	339	386
40000	352.43	358.09	362.50	5.65	10.07	1119	1161
45000	345.68	359.67	362.50	13.99	16.82	235	303
50000	353.14	360.84	362.50	7.71	9.36	322	354
54000	355.65	362.22	362.50	6.57	6.85	903	909

NOTES:

- Headpond condition assumes a constant elevation of 362.5 m
- Surveyed channel widths ignore the presence of islands (far right bank to far left bank)
- Surveyed depths are the maximum depths on the day of survey (May 21-31) at a higher than average discharge of about 2100 m³/s.
- (Lower depths will occur with lower discharge)







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RESULTS OF BATHYMETRIC SURVEY



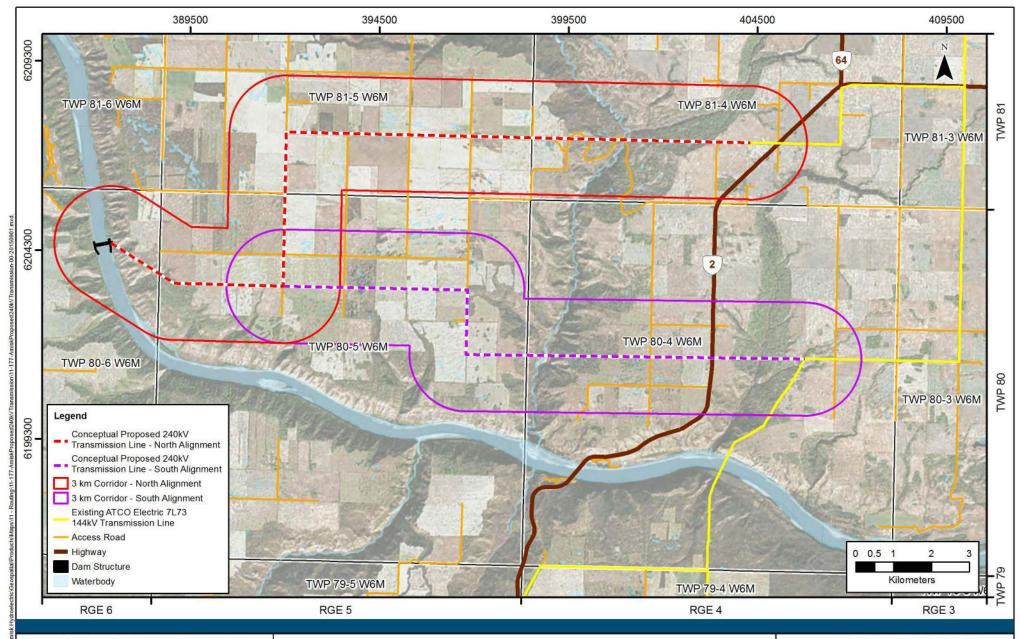
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Sources Imagery

Substation and Transmission/Power Supply Line

A substation containing switchgear and transformers will be located onsite to transform power generated by the facility to the transmission voltage of 240 kV. A new, approximately 25 km long transmission line will be required to connect the Project to the Alberta Interconnected Electricity System (AIES) located east of the site. The exact location of the transmission line has yet to be determined. The general corridor, through which potential transmission rights-of-way is expected to be located, is shown in Figure 2-4.

The right-of-way width for the transmission connection could range from 35 – 74 m and will be confirmed once more Project details become available.



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CONCEPTUAL PROPOSED ALTERNATE ROUTING FOR 240 kV TRANSMISSION LINE FROM HEADWORKS

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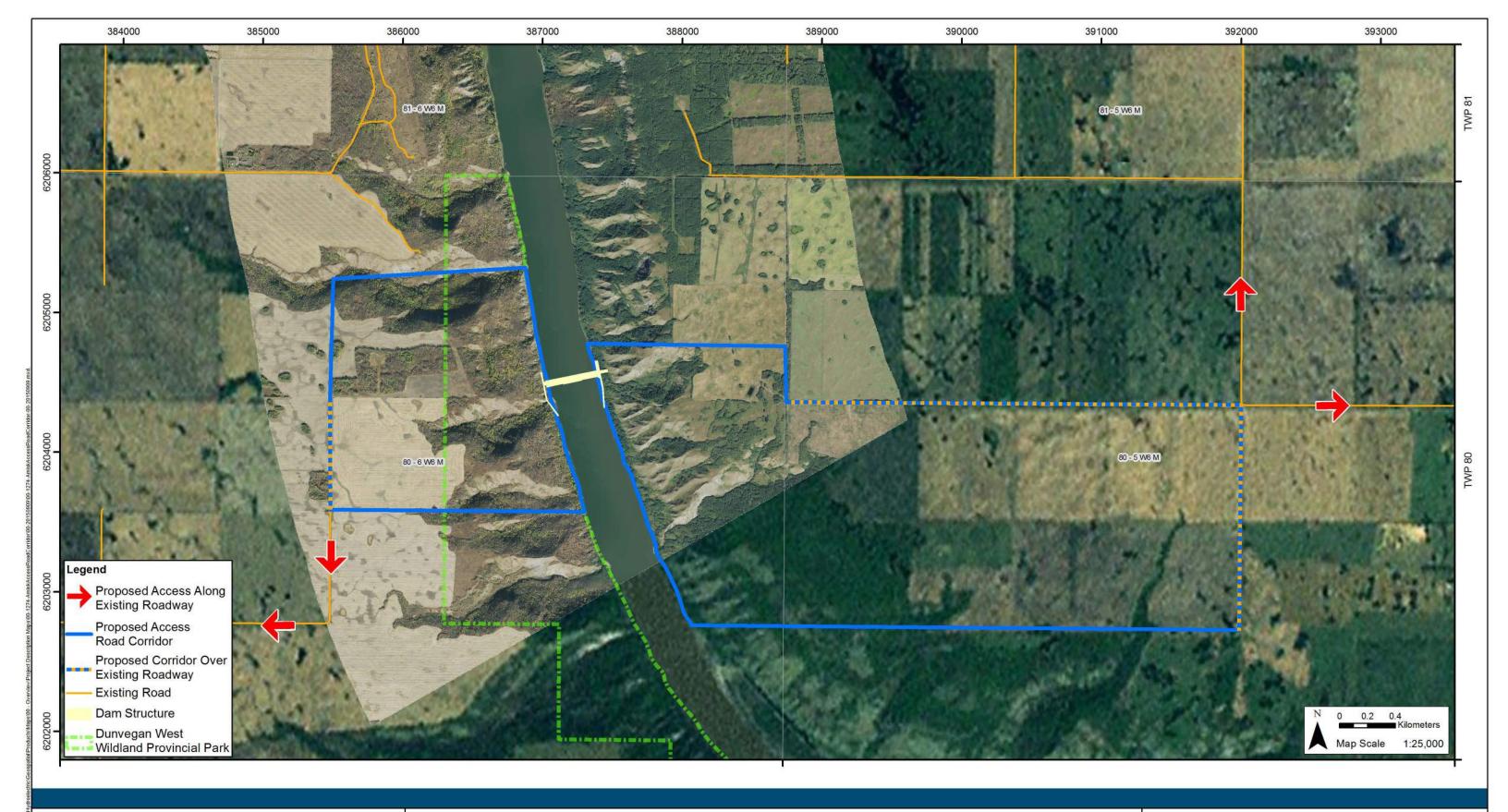


Sources: Highway/Access Roads: Geobase 2007; Waterbody: NRCAN 2013; ATCO Transmission Line: AltaLIS 2014

Imagery: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Access Roads

Permanent road access to the site will be provided on both the east and west sides of the Peace River valley via connections with existing local roads. Figure 2-5 shows corridors within which these access roads may be constructed. A total of 7 km of new access roads will be required for both sides of the Peace River. Anticipated grades will not exceed 8% and roads will be designed to accommodate two-way construction traffic. The access road width is anticipated to be approximately 7 - 10 m, but this is subject to confirmation during the design process. In addition to new roads, approximately 18 km of existing roads will require upgrading to handle the anticipated construction traffic.



Projection: NAD 83 UTM Zone 11N. When printed on 17" X 11" sheets, scale is 1:25,000

ACCESS ROAD CORRIDOR



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Fish Passage

To date, criteria required for managing upstream fish passage is under development. The Project has initially made an allowance to accommodate upstream fish passage. Consultation with Fisheries and Oceans Canada is planned to establish regulatory requirements including the species requiring passage which is anticipated to dictate the type of fish passage facility that will be required.

Boat Passage

The Peace River between Williston Headpond and the Slave River is explicitly classified as a navigable waterway under the *Navigation Protection Act* (*NPA*). Regulatory approval under the *NPA* is expected to be required for the Project. Consultation with Transport Canada (Navigation Protection Program) is planned to establish regulatory requirements. AHP is currently evaluating a number of options for boat passage including a possible boat lock, portage system or a combination of boat launches.

2.2 Project Activities

Project construction and operation phases are described below.

2.2.1 Construction

Construction of the proposed facility is scheduled to take place over approximately five years from 2018 to 2023. A detailed construction schedule will be prepared as part of the Project application process and will take into consideration potential environmental constraints including work to avoid sensitive timing windows and to minimize Project effects on breeding birds and other wildlife species.

Construction activity details will be developed as part of Project feasibility study, but it is anticipated that construction would likely include the following activities (with potential timing and duration in parentheses):

Site Preparation (2018)

- Installation of sediment and erosion controls, as required prior to ground disturbance;
- Installation of construction camp (if required), including provisions for potable water and sewage collection/discharge;
- Construction of permanent granular access roads to each side of the proposed facility, with activities including:
 - Vegetation clearing;
 - Topsoil stripping;
 - Grading and foundation preparation;
 - Installation of granular fill (granular sources to be determined);
 - Ditching and other stormwater/erosion and sediment control mitigation; and
- Construction of works and laydown areas, including office facilities.

Stage 1 Construction (2018-2020)

- Installation of the first stage cofferdam in the river to facilitate construction of facilities on one side of the river (e.g. powerhouse, fish passage facility, partial portion of spillway) in a dry condition. Potential cofferdam designs to be determined during future engineering phases.
- Construction of facilities behind the cofferdam, with general construction activities including:
 - Mechanical excavation of existing soils and sediments (temporary and/or permanent disposal on or off-site to be determined);
 - Bedrock excavation (if required) mostly mechanical removal (temporary and/or permanent disposal locations on or off-site to be determined). Some local blasting may be required for large boulders;
 - Installation of water management measures within excavation;
 - Foundation preparation;
 - Installation of formwork and concrete for powerhouse and spillway (on-site requirements for a concrete batch plant to be determined); and
 - Installation of powerhouse and spillway mechanical equipment (e.g., spillway gates, turbines, generators) as well as balance of plant equipment (e.g. electrical, HVAC, water supply, sewage, office facilities, etc.)
- Commissioning of water passage through partially constructed spillway and/or powerhouse, and removal of Stage 1 cofferdam.

Stage 2 Construction (2021-2023)

- Installation of Stage 2 cofferdam to construct the remaining portion of facility, with all flow diverted through the portion of the facility constructed during Stage 1;
- Construction of remaining facilities within the area dewatered behind the Stage 2 cofferdam;
- Removal of Stage 2 cofferdam;
- Construction of substation and transmission line, including vegetation removal within right-of-way;
- Headpond preparation including vegetation removal within the anticipated inundation area (as necessary);
- Inundation of headpond by slowly decreasing flow through powerhouse/spillway (maintaining a minimum downstream flow at all times);
- Testing and commissioning; and
- Site rehabilitation (e.g. stabilization, re-vegetation, removal of all temporary features).

The staging noted above is subject to change pending the completion of the Feasibility Study.

2.2.2 Operation

The Project will operate as a run-of-river facility, which is a term used to describe hydroelectric facilities that do not have significant long-term storage.⁵ It will operate with a full supply level (FSL) of about 362.5 masl. This would result in a total headpond volume of about 124,000,000 m³. The potential for a limited amount of drawdown during times of peak demand and/or supply shortfall on the Alberta electricity grid is currently under evaluation.

Flow up to the facility's capacity (approximately 1,760 m³/s) will be directed through the powerhouse and turbines, and any flow required for operation of the fish and boat passage facilities will be passed through those facilities. All excess flows over and above this amount will be passed through the spillway. It is anticipated that the powerhouses and spillway will be operated to maintain the headpond within a narrow band around the FSL in order to ensure the run-of-river mode of operation is maintained. Due to this run-of-river mode of operation, there will not be a meaningful change to existing flow patterns in the Peace River.

An operating plan will be prepared as part of the Project application process and it is anticipated that the facility will be required to monitor river flow and water levels on a regular basis.

The facilities will be designed for remote operation in addition to having on-site controls. It is anticipated that at least one permanent operator will be at the facility on a regular basis.

Regular facility monitoring, periodic testing (e.g. backup diesel generators, if present) and routine maintenance will be conducted throughout the life of the facility.

Routine maintenance may include items such as:

- Access road grading, granular addition, dust suppression and snow ploughing and/or de-icing;
- Grass cutting around the facility;
- Periodic tree/shrub removal along the transmission line corridor;
- Mechanical equipment maintenance (e.g. fluid changes); and
- Concrete spot repairs.

2.2.3 Decommissioning

Presently, there are no plans to decommission the Project. Upgrading or rehabilitation to extend the facility's life will take place as part of major maintenance expenditures and depend on the condition of the plant and equipment. Decommissioning, if required, would typically occur 100 years or later following construction. It would depend on the structural/historic attributes of the facility as well as economic and financial considerations at the time. The decision on decommissioning (or alternatively upgrading or

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⁵ Run-of-river implies a less than 48 hour retention time for river flows in the headpond according to the Quantification Protocol for Run-of-River Projects under Alberta's Specified Gas Emitters Regulation.

further rehabilitation to extend facility life) will depend on numerous factors which will be considered. A Conceptual Decommissioning Plan will be prepared as part of the Project application process.

2.3 Emissions, Discharges and Waste

2.3.1 Atmospheric Emissions

During construction, gaseous emissions to the atmosphere will occur from various pieces of operating construction equipment, including heavy machinery and generators. Blasting, if required, may also result in periodic air emissions during construction. It is not anticipated that any explosives will be manufactured on-site. Any explosives stored on-site will be contained in a manner compliant with Natural Resources Canada requirements and industry standards. Transport of explosives will be done in accordance with Transport Canada requirements (i.e. Transportation of Dangerous Goods Regulations). Fugitive dust may also occur periodically during construction.

Gaseous wastes from the facility are not anticipated to occur during normal operations, although air from the powerhouse will be vented through the facility's HVAC system. This is not anticipated to include any potentially harmful gases or particles. However, periodic operation of back-up diesel generators (during testing and on an as-required basis during power outages) would result in some air emissions.

2.3.2 Liquid Discharges

Industrial Liquids

Fuels, hydraulic fluids, and lubricants will be used in equipment during Project construction and operation. The storage facilities for these materials will comply with all current regulations and guidelines.

No specific discharge of these materials is anticipated to occur during Project construction. A spill prevention and response plan will be prepared and implemented throughout the construction process to ensure that accidental spills are prevented to the best extent practicable, and that mitigation measures are implemented to minimize negative effects in the event of an accidental spill.

An operational spill prevention and response plan will be prepared and implemented during long-term operation of the facility. This will include specific protocols on storage, handling and use of industrial liquids at the facility. In addition, spill containment facilities are anticipated to be included in the powerhouses and at the substation to prevent accidental discharge of industrial liquids to the environment, should a spill occur.

Any waste fluids generated during construction or operations will be retained in an appropriate storage container and transported and disposed off-site at an appropriate disposal facility, in accordance with all regulatory requirements.

Water Management during Construction

It is anticipated that stormwater management and/or sediment control ponds will be required during construction to manage stormwater and/or water seeping into excavations and prevent discharge of sediment laden water back to the Peace River. The locations for these facilities have not been determined but it is anticipated that they will be required on both sides of the Peace River and will discharge back to

the river downstream from the work area. Treatment requirements and control measures will be determined during the Project application process.

It is anticipated that the powerhouse will discharge water that may accumulate within the structure, through a sump pump or other similar system. Spill containment measures will be in place to prevent discharge of industrial liquids through this system in the event of an accidental spill inside the powerhouse.

Sewage

Human sewage generated during construction at the camp (if required) and working areas will either be contained and hauled off-site or treated through an appropriately designed sewage treatment or disposal system.

It is anticipated that the powerhouses will have washroom and sink facilities. The method of collection and treatment of sewage from these features has not yet been determined, but it is anticipated that sewage will either be collected and transported off-site or treated and disposed in an appropriate designed sewage treatment or disposal system.

2.3.3 Waste Disposal

Solid nonhazardous construction waste (e.g. material packaging), generated during the construction process, will be removed from the site to an approved disposal location (likely a municipal landfill) or recycling/composting facility, as available. Waste debris from clearing activities (e.g. grubbing, non-merchantable timber) will be disposed of in accordance with regulatory requirements. Industrial liquids such as paints, sealants, fuels, and lubricating fluids will be stored in a secure containment area and disposed in accordance with applicable regulations.

3. PROJECT LOCATION

3.1 Description of Project Location and Site Plan

3.1.1 Project Coordinates

The proposed Project would be located on the Peace River in northwestern Alberta approximately 28 km southwest from the town of Fairview.

As currently planned, the centroid of the dam headworks are located at $55^{\circ}58'19.6''$ North latitude and $118^{\circ}48'28.8''$ West longitude and the western extent of its headpond at $56^{\circ}18'05''$ North latitude and $119^{\circ}11'45''$ West longitude.

3.1.2 Site Plan

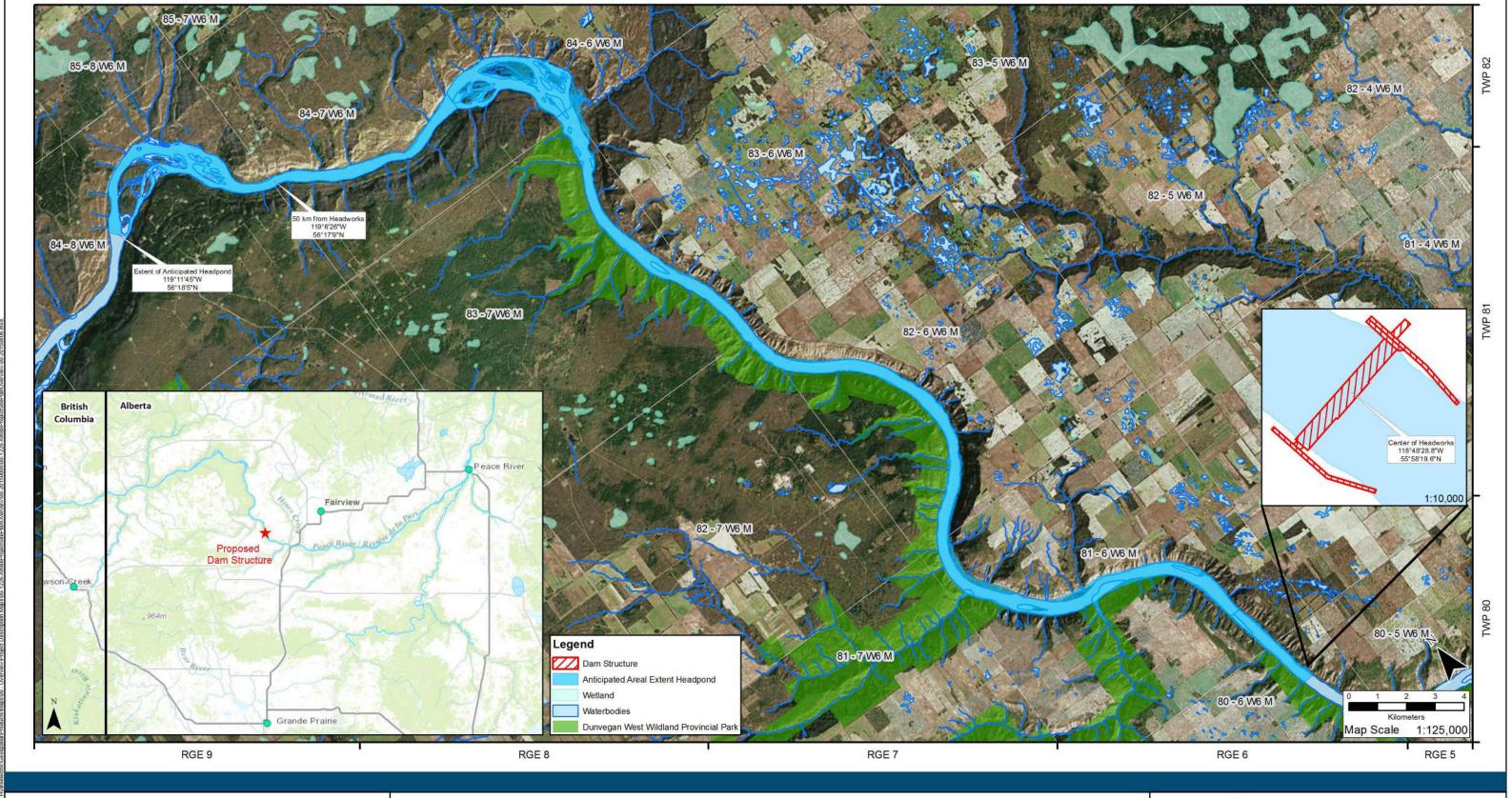
The Project headworks and an approximately 50 km long headpond constitute the Project area as shown in the site map (Figure 3-1). The right and left banks of the Peace River, upstream of the headworks consist generally of steep valley walls that have been dissected by frequent large gullies and ravines.

3.1.3 Project Maps

A series of maps are presented in Figures 3-1 through 3-4 showing the following information:

- Named watercourses and waterbodies;
- Linear infrastructure;
- Land use;
- Location of nearby aboriginal settlements;
- Federal lands;
- Nearby communities;
- Land ownership;
- Environmentally sensitive areas; and
- Provincial and international boundaries.

Text descriptions to the maps are also provided.



AMISK SITE MAP

PROJECT OVERVIEW



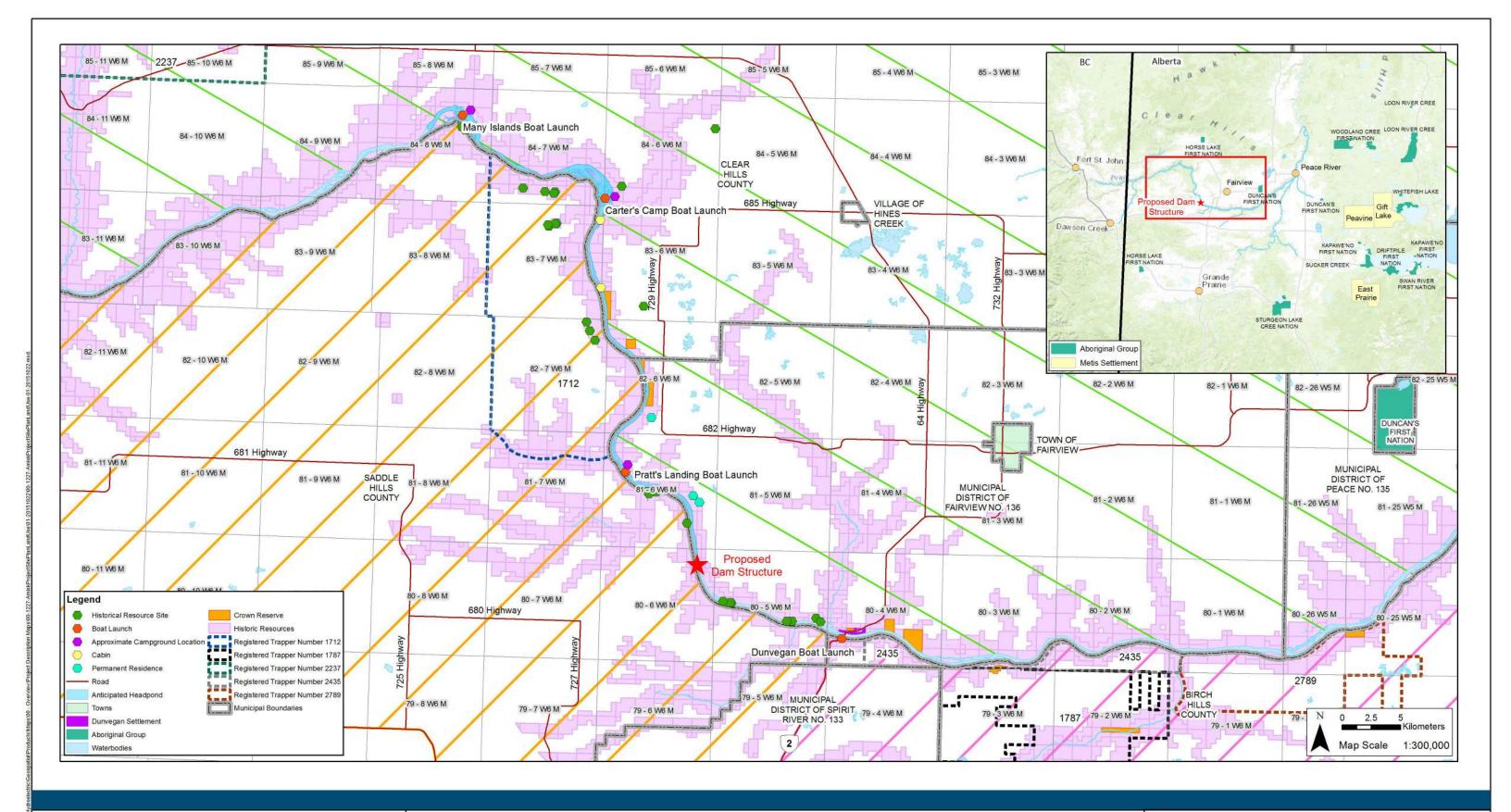
This drawing is prepared solely for the use of AHP Development Corporation. Integrated Environments (2006) Ltd. assumes no liability to any other party for any representations contained in this drawing. Although there is no reason to believe that there are any errors associated with the data used to generate this product or the product itself, users of this data are advised that errors in the data may be present.

Projection: NAD 83 UTM Zone 11N. When printed on 8.5" X 11" sheets, scale is 1:125,000

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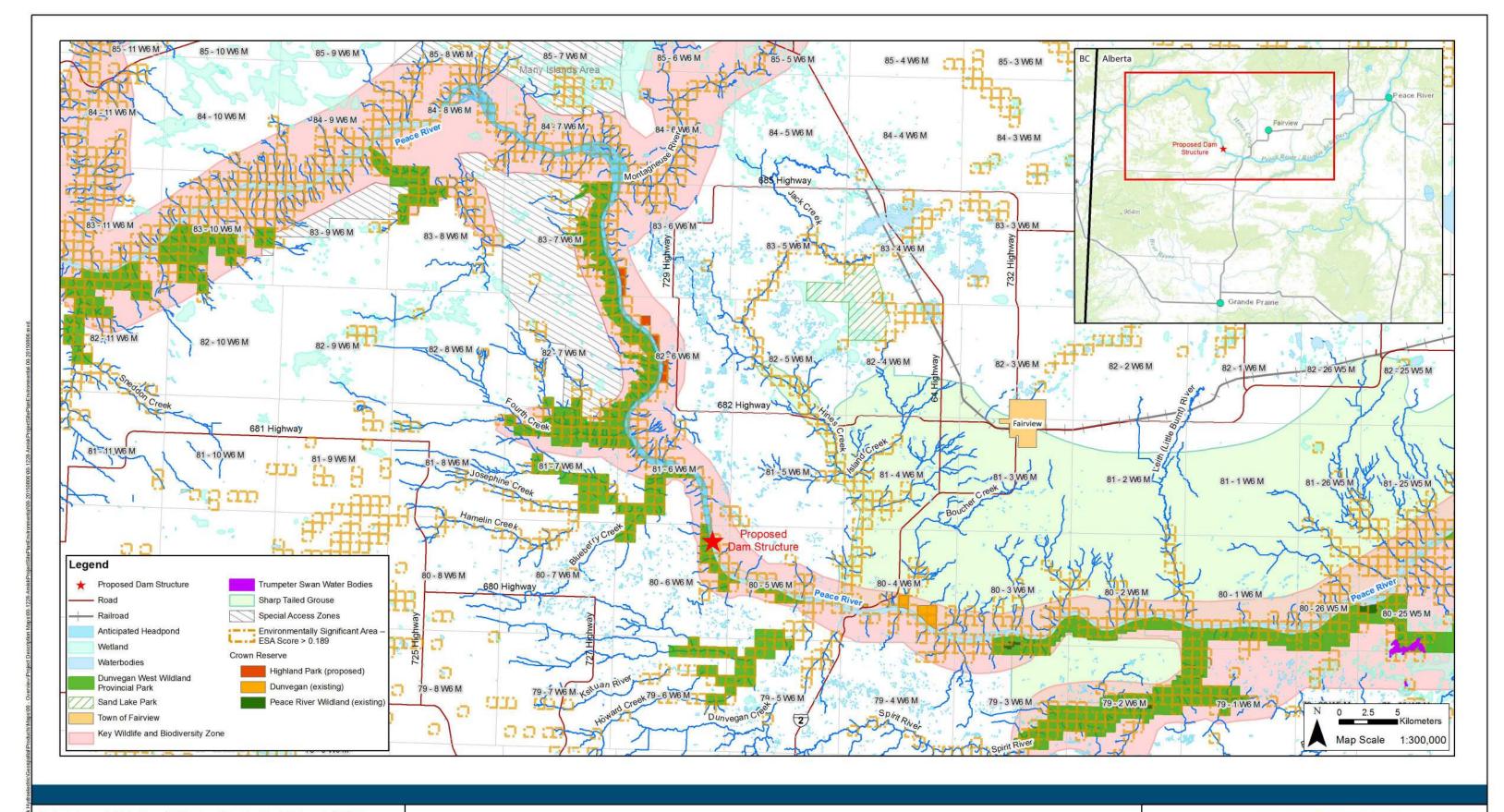
Projection: NAD 83 UTM Zone 11N. When printed on 8.5" X 11" sheets, scale is 1:300,000 **AMISK SITE MAP**

LAND USE

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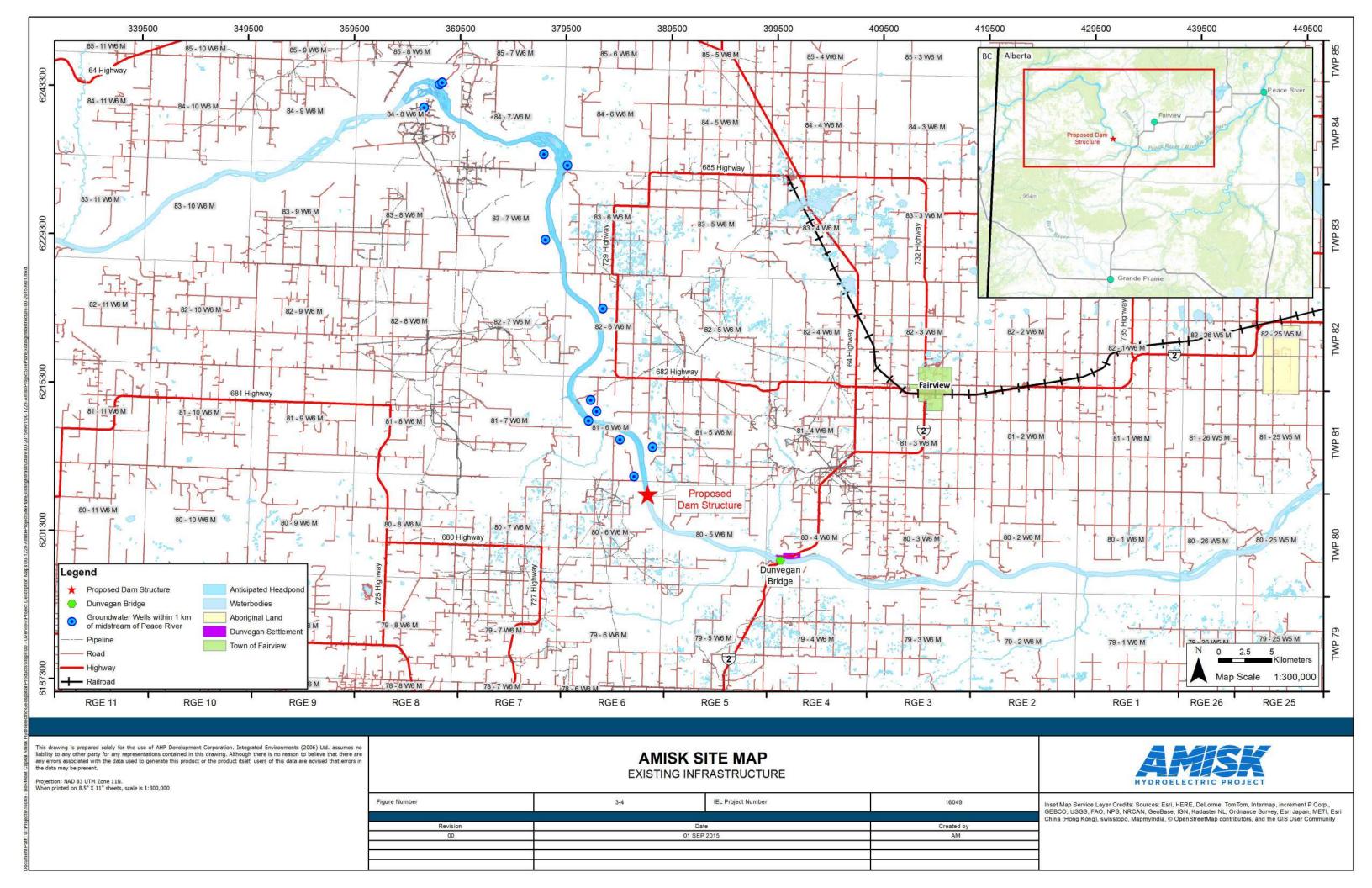
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AMISK SITE MAP ENVIRONMENTALLY SENSITIVE AREAS



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Waterbodies and Fishing Areas

There are several watercourses which drain into the segment of the Peace River encompassed by the Project area: Blueberry, Hamelin, Josephine, Mulligan, and Fourth Creeks (near the headworks) and the Montagneuse River (approximately 38 km upstream from the headworks). A number of unnamed tributaries flow into the Peace River between the headworks and the upstream extent of the headpond. Numerous small waterbodies (wetlands) occur within the Project area. Aboriginal and recreational fishing areas are yet to be determined.

There are three boat launches currently located along the proposed headpond and one downstream of the headworks (Figure 3-2).

Existing Infrastructure

One railway line runs northeast of the Project area and there are several roads in proximity, with the Dunvegan Bridge crossing the Peace River approximately 15 km downstream of the headworks. No pipelines have been identified crossing the Peace River within the Project Area, although several, related to oil and gas activities, are in proximity (Figure 3-4). There is one major electrical transmission line which crosses the Peace River at approximately 51 km upstream of the headworks (just east of Many Islands).

At least 13 groundwater wells are located within 1 km from the midstream of the Peace River (Figure 3-4) between the headworks and the western extent of the headpond. These wells consist of domestic, industrial, municipal, observation and structure test holes uses.

A search made on AEP's Authorization Viewer on August 31, 2015 for municipalities within the Project area identified licensees holding surface water diversion licensees for the Peace River.

Land Use

Features of existing and past land uses are shown in Figure 3-2.

Locations of Aboriginal groups and settlement land are shown in Figure 3-4. Duncan's First Nation and Horse Lake First Nation are approximately 60 and 90 km away respectively from the Project. The Peavine (Métis) Settlement is approximately 159 km from the Project area. The location of traditional territory and its proximity to the Project area is still to be determined and is therefore not shown.

Several small communities are in proximity to the Project area, the largest being the town of Fairview (Figure 3-4). There are at least three permanent residences on the east side of the Project area at approximately 5.5, 6, and 18 km upstream from the headworks. Seasonal residences are located at Pratt's landing and Carter Camp at approximately 12 and 38 km upstream from the headworks (Figure 3-2).

Environmentally Sensitive Areas

The Project is located within the Dunvegan West Wildland Provincial Park on the west bank of the river. This 20,968 ha park was established in 2000 and includes a unique mixture of grassland, aspen forest and steep-sided creek valleys. Several plants and birds located in the park are more typical of those in the Foothills Parkland subregion. The areas of the park are limited to unleased Alberta Crown land resulting in a non-contiguous park boundary (ATPR, 2014).

Within a 1 km buffer on either side of the Peace River, extending from the headworks to the western extent of the headpond, approximately 13,600 ha are designated as Environmentally Significant Areas (ESRD, 2014). These ESAs have relatively high ecological integrity and ability to contribute to water quantity and quality (Fiera, 2014). Key Wildlife and Biodiversity Zones are present throughout the river valley of the Project area. These areas are considered to be a combination of key winter ungulate habitat and higher habitat potential for biodiversity (ESRD, 2010). Protective notations have been established by the Alberta Crown along the Peace River to protect ungulate habitat and winter ranges as well as watercourse protection, recreational natural area potential and fragile slopes.

3.1.4 Photographs

A photograph of the location of the proposed headworks is provided in Appendix A.

3.1.5 Proximity of the Project

The Project is not located on any federal lands, however the nearest lands belonging to the Department of National Defence are approximately 420 km southeast (Edmonton Garrison) and the nearest National Park is Jasper National Park, located approximately 278 km southwest. Locations of First Nations are described above.

3.2 Land and Water Use

3.2.1 Zoning Designations

The Peace River forms a portion of the boundary between the Alberta municipal districts of Clear Hills County, Saddle Hills county and MD of Fairview No. 136.

Clear Hills County

Clear Hills County is on the north side of the Peace River. Current zoning in Clear Hills County within the area impacted by the Project is predominantly agricultural district 1 on the left bank of the river, with agricultural district 1 further from the river. Agricultural district 1 focuses on encouraging agricultural use. Agricultural district 2 serves to control larger scale use around urban centres. Rural recreational district zoning and highway development zoning may also impact aspects of the Project. No zoning specifically permits or prohibits the Project; however, components will require changes or relaxations in the existing bylaws to ensure compliance with county requirements. Impacts on environmentally sensitive lands require review by the County (Clear Hills Bylaw, 2015).

Municipal District of Fairview No. 136

The MD of Fairview No. 136 is on the north side of the Peace River, adjacent to Clear Hills County. Current zoning in the MD of Fairview No. 136 contains agricultural zoning for conservation of contiguous agricultural lands and complimentary agricultural industry. Rural recreational district zoning and highway development zoning may also impact aspects of the Project. No zoning specifically permits or prohibits the Project; however, components will require changes or relaxations in the existing bylaws to ensure compliance with county requirements. Impacts on environmentally sensitive lands require review by the MD (MD of Fairview, 2015).

Saddle Hills County

Saddle Hills County is on the south side of the Peace River. Current zoning in Saddle Hills County within the area impacted by the Project contains agricultural zoning and Alberta Crown lands. The agricultural use focuses on compatibility and Alberta Crown land use varies in purpose. The zoning immediately adjacent to the Peace River is Alberta Crown land district. Rural recreational district zoning and highway development zoning may also impact aspects of the Project. No zoning specifically permits or prohibits the Project; however, components will require changes or relaxations in the existing bylaws to ensure compliance with county requirements. Impacts on environmentally sensitive lands are impacted by zoning and require review by the county (Saddle Hills County, 2015). The Dunvegan West Wildland Provincial Park lies within Saddle Hills County. Re-designation of any portion of this park to allow the Project to proceed will be made through Alberta Environment and Parks.

3.2.2 Legal Land Descriptions

The land within the Project local study area (LSA), as represented by all sections within a 1 km buffer on either side of the centre line of the river, contains a mix of private and Alberta Crown for both surface and subsurface ownership (Table 3-1). There are no surface or subsurface Federal lands within this area.

Table 3-1: Lands within one kilometre study area (full sections included)

Legal Description				
Township 80, Range 6, W6M: sections 25, 26, 35, 36				
Township 81, Range 6, W6M: sections 1, 2, 3, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23,				
28, 29, 30, 31, 32				
Township 81, Range 7, W6M: sections 25, 36				
Township 82, Range 6, W6M: 4, 5, 6, 7, 8, 9, 16, 17, 19, 20, 21, 28, 29, 30, 31, 32				
Township 82, Range 7, W6M: 1, 25, 36				
Township 83, Range 6, W6M: 6, 7, 18, 19, 30, 31, 32				
Township 83, Range 7, W6M: 1, 11, 12, 13, 14, 23, 24, 25, 26, 35, 36				
Township 84, Range 6, W6M: 5, 6, 7, 8, 18				
Township 84, Range 7, W6M: 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20				
Township 84, Range 8, W6M: 12, 13, 14, 15, 16, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 33, 34, 35, 36				

The Crown in the right of Alberta (referred to as "Alberta Crown") owns the Peace River, including the beds and shores. The *Public Lands Act* section 3(1) confirms this ownership and the *Surveys Act* section 17 confirms the definition of the boundaries. References to left and right bank indicate the position of the bank in relation to a downstream facing direction.

3.2.3 Surface Description

Surface ownership of the sections of land within the 1 km study area is held by both Alberta Crown and private owners. Prior to final applications and submissions, information for impacted Alberta Crown lessees and private landowners will be updated. There is no federal ownership within the LSA.

The planned inundation will exceed the current boundary of Alberta Crown ownership along the shore and impact privately held lands as shown in Table 3-2. Inundation maps indicate the predicted extent of the impact.

Table 3-2: Inundation impact on private lands

Legal Description	Side of River
NE19-81-6W6	Right
SE21-81-6W6	Left
SE22-81-6W6	Left
SW31-81-6W6	Left
SW5-82-6W6	Left
SW21-82-6W6	Left
NW31-82-6W6	Left
NW7-83-6W6	Left

3.2.3.1 Private Surface

Ownership

Based on searches conducted in June 2015, private land within the Project area occurs mostly along the left bank of the Peace River.

Occupants

Information on the individual occupants, residents or lessees with respect to private lands, where they are not the landowner, will be gathered during contact with the landowners and during any land surveying activities.

3.2.3.2 Alberta Crown Surface

Ownership

Land adjoining the Peace River for the extent of this Project is predominantly owned by the Alberta Crown. Immediately adjacent to the proposed dam site, the lands in the east half of section 35 and east half of 26, Township 80, Range 6, West of the 6th Meridian are currently part of the Dunvegan West Wildland Provincial Park.

Occupants

Agreements for occupation on Alberta Crown surface encompasses activities for the oil and gas, forestry, recreation and agriculture sectors, as well as trapping and county use. The additional category of protective notations are present to provide ongoing protection with respect to slope stability, erosion prone areas, and ungulate zones. Portions of any agreements which abut the current shoreline of the Peace River for the extent of the inundation will be flooded.

3.2.4 Subsurface Description

Subsurface or mineral ownership of the land within the Project study area is predominately held by the Alberta Crown. Prior to final application, information for impacted Alberta Crown lessees and private landowners will be updated. There is no Federal mineral ownership within the local study area.

3.2.4.1 Private Subsurface

Ownership

Private ownership of minerals within the 1 km study area accounts for 1% of the total acreage (Table 3-3).

Table 3-3: Private Lands Subsurface Ownership

Legal Description	Hectares	Acres
084-06W6: NW5	64.7	160
081-06W6: NW32	64.7	160
081-06W6: NE28	64.3	159
081-06W6: SW32	64.7	160

3.2.4.2 Alberta Crown Subsurface

Ownership

Alberta Crown subsurface ownership encompasses 99% of the total acreage within the Project study area (Table 3-4).

Table 3-4: Alberta Crown Subsurface Ownership

Legal Description	Hectares	Acres
080-06W6: 25, 26, 35, 36	1,024	2,560
081-06W6: 01, 02, 03, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, S28, NW28, 29, 30, 31, E32	5,952	14,880
081-07W6: 25, 36	512	1,280
082-06W6: 04, 05, 06, 07, 08, 09, 16, 17, 19, 20, 21, 28, 29, 30, 31, 32	4,096	10,240
082-06W6: 04, 05, 06, 07, 08, 09, 16, 17, 19, 20, 21, 28, 29, 30, 31, 32	1,024	2,560
082-07W6: 01, 25, 26, 36	2,304	5,760
083-06W6: 06, 07, 18, 19, 30, 31, 32	2,816	7,040
083-07W6: 01, 11, 12, 13, 14, 23, 24, 25, 26, 35, 36	1,216	3,040
084-06W6: S5, NE5, 06, 07, 08, 18	4,864	12,160
084-07W6: 01, 02, 03, 04, 05, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	4,864	12,160

3.2.4.3 Lessees

Lessees of the Alberta Crown subsurface are oil and gas industry corporations or their representatives.

3.2.5 Water Use

At least 13 groundwater wells are located within 1 km from the midstream of the Peace River (Figure 3-4) between the headworks and the western extent of the headpond. These wells consist of domestic, industrial, municipal, observation and structure test holes uses.

A search made on AEP's Authorization Viewer on August 31, 2015 for municipalities within the Project area identified licensees holding surface water diversion licensees for the Peace River.

3.2.6 Relevant Planning Documents used for Consultation Purposes

AHP is currently in the process of determining applicable resource management and conservation plans to the Project. Land use requirements within the municipalities located in the Project area is presented under Section 3.2.1.

Land on the west/south side of the river bank required for the headworks and associated access roads are within the Dunvegan West Wildland Provincial Park and construction of the Project is prohibited. Park lands affected by the Project will require rezoning or re-designation to another recreational use. Counties, towns and government authorities have been made aware of these potential impacts to the Park.

3.2.7 Use of Traditional Lands for Project Development

Early consultation has indicated that Duncan's First Nation and Horse Lake First Nation are the two most likely Aboriginal Groups to have their traditional territory impacted by the Project. AHP is currently working with these Aboriginal Groups to determine the extent of their traditional use on the Peace River. Meetings, open houses, boat and helicopter tours with elders and knowledge keepers have been conducted with both Aboriginal Groups to further understand impacts to traditional use. The involvement of Aboriginal Group members in AHP environmental studies has been proposed to both Aboriginal Groups.

AHP will continue to work with these Aboriginal Groups to understand traditional use in the area and the potential impacts to traditional use.

AHP will work with all Aboriginal groups that have concerns the Project will impact their traditional territory and traditional use of that territory.

4. FEDERAL INVOLVEMENT

4.1 Federal Financial Support

The Project will be privately financed. There is no proposed nor anticipated federal financial support from federal authorities.

4.2 Use of Federal Lands for Project

The Project will be located entirely on Alberta Crown land or privately held land. There are no federal land holdings or interests involved.

4.3 Federal Regulatory Requirements

The Project requires a Project Description to determine whether an environmental assessment is required under the *Canadian Environmental Assessment Act, 2012*.

Specific regulatory requirements requiring applications are outlined in Table 4-1. The Project activities will require compliance with additional federal regulations. These will be fully assessed as part of the Project Application. If the Project changes, further compliance or additional applications may be necessary. The impact on regulatory requirements will be assessed with these changes in Project components.

Table 4-1: Preliminary Federal Regulatory Requirements

Act, Regulation, Code of Practice or Guideline	Regulatory Body
Canadian Environmental Assessment Act, SC	Canadian Environmental Assessment Agency
2012, c.19, s.52	Canadian Environmental Assessment Agency
Fisheries Act, RSC 1985, c.F-14	Fisheries and Oceans Canada
Fishery (General) Regulations (SOR/93-53)	Fisheries and Oceans Canada
Navigable Waters Works Regulations (CRC,	Transport Canada
c.1232)	Transport Canada
Navigation Protection Act, RSC 1985, c.N-22	Transport Canada

5. ENVIRONMENTAL EFFECTS

This section describes the anticipated environmental effects of the Project. It is based on preliminary information and desktop review at this time. A full analysis of effects will be completed as part of the environmental assessment process associated with the Project Application.

5.1 Physical and Biological Setting

5.1.1 Air Quality, Noise and Climate

Air Quality

Air quality in the vicinity of the Project can be classified as "good," with little to no industrial presence. The environmental setting for the Project in the context of air quality will be quantified using monitoring stations maintained by the Peace Airshed Zone Association (PAZA), which encompasses the Grande Prairie region. The nearest ambient monitoring stations to the Project are Beaverlodge (91 km south-southwest of the Project), Henry Pirker (86 km south), Evergreen Park (93 km south), and Smoky Heights (69 km south-southeast), which monitor the following contaminants of concern: sulphur dioxide (SO₂), hydrogen sulphide (H₂S), oxides of nitrogen (NO_X), carbon monoxide (CO), ozone (O₃), fine particulate matter (PM_{2.5}), and various hydrocarbons. There are no other airshed zones located north of PAZA, nor any closer to the Project from which to acquire ambient data. The Beaverlodge and Smoky Heights stations are the most representative due to their more rural surroundings and their proximity to the Project.

Noise

The environmental noise setting in the vicinity of the Project can be classified as "rural" in the context of AUC's Rule 012 – Noise Control. The acoustic environment is currently characterized by sounds due to natural sources (wildlife, wind and the river) as well as occasional boat and vehicle traffic. There is no significant industrial activity in the area that impacts the ambient noise levels near the Project.

Climate

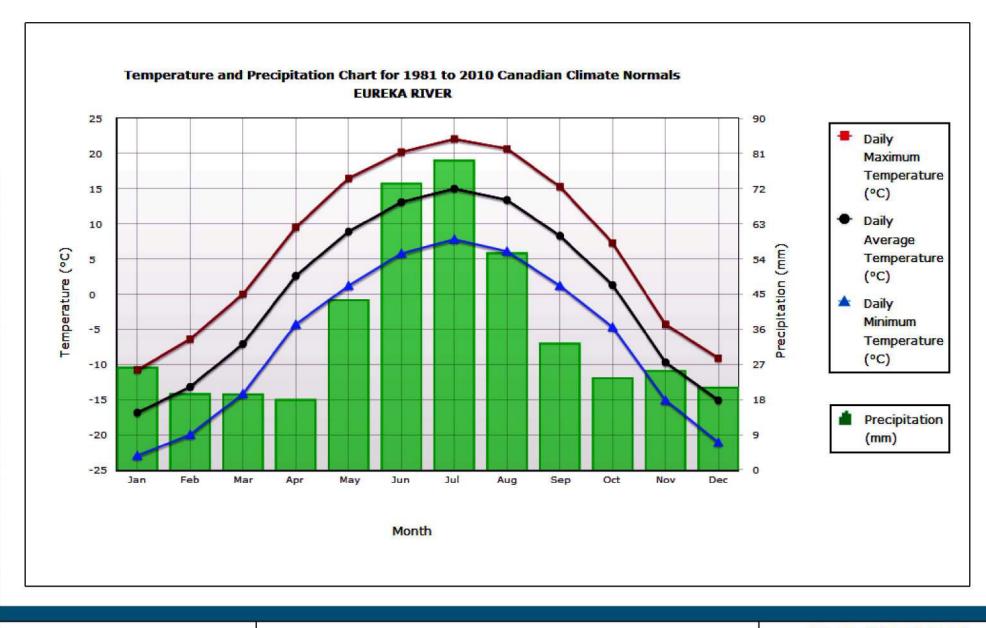
The climate setting in the Project area can be summarized as "humid continental" and borderline "sub-arctic." This is characterized by a long and cold winter season, followed by a relatively short-lived but warm and moist summer. Days where the temperature exceeds 30°C are rare in the summer. The summer months (June to August) are also typically those with the most precipitation (Environment Canada, 2015). The nearby Canadian Climate Normals stations that provide data representative of the region are Eureka River (59 km north of the Project) and Grande Prairie A (87 km south); their data are presented in Figures 5-1 and 5-2.

Potential Project Effects on Air Quality, Noise and Climate

The Project could affect air quality in the area due to emissions from trucks and heavy equipment during construction. Operational air quality emissions will be negligible due to the nature of hydroelectric power generation, and may be impacted due to increases in localized traffic.

The Project could contribute to elevated noise levels arising primarily from construction activities and increases in vehicle traffic. The operational noise levels from the project will be minimal, as all electrical generating equipment will be located within the headworks.

The Project's effects on climate will be via the emissions of greenhouse gases, expressed as equivalent tonnes of carbon dioxide (CO_2e) from construction equipment and vehicles. Other Project contributions to climate change include methane emissions from decaying organic material once the headpond is created.



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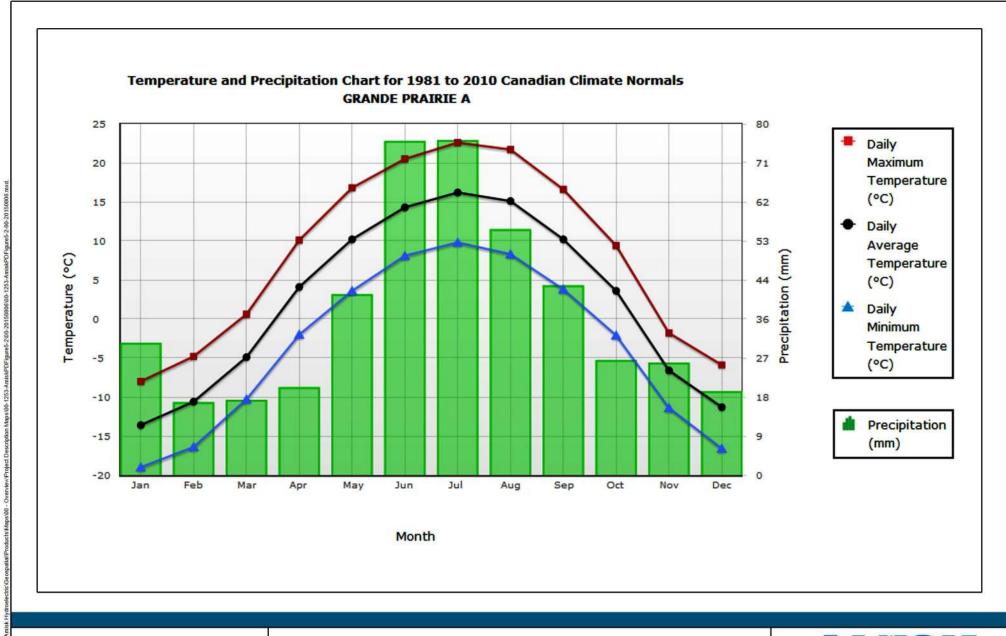
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CLIMATE NORMALS FROM EUREKA RIVER



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CLIMATE NORMALS FROM GRANDE PRAIRIE A



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5.1.2 Geology, Terrain and Soils

Geology

Unconsolidated surficial geological deposits over the upper bedrock range from 0-15 m in thickness within the region (Pawlowicz and Fenton, 1995). Surficial geology of the Project consists of fine to coarse textured fluvial deposits (river deposited sediments) and colluvial deposits (sediments from gravity induced movements), as well as shallow bedrock outcrops (Fenton et al., 2013).

Upper bedrock materials of the region have been identified to consist of the Upper Cretaceous Shaftesbury Formation (exposed at the base of the Peace River valley) and the Dunvegan Formation (exposed along the slopes of the Peace River valley) (Alberta Geological Survey, 2015). The Upper Shaftesbury Formation is characterized as marine off-shore dark grey, blocky-weathering mudstone with concretionary sideritic nodules, silty in the upper part, basal Fish Scales Zone consists of fissile fish scalebearing shale with thin interbeds of siltstone and very fine grained sandstone, generally sand-grade fish-debris bone beds and bentonite. The Dunvegan Formation consists of marginal marine (deltaic) to locally non-marine, light to yellow-grey sandstone interbedded with laminated siltstone and dark grey shale (Alberta Geological Survey, 2015). These marine bedrock formations are documented to have elevated sodicity characteristics, particularly with magnesium sulphate, which contributed to the presence of naturally-occurring saline soils in the region (Alberta Agriculture and Forestry, 2012).

Terrain

The Project is located at the base of the deeply incised Peace River valley within the Northern Alberta Lowlands (Pettapiece, 1987). The Peace River channel along the Project is comprised of a low-gradient (1% slope) surrounded by extreme topographic slopes (> 45 - 70%) with an approximately 250 m elevation change (Government of Canada, 2015).

Soils

The Project is located within Soil Correlation Area 18 coinciding within the Dry Mixedwood Natural Subregion of the Boreal Natural Region (Pedocan Land Evaluation Ltd., 1993). Soils are mapped to consist of a mix of Orthic Regosols and Orthic Humic Gleysols. Orthic Regosols are poorly developed soils with a thin A (topsoil) horizon (less than 10 cm thick) and B (subsoil) horizon (less than 5 cm thick). Orthic Regosols are identified in areas of poor slope stability and high erosion risks. Orthic Humic Gleysols are water saturated soils with thick A and B horizons present (greater than 10 cm thick) (Soil Classification Working Group, 1998). Orthic Humic Gleysols are located in low elevations, where water can accumulate in soils for prolonged periods (Alberta Agriculture and Forestry, 2015). The occurrence of extreme slopes contributes to exacerbation of severe water erosion risks potentially associated with development of the Project (Tajek and Coote, 1993). Wind erosion risks for the Project have been identified as negligible as a result of the fine-textured soil characteristics found within the Project area (Coote and Pettapiece, 1989).

Land Suitability Rating System for Spring Seeded Small Grains (Pettapiece, 1995) uses soil, landscape, and climatic information to determine the capability of land for agricultural production. The Project was identified to consist of Class 5 lands — having very severe limitations for sustained small grain production within slopes of the Peace River. Annual cultivation on Class 5 lands using common cropping practices are not recommended. Class 5 lands at the Project are limited by steep slopes, lack of water holding capacity

or excess water (Pettapiece, 1995). Most agricultural activities occur on flat lands outside of the river valley.

Potential Project Effects on Geology, Terrain and Soils

Project related activities that may have a potential impact on existing geology, terrain and soil resources include:

- Construction and operation of the Project infrastructure and facilities could contribute to increased soil erosion risks and slope instability. Slope instability and water erosion could also increase by changes to the groundwater regime and wave action from the development of the headpond.
- The construction of Project infrastructure and development of the headpond could contribute towards to the loss or inundation of soil resources.
- Project construction and operation activities could contribute towards soil contamination from spills associated with Project equipment and facilities. Potential environmental effects with soil contamination could also occur with the weathering of naturally saline parent materials and bedrock spoil stockpiles on undisturbed soils.
- Soil reclamation suitability could decline from vehicle and equipment rutting, soil compaction, and topsoil-subsoil admixing from Project infrastructure construction and operations. Improper soil conservation methods during construction activities for future use could impact the Project's reclamation suitability.

5.1.3 Vegetation

The Project occurs primarily in the Dry Mixedwood Natural Subregion, a landscape containing extensive tracts of native mixedwood aspen upland forest, cultivated lands, and wetlands occurring in low areas (NRC, 2006).

The Project traverses areas with a large proportion of native vegetation. Key vegetation resource features include forested native lands, wetlands, riparian areas, rare plant communities, sensitive plant communities (e.g., exposed slopes), and rare plant species. Within the Project LSA, the driest sites occur along the steep south and west facing upper slopes of the Peace River. Species such as Porcupine grass, June grass, sedges, and sagewort are interspersed with the bare steep slopes.

Tall tree stands mixed with thick shrub understories occur at the top of the valley river and along the river and tributary terraces. Lower shrub patches are restricted to ravines or riparian areas. Wetlands occur along the shores of the Peace River and in low moist areas covered by trees such as trembling aspen, white spruce, and pine species.

The Project LSA traverses the Dunvegan West Wildland Provincial Park located on the west side of the Peace River. The park serves as a wildlife corridor and has the potential to contain rare plants and rare plant communities.

Potential Project Effects on Vegetation and Wetlands

The main Project impact will be the loss of vegetation communities under the headpond and also at the location of the headworks. A permanent loss of 800 ha of vegetation communities will occur within the

flooded extent of the headpond. The extent of this loss will be determined by vegetation community mapping and ecotype classification.

In addition to the loss of vegetation communities, there could be potential loss of rare plants or sensitive vegetation communities.

A number of wetlands have been identified within the Project area. The loss of or alteration to wetlands will be assessed within the extent of the headpond and considered in relation to the 2013 Alberta Wetland Policy implementation process released in 2015.

Finally, there will be impacts related to the loss of bottom land riverine forest and resultant methane emissions due to decay of organic material in the headpond.

5.1.4 Water

Ice Processes

Ice forms in the Peace River each winter as the water temperature cools to the freezing point. Frazil particles form and rise to the surface forming frazil pans which are carried downstream by the flow, with the surface concentration of the pans increasing downstream along the river. This process continues until the concentration of frazil pans is high enough that the pans jam and a stationary ice cover is formed. The ice cover then builds upstream as more frazil pans accumulate at the ice front. Freeze-up typically is initiated in the vicinity of Fort Vermilion and the ice front progresses upstream over the winter reaching its maximum upstream position somewhere between the towns of Peace River and Taylor. Towards the end of the winter, the water in the upstream open water reach warms up and begins to melt the ice and the ice front recedes downstream.

The operation of the G.M. Shrum (located at the W.A.C. Bennett Dam) and Peace Canyon generating stations in BC has caused the winter flows in the Peace River to be warmer and greater than they would have been under natural conditions. These higher flows have caused higher freeze-up levels to occur in the reach near the Town of Peace River and fluctuating flows have increased the risk of an ice jam forming in this reach. The effect of these higher freeze-up levels is most serious at the Town of Peace River. A Joint Task Force consisting of Alberta Environment, BC Ministry of Environment and BC Hydro has been set up to manage the operation of the Peace River through the winter months to reduce the risk of flooding at the town.

The proposed Site C Project upstream of Taylor will further alter the existing ice regime by changing the water temperatures in the river and by blocking ice from drifting downstream. Both these factors are expected to delay freeze-up and reduce the upstream extent of the ice cover.

<u>Potential Effects of the Project on Ice Processes</u>

The presence of the Project will affect the ice cover both upstream and downstream by blocking the movement of ice.

The Project headworks will trap ice that has formed in the river upstream and initiate an ice cover in the headpond. The ice cover will progress upstream earlier and farther than it would without the Project. This process will tend to counteract the effects of Site C. The Project is expected to cause the ice cover to progress farther upstream than it would with just Site C in operation.

Analysis of ice effects of the Site C Project presented by BC Hydro indicated that the now cancelled Dunvegan Project would have had an effect on the probability that an ice cover would form in the BC portion of the river. This analysis indicated that the Site C project by itself would delay the upstream progression of the ice front so that the probability of an ice cover forming in BC was reduced from about 22% to 10%. The Dunvegan Project would have increased this probability to about 15%. The proposed Project is expected to have a similar effect.

Downstream of the dam, the advance of the ice cover upstream will be delayed because of the reduction in ice supply due to the trapping of ice in the headpond. The timing of freeze-up in the lower reaches of the river are not expected to be affected because all the ice that contributes to the development of the ice cover during this period forms downstream of the dam. However, it is expected that the ice cover formation at the Town of Peace River will be delayed somewhat due to the reduction in ice supply. The length of time that the Shaftesbury ice bridge is in operation may also be reduced. A reach of open water will exist downstream of the dam throughout the winter, and this zone will continue to produce frazil ice. However, these frazil ice particles are expected to be swept under the ice cover and transported downstream.

The Project is not expected to have any effect on ice jam water levels in the Peace-Athabasca Delta (PAD). These ice jam-related water levels are thought to be affected by breakup flow rates and freeze-up water levels. The Project is not expected to have an effect on breakup flow rates or freeze-up levels. Most of the flow increases during breakup on the Peace River are supplied by the Smoky River, which enters the Peace River downstream of the Project. As well, the Project would operate as run-of-the-river with potentially limited active storage so it would have virtually have no effect on flows originating from upstream of the Project. When freeze-up is occurring in the PAD, ice does not form in the Peace River until well downstream of the Project location. Therefore, the Project is not expected to affect the ice supply during freeze-up, and so should have no effect on the timing and severity of freeze-up, and therefore it will have no effect on freeze-up water levels in the PAD.

The magnitude and timing of the Project effects on ice processes will be investigated using a one dimensional river ice numerical model, Comprehensive River Ice Simulation System Project (CRISSP), developed for the assessment of the effect on the ice regime of the previously approved Dunvegan and Site C projects. Ice formation, freeze-up progression and breakup will be evaluated in the river between Hudson Hope and Fort Vermilion to assess potential changes to ice conditions in this segment.

Surface Water Flows

The Peace River originates in the Rocky Mountains of northeastern BC and flows eastward into Alberta before flowing in a north-easterly direction into the PAD. Flows from the Rivière des Rochers and other delta channels combine with the Peace River to form the Slave River which flows northward into Great Slave Lake in the Northwest Territories. The Mackenzie River then flows out of Great Slave Lake northward to the Beaufort Sea.

Presently there are two dams on the Peace River, the W.A.C. Bennett Dam and the Peace Canyon Dam, both located in BC. A third dam, the Site C Project, is proposed to be constructed downstream of the Peace Canyon Dam near Taylor, BC. The operation of the G.M. Shrum generating facility at the W.A.C. Bennett Dam reduces summer flows and increases winter flows relative to the unregulated condition. The

operation of Peace Canyon and Site C do not have an effect on seasonal flow rates but do produce short term flow fluctuations.

Peace River flows are monitored by the Water Survey of Canada (WSC) at eight active stations between the W.A.C. Bennett Dam and the PAD (Table 5-1). The drainage area at the hydrometric stations increases from 73,100 km² at Hudson Hope, just downstream of the Peace Canyon, to 293,000 km² at Peace Point. Once Site C is operational, 36% of the contributing area at the Dunvegan WSC gauge just downstream of the Project will originate from unregulated tributaries downstream of Site C. At the Town of Peace River, 55% of the upstream basin is unregulated, with most of the additional drainage area being provided by the Smoky River, which enters the Peace River just upstream of the Town of Peace River.

Table 5-1: Summary of active WSC flow monitoring stations on the Peace River

Station	Station Name	Province	Drainage Area (km²)	Years of flow data	Start Year
07EF001	Peace River at Hudson Hope	ВС	73,100	70	1917
07FA004	Peace River above Pine River	ВС	87,200	33	1979
07FD002	Peace River near Taylor	ВС	101,000	68	1944
07FD010	Peace River above Alces River	ВС	121,000	19	1974
07FD003	Peace River at Dunvegan Bridge	AB	135,397	50	1960
07HA001	Peace River at Peace River	AB	194,374	74	1915
07HF001	Peace River at Fort Vermilion	AB	227,026	33	1915
07KC001	Peace River at Peace Point	AB	293,000	55	1959

Potential Effects of the Project on Surface Water Flows

The operation of the proposed Project will not significantly affect flow rates in the Peace River. The Project is expected to operate as a run-of-river plant with a total headpond volume of about 124,000,000 m³. The average open water flow rate in the Peace River at Dunvegan is about 1,600 m³/s so the average retention time of the headpond would be less than one day.

The rate of initial filling is not known at present, but it is anticipated that the headpond will be filled slowly to limit the impacts on downstream water levels and to minimize changes in water pressure at the dam. Assuming that the headpond is filled over a two week period, about 100 m³/s (6% of the mean flow) would be extracted from the daily flow entering the headpond. This flow reduction is not expected to have a significant effect downstream because it is a one-time occurrence. At Peace Point it would only reduce water levels in the Peace River by 8 to 10 cm over the two week filling period. If the headpond is filled during high flows, it could be filled more rapidly without affecting downstream water levels significantly. Therefore, filling of the headpond is not expected to affect peak water levels during peak flow events in the PAD.

The full supply level of the headpond is proposed to be 362.5 m which represents a rise of about 17 m in water level, relative to existing water levels at average flows. The headpond is expected to increase water levels, relative to existing conditions, for a distance of approximately 50 km upstream of the dam. Additionally there will be a backwater transition zone approximately 10 km long between the flat headpond and the uniform flow of the river. The exact termination of this transition zone is still under review.

Open water flows and water levels will be simulated using HEC-RAS, a one-dimensional unsteady flow model developed by the US Army Corp of Engineers. Flows will be simulated from Hudson Hope to Peace Point to evaluate potential changes in flows rates and water levels that would arise while the headpond is being filled and during the day to day operation of the facility.

Sedimentation and Morphology

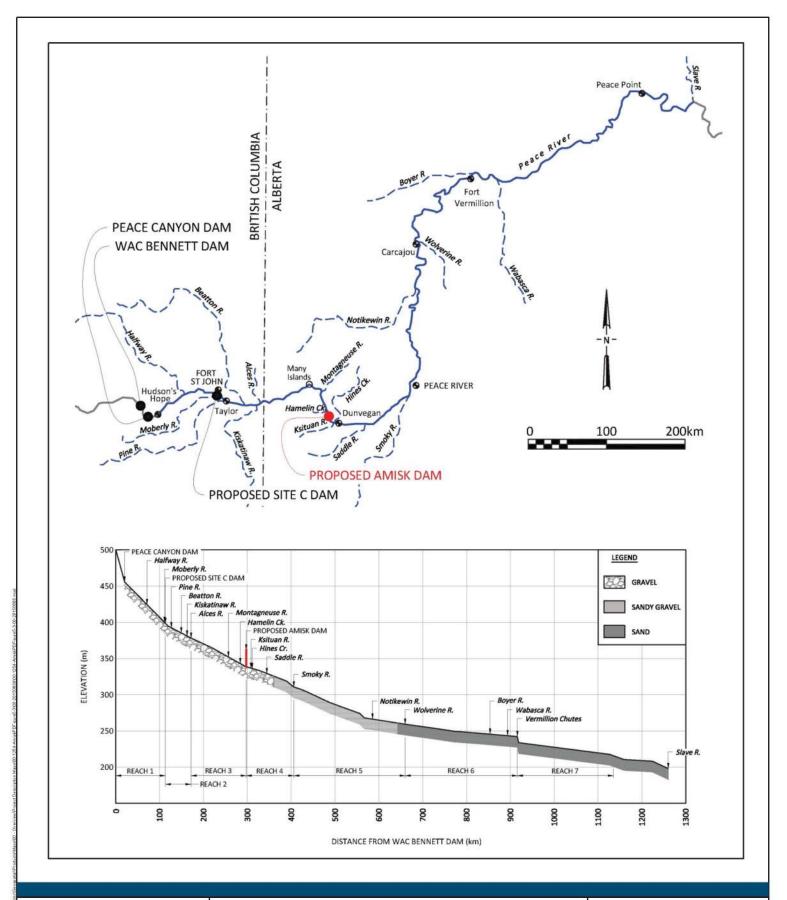
Physical Setting

Figure 5-3 shows the Peace River extending from W.A.C. Bennett Dam to the Slave River and includes significant tributaries, reference points, and the main reaches. The focus of the sedimentation and morphology studies encompasses Reach 2 through Reach 6 and covers a distance of over 810 km.

Peace River drains 293,000 km² of northeast BC and Alberta. Its headwaters lie in the northern Rocky and Omineca Mountains. Over most of its course the Peace River is entrenched into the Alberta Plateau within the Peace River Lowlands, a physiographic region that extends east of the Rockies and along both sides of the Peace River to about 80 km downstream of Fort Vermillion.

The Peace River Lowlands are characterized by steep valley walls and tributaries that deliver abundant sediments to the river. Pleistocene sediments are found along the valley including outwash gravels and glacio-marine, glacio-lacustrine, and post-glacial lacustrine silt and clay. A consequence of this is a general downstream increase in the sediment yield along the river (Church, 2015). Episodic events have a potential to rapidly deliver significant volumes of sediment to the channel either from the river valley walls or from tributaries.

Historically, the Peace River Lowlands are considered to be one of the most active regions of mass movement in western Canada (Morgan et al, 2012). Over the past 25 years, several Peace River tributaries have experienced landslide events that, by volume, rank as some of the largest in Alberta: Hines Creek, Spirit River, Eureka River, Vessall Creek, and Saddle (Burnt) River (Miller, 2000). When the Saddle River event was triggered by a large flood event in June 1990, it resulted in lateral and vertical erosion of the river, formation of a temporary dam and mobilization of an estimated 40,000,000 m³ of material (Cruden et al, 1993). The 1973 Attachie Slide at the Halfway River confluence in BC blocked the river for 12 hours and Cruden et al. (1990) reported more than 60% of the valley walls have failed in Alberta downstream to Fort Vermilion.



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Not To Scale

PLAN AND LONGITUDINAL PROFILE OF THE PEACE RIVER DOWNSTREAM OF THE W.A.C BENNETT DAM

AMISK HYDROELECTRIC PROJECT

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Channel Morphology

Near the BC-Alberta border, the Peace River is entrenched by more than 200 m into the surrounding plateau which partially or totally confines the river. This reach has an irregularly sinuous pattern with minor meander development in places. It is predominantly single threaded with an irregular spacing of islands and bars. The river bed consists of cobble and gravel downstream to the Smoky River confluence where it changes to sandy gravel. Downstream of the Smoky River, the Peace River has formed a series of sinuous meanders that are partly controlled by bedrock in the valley walls. The river changes to a sand bed river further downstream near Carcajou.

The hydrology, hydraulics, and morphology of the Peace River have been affected by construction of W.A.C. Bennett Dam in 1967. These effects have been monitored and assessed over the last 30 years by a number of scientific and technical authorities and researchers, particularly BC Hydro (Kellerhals and Gill, 1973) and Michael Church of the University of British Columbia (Church, 1995; Church, 2014). Contribution of sediment upstream of W.A.C. Bennett Dam is relatively minor in comparison to downstream areas; therefore, the downstream effects of W.A.C. Bennett Dam on sediment loads has been minor. The main effects of W.A.C. Bennett Dam have been caused by flow regulation, which has modified the temporal pattern of the flows and substantially reduced the peak discharges. The reduction in peak flows has reduced the sediment transport capacity of the river downstream of W.A.C. Bennett Dam, triggering morphological changes.

Changes to the river's morphology have been described as mainly passive in nature, due to the reduced competence of the river to transport and erode sediment. As a result, sediment inputs from tributaries tend to build out or aggrade into the main channel which has led to the river developing a more stepped profile than existed prior to regulation. The effect is most evident in the BC portion of the river and generally decreases with distance downstream. The Smoky River, which is the largest tributary of the Peace River and joins at the Town of Peace River, has extended into the Peace River by up to 200 m causing bar accretion around islands downstream of the confluence and causing backwatering of the Peace River (Church, 2014).

Tributaries on the BC portion of the river downstream of W.A.C. Bennett Dam have experienced degradation due to reduced water levels in the mainstem following regulation. However, tributaries downstream of the BC-Alberta border showed no consistent pattern of degradation or aggradation.

Because the regulated flows lack the capacity to move bed material along much of the river, the active channel has started to shrink along most of its length. At Many Islands and the Montagneuse River confluence, this has resulted in abandonment of secondary channels. Post regulation vegetation encroachment on formerly active bar surfaces and floodplain has been documented, most noticeably along the BC portion of the river but has also in Alberta.

Predictions by Church (2014) suggest that the effects of W.A.C. will continue to alter the physical characteristics of the river and that channel width reductions by between 50% and 30% could occur along much of the river. The time scale for these adjustments to be completed is expected to span the remainder of this century or possibly longer. Therefore, the Peace River is continuing to adjust to flow regulation effects from the W.A.C. Bennett Dam that were initiated over 40 years ago.

Potential Project Effects on Sedimentation and Morphology

Construction of the Project will alter the balance between the flow of water and sediment on the Peace River, both upstream and downstream of the dam. The effects on the Peace River include changes to the channel cross section, gradient, planform, and texture of the riverbed sediment. These changes will be superimposed on other ongoing long-term channel adjustments that are occurring as a result of flow regulation from W.A.C Bennett Dam as well as from other planned operations from the proposed Site C dam. Previous studies indicate that the Site C dam in British Columbia will have a minor effect on sediment loads in Alberta (Knight Piésold, 2012).

Upstream Effects

Immediately after construction, the headpond will extend approximately $50 \, \text{km}$ upstream of the dam with the water depth in the headpond ranging from about $9-23 \, \text{m}$. During average flow conditions, the current through the headpond will be relatively slow moving but will still act more like a river than a lake. The headpond will trap 100% of the incoming gravel bed load and a high percentage of the suspended sand load. Most of the incoming fine sediment (clay and silt) will be flushed through the headpond and will be discharged downstream.

A sandy delta will form near the upstream end of the headpond and will prograde downstream towards the dam over time. As sediment deposition continues, it will reduce the headpond depth and increase flow velocities, producing a backwater effect that will extend the headpond further upstream.

Downstream Effects

Sedimentation in the headpond will reduce the downstream sediment load on the Peace River, particularly the suspended sand load and gravel bed load. Preliminary sediment transport modelling indicates that after the Amisk Hydroelectric Project is completed, the annual suspended sediment load downstream of the dam will be reduced by more than half immediately after construction. As the headpond fills, the trap efficiency will reduce, allowing more sediment to be discharged downstream.

At present, the Peace River near the dam site is estimated to transport somewhere approximately between 12 - 15.6 million tonnes of suspended sediment. The Smoky River adds in the order of 17 - 21 million tonnes/year at its confluence, more than doubling the load of the Peace River downstream of the Smoky River.

It is expected that the effect of the Amisk Dam is attenuated downstream of the confluence of the Smoky River though the effects of the reduction in sediment load will occur to Peace Point. The distance and degree that downstream effects will occur is a function of the channel and bank composition, and tributary contribution of flow and sediment.

5.1.5 Water and Sediment Quality

Environment Setting

Water and sediment quality are important characteristics of the aquatic environment that influences fish and fish habitat. A description of the water and sediment quality baseline conditions within the Project area will be used to support the effects assessment of fish and fish habitat.

Water quality data is currently being collected from the Peace River and selected tributaries. Sampling of the Peace River was initiated in 2014 and will continue in 2015. Samples are being collected from the Montagneuse River in 2015, which is a named tributary to the Peace River within the Project area. Sample locations include upstream, headpond and downstream sites in the Peace River and the lower section of the Montagneuse River. Sample frequency is intended to capture seasonal variation in water quality. Measured parameters include water temperature, turbidity and total suspended solids, nutrients, metals (including methylmercury), carbon and polycyclic aromatic hydrocarbons.

Sediment quality data is currently being collected from the Peace River. Sampling of the Peace River was initiated in 2014 and will continue in 2015. Sample locations in the Project area include upstream of the headpond, upper, middle, lower sections of the headpond and downstream of the headpond. One set of samples are being collected each year. Measured parameters include particle size, nutrients, metals (including total and methylmercury), and organic carbon.

The water and sediment quality data collected by the baseline studies program will be augmented by data being collected by other Project disciplines, historical data available from government files, as well as information presented in support of environmental assessment applications for the Dunvegan and Site C projects.

Preliminary findings indicate that the Peace River is a cool water system that can exhibit high total suspended solids concentrations and levels of measured contaminants in both water and sediment are generally low. These characteristics likely influence fish distribution, fish species diversity and fish use of habitats.

Peace River water temperatures vary seasonally, but there is a minor difference in water temperature between upstream and downstream locations separated by 29 km (Table 5-2). Peace River water temperatures are cooler than tributary water temperatures during the summer months. Total suspended solids in the Peace River vary seasonally and can exceed values of 4,000 mg/L (Table 5-3). Total suspended solids concentrations are highest from May to July, which corresponds to the period of increased tributary discharge and then decline during late summer, fall, and winter months.

Table 5-2: Peace River monthly water temperatures recorded in the Peace River Project area (from Mainstream 2006a)

Month	Ups	tream	Downstr	eam			
WIOIILII	Mean	Range	Mean	Range			
May	10.2	7.7 - 12.0	10.5	8.1 - 12.1			
June	13.7	9.9 - 18.8	14.0	10.2 - 18.8			
July	15.4	13.2 -17.8	15.8	13.6 - 18.0			
August	13.3	11.2 - 15.9	13.6	11.5 - 15.9			
September	9.3	5.8 - 12.3	9.4	5.8 - 12.3			
October	7.8	3.5 - 9.3	7.9	3.8 - 9.2			

Table 5-3: Seasonal range in suspended sediment concentration in the Peace River Project area (from Glacier 2006)

Month	Suspend	ed Sediment Concentratio	n (mg/L)
	Mean	Minimum	Maximum
April	315	78	482
May	481	0	2470
June	439	79	4730
July	256	32	1390
August	87	11	734
September	46	5	221
October	31	10	115
Winter Period	20-30	-	-

Potential Project Effects on Water and Sediment Quality

Preliminary water quality results indicated that concentrations of some total metals (e.g., aluminum) recorded in the Peace River were related to the concentration of total suspended solids. Some total metal concentrations exceeded provincial and federal water quality guidelines for the protection of aquatic life. In contrast, concentrations of dissolved metals tended to be near or below detection limits. Preliminary results from sediment quality data indicated that total metal concentrations recorded in the Peace River sediment were low and did not exceed existing federal sediment quality guidelines for the protection of aquatic life.

5.1.6 Wildlife

The Project is located in the Peace River Valley which supports a wide and diverse range of wildlife and their associated habitats, representative of the Dry Mixedwood subregion (Boreal Forest Natural Region). Elements of the Peace River Parkland subregion (Parkland Natural Region) may also be present. The Peace River Valley provides seasonal and/or year round habitat for approximately 44 species of mammals, 166 species of birds, and seven species of reptiles and amphibians (Tera, 2000), (Federation of Alberta Naturalists, 2007). It is an important natural wildlife movement corridor offering a protective sanctuary from the highly human altered landscape that lies beyond the valley breaks.

Portions of the Project area also are contained within the Dunvegan West Wildland Provincial Park that covers 20,968 ha and is fragmented into 11 different sections to the west and southwest of the Peace River (Hermanutz and Stavne, 2009). A range of land uses occur outside of the valley, including oil and gas, agriculture, several traplines, and sand/gravel extraction. Recreational activities occur within the valley including canoeing, jet boating, fishing, hunting, camping, hiking, snowmobiling, and off road vehicle use. A spring bear hunt and fall hunt for moose, elk, and white-tailed and mule deer occurs both within the Park and elsewhere in the valley.

Wildlife baseline surveys will build on existing data sets prepared for the Glacier Power Environmental Impact Assessment (Jacques Whitford Limited, 2006) and the recent Site C Application (BC Hydro, 2013). Discussions about the scope of wildlife surveys have been held with Alberta Environment and Parks,

previously Alberta Environment and Sustainable Resource Development, wildlife representatives in Grande Prairie and Peace River.

The following wildlife technical studies are either underway or being considered in support of the Project Application:

- Spring raptor and waterfowl studies;
- Amphibian surveys;
- Breeding bird surveys;
- Snake hibernacula surveys;
- Fall migration surveys;
- Winter mammal tracking; and
- Additional studies, as required.

Potential Project Effects on Wildlife

The primary impact of the Project on wildlife will be direct and indirect habitat loss associated with flooding of the Project area. Due to the steep sided nature of the Peace River valley, this impact will be minimal over the 50 km extent of the headpond; approximately 800 ha of habitat will be lost. This loss will be replaced over time by the creation of new habitat types within and upstream of the headpond.

Direct habitat loss and disturbance to wildlife may occur in the immediate area of the Project headworks, access roads, transmission lines, and associated camps and laydown areas.

Flooding may also impact calving habitat on river islands. Wildlife movements across the river during the winter months may be affected due to changes in ice conditions and the timing of ice formation. The Project may also have the potential to increase wildlife vulnerability due to predation, increased hunting and accidents (e.g. vehicle collisions, avian collisions with transmission lines, drowning during headpond filling or operation etc.). Human disturbance during the construction phase may lead to a temporary displacement of wildlife.

Baseline studies will allow for a further understanding of these Projects effects on animal distribution and movements, habitat use, reproduction, survival, and mortality. Wildlife mitigation, monitoring, and management measures will be developed as part of the Project Application.

5.1.7 Aquatic Resources

Environmental Setting

The purpose of the Aquatic Resources baseline studies program is to collect and compile information needed to describe baseline conditions which will be used to inform the environmental assessment of Project effects on fish and fish habitat. Components of the baseline studies program include fish and fish habitat studies, benthic productivity studies, and characterization of methylmercury in the aquatic environment. The information generated from the benthic productivity and methylmercury studies will be used to support the environmental assessment of fish and fish habitat.

Data collected by the current baseline studies program will be augmented by historical data, as well as information presented in support of environmental assessment applications for the Dunvegan and Site C projects.

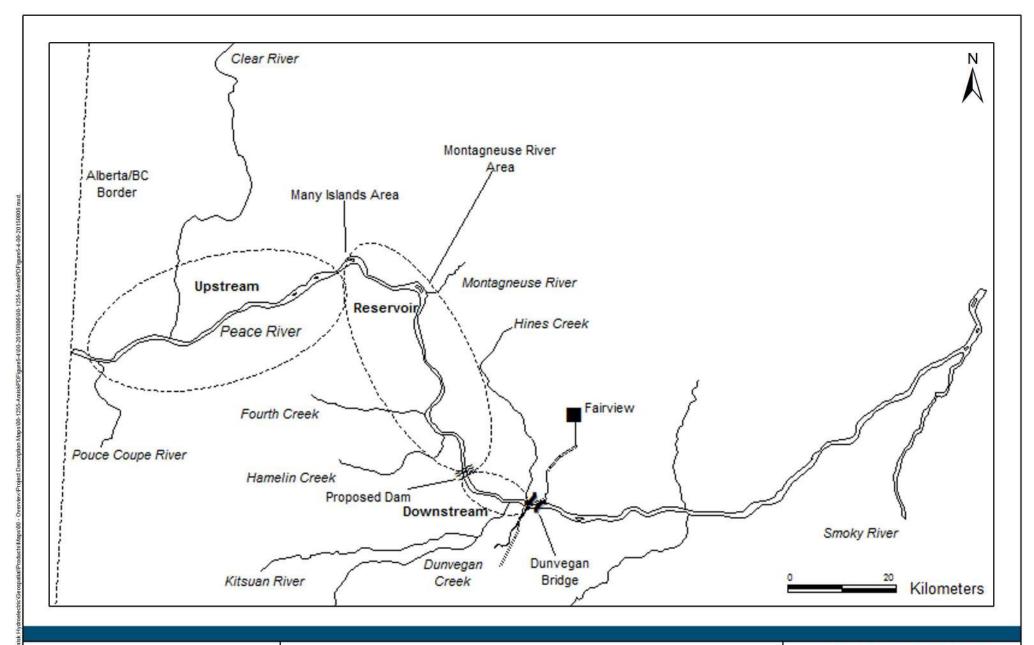
The following provides a concise overview of each component of the program component and provides a summary of initial findings. These will be fully elaborated as part of the Project Application.

Benthic Productivity

Benthic productivity is a key component of large river ecosystems. Productivity and diversity of benthic communities are indicative of aquatic ecosystem health and benthic communities are an important food source for fish. The benthic productivity program will collect data from the Peace River at locations within upstream, headpond and downstream sections of the Project area (Figure 5-4). The program will use protocols developed specifically for large rivers such as the Peace River (Schleppe et al., 2013). Artificial substrates will be deployed during the open water period from July to September. Sampling will include collection of time series data from the artificial substrates to ascertain peak biomass production. In addition, natural substrate sampling will augment artificial substrate sampling to provide insights into how established communities compare to more recent communities that establish on artificial substrates. Parameters to be measured will include abundance, diversity, and biomass of periphyton and benthic invertebrates.

From past studies of benthic communities in the Peace River in Alberta, the abundance, diversity and productivity of the benthic algae and benthic invertebrate community in the Project area is a function of habitat characteristics that define the area (i.e., water velocity, suspended sediment load and substrate particle size). The Project area contains two general types of benthic algae and invertebrate communities: hard substrate communities associated with swift water and large particle sizes and soft-substrate communities associated with slower water velocity and small particle sizes. Due to the high water velocities in the main channel, this part of the aquatic habitat likely supports hard-substrate communities, whereas the soft-substrate communities are likely to be restricted to habitats in low velocity areas found in near-shore areas.

The benthic algae and invertebrate communities in the Project area are currently influenced by several factors that limit their productivity capacity. Some important factors include the operational regime of the W.A.C. Bennett Dam that causes dewatering on a seasonal and daily basis, and high sediment loads that cause reduced light penetration, scour and sediment deposition.



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Not To Scale

AQUATIC BASELINE STUDIES PROJECT AREA, 2015



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Notes:
Sources:
Imagery:

Methylmercury

Flooding of organic soils to create new headponds can increase the concentration of organic or methylmercury concentration in the environment and bio accumulate in fish. The magnitude and duration of increase in methylmercury in fish is highly dependent on site-specific conditions, with potential risks to wildlife and to humans changing over time, depending on fish mercury concentrations. The methylmercury program is designed to collect data needed to address the potential issue of mercury accumulation in aquatic biota related to the Project. This strategy is intended to build an information base to support the environmental assessment of fish and fish habitat and to allow informed decisions and predictions around impacts to human health.

Data collection was initiated in 2014, which focused on water and river sediment. Data collections in 2015 are expanded to include (in addition to water), soil, benthic invertebrates and fish. Sample locations in the Project area include upstream, headpond and downstream sites in the Peace River. Measured parameters are as follows:

- Total and dissolved concentrations of inorganic mercury and total methylmercury in water;
- Total and methylmercury concentration in river sediments (collected in 2014);
- Total mercury and methylmercury concentration, as well as stable isotopes (carbon/nitrogen), in benthic invertebrates;
- Total mercury and stable isotopes (carbon/nitrogen) in fish; and
- Total mercury and methylmercury in soil.

Preliminary Findings

Total mercury concentration in 2014 water samples was influenced by total suspended solids. Total mercury was highest in May (22 - 27 ng/L) during the period of elevated total suspended solids, but with low dissolved mercury (3 - 12 ng/L). During periods of low total suspended solids, total mercury concentration was lower (4 - 5 ng/L). Methylmercury was only detectable during May (0.15 ng/L), at less than 1% of the total mercury concentration. Total mercury concentration in sediment also was low and ranged from 0.049 mg/kg dry weight to 0.065 mg/kg dry weight. Sediment methylmercury concentrations ranged from 0.0003 - 0.0013 mg/kg dry weight. These values were very low and comprised only 0.6% - 2.4% of total mercury concentrations.

<u>Fish</u>

Fish studies are being undertaken to develop an understanding of baseline conditions of the Peace River fish community and species population life histories and habitat uses. Data collected by the current program will be used to augment the comprehensive information base used to support the environmental assessment and post-approval monitoring of the Dunvegan Hydroelectric Project.

A list of pertinent baseline information documents are as follows:

- 1999 Fish and habitat inventory comprehensive report (RL&L, 2000)
- 2002/2003 Fish movement study (Mainstream, 2004)
- 2004 Baseline fish inventory study (Mainstream, 2006a)
- 2004/2005 Fish movement study (Mainstream, 2006b)
- Habitat no net loss plan (Mainstream, 2006c)

- 2008 Fish community monitoring Program (Mainstream, 2009a)
- Burbot (Lota lota) mercury study (Mainstream, 2009b)
- 2008/2009 Fish movement study (Mainstream, 2010a)
- Burbot (Lota lota) life history and movement study (Mainstream, 2010b)

The goal of the Project fish studies program is to address potential data gaps and to update the existing information base. The current program includes collection of fish data from the Project area with a focus on locations not previously investigated (i.e., the upper section of the headpond and Montagneuse River). Sample locations in the Project area include upstream, headpond and downstream sites in the Peace River, and the lower section of the Montagneuse River. Sample frequency is intended to capture seasonal variation and includes spring, summer and fall. Parameters being measured include species diversity, species abundance, life history characteristics, and habitat use.

The Peace River is a transition zone between a cold clear water fish community located primarily upstream and a cool turbid fish community that dominates within the Project area. The community is composed of sportfish, suckers, minnows and sculpins. Of the 27 fish species recorded in the Project area (Table 5-4), none are listed as endangered, threatened or of special concern under Schedule 1, or are being considered for official listing under Schedule 2 or 3, of the federal *Species at Risk Act*.

Four fish species that are infrequently encountered in the Project area are designated as sensitive by the Alberta government (Table 5-4). These are Arctic Grayling, Bull Trout, Largescale Sucker and Northern Pikeminnow. One species infrequently encountered in the Project area is designated as May be at Risk, the Spoonhead Sculpin.

The large-sized component (>200 mm length) of the fish community in the Project area is numerically dominated by sucker species, with the Longnose Sucker being the most numerous in this group. Sportfish are typically less numerous. Walleye, Burbot, Goldeye, Northern Pike, and Mountain Whitefish are the numerically dominant species in this group. The small-sized component (≤ 200 mm length) of the fish community consists primarily of fish in the minnow or sucker groups. Lake Chub and Longnose Sucker are the numerically dominant species. Small-sized sportfish are typically encountered in very low numbers. They can include Walleye, Burbot, Northern Pike, and Mountain Whitefish. During sampling of Peace River tributaries, including the Montagneuse River, only suckers and minnows were recorded. Low numbers of sculpins are recorded in the Project area, with Slimy Sculpin being the most frequently encountered.

Table 5-4: Fish species present in the Peace River in the vicinity of the proposed Project and their provincial status.

Family	Common Name	Scientific Name	Alberta Status ^a
Sportfish			
Salmonidae	Arctic Grayling	Thymallus arcticus	Sensitive
	Bull Trout	Salvelinus confluentus	Sensitive
	Rainbow Trout	Oncorhynchus mykiss	Secure
	Mountain Whitefish	Prosopium williamsoni	Secure
	Lake Whitefish	Coregonus clupeaformis	Secure
	Kokanee	Oncorhynchus nerka	Exotic/Alien
Hiodontidae	Goldeye	Hiodon alosoides	Secure
Esocidae	Northern Pike	Esox lucius	Secure
Percidae	Walleye	Sander vitreus	Secure
	Yellow Perch	Perca flavescens	Secure
Gadidae	Burbot	Lota	Secure
Non-sportfish			
Catostomidae	White Sucker	Catostomus commersonii	Secure
	Longnose Sucker	Catostomus	Secure
	Largescale Sucker	Catostomus macrocheilus	Sensitive
Cyprinidae	Lake Chub	Couesius plumbeus	Secure
	Spottail Shiner	Notropis hudsonius	Secure
	Finescale Dace	Phoxinus neogaeus	Undetermined
	Fathead Minnow	Pimephales promelas	Secure
	Flathead Chub	Platygobio gracilis	Secure
	Northern Pikeminnow	Ptychocheilus oregonensis	Sensitive
	Longnose Dace	Rhinichthys cataractae	Secure
	Redside Shiner	Richardsonius balteatus	Secure
Percopsidae	Trout-perch	Percopsis omiscomaycus	Secure
Gasterosteidae	Brook Stickleback	Culaea inconstans	Secure
Cottidae	Spoonhead Sculpin	Cottus ricei	May be at Risk
	Slimy Sculpin	Cottus cognatus	Secure
	Prickly Sculpin	Cottus asper	Not Assessed

^a May Be At Risk: any species that "May Be At Risk" of extinction or extirpation, and is therefore a candidate for detailed risk assessment; Sensitive: any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk; Secure: a species that is not "At Risk," "May Be At Risk" or "Sensitive."; Exotic/Alien: any species that has been introduced as a result of human activities (from http://aep.alberta.ca/fish-wildlife/species-at-risk/wild-species-at-risk/wild-species-status-search.aspx; 10 June 2015).

Species Population Structure

The majority of sportfish in the Project area are adults. The only exceptions are Mountain Whitefish (juveniles, adults and few young-of-the-year fish) and bull trout (primarily subadults). In contrast to sportfish, all life stages of nonsportfish species are well represented (Table 5-4 provides the list of nonsportfish species). The majority of fish species in the Project area spawn in spring or early summer and have short egg incubation periods. Burbot is the only species that spawns during winter (January or February), but the egg incubation period is also brief. Only two species recorded in the Project area are fall spawners with an extended egg incubation period – Bull Trout and Mountain Whitefish. It is suspected that this life history strategy is not appropriate for the Project area due to unfavourable sediment loads and ice conditions in the Peace River and the lack of water in tributaries, which are factors that minimize the probability of reproductive success.

Fish Movements

There is a substantial amount of information collected from the Project area that describes movements of several fish species. The information presented in this section is based on seasonal catch rates, tag returns, radio-telemetry data, and information from other studies.

Goldeye that occur in the Project area are part of a migratory population that overwinter in the Peace River downstream of the Smoky River confluence. A portion of the population moves upstream into and through the Project area to spawn and/or feed. Some Goldeye remain downstream of the Project area during their annual migration cycle. Other species populations in the Project area are non-migratory. Radio telemetry data for Burbot, Walleye and Longnose Sucker indicate that most fish undertake only local movements within a discrete section of the Peace River between the confluence of the Smoky River and the Many Islands area. Seasonal movement patterns were documented, but distances traveled were generally short (<20 km). Movement data for Walleye, Burbot, and Longnose Suckers indicate that at least a portion of each population spawns outside of the Project area.

For most fish species expected to occur in the Project area, upstream movements likely commence in April and end in October. Downstream movements likely occur from August to November. During the months of December to March, fish tend to be stationary. Within this general pattern there are species specific movement strategies that are illustrated in Table 5-5.

Fish Habitat

Fish habitats in a large section of the Project area were characterized in terms of quality and quantity. These data were used to evaluate habitat losses and gains in preparation for a No Net Loss Habitat Plan for the Dunvegan Hydroelectric Project (Mainstream, 2006c). The 2015 AHP fish habitat program uses methods similar to the previous investigation. It is designed to update the existing database and address data gaps that exist for the upstream portion of the Project area.

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Table 5-5: Predicted movement patterns of the selected fish species and life stages in the Project area (from Glacier 2006)

Species/	Jar	n	Fe	eb	M	ar	Apr		Ma	ау	Jur	1	Ju	ıl	Au	g	Sep)	Oct		N	0 V	De	ec
Life Stage	Da	Ua	D	U	D	U	D	U	D	U	D	U	D	U	D	U	D	U	D	U	D	U	D	U
Bull trout										J,A		J,A		J,A		J,A	J,A		J,A					
Flathead chub									F		F													
Goldeye								Α	Е	Α	E	А	Α	Α	Α		Α		Α					
Walleye								А	F,A	J, A	F,A	J, A		J, A		J, A	J,A	Α	J, A		Α	ļ	Α)
Burbot	Fb,A		F	A c	F	Α		Α													Α		Α	
Longnose sucker							Α	Α	F,A	J,A	F,A	J,A	Α	J,A	J,A	Α	J,A	Α	Α	Α	Α	Α		
Mountain whitefish							F,J,A		F,J,A		F,J,A		F,J,A		F,J,A		F,J,A		F,J,A					
Northern pike								Α		Α		Α		Α	Α		Α		Α					
White sucker							Α	А	F,A	J,A	F,A	J,A	Α	J,A	J,A	Α	J,A	Α	Α	Α	Α	Α		
Small-fish spp. b								*		*		*		*		*	*		*		*			
Egg									1		1													
Fry	1 ^e		1		1		1		5		5		1		1		1		1					
Juvenile							1		1	4	1	4	1	4	3	2	5		3					
Adult	1			1		1	3	6	4	6	4	6	4	6	5	4	7	3	7	2	4	2	2	

^a D: downstream; U: upstream

Includes all small-sized species populations (≤ 200 mm length).

Number of species, excluding small-fish spp.

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b Life stage abbreviations Egg (E), Fry (F), Juvenile (J), Adult (A), and Combined (*). Note that juvenile life stage for bull trout includes the subadult.

^c Bold letter indicate core movement period for adults in the proposed Project area.

Peace River fish habitats within the majority of the Project area are generally uniform and are dominated by instream Run mesohabitat. River bank mesohabitats provide limited amounts of cover for fish and unique instream mesohabitats are restricted in distribution. Backwaters that provide protected, low velocity areas for fish, although present, are not abundant. Shoal and riffle/rapid habitats that could potentially be used for spawning and rearing habitats are primarily restricted to the Montagneuse River area and the Many Islands area, which are localized areas of increased habitat complexity.

Peace River fish habitats are strongly affected by daily fluctuations in water elevation and are frequently damaged by the unconsolidated ice sheet that forms each year. These impacts are caused by the regulated flow regime associated with operation of the W.A.C. Bennett Dam.

Tributaries to the Peace River in the Project area are characterized by variable flows. Flows are highest during spring freshet or following major rain events. In summer and fall, fish habitat is frequently limited to isolated pools with no surface connection to the Peace River. Channel characteristics of the tributaries in the Project area indicate that they are subject to significant flow events and extensive bedload movement. Due to low or negligible flows, an absence of deep-water habitat capable of supporting overwintering fish, and the prevalence of fine substrates, tributaries in the Project area provide poor habitat for most fish species. They have very limited value to sportfish populations originating from in the Peace River; however, they provide seasonal habitats for minnow and sucker species.

The predicted distribution of fish habitats in the vicinity of the Project area is presented in Table 5-6. The majority of habitats required by fish species in the Project area exhibit widespread distributions.

Table 5-6: Distribution of habitats for selected fish species in the Peace River between Vermilion Chutes and Peace Canyon Dam (from Glacier Power 2006)

	Uį	ostream	of Proje	ect		Projec	t Area		D		ream ject	of
Species	Spawning	Rearing	Feeding	Wintering	Spawning	Rearing	Feeding	Wintering	Spawning	Rearing	Feeding	Wintering
Bull Trout		>	~	~		>	>					
Burbot	>	>	~	~	~	>	>	>	>	>	~	>
Goldeye	>		>		•		>		>	>	>	>
Kokanee	>	>	~	~								
Mountain Whitefish	>	>	~	~		>	>			>	•	
Northern Pike	>	>	~	>	>	>	>	<	>	>	*	<
Walleye	>	>	~	>	>	>	>	<	>	>	*	<
Fathead Minnow	>	>	~	~	~	~	>	>				
Flathead Chub	>	>	~	~	~	~	>	>	>	>	~	\
Lake Chub	>	>	~	~	~	~	>	>	>	>	~	>
Longnose Dace	>	>	~	~	~	~	>	>	>	>	~	>
Longnose Sucker	>	>	~	~	~	~	>	>	>	>	~	>
Northern Pikeminnow	>	>	~	~		~	>			>	~	
Redside Shiner	>	>	~	~	~	~	>	>	>	>	~	>
Slimy Sculpin	>	>	~	~	~	~	>	>	>	>	~	>
Spoonhead Sculpin	>	>	~	~	~	~	>	>	>	>	~	>
Spottail Shiner	>	>	~	~	~	~	>	>	>	>	~	>
Trout-perch	>	>	~	~	~	~	>	>	>	>	~	>
White Sucker	>	>	~	~	~	•	>	>	>	>	•	>

Potential Project Effects on Fish and Fish Habitat

The development of the Project would potentially affect fish populations and fish habitats in the Peace River and its tributaries. Changes would be associated with both construction and operational phases of the facility. Project effects would occur within the spatial footprint of the Project and would extend some distance downstream.

Impoundment of the river by the dam and operation of the facility may cause physical changes to fish habitat, and may alter temperature, sediment transport, nutrients and ice. Operation of the facility would result in entrainment of fish from the headpond over the spillway or through the turbines, which would result in loss of fish from upstream populations and could cause mortality of fish during passage. Spills of water over the spillway and water flow through the turbines may result in elevated levels of total dissolved gas, which could be detrimental to fish. Finally, the presence of the dam is a physical obstruction that would hinder upstream and downstream movements of fish.

These Project effects individually, or in combination, have the potential to destroy or alter fish habitat, alter aquatic productivity and kill fish. The outcome of these effects, without mitigation, would result in harm to fish by causing a shift in species composition, abundance and distribution.

5.2 Changes to Fish, Fish Habitat and Wildlife

The following section describes potential effects of the Project on fish, fish habitat and wildlife under federal responsibility.

5.2.1 Fish and Fish Habitat

See above.

Mitigation measures for Project effects will be examined, including use of a fish passage facility. Mitigation measures predicted to be effective and practicable will be incorporated into the Project design.

5.2.2 Migratory Birds

The development of the Project will result in a loss of riparian habitat as a result of inundation resulting from creation of the headpond. Approximately 800 ha of wildlife habitat will be lost affecting terrestrial migratory bird populations. A total of 166 bird species may occur in the LSA (Federation of Alberta Naturalists, 2007), 132 of which are protected under the Migratory Bird Convention Act. There were 79 bird species identified during the initial June 2015 breeding bird surveys.

The extent of this habitat loss and its consequence will be evaluated as part of breeding bird surveys that will be conducted in the Project area.

Waterfowl may use the Peace River valley for spring and fall staging during migratory movements. The extent of this use and potential project impacts will be assessed.

Mitigation measures for this habitat loss in the form of offset compensation will be considered in conjunction with Alberta Environment and Parks.

5.2.3 Changes to Environment on Federal Lands in another Province

The Project is not expected to impact any federal lands upstream in BC, nor downstream within Alberta or beyond.

5.3 Effects on Aboriginal Peoples

5.3.1 Effects on Health

AHP is currently in the process of evaluating the potential effects on health of aboriginal peoples.

5.3.2 Effects on Socio-economic Conditions

AHP is in the initial stages of a socio-economic assessment for the Project. Many key Project details have yet to be determined, which would significantly affect the socio-economic conditions. What is currently understood is that the "construction phase" of the Project would last approximately 5 years. Direct, indirect and induced economic benefits would be most prevalent during this 5-year construction phase of the Project due to the large work force needed at the time. The workforce needed for the operation phase of the Project after construction would be significantly less than construction. These numbers are yet to be determined.

AHP commits to using local (including Aboriginal) labour and services if they meet quality standards and are cost competitive. AHP is evaluating the opportunity to participate in Mutual Benefit Agreements with Aboriginal Groups significantly impacted by the Project.

5.3.3 Effects on Physical and Cultural Heritage Effects

Studies will occur in 2015 and 2016 that will help provide information on possible effects to physical and cultural heritage. Evidence of contemporary use of the Peace River has been minimal with a few references to fishing. Additional activities with potentially impacted Aboriginal Groups will be planned for 2015 to further understand potential effects. To date the following activities have been utilized to understand potential effects:

- Notification soliciting feedback;
- Meetings with Chief and Council;
- Meeting with Aboriginal Group's designated consultation personnel;
- Consultation with AEP noted First Nation contacts;
- Open Houses held at Aboriginal Group's designated locations;
- River boat tours starting 15 km downstream of the Project site to approximately 50 km upstream of the Project site to encompass the potential inundation area; and
- Helicopter tour of the river valley.

Potential impacts to the river valley include impacts to: vegetation, wetlands, wildlife (including avian and amphibian), aquatics (including fish habitat). Field studies in 2015 and 2016 will occur to understand the extent of these impacts.

To date, no Aboriginal cultural/historical sites have been identified in the river valley by the First Nation Aboriginal Groups or Metis groups, but consultation remains ongoing.

5.3.4 Effects on the Current Use of Lands and Resources for Traditional Purposes

AHP continues to work with Aboriginal Groups that may be impacted by the Project to understand their interests and concerns. Some general concerns that have been put forth to date include impact to fish, habitat (e.g. fish spawning grounds, bear dens), wildlife crossings (if ice composition is impacted) and stability of the river banks. Field studies are occurring to understand baseline information and Project effects. Discussion with Horse Lake First Nation and Duncan's First Nation has occurred regarding the participation of Aboriginal Group members in environmental studies.

5.3.5 Historical Resources

The proposed Project occurs within the Peace River valley, a major travel corridor utilized in both Precontact and Historic periods, with known exposures of fossil bearing Shaftesbury and Dunvegan Formation bedrock. The entire Project occurs in lands assigned Historic Resource Values (HRVs) of 4 and/or 5 for archaeology and/or palaeontology. This potential will be assessed during field surveys planned for the summer of 2015.

Archaeology

Based on preliminary geomorphological analysis, there exists potential for stable landforms within the valley itself, which may contain buried, intact cultural deposits, some of which may be deeply buried. This was confirmed during the Historical Resources Impact Assessment (HRIA) for the Dunvegan Hydroelectric Project, which selected target areas based on the same geomorphological applications and identified a number of sites within the proposed inundation. In addition, the proposed access roads traverse areas of potentially deep sedimentation, given its location through the valley and upper margins of the Peace River.

Preliminary assessment using national topographic system (NTS) maps and ESRI World Imagery shows potential for well-defined, stable and elevated landforms in a number of areas throughout the valley. The Project is in close proximity to six known archaeological sites, four of which may be impacted by the inundation; of these, three are deemed to be of high historic resource significance (HRV 4).

Palaeontology

The Peace River is highly incised in the Project area and is likely to contain fossiliferous exposures of Lower Cretaceous (Albian to Cenomanian) Shaftesbury to Upper Cretaceous (Cenomanian) Dunvegan Formation bedrock. The entire Project footprint contains lands with an HRV of 5p (paleontology) and portions of least three fossil sites containing predominately invertebrate material. The Dunvegan Formation contains abundant invertebrate material in the Project area including bivalves, gastropods, and ammonites. Ornithischian ichnites have been recorded from the Dunvegan Formation at a location near the Dunvegan Bridge, approximately 16 km downstream from the proposed Project headworks. Also of importance is a euselachian assemblage from the Dunvegan Formation which represent the northernmost such assemblage from the Western Interior Seaway. Three of the six sites where this fossil material occurs are located 4-15 km downstream of the proposed Project headworks.

6. PROPONENT ENGAGEMENT AND CONSULTATION WITH ABORIGINAL GROUPS

6.1 Aboriginal groups that may be interested in, or potentially affected by, the Project

AHP has prepared a list of Aboriginal groups that may be interested or potentially affected by the Project. This scoping was based on:

- a preliminary understanding of the geographical extent of impacts of the proposed Project;
- reviewing the existing information for other proposed hydroelectric projects on the Peace River such as the Dunvegan and Site C projects;
- reviewing maps of First Nation reserves and Métis settlements located in the region of the proposed dam site;
- early consultation with the Alberta Environment and Sustainable Resource Development (ESRD), now Alberta Environment and Parks (AEP) and the Aboriginal Consultation Office(ACO);
- discussion with and input from representatives of the Canadian Environmental Assessment Agency; and
- discussions with Aboriginal Groups.

Table 6-1 shows AHP's the level of engagement with Aboriginal groups that may be interested or potentially affected by the Project.

Table 6-1: Aboriginal groups that may be interested in; or potentially affected by the Project

Aboriginal Groups				
Aboriginal Groups to be consulted				
Duncan's First Nation				
Horse Lake First Nation				
Fairview Metis Local (of Metis Nation of Alberta Region 6)				
Doig River First Nation				
Sucker Creek First Nation				
Aboriginal Groups to be notified				
Beaver First Nation				
Dene Tha' First Nation				
Little Red River Cree Nation				
Mikisew Cree First Nation				
Tallcree First Nation				
Woodland Cree First Nation				
Paddle Prairie Métis Settlement				
Metis Nation of Alberta Region 6				
Athabasca-Chipewyan First Nation				
Smith's Landing First Nation				
Northwest Territory Métis Nation				
Fort Resolution Métis Council				
Fort Smith Metis Council				
Fort Chipewyan Métis Local 125				

Aboriginal Groups
Driftpile First Nation
Metis Nation of Alberta Region 5
Metis Nation of BC Region 7
Treaty 8 Tribal Association of BC
Treaty 8 First Nations of Alberta(Association)
Western Cree Tribal Council
Aboriginal Groups that have been disengaged
Deninu K'ue First Nation
Loon River First Nation
Salt River First Nation #195
Sturgeon Lake First Nation
Whitefish Lake First Nations

6.2 Engagement or consultation activities carried out to date with Aboriginal groups.

AHP began Aboriginal consultation activities in March, 2013 during the conceptual stages of the Project. A description of engagement or consultation activities is being constantly updated as the Project progresses. AHP met with Aboriginal Groups and gave a preliminary presentation of the Project to lay the foundation for future consultation should the Project move forward. Since then, AHP has made repeated calls and visits to Aboriginal groups, organised river tours and open houses, sent notification packages and Project updates by registered mail (or by alternate methods specified by the Groups) and exchanged several emails.

AHP has also prepared a draft Aboriginal Consultation Plan (ACP) (Appendix A) which provides a detailed description of AHP's consultation methodology, timelines, milestones and procedures. AHP submitted the ACP to the Aboriginal Consultation Office (ACO) in October 2014 and received approval from the ACO in August 2015.

One concern expressed by Aboriginal groups is the potential impact to the Peace Athabasca Delta. AHP has completed a preliminary assessment of the potential effects of the Amisk Hydroelectric Project on the PAD. This information has been shared with Aboriginal Groups and discussion has been initiated regarding potential implications to the PAD.

Some Aboriginal Groups have expressed concern about the potential impact to Peace River water levels and flow. AHP has responded by providing a "flow regime" section in its June 2015 brochure. This section explains that the Project will have little to no effect on the flow of the river as this flow is regulated through BC Hydro and the W.A.C. Bennett Dam.

Other comments and concerns expressed by Aboriginal groups include:

- Potential Project impact to the Peace Athabasca Delta;
- Potential Project impact to culturally sensitive sites;
- Potential Project impact to spawning grounds for fish;
- Potential impact to habitat, including bear dens;

- Potential Project impact to Treaty Rights and traditional land use;
- Potential Project impact to the ice regime;
- Potential Project impact of dam to debris flow downstream;
- Cumulative Effects of the Project (specifically taking in account W.A.C. Bennett Dam, Peace Canyon Dam, and the recently approved Site C dam); and
- Project benefits that will filter down to First Nations.

AHP has responded to Aboriginal groups stating that environmental baseline studies are currently being conducted for the Project. Furthermore, the Project application will address these concerns.

6.3 Key Comments and Concerns from Aboriginal Groups

Comment	AHP Response
What happens to wildlife and habitat along	AHP understands that there will be impacts on wildlife and
areas that will be inundated with the	habitat. Wildlife and habitat studies are currently occurring
headpond (upstream)? There is key bear and	to understand the extent of the impact.
moose habitat in the area.	
How will land use change due to the project?	AHP is performing a land use study for the environmental
	impact assessment. This study will help AHP understand
	what land and water use currently exists in the Project Area.
	It is currently understood that at least one campground will
	be inundated (Pratt's Landing) and another (Carter's Camp)
	may be impacted. AHP is evaluating alternative options for
	camp facilities in the area.
Will the Project create erosion and stability	The geologic conditions found upstream throughout the
issues along the banks of the river?	headpond area are favourable with respect to stability, as
	attributes that have led to largescale erosion upstream and
	downstream are not found along the headpond area. The
	impoundment of the headpond may result in an initial,
	modest increase in normal slope processes including
	weathering, erosion and slumping; however, those
	processes are not expected to impact dam stability. At the
	dam site, any slopes found to be unstable will be stabilized
	by common geotechnical practices e.g. use of wiremesh,
	shotcrete, retaining walls, consolidation grouting, etc. The
	geological mapping and geotechnical investigation will help
	to determine the best method to stabilize the banks and
	establish the design characteristics of the abutments.
	Access roads to the headworks will be designed and
	constructed to manage slope stability and erosion.
	Additional studies are being initiated to further understand
	the effects of the Project on bank erosion and stability.

Comment	AHP Response				
Where would the electricity created by the	Electricity generated by the Project will be supplied to the				
Project go?	Alberta Interconnected Electricity System via an				
	approximately 25 km transmission connection.				
With fishways and fish friendly turbines what	Potential fish passage options are currently being evaluated.				
will be the impact of the fish moving	Preliminary analysis indicates that upstream fish passage				
upstream and downstream of the dam?	using fishways and downstream fish passage using best				
	available fish friendly turbines would provide potentially				
	viable mitigation for direct effects on fish populations.				
There may be potential caves used by	AHP will evaluate this during the Historical Resource				
ancestors in or near the inundation area.	Assessment in addition would evaluate an option to ground-				
	truth the area with members of the concerned Band.				
Will there be an impact on the type or	The Project is not expected to substantively change the				
amount of fish?	Peace River water temperature because the headpond is not				
	large enough. As such, the Project will not affect the Peace				
	River fish community due to the influence on water				
	temperature. Aquatic studies are currently being performed				
	to further understand the potential impact.				

6.4 Consultation Plan

A general schedule for ongoing and proposed Aboriginal engagement or consultation activities and the type of information exchanged or will be exchanged and collected is presented in Table 6-2.

Table 6-2: Previous and Proposed Aboriginal Engagement or Consultation Activities Schedule

Activity	Schedule
Notification with updated Project Information	Spring 2014
Follow-up on updated Project information through phone calls and meetings	2014
Notification on Project Status	Fall/Winter 2014
Notification with updated Project Information including report on the extent	Spring 2015
to the Project's impact downstream demonstrating negligible impact on the	
Peace Athabasca Delta. Solicitation of specific feedback if Aboriginal Group	
believes they would be impacted.	
Open Houses to provide detail on the Project including forecasted impacts and	June 2015
schedule. General and specific input on culturally sensitives sites, traditional	
and contemporary use.	
Project tours to physically show the Project footprint and solicit specific	Q2 and Q3 2015
traditional and contemporary use of the river	
Project notification of additional Aboriginal Groups	August 2015
Participation of Aboriginal Groups in various environmental studies	2015 & 2016
Ongoing Consultation to understand traditional and contemporary use of land	2015/2016
potentially impacted by the Project.	

Activity	Schedule	
Provision of Updated Project information through Project mail out.	Q4 2015 and Q1 and	
	Q2 2016	
Meetings for the presentation of information gathered during the	Q4 2015 and Q1 and	
environmental studies and new project information.	Q2 2016	

6.5 Treaty Rights

AHP is currently assessing Project impacts on Treaty Rights with a number of Aboriginal Groups.

6.6 Overlap of Project Area with Traditional Land Use under Treaty Rights

AHP is currently engaged in consultation with potentially affected Aboriginal groups. As of September 2015, no specific traditional land use information or land use maps have been supplied to AHP in relation to the Project and potential impacts. AHP is currently in meaningful consultation with Duncan's First Nation and Horse Lake First Nation and is seeking to understand the geographical extent of their traditional land use and how it overlaps with the Project area.

AHP continues to discuss the Project on an ongoing basis with potentially impacted Aboriginal Groups. To date, although many First Nations and Metis groups have been engaged, meaningful consultation has only occurred with Duncan's First Nation and Horse Lake First Nation. AHP has openly engaged other Aboriginal groups and actively seeks confirmation on adverse impacts upon which, once understood to be related to the Project, meaningful consultation would commence.

7. CONSULTATION WITH THE PUBLIC AND OTHER PARTIES (OTHER THAN ABORIGINAL CONSULTATION INCLUDED ABOVE)

7.1 Key Comments and Concerns from Stakeholders

A Record of Consultation (RoC) which identifies the stakeholders that may be interested and potentially affected by the Project has been prepared and is constantly being updated. The RoC also outlines consultation activities carried out to date including:

- names of stakeholders previously consulted;
- date(s) each stakeholder was consulted; and
- means of consultation (e.g., community meeting, mail or telephone).

Table 7-1 is a list of key comments and concerns put forth by stakeholders during the various notification and consultation activities carried out to date.

Table 7-1: Key Comments and Concerns from Stakeholders

Comment	AHP Response
How will boat passage occur?	AHP is currently evaluating boat passage options. Options being considered include; a boat lock, portage system, and a combination of boat launches.
What happens to wildlife and habitat along areas that will be inundated with the headpond (upstream)?	AHP understands that there will be impacts on wildlife and habitat. Wildlife and habitat studies are currently occurring to understand the extent of the impact.
How will the Project affect the ice regime of the Peace River, including the Shaftesbury Crossing?	Potential changes to the ice regime are currently being evaluated. It is expected that the total combined duration of ferry and ice bridge operations at Shaftesbury Crossing will be reduced. AHP commits to providing compensation to mitigate negative impacts to users of the Shaftesbury Crossing to the extent they are expected to occur as a result of changes to the ice regime precipitated by the Project.
What happens to recreational areas upstream (Pratt's Landing, Carter's Camp, and Many Islands)?	Early indications forecast that the Pratt's Landing and Carter's Camp campgrounds will be impacted to the extent that they would need to be relocated or reconfigured. Possible relocation and reconfiguration options are being evaluated.

Comment	AHP Response
	At this time the Project is not expected to affect the recreation value of the Many Islands area.
	AHP is evaluating means to create equivalent or greater recreational opportunities for those lost as a result of the Project.
How will the Dunvegan West Wildland Park be affected?	Initial calculations indicate that approximately 300 ha of the Park will need to be redesignated due to Project needs and the forecasted extent of the impoundment.
	AHP will work with the Province to provide compensation for lost Park land.
Will vegetation be removed prior to the creation of the headpond?	AHP expects to salvage merchantable timber and remove selected vegetation prior to the creation of the headpond. Ongoing studies will specify the type and location of vegetation management programs.
What roads and upgrade to roads are needed to construct and access the dam site?	Permanent road access from both sides of the river escarpment to the dam site will be required for the dam construction, operations and maintenance. Potential alignments of dam site access roads are being evaluated to determine the best option given the river escarpment characteristics. Existing county road interconnections and upgrade requirements for access from major highways to the river will be evaluated and discussed with municipal and provincial transportation authorities.
Will private land be lost and, if so, what compensation can be expected?	Some private land will be impacted by the Project. AHP commits to compensating landowners for this impact based on the specific extent of the impact to each individual owner.
What will be the impact on water temperature and subsequently on fish?	The existing upstream BC hydro dams on the Peace River have caused water temperatures to be warmer in the winter and colder in the summer. The change is due to the large headpond behind the Bennett Dam. The change in temperatures and other factors like sediment load and flow regime have allowed cold water fish species to extend their distributions downstream

Comment	AHP Response
	and cool water fish species to be "pushed" downstream. The Site C Project will extend this effect farther downstream.
	The Project is not expected to substantively change the Peace River water temperature because the headpond is not large enough. As such, the Project will not affect the Peace River fish community due to the influence on water temperature.
Will the Project create erosion and stability issues along the banks of the river?	The geologic conditions found upstream throughout the headpond area are favourable with respect to stability, as attributes that have led to largescale erosion upstream and downstream are not found along the headpond area. The impoundment of the headpond may result in an initial, modest increase in normal slope processes including weathering, erosion and slumping; however, those processes are not expected to impact dam stability. At the dam site, any slopes found to be unstable will be stabilized by common geotechnical practices e.g. use of wiremesh, shotcrete, retaining walls, consolidation grouting, etc. The geological mapping and geotechnical investigation will help to determine the best method to stabilize the banks and establish the design characteristics of the abutments.
	Access roads to the headworks will be designed and constructed to manage slope stability and erosion.
	Additional studies are being initiated to further understand the effects of the Project on bank erosion and stability.
Will the Project change the flow of the river?	The Project will have minimal effect on the flow of the river. A majority of the flow is regulated by BC Hydro operations of the W.A.C. Bennett Dam. Unregulated flow from tributaries below the Site C Project will not be regulated by the Project.
Where would the electricity created by the Project go?	Electricity generated by the Project will be supplied to the Alberta Interconnected Electricity

Comment	AHP Response		
	System via an approximately 25 km transmission connection.		
When would the dam be completed?	It is anticipated that after the regulatory process is completed the earliest the dam could be completed would be 2023 after a 5-year construction period.		
What is the impact on sediment both downstream and upstream of the dam?	Potential impacts on sediment transport are currently being evaluated. It is expected that the Project will slightly reduce the amount of sediment transported downstream of the dam location. Sedimentation deposition at the upstream extent of the headpond are expected to cause the backwater effects to migrate further upstream over time.		
With fishways and fish friendly turbines what will be the impact of the fish moving upstream and downstream of the dam?	Potential fish passage options are currently being evaluated. Preliminary analysis indicates that upstream fish passage using fishways and downstream fish passage using best available fish friendly turbines would provide potentially viable mitigation for direct effects on fish populations.		

7.2 Ongoing or Proposed Consultation

AHP recognizes the consultation is an ongoing process. In these early stages of the Project, AHP is striving to identify key stakeholders and solicit feedback and discussion to incorporate input into the Project planning where feasible. AHP continues to build the stakeholder database for this Project. A description of engagement or consultation activities is being constantly updated as the Project progresses.

Activities that facilitate the consultation process include:

- The first set of open houses occurred in June 2015 which provided stakeholders and interested
 parties the opportunity to receive detailed Project information as well as specific questions to
 discipline specialists of the Projects. In addition, attendees could provide their email address if
 they would like to receive future updates of the Project.
- Project notifications will be sent on an as needed basis. It is expected that update notifications
 will occur 1 to 3 times a year with additional updates occurring if a significant change is realized
 in the Project planning.
- In June 2015, the Project website was launched; www.amiskhydro.com. Project updates will occur on the website on a consistent basis. The website provides the opportunity to see frequently asked questions as well as pose new ones.
- In June 2015 a 1-800 number (1-844-287-1529) was created and provided to stakeholders as an additional medium to contact AHP directly. Phone calls that are received on this line are

- acknowledged and if specific information is requested the question is distributed to the relevant technical specialist for a prompt response, which is subsequently provided back to the interested stakeholder.
- AHP is currently planning early fall meetings in 2015 with town and municipal councils and a
 potential next set of open houses to the public in the spring of 2015 following a large scale
 notification mail/email process.

AHP continues to discuss the Project on an ongoing basis with interested parties.

To date AHP has responded to every inquiry needing a response by email, telephone, mail or personal meeting.

7.3 Consultation with Other Jurisdictions

AHP has discussed the Project with representatives of the Alberta government from the Ministries of Environment and Parks and Energy. Additional jurisdictions will be consulted as required on an ongoing basis.

8. REFERENCES

- Alberta Agriculture and Forestry. 2012. Types and Sources of Salts. Website: http://www1.agric.gov.ab.ca/\$Department/deptdocs.nsf/all/sag4648. Accessed: June 22, 2015.
- Alberta Agriculture and Forestry. 2015. Alberta Soil Information Viewer. Website: http://www4.agric.gov.ab.ca/agrasidviewer/. Accessed: June 18, 2015.
- Alberta Environment and Sustainable Resource Development (ESRD). 2014. Alberta Tourism, Parks and Recreation, Edmonton, Alberta. Environmentally Significant Areas of Alberta Update. Shapefile. September 2014. Website: http://www.albertaparks.ca/albertaparksca/library/environmentally-significant-areas-report.aspx. Accessed: July 2015.
- Alberta Environment and Sustainable Resource Development (ESRD). 2010. Recommended Land Use Guidelines: Key Wildlife and Biodiversity Zones, Fish and Wildlife Division.
- Alberta Geological Survey. 2015. Alberta Interactive Minerals Map. Website: http://ags-aer.maps.arcgis.com/apps/webappviewer/index.html?id=cfb4ed4a8d7d43a9a5ff766fb8d0aee5. Accessed: June 18, 2015.
- Alberta Tourism, Parks and Recreation (ATPR). 2014. Park Research & Management, Dunvegan West Wildland Provincial Park. Website: http://www.albertaparks.ca/dunvegan-west/park-research-management.aspx (accessed March 18, 2014)
- BC Hydro. 2013. Site C Clean Energy Project Environmental Impact Statement. Volumes 1-5. Prepared by BC Hydro. Vancouver, BC.
- Church, M. 1995: Geomorphic Response to River Flow Regulation Case Studies and Time Scales, in Regulated Rivers: Research & Management, Vol. II, 3-22.
- Church, M. 2014. The Regulation of the Peace River: A Case Study for River Management, John Wiley and Sons Ltd., Chichester, UK.
- Church, M. 2015. The Regulation of Peace River: A Case Study for River Management. John Wiley & Sons, Ltd.
- Clear Hills Bylaw No. 107-08. 2015. Bylaws and Policies. Retrieved June 26, 2015 from, http://clearhillscounty.ab.ca/
- Coote, D.R. and Pettapiece, W.W. 1989. Wind Erosion Risk, Alberta. Land Resource Branch, Agriculture Canada. Ottawa, Ontario.
- Cruden, D.M., M. Ruel, and S. Thomson. 1990. Landslides along the Peace River, Alberta. In Proceedings of the 43rd Canadian Geotechnical Conference, 1, 61-68. Geotechnical Society of Canada.
- Cruden, D.M., T.R. Keegan, and S. Thomson 1993. The landslide dam on the Saddle River near Rycroft, Alberta. Canadian Geotechnical Journal.
- Environment Canada. 2015. Canadian Climate Normal Data (1981-2010). Available at: http://climate.weather.gc.ca/climate normals/index e.html.

- Federation of Alberta Naturalists. (2007). *The atlas of breeding birds of Alberta: A second look*. Edmonton: Federation of Alberta Naturalists.
- Fenton, M.M., Waters, E.J., Pawley, S.M., Atkinson, N., Utting, D.J., and Mckay, K. 2013. *Surficial Geology of Alberta. Map 601*. Alberta Geological Survey, Energy Resources Conservation Board. Edmonton, Alberta.
- Fiera Biological Consulting Ltd. (Fiera). 2014. Environmentally Significant Areas in Alberta: 2014 Update. Report prepared for the Government of Alberta, Edmonton, Alberta. Fiera Biological Consulting Report Number 1305. Pp. 51.
- Glacier Power Ltd. 2006. Environmental Impact Assessment for the proposed Dunvegan Hydroelectric Project and technical supporting documents. Submitted for review on October 31, 2006.
- Government of Canada. 2015. *The Atlas of Canada Toporama*. Website: http://atlas.gc.ca/toporama/en/index.html. Accessed: June 22, 2015.
- Hermanutz, R., and R.B. Stavne. 2009. Inventory of biophysical features and off- highway vehicle trails in three parks in the Peace River Corridor. Technical Report, T-2009-003, produced by the Alberta Conservation Association. Peace River. Alberta. Canada. 39 pp + App.
- Jacques Whitford Limited. 2006. Environmental Impact Assessment. Dunvegan Hydroelectric Project. Prepared for Glacier Power Ltd. Calgary. Alberta. Project No. ABC50541.
- Kellerhals, R. and D. Gill. 1973. Observed and Potential Downstream Effect of Large Storage Projects in Northern Canada. In International Commission on Large Dams, Eleventh Congress Proceedings, Vol. 1, pp 731-754.
- Knight Piésold Consulting. 2012. Peace River Bed Material and Channel Gradation Adjustments Related to Dam Construction and Operation. BC Hydro Site C Clean Energy Project. Prepared for BC Hydro.
- Mainstream Aquatics Ltd. 2004. Fish Movement Study (2002-2003) Dunvegan Hydroelectric Project.

 Prepared for Glacier Power Ltd. Mainstream Report No. 03009F 49 p + Plates and Appendices.
- Mainstream Aquatics Ltd. 2006a. Baseline Fish Inventory Study (2004), Dunvegan Hydroelectric Project. Report prepared for Glacier Power Ltd. Mainstream Report No. 04011F: 100 pp + appendices. April 2006.
- Mainstream Aquatics Ltd. 2006b. Fish Movement Study (2004/05) Dunvegan Hydroelectric Project. Prepared for Glacier Power Ltd. Mainstream Report No. 05011F: 70 pp. + appendices. April 2006.
- Mainstream Aquatics Ltd. 2006c. Habitat No Net Loss Plan for the Dunvegan Hydroelectric Project 2nd Revision. Prepared for Glacier Power Ltd. Mainstream Report No. 04005DF: 55 p + appendices. February 2006.
- Mainstream Aquatics Ltd. 2009a. Dunvegan Fish Community Monitoring Program 2008 Studies Interim Report. Prepared for Glacier Power Ltd. Report No. 08009F: 59 pp. + Appendices.

- Mainstream Aquatics Ltd. 2009b. Burbot (Lota lota) mercury study in the Dunvegan area of the Peace River Data Report. Prepared for TransAlta Corporation. Report No. 08014F: 11 p. + appendices.
- Mainstream Aquatics Ltd. 2010a. Fish movement study (2008/09) Dunvegan Hydroelectric Project. Prepared for Glacier Power Ltd. Mainstream Report No. 08010F: 64 pp. + appendices.
- Mainstream Aquatics Ltd. 2010b. 2009 Burbot Study Dunvegan Hydroelectric Project (Final). Prepared for TransAlta Corporation. Report No. 09006F: 52 p. + appendices.
- Miller, BGN. 2000. Two landslides and their dams, Peace River lowlands, Alberta. Master's Thesis, Department of Earth and Ocean Sciences, University of Alberta.
- Morgan A.J., R.C. Paulen, S.R. Slattery and C.R. Froese 2012. Geological Setting for Large Landslides at the Town of Peace River, Alberta (NTS 84C). Energy Resources Conservation Board/Alberta Geological Survey (Open File Report 2012-04).
- Municipal District of Fairview No. 136. 2015. Land Use Bylaw No. 876. Retrieved June 26, 2015 from http://www.mdfairview.com/bylawspolicies.aspx
- Natural Regions Committee (NRC). 2006. Natural Regions and Subregions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852. 264pp. Website: http://www.tpr.alberta.ca/parks/heritageinfocentre/docs/NRSRcomplete%20May_06.pdf. Accessed: May 2014.
- Pawlowicz, J.G. and Fenton, M.M. 1995. Drift Thickness of Alberta. Alberta Geological Survey, Alberta Energy and Utilities Board. Edmonton, Alberta.
- Pedocan Land Evaluation Ltd. 1993. Soil Series Information for Reclamation Planning in Alberta. Alberta Conservation and Reclamation Council. Edmonton, Alberta.
- Pettapiece, W.W. 1987. Physiographic subdivisions of Alberta. Canada Land Resource Research Centre, Agriculture Canada. Ottawa, Ontario.
- Pettapiece, W.W. 1995. Land Suitability Rating System for Agricultural Crops. 1. Spring-seeded small grains. Technical Bulletin 1995-6E. Centre for Land and Biological Research Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario.
- Public Lands Act, RSA 2000, c P-40
- RL&L Environmental Services Ltd. 2000. Dunvegan Hydroelectric Project Fish and Habitat Inventory Comprehensive Report. Prepared for Glacier Power Ltd. RL&L Report No. 809F: 123 p. + appendices and plates.
- Saddle Hills County. 2015. Land use Bylaw No. 173-2009. Retrieved from, http://www.saddlehills.ab.ca/department___services/planning___development/land_use_bylaw
- Schleppe, J., H. Larratt, A. Cormano, and N. Swain. 2013. Peace River Water Use Plan GMSMON5 Peace River Productivity Monitoring, Year 1 Report, 2013. Prepared for BC Hydro. Prepared by Ecoscape Environmental Consultants Ltd. and Larratt Aquatic. Ecoscape File No. 13-1107. Kelowna, BC.

- Soil Classification Working Group. 1998. The Canadian System of Soil Classification. Third Edition. Research Branch, Agriculture and Agri-Food Canada. Ottawa, Ontario.
- Species at Risk Act. 2014. Schedule 1, 2, and 3. Available from, www.sararegistry.gc.ca/sar/listing/default_e.cfm
- Tajek, J. and Coote, D.R. 1993. Water Erosion Risk, Alberta. Land Resource Research Centre, Research Branch, Agriculture Canada. Publication 5292/B. Ottawa, Ontario.
- Tera Earth and Environmental Ltd. (Tera). 2000. Survey and Assessment of Avian and Herpetological Resources for the Glacier Power Ltd. Dunvegan Hydroelectric Project. August 2000.

Appendix A: Photograph of Proposed Location of Headworks



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Not To Scale

PROPOSED AXIS OF HEADWORKS ACROSS THE PEACE RIVER: VIEW DOWNSTREAM

Figure Number	Appendix A	IEL Project Number	16049	No
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Sources: Imagery: