September 28, 2020

The Inuvialuit Energy Security Project

IESP PROJECT DESCRIPTION

Inuvialuit Energy Security Project

Attention: Coordinator, Environmental Impact Screening Committee
EISC Reference Number: 09/20-04

INUVIALUIT PETROLEUM CORPORATION

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1.0 COVER LETTER

The Cover Letter has been submitted as a separate document.

2.0 TITLE OF THE PROPOSED DEVELOPMENT

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

The Project Description should be clearly identified. The title should inform the reader as to the nature of the development. This title will be used in all subsequent correspondence.

The Inuvialuit Energy Security Project:

Development and Production of the M-18 Gas Well

3.0 CONTACT NAME & ADDRESS

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

Include the name of the Developer (company, government department or individual) and a contact name, address, telephone, fax, and email address.

DEVELOPER:

Inuvialuit Petroleum Corporation

107 Mackenzie Road
Inuvik, NT X0E 0T0

Phone: +1 867 777 7000
Toll Free: +1 855 777 7011
Fax: +1 867 289 2389

DESIGNATED CONTACT:

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107 Mackenzie Road
Inuvik, NT X0E 0T0

Phone: +1 867 678 0099
Fax: +1 867 289 2389
Email: kdarling@inuvialuit.com

4.0 APPROVALS – REGULATORY & OTHER AUTHORIZATIONS

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

A list of all the authorizations, licences or permits that are required from governments (federal territorial, municipal), regulatory agencies and private landowners in order to proceed with the development.
If it is a government project, the authority competent to authorize the development.
The name address, telephone number, email address and fax numbers should be provided of the contact person within each organization who will authorize the proposed development.

Introduction

The Inuvialuit Petroleum Corporation (IPC), is an Inuvialuit corporation established under the *Inuvialuit Final Agreement* (IFA), a modern treaty under subsection 35(3) of the Constitution Act (1982). IPC proposes the development of the Inuvialuit Energy Security Project (IESP) on certain 7(1)(a) Inuvialuit Private Lands (IPL) located south of Tuktoyaktuk within the Inuvialuit Settlement Region (ISR) of the Northwest Territories (NWT).

The framework for petroleum resources regulation on IPL within the ISR is unlike any other jurisdiction in Canada. First, Inuvialuit, not the Crown, own and administer the surface and subsurface interest in the land and resources pursuant to the IFA. Second, the IFA establishes the rules regarding environmental impact screening and review, land access and use, and, participation in the benefits of a development on these lands. Third, pursuant to the NWT Land and Resources Devolution Agreement (Devolution Agreement), the Canada Energy Regulator (CER) remains the regulator of oil and gas operations within the ISR until 2034 whereas the NWT Office of the Regulator for Oil and Gas Operations acts as the regulator for most of NWT.

Within this modern treaty context and pursuant to the regulatory framework flowing therefrom, IPC will be seeking major approvals from: the Inuvialuit Land Administration to access and continue the development of the lands, from the Environmental Impact Screening Committee to proceed with the development of the IESP and from the CER for development and operation of the M-18 well. IPC will also be seeking permits from other regulators as outlined below.

Contextual Elements Relevant to the IESP

The Inuvialuit Final Agreement and Development on Inuvialuit Private Lands

The Inuvialuit Final Agreement was signed by all parties on June 5, 1984 and was given the force of law through the Western Arctic (Inuvialuit) Claims Settlement Act, s.c. 1984, chp. 24.It is a land claim agreement under subsection 35(3) of the Constitution Act (1982). The IFA applies throughout the Inuvialuit Settlement Region (ISR). To the extent of inconsistency between the IFA and other federal, territorial, or municipal laws, regulations and policies, the IFA prevails (IFA s. 3(3)).

The IFA - and the responsibility for implementing it in satisfaction of its objectives - belongs not only to Inuvialuit, but to all signatories. Those objectives, which guide activities and decision-making under the IFA, include:

- Preserving Inuvialuit cultural identity and values within a changing northern society;
- Enabling Inuvialuit to be equal and meaningful participants in the northern and national economy and society; and,
- Protecting and preserving Arctic wildlife, environment, and biological productivity.

IPC intends for the IESP to respond to the impending local energy security crisis while actively advancing these objectives.

As described above, the proposed IESP is located entirely upon Inuvialuit 7(1)(a) Lands, within an existing Concession Area. Devon NEC Corporation and Suncor Energy Inc submitted a Discovery Notice (DN) and Productive Acreage Block (PAB) Application to ILA on February 10, 2010. ILA provided notice of agreement with the DN and PAB on June 2010. IPC is currently engaged in transfer discussions with the current owners.

Post-Devolution Oil and Gas Regulation in NWT

Under the 2014 Devolution Agreement, the Government of the Northwest Territories (GNWT) assumed responsibility for the regulation of onshore oil and gas activities in the NWT outside of the Inuvialuit Settlement Region (ISR),the Norman Wells Proven Area, and other miscellaneous federal lands, previously regulated by the National Energy Board (NEB). However, within the ISR, it was agreed that the NEB would continue to act as regulator pursuant to NWT oil and gas mirror legislation for a period of 20 years from the signing of the Devolution Agreement.

On June 21, 2019, the Parliament of Canada passed Bill C-69, which replaced the National Energy Board Act with the Canadian Energy Regulator (CER) Act. The NEB is now known as the Canada Energy Regulator (CER).

In the ISR, the CER now administers the NWT Oil and Gas Operations Act (OGOA) whereas outside of the ISR and the Norman Wells Proven Area, the NWT Office of the Regulator of Oil and Gas Operations (OROGO) is the primary regulator.

The purpose of OGOA is “to promote, in respect of the exploration for and exploitation of oil and gas,

a. safety, particularly by encouraging persons exploring for and exploiting oil or gas to maintain a prudent regime for achieving safety;
b. the protection of the environment;
c. the conservation of oil and gas resources;
d. joint production arrangements; and
e. economically efficient infrastructures.”

Of specific concern to the approval of the IESP, are the sections of OGOA that are relevant to approvals and authorizations. These sections include but are not limited to: Section 10: Operating Licenses and Authorization for Work; and Section 14: Development Plan Approval.

A Development Plan Approval as per Section 14 of OGOA will be sought from the CER as part of the project approval process. Additional applications to the CER will seek both an Approval to Alter the Condition of a Well (ACW) and an Operations Authorization (OA) under OGOA Section 10, for facility construction and operation.

An overview of the anticipated CER process is provided in Figure 4.1. In addition to OGOA, the following guidance documents from CER will be consulted:

- CER Transparency Guidelines for Information under the Canada Oil and Gas Operations Act
- CER Pre-application Meetings – Guidance Notes
- CER Time Limits and Service Standards

Other applications that may be needed for the project include GNWT Registration of the gas production facility; GNWT Worker's Compensation Board (WCB) Registration for operations; and Permits and Licenses related to land use, quarrying, lease and license of occupation from the Inuvialuit Land Administration.

Inuvialuit Water Board

The IESP will not require a permit from the Inuvialuit Water Board (IWB). The project will use less than 100 m^3/day of direct water, which will be sourced by truck from Tuktoyaktuk if and when needed. No local lakes or rivers will be used for water requirements. The project does not cross any watercourse greater than five metres wide at high water; does not require flood control, dams, dikes, or watercourse training; and will not require the deposit of any type of waste. The stream crossing will be constructed during the winter while the creek is completely frozen so it will not require temporary cofferdams or diversions. Recent field studies (Kiggiak EBA 2018c) indicate that the creek is shallow and will freeze to bottom in the winter. The existing drilling sump at M-18 will be contained, with the restoration of drainage around the sump, to ensure containment. The sump will be remediated and reclaimed as part of the eventual decommissioning of the site in the future, at which point application will be made to the IWB or the authority of that time.

Activity to Date

In preparation of this PD, IPC has actively consulted with and provided project-related information to interested parties in all the Inuvialuit communities as well as in Ottawa and Yellowknife. Consultation sessions were held with the Aklavik Community Corporation, the Inuvik Community Corporation, the Tuktoyaktuk Community Corporation, the Inuvik Hunters and Trappers Committee, the Tuktoyaktuk Hunters and Trappers Committee, the Town of Inuvik, the Hamlet of Tuktoyaktuk, Inuvik Gas Limited and the Gwich'in Tribal Council. We provided a further consultation session (open house) to the residents of Tuktoyaktuk. We have also provided information about and an invitation to discuss the IESP to the Paulatuk, Ulukhaktok and Sachs Harbour Community Corporations, to the Inuvialuit Game Council, to relevant Ministers within the Government of the Northwest Territories, to the Northwest Territories Power Corporation (NTPC), and to the Inuvialuit Fisheries Joint Management Committee and the Inuvialuit Wildlife Management Advisory Council – NWT. Throughout this process, we have remained available for any questions that stakeholders may have and have continued to provide IESP updates as the work progresses. A summary of our consultations and engagement is provided in Sections 12 and 13 of the PD.

IPC submitted a Preliminary Information Package (PIP) to and participated in a pre-Application meeting with the CER on July 27, 2020. IPC understands that EISC approval and all other necessary applications for permits and authorizations necessary for the execution of the project are required prior to CER reviewing the IPC's Development Plan application.

For a complete listing of the major permits and approvals, please see Table 4.1 below. IPC has already engaged with the appropriate regulatory agencies listed in in this table and will submit the required permit and license applications to ILA, EISC and CER. Consultants on this project have and/or will have, as the case may be, the credentials required by the Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists (NAPEG). Under NAPEG guidelines, IESP consultants will be submitting approvals for the road access (GNWT) and the single stream crossing (DFO) on behalf of the project.

Table 4.1: Major Approvals Required for the Proposed Project	
Agency and Contact Person	***Required Approvals***
Inuvialuit Land Administration (ILA) P.O. Box 290 Tuktoyaktuk, NT X0E 1C0 Charles Klengenberg Director of Lands Tel: (867) 777-7000 Fax: (867) 977-7101 Email: cklengenberg@inuvialuit.com	Land Use Permit, Access Authorization, Quarrying Permit, Production Licence, Licence of Occupation, Surface Development Plan approval and Temporary Right-of-Way Permit
Environmental Impact Screening Committee Joint Secretariat, Inuvialuit Settlement Region Inuvialuit Corporate Centre, Suite 204, 107 Mackenzie Road PO Box 2120, Inuvik, NT X0E 0T0 Michel Lindsay Coordinator Tel: (867) 777-2828 Fax: (867) 777-2610 Email: eisc@jointsec.nt.ca	Environmental Screening and *a*pproval of the Project Description under the *Inuvialuit Final Agreement.*
Canada Energy Regulator Suite 210, 517 Tenth Avenue SW Calgary, AB T2R OA8 Anne-Marie Hesse Technical Specialist, Environment Tel: (403) 604-3034 Fax: (403) 292-5503 Email: Anne-Marie.Hesse@cer-rec.gc.ca	Development Plan approval, Financial Assurance, Operations Authorization (OA), Authorization to Alter the Condition of a Well (ACW), and Production Authorization under the Northwest Territories *Oil and Gas Operations Act and Regulations.*
Department of Transportation - Inuvik Region Government of the Northwest Territories 2nd Floor, Mack Travel Building Inuvik, NT X0E 0T0 Wayne Patrie, P. Eng. Project Engineer Tel: (867) 777-7345 Fax: (867) 777-4290 Email: wayne_patrie@gov.nt.ca	Permit under the *Public Highways Act* to access the project site from the Inuvik Tuktoyaktuk Highway (ITH) and to ensure a proper turn lane and entrance to the access road meet or exceed government requirements
Fisheries and Oceans Canada Fish and Fish Habitat Protection Program 867 Lakeshore Road Burlington, ON L7S 1A1 Lucas Coletti Senior Biologist Tel: (905)-317-1541 Email: Lucas.Coletti@dfo-mpo.gc.ca	Federal Fisheries Act Authorization under Paragraph 35(2)(b) of *the Fisheries Act*. Inasmuch as the four kilometer, all-weather, private, access road must cross a small stream (less than five metres wide), an application to authorize the crossing will be submitted.

5.0 SUMMARY OF THE PROJECT DESCRIPTION

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

A plain language summary of the proposed development, the potential environmental and wildlife harvesting impacts, significance determination and the Developer's mitigation commitments. This summary can be used to facilitate community engagement and understanding of the proposed development and its environmental and wildlife harvesting implications for the ISR.

5.1 Project Summary

The Inuvialuit Petroleum Corporation (IPC) is proposing to develop and produce the suspended gas well registered officially as TUK M-18 ("M-18") with technical support from Ferus Natural Gas Fuels Inc. (Ferus NGF). The project is formally known as the Inuvialuit Energy Security Project (IESP).

The IESP is located entirely upon Inuvialuit 7(1)(a) Lands. A Productive Acreage Block concession was issued by the Inuvialuit Land Corporation on June 10, 2010 to Devon NEC Corporation and Suncor Energy Inc. IPC is engaged in final negotiations for the transfer of the M-18 well.

The IESP will involve the construction and operation of a small gas processing facility ("IESP Energy Centre") near the M-18 wellsite that will convert natural gas and condensate into Liquefied Natural Gas (LNG) and Synthetic Diesel. The hydrocarbon products will then be transported by truck on the Inuvik-Tuktoyaktuk Highway (ITH) to customers for power, heat, and fuel.

5.1.1 Proposed Work Scope

The proposed work scope includes three phases and ten main parts:

Phase 1 – Pre-Commissioning

1. Site Works - construct and maintain a four-kilometre all-weather gravel access road from the ITH, and two gravel pads at the site
2. Remediate the existing drilling sump at M-18
3. Complete and prepare for production of the suspended M-18 well (Well Completion)
4. Fabricate the gas plant modules (off-site)
5. Transport the gas plant modules and support buildings to site
6. Installation of gas plant modules, interconnects, and plant infrastructure

Phase 2 – Commissioning and Operations

7. Commission the Facilities

8. Operate the gas plant for 50+ years
9. Transport LNG and synthetic diesel by truck to regional users

Phase 3 - Decommissioning

10. Decommission the facility and reclaim the site

Table 5-1: Project Phase Descriptions

Phase	Project Phase Description
Pre-commissioning	**Site (Civil) Works** will involve winter construction of a four (4) kilometer all-weather access road from the ITH to the wellsite and to the facility pad areas; winter construction of two gravel pads; placement of ad-freeze piles; and winter construction of a bridge or culvert to cross the unnamed stream at the two kilometer post. The scope will include borrow excavation and transport on the ITH; ground preparatory work, such as laying down willows and brush, installation of temporary construction trailers, construction activities and cleanup as per Northern Land Use Guidelines for Access Roads and Trails (Indian and Northern Affairs Canada, 2010).
	Remediation As permitted through the Inuvialuit Land Administration (ILA), the pre-existing drilling mud sump will be remediated and re-capped to prevent the contents from contacting the environment and to prevent surface water drainage from pooling at the cap and disturbing the permafrost. The scope includes addition of borrow (fill) material on the existing sump cap, and recontouring the existing drainage to flow around the cap. The cap will be joined to the new Well Pad. The new Well Pad will be built on undisturbed ground north of the wellhead for well completion and future well servicing.
	Well Completion As permitted by the Canada Energy Regulator, well completion includes seven steps: install blowout prevention equipment; drill out existing cement and plugs; circulate the well to remove debris; install production tubing; insulate gas production from the permafrost; cap the well with a new wellhead; pressure test the wellhead and secure for future tie-in with the gas plant.
	Fabrication will involve the building of facility modules on transportable skids in the south at an established fabrication facility. The completed modules will be tested and then prepared for shipment to the north.
	Transportation of Modules will include testing and then delivering modules to a staging area in Inuvik or Tuktoyaktuk via the Dempster Highway or via Barge from Hay River. Transportation logistics will involve the appropriate authorities for highway, barge, or rail use. Final delivery from the staging area(s) to the project site will occur via truck along the ITH from Inuvik or Tuktoyaktuk.
	Installation of Modules and Plant Infrastructure will involve setting of Plant Modules and off-module equipment (such as tanks, SynGas Generator, FT Reactor) on pile foundations, and assembly and installation of interconnecting pipe ways and electrical systems. Plant Infrastructure such as office/control room and warehouse will also be installed.
Commissioning and Operations	**Commissioning** includes activities associated with the start-up of the facility. Preliminary activities undertaken to test the equipment, connections, etc.; and completion activities to validate construction as per design, demonstration of strength and integrity of the piping /mechanical systems and communication / function of the control systems.
	Operations will involve a Canada Energy Regulator regulated, fully operational facility. Operational activities include natural gas treatment and natural gas liquids extraction, LNG production, synthetic diesel production, fuel loading, waste management, and supporting infrastructure and equipment.

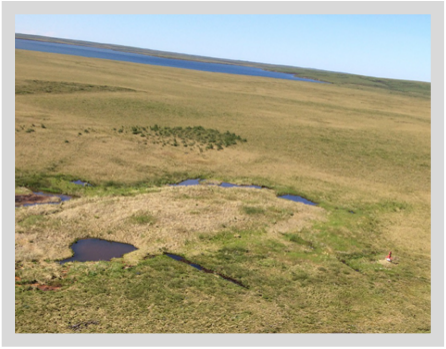
Table 5-1: Project Phase Descriptions	
Phase	**Project Phase Description**
	Transportation of fuels will be contracted to others. The activity includes trucking LNG and synthetic diesel to commercial and residential consumers. The primary route of transport is the ITH to the communities of Tuktoyaktuk and to Inuvik in compliance with Transportation of Dangerous Goods (TDG) Regulations.
Decommissioning	Decommissioning will involve cleanup, removal of all structures and equipment, remediation, reclamation, revegetation, and monitoring to meet the standards of a future time in 50 or more years. A separate Cleanup, Decommissioning and Remediation plan is provided in Section 17 of this Project Description and as part of the Project EMS.

Information on Phase 1 – Pre-commissioning, and Phase 2 – Commissioning is provided in greater detail in Section 6 of this Project Description. Details on Phase 3 – Decommissioning are provided in Section 17. Some high-level information about Phases 1 and 2 are provided in the following paragraphs.

Phase 1 - Pre-Commissioning

The M-18 well was drilled in 2002. The well is currently in a state that is called "suspended." A well workover must take place to remove safety plugs which currently prevent hydrocarbons from leaking from the well; and to install equipment that will allow the well to be safely produced in the future. This will require a service rig to be brought into the location. To provide for future well servicing and/or emergency work, a gravel pad must be built at the wellsite location. The gravel pad needed for the workover will be joined with the new sump cap to create one large pad.

Remediation of the ponds around the existing M-18 drilling waste sump will include cleanup of small surface stained areas, addition of borrow (fill) material on the existing sump cap, and recontouring the existing drainage to flow around the new large pad. The sump cap will be revegetated with native species, while the well servicing pad will be kept free of vegetation by non-chemical methods.



To move the liquified natural gas (LNG) and synthetic diesel produced from the new gas processing facility (GPF) at M-18, an all-weather road connecting the well site to the recently completed Inuvik to Tuktoyaktuk Highway will be required. The access road will be approximately four kilometer in length. The M-18 wellsite location is roughly 16 km from Tuktoyaktuk.

To produce the fuel products from the well a separate gravel pad will be constructed. The pad will be used to support all the gas processing facility modules, some tanks for storage and finally the trailers that will be used to move the energy products to market. Ad-freeze piles will be used where necessary to support equipment and/or protect the permafrost.

Phase 2 - Commissioning

The IESP Energy Centre consists of two main compounds – (1) the LNG section, which processes well gas into liquid Natural Gas (LNG) for trucking to communities; and (2) the GTL section, which converts gas to liquids (GTL). In this area of the facility, the gas from the well will be converted to synthetic diesel. Additional information about both processes is provided in Section 6.

A tandem or tridem tractor and tridem trailer configuration is proposed for the transportation of LNG from the Energy Centre to customers. This configuration brings with it key advantages:

- Tridem trailers have been designed and engineered specifically for LNG transport.
- Tridem trailers can legally and safely haul over 14,500 USG of LNG, or approximately 1,200 GJ of energy.
- Tractors provide control and ability to navigate challenging roads and conditions.

Synthetic diesel will be trucked to Tuktoyaktuk and Inuvik in standard fuel haul truck configurations. Additional information about transportation of the energy products is provided in Section 6.

5.1.2 Proposed Schedule

A preliminary timeline for the project is provided in Figure 6-1 (Appendix 1). Key Milestone dates are as follows:

Table 5-2: Key Milestone Dates for the IESP

Date	Milestone
28SEP2020	Environmental Impact Screening Committee (EISC) Application (PD)
08OCT2020	Presentation to the EISC
19NOV2020	EISC Regular Meeting (Decision)
21NOV2020	Canada Energy Regulator (CER) Development Plan Application
21NOV2020	CER Operations Authorization (OA) Application
21NOV2020	CER ACW (Alter the Condition of a Well) Application
30NOV2020	Completion of Front-End Engineering and Design (FEED)
15DEC2020	Completion of Site Works Engineering Design
19FEB2021	CER Approvals (Development Plan, OA and ACW) (estimated)
22FEB2021	Final Investment Decision
23FEB2021	Begin Site Works Construction
15MAYto15AUG2021	Migratory Bird Season – no construction activity on site
MAY2021	Completion of Detailed Engineering
MAY2021	Begin Fabrication of Modules in Alberta
16AUG2021	Renew Site Works Construction Activity
OCT2021	Well Completion
JAN2022	Begin Adfreeze Pile Installations
FEB2022	Modules Begin to Arrive
MAY2022	Facility Commissioning
JULY2022	First Gas Production

5.1.3 Proponent Information

The Inuvialuit Petroleum Corporation is a subsidiary of the Inuvialuit Regional Corporation (IRC). IPC was created and subsequently included as a key entity under the Inuvialuit Final Agreement (IFA) in 1985. IPC has as a principal objective facilitating the engagement of Inuvialuit in the energy and resources sector. Since the late 1990's, Inuvialuit leadership have focused the efforts of IPC on northern oil and gas opportunities.

Ferus NGF is a privately held Alberta-based company focused on end-to-end LNG fueling services including liquefaction, transportation and logistics, emergency response, and storage for its customers in Northern and Western Canada.

Ferus NGF owns and operates Canada's first merchant LNG facility located in Elmworth, Alberta, a hamlet located about 50 km west-southwest of Grande Prairie, Alberta. The 50,000 gallon per day (GPD) facility is currently being expanded to 150,000 GPD to support a growing domestic LNG market. Ferus NGF has delivered over 35 million gallons of LNG to its customers since 2014, and more specifically, over 17 million gallons to customers in Northern Canada, including to NTPC in Inuvik and Yukon Energy in Whitehorse.

5.2 Community Engagement Summary

As described in Section 12 and 13, IPC has engaged with and consulted with numerous Inuvialuit institutions; co-management bodies and community level organizations, namely the Community Corporations in Tuktoyaktuk, Inuvik and Aklavik, as well as the Tuktoyaktuk and Inuvik Hunters and Trappers Committees (HTCs), and various political leaders including NWT Ministers, the Town of Inuvik and the Hamlet of Tuktoyaktuk. An open house was also held in Tuktoyaktuk on July 29, 2020.

Community engagement to date has included a comprehensive slide deck with verbal explanations of the project components and the potential impacts of project aspects to the environment and communities. This consultation has also involved teleconferences, one-on-one meetings, mailouts, distribution of Frequently Asked Questions and Answers, presentation to Inuvialuit leaders, conversations in the grocery store and at the post office and the like.

Specifically, potential impacts to air, water, soil, permafrost, water, fisheries, wildlife, wildlife harvesting, vegetation and wildlife habitat, heritage resources, other land users, greenhouse gases emissions as well as climate change, traffic impacts, flaring, remediation and end reclamation, were discussed during the community presentations.

IPC also interviewed harvesters and elders in Tuktoyaktuk concerning traditional land use and lessons learned from past development projects in the region. IPC assigns equal value to Indigenous traditional local knowledge along with western science in our impact assessment.

5.2.1 Engagement Outcomes

During these sessions, IPC received a range of input, questions, and concerns. At a high level, these contributions

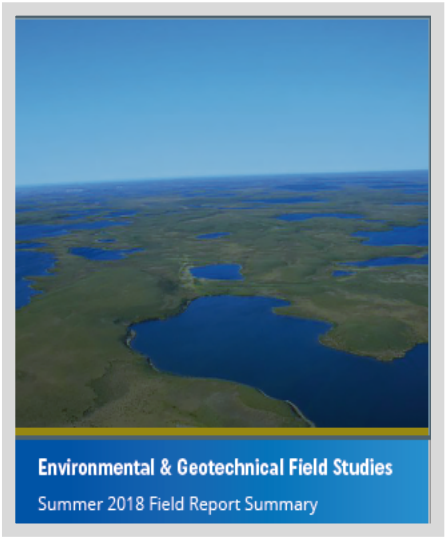
generally touched upon: how decisions regarding the IESP are going to be made; how IPC will continue to provide information and communications about the project; local benefits; employment, contracting and training opportunities; environmental impacts on surrounding lands and waters; anticipated emissions; engineering design relating to the well, the creek crossing, borrow sources and remediation of the waste site; design solutions in anticipation of changes to the climate; operations including site safety and security, trucking, road maintenance and future uses for the products.

Feedback from the early engagement has influenced our site works designs, including access road route selection, as well as our project impact mitigation measures. The early consultations have also influenced our training and capacity building planning. Additional detail on community engagement and outcomes is provided in Sections 11 and 12 of this PD.

5.3 Project Feasibility and Benefits

5.3.1 5.3.1 Feasibility Studies

The environmental and geotechnical feasibility of the project has been studied thoroughly in a series of field studies in August 2018 and March 2020 with support of the Inuvik and Tuktoyaktuk Hunters and Trappers Committees, the Aurora Research Institute, and the Inuvialuit Land Administration. The results of the field studies show that the wellsite and area can be developed without any significant impacts to wildlife, permafrost, or any other aspect of the environment. Digital copies of the Environmental Studies Summary from 2018 are available from the IRC on request. Summaries of the 2020 work are still in development. The list of previous environmental assessments relevant to the project are provided in Section 18 of the Project Description.



The economic feasibility of the project has also been studied through several independent experts including through a funded feasibility study completed in 2018, funded in large part by CanNor with contributions from IRC and GNWT, and three independent evaluations. These evaluations are currently confidential; however, we hope that some of the results of the economic feasibility studies will be provided in our forthcoming Development Plan application to the Canada Energy Regulator (CER).

5.3.2 Summary of Project Benefits

The IESP would benefit the Region and its residents in many fundamental ways:

- Provide a long-term solution to the impending energy security crisis that has resulted from the logistical challenges of importing energy from the south and the loss of production at the Ikhil well.
- Reduce the cost of living and doing business for residents.
- Attract business and investment to the Region by reducing business operating costs.
- Provide contracting opportunities for Inuvialuit and Northern businesses.

- Create good quality long-term employment opportunities in construction and production phases.
- Provide training and capacity-building opportunities for local residents.
- Leverage recent investments and existing infrastructure in the Region.
- Reduce GHG emissions by thousands of tonnes per year.
- Provide rents to support the land management functions of the ILA.
- Retain resource revenues in the Region.
- Provide tax revenues to Canada and GNWT.

5.3.3 Summary of Project Opportunities

Opportunities for businesses include engineering, environmental, construction, well servicing, logistics, maintenance, and, transportation contracts. A poster that was provided to Community Corporations for distribution in the communities was called “Get Ready!” A full-size version is provided in Appendix 8.

Opportunities for individuals include:

- Processing facility fabrication-related work
- Class 1 truck drivers
- Wellsite and plant operators
- Electrical and instrumentation maintenance
- Mechanical/millwright maintenance opportunities
- Road maintenance and snow removal
- Environmental monitoring
- Wildlife monitoring
- Hospitality and catering
- Security
- First responder/emergency personnel training

5.4 Impact Assessment Methodology

The IESP has followed the Federal Cumulative Effects Assessment Practitioners' Guide (Hegmann, et al. 1999), still in use by the new Canada Impact Assessment Agency, to define the geographic and spatial boundaries of the project.

The Guide defines a Regional Study Area (RSA), as: “The spatial area within which cumulative effects are assessed (i.e., extending a distance from the project footprint in which both direct and indirect effects are anticipated to occur)”. The RSA selected for this project is conservative and includes an area extending in a 10km radius from the M-18 wellsite (See Figure 5-2). This radius incorporates the entire watershed of Gunghi Creek upstream and downstream of the Project site and an area extensive enough to fully assess potential air quality impacts. For context, the emergency evacuation zone radius from a wellsite or sweet gas plant emergency in Alberta is 1.6 km.

The Guide defines Local Study Area (LSA) as: "The spatial area within which local effects are assessed (i.e., within close proximity to the action where direct effects are anticipated)". The LSA selected for the Project includes the area in the vicinity of the M-18 wellsite, including the private access road corridor and extending a setback of 250m from the proposed pad areas and the proposed access road; and a radius of 500 m from the wellsite itself. By comparison, a 500m setback is five times greater than the safety setback distance required by the Alberta Government for a sweet well in Alberta.

The Federal Guideline defines the Zone of Influence as "a geographic area, extending from an action, in which an effect is non-trivial." For the IESP our Zone of Influence has been defined to include the most westerly portion of Husky Lakes, the Pingo Canadian Landmark site, the ITH, and the community of Tuktoyaktuk. These areas could be affected by the transportation of fuels on the ITH; and the community of Tuktoyaktuk is a potentially affected community due to its proximity for housing and services.

The Temporal Boundary, or "the period of time examined in the assessment" varied by major activity, as based upon duration, as follows:

Table 5-3: Temporal Boundaries of the Environmental Assessment

Major Activity	Duration	Season
Site Works (Road and Pad Construction)	Less than six months	Winter/early Spring/Fall
Sump Remediation	Less than one month	Winter
Well Completion	Less than one month	Fall
Facility Commissioning	Less than three months	Spring/Summer
Facility Operations (incl transportation)	Greater than 50 years	All Season
Facility Decommissioning	Less than three years	Undetermined

The Valued Components (VCs) assessed included a review of all biophysical, social, or environmental components relevant to the project. Valued Components were determined from community engagement, traditional land use interviews, previous Project Descriptions, recent field studies, government legislation and guidelines and the combined expertise of more than 25 subject matter experts involved in the project.

The VCs selected for assessment of the project are listed in Table 5-3:

Table 5-4: Valued Components (VCs) for the IESP

VC	Component Considerations
Wildlife Harvesting	Caribou, Fish, Grizzly Bear
Wildlife	Grizzly bear, wolverine, caribou, conservation areas; nesting birds, waterbirds
Fish	Fish habitat and free flow of local streams
Wildlife Habitat	Denning areas, caribou winter range, wolverine winter range, fish lakes and rivers
Lakes and Rivers	Discharge, bankfull width, wetted width, water depth, crown closure, dominant bed material; temperature, pH, conductivity, alkalinity, turbidity, dissolved oxygen content
Land Use	Fishing, harvesting, guide-outfitting, settlement, and transportation infrastructure, mineral and oil and gas activity, tourism and non-consumptive recreation, ITH use, and protected areas
Socio-economic conditions	Training opportunities, employment opportunities, business opportunities, traffic, strain on local public resources, and maintenance of traditional way of life

Table 5-4: Valued Components (VCs) for the IESP	
VC	**Component Considerations**
Permafrost and Soil	Permafrost thawing and erosion, ground temperatures; ice content, active layer thickness, drainage (lack of ponding)
Air Quality	Particulate matter, road dust, NO_X, carbon monoxide, and greenhouse gases
Traffic Issues	Number, length, and weight of trucks per day; traffic incidents with people, incidents with wildlife, accidents, spills
Noise	Noise levels at site facility, 100m from site facility, 1.5 km from site facility
Climate	Temperature, precipitation, snowpack, and wind
Vegetation	Rare plants, uncommon vegetation communities
Heritage resources	Historical, archaeological and paleontological sites
Waste	Zero waste on site, waste disposal to certified facilities only
Borrow	Quality; noncompeting with other projects

5.4.1 Significance Determination

The Environmental Impact Screening Panel considers three main questions when making a significance decision (EISC 2014). These are:

- Whether a proposed development could have a significant negative environmental effect.
- Whether a proposed development could have a significant negative effect on wildlife or wildlife habitat.
- Whether any development of consequence that is likely to cause a negative environmental effect could have a significant negative impact on present or future wildlife harvesting.

The IESP considered three primary questions in our assessment of significance:

1. What are the project activities that could cause a negative effect?
2. What specifically about that activity could cause a negative effect?
3. Would the negative effect impact a Valued Component?

The potential to cause a negative effect considered duration, extent, frequency, reversibility, and magnitude. Magnitude was assessed after Kavik-Axys (2002). Additional detail on the determination of significance is provided in Section 14.

5.4.2 Summary of Potential Impact Significance

Residual program effects, once mitigations are applied, are predicted to be **positive** for the following VCs:

- Socio-economic: Energy security
- Socio-economic: Business and employment opportunities
- Socio-economic: Local infrastructure
- Net greenhouse gas emissions
- Socio-economic: Local diesel fuel and gas costs

- Sump remediation

Residual negative program effects, once mitigations are applied, are predicted to be **none to negligible** for the following VCs:

- Heritage and archaeological resources
- Climate
- Water lakes and rivers
- Regional drainage
- Traditional land use
- Fish and fish habitat
- Wildlife harvesting
- Wildlife – waterbirds
- Waste
- Wildlife habitat

Residual Program effects, once mitigations are applied, are predicted to be **low** for the following VCs:

- Air quality
- Permafrost and soil
- Noise
- Light
- Waste
- Increased access to the area because of the access road

The predicted **residual** effects from the Program include:

- Loss of less than 15 ha of vegetation (road and pad footprints) within the LSA
- Disturbed local drainage
- Use of borrow from Borrow Source 312
- Potential for localized effects to barren-ground caribou from sensory disturbance
- Potential for localized effects to grizzly bears and wolverine from sensory disturbance
- Potential for localized effects to tundra-nesting birds, short-eared owl, gray-headed chickadee and rusty blackbird from sensory disturbance
- Land Use – increased traffic on ITH

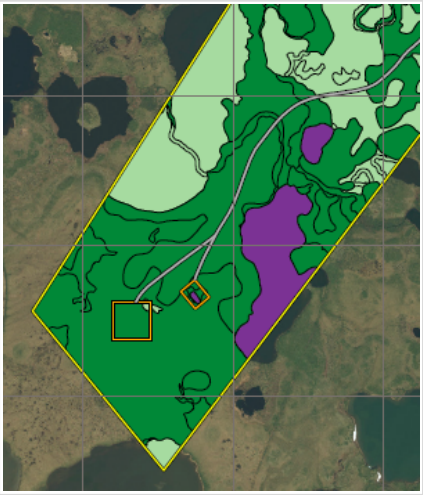
Predicted **significant** impacts from the Project include:

- None

All predicted impacts are reversible, and no predicted impacts exceed Level 3 magnitude. The only predicted impacts of any duration are sensory disturbance to humans or wildlife from noise, light and/or traffic. Detailed mitigations for these and all other potential impacts are provided in the following section.

5.5 Overview of Predicted Impacts and Mitigations

5.5.1 Wildlife and Wildlife Habitat



See Figure 10-13 Appendix 1

Our contract wildlife biologists, with the support of local residents from Tuktoyaktuk, concluded that the LSA could provide suitable habitat for 8 (eight) wildlife species with Special Conservation Status that have the potential to visit the Study Area. The 8 species included five birds, as well as the Barren-Ground Caribou, Grizzly Bear and Wolverine. Local harvesters supplemented our wildlife study with additional information about bear den potential in the RSA, as well as knowledge of infrequent sightings of moose and reindeer, although this area was not designated in the Community Conservation Plans for either animal. Details are provided in Sections 10, 11 and 12 of this Project Description. (See also Figures 10-12 and 10-13.)

Mitigations:

1. All pre-commissioning activity in the LSA will be completed outside the bird nesting period (mid-May to mid- August) to the extent possible, thus reducing the potential impact during pre-commissioning to nil.
2. A fall survey for bear dens will be completed prior to any winter construction.
3. IPC will follow the details of the IESP's Wildlife and Wildlife Habitat Protection Plan (WWHPP) for education and training of all personnel; infrastructure design; timing restrictions and set-back distances; animal attractants; management of sensory disturbances, animal-human interactions, and traffic disturbances; monitoring; adaptive management; and reporting.

IPC anticipates very minor localized and temporary disturbance to local wildlife (small mammals or rodents) during the well completion, scheduled for October 2021. All construction and tying-in of modules is currently scheduled for wintertime. IPC will respect the nesting season of migratory birds by halting all construction from May 15 to August 15. Once the project is operational, all kitchen waste will be disposed weekly to avoid attracting wildlife. Fencing will be used where it is safe and appropriate to do so, to ensure curious animals cannot encounter equipment. Numerous additional mitigation measures are provided in our extensive WWHPP. The WWHPP will be part of our core orientation training and will be followed by all personnel, including contractors.

Based upon our assessment, IPC has concluded that development and operations can proceed without significant impact to wildlife, wildlife habitat, or harvesting.

5.5.2 Wildlife Harvesting

The RSA lies within the NWT ENR "no caribou Hunting Zone" (I/BC/07). There is no hunting of barren ground caribou permitted at any time of year by residents, non-residents nor non-resident aliens. Traditional knowledge holders provided information that the area is not currently used for berry-picking and rarely for hunting. There are no cabins within five kilometres of the proposed facility, and only one cabin within 10 km. The cabin is located across the ITH (east) and is not currently being used (the former owner has passed away). Four harvesters interviewed said they have hunted in the RSA in the past, but not recently. None of them use the LSA. In the past, local hunters harvested fox, ptarmigan, geese, grizzly bear, moose, and sometimes "the odd wolf" in the RSA. All of the outfitters that are registered with the EISC as of September 1, 2020 were interviewed, and none of them

expressed concern about the project. Figure 11-8 provides a map of cabins and other land users in the RSA.

A trail to the small lake west of Iqalushaq Lake (used in the fall and/or winter for ice fishing) cuts west-south-west across the top of the LSA but does not cross the proposed access road. The THTC expressed concern about increased access to the area and wanted to ensure security for the access road. IPC is committed to ensuring the road is used for authorized traffic only, for safety reasons. We will be placing a gate at the ITH intersection and monitoring use of the road 24 hours a day, 7 days a week. The IESP Energy Centre site will be fenced to limit site access. Live security guard(s) are anticipated to be utilized. The facility will be operational and shipping fuel products 24 hours per day 7 days per week. Security cameras will also be utilized on premise.

In summary, the Project RSA is rarely used for wildlife harvesting. The LSA is not used at all, currently nor traditionally. There are better areas towards Husky Lakes or along the coast. For these reasons, we do not expect the project to impact harvesting in the area at all.

5.5.3 Fish and Surface Water

There are two unnamed creeks and two unnamed small lakes in the LSA, as well as seven ponds. The proposed access road route is able to maintain 100 meter or greater set-backs from all the ponds, however, a single stream crossing is required. The crossing occurs over an unnamed stream that flows generally north from Tiktaliq Lake into Gunghi Creek and into Tuktoyaktuk Harbour. The unnamed stream was assessed in August 2018. The bankfull width of the stream (the width during spring runoff) was less than two metres. The bankfull width during spring runoff was assessed using remote sensing and is less than five metres (See Figures 10-9 and 10-10). Our contract fish biologist concluded that the stream is unlikely to provide any overwintering habitat for fish and is a poor spawning area for salmonids (salmon, trout or char), given the general lack of gravel/cobble at the bottom of the stream. A section of the stream that does have gravel has been mapped and will be avoided.

See Figure 10-9 Appendix 1

The Project LSA is within the Fish Lakes and Rivers Management Area (704C) for the Tuktoyaktuk Community Conservation Plan. 704C is designated as important fish habitat and important historic and present subsistence harvesting area for residents of Inuvik and Tuktoyaktuk. Traditional Land users have identified three lakes in the RSA used for fishing. Iqalushaq Lake is used by two local fishermen for fall fishing after first ice-over. A small lake west of Iqalushaq Lake is used in the winter for whitefish. Local harvesters expressed concern that a spill at the Project site could impact the waters at Iqalushaq Lake, however, Iqalushaq Lake and the fishing lake west of it, are in a completely separate watershed from the stream near the IESP which feeds into Gunghi Creek. (See Figure 10-6) The large lake east of M-18, known as Tiktaliq Lake, is used by several local harvesters for jackfish and burbot (reportedly for dog food). This lake is upstream of the project LSA and also not susceptible to damage from a spill.

In March 2020, IPC hired Kiggiak EBA to drill two geotechnical boreholes on either side of the stream crossing. IPC acquired this information to make the best decision for protection of the stream, the intermittent fishery, and the permafrost with respect to creek crossing infrastructure. During meetings held with the Tuktoyaktuk Hunters and Trappers Committee (THTC), traditional land users expressed significant concern about the placement of a culvert in the stream. A letter of support from the THTC included a condition that IPC “construct a bridge instead of a culvert at the proposed creek crossing site”.

Traditional knowledge was provided that indicated dusting from the gravel roads can create significant dust fall-out into the surrounding watersheds. During the short summer period, if roads become dry, dust suppression measures will be applied 50 m either side of the access road stream crossing to minimize this impact. The NWT Dust suppression guidelines will be followed. An ambient dust monitoring program will be in place during summers to provide timely information. Management strategies will be adapted based upon the findings of the monitoring, to ensure dust impacts on the access road are minimized.

Mitigations:

1. Winter construction work to ensure no impacts to fish, fish habitat or water quality.
2. Construction of a bridge rather than culvert over the unnamed stream.
3. GNWT guidelines for road access will be applied to all contractors to mitigate siltation, erosion issues, permafrost disturbance, etc.
4. Dust suppression based on NWT Guidelines will be applied to minimize dust in the summer from truck traffic.
5. Dust monitoring and adaptive management.
6. A section of the stream that does have gravel has been mapped and will be avoided.
7. No spills will enter a waterway at any time – comprehensive spill response plan is provided in Appendix 5.

Finally, salt-impacted soils near the sump will be remediated. This will ensure that no salts from the sump enter the local lakes or streams. The current surface water drainage from the existing M-18 sump will be re-routed. Local drainage at the sump will be restored to ensure runoff does not intersect the sump, to provide long-term protection of the environment.

Based upon our assessment, IPC has concluded that development and operations can proceed without significant impact to fish, fish habitat, or surface water flow. The remediation of the sump will be a benefit to the local environment.

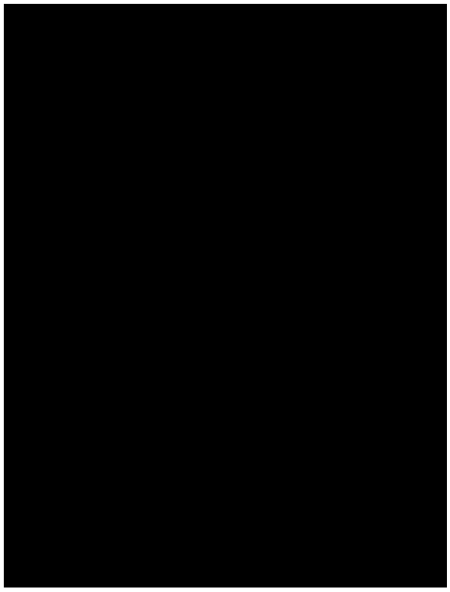
5.5.4 Vegetation

Nine types of vegetation communities were identified in the study area (See Figure 10-11). There were no rare or 'at risk' plant species or communities detected during the field assessment. Our contracted professional biologists concluded that development could proceed without disturbance or destruction of rare or at-risk plants or communities (Kiggiak EBA 2019c). There will be a loss of approximately 15 hectares of typical tundra vegetation due to the construction of pads and the access road for a period of more than 50 years. The road and pads will be reclaimed in the future to the regulatory standard of the day.

The proposed access road will utilize a route that runs through the common/dominant vegetation communities of the area (see Figure 10-11). The pads will be placed on areas of common/dominant vegetation. The current sump cap, planted in 2003 to non-native wheat grasses, will be re-capped and re-vegetated following pre-commissioning with native plant species to halt any local invasion.

5.5.5 Archaeology/Heritage Resources

No impacts are anticipated to archaeological or heritage resources from the IESP. In 2018, a qualified archaeologist, licensed with the Prince of Wales Northern Heritage Center, was retained for the IESP by Kiggiak-EBA Consulting Ltd. to complete a desktop based Archaeological Overview Assessment (AOA) of the LSA (Soriak and Kiggiak-EBA, 2019).



The AOA considered all the previous studies in the area, including the comprehensive work done for the ITH. Soriak found that no previously recorded archaeological sites conflict with the potential development of the LSA. One area of high archaeology potential along the proposed access road route was identified at approximately KM2.5 from the ITH, south of the stream crossing. This is an area of elevated terrain near water and has the potential for historical or pre-historical camps. (See Figure 11-6). IPC has developed a chance find (stop work) procedure for the project as part of our Archaeological Site Management Plan. The procedure will be in force during road construction, and we will stop work and contact the ILA if any artifacts are discovered. (See Appendix 3.)

Project planning has also included traditional land use discussions with the Tuktoyaktuk HTC and Tuktoyaktuk elders to identify any local knowledge of heritage resources. No new sites were identified; however, a burial site west of Iqalushaq Lake has been mapped by Environment Canada in the Beaufort Regional Coastal Sensitivity Atlas. (Environment Canada, 2015). The site is about 4.5 km from the project site and is unknown to the ILA.

5.5.6 Water Use

There will be no water, or any other liquids discharged to the environment by this project before or during operations. Drilling mud from the well completion will be stored in double-walled tanks on-site and disposed off-site in a licensed, regulated facility. Minor quantities of water will be required for the well completion. This water will be provided from Tuktoyaktuk by truck. No local lake or river water will be withdrawn for the project.

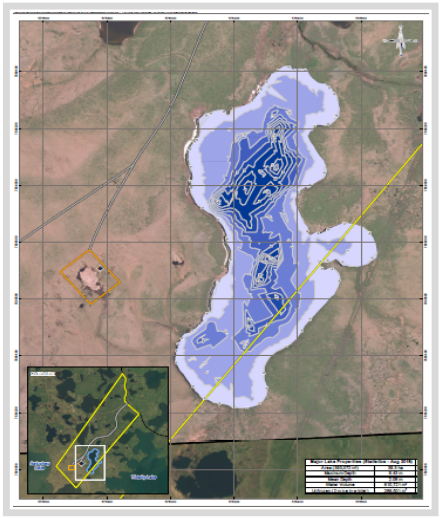


Figure 10-8 in Appendix 1

For planning purposes, the two local lakes nearest to M-18 were mapped. The unnamed lake immediately east of the M-18 well was surveyed and found to have an estimated 268,500 m^3 of water under 2m of ice, and more than 810,000 m^3 when unfrozen (see Figure 10-8). Tiktaliq Lake, further to south-east, and between the LSA and the ITH, was mapped for potential water withdrawal for the ITH. The lake was proven to have a depth of up to eight metres and with sufficient quantities (more than 17.7 million cubic metres unfrozen/ 4.37 million fully frozen) of water. Our engineering and construction plans do not require lake water to be withdrawn for any phase of the project.

5.5.7 Waste

This project will generate minimal waste. There will be no camp on site, so kitchen waste will be minimal. All kitchen waste will be gathered daily and stored in bear-proof containers inside a heated warehouse. Kitchen waste will be removed from the site weekly to the local landfill in Tuktoyaktuk, pending approval from the Hamlet. Sewage will be stored in septic tank on site as part of the office trailer and collected by truck from Tuktoyaktuk and disposed to the local sewage lagoon, pending approval from the Hamlet.

There are no liquid waste streams from the gas plant process. All industrial, non-hazardous solid waste will be sent to the nearest regulated waste facility licensed by the GNWT to receive that waste. Construction waste will be minimal because of off-site fabrication and modularization. All solid waste generated during the well completion (e.g. cement cuttings, dunnage, tubing protectors, packing material, etc.) with be collected in waste bins and disposed of at an approved landfill. The total volume will be less than 2000kg.

Hazardous wastes will be taken south for proper disposal at a licensed and regulated facility in B.C. or Alberta. Management and disposal of all waste will meet or exceed regulations. Industrial and hazardous wastes will be manifested, tracked, and quantified for an annual report. A detailed Waste Management Plan for the Project with anticipated waste streams and volumes is provided as Appendix 4.

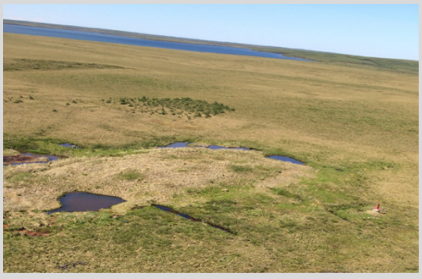
5.5.8 Permafrost

Protection of permafrost is of critical importance to the Project. Thawed permafrost can lead to subsidence, ponding, and damage to structures built on the permafrost.

The entire Local Study Area has been surveyed to support the identification and engineering design of the best locations for a road and pads (see Figure 10-3); as well as the placement of culverts in the road for good drainage flow to avoid thermal degradation of the permafrost.

To mitigate potential impacts to permafrost, IPC will protect the natural tundra vegetation in undisturbed areas. Tundra forms a natural insulation barrier ensuring permafrost does not thaw. The layer of “topsoil” under the tundra that thaws and then freezes every year is known as the “active layer”. Active layer depths within the LSA range from 0.4 m to 0.7m (Kiggiak EBA 2019a). Poorly designed road embankments constructed in permafrost can result in the active layer increasing in depth and exposing the ground ice to thaw.

In addition, poor drainage conditions along a road over permafrost terrain can cause surface water ponding, thermal erosion, formation of icings, and other maintenance problems. Water ponding changes the geothermal conditions and induces accelerated thawing of perennially frozen soils below and around a road embankment. Gradual melting of the ground ice results in ponding and settlements, which could cause depressions, dips, and longitudinal cracks on the road surface and embankment slopes. This type of thermal degradation is currently seen around the M-18 sump.



To minimize changes to the ground temperature, and, as such, prevent the permafrost below the road or pad from thawing and degrading, we will design our all-season roads and pads to do three things:

- Insulate the underlying permafrost to keep the subsoil frozen
- Prevent ponding
- Move the frozen layer upwards into the pad or road

In addition, all facilities, including storage tanks, will be set on adfreeze piles on top of the insulating pads. (See Figure 6-8 in Appendix 1 for a drawing of a typical adfreeze pipe pile.) The use of piles will help with snow removal as well as protect the permafrost. Details of the design are in development with our contract site works (civil) engineering firm.

Design, construction, and maintenance of roads and pads in sensitive permafrost environments requires significant consideration for permafrost preservation and safety in design (See Figure 6-6). Suggested guidelines for designing all-weather roads in permafrost are presented in the Transport Association of Canada (TAC) Guidelines for Development and Management of Transportation Infrastructure in Permafrost Regions (TAC 2010). TAC recommends researching previously built roads applicable to the project, understanding the thermal properties of the region's permafrost, designing based on the thermal regime, and being willing to compromise geometric road design criteria to accommodate permafrost. The proposed access road will be designed and constructed considering these guidelines; and lessons learned from the recent ITH construction, Borrow Source 312 and 177 roads, and numerous pads built in Tuktoyaktuk.

IPC intends to monitor the permafrost temperatures in the LSA during the life of the Project. During the 2020 geotechnical borehole program, ground temperature cables (GTCs) were installed in four boreholes to depths of 8.0 m to 20.0 m. (see Figure 10-3). Ground temperature readings were collected at the end of the field program in March to confirm all the beads were working and a second set of readings were collected on April 27, 2020. The measured temperatures ranged from -3.3°C to -5.6°C. (Kiggiak EBA 2020)

Permafrost and the M-18 well

The temperature of the gas reservoir is significantly higher (~50°C) than the surrounding ground temperature, so if left unprotected, a significant amount of heat would be transferred to the permafrost soil, causing it to thaw. To minimize the chance of this ever occurring the annulus (area between well casing and the production tubing) will be filled with a gelled fluid that will limit the heat transferred to the surrounding frozen ground. Special production tubing that is vacuum jacketed is being looked at to further protect the surroundings from heat transfer. Vacuum jacket tubing is a special configuration where the tubing contains an inner portion surrounded by a vacant space and then an outer portion. The empty space between the inner and outer portions will have all the air removed from it - creating a vacuum in that space and protecting the permafrost (See Figure 6-10).

5.5.9 Other land users

The area south of Tuktoyaktuk has been subject to industry exploration for more than 50 years. Several dozen seismic and drilling programs have occurred over the past five decades within the LSA and RSA. There are 18 abandoned oil or gas wells within a 15 km radius of M-18 and 13 wells in the RSA. The wells were drilled between December 1968 and February 2002. In addition, the new Inuvik to Tuktoyaktuk Highway (ITH) runs through the Project RSA, and, indeed, is a reason the project is under consideration. Other development near the RSA and the ITH include a new landfill for Tuktoyaktuk, Borrow Source 177, the existing sewage lagoon at Tuktoyaktuk and numerous industrial camp complexes developed in the 1970s and 1980s. A complete list of other land uses in or near the RSA is provided in Table 5-6.

Table 5-5: Other Land Uses/Developments/Structures near the RSA	
Activity	**Distance from Project (km)**
Iqalushaq Lake Winter Fishing Camp	4.05
Tuktoyaktuk Municipal Boundary	4.83
Borrow Source 177 (overland)	6.06
Borrow Source 177 (via ITH)	13.5
New Landfill	6.48
Closest Cabin	7.61
Canadian Pingo Landmark (Ibyuk)	11.45
Tuktoyaktuk Sewage Lagoon	11.62
Tuktoyaktuk Harbour	12.05
Closest Residence (Reindeer Point)	12.76
Tuktoyaktuk Landfill	13.88
EGT Base Camp	13.95
Nalluk (BeauDril) Base Camp	14.17
Canadian Coast Guard	14.08
Can-Mar/AMOCO Base Camp	15.00
ESSO Base Camp (Imperial Oil)	15.11
Tuktoyaktuk Airstrip	15.53
Tuktoyaktuk Water Reservoir	15.85
NTCL Wharf	15.88
Mangilaluk School	16.43
North Warning System Radar Station (BAR-3)	16.60
Tuktoyaktuk Cemetery	17.13
Northern Store (Tuktoyaktuk)	17.18
Parks Canada Picnic Shelter	17.70
Borrow Source 312 (via ITH)	68.00

Note: Distances measured via straight line on Google Earth from M-18 wellhead, unless specified as via ITH.

As based upon ARI/POLAR NWT Research Database and the EISC Registry there is one research project within this Project RSA. There are six additional projects within the greater area that might come into the RSA along the ITH. We do not expect that the IESP will conflict with any other land users in the area.

5.5.10 Air Quality

Clean air, free of concentrations of pollutants that possibly have toxic health effects, or cause breathing difficulty, is essential to all people for good quality of life. The air surrounding us on the land and in our communities is

called “ambient air.” It contains nitrogen, oxygen, a small amount of carbon dioxide and water vapour. It also contains small amounts of particulate matter and other chemicals. The NWT Ambient Air Quality Standards (AAQS) describe the amount of chemicals and particulate matter allowable in the ambient air. The naturally occurring levels of particulate matter and chemicals in the air are called “background levels.”

Human activities, such as this project, and natural events, such as forest fires, can cause the amount of pollutants in the ambient air to increase. By quantifying the air emissions from the IESP facility and modelling the interaction of these potentially harmful compounds in the local environment we can better assess the impacts of the proposed activities on local air quality and ensure that the NWT Ambient Air Quality Standards are not exceeded.

Some of the compounds that will be modelled and checked for their impact on the local airshed include the following:

Particulate Matter (PM2.5 and PM10): Particulate matter comes in different sizes. Fine particulate matter (PM2.5) is about 30 times smaller than the width of a human hair. Coarse particulate matter (PM10) is slightly larger than PM2.5. Both types of particulate matter can be inhaled and can aggravate existing pulmonary and cardiovascular disease. PM2.5 is more dangerous because the particles are so small that they pass easily through our nose and throat defenses and can get deep into our lungs. Particles in the PM2.5 range are primarily the result of industrial activities, commercial and residential heating, vehicle emissions and forest fire smoke. Particles in the PM10 range include road dust and wind-blown soil.

Sulphur Dioxide (SO_2): SO_2 is a colourless gas that can have negative effects on human and environmental health. Certain types of vegetation (especially lichens) are very sensitive to SO_2. SO_2 also contributes to the formation of other pollutants in the air. Emissions of SO_2 are created during the burning of fossil fuels containing sulphur. Sources of SO_2 in the north include power generating plants, commercial and residential heating, and forest fires.

Sulphur has not been measured in the gas and fluids from the well and so it is not expected that significant SO_2 emissions will be generated from the processing facility.

Nitrogen Dioxide (NO_2): The sources of NO_2 are the same as SO_2 as well as vehicle exhaust. High levels can cause serious breathing problems that can become chronic. High levels of NO_2 can also lead to formation of other pollutants. Nitrogen Dioxide is the largest volume of criteria pollutant released from the plant.

Ground Level Ozone (O_3): This is the same gas that is found higher up in the atmosphere, where it is called stratospheric ozone. High in the atmosphere, ozone is a good thing – it protects the planet from the sun’s harmful ultraviolet rays. However, at ground level, ozone can be harmful to humans and plants. High levels of ozone can be created in the lower atmosphere by sunlight and heat causing gases, usually NO_2, and causes substances called volatile organic compounds (VOCs), primarily methane, to undergo chemical reactions with each other. High ozone levels can lead to chest tightness, coughing, wheezing and other heart and lung problems. The effect of ozone on plants can be seen as discolored leaves and general poor vegetation growth. Minimal O_3 is produced at the facility.

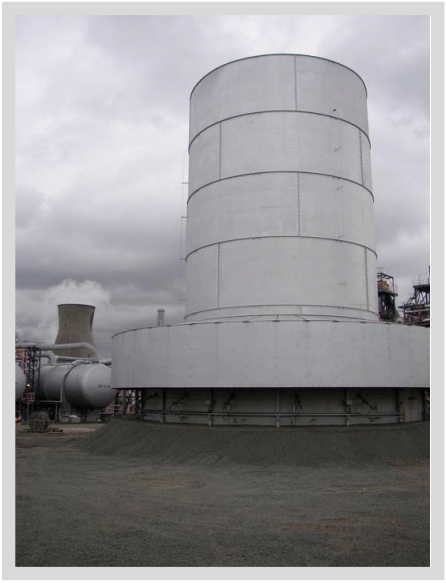
Carbon Monoxide (CO): CO comes from a number of sources, including home heating, vehicle exhaust, power generation and forest fires. Extremely high levels of CO in our air can be poisonous and can cause headaches, shortness of breath and nausea.

Emissions from IESP Energy Centre

Emissions from the IESP Energy Centre will include amounts of NO_2, CO, PM2.5 and possibly fugitive VOC

(methane) and NH_4 (ammonia). The major combustion sources, which are where the emissions come from, are discussed in Section 6 of the Project Description. At the estimated emission rates supplied in Table 5-7, none of the emissions from the Project are expected to exceed the government ambient air quality criteria.

A ground flare or combustor will be in operation at the facility to burn off gases from non-routine operations such as if parts of the plant need to be quickly and safely shutdown; or a pressure safety valve is activated for process safety reasons; or to burn off intermediate fuel products that cannot be recycled to keep the process operating. The only regular stream to the site ground flare would be tank "breathing" vapours which include a small amount of fuel gas from when the tanks are being filled. A ground flare system or combustor is preferred in order to have no visible flame and to minimize noise from flaring events.



For the LNG plant there is no continuous venting or flaring with no plans for an automated full plant blowdown scenario. All PSVs will be vented directly to atmosphere for the natural gas system and refrigeration system in the unlikely event of a system overpressure.

For the natural gas system manual depressurization will be directed to the site ground flare during initial purging operations or during turnaround or maintenance activities.

Buildings will have appropriate gas detection to detect a leak. The gas detection will activate visual and auditory alarms inside and outside of buildings affected and the plant control system will also identify where and what the issue is. HVAC systems will be designed in such a manner to manage leaks.

CO_2 separated from the natural gas before liquefaction is sent to the GTL plant and converted to synthetic diesel. There are minor CO_2 emissions from the exhaust stacks of heat medium heaters, steam methane reformer (SMR), and power generation engines.

Ammonia is used as the refrigerant for the LNG liquefaction system. The system is closed loop so there should be no emissions. In the case of an ammonia leak the buildings that contain ammonia are monitored with visible and audible alarms. Any ammonia vapor or aqua-ammonia solution that is to be removed from piping or equipment for maintenance or turnaround activities will be discharged into drums of water and fully absorbed for recovery and re-use.

The air emissions generated from operations will be modelled to ensure the design of the plant will not exceed NWT AAQG or foreseeable Canadian Ambient Air Quality Guidelines.

Fugitive emissions consist mostly of methane and smaller amounts of ammonia that escapes the process equipment through undetected leaks, equipment seals and loading operations. Fugitive emissions are not expected, as the plant will have a monitoring program to find potential leaks and fix them. Table 5-6 provides our current estimate of air emission compounds from design rate routine facility operations.

Table 5-6: Site Emissions (estimate)	
Air Quality Chemical	**Total (Tonnes/day)**
CO_2eq	142.4
CO_2	136.5
CH_4	0.214
N_2O	0.001
CFCs + HFCs	0.000
CO	0.073
NOx	0.270
VOC-Ozone weighted	0.008
SOx	0.008
PM	0.014

5.5.11 Greenhouse Gases

The IESP provides significant GHG savings from the current energy supply scenario, (trucking propane from Taylor, B.C. and diesel from Edmonton, Alberta) due to severely reduced trucking distances and the reduced number of trucks needed per year. The round-trip distance from Taylor, B.C. (the current source of gas for Inuvik) is 5,150 km. A round trip from Edmonton to Tuktoyaktuk is 6,750 km.

Greenhouse gases (GHG) in the Earth's atmosphere have the potential to trap heat. They let sunlight pass through the atmosphere, but they prevent the heat that the sunlight brings from leaving the atmosphere, acting like a greenhouse. The main greenhouse gases are, water vapour, carbon dioxide, methane, ozone, and nitrous oxide.

GHG emissions, consisting of mostly CO_2, have been calculated for local LNG and diesel fuel production from the IESP and compared against the emissions that are currently generated in the production, transport and use of fuels that will be displaced in the north by the SynDiesel® and LNG produced by the new facility. The reduction of GHG emissions from transporting fuels from M-18 versus the current southern supply is more than 22,000 tonnes per year. The total Lifecycle GHG Emissions for IESP local LNG and SynDiesel® production of fuels locally compared to the importation of an equivalent amount of energy from the south will result in a net reduction of 17,000 tonnes per year GHG emissions as CO_2e. Using LNG to replace diesel for community power and propane for heat will result in an additional 40,000 tonnes saved per year. The net reduction of GHG emissions because of the Project is a significant environmental benefit.

Table 5-8: Relative GHG Emissions	
Sector	**Total (kT/a or x 1000Tonnes/year)**
NT Power (Inuvik)	23
IESP Energy Centre	52
NWT Residential Heating (2018)	57
NWT Heavy Duty Diesel (2018)	370
NWT Forest Fires (2017)	550

5.5.12 Noise

Noise levels during routine activity of pre-commissioning and operations will meet or exceed all regulations. An assessment of our project activities found five primary sources of noise that might be considered "loud." Nevertheless, these sources are not expected to exceed the typical government standard for industrial noise. The sources are:

- Heavy equipment operation during road and pad construction
- Service rig operation during well completion (similar to a diesel truck in volume, this will be short duration "background" operating noise)
- Pneumatic tools and heavy equipment during module tie-in (also short duration)
- Noise produced by the operating Energy Centre – this noise will diminish quickly with distance from the facility. Noise will be produced by compressors, pumps, heaters, emergency relief, truck traffic and electrical equipment. At the process equipment units' boundary, the noise level is not expected to exceed 100dB.
- Transportation of fuels – truck traffic

The GNWT and the Government of Canada have no written requirements for noise control. In Alberta, noise is regulated under Directive 038: Noise Control (2007). The intent of Directive 038 is to take a balanced viewpoint by considering the interests of both the nearby residents and the industry operator. It does not guarantee that a resident will not hear noises from a facility; rather it aims to not adversely affect indoor noise levels for residents near a facility. The directive sets permissible sound levels (PSLs) for outdoor noise, taking into consideration that the reduction of noise through the walls of a dwelling should decrease the indoor sound levels to where normal sleep patterns are not disturbed. In Alberta, the PSL is 40 dB at a distance of 1.5 km from the facility.

Several tools, equipment, and machinery from the IESP will exceed 40 dB at the source of the noise. Some of the machinery in the Energy Centre will exceed 100 dB at one meter. However, noise will lessen with distance. Noise will also carry farther in nighttime and in winter. Nevertheless, IPC do not anticipate that any of our operations will exceed the Alberta PSL of 40 dB at a distance of 1.5 km. Since the nearest human receptor to our project is more than seven kilometres, we do not expect any noise complaints from pre-commissioning or operation of the facility.

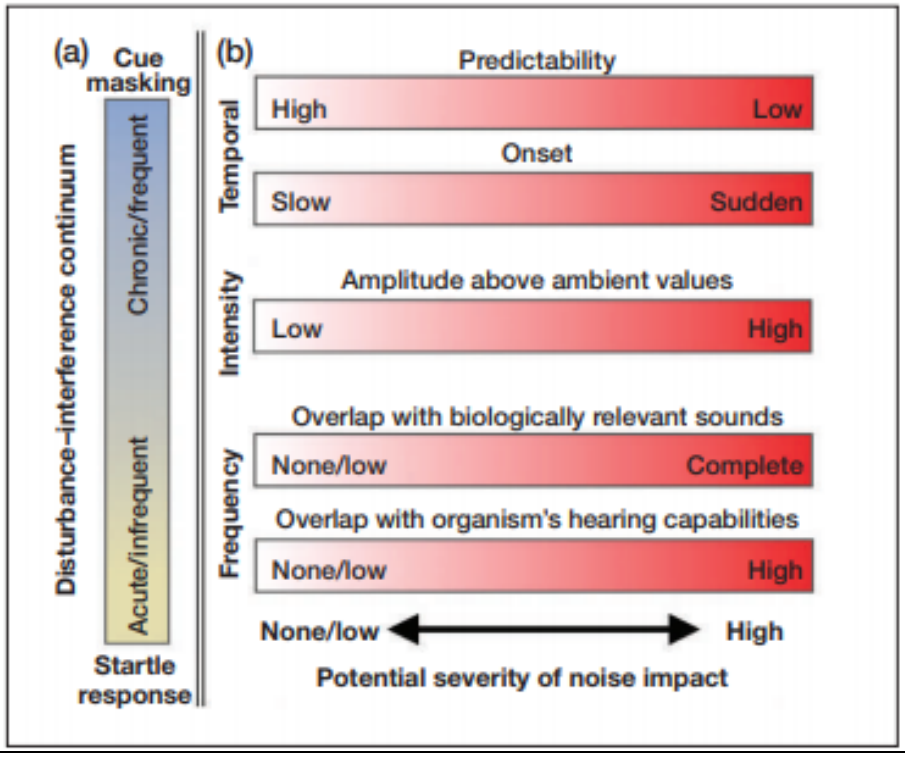
The sensory disturbance of wildlife is a potential impact. Directive 038 states that, "Landowners and residents often express concern about the impact of industrial noise on domestic animals and wildlife. While not the basis for these requirements, the EUB continues to examine peer-reviewed scientific literature and has concluded to date that typical industrial noise regulated under its jurisdiction does not significantly impact the physiology and habituation patterns of animals over the long term. The literature does suggest that animals might temporarily avoid an area until they become familiar with or acclimatized to industrial noise."

The effect on wildlife is a complicated relationship and the noise impact on wildlife cannot just be determined from sound levels but also the regularity and frequency profile of the noise. In the case of the IESP facility local wildlife will have also been habituated to the sound of vehicular traffic on the ITH.

Francis and Barber (2013) found that, "the disturbance–interference continuum on wildlife can range from acute or infrequent noise stimuli that will likely trigger, startle, or hide responses; to frequent or chronic noises that interfere with cue detection." In other words, startling, but infrequent, noise (e.g. a loud pressure relief valve sounding off) can disturb animals and send them into flight. Animals will not be as disturbed by ongoing "background" noise (e.g. a diesel generator), but the background noise could affect their ability to detect a predator ("cue detection"). Table 5-8 below shows graphically how the severity of an impact from a noise source will depend on the temporal, intensity, and frequency features of the stimulus, or source. Noise that is sudden

and unpredictable, of high amplitude (much louder) than background noise, overlaps with biologically relevant sounds and is easy for the wildlife to hear, is much more disturbing than the opposites. This makes sense – a blood-curdling scream would tick all the boxes, however none of our predicted (routine) operational noise sources will.

Table 5-7: Factors Impacting Wildlife Disturbance from Noise



Source: Francis and Barber 2013. Accessed September 16 2020: https://scholarworks.boisestate.edu/cgi/viewcontent.cgi?referer=https://duckduckgo.com/&httpsredir=1&article=1384&context=bio_facpubs

Nevertheless, IPC will endeavour to mitigate noise impacts from our operations by:

1. Remaining within industry standards for noise at all times.
2. Design and mitigate for noise from our various operations.
3. Respond immediately to any noise complaints.
4. Construction noise will be minimized by fabrication offsite in the south.
5. Loud equipment will be housed in buildings to reduce noise.
6. Monitor noise levels quarterly (daytime and night-time) and adapt our facility and management processes based upon any new information about our noise levels.
7. The Energy Centre will be designed and constructed utilizing technologies and equipment to mitigate noise from rotating equipment noise sources such as heat exchanger fin fans, compressors, and generator engine exhaust.
8. Additional noise mitigation methods may include selection of lower noise fan designs with slower speeds, sound baffling systems, perforated wall panels for compressor buildings, and use of high-grade mufflers for generator engine exhaust.
9. Once the noise study has been completed and maximum acceptable noise levels at the identified point sources has been confirmed, IPC will be more specific about design noise levels for the specific noise generating points.
10. Noise attenuation is not a significant technical or cost challenge for the type and size of equipment utilized in our facility configuration.

The projected sound level 1.5 km from the facility is expected to be approximately 40dB which is about the noise level in a quiet library. The following table shows the gradient of sources and their respective noise levels.

Table 5-8: A Comparison of Noise Levels from Various Sources

Sources of Noise, Examples with Distance from Source	Sound Pressure Level (decibels, dB SPL)
Jet Aircraft, 50m away	140
Threshold of Pain	130
Threshold of Discomfort	120
Chainsaw, 1m distance	110
Disco, 1m from speaker	100
Diesel Power Generator, 1m	100
Diesel Truck, 10m away	90
Curbside of busy road, 5m	80
Vacuum cleaner, 1m	70
Conversational chat, 1m	60
Average home (background)	50
Quiet Library	40
Alberta Energy Regulator Requirement, 1.5 km	40
IESP Energy Centre, 1.5 km	**<40**
Quiet Bedroom at Night	30
Background in a TV studio (quiet on the set!)	20
Rustling leaves in the distance	10
Hearing Threshold	0

5.5.13 Soils

All soils within the LSA and RSA will be left undisturbed to protect permafrost. Borrow will be required for the construction of roads and pads. This could create an impact to soil outside the RSA, however, no impacts related to the development of a borrow source are anticipated because all borrow is expected to come from existing borrow sources. Discussions to date with the ILA and the GNWT indicate that the preferred source for borrow for the IESP is Borrow Source 312, located near the ITH about 68 km south of the Project LSA. Borrow Source 177, located about 13 km south of the Project is depleted and may not have the quality or quantity of gravel needed for the Project.

Erosion of soil from permafrost degradation is a concern. Detailed drainage plans will be developed to ensure that drainage continues to flow and thermal degradation from ponding does not occur. Culverts will be built throughout the access road to ensure drainage is not impeded.

5.5.14 Reclamation

Final reclamation of the site will be to highest requirements of the day. The complete IESP Decommissioning and Reclamation Plan is provided in Section 17 of this Project Description.

Following cleanup, decommissioning, and removal of all infrastructure, and the remediation of any potential surface or sub-surface contamination, the M-18 wellsite and gas plant processing areas will be reclaimed in a manner consistent with ILA Rules and any applicable regulations. Reclamation activities may include the following:

- Natural drainage may be restored
- Pre-disturbance topography may be restored
- Soils may be restored to equivalent land capability
- Revegetation efforts may include planting and successful restitution of native plant species

Reclamation efforts will be monitored to ensure all reclamation activities achieve the regulatory requirements in place at the relevant time. A period of monitoring in accordance with ILA Rules will be implemented following final reclamation.

If the closure monitoring provides results that meet established guidelines, and the program is considered successful, ongoing monitoring will not be required. At that time IPC would apply for a final clearance letter (or relevant legal acknowledgement of the time) from the ILA. If guidelines are not met, ongoing monitoring will be required in the affected area. Details of the monitoring programs will be presented to the ILA for approval one year prior to the closure of the site.

5.5.15 Community

The IESP will maximize use of local businesses and contractors, encourage and support training for full time jobs, and contribute to the enhancement of the local hospitals, fire departments and other services in Tuktoyaktuk and Inuvik. We intend to provide regular educational opportunities and customized training materials for local students to learn about LNG, the energy industry, and the project.

There will be full-time security to ensure public safety.

The project is expected to create at least 25 direct full-time jobs. Statistics Canada reports (from 2010 to 2016) an average of 2.38 indirect jobs are created in the oil and gas sector per every $1million of output (Statistics Canada, 2020). By conservative estimates the IESP will support more than 35 indirect jobs in the local community. This is a significant benefit.

6.0 SUMMARY OF THE PROPOSED DEVELOPMENT

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

- *Purpose of the proposed development*
- *Components of the proposed development including transportation, staging, exploration, monitoring, reclamation, abandonment and decommissioning.*
- *Location, including any offsite activities related to the development*
- *Timing and scheduling of the proposed development i.e., key dates, or phases of the development. If multi-year, indicate timing and scheduling for each year is required*
- *Infrastructure, personnel and equipment requirements*
- *Waste handling and disposal (garbage, sewage [black water and grey water], hazardous materials)*
- *Fuel requirements, storage, transportation and handling (method of transfer)*

6.1 Purpose of the Proposed Development

The Inuvialuit Settlement Region is energy insecure. This insecurity stems from the high price families must pay to heat and power their homes and run their vehicles. The average household in the ISR does not have a lot of disposable income and a significant portion of that goes to paying for utilities. Not infrequently, choices must be made between the heating bill and other household needs. This insecurity also stems from the vulnerability of the transportation network on which the energy imported into the ISR relies. The Dempster Highway crosses two rivers, which take weeks to freeze into an ice road in the fall and weeks to thaw into a ferry-friendly waterway. During those times, the ISR is isolated from its southern energy supply. The Mackenzie River is also closed to barges in the fall, winter, and spring months. River transportation is beset with its own raft challenges and unpredictability.

The ISR is also a place that has fought and waited, negotiated, and waited, advocated, and waited, for a sustainable modern economy to take root. However, just as the Inuvialuit Final Agreement came into its own, as local businesses incorporated, staffed-up and acquired assets and as the relationships between Inuvialuit communities and industry formalized, the market conditions supporting a future Mackenzie Gas Project changed. The main proponents began to look elsewhere for opportunities, offices were abandoned, and, work dried up.

The Inuvialuit Energy Security Project (IESP) is critical to ensuring a secure and affordable energy supply for local communities. Situated 16 km south of Tuktoyaktuk and four kilometres off of the new Inuvik-Tuktoyaktuk Highway, with reserves anticipated to last more than 100 years, the IESP proposes to provide a reliable replacement to the dwindling Ikhil gas well, which is anticipated to have between two and three years remaining based on current draw volumes. The IESP also proposes to provide a more affordable supply of natural gas and synthetic diesel to the residents of Tuktoyaktuk, which would improve access to energy and improve quality of life overall.

The IESP, which will be located on Inuvialuit Private Lands, supports the principal objectives of the Inuvialuit Final Agreement (IFA) and is a clear example of promoting the full participation of Inuvialuit in the northern economy. The project also reinforces the Inuvialuit Regional Corporation's strategic plan, which was developed in consultation with the leadership of all Inuvialuit communities. Finally, the IESP coheres strongly with the Inuvialuit Community Economic Development Organization (ICEDO) 2020 Regional Opportunity Readiness Plan to complement and maximize Inuvialuit economic opportunities. The IESP will maximize the retention of benefits and

opportunities in the ISR with more than 1500 person-years of direct employment created over the next 50 years.

The IESP also reinforces the Canadian Northern Economic Development Agency (CanNor) mandate to help advance northern economic development by contributing to northern economic growth and diversification. The Mackenzie Delta Region has mineral resource wealth more than one billion barrels of oil and ten trillion cubic feet (tcf) of gas from 60 significant discoveries (INAC 1999). The M-18 well will be the third full production well in the history of the Region and the first one fully owned and operated by a 100% Inuvialuit-owned company. This project is also supportive of Natural Resources Canada's Arctic Energy Strategy – specifically to support energy security in communities; to upgrade existing fossil fuel-based energy systems and to reduce the reliance of northern communities on southern fuels for energy. It is expected that the availability of a secure gas supply in the region will allow the Northwest Territories Power Corporation (NTPC) the opportunity to convert numerous community diesel fired generators to co-blended fuels.

The IESP advances the goals of the GNWT 2030 Energy Strategy to reduce GHGs from electricity generation and road vehicles and to develop the NWT's energy potential. The potential GHG emission reductions of transporting local gas versus trucking from the south exceed 22,000 tonnes per year – a massive reduction over the existing fuel transportation scenario. The IESP also contributes to the GNWT 2013 Energy Action Plan - specifically to introduce LNG supply in the Beaufort Delta Region and the current mandate of the NWT Executive in Council. The replacement of diesel with LNG for community power could result in an additional 40,000 tonnes of GHG saved per year over using the LNG for propane heating fuel replacement.

6.2 Location of the Proposed Development

The gas well registered under the name TUK M-18 (M-18) is located approximately 16 kilometres south of Tuktoyaktuk, Northwest Territories, Canada, and less than four kilometres west of the new Inuvik to Tuktoyaktuk Highway (ITH). The coordinates of the well are 69°17'50.6"N latitude and 133°04'34.6"W longitude within the TUK 2 concession block.

The proposed access road into the wellsite is approximately four kilometres from the ITH to the well and will intersect with the ITH at KM Post 128+700. The highway intersection is less than one kilometer from the Municipal Boundary of Tuktoyaktuk and approximately 12 km from the Hamlet center.

The Development will require two gravel pad areas to protect permafrost and provide suitable ground for the well completion and possible future well servicing; and, the IESP Energy Centre. The Well Pad will be located immediately north of the existing sump and M-18 wellhead. A preliminary sketch of the proposed Well Pad is provided in Figure 6-9.

The Energy Centre Pad is proposed for a location 350m west-southwest of the M-18 wellsite on slightly higher and drier ground. Both pad areas were inspected and drilled for geotechnical feasibility in 2020. The final locations and configurations of the pads will be designed by the IESP's professional engineering consultants. The proposed development, including the road and pads, is located entirely on Inuvialuit 7(1)(a) Private Lands.

Maps of the Project Location, Regional Study Area and Local Study Area, including the proposed access road route

and proposed pad locations are provided in Figures 5-1, 5-2 and 5-3.

6.2.1 Related Offsite activities

Facility modules for the IESP Energy Centre will be built on transportable skids in the south at an established fabrication facility, likely in Alberta. The completed modules will be tested and then prepared for shipment to the IESP site.

Modules will be delivered to a staging area in Inuvik or Tuktoyaktuk via the Dempster Highway or via barge from Hay River. Final delivery from the staging area(s) to the IESP site will occur via truck along the ITH from Inuvik or Tuktoyaktuk. Transportation logistics will involve the required permits for highway, barge, or rail use.

6.3 History of the Proposed Development

Exploration on the Tuk 2 Concession began in 1968 with the drilling of the first well by Imperial Oil at TUK F-18 in the winter of 1968/69. This well was a dry hole, no hydrocarbons were found. The lands were not explored again until the Esso PCI Home TUK L-09 well was drilled in the winter of 1983/84 and discovered the TUK natural gas field. The original discovery was based upon poor quality, 2-D seismic. Esso chose not to apply for a Productive Acreage Block License for the discovery and the lands returned to the Inuvialuit Land Corporation (ILC).

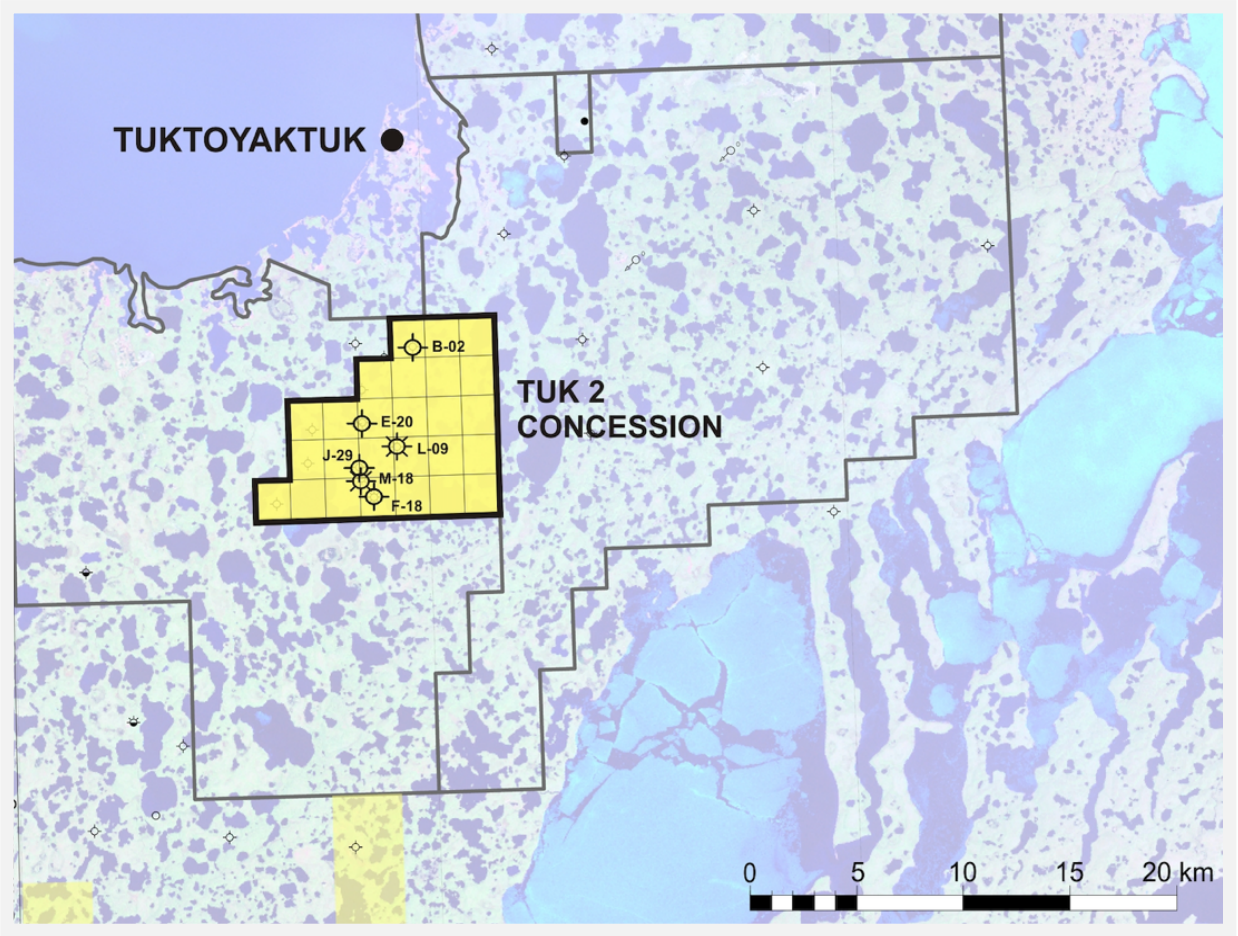


Figure 6a: Tuk 2 Oil and Gas Concession and the Productive Acreage Block, yellow.

The TUK 2 Concession was then awarded by the ILC to Home Oil and Petro-Canada for exploration in the late 1990's. In 2000 to 2001, two 3-D seismic data surveys were acquired by the operator and partner. (See Figure 6b.)

The partners then drilled the Home/Devon Petro-Canada M-18 well in 2001/02 and encountered the same geological structure containing natural gas and associated liquids that was found at TUK L-09 location in 1984, approximately three kilometres to the southwest of the original well. This time the partners decided to complete, test, and then plug and suspend the well, leaving the wellhead in place, rather than abandon the well.

6.3.1 The Kamik Formation

M-18 encountered 75 metres of Kamik Formation. The Kamik sandstones are Early Cretaceous-aged sandstone with excellent porosity and permeability. The Kamik consists of fine to coarse grained sandstones, with rare conglomerates, siltstones, shale, and minor amounts of coal and were deposited as a series of marine shelf to shoreface/beach/channel deposits near the shores of the Cretaceous ocean. This same Kamik Formation is a gas reservoir in a number of fields onshore in the Mackenzie Delta.

The gas pool encountered in the M-18 well was at -2660 metres below ground level and the well also drilled through the gas/water contact at -2915 metres below ground level. The well encountered 70 metres of sandstone with good porosity containing significant quantities of natural gas.

The TUK Field exists over an area of 630 hectares and is contained within the TUK 2 Concession. The field has an initial reservoir pressure of 28,600 kPa and a reservoir temperature of 87^{o} Celsius. The gas is sweet, with no hydrogen sulfide (H_2S), and contains a very minor amount of Carbon Dioxide (CO_2), and about 84% Methane (natural gas), and also contains natural gas liquids and condensate. Condensate rates from the well are estimated at 30 to 40 barrels per million cubic feet of natural gas production.

The M-18 field contains an estimated in-place resource of 334 Billion Cubic Feet, BCF, of natural gas. For comparison, the Ikhil gas field, that has been the primary supplier of natural gas to the town of Inuvik for close to two decades, contained 14.5 Billion Cubic feet of natural gas. The M-18 gas field resource is more than 20 times larger than the Ikhil field.

6.4 Components of the Proposed Development

As described in Section 5, the proposed work scope to develop and produce the M-18 well includes three phases and ten main parts (See Table 5-1 for a summary of the ten phases.)

Phase 1 – Pre-Commissioning

1. Site Works - construct and maintain a four kilometer all-weather gravel access road from the ITH to the site and two gravel pads at the site.
2. Remediate the existing drilling sump at M-18.
3. Complete and prepare for production of the suspended M-18 well (Well Completion).
4. Fabricate the gas plant modules (off-site).
5. Transport the gas plant modules and support buildings to site.

6. Installation of gas plant modules, interconnects, and plant infrastructure.

Phase 2 – Commissioning and Operations

7. Commission the facility.
8. Operate the gas plant for 50+ years.
9. Transport LNG and other fuels by truck to regional users.

Phase 3 - Decommissioning

10. Decommission the facility and reclaim the site.

Details on Phase 3 – Decommissioning are provided in Section 17. Information about Phases 1 and 2 are provided in the following sections. The schedule of proposed activities was provided in Section 5.1.2 and in Figure 6-1 (Appendix 1).

6.4.1 Phase 1 - Pre-Commissioning

The M-18 well was drilled in 2002. The well is currently in a state that is called "suspended." A well workover must take place to remove safety plugs which currently prevent hydrocarbons from leaking from the well; and to install equipment that will allow the well to be safely produced in the future. This will require a service rig to be brought into the location. To provide for future well servicing and/or emergency work, a gravel pad must be built at the wellsite location. The gravel pad needed for the workover will be joined with the new sump cap to create one large pad.

Remediation of the ponds around the existing M-18 drilling waste sump will include addition of borrow (fill) material on the existing sump cap and recontouring the existing drainage to flow around the large new pad. The sump cap will be revegetated with native species, while the well servicing pad will be kept free of vegetation by non-chemical methods.

To move the liquified natural gas (LNG) and synthetic diesel produced from the new gas processing facility (GPF) at M-18, an all-weather road connecting the well site to the recently completed Inuvik to Tuktoyaktuk Highway will be required. The access road will be approximately four kilometres in length and will cross a stream at approximately KM2. The stream crossing will require additional care and work to ensure fish and fish habitat is not disturbed or damaged at the time of construction or in the future.

To produce the fuel products from the well a separate gravel pad (the IESP Energy Center Pad) will be constructed about 350 metres from the M-18 wellhead. The IESP Energy Centre pad will be used to support all the gas processing facility modules, some tanks for storage and finally the trailers that will be used to move the energy products to market. Ad-freeze piles will be used to support equipment and/or protect the permafrost.

6.4.2 Phase 2 - Commissioning

The IESP Energy Centre consists of two main compounds – (1) the LNG section, which processes pretreated well gas into liquid Natural Gas (LNG) for trucking to communities; and (2) the GTL section, which converts natural gas and natural gas liquids (NGLs) to liquids (GTL). In the GTL area of the facility, the gas from the well will be converted to synthetic diesel. Additional information about both processes is provided in Section 6.6.

A tandem or tridem tractor and tridem trailer configuration is proposed for the transportation of LNG from the IESP Energy Centre to customers. This configuration brings with it key advantages:

- Tridem trailers have been designed and engineered specifically for LNG transport.
- Tridem trailers can legally and safely haul over 14,500 USG of LNG, or approximately 1,200 GJ of energy.
- Tractors provide control and ability to navigate challenging roads and conditions.

Synthetic diesel will be trucked to Tuktoyaktuk and Inuvik in standard fuel haul truck configurations.

6.5 Well Completion

The M-18 well was drilled and extensively evaluated in 2001-2002. After testing, the tubing was removed and the wellbore was sealed with two mechanical "bridge plugs", each capped with five metres of cement. The wellhead was left in place.

To prepare the well for production, a service rig, flowback equipment, and wireline truck will be needed. The equipment will be rigged up and the wellhead replaced by a set of blowout preventers (BOPs) which will be pressure tested to ensure proper operation. The service rig will be equipped with a Class III BOP rated at 35MPa. It will be pressure tested prior to commencing operations. A completion fluid of sufficient density to control the downhole pressures will be used to drill out the plugs and run off the completion string.

Once the BOPs are set up, the existing cement plugs will be drilled out. The wellbore will be pressure tested to ensure that the steel casing is still in good condition (all indications are that it is). A new completion assembly consisting of tubing, a packer, and a sub-surface safety valve (SSSV) will be installed.

The completions program will include some form of insulation in the annular space between the tubing and the casing to minimize thawing of the permafrost due to the warm gas flow. (See Figure 6-10 for a conceptual well bore diagram.) The exact design of this insulation has not been finalized yet. Working examples from Alaska are being assessed for suitability to M-18.

Once the completion system has been run, the BOPs will be removed, and the wellhead reinstalled and tested. The tubing will be "swabbed" by the service rig to start it flowing. The well will be flowed (likely for a couple of days) to clean up any water left from the recompletion process. The gas will be flared during this process. Once the cleanup is done, the well will be secured until the gas processing facility is completed and ready to tie into the well. To ensure safety, the valves will be closed, and all outlets plugged. Concrete barriers will be installed to protect the well from accidental damage during construction and operations.

6.6 IESP Energy Centre Process Overview

The underground reservoirs of the Kamik Formation that the M-18 well taps into contain a mix of natural gas, liquid hydrocarbons, non-potable water, and other gases such as carbon dioxide and nitrogen. M-18 can produce more gas than can be used in the region. However, there is a need for diesel fuel in the region for homes not converted to natural gas heat as well as many vehicles and heavy equipment. The creation of synthetic fuel from natural gas (Gas to Liquids, or GTL), developed in Germany in the 1930's, was heavily industrialized during World War Two and used extensively in South Africa in the 1980's. (See Figure 8-1 for a Graphic Timeline depicting the development of GTL technology.)

Using GTL processes, refineries can convert some of their gaseous waste products (such as flare gas) into valuable fuel oils. The World Bank estimates that over 150 billion cubic metres (5.3×10^{12} cu ft) of natural gas are flared or vented annually, an amount worth approximately $30.6 billion. GTL processes may also be used for the economic extraction of gas deposits in locations where it is not economical to build a pipeline.

Today more than 800,000 barrels per day of synthetic fuels are produced globally. Royal Dutch Shell produces a diesel from natural gas in a factory in Bintulu, Malaysia. Another Shell GTL facility is the Pearl GTL plant in Qatar, the world's largest GTL facility. SASOL has recently built the Oryx GTL facility in Ras Laffan Industrial City, Qatar and together with Uzbekneftegaz and Petronas builds the Uzbekistan GTL plant. Chevron Corporation, in a joint venture with the Nigerian National Petroleum Corporation is commissioning the Escravos GTL in Nigeria, which uses Sasol technology.

The gas processing facility at M-18, known as the IESP Energy Centre, will take the production from the newly completed and prepared M-18 Well and convert it to two products: LNG (Liquid Natural Gas); and synthetic diesel (SynDiesel®). Both products can be used to support local energy, power, and fuel demands.

The major steps to the process include the following:

1. Natural Gas Pre-treatment (Sections 6.6.3.1 to 6.6.3.4): This step separates the natural gas and NGL from the well production, and re-purposes or properly disposes of other products. The natural gas becomes the feedstock for the LNG Process Module while the remaining hydrocarbon liquids becomes the primary feedstock for the Gas to Liquids (GTL) Process Module.
2. LNG Process Module (Section 6.6.3.6): This step condenses the natural gas to become a liquid, known as LNG. The LNG is then stored and hauled to communities as needed where it is converted by reheating back to natural gas to use for power generation and heating.
3. GTL Process Module (Section 6.6.3.7): This step takes the remaining hydrocarbons and breaks them apart into simple building blocks and then recombines them to become SynDiesel®. SynDiesel® can be used in the same way conventional diesel fuel is used and is also the cleanest form of diesel containing no sulfur and having very high cetane content.
4. The result of these three steps is that the complex mix of well production components from M-18 are simplified and transformed into two useful products, LNG and SynDiesel®.

6.6.1 Hydrocarbons

Hydrocarbons are named aptly because they contain hydrogen and carbon. The hydrogen and carbon are combined in chains to make different hydrocarbons. Some hydrocarbons are more commonly known (propane and butane) while others are not commonly known (ethane and pentane, for example).

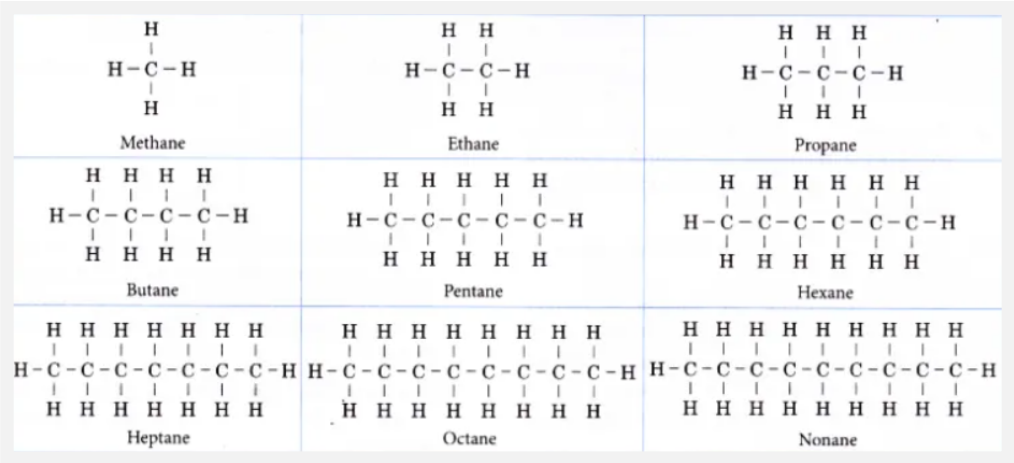


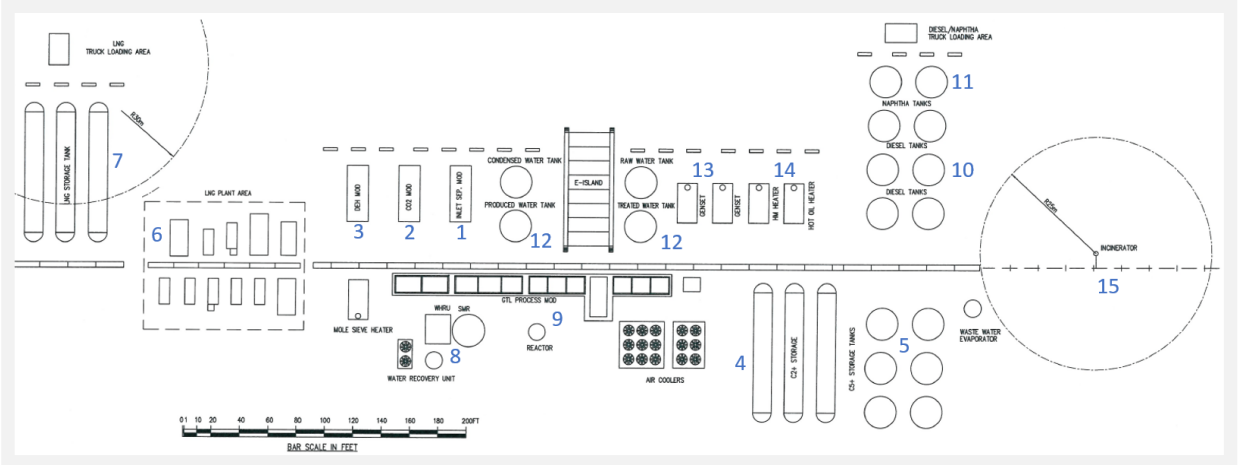
Figure 6c: Various Hydrocarbon Molecules

Natural gas, or methane, is the cleanest and simplest burning hydrocarbon and is represented as one carbon atom combined with four hydrogen atoms. (see Figure 6c.) The natural gas is separated in the Natural Gas Pre-treatment step and cooled and condensed to LNG in the LNG Process Module.

Once the natural gas is separated, the remaining hydrocarbons are manipulated to create SynDiesel® in the GTL Process Module. In theory, any hydrocarbon combination could be created from the well through separating and recombining carbon and hydrogen atoms; however, SynDiesel® has the best practical demand in the Inuvialuit Settlement Region. SynDiesel® is made by combining approximately twelve hydrogens and twenty-four hydrogens ($C_{12}H_{24}$). This is accomplished in the GTL Process Module.

6.6.2 6.6.2 Plot Plan Overview

A larger version of the IESP Energy Centre plot plan is provided in Figure 6-3, Appendix 1. A smaller version of the Figure appears below for ease of reference. The overlaid numbers will assist in referencing the different process steps as described in Section 6.6.3.



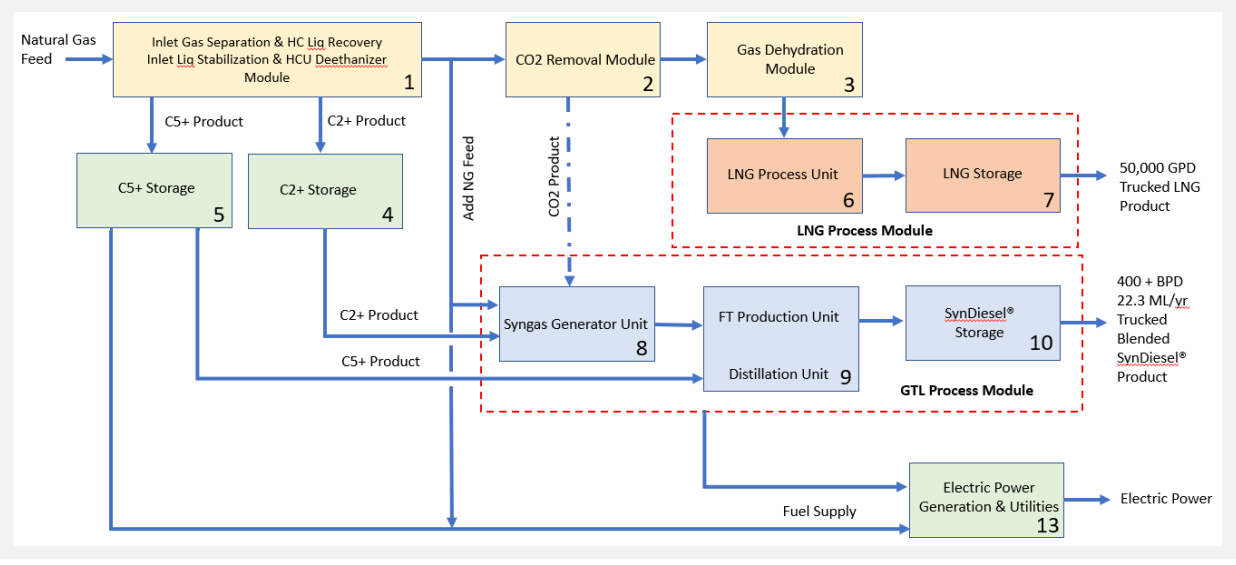
See also Figure 6-3 Appendix 1: IESP Energy Centre Proposed Plot Plan

Natural Gas Pre-treatment 1. Inlet Separator Module 2. CO_2 Module 3. Dehydration Module 4. C2+ Storage 5. C5+ Storage **LNG Process Module** 6. LNG Plant Area 7. LNG Storage Tanks	**GTL Process Module** 8. SynGas Generator Unit (Steam-Methane-Reformer) 9. Fischer-Tropsch Production Unit (GTL Process Module) 10. Diesel Storage 11. Naphtha Storage **Auxiliary Systems** 12. Water Treatment and Storage 13. Electrical Generators (Genset) 14. Hot Oil and TEG Heaters 15. Enclosed Ground Flare

The numbers that are included in Figure 6-3 and Figure 6-4 to denote process sections are included in square brackets the section sub-headings to allow the reader to reference the plot plan and process diagram. For example, the "6.6.3.3 CO_2 Removal Module [2]" heading references the CO_2 module and the number [2] label on the diagrams.

6.6.3 IESP Energy Centre Process Description

The following content (Section 6.6.3) is meant to provide a very basic description of the major components of the Energy Centre. The Energy Center has been broken down into a number of stages and processes as depicted in Figure 6-4.



See also Figure 6-4, Appendix 1 IESP Energy Centre Proposed Facility Process Flow Diagram

6.6.3.1 Inlet Gas Separation & HC (hydrocarbon) Liquid Recovery [1]

The purpose of the Inlet Gas Separation and HC Liquid Recovery is to take the M-18 well production and separate it into natural gas, hydrocarbon liquids, and water.

First, the module takes the M-18 well production that is at 2,900 psi and 50 degrees Celsius and reduces the pressure to approximately 1,300 psi. This helps to reduce the cost and size of surface equipment needed to process the gas and lowers the gas temperature.

The pressure unit of psi, or pounds per square inch, is literal in meaning. Imagine an inch by inch area, slightly bigger than a toonie in your hand. The pressure value in psi is the force you would feel if you had that many pounds sitting on the toonie in your hand. Therefore 2,900 psi is equivalent to three fully-grown, male polar bears balanced on top of each other with all of their weight completely on that toonie in your hand. This seems like a lot of pressure, but the high pressure is actually good. A well with a lot of pressure will last a very long time and that is why third parties have estimated the M-18 well will last well over 100 years.

After reducing the pressure of the incoming gas and liquids, the well production enters a large cylindrical vessel. The natural gas from the well production stays near the top of the vessel while the hydrocarbon liquids settle to the bottom. Water is heavier than the hydrocarbon liquids and over time will settle at the very bottom. The three product streams are handled as follows:

1. The natural gas continues through the Inlet Gas Separation process. Heavier hydrocarbons and impurities are removed for eventual use as feedstock in the GTL Process Module.
2. The hydrocarbon liquids are syphoned to the Inlet Liquid Stabilization & HCU De-ethanizer Module where they are further refined into C5+ and C2+ product streams that are eventually used for the SynGas Generator Unit, feedstock for the Distillation Unit, and, fuel supply for Electrical Power & Utilities.
3. The produced water (less than 20 litres per day) is pumped from the bottom of the separation vessel to the produced water tank [12] adjacent to the Inlet Separator Module [1]. The produced water may be high in salt content and there may be a small amount of hydrocarbons entrained in the water, so it cannot be discharged to the environment and must be handled appropriately. The produced water tank will be internally coated to prevent corrosion and has two walls with a space in between them (double-walled tank) that will contain any leaks such that the produced water cannot contaminate the ground and can be properly stored until it is sent off-site to a regulated disposal facility.

6.6.3.2 Inlet Liquid Stabilization & HCU De-ethanizer Module [1]

Hydrocarbon liquids separated in the Inlet Gas Separation & HC Liquid Recovery module are sent to the Inlet Liquid Stabilization & HCU De-ethanizer Module. The purpose of the inlet liquid stabilization portion of the module is where the heavier C5+ stream has the lighter hydrocarbons removed such that it is safe to store the C5+ liquids in a low-pressure storage tank. The purpose of the HCU De-ethanizer in the module is similar, it just separates the lighter ethane and methane from the natural gas liquids (mostly propane and butane) such that the natural gas liquids can be safely stored in a pressurized storage tank onsite. The HCU De-ethanizer only operates when the GTL plant is not operating. When the GTL plant is operating, the C2+ stream is sent directly to the GTL portion of the plant without going through the HCU De-ethanizer. The lighter hydrocarbons in both streams would cause over-pressure of the onsite storage vessels over time if this HCU De-ethanizer were not in place.

6.6.3.3 CO_2 Removal Module [2]

The gas from the M-18 well contains approximately 2.0% carbon dioxide (CO_2). Carbon dioxide is a very common, naturally occurring molecule in the atmosphere. Humans and mammals breath out CO_2; whereas trees and foliage consume CO_2 and convert it back oxygen using sunlight. CO_2 is also a greenhouse gas that is produced during combustion. The CO_2 must be removed from the natural gas prior to liquefaction because CO_2 becomes a solid at the temperature that the natural gas must be liquefied at. The CO_2 will freeze on to the heat exchanger surface and reduce the efficiency and environmental performance of the process equipment.

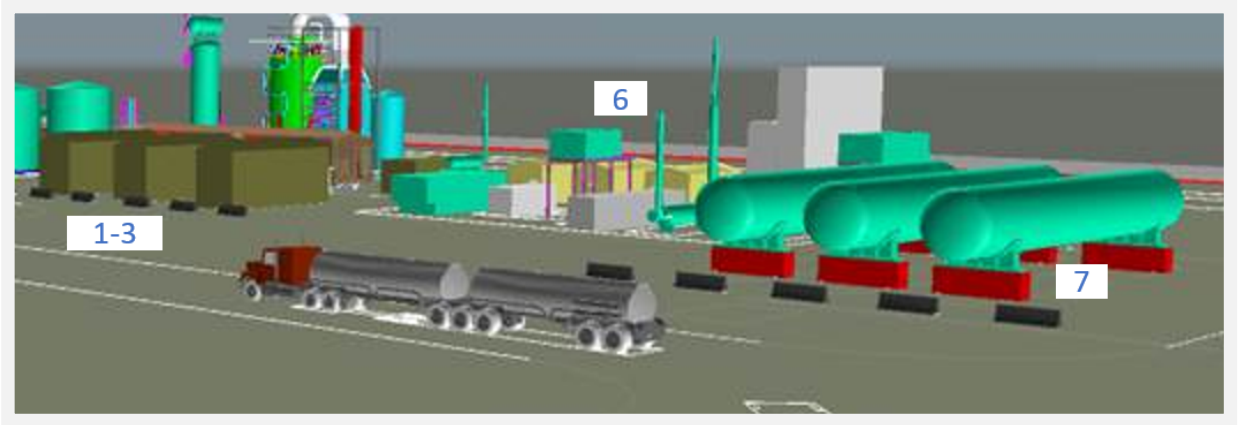
The CO_2 Removal Module removes the CO_2 from the gas stream by passing the gas through a water-based solution that contains a chemical that attracts the CO_2 to the water-based solution. Once the water solution is full of CO_2, the water solution is de-pressured and heated to a high temperature causing the CO_2 vapour to leave the water solution. The lean water solution is then cooled so that is can be re-used in the CO_2 Removal Module. The CO_2 that is removed from the natural gas is sent to the SynGas Generator Unit where it is re-purposed as an important input to the development of SynGas.

6.6.3.4 Gas Dehydration Module [3]

The natural gas is now CO_2-free but still contains a small amount of water. Water is removed to prevent freezing in the LNG liquefaction process that reduces the efficiency and can damage process equipment. The wet natural gas is passed through moisture retaining beads (these beads are a molecular sieve in that they strain the water out of the natural gas). These beads are held in a large vertical cylinder called a bed. These beads attract and adsorb moisture from the natural gas removing almost all water. In this system there are two beds. Once one bed is saturated with water, it is heated such that the water boils out, and the bed is ready to be placed back in service. While one bed is in service the other is being regenerated. Water removed from the natural gas is sent to be used as make-up in the CO_2 Removal Module or in the GTL Process Module.

The three modules discussed above will be enclosed in buildings, as shown in the 3D graphic below.

Schematic 6-1: Pretreatment Modules [1-3], LNG Plant Area [6], and LNG Storage Tanks [7]



6.6.3.5 C5+ and C2+ Storage [4,5]

The C2+ Storage consists of three 80 m^3 horizontal storage tanks that provide approximately fourteen days of

storage. The C2+ Storage will contain liquid hydrocarbons delivered from the Inlet Gas Separation & HC Liquid Recovery module. The hydrocarbons in the C2+ Storage feed the SynGas Generator Unit and, along with natural gas liquids from the Natural Gas Pre-treatment system, is the input to the GTL Process Module.

The C5+ Storage consists of six vertical double walled low pressure storage tanks that store the C5+ liquids during periods of downtime on the GTL plant and in preparation for final SynDiesel® blending. The double walled tanks are used so that a leak in the inside tank will collect fluid inside the outer layer and there is no risk of ground contamination. A pressure sensor inside the outer wall will let the operators know that a leak has occurred so the tank can be isolated, emptied, and repaired.

6.6.3.6 LNG Process Module

6.6.3.6.1 LNG Process Unit [6]

The LNG Process Unit takes the natural gas and converts it to LNG. Changing natural gas from a gas to a liquid requires that it reaches temperatures of -153 degrees Celsius (at 12 psi). (Natural gas changes from a gas to liquid at -162 degrees Celsius when at atmospheric pressure). There is one fundamental concept to understanding the LNG Process Unit: when a gas is compressed and its pressure increases it generates heat; the opposite is also true, when a gas is expanded and its pressure decreases, the gas loses temperature.

The natural gas enters the LNG Process at a moderate pressure (~615 psi) and is compressed to high pressure (~1,300 psi). This high-pressure gas is now high temperature and is cooled by passing through a heat exchanger that contains a refrigerant. Once the high-pressure natural gas is cooled to a reasonable temperature it is forced to undergo a large pressure drop (to ~12 psi) that liquifies approximately half of the natural gas. The gas that remains is recycled to start the process over.

The LNG production process is a similar process to the air conditioning in a home or vehicle as well as a refrigerator at home. The difference is that the temperature drop in the natural gas is large enough to turn it to a liquid.

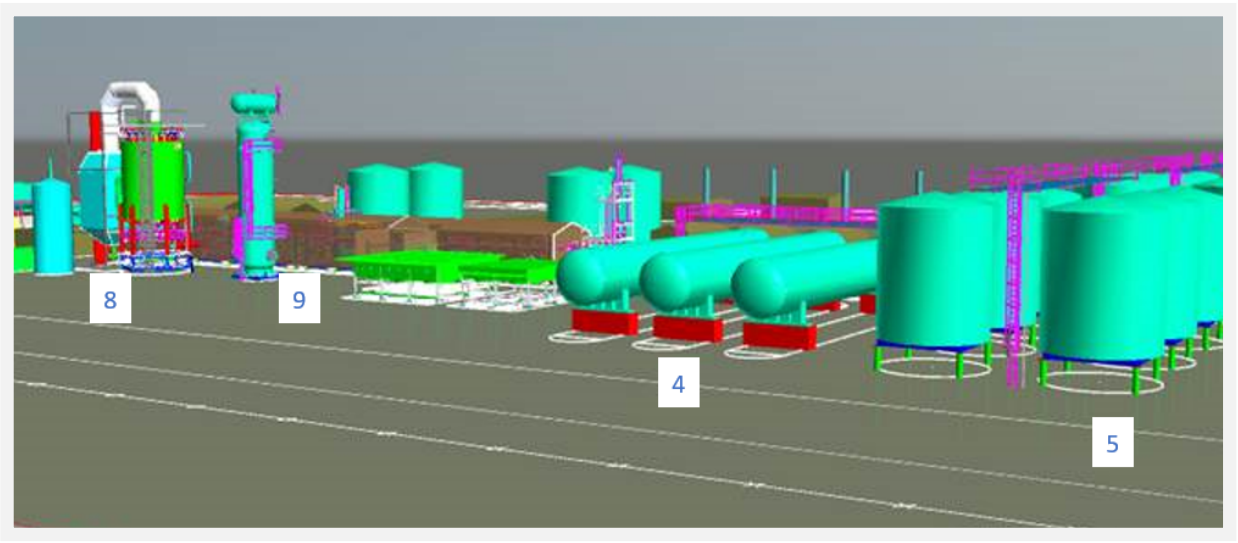
6.6.3.6.2 LNG Storage [7]

The LNG Storage consists of horizontal tanks that are double-walled stainless steel with a vacuum pressure between the walls, like a good quality coffee thermos. The LNG Storage provides a buffer for the LNG Process Unit to produce at a steady rate – and therefore at a high efficiency – and allows LNG transportation trailers to come and go as required depending on end user demand.

In the case of LNG Storage, the double walled tanks are used as containment as well as to maintain the LNG at cryogenic temperatures. Like the C5+ Storage tanks, a leak in the inside tank will collect fluid inside the outer layer and there is no risk of damaging any of the nearby equipment or buildings. LNG spilled onto gravel or soil will boil off and disperse into the atmosphere presenting minor environmental risk other than the associated GHG release. A pressure sensor inside the outer wall will let the operators know that a leak has occurred so the tank can be isolated, emptied, and repaired.

6.6.3.7 GTL Process Module

Schematic 6-2: SynGas Generator Unit [8], FT Production Unit [9], and C3+/C5+ Storage Tanks [4,5]



6.6.3.7.1 Syngas Generator Unit [8]

The SynGas Generator Unit is meant to take feedstock from the other processes (including natural gas liquids from the Inlet Gas Separation and HC Liquid Recovery, C2+ Product from C2+ Storage tanks, and CO_2 from the CO_2 Removal Module) and make SynGas. SynGas is a mixture of carbon monoxide and hydrogen that is created from the feedstock using warmer temperatures and introducing water, as steam. The SynGas is the building block needed to construct SynDiesel® in the FT Production Unit

6.6.3.7.2 Fischer-Tropsch (FT) Production Unit [9]

The FT Production Unit takes the SynGas and catalytically reforms Syngas to SynDiesel®. Recall that SynGas is composed of small atoms and molecules, carbon monoxide (CO) and hydrogen (H2). These are the building blocks to make the longer hydrocarbon chain of SynDiesel®. The SynGas undergoes a chemical reaction in the presence of a catalyst (a material to the increase rate of the chemical reaction, an accelerant) to create SynDiesel® (C12H24) and water (H2O).

6.6.3.7.3 Distillation Unit [9]

The Distillation Unit takes C5+ product from the C5+ Storage tanks and combines this with the SynDiesel® from the FT Production Unit to create a final, stabilized SynDiesel® product. The SynDiesel® is the final product that consumers can use as a cleaner diesel replacement.

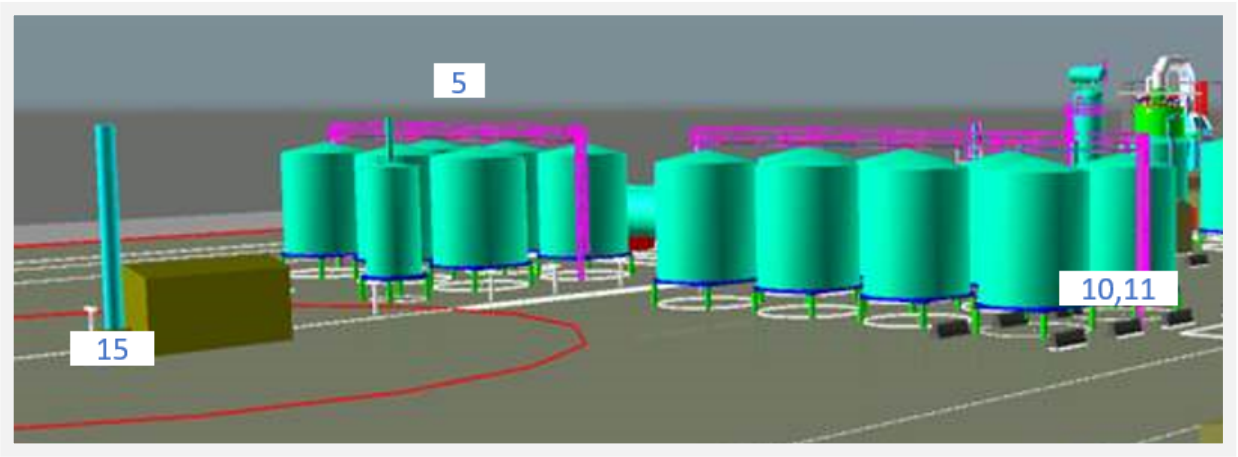
6.6.3.7.4 SynDiesel® & Naptha Storage [10,11]

The SynDiesel® will be stored in industry standard vertical tanks that are double walled, insulated and heated. There will be six tanks that will act as a buffer between the GTL Process Module and the truck offload station. The tanks will be equipped with automatic valving and safety systems that ensures all tanks remain at appropriate levels, temperatures, and pressures. The tanks will have a blanket of low-pressure natural gas that resides above

the SynDiesel®. The purpose of this common practice in industry is to keep a slight pressure in the tank to avoid corrosion breakdown of the diesel from oxygen (air) exposure.

The facility gas balance is continually measured, and computer balanced throughout the entire plant processing system, and continuous gas detection monitoring occurs in all processing buildings such that any system leaks are noticed and resolved quickly, if they occur.

Schematic 6-3: Enclosed Ground Flare [15], SynDiesel® & Naptha Storage [10,11], and C5+ Storage Tanks [5]



6.6.3.8 Auxiliary Systems

There are other auxiliary systems that ensure the overall gas process facility can operate as needed. These systems support the primary purpose of the overall facility and include power generation, instrument air, steam, heating, and water lifecycle systems.

6.6.3.8.1 Electrical Power Generation [13]

In the GTL Unit, the excess steam generated by the Syngas generation and SynDiesel® production units is used in steam turbines to create over half of the electrical power necessary for the process facility. The remaining electrical power requirements will be provided by stand-alone generators that burn natural gas and C5+ product (naphtha). Naphtha is also a product of the GTL process and can be recycled back through the GTL process or stored and used onsite for power generation. The stable naphtha will be stored in two vertical, double walled tanks similar to the diesel. By using this by-product steam for power generation, the facility is operating more efficiently and reducing GHG emissions.

6.6.3.8.2 Raw Water, Wastewater, Treated Water Plant [12]

The Raw Water tank is 80 m^3 and is only needed on plant start-up. Water produced in the GTL unit will be recycled from the FT Production Unit and re-used to generate hydrogen in syngas in the SynGas Generator Unit. Water recovered from cooling the syngas and cooling exhaust gases from the SynGas Generator Unit will be reused as makeup water to make utility steam. The Treated Water tank is also 80 m^3 and collects this recycled water to keep an inventory of water to balance needs during this closed-loop process. A small amount of concentrated solids wastewater, commonly referred to as blowdown water, is heated and evaporated using a small steam element, and safely discharged to the atmosphere. Water tanks will be internally coated and double walled like other liquid

tanks at the facility to provide secondary containment should there be a leak in the primary containment.

6.6.3.8.3 Heating Systems [14]

There are two heating systems deployed at the process facility. The Hot Oil Heating System is maintained at 220 degrees Celsius and the Glycol Heating System is maintained at 160 degrees Celsius. Both these Heating Systems are usually heated by excess steam. Together these heating systems provide the high temperatures needed throughout the process and the Glycol Heating System is also used to heat all buildings. The Hot Oil and Glycol Heating Systems utilize a standby natural gas fired heater to provide heating requirements for cold facility start-up and when the GTL plant is shutdown.

6.6.3.8.4 Enclosed Ground Flare [15]

The enclosed ground flare (EGF) is used for emergency relief scenarios. In the unlikely event that there is a fire, total power failure, or severe equipment over-pressure situation, the gas processing facility will automatically protect the individuals and equipment on location by shutting down plant operations and sending flammable or dangerous gases and liquids to the EGF that will combust everything. This is not anticipated to occur but is a safety measure in a worst-case scenario.

The EGF will also be used during regular operations to combust minor amounts of hydrocarbons (estimated to be less than 65 m^3 /day at max production rates) from the SynDiesel®, Naphtha and C5+ Storage Tanks blanket gas and vapors generated in the Produced Water Tank that may contain hydrocarbons. Ten typical Canadian homes in the south would use 65 m^3 of natural gas for heating per day. No hydrocarbon vapours will be venting from the plant directly to atmosphere.

6.6.3.8.5 Instrument Air

The overall facility will consist of many automated control systems. Many of the control valves are operated using instrument air. The instrument air system consists of dryer beds that remove moisture from the air, a compressor, and a holding tank for the dry, compressed air.

An example of a simple automated control system is the pressure control valve at the inlet of the facility. Well production will be at 2,900 psi but needs to be dropped to 1,300 psi. This will need to be done via a control valve that closes to restrict the flow. By restricting the flow from the well using the control valve the pressure is also reduced. A control valve can fully open, fully close, or partially close as required. If the well flow rate is exceedingly high, then the valve will only need to be closed slightly to impose enough resistance to drop the pressure. If the flow rate is exceptionally low, then the valve will need to be almost completely closed to drop the pressure. A pressure transmitter downstream of the control valve will record the pressure and tell the control valve to open more, close more, or remain the same depending on the pressure it is trying to achieve vs. the pressure it is reading. The control valve requires to be able to automatically do this work without a plant operator manually opening and closing it, so instrument air provides the force for the valve to open or close.

6.6.3.8.6 Truck Loading Area

At the IESP Energy Centre there will be a truck loading station to load the LNG into transport units and a separate truck loading station for loading the SynDiesel® into conventional diesel transport trucks. The loading stations will utilize metres that are approved and meet regulation for the custody transfer of their respective products. These metres will measure the amount of product loaded for transportation and help to ensure that the LNG transport

and the diesel transport trucks are not overfilled.

LNG loading stations have a connection to send LNG into the transport and a connection that returns natural gas vapour that is already in the transport to the plant's storage tanks. This vapour connection makes sure that natural gas vapour that is present in the transport is returned to the plant for safe handling as it is displaced by the LNG entering the transport. These connections are on a swivel load arm system to make them easier to connect and disconnect. The loading station is equipped with an automated system that, upon completion of the loading process, will drain the LNG hose of any remaining liquid product so that when a driver disconnects the hose they cannot be splashed by the extremely cold LNG.

SynDiesel® loading uses similar swivel loading arms to the LNG loading station with a connection for loading diesel into the truck and a vent equalization line that returns vapour to the plant for safe handling. Before a driver connects hoses to the truck, they will place a drip tray system under the connections to make sure that no SynDiesel® can reach the ground. If any liquid has been collected in the drip trays at the end of the load the driver will dispose of the liquid in an appropriate receptacle so that it can be consolidated, properly stored and eventually safely transported to an authorized waste treatment facility.

6.6.4 Site Works

As stated in Table 6-1, Site Works to prepare for the well completion activity and the IESP Energy Centre will involve winter construction of a four (4) kilometer all-weather access road from the ITH to the wellsite, and to the facility pad area; winter construction of the two gravel pads; placement of ad-freeze piles; and winter construction of a bridge or culvert to cross the unnamed creek at the two kilometer post. The scope will include borrow excavation and transport of borrow on the ITH; ground preparatory work, such as laying down willows and brush, installation of temporary construction trailers, construction activities and cleanup in accordance with the Northern Land Use Guidelines for Access Roads and Trails (Indian and Northern Affairs Canada, 2010).

We are proposing to build the all-weather road from approximately KM128+700 on the ITH to the wellsite, beginning in early 2021 and continuing after migratory bird season in Fall and Winter 2021. The alignment is generally an SSE direction from KM128 (See Figure 5-3). The proposed route does not impact existing rare vegetation, hydrology, known archaeology or fish habitat. A small stream must be crossed, which will require a culvert or a bridge. In terms of environmental and permafrost protection, our proposed construction methods will meet or exceed those used by the ITH construction teams. IPC will use local Inuvialuit contractors to construct and maintain the road and well pad.

Although IPC has ground surveyed the entire LSA, IPC has not yet completed the final routing, location or design of the proposed roads and pads. The IESP Site Works concepts, based upon the preliminary recommendations of our geotechnical engineers, and including feedback from local contractors and community engagement, are as follows.

6.6.4.1 Borrow

The road embankment materials are expected to be sourced from Borrow Source 312 which is the nearest borrow with sufficient quantity and quality of material available to the project. Although Borrow Source 177 is the closest source, the GNWT and local contractors have reported that the source is depleted, and the remaining material is not ideal for road and infrastructure pad construction. Better quality borrow materials are available from Borrow Source 312 located along the ITH about 70 km south of the Study Area and 60 km north of Inuvik.

The IESP team has decided that we will not be building the road during migratory bird season from mid-May to mid-August. Frozen materials placed in the winter months cannot be compacted to the same density in the winter as they can in the fall, so there is a trade-off. Summer placement allows for higher compaction but there are other constraints associated with managing the moisture content of the embankment material. These items will be discussed during design development. Also, during design, the specific material properties, and placement and compaction requirements will be addressed including soil gradation, moisture, and ice content limits, and compaction.

6.6.4.2 Road

The proposed access road would be designed and constructed using the design basis and approach successfully applied to the ITH, specifically the north half of the ITH, which is in the same geologic and permafrost regime as the proposed development. Performance observations and ground temperature monitoring data being collected along the ITH and in the LSA will aid in optimizing the design and construction of the proposed access road.

The geometry of the road is dependent of many factors that are not known at this time The access road is anticipated to be 8.0 m wide to accommodate the transportation of equipment, materials, and modules and provide safe turning for haul/fuel trucks. The final width would depend on the design vehicle, vehicle mix, and overall traffic volumes. The permanent road would likely be designed for a maximum speed of 60-Km/hr, longitudinal slopes/grades would likely not exceed 6%, with a maximum cross fall of 3%. This will be fill-only embankment construction with no cuts into the native ground.

The road will be constructed with a minimum fill thickness required to cover microrelief and protect permafrost. A typical roadway cross-section is illustrated in Figure 6-6. In this design, side slopes are proposed at an angle of 3H:1V. Roadway drainage is proposed via 3% surface grading in both directions from the centreline of the roadway. The embankment would consist of a minimum 250 mm thick surfacing grade layer overlying embankment material. An intermediate transition layer material may be required to transition between the different gradations of the surfacing material and the embankment material, but this would be determined during final design.

Design, construction, and maintenance of roads in sensitive permafrost environments requires significant considerations for permafrost preservation and safety in road design. Suggested guidelines for designing all-weather roads in permafrost are presented in the Transport Association of Canada Guidelines for Development and Management of Transportation Infrastructure in Permafrost Regions (TAC, 2010) recommends researching previously built roads applicable to the project, understanding the thermal properties of the region's permafrost, designing based on the thermal regime, and being willing to compromise geometric road design criteria to accommodate permafrost. The proposed access road will be designed and constructed considering these guidelines.

Kiggiak EBA has reported that the major challenge with road embankments built on thaw sensitive soils is permafrost degradation under the toe of the side slopes. The degradation is caused by the thermal, mechanical, and hydraulic changes in surface characteristics, which causes differential settlements and embankment shoulder instabilities. Drainage and erosion control are other critically important design and construction elements especially for roads constructed on permafrost. Poor drainage conditions along a road over permafrost terrain may cause surface water ponding, thermal erosion, and formation of icings. The effects of these processes may have an impact on the environment and traffic and result in higher maintenance costs.

To mitigate shoulder rotations and road cracking, IPC will consider placing the toe of the embankment side slopes further away from the shoulders of the road, by using flat slopes or toe berms, for the embankment design. Flatter side slopes promote maintaining the permafrost and active layer underneath the full width of the driving surface.

Flatter side slopes also reduce the thickness of the snow cover on the natural ground along the embankment edges, reducing its insulating effect, and moves the problematic permafrost thaw zone away from the critical parts of the embankment under the actual driving surface where traffic loads are concentrated.

Kiggiak EBA reported that permafrost preservation is accomplished by designing the embankment to be of sufficient thickness such that the active layer remains within the overlying fill and does not penetrate below the original ground surface into the ground. If the embankment is of sufficient thickness, the permafrost moves into the embankment subgrade, the active layer will be within the embankment fill, and the soil will provide sufficient bearing capacity for the embankment and designed loads.

6.6.4.3 Pads

As described, the IESP team is proposing two separate embankment pad areas. A new Well Pad that will be integrated with the new sump cap (see Section 6.6.4.5) and a new pad for the Energy Centre facilities, truck loading and support buildings. A sketch of the new well pad is provided in Figure 6-9. The proposed new pad is approximately 30mx75m. Including the new sump cap, the anticipated footprint of the entire Well Pad will be an oval-shaped pad 100 m wide at the widest point and 150m long. The pad for the IESP Energy Centre will be approximately 350m x 300m. A scale drawing of the Centre is provided in Figure 6-3 Plot Plan.

Embankment pads are preferably constructed using sand and gravel materials with no ice content. Embankment pads are constructed on-grade (original ground) and should be well compacted; however, compaction can be an issue in some cases due to winter placement, limited or no prestripping, subgrade materials, imperfect granular fill materials and subgrade materials, and limited compaction equipment.

The embankment pad will be designed to prevent the thawing of ice-rich permafrost below and seasonal freeze-thaw of frost-susceptible soils. The design will consider the seasonal air temperature data, climate change considerations, and the design active layer for the project. The crest elevation and footprint of the pad will extend beyond the perimeter of the facilities, and the surface of the pad will be graded away from the structure in all directions to avoid ponding water. The embankment pad thickness may be reduced in cases by installing horizontal insulation that provides an equivalent barrier to heat flow and adequate bearing capacity to support the design loads of the foundation(s). Final design will consider insulation alternatives that might save borrow.

The loads imposed on the infrastructure pad will likely be the same or less than those imposed on the ITH since all equipment will need to travel the ITH on trailers to get to the site. Weight restrictions on public highways are typically limited to 64,000 kg with seasonal weight restrictions. IPC expects that the pads will perform in a way similar to an all-season road such as the ITH.

The use of geogrids and geotextiles is a consideration and may be used in areas of the infrastructure pad and along the access road alignment that will be prone to settlement and are a risk to the embankment integrity. Geotextiles typically perform two functions: separation and reinforcement. The separation function maintains the integrity of the embankment fill over the softer subgrade by preventing the mixing of the embankment and subgrade materials.

Geogrids are utilized, where appropriate, for reinforcement within the embankment to restrict and reduce embankment spreading over soft subgrades and minimize differential settlement. The ITH did not use geogrids for construction of the road embankment but did use a non-woven geotextile as a separator between the embankment fill and original ground to reduce embankment sideslope sloughing/sliding. Locations where geotextile and geogrid may be contemplated for use on the Project, are as follows:

- Ice-rich permafrost prone to settlement and weak subgrade;
- Thick peat and/or organics;
- Culverts; and
- High embankment fills.

In permafrost areas, a large percentage of the surface water moves through the active layer following spring snowmelt/freshet. The construction of an embankment will cause the permafrost table to aggrade up above the original permafrost table and possibly within the embankment. This blocks water flow through the active layer and causes the surface water to pond against the embankment.

Ditches should not be constructed to improve drainage around embankments as it is well established that ditches in permafrost areas, especially ice-rich permafrost terrain, rapidly deteriorate to the point that water ceases to flow and thus aggravates thaw around the embankment. If these ditches parallel the embankment, the stability of the toe of the embankment rapidly decreases and embankment failures occur. The best protection from the effects of water is to avoid areas with large side-hill drainage, routing the embankment along ridges or topographic highs, or running with drainage, rather than against it.

Culverts are chosen to be oversized (two to three times the size that would be used in a temperate climate) to allow for inaccuracies in estimating the runoff and to account for the probability of ice, snow, or sediment blocking the culvert. Culverts require constant maintenance and should be used only when necessary. In cold climate areas, culverts often tend to heave due to the cold air that can circulate through them during the winter. This should be anticipated as a potential maintenance item throughout the life of the embankment. With embankment construction as presented, erosion of the side slopes due to surface runoff is not anticipated to be a problem. At locations where the embankments intersect drainage courses, measures must be undertaken to prevent embankment erosion. At creeks and streams, this may be accomplished using sandbags around culvert openings, or rip rap material should be used for erosion protection.

6.6.4.4 Creek Crossing

The proposed creek crossing will need to be crossed by either a large diameter culvert or a small single-span bridge, Kiggiak EBA considered both as acceptable options. The ITH uses both single and multi-span bridges founded on adfreeze piles and small and large diameter culverts. A culvert would be less costly and faster to construct, while a short span bridge crossing would have a longer design life, better support fish passage. The IESP team has clearly heard during community meetings that a bridge would be more acceptable to the Tuktoyaktuk HTC, and it is a condition of their letter of support. The concern of the THTC is that culverts can fill with ice and snow in the fall and early winter and remain plugged well into the spring and summer after snowmelt and runoff has begun. Thus, the road embankment and ice-filled culverts act as a dam, restricting the passage of runoff and disrupting fish.

To address this issue, one strategy is to install two culverts with one culvert vertically higher than the other so that it will remain ice-free over the winter. Given recent challenges with a bridge foundation near Aklavik, additional

design could consider this option.

The subject creek crossing connects a pond to a lake and is part of a chain of interconnected waterbodies within a watershed catchment area that flows into Gunghi Creek (see Figure 10-6). There is existing 2.1 m diameter corrugated steel pipe culvert at the Gunghi Creek crossing on the ITH about three kilometres north of the LSA. The culvert was installed between 2009 to 2010 and is presently under contract to be replaced by a precast concrete culvert.

Kiggiak EBA suggested that factors to consider when selecting a crossing design should include the anticipated service life for the required loading, the requirements for fish passage, hydrologic analysis, and the capital cost to supply and install the structure versus the annual cost to maintain the structure.

It was recommended that the new crossing be consistent with the culvert and bridge designs used for the ITH. If a bridge design is selected, then the road grade will need to be raised to support the approach fill slopes and bridge structure, and the associated hydrologic clearances. If a culvert is selected, then the culvert diameter will need to ensure that it is an adequate size for the site hydrologic conditions. The foundation soils at the site can provide adequate support for a Structural Plate Corrugated Steel Pipe (SPCSP) culvert. A standard Corrugated Steel Pipe (CSP) may be considered but will have less structural integrity. The uncertainty for the design of a culvert structure is the variability of foundation conditions within the creek bottom and immediately beneath the proposed culvert.

6.6.4.5 Piles

Adfreeze piles are the most common pile installation method in permafrost regions and have been used at many sites in Tuktoyaktuk, Inuvik, along the ITH, and across the north. An adfreeze pile typically consists of a steel pipe pile that is installed in a borehole drilled into the permafrost and backfilled with a sand-water slurry. The slurry backfill freezes back and forms an adfreeze bond between the surrounding permafrost and the pile. A typical conventional adfreeze pile installation is shown in Figure 6-8.

Infrastructure facilities, construction equipment, and operational loads during the construction and operation of the facility require stable foundations. The foundation support systems must be designed such that the facility structures and equipment do not settle or tilt with time beyond their operational tolerances. For this reason, the entire IESP Energy Centre, including the storage tanks, will be placed on adfreeze piles on a gravel pad.

For relatively small heated structures that can tolerate some foundation movement, variations of grade-supported foundations, such as pad footings, cribbing, screw jacks, or spaceframe foundations might be used. These foundations incorporate a mechanism that allows for adjustment in the event of differential movement, and adjustments are commonly required on an annual or as-needed basis. Of those foundations, Kiggiak-EBA recommended a spaceframe foundation system as it is considered more resilient to seasonal frost action and would likely require less maintenance.

6.6.4.6 Sump

On September 5, 2001, the Environmental Impact Screening Committee (EISC) reviewed the Anderson Tuktoyaktuk Winter 2001/2002 Water Licence Application. The decision was made that that the development would have no significant negative impact on the environment or Inuvialuit wildlife harvesting in the Inuvialuit Settlement Region (EISC, 2001). It was noted in the Screening Form – Level 1 that drilling fluids/wastes (up to 4500 cubic metres)

would be trucked to the Site, then buried and frozen into a single sump. It was also noted that a potassium chloride (KCl) drilling system was planned, with disposal of diluted muds into a small sump that would be blasted out of frozen ground with small explosive charges. The freeboard would be kept low enough to ensure that drilling fluids would be below the active layer, which would encourage permafrost to freeze the liquids, rendering them immobile. Grey water and camp sewage would be trucked back to a sewage lagoon in Tuktoyaktuk. Upon completion, wells and sumps would be capped, and all equipment would be removed or disposed of subject to approvals (ibid). Construction of the M-18 well, sump, and access road was initiated in the winter of 2001. The well was spudded on December 24, 2001 and drilling was completed in early 2002.

There has been some recent degradation of the sump associated with the original Devon M-18 drilling program. The sump is surrounded by, and overlies ice-rich fine-grained soils, with a thin active layer. The high ground-ice content of the native soils has resulted in thermal degradation (permafrost thaw) at the sides of the sump, with water ponding around the sump and surrounding area. The sump cap is revegetated. The cap appears to have been seeded with agricultural plants including oats, and other cereal grasses (Kiggiak-EBA 2018c). The cap material is sand, which appears to have been imported from off-site. The ponds surrounding the sump have grown since 2002. Poor surface drainage is causing water to collect and pond along the sides of the sump. The water warms the permafrost and causes thawing. This problem is magnified because the sump is in a low land depression and surface waters during spring run-off and rainfall events flow and collect alongside the sump.

As permitted through the Inuvialuit Land Administration (ILA), the M-18 sump will be remediated and re-capped to continue to prevent the contents from contacting the environment and to prevent surface water drainage from pooling at the cap and disturbing the permafrost. The scope includes addition of borrow (fill) material on the existing sump cap, and recontouring the existing drainage to flow around the cap. The cap will be keyed into the new Well Pad. As described, the Well Pad will be built on undisturbed ground north of the wellhead for the purpose of the well completion and future well servicing.

The sump contains non-toxic, water-based gel-chem drilling fluids. The previous well owners have assessed the sump on four occasions over the past 8 years, including sampling and geophysics. Most recently, in March 2020, a borehole was drilled into the sump and samples taken to a lab for analysis. Based upon all this information, and the conclusion of our environmental scientists, we can conclude that the sump does not contain any hazardous chemicals and is not a threat to the environment. Based upon the recommendation of our geotechnical engineers and the priority of maintaining the M-18 well structure, it is proposed that the sump be remediated, and the contents left in place. Removal of the sump is considered a more significant negative impact to the permafrost, the M-18 well, and the environment than properly maintaining it in place. We propose to integrate the new sump cap with the new Well Pad to make a single pad. IPC will use the equipment available on-site during construction of the Well Pad to complete the repairs.

Re-contouring the sump cap might be necessary in the future if subsidence is impacting positive drainage and resulting in ponding. The key to maintaining the sump will be to maintain good drainage.

6.7 Infrastructure, Personnel and Equipment Requirements

Table 6-1 provides a preliminary list of equipment and personnel that may be required for the proposed Site Works construction phase of the Project. IESP was unable to confirm this list prior to submission of the PD. The list is derived from the Project Description for the Tuktoyaktuk to Granular Source 177 Access Road (2008). This is the closest similar project to the IESP site works that is publicly available. The Tuktoyaktuk to 177 Access Road was a 19 km road. However, there were no pads constructed. Therefore, while the equipment will likely be similar, we

cannot accurately estimate the quantities at this time. The final list of equipment and personnel will be developed with the civil contractors. It is the intention of the IESP team to contract all the site works components to local businesses.

Table 6-1: Equipment and Personnel Required for Site Works	
Equipment	***Personnel***
140 Grader	Project Management
966C Loader w/ Bucket / Plow	Site Supervisors
BR-180 Snowcat with Drag	Logistics
Crew Cab Pick-ups	Heavy Equipment Operators
D6D Cat Dozer w/ Drag	Dump Truck Drivers
D6R Cat Dozer with Winch	Water Truck Driver
D7G Cat Dozer	Fuel Truck Drivers
D8N Cat Dozer with Ripper	Class 1 Drivers
Deck Sleigh	Radio Operator
Delta 3 with Water Tank	Mechanics
Enviro-Tank (50m3)	Environmental Monitors
EX-300 Excavator	Wildlife Monitors
Fuel Sloop (13m^3 double walled)	Camp staff (Tuktoyaktuk)
JCB 20 Ton Articulated Dump Trucks	
JCB Vibratory Self-Propelled Packer	
Kenworth Tandem Fuel Truck	
Kenworth Water Truck Winter Road Maintenance	
Kenworth Tractors w/ End-Dumps	
Light Stands	
Mechanic Shack	
Miscellaneous small equipment (welders, air compressors, etc.)	
Mulcher	
Pumphouse on Skid	
Rig Mats	
Service Truck	
Snowmobiles for scouts / monitors	
Swamp Mats	
Tandem Dump Truck	

Table 6-1: Equipment and Personnel Required for Site Works	
Trailer Office	

Table 6-2 provides a preliminary list of equipment and personnel that will be required for the proposed Well Completion phase of the Project.

Table 6-2: Equipment and Personnel Required for Well Completion			
Equipment	***Quantity***	***Personnel***	***Number***
Service Rig - (Contractor TBD)	1	Rig crew - (if two crews are used)	10
Separator & flare system for flowback/cleanup	1	Rig manager	1
Double walled fuel tank, 40,000 litres	1	Completions supervisor	2
Loader	1	Flowback crew	5
Water truck	2	Tank farm operator	1
Picker truck	1	Lease hands	2
Bed Truck	1	Water /vacuum truck operator	2
Vacuum truck	1	Loader operator	1
Drilling Supervisor pickup	1	Picker operator	1
Rig Manager pickup	1	Bed Truck operator	1
Ambulance	1	Wildlife Monitor	1
Tank farm for completion fluids (6 X 30m3) - Double walled or bermed	1	Environmental Monitor	1
Wellsite trailers	3	Medic	1
Service company pickup	3	Power tong operator	2
Waste Bin	1	Electric wireline logging	3
Spill Response Container	1	Slick line truck and operator	3
Rig Mats	6	Packers/ down hole tool operator	1
Snowmobile	1	Camp Staff (Tuktoyaktuk)	4-6
		Total	**44**

Table 6-3 provides a preliminary list of equipment and personnel that will be required for the final assembly of modules on site.

Table 6-3: Equipment and Personnel Required for Energy Centre Assembly On-Site			
Equipment	***Quantity***	***Personnel***	***Number***
Construction Team office trailer	1	Construction Management Team	3
Contractor Office Trailer	1	Construction Supervisors	6
Site Construction Washroom Trailer	1	Mechanical Contractor Crew	20
Mechanical Toolcrib	2	Electric and Instrumentation Contractor crew	22
Instrument and Electrical Tool Crib	2	Scaffolding Crew	7
Cranes for setting modules	3	Subcontracts-Earthworks	1
Instrument Mechanic tool truck – c/w tools required for construction work	1	Subcontracts - Piles	5
Electrician Tool truck – c/w tools required for construction work.	1	Subcontracts - Cranes	5
Construction Management trucks	4	Subcontracts - Insulation	7
Crane Crew trucks	2	Subcontracts – Electrical Heat Tracing	3
Scaffolding crew truck	2	Vendor Services	3
Insulator Crew trucks	3	Camp Support (contractor)	12
Mechanical Contractor crew truck	3	**TOTAL**	**104**
Electrical Heat Tracing Crew Truck	1		

Table 6-4 provides a preliminary list of equipment and personnel that will be required for the commissioning of the Energy Centre on site.

Table 6-4: Equipment and Personnel Required for Energy Centre Commissioning			
Equipment	***Quantity***	***Personnel***	***Number***
Operators Commuter trucks	6	Commissioning Manager	1
Mechanic tool truck – c/w specialty tools for performing commissioning/start-up work.	1	Senior Operators	4
Instrument Mechanic tool truck – c/w calibration tools (Gas detection, HART communicator, multimetres)	1	Construction Supervisors	2
Electrician Tool truck – c/w tools required for commissioning/start-up work.	1	Engineering Support	2
Utility trailer c/w MeOH injection pump & storage tank	1	Intermediate-level Operators	6
Utility trailer c/w Flameless Heater system	2	Mechanical Crew	2
Vacuum Pump – c/w fittings and hoses	2	Electrical and Instrumentation Crew	2

Hand tools for Operations Staff (equip trucks)	1	Vendor Start-up Specialists	5
		Journeyman Mechanic – specializing in rotating equipment	1
		Journeyman Instrument Mechanics	2
		Journeyman Electricians	2
		Computer Programmers	3
		Scaffolding	2
		Environmental Monitors	1
		Wildlife Monitors	1
		Camp staff (Tuktoyaktuk)	6
		TOTAL (estimate)	**42**

Table 6-5 provides a preliminary list of equipment and personnel that will be required for the proposed Operations phase of the Project.

Table 6-5: Equipment and Personnel Required for Energy Centre Operations

Equipment	***Quantity***	***Personnel***	***Number***
LNG transport trailer	3	Regional Manager	1
Syn Diesel transport trailer	2	Plant Operators	6
Highway Tractors (contract)	6	Plant Maintenance	2
Utility/deck trailer	1	Electrician	1
Grader (Contract)	1	Logistics Coordinator	2
Bobcat/Loader	2	Transport operator	8
Snow blade attachment	1	HSE advisor	1
Clean-up bucket attachment	1	Heavy Duty Mechanic	2
Forklift attachment	1	Parts Coordinator	1
Shop Pick-up truck	1	Office Manager/ Admin	1
Operator Pick-up truck	6	Rotating equipment specialist	1
Management pick-up truck	1	Power Engineer	1
Portable Vaporizer flare stack	1	General labourer	2
Truck/ Trailer maintenance facility (3rd party)	1	Environmental Monitor	1
Snowmobiles	2	Maintenance manager (rolling equipment and road)	1
Bed Truck (contract)	1	Welder (contract)	1

Table 6-5: Equipment and Personnel Required for Energy Centre Operations			
Picker Truck (contract)	1	Pipefitter (contract)	1
Vac Truck (contract)	1	Instrumentation Tech (contract)	1
		Waste Removal (contract) Hot Shot	1
		Hot Shot	1
		TOTAL	**36**

6.8 Waste Handling and Disposal

Each phase of the Project will generate slightly different waste streams. None of the Project phases will generate significant waste. Because most of the construction and fabrication work will be completed off-site, the waste usually created during construction will remain in the south. There will never be a landfill on the site.

There are three types of waste that may occur onsite during all the Project phases. They are minor amounts of kitchen (domestic) waste, sewage from on-site workers and possibly contaminated soil or snow from a spill. There will be no camp at site, so kitchen and sewage waste will be minimal. All kitchen waste from lunch bags, etc., will be gathered daily and stored in bear-proof containers. Kitchen waste and empty containers will be removed from the site as needed to the local landfill in Tuktoyaktuk. During pre-commissioning, sewage will be collected from the temporary field trailers in on-site tanks and trucked to municipal sewage treatment in Tuktoyaktuk or Inuvik. During operations, sewage will be hauled away from site in a sewage truck to the local sewage lagoon in Tuktoyaktuk. Any waste created by a spill will be collected and managed in accordance with GNWT Regulations and Guidelines. Vehicle and heavy equipment maintenance will occur in Tuktoyaktuk or Inuvik. All vehicle maintenance wastes will be generated off-site and will be responsibly managed and disposed off-site in town.

Table 6-6: Anticipated Wastes		
Phase	**Project Phase Description**	**Anticipated Wastes**
Pre-commissioning	**Site (Civil) Works**	The main wastes produced during the construction of the site works will be typical domestic garbage and sewage. Management of these will be as described above. There may also be some woody debris waste. Brush and shrub cuttings will not be disposed of in or near water bodies. In some cases, brush may be salvaged and used to control erosion along the route. For instance, stacked brush on the downhill side of a slope can slow and trap sediment. Extra brush will be collected, mulched, and trucked away for use off-site or disposal in a landfill. Brush will not be disposed by burning.
	Remediation	There are no wastes expected to be generated on site during this activity. Any contaminated soil or snow cleaned up from the sump will be sent to an industrial landfill licensed to receive the waste.
	Well Completion	All solid waste generated during the well completion (e.g. cement cuttings, dunnage, tubing protectors, packing material, etc.) with be collected in waste bins and disposed of at an approved landfill. The total volume will be less than 2000kg. All gas produced during the well clean-up will be flared

Table 6-6: Anticipated Wastes		
		(not vented to atmosphere). At the end of operations, the waste drilling fluid will be hauled to disposal in the south at a regulated facility.
	Fabrication	All waste from manufacturing and fabrication of the Energy Centre will be generated off-site in Alberta or B.C. There will be no waste from fabrication on -site.
	Transportation of Modules	No waste will be generated onsite by transportation of modules. Any domestic or sewage waste will be disposed as above. All spills will be cleaned up and disposed as per the Spill Response Plan.
	Installation of Modules and Plant Infrastructure	There may be some packaging waste and minor amounts of construction waste in this activity. All waste will be collected, stored, managed, and disposed as per the IESP Waste Management Plan.
Commissioning and Operations	**Commissioning**	No waste will be generated onsite during commissioning. Any domestic or sewage waste will be disposed as above.
	Operations	There are no liquid waste streams from the gas plant process. All industrial, non-hazardous solid waste will be sent to a regulated waste facility licensed by the GNWT to receive that waste. Hazardous wastes will be taken south for proper disposal at a licensed and regulated facility in B.C. or Alberta. Management and disposal of all waste will meet or exceed regulations. Industrial and hazardous wastes will be manifested, tracked, and quantified for an annual report. A detailed Waste Management Plan for the Project with anticipated waste streams and volumes is provided as Appendix 4.
	Transportation of Fuels	No waste will be generated onsite from this activity. Any domestic or sewage waste will be disposed as above. All spills will be cleaned up and disposed as per the Spill Response Plan.
Decommissioning	**Decommissioning**	Waste may include numerous salvageable, re-usable or recyclable structures or equipment. Disposal will follow the requirements of the day. See Section 17 for more detail on the IESP Decommissioning and Reclamation plan.

6.9 Fuel and Chemical Management

Table 6-7 provides a summary of the above ground storage tanks that will be needed for the Project. Note that tanks are needed for the Site Works, Well Completion, and Operations Phases only. All tanks will be double-walled, with the exception of the tanks containing LNG and C2+. These products do not pose the same environmental risk as the other liquid fuels as they turn to vapour when released from storage.

Double-walled tanks will include interstitial monitoring between the tank walls to detect any leaks in the inner wall. All hydrocarbons will be stored in accordance with CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (2003) and Environment Canada's Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (2008) under the Canadian Environmental Protection Act, 1999.

Refueling activities during Site Works construction will only occur from double-walled fuel sloops and enviro-tanks, one of each located at the borrow source and at the Project site, contracted from a local contractor. Equipment will be refueled at least 30 m from water bodies following the DIAND Fuel Storage Tank Protocol (2003).

Table 6-7: List of Storage Tanks for the IESP					
Phase	**Tank**	**Tank Size**	**No. Tanks**	**Total Volume**	**Fluid Type**

Table 6-7: List of Storage Tanks for the IESP					
Site Works	Fuel Sloop	13m3	2	26m3	Diesel Fuel
Site Works	Enviro-Tanks	50m3	2	100m3	Diesel Fuel
Well Completion	Completion Fluid	30m3	6	180m3	Potassium Chloride (KCl) Brine
Well Completion	Rig Fuel	44m3	1	44m3	Diesel Fuel
Operations	Condensed Water	80m^3	1	80m^3	Water
Operations	Produced Water	80m^3	1	80m^3	Non-potable water, trace solids, trace hydrocarbons
Operations	Raw Water	80m^3	1	80m^3	Water
Operations	Treated Water	80m^3	1	80m^3	Water
Operations	Naptha Storage	500 bbl	2	1,000 bbl	Naptha (hydrocarbon)
Operations	SynDiesel Storage	500 bbl	6	3,000 bbl	SynDiesel (Hydrocarbon)
Operations	C2+ Storage	150m^3	3	450m^3	Light liquid hydrocarbons (C2+)
Operations	C5+ Storage	500 bbl	6	3,000 bbl	Heavier liquid hydrocarbons (C5+)
Operations	LNG Storage	60,000 gallon	3	180,000 gallon	Liquid Natural Gas

7.0 DEVELOPER'S COMMITMENTS

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

A summary or a consolidated list of the Developer's commitments and associated implementation timelines for the development, including all mitigation measures

The implementation timeline for the IESP is provided in Figure 6-1 and discussed in Section 5.1.2.

IPC and Ferus NGF are committed to developing the IESP in full compliance with all federal, territorial, and local laws and regulations. We intend to follow relevant industry best practices and government guidelines whenever possible. In the event that neither of the GNWT, the federal government or the Inuvialuit Land Administration has regulation applicable to a particular aspect or operation of the IESP, IPC and Ferus NGF will look to Alberta guides and regulations. An example of this is the Alberta Energy Regulator Directive 038: Noise Control.

In addition to following these applicable regulations, as IPC and Ferus NGF take stock of the priorities of stakeholders with respect to the IESP, the IESP team are incorporating commitments into its design and development processes. A Commitment is a voluntary statement of action, or a goal, that goes beyond legal requirements. Conversely, "Compliance Obligations" are activities the Proponent is legally bound to complete from existing laws and regulations. A list of current regulations which provide the basis of the Project compliance obligations are provided in Table 7-1. A list of guidelines and best practices relevant to the Project are provided in Table 7-2.

In support of this, IPC and Ferus NGF have been maintaining a Commitment and Concordance Register (Register) as part of the internal IESP execution and operations protocol. This Register will track the commitments IPC and Ferus NGF's contemplate in response to comments emanating from consultations and engagements with stakeholders as well as those that have been volunteered by the IESP team through external communications and this Project Description. The Register will also track any stipulations made by stakeholders as a condition of support as well as any conditions issued by regulators. The Commitment Register will be used as a central place to document, communicate, and track the commitments so they can be understood, remembered, and included in the implementation of the IESP. The Concordance component of the Register will help track where in the project documentation (e.g. engineering specifications, project management plans, drawings, etc.) the commitment has been addressed.

In specific relation to IPC and Ferus NGF's commitment to environmental stewardship, the IESP team is in the process of developing an Environmental Management System (EMS) based upon the ISO 14000 Standard and the PLAN-DO-CHECK-ACT cycle of continual improvement. The IESP environmental planning includes impact assessment, stakeholder and community consultations, regulatory review, and risk, hazard, and opportunity assessments. The IESP implementation approach includes procedures for training and awareness, documentation, standardized processes, contingency (emergency) planning, and methods and mitigation measures to reduce or prevent direct impacts from the implementation of the project, including on wildlife and wildlife habitat. The IESP team will assess and confirm the effectiveness of the EMS implementation through regular reporting, monitoring, audits, and management review. Finally, the IESP team will act on the results of our checking using an adaptive approach to continual improvement to reflect changing site conditions, activity levels, or lessons learned, to continue to mitigate potential effects on wildlife, wildlife habitat, people or the environment.

The EMS includes four management plans to date. These plans are provided in Appendices in the PD and include the IESP Wildlife and Wildlife Habitat Protection Plan, IESP Archaeological Site Management Plan, IESP Waste Management Plan, and the IESP Emergency Response Plan and Contingency Plans.

The IESP team is also in the process of developing a Project Code of Conduct. The IESP Code of Conduct will summarize high-level commitments to the community, local harvesters, local businesses, and contractors, as well as staff, the public, regulators, co-management bodies, the environment and safety. The IESP Code of Conduct will incorporate the commitments and obligations reflected in this Project Description and will be provided later following the necessary internal approvals.

Table 7-1: Legislation and Rules Relevant to the IESP
INUVIALUIT
ILA Rules and Procedures, 2012
FEDERAL
Western Arctic (Inuvialuit) Claims Settlement Act, s.c. 1984 / Inuvialuit Final Agreement (IFA)
Fisheries Act and Regulations
Canada Environmental Protection Act
Species at Risk Act (SARA)
Canada Wildlife Act
Migratory Birds Convention Act
National Pollutant Release Inventory
Fugitive Emissions
Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations
Regulations Respecting Reduction in the Release of Methane and Certain Organic Volatile Organic Compounds (Upstream Oil and Gas Sector), 2018.
Transportation of Dangerous Goods Act
Interprovincial Movement of Hazardous Waste Regulations
Canada Labour Code
Radio Communications Act
Explosives Act (borrow pit)
Aeronautical Act/Canadian Aviation Regulations
TERRITORIAL
Northwest Territories Oil and Gas Operations Act and Regulations, as amended
Petroleum Resources Act, as amended
Northwest Territories Power Corporation Act
NWT Devolution Agreement
Northwest Territories Water Act
Wildlife Act and Regulations
Heritage Resources Act
Archaeological Sites Act and Regulations
Environmental Rights Act
Environmental Protection Act
NWT Oil & Gas Occupational Health and Safety Regulations
Spill Contingency Planning and Reporting Regulations

Table 7-1: Legislation and Rules Relevant to the IESP
Used Oil and Waste Fuel Management Regulations
Pesticide Act and Regulations
Reindeer Act and Regulations
Species at Risk (NWT) Act
Waste Reduction and Recovery Act
Electronics Recycling Regulations
Waters Act and Regulations
Commercial Transportation Act
Transportation Act
Transportation of Dangerous Goods Act
Public Health Act
Drinking Water Protection Act

Table 7-2: Guidelines and Best Practices Relevant to the IESP
Alberta Energy Regulator Directive 037 – Service Rig Inspection
AER Directive 038: Noise Control
Bear Encounter and Response Guidelines, Inuvik Region, 2018
Canada Energy Regulator Early Engagement Guide, 2020
CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products
CCME Guidelines for Decommissioning Industrial Sites, 1998
Co-management Plan for Grizzly Bears in the Inuvialuit Settlement Region, Yukon Territory and Northwest Territories, 1998
CSA B51-14 – Boiler, pressure vessel and pressure piping code
CSA-Z276-18: Liquefied Natural Gas (LNG) – Production, storage, and handling
DFO (1993) Land Development Guidelines for the Protection of Aquatic Habitat
DFO Guidelines for Water Withdrawal
DFO Northwest Territories Operational Statement: Ice Bridges and Snow Fills. Version 3.0
Environmental Impact Screening Guidelines, 2014
Energy Safety Canada – Industry Recommended Practices (where applicable)
Federal Cumulative Effects Assessment Practitioners' Guide, 1999
GNWT 2013 Energy Action Plan
GNWT 2030 Energy Strategy
GNWT Guidelines for Dust Suppression on Roads, 2013
GNWT Guidelines for Installing Commercial or Non-Commercial Signs Within a Public Highway Right-Of-Way, 2014
Guidelines for Developers or the Protection of Archaeological Sites in the Northwest Territories
Guidelines for Development and Management of Transportation Infrastructure in Permafrost Regions, 2010
INAC Northern Land Use Guidelines for Access Roads and Trails, 2010
Inuvialuit Community Economic Development Organization (ICEDO) Regional Opportunity Readiness Plan
Inuvik Community Conservation Plan, 2016
Inuvik to Tuktoyaktuk Highway Fishery Management Plan and Wildlife Protection Plan, 2013
ISR Granular Resources Management Plan, 2010

Table 7-2: Guidelines and Best Practices Relevant to the IESP
Alberta Energy Regulator Directive 037 – Service Rig Inspection
AER Directive 038: Noise Control
National Fire Code of Canada 2015
Natural Resources Canada Arctic Energy Strategy
Northern Land Use Guidelines for Access Roads and Trails. (Indian and Northern Affairs Canada, 2010
Northwest Territories Operational Statement: Ice Bridges and Snow Fills, 2013
Northwest Territories–Nunavut Spills Working Agreement, 2014
NWT Guidelines for Spill Contingency Planning (INAC 2007)
NWT Environmental Guideline for Contaminated Site Remediation, 2003
NWT Guide to the Spill Contingency Planning and Reporting Regulations
NWT Guideline for Ambient Air Quality Standards in the NWT
NWT Guideline for Hazardous Waste Management
NWT Guideline for Industrial Waste Discharges in the NWT
NWT Guideline for Ozone Depleting Substances and Halocarbon Alternatives
NWT Guideline for the Management of Biomedical Waste in the NWT
NWT Guideline for the Management of Waste Antifreeze
NWT Guideline for the Management of Waste Batteries
NWT Guideline for the Management of Waste Paint
NWT Guideline for the Management of Waste Solvents
NWT Guidelines for Aquatic Effects Monitoring Programs
NWT Protocol for Drum Disposal in Municipal Landfill
NWT Safe Work Practices for Fuelling Equipment and Handling Petroleum, 2013
One People One Plan – Inuvialuit Plan for Fishing on the Inuvik to Tuktoyaktuk Highway, 2017
Safety in Grizzly and Black Bear Country Brochure, 2017
Traditional Knowledge Guide for the Inuvialuit Settlement Region, 2008
Tuktoyaktuk Community Conservation Plans, 2016

8.0 NEW OR INNOVATIVE TECHNOLOGY

8.1 Introduction

The EISC Guidelines indicate that the purpose of this Section is to describe new or innovative technologies that a proponent intends to employ in a project. While the technologies that IPC and Ferus NGF propose to use in the IESP are not new in global terms, they may be less familiar to stakeholders and members of the EISC. Additionally, new technologies, which could potentially be added to the Project, are emerging. These technologies could complement the IESP and respond to local needs in significant ways. As such, IPC and Ferus NGF have approached Section 8 in three main parts.

The first part provides some context for readers that may not be as familiar with Energy Centre construction. This part outlines the general design considerations for energy facilities in North America and explains at a high level how these considerations will apply to the IESP.

The second part outlines the technologies that are being deployed and are critical to the successful execution the IESP. These include the LNG Refrigeration Process and the Gas-To-Liquids Process.

The third part outlines the technologies that could further enhance the community benefits of the Project. These include a Biomass and Wood Waste Recycle Module and a Combined Heat and Power (CHP) supported Greenhouse, which are innovative technologies for northern Canada. These are optional technologies that have not had preliminary design or engineering conducted to date but could be explored if consultations with leadership and communities determined this to be beneficial overall.

8.2 Part 1: General Design Considerations

Manufacturing and industrial processes in North America use standardized equipment that is designed and engineered to accomplish a specific task safely and efficiently. Standardized equipment can be as simple such as a *length of pipe*, or more complex such as a *large pump*. The standardized equipment pieces are combined to build complex industrial facilities that are safe and compliant with regulations.

Each piece of standardized equipment undergoes significant quality control and is regulated by provincial, territorial and/or federal bodies. Standard equipment must be compliant with codes and standards and ensure the general safety of the public and environment. For example, a certain Schedule of pipe is guaranteed to perform safely over its entire lifetime as long as the pressures, temperatures, and fluids within the pipe comply with the manufacturer's specifications.

Another example is a *large pump*. The large pump could be the size of vehicle with lubricating systems, inlet and outlet filter systems, temperature and pressure sensors, an electrical motor, many lengths of pipe, and hundreds of moving parts. But this large pump is no different than the single length of pipe. The manufacturer has designed and engineered all components to perform safely over its entire life as long as the facility complies with the manufacturer's specifications and maintenance programs. It does not matter if this large pump is deployed at a manufacturing plant, a fertilizer plant, or the IESP Energy Centre. It will perform safely in any of these applications and over its lifetime because it has been designed and engineered to do so using proven technology, regulatory

monitoring, and established scientific principles.

Both the LNG Refrigeration Process and the Gas-To-Liquids Process use standard equipment only. All components of the IESP Energy Centre will be standardized equipment that has been designed and engineered to safely execute its purpose and will comply with all applicable codes and standards. This equipment will be arranged to make a complex facility that will safely provide local communities with heat, power, and fuel over its lifetime. Onsite staff will monitor the facility and ensure the standardized equipment works within the specification required by manufacturers. Alarms, shutdowns, and control systems will be put in place that allow a control room operator to monitor and manage the facilities' operating conditions safely.

8.3 Part 2: Technologies that will be used in the IESP

8.3.1 LNG Refrigeration Process

The liquefaction of natural gas dates back to 1820, when British scientist Michael Faraday first experimented and successfully chilled natural gas into a condensed, liquefied form. By 1912, the world's first LNG facility was constructed in West Virginia. LNG development continued and there are now over one hundred LNG facilities in the U.S. An example of a northern installation, an LNG facility successful operated from 1969 to 2011 on the Kenai Peninsula near Anchorage Alaska.

Most LNG Technology is similar, and quite simple in nature: the main difference between LNG technologies is the refrigerant and type of heat exchanger used to cool the natural gas such that it becomes a liquid. As with all LNG facilities, the LNG Refrigeration Process at the IESP Energy Centre will be composed of two systems:

- A refrigeration system, MA3™ (Modified Aqua-Ammonia Absorption)
- A natural gas system, DPLC™ (Dense Phase Liquefaction Cycle)

The patented MA3™ refrigeration technology is based on 160-year-old ammonia absorption refrigeration technology and is a closed loop system. The refrigerant is water and ammonia, like a concentrated Windex solution. This is a similar technology to what is utilized in propane fired refrigerators used in RV's or at off-grid cabins but used on a larger scale for this facility.

The natural gas system that is used with MA3™ refrigeration technology is called DPLC™. The DPLC™ process is very simple high-pressure natural gas in the dense phase is chilled and then flashed to a lower pressure, producing LNG. The DPLC™ process is very similar to the most common of liquefaction processes in North America – N_2 expander and mixed refrigerant systems – and uses the same basic methodology and thermodynamic principles. The DPLC™ technology's history from origin to the current state is outlined below.

Stage 1 – Conceptual Development: The DPLC™ technology started with a need to find a better solution for small scale LNG production. The concept was presented to Sonoma Resources Ltd. in late 2014 as a means to upgrade the value of their natural gas at Talbot Lake, Alberta, Canada to provide LNG for diesel displacement opportunities and Sonoma agreed to invest in the technology. Sonoma funded further due diligence with completion of process simulation and preliminary project design and costing for a commercial plant at Talbot Lake. In the fall of 2015, it was determined that a facility was needed and the design and cost estimate for the facility was completed in December 2015.

Stage 2 - DPLC™ Pilot LNG Facility: The initial version of the pilot LNG plant using DPLC™ technology was completed and commissioned in 2016. Over the next three years, upgrades were made, and further tests were conducted to further validate the DPLC™ technology. This 500 USG/day facility is located at Spectrum Process Systems' facility east of Calgary. By the end of 2019, there had been a total of 104 facility tours for 433 individuals, representing 181 separate organizations (largely private sector).

Stage 3 - Development of Talbot Lake LNG Project / Sonoma LNG Project: Sonoma commissioned a Design Basis Memorandum (DBM) by Status Engineering Associates Ltd., which lays out the design and construction plans for the 90,000 USG/d Talbot Lake LNG Project, along with a schedule and a capital expenditure budget. This was completed on September 21, 2018, and Final Investment Decision for the Talbot Lake project is now subject to financing and a positive advancement of Fortune Minerals – NICO mine project which is the primary anchor market supporting this project.

The MA3™ and DPLC™ technology are well suited for operation in remote northern climate applications due to the robust nature of the technology and low system complexity which results in simple control strategy for the operations team. The process can be readily started and stopped in cold or warm ambient conditions with established procedures developed through the many cycles of running the LNG facility. Cold weather design and operating practices are well understood by the developers of the DPLC technology.

8.3.2 Gas-to-Liquids

Typical conventional diesel production is done by cracking, or breaking apart, heavy hydrocarbons from petroleum crude oil and bitumen to produce diesel. The heavy hydrocarbons used to make conventional petroleum diesel may contain undesirable constituents such as sulphur, and nitrogen, and aromatic compounds - the results of refinery cracking to produce conventional diesel from crude oil and bitumen. When conventional diesel is combusted, these constituents produce harmful emissions such as sulphur oxides, nitrous oxides, and particulate matter (soot).

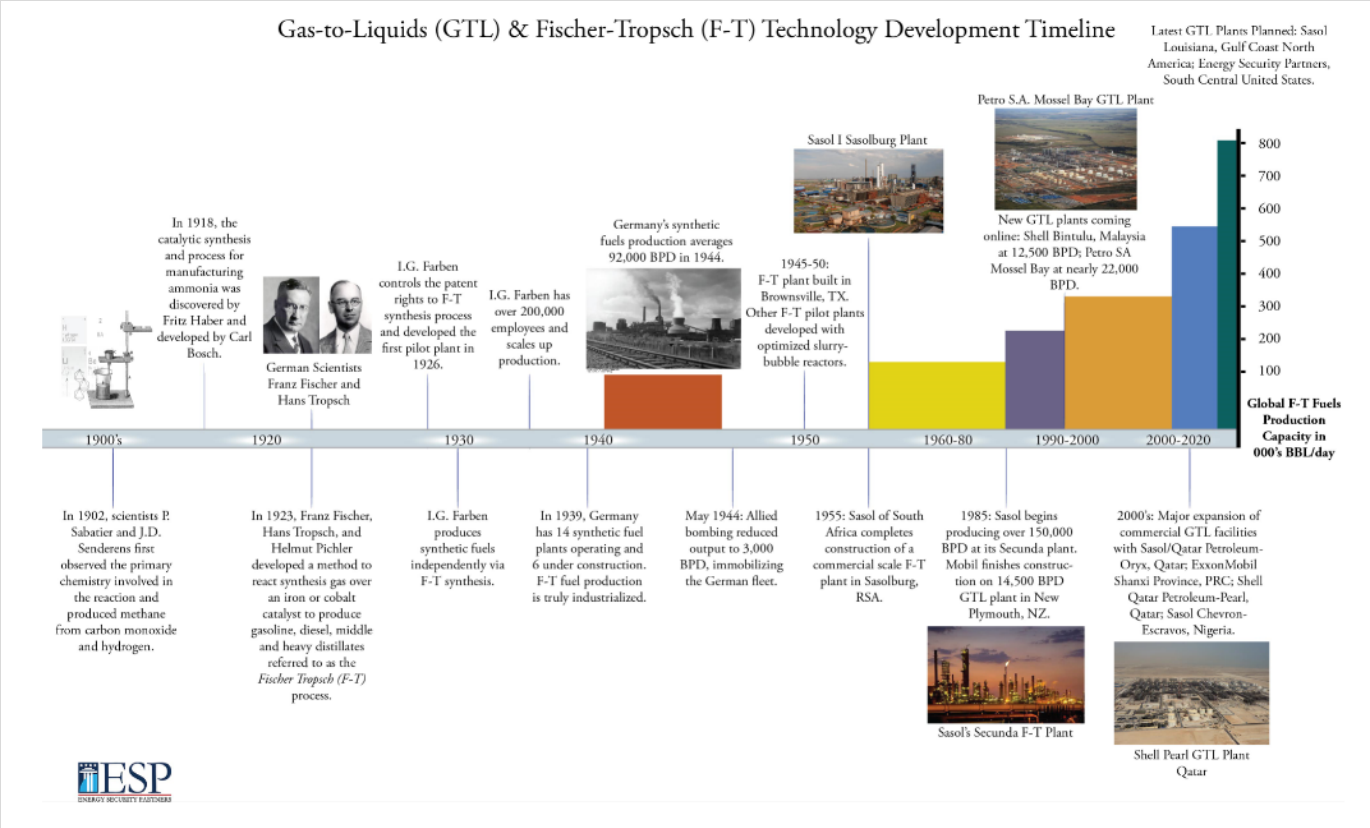
Gas to Liquids (GTL) technology is a process to convert methane (natural gas) into other hydrocarbons, such as synthetic diesel (SynDiesel®). Instead of cracking heavy hydrocarbons in an Edmonton refinery to make conventional diesel, natural gas and light hydrocarbons known as natural gas liquids (NGLs) can be combined at the IESP Energy Centre to produce SynDiesel®. The SynDiesel® is primarily "near pure" diesel fuel and exceeds all specifications for diesel engines. The measure of diesel quality is represented by centane number, whereby perfect diesel is centane 100. The world highest standard for diesel quality is 55 cetane, currently required in European Union (EU) and California, USA. Over countries, like Canada, are rapidly upgrading their diesel fuel standards. Current conventional petroleum diesel standard is a cetane number of 40. SynDiesel® has a cetane number of greater than 70. SynDiesel® burns cleanly and contains no harmful byproducts because the natural gas has a lower concentration of contaminants and can be treated to remove them easier. SynDiesel® made from the M-18 well will have virtually no harmful emissions, including no sulphur oxides. There are over 800,000 barrels per day of synthetic diesel produced and used worldwide at existing GTL facilities.

The GTL process undergoes two major stages to produce SynDiesel® from natural gas

1. **Steam Reforming to Create SynGas:** SynGas is a mixture of carbon monoxide and hydrogen that is created from methane using high temperatures and introducing water. The SynGas is an intermediate product and the feedstock needed for the next stage.

1. **SynGas Undergoes Fischer-Tropsch Process:** The SynGas undergoes a chemical reaction in the presence of a catalyst to form the SynDiesel® and water. The water is recovered and re-used in the steam reforming stage to produce the required hydrogen.

The Fischer-Tropsch (FT) process was developed in 1923 by Franz Fischer, Hans Tropsch, and Helmut Pichler on the back of scientific breakthroughs in catalytic synthesis in early 20th century. They were able to react SynGas over an iron and cobalt catalyst to produce gasoline, diesel, and other distillates. In 1926, the first FT process pilot plant was developed and by 1939 Germany had up to 20 synthetic fuels facilities producing 92,000 barrels per day. Between 1945 and 1955 additional commercial synthetic fuels facilities were built in South Africa and the USA. Today there is over 800,000 barrels per day of synthetic fuels produced using the FT process globally. A more detailed history of the FT Process is provided below and in Appendix 1, Figure 8-1.



Ultimately, SynDiesel® is a very high-quality diesel that represents a more environmentally friendly diesel alternative that can be produced in the Inuvialuit region with no fracking or additional underground oil and gas activity.

8.3.3 IESP Technology Highlights

It should be emphasized that the LNG Refrigeration Process and the Gas-To-Liquids Process only utilize standard equipment. All components of the IESP Energy Centre will be standardized equipment that has been designed and engineered to safely execute its purpose. The Energy Centre will safely provide the communities of Inuvik and Tuktoyaktuk with heat, power, and fuel over its lifetime.

As shown, these processes have long histories in North America with hundreds of proven commercial operations in

various manufacturing and industrial applications. The specific refrigeration and GTL processes being deployed have been fine tuned to improve the process efficiency and these specific processes have been deployed and demonstrated in Canada. After a thorough review of the various gas processing technologies for the IESP, the decision was made to utilize these two technologies, the LNG refrigeration process (using the MA3^{TM} technology) and the GTL Process (using the FT Process), as being the best application of available equipment, technology, and scientific principles for this project. These technologies will deliver an environmentally and economically efficient Energy Centre designed specifically for the northern Canadian climate experienced in the Inuvialuit Region.

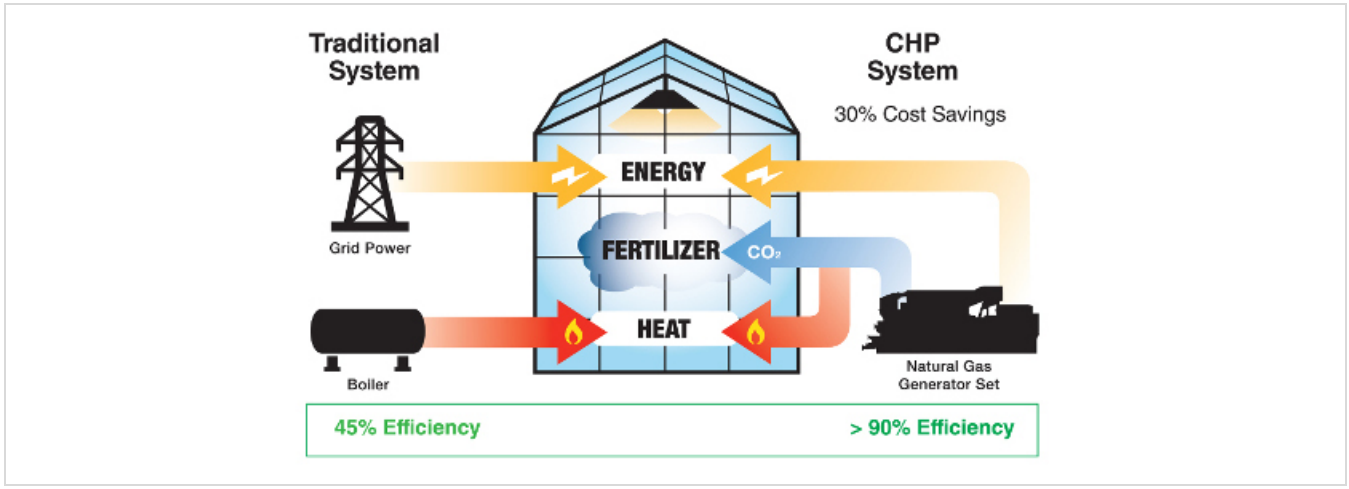
8.4 Part 3: Potential Technology Deployments to Support Local Residents and Businesses

8.4.1 Local Greenhouse

When an engine runs, some of the energy is converted to drive equipment and the remaining energy generates heat. That is why the exhaust and engine block from a vehicle is hot after being driven and the excess heat energy is removed through the radiator. Combined heat and power (CHP) generation captures the waste heat from the electric generators that produce onsite power and re-uses this heat for other applications that require heat.

The IESP Energy Centre is already being designed to re-use heat from the GTL Unit for plant process heating, to heat buildings and run steam turbines that generate electricity. This is being done because re-using heat increases the overall efficiency of the facility and reduces its greenhouse emissions. It also helps us be self-reliant for power. However, after detailed engineering is complete, we may find additional heat that is not being re-used. This heat could be captured. One way this heat could be re-used is to maintain a warm greenhouse in the Inuvialuit Region all year.

In a traditional greenhouse, grid power and a dedicated heat source – like a boiler – would be required for heating operations. In a greenhouse utilizing combined heat and power, waste heat would maintain adequate temperatures, CO_2 from the engine exhaust could be re-used to fertilize the plants, and electricity from the existing generators could power the lighting. This results in a reduced environmental footprint and efficient use of resources for the overall Project. Below is a generic process diagram of how a combined heat and power solution may look with a local greenhouse compared to a traditional greenhouse.



There are international examples of greenhouses run by CHP throughout North America, but currently none in northern Canada. There is an exploratory project ongoing in the community of Naujaat, Nunavut, to conduct a geodesic greenhouse. The IESP Energy Centre could provide electricity, fertilizer, and heat to a greenhouse near the ITH that could provide local residents a source of fresh produce all year. If there is community interest in this concept, this possible technology deployment could be evaluated in forthcoming design phases.

9.0 ASSESSMENT OF ALTERNATIVES

An assessment of alternatives to the IESP was carried out to fulfill the requirements of the EISC Guidelines.

The alternatives were assessed through professional experience and consultation with Project stakeholders, including Regulatory Agencies, the public, local and Indigenous governing bodies, and subject matter experts (SMEs). The screening criteria considered potential environmental effects, social acceptability, operational feasibility, and cost.

The assessment of alternatives considered two categories of alternatives:

1. Alternatives to the Project, which are the functionally different ways to meet the Project need and achieve the Project purpose.
2. Alternative Means, which are the various technically and economically feasible ways the Project can be implemented.

The Methodology and Criteria for selection of alternatives are provided in the following section.

9.1 Assessment Method and Criteria

The available alternatives in Table 9-1 were initially screened against criteria adapted from Ontario Ministry of the Environment's Code of Practice: Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario (MOE 2009). The screening assessment consisted of answering the following screening criteria:

1. Does the alternative provide a viable solution to the problem or opportunity to be addressed?
2. Does the alternative use proven technologies, and is it technically feasible?
3. Is the alternative consistent with federal/territorial government priority initiatives?
4. Can the alternative be carried out without significant effects to Valued Environmental Components?
5. Is the alternative practical, financially realistic, and economically viable?
6. Is the alternative within the proponent's ability to implement and operate?
7. Can the alternative be implemented within the Project Site?

Each alternative was screened against the above criteria. The details of the screening are provided below. The result of the screening was either (1) the identification of one alternative (i.e., the preferred alternative), or (2) the identification of a number of alternatives that met the screening criteria. Each of the alternatives that met the screening criteria were advanced for a comparative evaluation using environmental, social, operational, and economic performance criteria. If only one alternative was considered feasible, it was identified as the preferred alternative for that Project aspect and assessed as part of the Project.

The qualitative evaluation of proposed alternatives was based on criteria and indicators developed for the assessment according to the following categories identified in Section 5, including:

Environmental Criteria

The following sub-indicators were considered in the evaluation of potential environmental effects:

- Harvesters: Potential disturbance of local harvesters, consideration of Community Conservation Plans.
- Water Quality: Potential effects on surface water quality.
- Terrestrial Ecology: Potential disturbance of wildlife or loss of wildlife habitat.
- Aquatic Biology: Potential disturbance of fisheries and/or loss of aquatic habitat.
- Hydrology: Potential changes in surface water flows or drainage.
- Permafrost: Potential effects on permafrost stability.
- Air quality: Potential changes in ambient air quality due to emissions.
- GHG emissions: Potential impact to climate from GHG emissions.
- Noise – potential disturbance to people or wildlife from noise

Operational Criteria

The technical evaluation considered constructability, operability, construction risk and closure.

Economic Criteria

The economic evaluation considered total project costs including capital costs, operating cost, and closure costs.

Social Criteria

The social evaluation considered cultural heritage, potential strain on services and infrastructure, land use, local resources and potential benefits to the local population and economy.

9.2 Alternatives to the Project

The Purpose of the IESP includes, but is not limited to, solving the impending energy security crisis resulting from the loss of production at the IKHIL J-35 well and the fragile transportation network from southern suppliers to the Inuvialuit Settlement Region, reducing the cost of living and doing business for residents, and attracting business, investment, and long-term employment opportunities to Inuvialuit residents and businesses.

There are several Alternatives that could potentially achieve the Purpose of the Project. The Alternatives considered are summarized in Table 9-1. Each of these Alternatives are evaluated in Sections 9.2.1 through 9.2.5.

Table 9-1: Alternatives Considered for the Project

No.	Description	Consideration
#1:	Continue to haul and barge LNG, diesel and other fuel via the Dempster Highway and Mackenzie River from Alberta and British Columbia	Current Status / Declined Alternative
#2:	Design, build, construct, and operate a pipeline that would carry fuel from M-18 to the IKHIL J-35 well facility	Declined Alternative
#3:	Drill a new well within the ISR to locally supply LNG and fuel needs	Declined Alternative
#4:	Source and barge LNG and other fuel from another region and expand storage in Inuvik	Declined Alternative
#5:	Procure the M-18 Well and design, build, and operate a facility to provide local supply of LNG and SynDiesel®.	Preferred Alternative

9.2.1 Alternative #1

Description: The current propane supply for the community of Inuvik is trucked from southern Canada and the back-up gas supply is from the IKHIL J-35 well. The current energy supply for other communities is largely transported by barge down the Mackenzie River.

Discussion: Trucked and barged fuel requires a round trip of more than 5,000 kilometres involving ice bridges, ferries, and seasonal road closures. The long trucking distance means fuel sourced from southern Canada is expensive. Fuel that is barged by river or trucked north on the Dempster Highway could face a major disruption due to the long and complex transportation routes. This could cause shortages to the regional fuel supply with a severe negative impact on the communities in the Inuvialuit region.

Looking specifically at the community of Inuvik, the lifespan of the IKHIL J-35 becomes more uncertain after June 2022. Once the well is fully depleted, thousands of residents will need to rely entirely on imported energy. This additional fuel will need to be sourced from southern Canada. The Inuvialuit Settlement Region (ISR) will have limited economic development, revenue, and direct employment associated with sourcing this fuel.

The IKHIL infrastructure is isolated to Inuvik and is unable to supply other communities with heat and power. These other communities are completely reliant on fuel sourced from southern Canada, and have limited local resources, back-up supply, and emergency services to withstand a supply chain disruption.

Conclusion: Regional heating and power demand cannot continue to be reliably or affordably sourced from the IKHIL J-35 well or the south over the near to long term.

9.2.2 Alternative #2

Description: The M-18 well is four kilometres from the ITH and contains enough hydrocarbons to supply the communities of Inuvik and Tuktoyaktuk with fuels for more than 100 years.

Discussion: A pipeline from M-18 to IKHIL J-35 would require a significant amount of capital. Even a cost-effective pipeline route that aims to make maximum use of existing infrastructure by following the ITH would be uncompetitive economically with other Alternatives.

The pipeline would require over 150 kilometres of pipeline development and would have a more significant environmental impact due to the relatively larger footprint of impacted area.

There would be minimal direct employment opportunities after construction of the pipeline is complete. Meeting regulatory requirements would need a third-party firm to be consulted or hired to manage the various aspects of the pipeline development and construction, and this work would largely be conducted from outside the Inuvialuit region.

Secondary markets for hydrocarbon products cannot be easily tied-in to existing infrastructure and would require significant capital investment.

Conclusion: Constructing a pipeline from the M-18 well is less cost effective, has more adverse environmental impacts, and provides the region with minimal long-term direct employment opportunities. Therefore, this is not the preferred alternative.

9.2.3 Alternative #3

Description: A new well could be drilled in the ISR that could be tied into the existing natural gas and propane-air infrastructure. The well would supplement the current IKHIL J-35 well that is providing natural gas to Inuvik. This well, however, could not provide an additional source of energy to other communities in the region.

Discussion: A well that is close to the IKHIL J-35 well would likely target the same natural gas reservoir and be prone to similar production performance and declines. Therefore, this alternative does not increase regional energy security. The well would be limited to providing only Inuvik with natural gas for heat and power, and it would be difficult to provide other regional communities. It represents a low-capital solution to replace the current IKHIL J-35 well natural gas supply, but the newly drilled well is subject to the same risks and declines of the IKHIL J-35 well and would require additional infrastructure and development to service other communities.

Drilling a new well would require significant coordination with an oil and gas company that is familiar with drilling operations in the region. They would need to be persuaded to allocate the resources required to conduct geological, geophysics acquisition, exploration drilling, completion, and production due diligence and engineering design such that the newly drilled well would comply with all regulations, best practices, and successfully produce natural gas. Timelines from initial awarding of land rights for exploration to production would be seven to ten years. Capital investment would be at risk or lost if the newly drilled well did not produce the hydrocarbons required to support the demand of the nearby communities.

Conclusion: Alternative #3 does not meet the Project Purpose to provide energy security to the Inuvialuit region and is not a satisfactory alternative to the Project.

9.2.4 Alternative #4

Description: The ISR could receive fuel for heat and power via barge or waterways from another jurisdiction.

Discussion: The region will need to stockpile fuel while the waterways are open that will last the remainder of the season while ice formation prevents typical shipping vessels from reaching the Inuvialuit region. This will require significant capital investment. Inventory management also becomes especially important; fuel storage could run very low or run out if any of the communities in the Inuvialuit region are experiencing a harsher winter and fuel demand is increased for a prolonged time.

Answering the additional demand following the depletion of IKHIL will require fuel to be sourced from jurisdictions outside of the ISR, as it is now for diesel and smaller amounts of other fuel. There would be minimal direct employment opportunities on this additional import. Work would largely be conducted from outside the Inuvialuit region. The Inuvialuit region will have limited economic development and revenue associated with sourcing this additional fuel.

Long supply chains over the water, which is similar for long haul truck transport, introduce more environmental risk as there is a higher chance of accident then shorter supply chains. This can cause undesirable water or soil contamination. This alternative also emits more overall air emissions from long-distance truck and barge supply chains.

Fuel that is barged in is dependent on international fuel prices. There is significant variability in international fuel prices and therefore regional fuel prices experience a lot of variability. The ISR pays a significant premium on these

international prices due to its remote location from the fuel production sources. Sourcing fuel from regional resources protects communities from international variability in fuel prices and improves predictability.

Conclusion: Barging fuel from other jurisdictions is expensive with high variability and risk, it does not provide the region with long-term revenue or direct employment opportunities and was therefore not chosen.

9.2.5 Preferred Alternative

Description: As previously described in this Project Description, IPC and Ferus NGF are proposing to develop and produce the suspended M-18 gas well and operate a small Energy Centre at the M-18 wellsite that will convert natural gas and condensate into Liquefied Natural Gas (LNG) and Synthetic Diesel (SynDiesel®). The hydrocarbon products will then be transported by truck on the ITH to customers for power, heat and fuel.

Discussion: The preferred alternative is feasible and will provide a number of benefits to the ISR and its residents in fundamental ways:'

The Project will solve the impending energy security crisis through a locally sourced supply of fuel that can provide heat, power, and fuel for the Region. The Project is a long-term solution that will last over 100-years by utilizing the large M-18 well reserves. After the M-18 well production has decreased, additional wells can be drilled nearby and tied into the existing surface infrastructure. This will require minimal investment to perpetually provide energy security to the Region.

The IESP will solve the impending energy security crisis that has resulted from the loss of production at the IKHIL J-35 well.

Locally sourcing energy will reduce the cost of power, heat, and fuel helping residents lower their cost of living and provide business with lower operating costs. Reducing operating costs will attract business and investment to the Region and create good quality long-term employment opportunities in construction and production phases. The Project will provide training and capacity-building opportunities for local residents, which will include the need to operate facilities, haul fuel products, and support the various Project services such as maintenance and back-office operations.

Natural gas is the cleanest burning hydrocarbon. When burning natural gas less GHG, particulate (smog), and harmful SOx and NOx are produced when compared to diesel or propane. The SynDiesel® that is produced at the facility will be cleaner than typical diesel. It is clear in color and burns with greatly reduced particulate (smog) because it does not contain the harmful compounds that conventional diesel contains. The fuels produced at the facility will replace diesel and propane that is currently burned in the Region and will reduce GHG emissions by tens of thousands of tonnes per year.

Conclusion: The Purpose of the IESP project is to provide energy security and economic benefit to Inuvialuit and northern residents and businesses. The Preferred Alternative has been chosen for the IESP Project because it meets the IESP purpose with feasible deployment of existing and proven technology and has very attractive environmental performance.

9.3 Alternative Means of Carrying out the Project

A full range of alternative methods of carrying out the Project have been examined and assessed, as discussed herein. Alternatives that meet the Project objectives were identified and an initial screening process was completed. The alternatives that were deemed reasonable were carried forward for further evaluation and were investigated in greater detail. Comparative summaries of the features of the alternatives, environmental and social impacts, cost requirements, and discussions of the degree to which the alternative fulfills the need identified were used to determine which option is best overall. A summary of the preferred alternative for each Project constituent is presented below in Table 9-2. The aspect chosen for the IESP between two or more alternative considered is provided in bold and highlighted in grey. The primary reason(s) for the selection of that aspect is also provided.

Table 9-2: Alternative Means of Carrying Out the Project

Project Consideration	Alternatives Assessed	Primary Reasons for Selection
Which Natural Gas Liquids should the IESP produce from M-18 for market?	**LNG**	Existing Local Demand, Better Economics, better for air emissions, provides local benefits in price reduction to consumers
	SynDiesel®	
	Propane	
	Condensate	
How should we transport the energy products to the communities?	**Using trucks on the ITH**	Less Capital, More Flexibility, Less Environmental Impacts
	Pipeline to IKHIL or Inuvik	
Which Method should we use for preparing the gas for transport?	**Liquid Natural Gas**	More efficient, Less Environmental Impacts, Less Capital
	Compressed Natural Gas	
Which Technology shall we use to liquify the gas?	**Dense Phase Liquefaction Cycle**	Higher Efficiency, More Robust Operability
	Mixed Refrigerant / Nitrogen	
What will IESP use for Power Source at the Energy Centre?	**Self- generating on-site (Behind-the-fence)**	Less Capital, Less environmental footprint, Readily Available

Table 9-2: Alternative Means of Carrying Out the Project		
Project Consideration	**Alternatives Assessed**	**Primary Reasons for Selection**
	Grid Power (run a power line from Tuk)	
What fuel will we use to generate power on-site?	**Natural Gas from M-18 (and Naphtha from process)**	More Robust Operability, Less Capital, Less Environmental Impact
	Diesel from South	
	Renewables	
Should we build worker accommodations on site or use existing off-site accommodations in Tuktoyaktuk?	**Off-site accommodations in Communities**	Community Benefits, Less Environmental Impact, easier to operate
	On-site accommodations	

The following sections provide greater detail into the considerations in the assessment of the various alternatives for carrying out the project.

9.3.1 Which Natural Gas Liquids should the IESP produce from M-18 for market?

The purpose of the gas processing facility is to separate the methane (commonly known as natural gas) from the other hydrocarbons. The natural gas will be cooled to liquid and transported as LNG to provide to local residents and businesses with power and heat.

Once the natural gas is separated, the remaining hydrocarbons can be combined and manipulated to create oil-like products. In theory, any hydrocarbon combination could be created from the well through separating and recombining carbon and hydrogen atoms. But many combinations will be costly if they do not align with what the well is producing. Two hydrocarbon mixes have been established that could economically be recovered based on the hydrocarbon analysis conducted on the M-18 well.

1. Propane and condensate
2. Synthetic diesel, also known as "SynDiesel®"

Creating propane and condensate (condensate is mostly made up of pentane that consists of five carbon atoms and 12 hydrogen atoms) could be accomplished relatively simply based on the hydrocarbon analysis of the M-18 well. However, there is not very much local demand for propane and condensate. The largest proximal market for condensate is the oil sands industry in northern Alberta. The condensate is used to dilute the heavy bitumen produced so it can flow easier. Transporting condensate from the M-18 well is not cost or environmentally effective. There may be local demand for propane, but this existing demand will have the option to use cleaner burning LNG fuel. The cost to convert propane heating infrastructure to natural gas is quite small. Once the region adopts natural gas infrastructure the propane produced from the well would have very little local demand and

trucking the propane outside of the region would not be economic.

Carbon and hydrogen can be combined to make a SynDiesel®. SynDiesel® is a cleaner burning diesel when compared to ultra-low sulphur diesel (ULSD) – the type of diesel that would be purchased at a typical gas station. SynDiesel® has very little sulphur, nitrous-oxide, or particulate matter.

Emissions are reduced when burning SynDiesel® compared to ULSD trucked in from other jurisdictions. There is local demand for SynDiesel® fuel that requires no different infrastructure when compared to diesel to burn. From a technical and environmental perspective, SynDiesel® represents the best hydrocarbon to create from the M-18 well's production and it can be used locally to reduce GHG and other emissions.

9.3.2 How should we transport the energy products to the communities?

From the M-18 well the natural gas could be transported to various demand points via a pipeline or truck. A cost-effective pipeline route would aim to make maximum use of existing infrastructure following the ITH and could be tied into existing natural gas infrastructure in Inuvik. Trucking natural gas can be accomplished through two methods:

1. Compressing the natural gas by increasing its pressure (CNG), or,
2. Condensing the natural gas into a liquid (LNG) by reducing its temperature.

When natural gas is condensed into liquid natural gas (LNG) it is approximately 1/700th the size it was previously providing a denser product to transport at low pressures. When natural gas is compressed its reduction in size is proportional to the amount of pressure applied. In newer CNG transportation trailers the pressure is increased to approximately 3,000 pounds per square inch (psi) that reduces the natural gas to approximately 1/200th of its size.

Independent studies have shown that constructing a pipeline to service Inuvik and Tuktoyaktuk requires a higher capital investment and is less economic. Utilizing pipeline for natural gas distribution to various communities is less economic, but also less flexible. New markets for natural gas and SynDiesel® products cannot be easily tied-in to existing infrastructure and would require additional pipelines built to service new regions.

There are negative environmental impacts of pipeline installations. There would need to be significant design and capital to ensure the permafrost would not be impacted negatively by having natural gas pipelines passing heat into the ground. Also, pipeline construction would occur over 150 km of northern land with ground disturbance, noise, and wildlife impacts. A 150 km above-ground pipeline could create a serious barrier to wildlife movement. These impacts are greater when compared to a centralized CNG or LNG facility that then moves product over the existing highway infrastructure.

With a robust LNG and SynDiesel® supply chain, new customers can be added with minimal investment (if any) into new transportation units and customer storage. The reduction of initial capital allows existing diesel customers to easily begin using the cleaner and less expensive SynDiesel® product.

The LNG supply chain will provide greater local economic development and these opportunities will be ongoing over the length of the project. In comparison, a pipeline solution will have a smaller need for employment and training opportunities over the operating life of the Project.

9.3.3 Which Method should we use for preparing the gas for transport?

There are a number of reasons why LNG is the preferred method of natural gas transportation when compared to CNG.

Large Number of Assets Required for Storage: Within the CNG industry, the preferred method of storage is the actual CNG transportation trailer. To supply Inuvik and Tuktoyaktuk with seven days of natural gas storage there would need to be approximately 60 CNG trailers constructed, not including the trailers travelling the road. The large number of storage units increases the footprint required at site. It can also increase maintenance and operating costs and health and safety incidents due to the complexity of the operations required at site.

Higher Transportation Costs and Traffic: LNG trailers can hold significantly more natural gas when compared to CNG trailers. Therefore, delivered costs of CNG are more expensive because loads are smaller. Because of the small trailer size, there will be more road traffic associated with CNG trucking to meet the heat, power, and fuel demands of the communities when compared to LNG. Having less loads travel the highway will result in less environmental impact, less road maintenance, and less road congestion.

Prohibitive Capital Requirement: The capital cost estimated for the CNG solution was higher than LNG because of the elevated costs for storage and transportation for the CNG. This is attributed to the numerous trailers required for storage and transportation of energy. Third-party reports also expected CNG to be the more expensive option compared to LNG.

Uncertainty with Large Storage Technology Option: There are two other storage options for CNG (other than CNG trailers) and they are horizontal bullets and spheres. Although storage of gaseous products in bullets and spheres is common practice within the industrial gas industry, this approach is not typical in the CNG sector. CNG storage options are very high pressure and are often greater than 3,000 psi, compared to LNG storage that is typically less than 150 psi. It is very difficult to find Canadian vendors for CNG because of the difficulty in manufacturing and welding 8-inch thick walled structures. There is high uncertainty that larger storage technology options could be found.

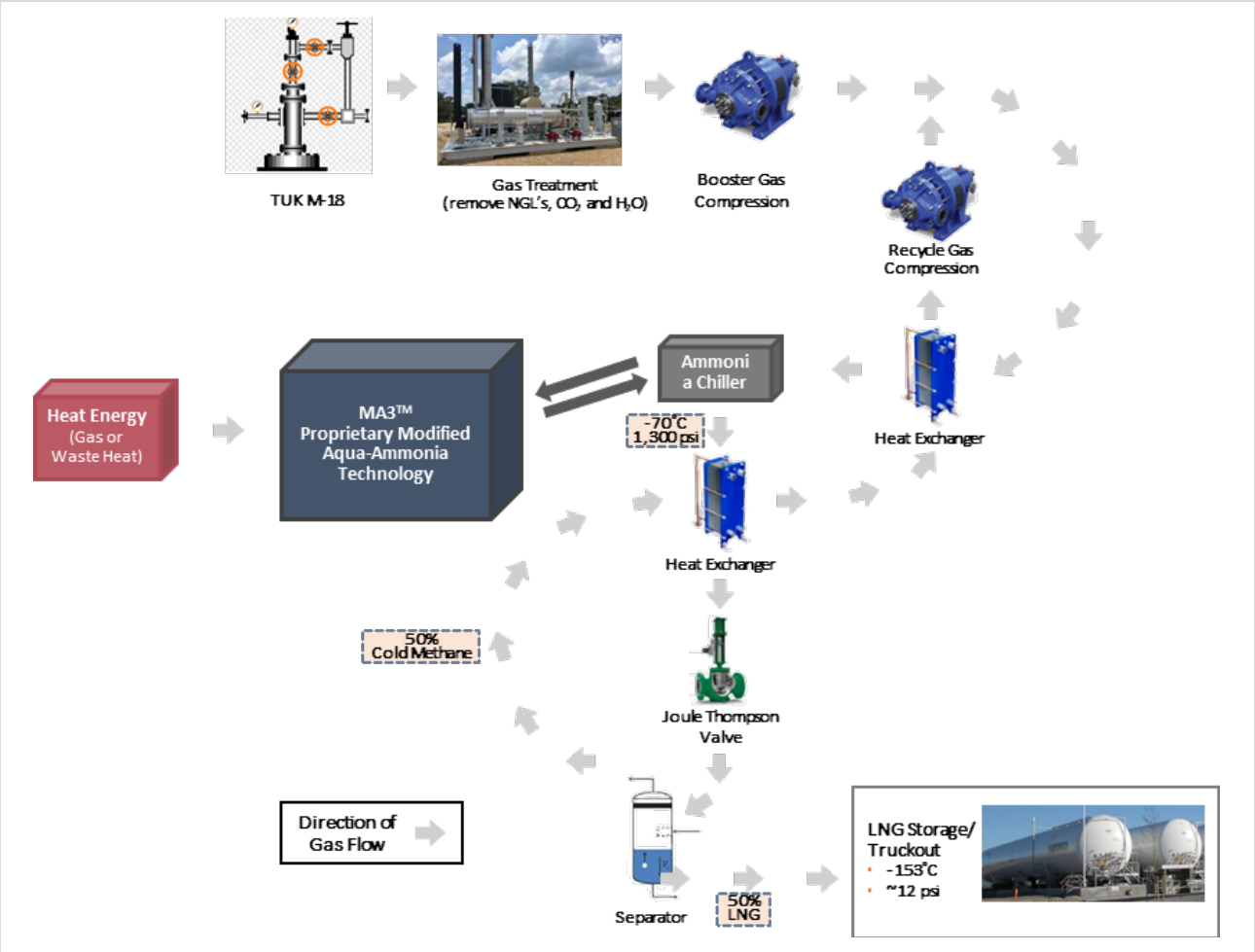
Significant Local Logistics, Maintenance, and Skilled Driver Requirements: Trucking CNG is a high-risk element of the project due to the increased number of drivers, trailers, and loads required to provide local communities with heat, power, and fuel. An interruption in the energy supply chain brought about by a mechanical failure of a truck, if not corrected immediately, could leave a community without energy. An LNG operation can be more easily managed with an experienced transportation and logistics provider that will train and develop local LNG skills and experience to support the long-term success and growth of logistics, maintenance, and driver capacity.

The Project will utilize LNG as the method to truck natural gas to provide heat, power, and fuel for customers in the communities.

9.3.4 Which Technology should we use to liquify the gas?

The application of MA3™ for LNG configuration is called Dense Phase Liquefaction Cycle (DPLC™). With DPLC™, chilled high-pressure natural gas in the dense phase is flashed to a lower pressure using MA3™, producing roughly half of the product into LNG. The remaining gas is a cold recycle stream which provides a portion of the refrigeration, adding to the refrigeration provided by the MA3™ refrigeration system.

Pre-treated inlet gas enters the DPLC™ process equipment, runs through a booster compressor, the pressurized gas then joins a stream of recycle gas that is returning via two heat exchangers and a recycle compressor. The commingled gases then pass through the initial heat exchanger and an ammonia chiller, which cools the gas to approximately -70 oC using the MA3™ process. From the ammonia chiller, the chilled gas passes through a second heat exchanger and is throttled through a Joule Thomson valve and into a separator, where approximately half of the gas liquefies into LNG, which is then held in storage. The remaining cold gas is then recycled through both heat exchangers and a recycle compressor and subsequently commingled with the inlet gas stream, from where the process continues.



DPLC™ is highly efficient because it reduces the overall mechanical rotating equipment scope compared to most current commercial liquefaction technologies. The reduced level of rotating equipment scope lowers capital and operating costs. All the current commercial technologies contain a greater number of compressors and/or expanders. This equipment tends to be maintenance intensive. For stand-alone sites, DPLC™ utilizes recycle and flash compressors that augment refrigeration provided by MA3™.

One of the critical needs of small-scale LNG liquefaction is the ability to ramp production up and down according to varying market demand, while maintaining operating efficiency. Turbomachinery, as used in existing facilities, is not designed for ramping up and down and doing so tends to increase maintenance requirements. DPLC™ can ramp production up and down (10:1 turndown) primarily by adjusting the thermal input driving the MA3™ refrigeration system with minimal loss of efficiency.

The relevant alternative technologies are closed loop N_2 expander or mixed-refrigerant systems. All technologies require pre-treatment of natural gas feedstock and site storage for LNG product, but the liquefaction train is different. The closed loop N_2 expander or mixed-refrigerant systems have higher rotating equipment requirements that generally have less flexibility with fluctuations in operating conditions. N_2 expander systems have less turndown capability, and mixed refrigerant systems have higher complexity with refrigerants that must be monitored and adjusted with changing operating conditions. DPLC™ technology has low system complexity that requires simple control strategies for maintaining desired system temperatures, fluid levels, solution concentrations, and LNG production rates.

The key quantitative and qualitative performance parameters are indicated in Table 9-3. When considering investment in liquefaction, the various processes can be evaluated in different ways. Efficiency and power consumption will affect the operating costs of a process facility. While overall complexity and increased use of rotating equipment will generally improve efficiency, it will also increase capital costs. The table below reflects a high-level comparison of the various small-scale LNG technologies and DPLC™.

Table 9-3: Performance of Various Small-Scale LNG Technologies

Criteria	N_2 Expander	SMR	PRICO	DPLC™
Efficiency	Low	Low/Moderate	High	Low
Complexity	Low	High	High	Low
Heat Exchanger Type	Plate-fin	Plate-fin	Plate-fin	Plate and Frame
Heat Exchanger Area	Low	Low	Low	Low
Flexibility	Low	Moderate	Moderate/High	High

Overall, the DPLC™ ranks very well relative to other technologies: low complexity, low heat exchanger area, and high flexibility. The "low" efficiency rating of the DPLC™ refers to the ratio of total cold produced divided by the total energy consumed. It does not consider or differentiate the quality of the energy consumed. DPLC™ uses a high proportion of low-grade thermal energy, which can be provided as waste heat (<200°C), versus high grade shaft energy for mechanical refrigeration compressors (electrons or direct fired are approximately 33% efficient). In the M-18 project the thermal heat will be supplied by burning methane and the industrial heaters will have thermal energy efficiency of approximately 85%.

9.3.5 What will IESP use for Power Source and Fuel Source at the Energy Centre?

The gas processing and LNG facility will require less than two megawatts of power depending on the utilization of the equipment. There are no proximal transmission lines as the Project will support the power generation capacity of the region. The Project will need to be self-sustaining with respect to its power needs and generate behind-the-fence (BTF) power. It should be noted that the steam generated at the gas processing and LNG facility will be passed through a steam turbine to generate electricity to reduce the BTF power generation requirements and increase the facilities efficiency by capturing waste heat.

There are three main methods of BTF power that was considered for the Project.

1. Renewables, including solar and wind
3. SynDiesel®
4. Natural gas

Renewables are not preferred for BTF power generation for four primary reasons.

- **Large Footprint of Renewables:** Constructing two megawatts of solar power would require over 6,000 panels that requires a large land footprint. The land footprint for wind turbines would also be large as wind turbines would be limited in available sizes due to construction constraints. The permafrost in the Inuvialuit region is prohibitive to constructing wind turbines.
- **Uncertainty of Power Production:** The solar and wind power produced would be unpredictable. The gas processing and LNG facility require very specific power needs. For example, large compressors are driven by powerful motors that need stable and constant voltage and amperage to perform. Deviation from the power needs that would occur with renewable power generation would shut-down the gas processing and LNG facility resulting in poor environmental, safety, and maintenance performance of the facility.
- **Significantly Higher Capital Costs:** In order to build the capacity required to provide the gas processing and LNG facility with adequate power over the project life span a significant amount of capital would need to be deployed. Higher capital costs are recovered and passed onto the customers through higher power, heat, and fuel rates.
- **Low Efficiency of Technology:** Solar panels are not at the ideal angle to the sun when located at high latitudes and are significantly de-rated in northern Canada. Wind turbines will face freezing on the blades that greatly reduce their efficiency.

SynDiesel® and natural gas are both economic, viable, and environmentally focused solutions to generate power at the gas processing and LNG facility. Both are preferred alternatives that would be produced at the facility. From an operational perspective, natural gas and SynDiesel® generation equipment has no special labor or supervisory requirements, however, natural gas is the cleanest burning hydrocarbon and will have less GHG emissions associated with power generation. From a capital perspective, diesel generation equipment would be slightly less expensive. Natural gas would have lower operating costs and over the life of the Project would be preferable from an economic point of view.

Natural gas is the preferred alternative for BTF power generation because it is superior to SynDiesel® in operating costs and its environmental impact.

9.3.6 Office and Support Facilities – Worker Accommodations

Some remote facilities provide camp accommodations for workers. The other option to remote camps is having workers travel to the site every day. The Project will not provide camp accommodation for its workers and will require workers to travel from their home community for their work shifts. This will reduce the costs of the project and will also allow workers the ability to spend more time with their family and friends in the evening and weekends. The onsite footprint of the gas processing and LNG facility will be reduced with no camp accommodations. Human waste and food waste will also be significantly reduced with no camp accommodations with the corresponding benefit that local wildlife will not be disturbed. Having workers travel to the gas processing and LNG facility daily will increase the number of vehicles on the road. This could be reduced easily by providing shared transportation services such as bus transportation for the workers. Workers are preferred to be residents of Inuvik or Tuktoyaktuk resulting in more local opportunities for training and employment in the region.

10.0 DESCRIPTION OF THE BIOPHYSICAL ENVIRONMENT

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

Identify and describe in summary form the important biophysical resources that could be negatively impacted by the proposed development (i.e., climate, oceanographic resources, surface and ground waters, permafrost, vegetation, wildlife, sites of high biodiversity and special conservation status.

Describe the state and condition of the environment and environmental components prior to the proposed development. This information can help distinguish between environmental changes that might otherwise be attributed to the development, from those that could be caused by something else or be natural variation.

10.1 Information Sources and Spatial Areas

The baseline information provided in this Project Description was synthesized from existing literature and recent field studies.

Information was collected from:

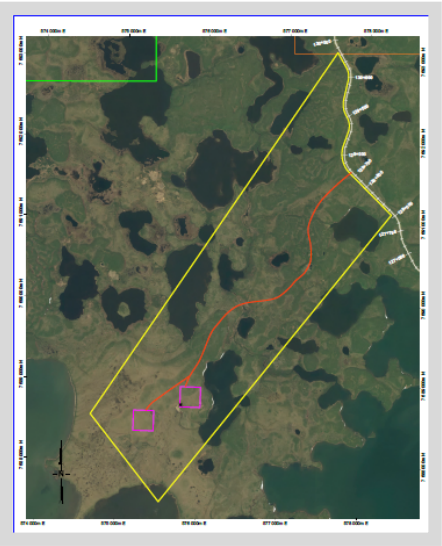
- Six (6) prior and overlapping Project Descriptions available from the Inuvialuit Environmental Impact Screening Committee (EISC), Environmental Impact Review Board (EIRB) and Inuvialuit Water Board (IWB) online registries (see Section 18).
- Tuktoyaktuk and Inuvik Community Conservation Plans.
- Reports and maps from governmental websites.
- Online climate datasets and species registries.
- Previous technical reports on various biophysical studies made in the same Regional Study Area (RSA) and Local Study Area (LSA).
- New technical documents produced since the implementation of ITH project.
- Eight (8) recent (2018-2020) field studies conducted within the LSA.
- Beaufort Regional Coastal Sensitivity Atlas
- Recent traditional land use interviews in Tuktoyaktuk.

Aerial photo of the LSA looking north

The baseline herein is provided with emphasis on the LSA and on the 8 recent field studies conducted by Kiggiak-EBA, Soriak Consulting and recent traditional land use interviews. The IESP has invested hundreds of thousands of dollars in the last three years on studies to ensure the biophysical environment of the LSA is well understood with the intent to fulfill the goals of the IFA to protect and preserve Arctic wildlife, environment and biological productivity.

As described in greater detail in Section 14, the Project Description uses three spatial areas for the Impact Assessment:

Local Study Area (LSA) – defined as: "The spatial area within which local effects are assessed (i.e., within close proximity to the action where direct effects are anticipated)". The LSA selected for the Project includes the area in the vicinity of the M-18 wellsite, including the private access road corridor and extending a setback of 250m from the proposed pad areas and the proposed access road; and a radius of 500 m from the wellsite itself. By comparison, a 500m setback is five times greater than the safety setback distance required by the Alberta Government for a sweet well in Alberta. See Figure 5-3.



Regional Study Area (RSA) – defined as: "The spatial area within which cumulative effects are assessed (i.e., extending a distance from the project footprint in which both direct and indirect effects are anticipated to occur)". The RSA selected for this project is conservative and includes an area extending in a 10km radius from the M-18 wellsite (See Figure 5-2). This radius incorporates the entire watershed of Gunghi Creek upstream and downstream of the Project site and an area extensive enough to fully assess potential air quality impacts. For context, the emergency evacuation zone radius from a wellsite or sweet gas plant emergency in Alberta is 1.6 km.

Zone of Influence (ZI) -defined as "a geographic area, extending from an action, in which an effect is non-trivial." (Hegmann et al. 1999). The project ZI includes Tuktoyaktuk, Inuvik, the west portion of Husky Lakes, and the entire Inuvik Tuktoyaktuk Highway (ITH).

An environmental overview of the Project LSA is provided in Table 10-1.

Table 10-1: Environmental Overview of the Local Study Area

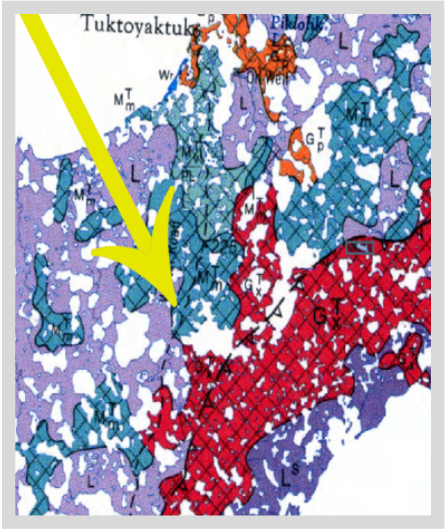
Environmental Component	Characteristics / Conditions of the LSA
Location	12 to 16 km south of Tuktoyaktuk, Northwest Territories, Canada, 3.5 km west of the Inuvik Tuktoyaktuk Highway. M-18 coordinates are 69° 17' 50.5"N latitude and 133° 4' 44.5"W longitude.
Climate	Low arctic ecoclimate. Average annual temperature -11°C. Average annual precipitation 130-190 mm. Severe winter climatic conditions. Extreme temperatures range from -49C (January) to +29C (July). Wind is dominantly from SE/E/NE and secondarily from W/NW.
Climate Change Considerations	Warming trend increased in last ten years. Shorter and warmer winters; and colder and wetter summer with less sunshine. Permafrost sensitivity is classified as High.
Terrain	Low elevation (10-25 metres above sea level), undulating to hummocky till plain; numerous pingos, low-and high-centre polygons, ponds and high ice content. 16% of the LSA is water.
Surficial Geology	West Tuktoyaktuk Peninsula / Tuktoyaktuk Coastal Lowlands. Glacial, delta and floodplain sediments. Glacial moraine and till (poorly sorted sediment left behind by glaciers) with colluvial (material from creeping, slumping or debris flows); fluvial (sediment deposited by small streams); or lacustrine (sediment from pre-historic lake beds) influences.
Bedrock Geology	Tertiary shales and sandstones. Iperk Formation, that were deposited near the paleo Beaufort Sea shoreline. Depth to bedrock was recorded as 21m below ground surface during drilling of the M-18 well.
Permafrost	Continuous permafrost with areas of talik (unfrozen ground below water bodies). Thin organic layer throughout acts as insulation. Active layer in late August varies from 20 cm to 70 cm deep,

Table 10-1: Environmental Overview of the Local Study Area	
Environmental Component	**Characteristics / Conditions of the LSA**
	with an average of 45 cm. Ground temperatures were measured in the LSA on April 27, 2020 with results at depth ranged from -3.3°C to -5.6°C, which are considered representative of site conditions across the LSA.
Seismicity	National Building Code of Canada Site Class C: very dense soil and soft rock. Natural Resources Canada estimates a peak ground acceleration (PGA) of 0.231 g for the Tuktoyaktuk area, given a 2% probability of exceedance in 50 years. A PGA of 0.231 g relates to very strong perceived shaking and moderate potential damage.
Soils	Turbic, Static and Organic Cryosols (ice rich permafrost soils) with highly variable moisture, clay, silt and sand content.
Hydrology	The LSA is entirely within the Kugmallit Bay Drainage Basin, with many isolated and interconnected lakes and ponds covering 16% of the LSA surface area. There is one creek that will require crossing (less than 5m wide), primarily flowing from Tiktaliq Lake into the Gunghi Creek drainage. The largest lake in the LSA is an unnamed lake about 350m east of M-18. The lake is 39.3 ha in size with an average depth of 2.06m and a maximum depth of 8.43m.
Ecological Classification	Tuktoyaktuk Coastal Plain Ecoregion of the Southern Arctic Ecozone
Fish	At least ten spp. of fish are expected to be encountered in the LSA, including important harvest species Lake Whitefish, Inconnu, Lake Trout and Northern Pike. Water bodies in the LSA drain to Kugmallit Bay. No connection to Husky Lakes.
Vegetation	Nine communities of vegetation types. The most common vegetation types were Upland Shrub (33%), Dwarf Shrub Heath (22%), High Centered Polygons (15%), and Cotton Grass-Tussock (10%). Together with water (16%), these vegetation types add up to 96% of the Study Area. Common plants encountered were willows, blueberries, green alder, labrador tea, dwarf birch, bearberry, crowberry, cloudberry, and cotton grasses. No rare plants were detected during field studies.
Wildlife	Potential for 11 species or groups of management concern to be present, including waterfowl, raptors, passerines and three mammals: Grizzly Bear, Wolverine and Barren-ground Caribou. Of the 8 bird species of management concern, the LSA provides suitable habitat for five birds: Horned Grebe, Red-Necked Phalarope, Short-eared Owl, Harris's Sparrow, and Rusty Blackbird.
Archaeological Resources	No known sites in the LSA. There is a high potential for additional archaeological sites in elevated terrain near water. The RSA includes five previously recorded archaeological Inuvialuit sites within five kilometres of the proposed study area that represent prehistoric campsites and include the remains of fishing practices. The sites are located at elevations of 15 m above sea level or higher and associated with large water bodies to the east and west of the LSA. There is one burial site east of the LSA and within the RSA.
Land Use	The LSA is entirely within Inuvialuit private 7(1)(a) Land and the Tuk 2 Oil and Gas Concession. Overlaps with 8 categories of designated lands defined by the Tuktoyaktuk Community Conservation Plan; and two categories defined by the Inuvik Community Conservation Plan. Mainly natural cover. The LSA is not traditionally used for fishing or trapping and is in a No hunting zone for caribou. The North corner of the LSA borders on the ITH and the Municipal boundary of Tuktoyaktuk. Land disturbances for oil and gas exploration since the 1960's have left linear features on the land. There are no cabins in the LSA and one cabin in the RSA, located about 2.5 km east of the ITH. The M-18 wellhead, former drilling waste sump and reclaimed kitchen sump (not used); and the TUK L-09 abandoned well (no surface structures) are the only man-made structures within the LSA.
Community Conservation Areas	Seven category C and one category E (701E: Blue-nose West Caribou Herd Winter Range) special designated lands overlay the Project Area. The LSA is 3-7 km inside the 701E Area.

Table 10-1: Environmental Overview of the Local Study Area	
Environmental Component	**Characteristics / Conditions of the LSA**
Environmental Elements Sensitive Areas	1. Permafrost 2. Gunghi creek watershed 3. Blue-nose West Caribou Herd Winter Range 4. Migratory Bird Habitat 5. Proximity to and use of the ITH

10.2 Geology, Soils and Permafrost

The surficial geology of the Tuktoyaktuk Peninsula consists of thick unconsolidated sediments, moraines, ice contact, glaciofluvial and organic lacustrine (lakebed) deposits (Rampton, 1987). The LSA occurs in an area mapped as ground moraine with a thin organic veneer (Rampton 1987). The till and glacial deposits are of the Buckland Glaciation, and till and associated gravel and sand deposited directly, or with minor reworking by glacier ice, are generally modified by cryoturbation (frost churning) (Kiggiak-EBA Consulting Ltd. 2017). See Figure 10-1.



Surficial geology

Bedrock in the Mackenzie Delta is sedimentary, comprised of tertiary-period shale and sandstone. Pre-glacial, glacial, and postglacial deposits overlie the bedrock. No bedrock outcrops were observed within the LSA (Kiggiak EBA 2019a). During the drilling of the M-18 well in the southern part of the LSA, depth to bedrock was reported 21 metres below ground surface (bgs). Nonetheless, the depth to bedrock is believed to be greater than the practical depth of development of the surface infrastructure.

10.2.1 Terrain

The Project Area lies within the Tuktoyaktuk Coastal Plain Ecoregion. (ECG, 2012). This ecoregion extends east from the Mackenzie River East Channel to encompass the land surrounding the Husky Lakes and Kugmallit Bay (See Figure 10-2). The terrain is characterized as hummocky with irregular deranged drainage patterns. Some of the terrain is poorly drained due to the ice contact deposits, glacial depositional features, and thermokarst (numerous “sinks” caused by thawing) activity.

Regional Physiography

The Tuktoyaktuk Coastlands are, for the most part, lowland, rarely rising more than 60 m above sea level (masl). Commonly 30 to 50% of the area is covered by lakes (Rampton, 1988; Mackay, 1963). Pingos, massive ice, and slope failures caused by the thaw of exposed ground ice and slumping of thawed soil are common to most of the Tuktoyaktuk Coastlands (Rampton, 1988), including the LSA. Depressions are typically post glacial lakes or infilled with organic-rich bogs and post glacial lacustrine silt and clay sediments (Rampton, 1988). Thaw flow slides and polygonal terrain were identified in the RSA and LSA. Elevations within the LSA range from 20masl in the south part to 35masl at the proposed ITH intersection. The ground elevation at the

IESP Energy Centre is expected to be about 30masl.

10.2.2 Soils

Cryosols (mineral and organic soils that have permafrost within one or two metres of the soil surface) are the dominant soil types in the Project Area. Turbic Cryosols are soils that develop on weakly to moderately calcareous fine clayey and fine loamy glacial till, while Static Cryosols are associated with soil development on well-drained glaciofluvial deposits (ECG 2012). Organic Cryosols are present in low lying terrain, depressed and or channeled areas (KAVIK-STANTEC 2015). These soils are underlain by a continuous layer of permafrost and are often water-logged due to poor drainage. Cryosols are challenging to build on because of their high ice content.

Pedon of Cryosol

In August 2018, 23 test pits were dug throughout the LSA to provide detailed terrain mapping and active layer thicknesses (Kiggiak-EBA 2019a). The active layer is the ground surface layer which thaws every summer and re-freezes every winter. Active layer thicknesses would be near their maximum in late August. Thicknesses measured in the LSA on August 27 and 28, 2018 ranged from 20 cm to 70 cm thick, with an average of 45 cm.

In March 2020, eight vertical boreholes ranging in depth from 8.0 mbgs (metres below ground surface) to 20.0 mbgs were drilled by Kiggiak-EBA in several points of the LSA, including the proposed creek crossing, the proposed infrastructure pad and up gradient of the existing M-18 drilling waste sump along the proposed access road route.

The following table (Table 10-2) summarizes the geotechnical findings of the eight boreholes (derived from Kiggiak EBA 2020).

Table 10-2: Geotechnical Characteristics of the Local Study Area

Parameter	Value / Condition
Moisture content	6% - 167%
Fine grained	5% - 66% clay; 18% - 77% silt
Coarse grained	0% - 96% sand; 0% - 44% gravel
Organic material thickness	0.1 m - 0.25 m
Silt layer thickness	1.5 m - 3.9 m
Sand layer thickness	1.8 m (only present in BH20-02 borehole)
Clay layer thickness	4.8 m - 7.2 m
Plasticity	Low to medium
Pore water salinity	1 - 6 ppt

Table 10-2: Geotechnical Characteristics of the Local Study Area	
Parameter	**Value / Condition**
Bulk density	1,112.8 - 1,956.9 kg/m^3

10.2.3 Permafrost

Permafrost exists throughout the LSA and RSA. Mean annual ground temperatures typically range from minus -2°C to minus -5°C, although unfrozen taliks are present under large lakes and perennial river channels. Taliks are layers of year-round unfrozen ground in permafrost areas that occur underneath shallow streams, rivers and thermokarst lakes, where deep or flowing water does not freeze in winter, and thus the soil underneath will not freeze either. It is characterized by high ground ice content (greater than 20%) in the upper 10-20 m of the ground.

Photo of thermistor installed March 2020

Ground temperature measurements taken approximately 2.5 km north of the LSA, (where the ITH crosses Gunghi Creek), are about -3.7°C to -4.0°C at depths of 15 m to 20 m below the top of embankment. Ground temperatures were measured in the LSA on April 27, 2020 with results at depth ranged from -3.3°C to -5.6°C. These results are considered typicrepresentative of site conditions across the LSA (Kiggiak-EBA 2020). Four thermistors were installed in the LSA in March 2020 to provide baseline temperatures and for ongoing monitoring of the permafrost. Geotechnical sample locations and thermistor locations are provided in Figure 10-3.

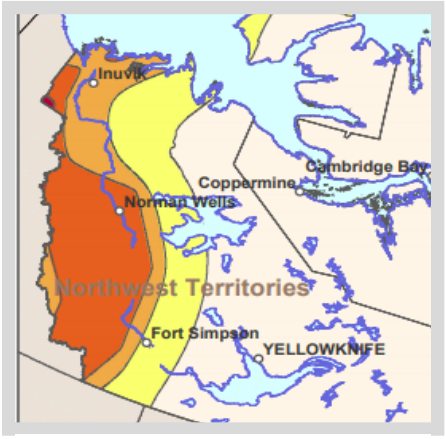
10.2.4 Permafrost and Climate Change Considerations

Historical data from the Tuktoyaktuk Meteorological Station indicate a warming trend of approximately 0.05°C per year since 1950, and more recently the warming trend has increased. The sensitivity of the site to potential climate change is therefore considered “High”.

For shallow foundations, the permafrost sensitivity is “High”, and the consequence is considered to be “Major”. The combination results in a Risk Level “A”, which requires a detailed quantitative analysis to design foundations. For deep foundations, the permafrost sensitivity is “High”, and the consequence is considered to be “Minor”. This combination results in a Risk Level “B” (Kiggiak-EBA 2020).

10.2.5 Seismic Site Classification and Seismic Hazard

The Geological Survey of Canada (2015) rate the Kugmallit Plain area as Medium-High (4 out of 5) for seismic hazard. The National Building Code of Canada (NBCC, 2015) provides a seismic classification based on the stiffness of the upper 30 m of soil. Based on available shear wave velocity data for frozen ground and considering that the soil beneath the site structures in the upper 30 m of the soil column is likely to be frozen over the project service life, the seismic classification for the site is interpreted to be Site Class C. (Class A is most resistant to earthquakes and Class F is least.) NBCC (2015) through Natural Resources Canada (2016) also provides interpolated seismic hazard values, with a peak ground acceleration (PGA) of 0.231 g for the Tuktoyaktuk area, given a 2% probability of exceedance in 50 years. A peak ground acceleration of 0.231 g relates to very strong perceived shaking and moderate potential damage.



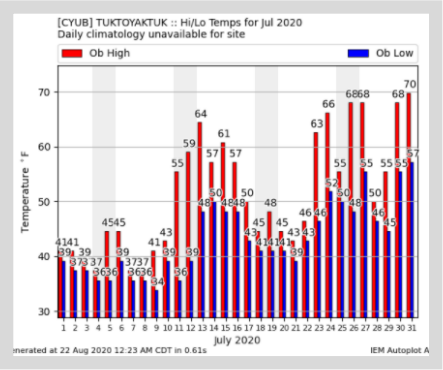
GSC seismic regions in the NWT

10.3 Climate

10.3.1 Regional Climatic Conditions

The Tuktoyaktuk Coastal Plain Ecoregion is classified as having a low arctic ecoclimate. The region experiences very short, cool summers and extremely cold and long winters (ECG, 2012). The average annual temperature is approximately minus -11°C, with an average summer temperature of 6°C (July) and an average winter temperature of minus -28°C (January) (ECG, 2012). Extreme temperatures vary widely from an extreme high in July of 29.4°C to an extreme low in January of minus -48.9°C. Winters in this area tend to be long, and there is an approximate two-month period where the sun does not rise above the horizon. During this period the extremely cold conditions prevail and may last for several weeks at a time. Very little precipitation falls when temperatures are this low. While precipitation is highly variable in the coastal regions, there is a general increase from the coast southwards. The average annual precipitation at Tuktoyaktuk is 130-190 mm, with about 50% falling as rain and 50% falling as snow (ECG, 2012). Areas near open water tend to receive most precipitation during summer and autumn before freeze-up, while areas further inland have a higher frequency of precipitation occurring in autumn and winter (IEG, 2001). Snow and freshwater ice persist for 6-8 months of the year. By mid to late June most of the snow on land has melted, although lake ice may persist until July. Spring runoff (freshet) is highly influenced by snow melt and is typically early to mid-June in the RSA. A series of satellite images provided in Figure 10-4 show how, in a matter of a few weeks, the landscape changes from snow and ice to ice free. Snow can fall at any time of year, but generally will begin to accumulate in early September.

10.3.2 Tuktoyaktuk Meteorological Station Data



Climate data from the meteorological station at Tuktoyaktuk has been collected and compiled by Environment Canada. Engineering Design requirements for the IESP examined the extreme climate conditions for temperature, precipitation, wind, and snow depth to ensure all aspects of design could meet the extreme climate of the region.

Climate normals and extremes between 1981 and 2010 have been summarized in Table 10-3.

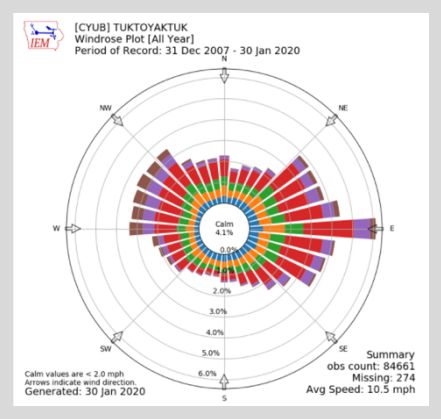
Table 10-3: Climate Normals for Tuktoyaktuk (1971-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature													
Daily Average (°C)	-26.6	-26.4	-25.1	-15.7	-4.7	6.4	11.0	8.9	3.3	-7.4	-20.7	-23.8	-10.1
Standard Deviation	4.1	4.6	3.2	2.6	2.8	1.1	2.0	1.8	1.7	2.6	3.8	3.8	1.3
Daily Av. Maximum (°C)	-23.0	-22.4	-21.1	-11.3	-1.1	11.0	15.1	12.3	5.8	-4.7	-17.3	-20.1	-6.4
Daily Av. Minimum (°C)	-30.4	-30.6	-29.2	-20.1	-8.2	1.7	6.9	5.4	0.7	-9.9	-24.0	-27.5	-13.8
Extreme Maximum (°C)	0.6	0.7	-0.5	4.8	20.9	28.2	29.4	27.6	20.9	17.4	2.2	0.8	
Extreme Minimum (°C)	-48.9	-46.6	-45.5	-42.8	-28.9	-8.9	-1.7	-2.5	-12.8	-28.5	-40.1	-46.7	
Precipitation													
Av. Rainfall (mm)	0.0	0.0	0.0	0.0	1.4	9.7	22.2	24.4	15.5	1.3	0.0	0.3	74.9
Av. Snowfall (cm)	13.4	10.2	9.0	9.4	6.2	1.3	0.1	1.2	8.9	20.1	12.1	11.2	103.1
Av. Precipitation (mm)	10.5	8.9	7.2	8.3	6.8	11.0	22.3	25.7	23.3	18.4	9.6	8.7	160.7
Average Snow Depth (cm)	25	28	34	35	18	1	0	0	0	6	13	18	15
Median Snow Depth (cm)	25	28	34	36	19	0	0	0	0	5	13	17	15
Snow Depth at Month-end (cm)	28	31	36	31	5	0	0	0	1	10	15	20	15
Extreme Daily Rainfall (mm)	2.5	0.4	0.0	0.4	4.6	30.4	19.6	14.7	24.2	8.0	1.0	4.8	
Extreme Daily Snowfall (cm)	13.0	9.8	6.5	7.1	9.6	7.6	1.0	7.4	12.8	11.8	15.0	9.4	
Extreme Daily Precipitation (mm)	8.4	9.8	6.5	7.1	10.8	30.4	19.6	14.7	24.2	9.1	15.0	9.4	

Table 10-3: Climate Normals for Tuktoyaktuk (1971-2010)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Extreme Snow Depth (cm)	61	62	72	72	61	45	0	0	21	26	34	49	
Wind													
Maximum Hourly Speed (km/h)	78	89	63	59	67	54	81	74	87	69	85	89	
Direction of Maximum Hourly Speed	W	W	W	W	NE	NW	NW	SW	W	W	NW	NW	
Source: Environment Canada (2018), Tuktoyaktuk A Climate Station #2203912 (69°26'00.000" N, 133°01'35.000" W)													

10.3.3 Wind

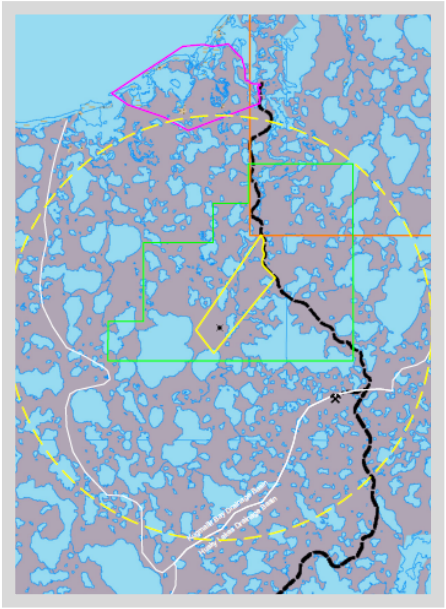
Wind data from the meteorological station at Tuktoyaktuk James Gruben Airport (YUB) has been collected and compiled by Iowa State University for their Environmental Mesonet project. The summary from 2008 to 2020 used 84,661 observations to plot a wind rose. (See Figure 10-5.) The All Year summary shows that wind in Tuktoyaktuk is dominantly from the SE/E/NE and secondarily from the W/NW. Wind from the south is much less frequent (plotting less than 11%). The data summary provided by Environment Canada (Table 10-3 above) shows that maximum speed winds are typically (10 out of 12 months) from the west or northwest. Wind rose data was used for air modelling to determine the airshed of any emissions from the project. Since the closest community is due north of the proposed project, infrequent wind from the south means that emission impacts will be less severe, less frequent and not likely 89% of the time.



10.4 Hydrology and Water Quality

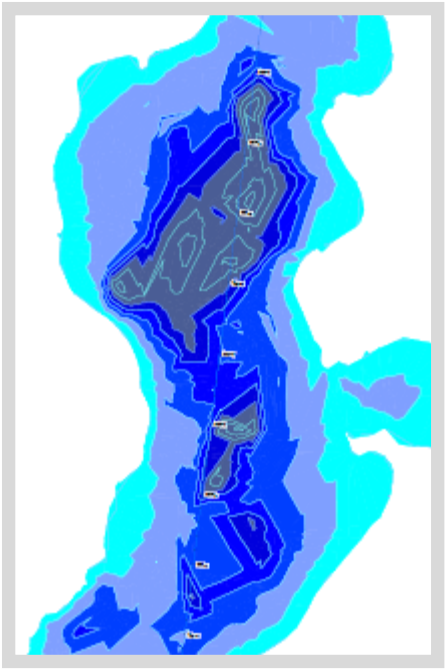
10.4.1 General Hydrological Description

Most of the RSA sits within the Kugmallit Bay Drainage Basin. Located north and west of the Husky Lakes, this drainage system is characterized by a large number of both isolated and interconnected lakes that drain into the Kugmallit Bay and Tuktoyaktuk Harbour (IEG, 2001). Similar to the entire Tuktoyaktuk Peninsula, these lakes cover 30% to 50% of the surface area (Ramlal *et al*., 1994). The south-east quadrant of the RSA is located within the Husky Lakes Drainage Basin, with drainage flowing into the western end of the Husky Lakes through interconnected lakes and ponds (See Figure 10-6).



The LSA, including the existing wellhead and sump, and all proposed development, is entirely within the Kugmallit Bay Drainage Basin. All drainage in the LSA flows into the Gunghi Creek watershed. There is no flow of water from within the LSA to either Tiktaliq Lake to the southeast nor Iqalushaq Lake to the west. Surface drainage from the existing wellsite lease flows into an unnamed lake immediately east, which flow northward through other ponds and lakes, eventually connecting to Gunghi Creek and into Tuktoyaktuk Harbour (See Figure 10-6.) Sixteen percent (16%) of the LSA is water. (Kiggiak EBA, 2019c)

Bathymetric (depth) surveys were taken of Tiktaliq Lake (referred to as Lake 120 in the IMG Golder ITH report) during the studies for the ITH (IMG Golder, 2012). The lake covers an area of 903 ha, with an average depth of 2.41m and a maximum depth of 8.0 m. IMG Golder (2012) estimated that the total available winter water volume (assuming 2.0m of ice) is more than 4.2million cubic metres. A map of the survey is provided as Figure 10-7.



Bathymetric surveys were taken in August 2018 of the unnamed lake immediately east of M-18. The lake covers an area of 39.3 ha, with an average depth of 2.06m and a maximum depth of 8.43m. Inukshuk Surveys estimate that the total available winter water volume (assuming 2.0m of ice) is more than 268,500 cubic metres. The results of that survey are shown in Figure 10-8. The unnamed lake has a pond connected at the south end which is a failed sump remaining from Imperial Oil exploration in 1968. The abandoned wellsite and drilling waste sump are completely submerged. The well was drilled by Imperial Oil Ltd and is known as TUK F-18. Water samples will be taken from the lake to establish a baseline chemistry prior to the M-18 development, and on a regular monitoring schedule thereafter.

10.4.2 Aquatics Assessment for Road Crossings

In August 2018, the IESP undertook an aquatics field survey that included hydrologic and fish habitat assessments

to assist with the planning and design of the access road within the LSA. The survey was completed at two potential watercourse crossing locations by a fisheries biologist from Kiggiak EBA, supported by local harvesters. The two watercourses studied are connected but separated by a small pond (Pond 1 on Figure 10-9). The locations of the assessments were based on the two potential access road alignments. Water at this part of the watershed is flowing from Tiktaliq lake towards the northwest and the Gunghi Creek drainage. The following table shows the main characteristics of both sites, named WC1 (upstream east) and WC2 (downstream west):

Table 10-4: Hydrology of Two Alternative Crossings of the LSA Creek

Parameters	WC1 (upstream east)	WC2 (downstream west)
Location	North of the unnamed lake east of M-18, upstream of WC2	North of the big hill west of M-18, downstream of WC1
Origin	Tiktaliq Lake	Unnamed Pond 1 downstream of Tiktaliq Lake
Destination	Unnamed Pond 1 and eventually Gunghi Creek and Tuktoyaktuk Harbour	Unnamed Pond 2 and eventually Gunghi Creek and Tuktoyaktuk Harbour
Type of watercourse	Perennial	Perennial
Average Channel Width	7.05m	3.74m
Average Wetted width	3.0m	2.75m
Water velocities and flow	Low	Low
Flash freshet flows	Expected in late spring	Expected in late spring
Average Water Depth	0.38m	0.22m
Gradient and discharge	Low / 0.041 cms	Low / 0.020 cms
Substrate	More uniform in substrate and cover types	A portion of the channel segment is dominated by gravel and cobble substrates

Although both creek crossing locations are similar, the downstream location (WC2) is less wide, shallower and with lower flow; consequently, the bankfull width is less. Although there is a segment of WC2 that has a gravel-cobble substrate (good habitat for sculpins and salmonids), by mapping this section of WC2 and avoiding it, this location would be preferable for the creek crossing. In addition, WC2 is further from Tiktaliq Lake and allows the access road to remain further from the unnamed lake east of M-18, as well as Pond 1, thereby remaining in compliance with Government of Canada Northern Land Use Guidelines - Access: Roads and Trails (Indian and Northern Affairs Canada, 2010) to remain at least 30m from the lakes.

To determine the bankfull width of the stream during spring runoff (freshet), when the stream would be at its peak, high quality satellite imagery was reviewed for the past four spring seasons (2017-2020). The year which had the best match for high water was 2017 on June 23. The imagery has a 30 cm resolution. The imagery was purchased and downloaded into ESRI GIS software and Google Earth for analysis and measurement. The section of the stream that IESP propose to cross is less than two metres wide bankfull at freshet. See Figure 10-10 for a magnified view of the proposed crossing area.

10.5 Fish and Fish Habitat

According to the Tuktoyaktuk Community Conservation Plan (CCP), the LSA is located within the Fish Lakes and Rivers (704C) Management Area (Community of Tuktoyaktuk *et al*. 2016). This Area provides important fish habitat and are culturally important to the Inuvialuit as both historic and present subsistence harvesting areas for residents of Inuvik and Tuktoyaktuk. Table 10-5 provides a summary of the fish habitat characteristics of the two alternative crossing of the unnamed creek in the LSA.

Table 10-5: Fish Habitat Characteristics of Two Alternative Crossings of the LSA Creek

Parameters	WC1 (upstream east)	WC2 (downstream west)
Location	North of the unnamed lake east of M-18, upstream of WC2	North of the big hill west of M-18, downstream of WC1
Habitat suitability during open water season	Can potentially support various life stages of common fish species, providing seasonal connectivity	Can support various life stages of common fish species, providing seasonal connectivity. The gravel section may also be utilized by gravel-spawning fish species, including potentially Arctic Grayling, which is highly sensitive to disturbance and habitat degradation
Overwintering capacity	Unlikely, as the stream is likely to freeze to bottom	Unlikely, as the stream is likely to freeze to bottom
Rearing habitat	Good rearing habitat for all species	Good rearing habitat for all species

Table 10-5: Fish Habitat Characteristics of Two Alternative Crossings of the LSA Creek		
Parameters	**WC1 (upstream east)**	**WC2 (downstream west)**
Spawning habitat	May be used by Northern Pike and forage fish species that preferentially utilize vegetated areas, such as Ninespine Stickleback. Poor for salmonids given the lack of gravel/cobble substrates.	Spawning habitat for both forage fish species and Northern Pike. The short segment with gravel-cobble substrate may also provide limited capabilities to sculpins and salmonids.
Fish feeding resources	Likely provides feeding areas for adult fish	Suitable for seasonal feeding
Support migrating fish	Only during high flow periods	Suitable for migrating adult large-bodied fish. Upstream movements may be difficult during low water periods

The following fish species were identified in past fish surveys and may be expected within the LSA: Lake Whitefish (*Coregonus clupeaformis*), Round Whitefish (*Prosopium cylindraceum*), Inconnu (*Stenodus leucichthys*), Northern Pike (*Esox lucius*), Arctic Grayling (*Thymallus arcticus*), Lake Trout (*Salvelinus namaycush*), Burbot (*Lota lota*), Least Cisco (*Coregonus sardinella*), Ninespine Stickleback (*Pungitius pungitius*) and Sculpin (*Cottus* spp.). The most important harvest species include Lake Whitefish, Inconnu, Lake Trout and Northern Pike (Community of Tuktoyaktuk *et al*. 2016; IMG-Golder 2012). Actual species presence is dependent on several habitat and watershed characteristics, often including the availability and accessibility of upstream lakes that provide feeding, rearing, and/or overwintering habitats (Kiggiak-EBA 2019b). A general summary of habitat preferences and life history information for these species is provided in Table 10-6.

Table 10-6: Life History Characteristics for Fish Species Common within the RSA						
Fish Species	**Migratory Behavior**	**Spawning Period**	**Spawning Habitat**	**Hatching Period**	**Juvenile Freshwater Habitat Preferences**	**Adult Freshwater Habitat Preferences**
Burbot *Lota lota* *"Tittaaliq"*	Migrate to lake spawning areas in winter Migrate to tributaries in late winter/early spring Migrate to deep water in summer	January-March Water temp. 0-4°C	Under ice in Lakes or river Sand/gravel substrate shallow areas (<3 m bay s or on gravel shoals)	At ice-out	Shallow waters Debris cover Rocky riffles Pools or deeper water in lakes	Mouths of creeks in fall May be found during winter/spring in coastal embayments (brackish or freshwater Deep water in summer

Table 10-6: Life History Characteristics for Fish Species Common within the RSA						
Fish Species	**Migratory Behavior**	**Spawning Period**	**Spawning Habitat**	**Hatching Period**	**Juvenile Freshwater Habitat Preferences**	**Adult Freshwater Habitat Preferences**
Lake Whitefish *Coregonus clupeaformis*	Resident or anadromous	Late September to early October	Lakes and large rivers Hard or stony substrate Water <7.5 m	Late spring	Larvae along steep shorelines Juveniles move to deep water in summer	Deep water in lakes and large rivers.
Round Whitefish *Prosopium cylindraceum*	Limited migrations to lake shallows or upstream to rivers	Late September to October	Gravelly shallows of lakes or river mouths	Spring	Near or beneath rocks	Moderate to deep lakes
Least Cisco *Coregonus sardinella*	Migrate upstream to spawning grounds in fall	Early October	Clear streams Gravel substrates	May-June, under ice	Lakes, rivers, lowest reaches of tributary streams	Lakes and streams Estuaries, plume of home river
Inconnu (Coney) *Stenodus leucichthys* *"Higaq"*	Anadromous or lake dwelling. Begin upstream migrations at spring break- up. Return to coastal areas or lakes after spawning.	Late September to early October	1-3 m depth Fast current Gravel substrate	Six months after spawning	Fry washed down-stream to coastal areas or lakes	Coastal areas or lakes
Northern Pike *Esox lucius "Siulik"*	Limited range Move from deep water winter habitat to spawning habitat in spring	Early spring, occasionally before ice melt	Grassy margins of lake shores slow moving streams or sloughs	Spring, ~30 days after spawning	Stream or lake margins Slow flowing waters	Lakes Main river channels Slack water areas in rivers
Lake Trout *Salvelinus Namaycush* *"Iqaluakpak"*	Limited migrations, usually within resident lake or large, deep river Migrate to nearshore areas for spawning Move into surface waters in winter Move into deeper waters in summer	Early September	Littoral areas of lakes Cobble boulder substrates 5-40 mwater depth	May-June, depending on water temperature	Shallow, inshore waters	Large deep lakes (common) Large rivers (less common) Little movement in summer

Table 10-6: Life History Characteristics for Fish Species Common within the RSA						
Fish Species	**Migratory Behavior**	**Spawning Period**	**Spawning Habitat**	**Hatching Period**	**Juvenile Freshwater Habitat Preferences**	**Adult Freshwater Habitat Preferences**
Arctic Grayling *Thymallus arcticus* *"Hulukpaugaq"*	Can be highly migratory at all life stages or non-migratory Usually migrate to winter habitat in early fall	Spring, just as ice breaks up	Gravel substrate <20-30% fines Good flow (25-60 cm/s)	Hatch three weeks after spawning	Fry: quiet waters near site of hatching	Clear small, shallow streams or medium rivers Groundwater- fed springs Overwinter in lakes or lower reaches of rivers Segregate in streams by age
Slimy Sculpin *Cottus cognatus*	Very limited movements	Spring, after breakup	Cobble in shallow water	Hatch 30 days after spawning	Gravel/ cobble substrate in streams	Rocky or gravel substrates
Ninespine Stickleback *Pungitius pungitius*	Very limited movements	Summer	Male builds nests of vegetation and debris	Hatch one week after spawning	Quiet, shallow waters in vegetated areas of streams or brackish waters	Brackish or freshwater lakes and streams Streams: vegetated areas in quiet waters

Fish sampling within the LSA creek confirmed the presence of Northern Pike and Ninespine Stickleback (Kiggiak EBA 2019b). Both studied watercourses (WC1 and WC2) provided good rearing habitat for the fish species common to the region, with diverse and ample cover types, as well as spawning habitat for species that preferentially utilize vegetation, and a portion of WC2 provided limited spawning habitat for fish species that require gravel- cobble substrates (see Table 10-5). It is expected that both watercourses freeze to bottom in the winter, and thus overwintering capability in the assessed reaches of both watercourses is nil. For this reason, the project will schedule construction of the creek crossing during the winter only, to ensure fish will not be disturbed.

10.6 Vegetation

10.6.1 2018 Vegetation Assessment and Rare Plant Survey

The IESP contracted Kiggiak EBA to conduct a detailed field study of the vegetation in the LSA. The field work was carried out on August 14-15, 2018. The intent of the study was to document the vegetation types present along the proposed road alignment options and in the LSA in general; and to look for rare plants and rare plant habitat potential. A total of 36 waypoints were assessed for vegetation type and rare plant habitat potential. Nine vegetation types were identified within the broader Local Study Area. Vegetation descriptions were based on the vegetation types developed for the Mackenzie Gas Project Environmental Impact Statement (Imperial Oil *et al*. 2004) and verified by Kavik-Stantec for the ITH impact assessment (2012c).

10.6.2 Vegetation Types in the LSA

A total of nine vegetation types and one waterbody unit were mapped within the LSA (See Figure 10-11). Seven of the mapped vegetation types correspond to those previously described by IOL *et al*. (2004) and KAVIK-STANTEC (2012c). The other two types were found associated with recently disturbed land. The most common vegetation types in the LSA are upland shrub (33%), dwarf shrub heath (22%) and high-centered polygons (15%). The distribution of vegetation types found within the LSA (including water) is provided in Table 10-7.

On well-drained, upland sites, vegetation is a mixture of willows (*Salix* spp.), dwarf birch (*Betula glandulosa*), and ericaceous shrubs (e.g., *Vaccinium* spp., *Arctous* spp.. In wetter, lower lying areas, *Rhododendron groenlandicum* [formerly *Ledum palustre*]). Sedges (*Carex* spp.) and cotton-grasses (*Eriophorum* spp.) are common. The LSA shows signs of previous disturbance, with revegetated seismic lines (or similar linear disturbances) running both lengthwise and widthwise through it. Uniform stands of sedges (typically water sedge [*Carex aquatilis*]) were occasionally found in the middle of these linear depressions with taller willows growing along the margins.

A small patch of agricultural/agronomic plant species (oats and other cereal crops), is growing on the reclaimed sump cap which was seeded with southern agricultural grasses. As part of the project proposal, the cap will be remediated and will be re-seeded with native seeds.

Table 10-1: Distribution of Vegetation Types Within the Local Study Area

Vegetation Type	Area (ha)	Proportion of Local Study Area (%)
Upland Shrub	240	33
Dwarf Shrub Health	163	22
Water	116	16
High-centered Polygons	111	15
Cotton-Grass – Tussock	73	10
Riparian Shrub	14	2
Riparian Sedge – Cotton-Grass	10	1
Low-centered Polygons	6	1
Sedge Wetland	4	1
Agronomics	<1	<1
Total	736	100

Of the nine vegetation types mapped within the LSA, only five intersected the potential road alignments. High-centered polygons, low-centered polygons, riparian sedge – cotton-grass, and the agronomic unit associated with

the well-head did not intersect the potential road alignment options, and as such were not formally assessed in the 2018 field studies. The upland shrub and dwarf shrub heath vegetation types were predominant.

It is recommended the least possible disturbance on the least represented vegetation types: sedge wetland, low-centered polygons, riparian sedge – cotton grass and riparian shrub.

10.6.3 Rare Plants

No rare plants were detected during the field assessment, nor during review of the NWT Species at Risk Infobase. However, their presence along the potential, preferred, and possible road alignments and within the broader Study Area cannot be conclusively ruled out (even the most rigorous of field surveys cannot confirm the occurrence of all rare plants within a Study Area) (Kiggiak EBA 2019c). Mitigation measures to ensure rare plants are not impacted by the project are provided in the IESP Wildlife and Wildlife Habitat Management Plan.

10.7 Wildlife

10.7.1 Wildlife Surveys in the LSA and RSA

As described in Section 18 of this Project Description, the LSA and broader RSA have been studied many times over the past 50 years. Significant portions of the LSA should have been the subject of ten previous environmental assessments. In addition, numerous research projects in the area south of Tuktoyaktuk since the 1960's have provided a wealth of information regarding the land, and particularly, the regional and local wildlife. The importance of wildlife to Inuvialuit culture and values, as well as the necessity to protect and preserve Arctic wildlife, environment and biological productivity are critical objectives of the Inuvialuit Final Agreement. These objectives are paramount to the IESP.

This section draws on previous environmental assessments, the Tuktoyaktuk and Inuvik Community Conservation Plans (2008; 2016) plus a compilation of the integrated information coming from two recent comprehensive field studies: KAVIK-STANTEC (2012d) for the RSA; and Kiggiak-EBA (2019d) in the LSA.

Additional key references included a project-commissioned Bear Den field study carried out by local harvester Erwin Elias in March 2020, the caribou no hunting zone map provided by the Tuktotyatuk Hunters and Trappers Committee; the Beaufort Regional Coastal Sensitivity Atlas (Environment Canada, 2015), and a series of interviews with local harvesters regarding Traditional Land Use in the RSA. (See Section 11.)

The IESP carried out a wildlife and wildlife habitat survey in the LSA on August 14-15, 2018. A list of species with special conservation status that have the potential to occur within the Study Area and their key habitats were compiled from a literature review that included the Northwest Territories (NWT) Species at Risk Infobase (2016), Species at Risk in the NWT 2018 Guide (Environment and Climate Change Canada et al. 2018), the Tuktoyaktuk Community Conservation Plan (2016), NWT Species at Risk status reports, and the Government of Canada Species at Risk Public Registry (2018).

Wildlife species targeted within the Study Area include those that are:

- Listed on the Species at Risk (NWT) Act;

- Listed on Schedule 1 of the federal Species at Risk Act (SARA) public registry; or
- Ranked by the General Status Ranks of Wild Species in the NWT as “May Be At Risk” and “At Risk.”

Wildlife species key habitat potentials were documented using a non-intrusive ground survey and a 15-minute aerial reconnaissance over the two-day field survey. Wildlife habitat, vegetation types, and wildlife sign (i.e., tracks, pellets) observed during the ground survey (approximately 11 km) and aerial reconnaissance within the Study Area were recorded.

10.7.2 Mammals

In addition to the CCP Listed mammals, Table 10-9 provides the list of mammals potentially occurring in the RSA, according to Wood (2019). Mammals that are of special consideration are highlighted in grey. These mammals are highlighted and further discussed in following text because they are listed on the Species at Risk (NWT) Act, on Schedule 1 of the Federal Species at Risk Act (SARA) public registry; or ranked by the General Status Ranks of Wild Species in the NWT as May Be At Risk and At Risk.

Table 10-8: Mammals potentially occurring in the RSA

Common Name	Latin Name	COSEWIC Status	SARA Status	NWT General Status Rank
Muskox	*Ovibos moschatus*	---	---	---
Barren-ground Caribou	*Rangifer tarandus groenlandicus*	Threatened	Under Consideration	Sensitive
Polar Bear	*Ursus maritimus*	Special Concern	Special Concern (Schedule 1)	Sensitive
Moose	*Alces americanus*	---	---	Secure
Grizzly Bear	*Ursus arctos*	Special Concern	Special Concern (Schedule 1)	Sensitive
Tundra Wolf	*Canis lupus*	---	---	Secure
Red Fox	*Vulpes vulpes*	---	---	Secure
Arctic Fox	*Vulpes lagopus*	---	---	Secure
Lynx	*Lynx canadensis*	Not at Risk	---	Secure
Wolverine	*Gulo gulo*	Special Concern	Special Concern	Sensitive
Ermine	*Mustela erminea*	---	---	Secure
Porcupine	*Erethizon dorsata*	---	---	Secure

Table 10-8: Mammals potentially occurring in the RSA				
Common Name	**Latin Name**	**COSEWIC Status**	**SARA Status**	**NWT General Status Rank**
Beaver	*Castor canadensis*	---	---	Secure
Least Weasel	*Mustela nivalis*	---	---	Secure
River Otter	*Lontra canadensis*	---	---	Secure
Arctic Hare	*Lepus arcticus*	---	---	Secure
Snowshoe Hare	*Lepus americanus*	---	---	Secure
Arctic Ground Squirrel	*Spermophilus parryii*	---	---	Secure
Barren-ground Shrew	*Sorex ugyunak*	---	---	Undetermined
Tundra Shrew	*Sorex tundrensis*	---	---	Undetermined
Masked Shrew	*Sorex cinereus*	---	---	Secure
Northern Red-backed Vole	*Clethrionomys rutilus*	---	---	Secure
Tundra Vole	*Microtus oeconomus*	---	---	Secure
Brown Lemming	*Lemmus sibiricus*	---	---	Secure
Collared Lemming A	*Dicrostonyx groenlandicus*	---	---	Secure
Collared Lemming B	*Dicrostonyx kilangmiutak*	---	---	Secure
Collared Lemming C	*Dicrostonyx richardsoni*	---	---	Undetermined

10.7.3 Grizzly Bear

Grizzly bears (Ursus arctos) are omnivorous, but primarily herbivorous and require a wide variety of plant species. They are habitat generalists with strongly seasonal habitat associations (eg., dependent local plant communities, fish migrations, and ungulate calving) (COSEWIC 2012; THTC et al 2016). Grizzly bear generally avoid areas of human activity, although some disturbed habitats, such as road allowances may attract bears (COSEWIC 2012).

The LSA lies entirely within an identified Grizzly Bear Denning Area (site 322C; Community of Tuktoyaktuk et al. 2016). Denning habitat is generally characterized by sand, silt, and gravel-dominated surficial material, well-drained areas, preferably on slopes with a southerly aspect, and preferably with at least 10% shrub cover (NWT Species at Risk Committee 2017; KAVIK-STANTEC 2012a).

Areas with higher habitat suitability for dens exist throughout the RSA. During the 2018 field studies (Kiggiak EBA 2019a), two attempted den sites and an old collapsed den were observed; each located within mapped areas of high habitat suitability. In addition, IPC commissioned a local hunter to look for bear dens along the proposed access route prior to the March 2020 geotechnical drilling program. Although no evidence was found of bears or active bear dens, a number of areas were mapped as having good potential for dens. These areas are provided in Figure 10-12.

The LSA provides similar habitat suitability for Grizzly Bear as the surrounding regional tundra landscape based on the suitability mapping completed within one kilometer for the ITH (KAVIK-STANTEC, 2012a). However, the Husky Lakes area has been identified by local harvesters as having a higher Grizzly Bear population (KAVIK-STANTEC, 2012b).

The potential effects to grizzly bears and their habitat from the Project are discussed further in the wildlife section of Section 14, as well as the Wildlife and Wildlife Habitat Protection Plan.

10.7.3.1 Wolverine

Wolverines (Gulo gulo) inhabit a variety of habitats including forested and open areas, however historical accounts of harvesters indicate wolverines are more common at higher elevation areas and uncommon in open tundra habitats found at the Project Site (COSEWIC, 2014). Wolverine numbers are strongly associated with abundance and diversity of prey and other carnivore species.

The LSA has similar habitat suitability for denning Wolverines as the surrounding region. Participants in a Traditional Knowledge workshop in 2012 identified that the populations of Wolverine near Tuktoyaktuk, along the coast, and near Inuvik were all healthy, with higher numbers than in previous years (KAVIK-STANTEC, 2012b). Participants also identified that Wolverine typically travel 100-200 km/day, a much larger daily range than the size of the RSA.

It is anticipated that wolverine may be encountered in the Project Area. The potential effects to wolverines and their habitat from the Project are discussed further in the wildlife section of Section 14, as well as the Wildlife and Wildlife Habitat Protection Plan.

10.7.3.2 Barren-ground Caribou

The Barren-ground caribou (Rangifer tarandus groenlandicus) is one of three subspecies of caribou in the Inuvialuit Settlement Region. They are the most abundant and economically important of the subspecies. Three distinct populations of Barren-ground caribou have been identified based on the location of their calving grounds; they are known as the Bluenose-east, Bluenose-west and Cape Bathurst herds (Community of Tuktoyaktuk et al., 2016). The Project lies within the home ranges of both the Bluenose-west and Cape Bathurst herds (Community of Tuktoyaktuk et al., 2016). (See Figure 11-4.)

Caribou potentially occur in the LSA year-round. Based on the 2016 CCP, the LSA overlaps the summer (Site 306C) and fall (Site 309C) harvesting areas, as well as the spring (Site 302C) and winter (Site 315C). The LSA also overlaps the Blue-nose West Caribou Herd winter range (Site 701E); located at the edge of the range approximately three to seven kilometres in from the ranges' northern border. This caribou site was also identified in the 2006 CCP and is extremely significant for cultural or renewable resources (Kiggiak-EBA, 2020).

The potential effects to barren-ground caribou and their habitat from the Project are discussed further in the wildlife section of Section 14, as well as the Wildlife and Wildlife Habitat Protection Plan.

10.7.3.3 Birds

Very few species of birds are adapted to overwinter in the Delta Region. The vast majority migrate into or through the area to nest, raise young, molt, accumulate fat reserves, and then migrate south in the fall to overwinter in other regions (Martell et al., 1984). Migratory birds have been protected in Canada since 1917. The NWT Wildlife Act and Birds of Prey Regulations and the Federal Migratory Birds Convention Act and Migratory Birds Regulations apply. Kiggiak EBA (2019d) concluded that the LSA provided suitable habitat for five species of "listed" birds: Red-necked Phalarope (Phalaropus lobatus), Horned Grebe (Podiceps auritus), Short-eared Owl (Asio flammeous), Harris's Sparrow (Zonotrichia querula) and Rusty Blackbird (Euphagus carolinus).

10.7.3.4 Waterbirds

Most species of waterfowl arrive at their nesting grounds by early June, but some of them even as early as April and May. They stay in the Mackenzie Valley during the breeding season and then start their fall migration to the south in the fall. The following table shows a summary of the waterfowl species:

Table 10-9: Migratory Waterfowl Species found in the RSA

Common Name	Latin Name	Arrives in	Leaves in
Canada Goose	*Branta canadensis*	Late April and first half of May	September to early November
White-fronted Goose	*Anser albifrons frontalis*	Late May or early June	Mid-August until early October
Lesser Snow Goose	*Chen caerulescens*	Late May or early June	Mid-August until early October
Mallard	*Anas platyrhynchos*	Mid to late May	September
Northern Pintail	*Anas acuta*	Between second and fourth week of May	Early September
American Wigeon	*Anas americana*	Late May	Late August to early September
Greater Scaup	*Aytha marila*	Mid to late May	Late September
Tundra Swans	*Cygnus columbianus*	Mid May	October
Loon	*Gavia* sp.	April or early May	Late October to early November

The potential effects to migratory waterbirds and their habitat from the Project are discussed further in the wildlife section of Section 14, as well as the Wildlife and Wildlife Habitat Protection Plan.

10.7.3.5 Ground Birds

Grouse inhabit forested and open areas throughout Canada are important prey for several species of raptors and mammals. Grouse usually remain within their breeding ranges during the winter (Godfrey, 1966 in Dome *et al*., 1982), although they may leave the northernmost of high-altitude areas. The sharp-tailed grouse is commonly found in the coastal Beaufort area (Dome *et.al*., 1982 in IEG, 2001).

The following table shows the most representative species of ground birds that might be found in the RSA.

Table 10-2: Representative Ground Bird Species in the RSA

Common Name	Latin Name
Willow Ptarmigan	*Lagopus lagopus*
Rock Ptarmigan	*Lagopus mutus*
Short-eared Owl	*Asio flammeus*
Snowy Owl	*Bubo scandiacus*
Northern Harrier	*Circus hudsonius*
Rough-legged Hawk	*Buteo lagopus*
Golden Eagle	*Aquila chrysaetos*
Bald Eagle	*Haliaeetus leucocephalus*
Gryfalcon	*Falco rusticolus*
Peregrine Falcon	*Falco peregrinus*
Rusty Blackbird	*Euphagus carolinus*
Savannah Sparrow	*Passervulus sanwichensis*
American Tree Sparrow	*Spizella arborea*
Water Pipit	*Anthus spinoletta*
Lapland Longspur	*Calcarius lapponicus*
Common Raven	*Corvus corax*

10.7.4 Incidental Wildlife in the LSA

All wildlife and wildlife sign observed during the August 2018 field survey were recorded. Waterbirds, primarily Sandhill Cranes (Grus canadensis), were by far the most common species detected. Additional bird and bird sign included Savannah Sparrows (Passerculus sandwichensis), Glaucous and Herring gull (Larus hyperboreus and L. argentatus), an American Tree Sparrow (Spizelloides arborea), and Ptarmigan species (Lagopus sp.).

Inactive Arctic ground-squirrel dens (Spermophilus parryii), lemming winter nests, and Red Fox (Vulpes vulpes) track and bones were also observed. (Kiggiak EBA 2019d).

10.7.5 Species of Management Concern

Based upon Kiggiak EBA (2019d) literature review, it was determined that there is the potential for 11 Species of Management Concern (SOMC) or SOMC wildlife groups to occur in the LSA.

Kiggiak EBA concluded that: *"Eleven species with special conservation status have the potential to occur within the Study Area and were the main targets for the wildlife baseline survey. Evidence of two species (Grizzly Bear and Barren-Ground Caribou) were observed in the Study Area during the field survey. Habitat suitability assessments, following the same approach used for the ITH (Kavik-Stantec Inc 2012a), were completed for each target species to determine whether key habitat is present, and if so, its proximity to the Project.*

*The Study Area provides suitable habitat for all eleven species at risk except for nesting Peregrine Falcons, Bank Swallows, and Barn Swallows. The Project options (*proposed access road routes*) intersect a small amount of suitable habitat for Short-eared Owl, Harris's Sparrow, Rusty Blackbird, Barren-ground Caribou, Grizzly Bear, and Wolverine. However, all habitat types within the specific Study Area are relatively common to the general Tuktoyaktuk Peninsula area."* (Kiggiak EBA 2019d)

A list of the SOMC and their federal and/or territorial status is provided in Table 10-12. Species highlighted in gray do not have suitable habitat in the LSA. (Kiggiak EBA 2019d). Bird species suitable habitat areas were mapped. A map showing all five species suitable habitats overlain on the LSA is provided as Figure 10-13.

Table 10-11: Wildlife Species of Management Concern that potentially occur in the Local Study Area

Species	Latin Name	COSEWIC Status	SARA Status	NWT General Status Rank
Mammals				
Grizzly bear	*Ursus arctos*	Special Concern	Special Concern (Schedule 1)	Under Consideration
Wolverine	*Gulo gulo*	Special Concern	Special Concern	No Status
Barren-ground caribou	*Rangifer tarandus groenlandicus*	Threatened	--	Under Consideration
Birds				
Red-necked Phalarope	*Phalaropus lobatus*	Special Concern	-	Not Applicable
Horned grebe	*Podiceps auritus*	Special Concern	Special Concern	Not Applicable

Table 10-11: Wildlife Species of Management Concern that potentially occur in the Local Study Area				
Species	**Latin Name**	**COSEWIC Status**	**SARA Status**	**NWT General Status Rank**
			(Schedule 1)	
Short-eared owl	*Asio flammeus*	Special Concern	Special Concern (Schedule 1)	No Status
Peregrine falcon	*Falco peregrinus anatum/tundrius*	Not at Risk	Special Concern (Schedule 1)	No Status
Bank Swallow	*Riparia* sp.	Threatened	Threatened	Not Applicable
Barn Swallow	*Hirundo rustica*	Threatened	Threatened	Not Applicable
Harris's Sparrow	*Zonotrichia querula*	Special Concern	No Status	Not Applicable
Rusty blackbird	*Euphagus carolinus*	Special Concern	Special Concern	No Status
Notes: *Species highlighted in gray do not have suitable habitat in the LSA. Sources: Kiggiak EBA 2019a				

11.0 TRADITIONAL & OTHER LAND USES / POTENTIALLY AFFECTED COMMUNITIES

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

Reference the relevant Community Conservation Plans and any updates or current information should be included: harvesting areas (i.e., hunting and berry picking) and harvest timing; sensitive wildlife harvesting areas and times and designation category (CCP) should be included. (EISC Guidelines: Appendix F 2014).

This section provides information on land use that overlaps with the Project Regional or Local Study Areas (RSA/LSA) including traditional land use (fishing, hunting and other harvesting activity), historic land use, archaeological areas, current land use (including cabins the RSA), special land designations (Pingo Canadian Landmark, Municipal Boundary of Tuktoyaktuk, recent commercial, research, and industrial land use in the RSA, and an overview of the current socio-economic situation and available services for the Hamlet of Tuktoyaktuk.

The Local Study Area (LSA) is located within the Tuktoyaktuk and Inuvik traditional harvesting regions. Traditional and other land use information for this region was obtained from the following sources:

- 2008 and 2016 Inuvik Community Conservation Plans (ICCP)
- 2008 and 2016 Tuktoyaktuk Community Conservation Plans (TCCP)
- Summary of Existing Traditional Knowledge for the Inuvik to Tuktoyaktuk Highway Study Area (KAVIK-STANTEC 2012a)
- Beaufort Regional Coastal Sensitivity Atlas (Environment Canada, 2015)
- Traditional Knowledge Workshops held in Inuvik and Tuktoyaktuk for the ITH study area, which encompass the Project area (KAVIK-STANTEC 2012b);
- Traditional Knowledge interviews held with Tuktoyaktuk harvesters during July and August 2020 by IPC for the Project
- Previous Project Descriptions
- Environmental Impact Screening Committee Registry Site
- Aurora Research Institute NWT Research Database
- Inuvialuit Land Administration Cabin Registry
- GNWT Petroleum Resources Division wellsite database
- 2018 Archaeological Overview Assessment (Soriak Consulting and Kiggiak EBA, 2019)
- Inuvialuit Regional Corporation report on Social, Cultural and Economic Conditions in the Inuvialuit Settlement Region (IRC, 2002)

11.1 Traditional Land Use and Special Designated Areas

The proposed Project is located within seven Inuvialuit Special Designated Areas as defined in the Community Conservation Plans. (see Table 11-1). Six of the Designated Areas are Category C areas, and the remaining Designated Area is a Category E area. These categories are defined as follows (Inuvik et al. 2016, Tuktoyaktuk et al. 2016):

Category C: Lands and waters where cultural or renewable resources are of particular significance and sensitivity during specific times of the year. These lands and waters shall be managed to eliminate, to the greatest extent possible, potential damage and disruption.

Category E: Lands and waters where cultural or renewable resources are of extreme significance and sensitivity. There shall be no development on these areas. These lands and waters shall be managed to eliminate, to the greatest extent possible, potential damage and disruption. This category recommends the highest degree of protection in this document.

Lands within the Project RSA have traditionally been used for the subsistence harvesting of caribou, wolverine, and fish. (see Figures 11-1, 11-2 and 11-3.) The LSA overlaps one Category E area – the Blue-nose West Caribou winter range (Site 701E). The LSA is located at the edge of the Caribou range - approximately three to five kilometres in from the ranges' northern border. (see Figure 11-4).

Table 11-1: Community Conservation Plan Special Designated Areas

Site Number	Site Name	Management Category	Importance	Siting Area Overlap	CCP Noting Site as Important
302C	Spring Caribou Harvesting Areas	Category C	Key harvesting area for caribou in the spring	LSA and RSA	TCCP 2016
306C	Summer Caribou Harvesting Areas	Category C	Key harvesting area for caribou in the summer	LSA and RSA	TCCP 2016
309C	Fall Caribou Harvesting Areas	Category C	Key harvesting area for caribou in the fall	LSA and RSA	TCCP 2016
314C	Winter Wolverine Harvesting Areas	Category C	Key area for subsistence harvesting of wolverine during the winter	LSA and RSA	TCCP 2016
315C	Winter Caribou Harvesting Areas	Category C	Key area for subsistence harvesting of caribou during the winter	LSA and RSA	TCCP 2016
322C	Critical Grizzly Bear Denning Areas	Category C	Important (from October to May) for denning grizzly bears	LSA and RSA	TCCP 2016
701E	Bluenose-West Caribou Herd Winter Range	Category E	Important winter habitat for the Tuktoyaktuk Peninsula, Cape Bathurst and Bluenose-West caribou herd, which are valued for subsistence harvest year-round	LSA and part of RSA	TCCP 2016 ICCP 2016
704C	Fish Lakes and Rivers	Category C	Important fish habitat and important historic and present subsistence harvesting area for residents of Inuvik and Tuktoyaktuk	LSA and RSA	TCCP 2016 ICCP 2016

Source: Inuvik et al. 2016, Tuktoyaktuk et al. 2016

11.1.1 Traditional Land Use

Traditional Knowledge and Traditional Land Use (TK/TLU) workshops were conducted in February 2012 in support of the Inuvik to Tuktoyaktuk Highway (ITH). In the final report compiling the findings of the workshops; numerous cabins were identified around the Husky Lakes (KAVIK-STANTEC 2012b). The nearest cabin to the Project LSA is approximately 7.62 km east of the M-18 wellsite. The cabin is located across the ITH (east) and is not currently being used (the former owner has passed away). There are no other cabins within the Project RSA.

Land use in the vicinity of the Project includes trails that support traditional and contemporary lifestyles (IEG 2001, Kiggiak-EBA 2011). Some of the trails are used by residents of Tuktoyaktuk and Inuvik to pursue winter fishing activities west of Iqalushaq Lake. Many of these trails are illustrated in the Proposed Inuvik-Tuktoyaktuk Highway Environmental Impact Statement (EIS). At least two of the trails illustrated in the ITH EIS appear to overlap with the proposed access road corridor; and they are joined by a third trail in the immediate vicinity of the Project LSA (Kiggiak-EBA 2001). (See Figure 11-8).

The RSA lies within the NWT ENR "no caribou Hunting Zone" (I/BC/07). There is no hunting of barren ground caribou permitted at any time of year by residents, non-residents nor non-resident aliens. Traditional knowledge holders provided information that the area is not currently used for berry-picking and rarely for hunting. Four harvesters interviewed said they have hunted in the RSA in the past, but not recently. None of them use the LSA. In the past, local hunters harvested fox, ptarmigan, geese, grizzly bear, moose, and sometimes "the odd wolf" in the RSA. All of the outfitters that are registered with the EISC as of September 1, 2020 were interviewed, and none of them expressed concern about the project. Figure 11-8 provides a map of cabins and other land users in the RSA. A list of registered outfitters is provided in Table 11-3.

11.1.2 Fish

In the Summary of Existing Traditional Knowledge for the Inuvik to Tuktoyaktuk Highway Study Area report (KAVIK-STANTEC 2012a) it is noted that:

> *Fish are an important component of the diet to the residents of Inuvik and Tuktoyaktuk. Much of the (ITH) Program Area is within the special lands designated area 704C "Fish and Lakes" which encompasses important fish harvesting areas for residents of Inuvik and Tuktoyaktuk (Inuvik et al. 2016; Tuktoyaktuk et al. 2016).*

During the February 2012 (TK/TLU) workshops, several of the larger lakes in the vicinity of the ITH Project Area were identified as lakes that were used for fishing (KAVIK-STANTEC 2012b). Confirmatory interviews held in August 2020 identified Tiktaliq Lake and a small lake west of Iqalushaq Lake as used for winter fishing, beginning in October through to December. Three families harvest over 200 fish in these months to feed themselves. Whitefish and Herring are caught by net, reported as 25 fish every few days. It is important to note that neither lake could be impacted by the project. Tiktaliq Lake is upstream of the LSA, while Iqalushaq Lake is in an entirely separate watershed west of the LSA. (See Figure 10-6.)

11.1.3 Grizzly Bear

The Summary of Existing Traditional Knowledge for the Inuvik to Tuktoyaktuk Highway Study Area report (KAVIK-STANTEC 2012a) also notes that:

Grizzly bears are often seen in association with caribou, wolves, and foxes. Grizzly bears are also found in areas where there are abundant number of fish, such as Parsons Lake, Holmes Creek and Pete's Creek in the fall. Grizzly bears are found from Qikuryuaq to Hans Bay, southeast of Hans Bay to Parsons Lake and south of Iqalussaaq (ICC et al. 2016).

Grizzly bears den from October to May (Inuvik et al. 2008). In ICC et al (2006) hunters from Tuktoyaktuk indicated grizzly bear dens in the big hills close to Parsons Lake while an Inuvik hunter indicated bear dens can be found in the area west of Sitidgi Lake northwest to the coast of Beluga Bay.

Grizzly bears were traditionally hunted for food and their hides which were used as mattresses. Generally, Inuvialuit do not harvest grizzlies for food anymore, instead hunters get tags to use in taking clients on sport hunts. Grizzly bears are generally hunted in winter and spring (ICC et al. 2006; Inuvik et al. 2016).

During the February 2012 (ITH TK/TLU) workshops, it was mentioned that there is a high grizzly bear den concentration, and many grizzly bears present during the spring, in the Husky Lakes area (KAVIK-STANTEC 2012b). Several grizzly bear denning sites near the Project LSA were identified during the workshops, the closest being approximately 5.3 km southeast of the M-18 wellsite (KAVIK-STANTEC 2012b). (see Figure 11-5.) During the TK/TLU workshops concerns were also raised that that the presence of the ITH may increase hunting pressures on grizzly bears, as well as the presence of nuisance bears needing to be shot, reducing the availability of grizzlies for harvesting.

11.1.4 Wolverine

The Summary of Existing Traditional Knowledge for the Inuvik to Tuktoyaktuk Highway Study Area (KAVIK-STANTEC 2012a) notes:

Wolverine is an important fur bearing animal trapped by community members of both Inuvik and Tuktoyaktuk and are also said to be important for maintaining balance in nature (Inuvik et al. 2008; Tuktoyaktuk et al. 2008). The wolverine was considered by some to be the counterpart to the grizzly in that their movements are similar. Although wolverines were said to be found in many places some areas identified by hunters included, Husky Lakes, North Storm Hills, Zed Lake and Parsons Lake. Wolverines are known to be able to travel long distances in a day (ICC et al. 2006).

Wolverine breed in March through May and generally have one or two young but can have up to five young.

Hunting for wolverines is often conducted in the winter and at the same time as hunting for other furbearers such as wolves and foxes.

During the ITH TK/TLU workshops it was mentioned that harvesting of wolverine may increase due to the presence of the ITH (KAVIK-STANTEC 2012b). Interviews held with harvesters from Tuktoyaktuk in 2020 revealed that no local hunters are using the RSA for hunting. Figure 11-2 provides the winter wolverine harvesting area from the Tuktoyaktuk CCP.

11.1.5 Caribou

Caribou is an important food source for the Inuvialuit (ICCP and TCCP 2016). In the *Summary of Existing Traditional*

Knowledge for the Inuvik to Tuktoyaktuk Highway Study Area (KAVIK-STANTEC 2012a) it is noted that:

> *Caribou in the (ITH) study area are continually moving, grazing when food is available. The caribou undergo seasonal migrations. These migration routes may vary between years allowing the land to replenish itself. Generally, Bluenose West caribou migrate from the east in the fall or in November and December and remain around the Tuktoyaktuk area until about March when they head east towards Paulatuk. Some stragglers will stay in the (ITH) study area throughout the summer (ICC et al. 2006). It was reported that the main feeding area for caribou was along the shore of Husky Lakes and that the caribou migrate along the shore and not along higher ground where there is less food available (Rescan 1999).*
>
> *Fall and winter were said to be the best times to harvest caribou as this is when the meat is better and has more fat. During spring and winter the main harvesting area is over the northern half of the (ITH) study area while in summer and fall the harvest area is generally more restricted to closer to the community of Tuktoyaktuk in the northern edge of the (ITH) study area (Tuktoyaktuk et al. 2008). Hunters from Tuktoyaktuk typically harvest caribou from northwest of Husky Lakes to the Mackenzie Delta. Inuvik hunters generally harvest in an area southwest and west of Parsons Lake. Harvesting of caribou can occur in the (ITH) study area at any time of the year when animals are available (Inuvik et al. 2008, Tuktoyaktuk et al. 2008). Hunting of caribou is now banned around Husky Lakes (ILA 2011).*

Although the area is designated as a traditional harvesting area for caribou (TCC et al. 206), the Project RSA lies entirely within the Tuktoyaktuk Hunters and Trappers Committee (THTC) no hunting zone. See Figure 11-1. No caribou are hunted in the RSA.

11.1.6 Hunting

Table 11-2 illustrates the hunting seasons in the Tuktoyaktuk region (depicted in shaded cells) for residents, non-residents and non-resident aliens based upon the Northwest Territories Hunting Regulations (2020). There is no caribou hunting permitted within the Project RSA.

Table 11-2: Hunting Seasons in the Tuktoyaktuk Planning Area

Species	Category	Season																							
		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
Barren Ground Caribou	All																								
Boreal Caribou	AH																								
	GHL																								
Moose	AH																								
	RES																								
Polar Bear	ALL																								
	ALL Female																								
Grizzly Bear	ALL																								
Wolf	AH																								
	GHL/RES/NR/NRA																								
Wolverine	AH																								
	GHL																								

Table 11-2: Hunting Seasons in the Tuktoyaktuk Planning Area																								
Species	**Category**	**Season**																						
	RES																							
	NR/NRA																							
Musk-ox	ALL																							
Ptarmigan	ALL																							

Acronyms from Table 11-2:
AH - Aboriginal Harvester within own land
RES - Residential - living in the NWT > 12 months
NRA - Non-residential Alien - Living outside NWT
GHL - General Hunting License - Aboriginal
NR – Non-residential - living in the NWT <12 months

A list of outfitters that work in the Tuktoyaktuk area, as provided from the EISC Registry, is provided in Table 11-3.

Table 11-3: Outfitters that work in the Tuktoyaktuk Area				
EISC File #	**Proponent**	**Activity Location(s)**	**Activity**	**Timing**
03/19-03	Cockney Big Game Hunting	Tuktoyaktuk Husky Lakes. Bailey Island, Atkinson Point	Sport Hunting	all year
01/20-09	James Keevik	between ITH and Pingo landmark, in the RSA	camping, fishing, tour of pingos	all year
01/20/04	James Pokiak	Tuktoyaktuk area. Husky Lakes. Trapper's cabins at Mason River, Anderson River Forks, and Iginilik (Husky Lakes).	Big game guiding and tourism. Research project support.	all year
01/20-07	Noksana Mushing Tours	Three areas near Tuktoyaktuk - Pingos. Out on the ocean. Cabin on Husky Lake at Ikinilik Bay.	dog sledding tours, camp	winter
11/18-05	Only Way Outfitting	Tuktoyaktuk, Inuvik, ITH	Tourism of area. Hunting	all year
01/20-02	Chuck Gruben's Guiding & Outfitting	Tuktoyaktuk hunting and trapping area. Camps at Mason River, Husky Lake, McKinley Bay and Liverpool Bay camp area (Nallok)	Guiding and outfitting based on Tuk. Also hunts for himself and distributes muskox meat to the elders.	all year
02/19-02	Joe Nasogaluak	Tuktoyaktuk. 160 miles north of Tuktoyaktuk. 20 miles NW of Tuktoyaktuk.	Hunting and outfitting	all year

11.2 Historic Land Use and Archaeological Resources

11.2.1 NWT Archaeology Program

Archaeological resources, consisting of sites and artifacts within sites, are protected and managed on Inuvialuit Private Lands by the Inuvialuit Land Administration (ILA, 1986). On Crown lands in the NWT, archaeological resources, fall under the authority of several pieces of legislation, regulations, and policies (Prince of Wales Northern Heritage Centre 2019). These include the Archaeological Sites Act, the Archaeological Sites Regulations, the Northwest Territories Lands Act, the Northwest Territories Land Use Regulations, the Historical Resources Act and the Access to Information and Protection of Privacy Act. All archaeological studies in the NWT require a permit issued by the PWNHC and the permit obligations include reporting on the methods and results of those studies.

11.2.2 Archaeological Resources Potential

Five previous archaeological studies, as identified in Table 11-4, were completed within, or in proximity of, the Project LSA, where five sites have been recorded. (See Figure 11-6.)

The five previously recorded archaeological sites are summarized as follows:

Table 11-4: Previously Recorded Archaeological Sites in the Vicinity of the Project Area

Permit	Permit Holder/ Affiliation	Relevant Assessment Area	Site	Site Classification	Relationship to Project
1991-696	K. Swayze PWNHC	Reconnaissance of Eskimo Lakes	NhTp-2	Prehistoric	NhTp-2 was identified approximately 800 m east of the LSA
1993-747	K. Swayze PWNHC	Tuktoyaktuk Peninsula Interior Archaeology	NhTp-3 NhTp-4 NhTp-5	Undetermined	Site NhTp-3, 4, and 5 were identified in locations approximately four kilometres west of LSA
2001-910	D. Hanna Bison Historical Services Ltd.	Mackenzie Delta Heritage Survey 2001	NhTp-6	Prehistoric	NhTp-6 was identified in location approximately 550 m southeast of the LSA
2009-024	G. Prager Points West Heritage Consulting Ltd.	Inuvik-Tuktoyaktuk Proposed All Season Road	-	Indigenous Historic	Desktop Assessment and Helicopter Reconnaissance of LSA in proximity of ITH
2011-014	B. Murphy IMG-Golder	HRIA of the proposed Inuvik to Tuktoyaktuk Highway	-	Undetermined	Desktop Assessment of ITH, including portion of adjacent LSA

One new site was also identified during the Heritage Resource Survey 2001 (IEG). The site consists of a very recent tent frame with stakes, cans, and a plastic pail. The site is a probable fish camp, which is very recent in age. This site had limited scientific or interpretive significance. The geographic coordinates for this site are 69º17’52” N, 132º59’02” W (IEG, 2001). This site is located approximately 3.8 km from the M-18 wellsite, on the east shore of

Tiktaliq Lake.

An undocumented historical site was also identified near Tiktakiq Lake during the TK workshops conducted by KAVIK-STANTEC (2012b). It is possible this site is one of two old campsites mentioned by a workshop participant during the TK workshops. The site near the south-east corner of Tiktaliq Lake is located approximately 6.4 km from the M-18 wellsite, very close to the ITH, and outside of the LSA.

It is not anticipated that the above mentioned archaeological and historic sites will be affected by the Project.

The LSA was analyzed in detail to identify areas of archaeological potential, relative to impacts to soil stratigraphy; however, ground disturbance appears to be minimal as most of the LSA is undisturbed.

A portion of the LSA was previously assessed in preparation of construction of the ITH (Prager, 2010, Murphy, 2011). During this previous work, no archaeological sites were identified; however, an area of potential was identified within the northern limit of the LSA.

In 2018, Soriak Consulting and Research Ltd. (Soriak), was retained for the IESP by Kiggiak-EBA Consulting Ltd. (Soriak and Kiggiak-EBA, 2019) to complete a desktop based Archaeological Overview Assessment (AOA) of the LSA.

Soriak identified twenty-eight areas of archaeological potential, including the one identified in 2009 (Prager 2010). (See Figure 11-7). Although generally small, these areas primarily include elevated terrain in proximity of water. Archaeological potential adjacent to water sources is considered to generally be high in areas near the LSA due to the recovery of fishing related materials/features at multiple sites in proximity (NhTp-2, NhTp-3, NhTp-4, and NhTp-5); however, a general buffer around water bodies is not recommended due to the small size of these hydrological features. Nearby archaeological sites are in proximity of larger, more significant water bodies than those located within the LSA (Soriak, 2019).

Soriak concluded: *"There are five previously recorded archaeological Inuvialuit sites within five kilometres of the proposed study area that represent prehistoric campsites and isolated finds and include the remains of fishing practices located at elevations of 15 m ASL or higher and are associated with significant water bodies to the east and west of the study area. Tiktaliq Lake, located to the east of the study area, is an important water body used for a considerable period. High landforms in the area that provide excellent vistas were likely used as part of a travel route towards the Mackenzie Delta to the northwest (Prager 2010). Previously recorded archaeological sites require a setback distance of a minimum of 30 m.; however, no impacts to previously recorded sites are anticipated within the study area and no specific set back is required."* (Soriak, 2019).

11.2.3 Graveyards and Burial Sites

The Beaufort Regional Coastal Sensitivity Atlas (Environment Canada, 2015) includes a map reference to a "burial site or cemetery" within the RSA, less than two kilometres northwest of Iqalushaq Lake and 4.7 km west of M-18. The identification of the site was attempted through the Inuvialuit Regional Corporation (IRC) and the Inuvialuit Land Administration. There is no record with either the IRC or the ILA of a burial site at this location. The Atlas reference is unconfirmed. No other burial sites are known in the RSA.

11.2.4 Summary of Pre-Historic and Historic Occupation in the RSA

In general, the RSA and broader region was occupied by various culture groups/traditions, such as the Northwest Microblade, Pre-Dorset, Dorset, and Thule, who adopted to their environment in different ways and at various times. The "historic" period is marked by Alexander Mackenzie's arrival in the region in 1789. Other explorers followed, most arriving as the result of expeditions seeking to explore and map the Canadian Arctic, in addition to others pursuing fur trading and mineral exploration (Prager 2010, Usher 1971, cited in Soriak 2019). Table 11-5 provides an overview of the region's prehistoric and historic period human occupation, as provided by Kiggiak EBA and Soriak Consulting (2019) to the present day.

Table 11-5: Overview of the Region's Prehistoric and Historic Period Occupation (from Soriak, 2019)

Cultural Affiliation	Period	Cultural Material	Location	Approximate Time Period
Northwest Microblade Tradition	Prehistoric	Burins, blades, microblade	Mackenzie valley; Eastern Mackenzie Delta; Cape Bathurst	Seasonal northward movement of interior people to hunt caribou and muskox as old as 6,000 years
Paleoeskimo	Prehistoric	Pre-Dorset or Arctic Small Tool tradition (ASTt)	Mackenzie Region	3,000 years ago
Inuvik Phase	Prehistoric	Regional variant of the ASTt, characterized by microblades, burins, and small finely worked bifaces	Southeast portion of the Mackenzie Region	4,300-3,400 years ago
NeoEskimo (Siglit) Western Thule	Prehistoric	Driftwood houses, whaling	Western Arctic	1,500-150 years ago
Thule	Prehistoric	Whaling related, multiple room wood houses, pottery, harpoons and arrowheads	Eastward migrations from northwest Alaska	1,000 years ago
Mackenzie Inuit (derived from Thule)	Prehistoric	Trading and cultural ties to the Alaskan Inuit	Descendants include Inuvialuit residents of the Mackenzie Delta	600-150 years ago
European Exploration	Historic	Trading goods	Mackenzie River Delta	Post 1789
Whaling Era	Historic	Influx of firearms and abandonment of communal hunting	Herschel Island, Mackenzie Delta	1889-1914
Trapping and Settlement	Historic	Primarily related to fur trapping	Herschel Island, Pokiak Point, Aklavik, Sachs Harbour, Ulukhaktok, Paulatuk	1915-1950

Table 11-5: Overview of the Region's Prehistoric and Historic Period Occupation (from Soriak, 2019)				
Cultural Affiliation	**Period**	**Cultural Material**	**Location**	**Approximate Time Period**
Militarization	Historic	Government-driven "Northern Vision"	Replacement of Aklavik by Inuvik	1953
Oil Exploration and Development	Historic	Geophysical and Oil and Gas infrastructure	Inuvialuit Land	1950-1990,1999-2002
Modern	Historic	Development of Infrastructure – Construction of ITH	Northwest Territories	2014-2017

11.3 Modern Industrial Land Use

Recent land use in the RSA and the LSA has mostly involved oil and gas exploration. Several dozen seismic and drilling programs have occurred over the past five decades within the LSA and RSA. There are 18 abandoned oil or gas wells within a 15 km radius of M-18. The wells were drilled between December 1968 and February 2002. Eleven of the wells were drilled in 1985-1986. Seventeen of the wells are owned by Imperial Oil and the most recent two wells (TUK M-18 and TUK B-02) are currently owned by Canadian Natural Resources Limited (CNRL). All of the wells with the exception of TUK B-02 had drilling waste sumps, currently in various states of repair. A list of the wells within the RSA and LSA is provided in Table 11-6.

Table 11-6: Oil and Gas Wells in the RSA						
SITE NAME	**OWNER**	**CLASS**	**WELL STATUS**	**Original Spud Date**	**Depth (m)**	**Land Owner**
TUK F-18	Imperial Oil	Exploratory Well	Abandoned	1968-12-29	3146	7(1)a
TUK L-09	Imperial Oil	Exploratory Well	Abandoned	1983-11-18	3030	7(1)a
TUK J-29	Imperial Oil	Exploratory Well	Abandoned	1985-01-11	3227	7(1)a
TUK H-30	Imperial Oil	Delineation Well	Abandoned	1985-04-21	1400	7(1)a
TUKTUK A-12	Imperial Oil	Delineation Well	Abandoned	1985-12-02	1790	7(1)a
TUK G-39	Imperial Oil	Delineation Well	Abandoned	1985-12-05	1797	7(1)a
TUK B-40	Imperial Oil	Delineation Well	Abandoned	1985-12-08	1800	7(1)a
TUKTUK H-22	Imperial Oil	Delineation Well	Abandoned	1986-01-11	1802	7(1)a
TUK G-48	Imperial Oil	Delineation Well	Abandoned	1986-01-14	1700	7(1)a

Table 11-6: Oil and Gas Wells in the RSA						
TUKTUK D-11	Imperial Oil	Delineation Well	Abandoned	1986-02-07	1810	7(1)a
TUK E-20	Imperial Oil	Exploratory Well	Abandoned	1991-01-25	3173	7(1)a
TUK M-18	CNRL	Delineation Well	Suspended	2001-12-24	2962	7(1)a
TUK B-02	CNRL	Exploratory Well	Abandoned	2002-02-17	3187	7(1)a

11.3.1 Early Development of Tuktoyaktuk

As mentioned previously in this Project Description, the area around Tuktoyaktuk has been a magnet for development and for research scientists for decades. Tuktoyaktuk was not occupied on a permanent basis until 1934 when the Hudson's Bay Company required an alternative location for its Herschel Island post. With the departure of the whaling industry, the Herschel Island post was no longer viable. The Harbour of Tuktoyaktuk was chosen as a suitable site for trans-shipping freight from Mackenzie River barges to Arctic coastal supply ships. With this development, families were attracted from Herschel Island, Kittigaryuit, Baillie Island and the Mackenzie Delta.

In 1937, Catholic and Anglican missions were established. A school was established by the Anglican mission in 1947 and a RCMP post was established in 1950. The initiation of the construction of the DEW (Distant Early Warning) Line in 1955 brought a boom to Tuktoyaktuk. The site was chosen as a key supply center for the western DEW Line. An airstrip capable of handling Hercules aircraft, a large diesel fuel tank farm and a DEW Line facility were built. The Northern Transportation Company Limited (NTCL) built a base camp at Tuktoyaktuk to supply the Arctic Coast as far as Iqaluktuuttiaq (Cambridge Bay) to the east.

11.3.2 Development of Oil and Gas in the Western Arctic

The discovery of oil in 1968 at Prudhoe Bay, Alaska initiated a major push from the Government of Canada for exploration and development in the Mackenzie-Beaufort Region, including offshore and onshore exploration activity. In 1970, Imperial Oil Limited struck oil with a well at Atkinson Point, northeast of Tuk. The Tuktoyaktuk Harbour became the preferred site for the operations base camps required for offshore oil exploration activity. By 1983, three major oil exploration companies had established base camps near the Hamlet, on the Harbour. Exploration activity peaked in 1984 with the expenditure of $1.03 billion. Total expenditures on oil and gas exploration for the period 1981-1986 totalled over $5.31 billion (Oilweek, cited in MacDonald, 1993). That is equivalent to $12.26 Billion in 2020 dollars. (https://www.inflationtool.com/canadian-dollar/1984-to-present-value)

The Beaufort-Mackenzie Basin hosts an immense petroleum resource. As of 1998, fifty-two petroleum fields found by 263 wells, including four gas hydrate research wells, had discovered huge reserves of oil and gas (GSC, 1998).

In a report prepared for the Beaufort Regional Environmental Assessment, Aboriginal Affairs and Northern Development Canada, in 2012 by LTLC Consulting and Salmo Consulting Inc. the size of the resources was reported as follows:

"The discovered recoverable oil resource in the combined Mackenzie Delta/Beaufort Sea is between one billion barrels (159 million cubic metres) (NEB 1998) and 1.2 billion barrels (183 million cubic metres) (Chen et al. 2007)

and the total recoverable oil resource may be as high as 10.6 billion barrels (1.7 billion cubic metres) (Chen et al. 2007). Most of the discovered oil reserves are located in the Beaufort Sea offshore. The estimated discovered marketable gas resource in the Mackenzie Delta and Beaufort Sea is between nine trillion cubic feet (254.8 billion cubic metres) (CPGC 2005) and 10.4 trillion cubic feet (294.5 billion cubic metres) (Drummond 2009) and the ultimate marketable gas resource may be as high as 56.9 trillion cubic feet (1.61 trillion cubic metres)(Drummond 2009). Discovered gas reserves are relatively evenly distributed between the Mackenzie Delta and the Beaufort Sea." Table 11-7 provides a summary of the regions currently estimated oil and gas potential.

Table 11-7: Mackenzie Delta and Beaufort Sea Oil and Gas Resource Potential (from LTLC and Salmo, 2012)	
Resource	Current Estimate
Discovered Recoverable Oil Resource	1 to 1.2bb (159 to 183 million m^3)
Total Recoverable Oil Resource	10.6bb (1.69 billion m^3)
Discovered Marketable Gas Resource	9 to 10.4Tcf (254.8 to 294.5 billion m^3)
Ultimate Marketable Gas Resource	56.9Tcf (1.61 trillion m^3)

The LTLC report concludes that: "It is important to note that the Mackenzie Delta/Beaufort Sea Geological Province is still in an early stage of exploration. Chen et al. (2007) states, "It is expected that there will be both increased data and understanding that will lead to new large discoveries in the more remote areas and deeper parts of the sedimentary succession as the scope of exploration expands both geographically and technologically" (LTLC and Salmo, 2012)

The huge spending focused on the Beaufort-Mackenzie Region in the 1980's was added upon during the Mackenzie Gas Project in the early 2000's. The project proposed to build a 1220-kilometre natural gas pipeline system along the Mackenzie Valley which would connect natural gas production from three fields in the Mackenzie Delta to the existing pipeline grid in Alberta. Engineering design, environmental assessments, and other studies in the region, along with nearly 100 new seismic and drilling programs were carried out between 2000 to 2004. The project was delayed several times and finally cancelled in December 2017 as the onset of cheaper shale gas in the south made the project uneconomic.

11.3.3 Current Land Use for Research in the Project Area

With the enormous potential of the Mackenzie-Beaufort region for development, and the excellent access to the arctic land and waters, numerous research scientists from all over the world have come to the area. A list of recent and current studies near the Project Area is provided in Table 11-8.

Table 11-8: Research Projects In or Near the RSA					
EISC File	**Proponent**	**Activity Location(s)**	**Activity**	**Duration**	**Timing**
Research Projects in the RSA					
04/20-01	York University - Jennifer Korosy	Three sampling sites are in the RSA. Not in the LSA.	Core sampling in lakes.	2 weeks	spring 2021

Table 11-8: Research Projects In or Near the RSA					
EISC File	**Proponent**	**Activity Location(s)**	**Activity**	**Duration**	**Timing**
Other Research Projects near the RSA					
03/20-11	ARI - Erika Hille	along ITH; unspecified	Investigate run-off quality from the ITH.	Spring and Summer	2020, 2021
01/20-05	ARI - Alice Wilson	Six research sites along the ITH	Permafrost research	48 days	2020
01/20-01	Michael Pisaric	Outer Mackenzie Delta. Tuktoyaktuk and Inuvik.	Research. Collect water samples from approximately 60-75 lakes	Five days in August 2020. Winter 2021.	2020, 2021
08/19-03	Simon Dumais, University of Laval	ITH. Near Tuk.	Mechanical and thermal design of embankments built on permafrost. ROW in the highway embankment located approximately at: 69.0118, -133.3024.	Five days each year in September	2019 and 2020
05-19-17	Paul Gammon	ITH	Groundwater, surface water, vegetation and soil sampling and measuring along ITH in select locations	50 days, Spring and Fall.	from 2019 to 2022
03/19-07	Dr Sharon L. Smith, Geological Survey of Canada	Tuk. Inuvik.	Permafrost monitoring and collection of baseline information in the Mackenzie Valley Corridor, NWT	May to September	Annually until 2024
05/18-10	Carissa Brown	ITH for site access	Research: vegetation / tree studies	Summer. About six days per year.	2018-2020

11.3.4 Land Use Related to the Inuvik to Tuktoyaktuk Highway

The other primary modern land use in the area is the Inuvik to Tuktoyaktuk Highway (ITH). The ITH is a new 138-kilometre gravel-based highway which extended the Dempster Highway from Inuvik to the Arctic Ocean at Tuktoyaktuk. The ITH was opened on November 15, 2017 after four years of construction. Previously, Tuktoyaktuk was accessible only by air or by winter ice road. The highway is the first in Canada to reach the Arctic Ocean. The Government of the Northwest Territories (GNWT) has reported that tourism has increased in the region substantially as a result of the ITH. A list of tourism companies that use the ITH as of September 8, 2020 is provided in Table 11-9.

Table 11-9: Tourism Companies that Use the ITH (from EISC, 08SEP2020)				
EISC File#	**Proponent**	**Project Title**	**Activity**	**Duration**
04/20-03	Arctic Chalet Ltd	Reindeer Viewing Tours	Driving tours to Tuk	all year

Table 11-9: Tourism Companies that Use the ITH (from EISC, 08SEP2020)				
EISC File#	**Proponent**	**Project Title**	**Activity**	**Duration**
01/20-06	A Taste of Yukon Adventures Inc	Road Trip to the Arctic	Photography Tourism. Inuvik, Tuktoyaktuk and Aklavik Ice Road.	all year
10/18-02	Arctic motorcycle adventures	Motorcycle Tours	Tourism by motorcycle. Inuvik to Tuk.	all year
01/19-03	Arctic Ocean Tuk Tours	Tuktoyaktuk Tours	Tours: of Tuktoyaktuk town	all year
05/19-10	Arctic Range Adventure Ltd.	Tourism	Driving tours to Inuvik, Pingo National Landmark and Tuktoyaktuk from or to Whitehorse.	all year
05/19-13	Arctic Tour Company Ltd	2019 Tourism Licence	Tourism - boating to Pingo. Tuktoyaktuk municipal tours and northern lights	all year
04/18-05	Bruce Noksana	Noksana Mushing Tours	Mushing Tours. Tuk. Pingos. Husky Lake at Ikinilik Bay.	November to May
02/19-02	Joe Nasogaluak	Beaufort Sea Adventures	Community tours in the Municipal Boundaries of Tuk	all year
09/20-01	MGM Bus Service Ltd.	Tourism Business - Highway Tours	Highway tours.	all year
04/19-13	Moses Gordon	Tourism - Highway and Boat Tours	Highway and Boat tours.	all year
01/20-03	Nature Tours of Yukon Inc.	Sightseeing Tours	Tour groups between Inuvik and Tuk. 5-6 participants per vehicle, with a maximum of two vehicles (SUV) per trip	all year
01/19-09	Renedian Adventures	Motorcycle Ride to Tuk	tourism. Motorcycle trip to from Yukon to Tuk	all year
03/20-08	Rotel Tours	Tourism	German tourists, short duration tourism to Pingo, Inuvik, Tuk	one trip
03/20-01	Ruby Range Adventures	Sightseeing Tours	Tourism: from Whitehorse to Tuktoyaktuk on highways	all year
08/20-03	Steen Enterprises Ltd.	Tuktoyaktuk Community Tours	local community tours	all year
02/19-03	Tuktoyaktuk Tours	Community Tours	Tourism: Local town tours	all year

11.4 Potentially Affected Community

The IESP Local Study Area is less than one kilometer from the Municipal Boundary of Tuktoyaktuk (aka “Tuk”). The

next closest community to the Project is Inuvik, which is approximately 130 km from the Project site. The closest resident to the Project is located in the southern portion of Tuktoyaktuk known as Reindeer Point, approximately 12 km from the M-18 wellsite.

Future proximity to the project may be influenced by the ongoing growth of Tuk, and the current relocation program wherein coastal residents are relocating to avoid the effects of coastal erosion.

Although the residents of Tuktoyaktuk are not located in the Project LSA nor the RSA, the Hamlet is within the broader Zone of Influence of the Project. It is expected that project workers will live in Tuktoyaktuk during operations; and that workers during pre-commissioning will utilize local camps or accommodations in Tuk. Obviously, the residents and businesses of Tuktoyaktuk will also be potential customers for energy from the IESP.

A brief profile of the community, including some demographics, a list of public services and a profile of the community infrastructure is provided in this section. Potential impacts to the community, and benefits to the community, are discussed in Section 14 and Section 5 respectively.

11.4.1 Background

Tuktoyaktuk or Tuktuuyaqtuuq, (meaning "place resembling a caribou") is one of six Inuvialuit communities within the Inuvialuit Settlement Region (ISR) and is located at 69°27'N and 133°02W along the coast of the Beaufort Sea. Whaling and other harvesting and gathering traditions that have been practiced since time immemorial are still practiced today. Strongly rooted in this economy, Tuktoyaktuk has also effectively operated as the centre of oil and gas activities in the Western Arctic through the 1970s and 1980s and today as a main tourist destination for travelers at the end of new Inuvik-Tuktoyaktuk Highway. The approximately 1000 residents of Tuktoyaktuk always have and will continue to adapt and thrive amidst changing dynamics. An overview of the demographics of Tuktoyaktuk is provided in Table 11-10.

Table 11-10: Socio-Economic Overview of Tuktoyaktuk

Indicator	Description
Population	The total population of Tuktoyaktuk in 2018 was 982, with 516 identifying as male and 466 identifying as female. Tuktoyaktuk is a predominantly Inuvialuit community with 898 individuals identifying as Indigenous.[1] Tuktoyaktuk has a large youth population with 40% of the population being less than 15 years of age. According to the 2015 Tuktoyaktuk Economic Measures Report (Tuktoyaktuk Report) prepared by IRC, "while Tuktoyaktuk recent economic growth has been beneficial, with such a young population it is hard to grow and sustain a strong economy. While younger populations do have more disposable income of late, they are still not achieving the working base that will sustain a local market for retailers of goods and services and of real estate. They have potential to be developed and trained to take over jobs; particularly those filled by non-Inuvialuit, but it will take time for them to contribute new money, new ideas, and have the capacity to foster greater stability."[2]
Employment	In 2016, the employment rate among Tuktoyaktuk residents was 43% compared to a territorial average of 66.2%. Employment rates among males was 43.3% while rates among females was 41.0%. Among those identifying as Indigenous, the employment rate was 39.3% compared to those identifying as non-indigenous with an employment rate of 72.7%.[3] According to the 2019 NWT Community Survey conducted by the GNWT Bureau of Statistics, the population of Tuktoyaktuk 15 years and older was 730, with 438 being considered part of the Labour Force. Of this Labour Force, 306 were employed and 132 were unemployed indicating a participation rate of 60% and an unemployment rate of 30%.[4] According to the 2020 Social, Cultural and Economic Conditions in the Inuvialuit Settlement Region Report prepared for IRC, the community of Tuktoyaktuk has been identified as having an undeveloped labour market. "Employment rates (percentage of people working compared to the total number of people eligible for work) are 41% and

Table 11-10: Socio-Economic Overview of Tuktoyaktuk	
Indicator	**Description**
	42% respectively. This means that the ratio of income earners to total population is small and is an indicator of financial deprivation (poverty when defined by income levels)."[5]
Traditional Activities	According to the Tuktoyaktuk Report, "many households in Tuktoyaktuk participate in the traditional economy to satisfy food security issues, therefore, a lot of residents of Tuktoyaktuk participate in harvesting… In 2015, Tuktoyaktuk had 56% of households obtaining more than half their meat and fish from harvesting."[6] According to the GNWT Bureau of Statistics, in 2013, 66% of Tuktoyaktuk residents hunted and fished, 8.4% trapped, 28% produced fine arts and crafts and 61% of households consumed country food for at least 50% of their diet.[7]
Education	In 2016, 40% of the population of Tuktoyaktuk aged 15 years or older had obtained their high school diploma. By comparison, the figure was 54% in Aklavik, 71% in Inuvik, 38% in Paulatuk, 50% in Sachs Harbour and 47% in Ulukhaktok.[8] Support is available for students through various government programs run both through IRC and at the community level.
Language	As of 2014, 24.5% of Tuktoyaktuk residents spoke an Indigenous Language. Since 1984, which represents the first year in the years reported by the GNWT Bureau of Statistics, this percentage of speakers of an Indigenous language represents a notable decline.[9]
Housing	In 2016, there were a total of 270 houses in Tuktoyaktuk. 90 of those were owned and 175 of those were rented. Since this latest GNWT Bureau of Statistics Report, IRC has constructed six additional homes with six more slated for construction in the coming months.[10]
Income	According to the Tuktoyaktuk Report, "Inuvialuit households in Tuktoyaktuk fall into four groups: households with one full-time income and additional full or part-time incomes (17%); households with only one full-time income or multiple part-time incomes (17%); households with only one part-time income (25%); and households with no employment income (41%). Looking at these groupings of households it is evident that almost half the households have no employment, creating a very precarious financial and economic situation for the community."[11]

[1] GNWT Bureau of Statistics, Community Totals (https://www.statsnwt.ca/population/population-estimates/bycommunity.php, accessed September 4, 2020).
[2] Inuvialuit Regional Corporation, Tuktoyaktuk Economic Measures Report: The Economic Lives of Inuvialuit Households, p.6 (2015).
[3] GNWT Bureau of Statistics, Tuktoyaktuk – Statistical Profile, (https://www.statsnwt.ca/community-data/Profile-PDF/Tuktoyaktuk.pdf, accessed September 4, 2020).
[4] GNWT Bureau of Statistics, 2019 NWT Community Survey (https://www.statsnwt.ca/recent_surveys/, accessed September 4, 2020).
[5] Inuvialuit Regional Corporation Social, Cultural, and Economic Conditions in the Inuvialuit Settlement Region, p.15 (2019)
[6] Inuvialuit Regional Corporation, Tuktoyaktuk Economic Measures Report: The Economic Lives of Inuvialuit Households, p.8 (2015).
[7] GNWT Bureau of Statistics, Tuktoyaktuk – Statistical Profile, p.3 (https://www.statsnwt.ca/community-data/Profile-PDF/Tuktoyaktuk.pdf, accessed September 4, 2020).
[8] Inuvialuit Regional Corporation Social, Cultural, and Economic Conditions in the Inuvialuit Settlement Region, p.35 (2019)
[9] GNWT Bureau of Statistics, Tuktoyaktuk – Statistical Profile, p.3 (https://www.statsnwt.ca/community-data/Profile-PDF/Tuktoyaktuk.pdf, accessed September 4, 2020).
[10] GNWT Bureau of Statistics, Tuktoyaktuk – Statistical Profile, p.2 (https://www.statsnwt.ca/community-data/Profile-PDF/Tuktoyaktuk.pdf, accessed September 4, 2020).
[11] Inuvialuit Regional Corporation, Tuktoyaktuk Economic Measures Report: The Economic Lives of Inuvialuit Households, p.18 (2015).
[12] Joe McKendy, "Climate change: Arctic coastlines eroding up to 40 m yearly" (https://www.nrcan.gc.ca/simply-science/20661, accessed September 11, 2020).

11.4.2 Local Services and Community Infrastructure

The Community of Tuktoyaktuk offers comprehensive services and infrastructure for local residents and businesses. The IESP is intended to benefit the community. Our assessment has reviewed the local services and infrastructure and the needs of the IESP. A summary of our findings is presented in this section of the Project Description.

IPC intend to work in a cooperative and collaborative manner with the Hamlet of Tuktoyaktuk in all respects. Based upon our extensive discussions to date, we do not expect the Project to create any impacts to the community structure or services. Nevertheless, our Project team will communicate, plan and coordinate with the various local services and infrastructure providers regularly, through the life of the Project, to ensure any strains on demand are mitigated quickly. As mentioned, our intent is to benefit the community.

Over the last few decades, the high rate of coastal change in some parts of the Beaufort Region bears witness to the loss of up to 40 m of coastline each year[12] due to declining sea ice, warming temperatures and stronger climate forcing. The rapidly increasing burden on Arctic infrastructure and communities is requiring mitigation. Tuktoyaktuk is particularly vulnerable to the impacts of climate change and coastal erosion. (sources)

In response to these circumstances, a Disaster Mitigation and Adaptation Fund Stakeholder Committee has been formed. Further, IRC and the Hamlet of Tuktoyaktuk, supported by an engineering firm, are pursuing the development of coastal erosion mitigation options for the Tuktoyaktuk Peninsula and Islands. Fieldwork is now underway, and options will be presented for approval. This program is expected to require the non-renewable, and limited, supply of gravel and sand. Through the Inuvialuit Land Administration, GNWT Municipal and Community Affairs (MACA), and the Hamlet of Tuktoyaktuk, IPC has already identified suitable, non-conflicting, gravel sources and we will pursue a coordinated and cooperative approach to final gravel sourcing.

Table 11-11: Infrastructure & Emergency Services

Category	Description	Potential Overlap Demand
Borrow Sources	Gravel in the Mackenzie Delta Region is a valuable commodity that is not always in abundant supply. 177, 170, 172, 174, 309 and 312 are the borrow sources located between Tuktoyaktuk and M-18. Only 177 and 312 have all-weather access.[14]	The community of Tuktoyaktuk and the IESP will both require gravel in the coming years – for coastal erosion mitigation projects in Tuktoyaktuk and for building the access road and pads for the IESP. Through the Inuvialuit Land Administration, MACA and the Hamlet of Tuktoyaktuk, IPC will pursue a coordinated and cooperative approach to gravel sourcing.
Power	Power is generated by the Northwest Territories Power Corporation and sold to residents and businesses of Tuktoyaktuk.	The IESP will not require any power from Tuktoyaktuk.
Heating	Properties in Tuktoyaktuk are largely heated with diesel fuel, which is shipped to Tuktoyaktuk by barge, stored in Tuktoyaktuk in large tanks and distributed to homes and businesses throughout the year.[15]	The IESP may require a minimal amount of diesel sourced from Tuktoyaktuk. IPC do not anticipate any demand impacts to the community.
Water	Tuktoyaktuk's water treatment facility is located in the center of town and is run by the Hamlet's Department of Public Works. Public Works manages water supply, storage, treatment and distribution and wastewater collection, treatment and discharge.[16] According to the Operations & Maintenance manual, the Plant was designed for a 20-year life and a design population of 1,167. The average day water demand is 186 m^3/day, and the peak demand is 279 m^3/day. The active storage capacity of the raw water reservoir is stated to be	The IESP may require a minimal amount of water sourced from the Tuktoyaktuk Water Treatment Plant. IPC do not anticipate any demand impacts to the community.

Table 11-11: Infrastructure & Emergency Services		
Category	**Description**	**Potential Overlap Demand**
	approximately 90,300 m^3. The treated water tank holds about one truck's worth, probably about 14 m^3.[17]	
Solid Waste	The Hamlet's Mayor and Council are currently in the process of opening a new landfill site. Expected time of completion is 2022.[18]	The IESP will not generate a significant amount of domestic/kitchen waste. No industrial waste will be sent to Tuk. IPC do not anticipate any demand impacts to the community.
Sewage	Public Works manages wastewater collection, treatment and discharge. The lagoon Operations & Management Plan reports collection volumes of ten truckloads per day, seven days per week, and 14,320 L per load, for a total annual volume of approximately 52 million litres. The lagoon is about 5.9 ha in area, with a likely capacity for that annual volume of 52 million litres.[19]	The IESP will not generate a significant amount of sewage waste. IPC do not anticipate any demand impacts to the community.
Internet	Access to the internet may be available at the Hamlet office to visitors coming into the community. The community also has 3G wireless services.[20]	The IESP will require hi-speed internet. The IESP will likely access internet via satellite until fiber is extended to Tuktoyaktuk. There will be no impact on the residents and businesses of Tuktoyaktuk.
Stores	The Northern Store and Stanton's Tuktoyaktuk are the only two grocery stores located in Tuktoyaktuk and have a wide selection of grocery items including, fresh produce, dairy, canned goods, frozen foods, health and beauty items as well as a lotto centre and an ATM machine. These are open year-round.[21]	Contractors working on the IESP during pre-commissioning will stay in catered camps. Groceries and other supplies will be provided by the camp. During operations, an additional 25-30 persons will be employed for the Project. If large orders of any items are anticipated, IPC and Ferus will work directly with wholesale purchasing to ensure there is no strain on local supply.
Police	Police services in Tuktoyaktuk are provided by the Royal Canadian Mounted Police. There is one Sergeant and five constables on staff. The RCMP Detachment is located at 364 Oceanview Road in Tuktoyaktuk.[22]	IPC will work closely with the RCMP in the event of an emergency or incident requiring police attention. We do not expect any demand impacts from the Project.
Fire	The Tuktoyaktuk Fire Department (TFD) has seven volunteer members and a fire chief. Members respond to structural and vehicle fires and other scenes when requested. The TFD response capacity is normally four fire fighters on a call. The TFD also has 1988 mid shift pumper; a 2012 CAFS compressed air foam pumper; and, a 2011 F150 truck. There is currently planning underway to obtain level 2 certification for the firefighters. The TFD is located on Beaufort Road.[23]	IPC will work closely with the TFD in the event of an emergency or incident requiring fire responders and/or fire fighting equipment. The IESP is planned to be self-reliant for fire and spill response. We do not expect any demand impacts from the Project.
Medical	Most medical services are provided through the Rosie Ovayuak Health Centre, which is located on Beaufort Road. According to the GNWT, health services include, Emergency, Diagnostic, Restorative, Rehabilitative, Immunization, Disease Prevention, and others. The OHC is open five days a week and provides primary health care services. During non-office hours, a nurse is on call for emergencies. A visiting doctor serves the community once per month, and there are four nurses on staff year-round full-time and one on one rotation.[24]	IPC will work closely with the Health Centre in the event of an emergency or incident requiring medical attention. We do not expect any demand impacts from the Project.
Airport	The James Gruben Airport offered regular scheduled flights and chartered flights year-round. Since the ITH has been complete, the airport has been used less frequently. Aklak Air continues to have charter services available if needed.[25]	The IESP is not expected to require air service to or from Tuktoyaktuk, except in the case of emergency, such as medical evacuation. We do not expect any demand impacts on the community from the Project.
Road Transportation	Tuktoyaktuk has a network of gravel roads that lead into the community from the all-season Inuvik-Tuktoyaktuk	The IESP does plan to use the ITH to transport borrow, well completion

Table 11-11: Infrastructure & Emergency Services		
Category	**Description**	**Potential Overlap Demand**
	Highway. These roads are maintained by Municipal Public Works.[26]	equipment, facility modules and eventually to regularly transport energy products daily all year round. IPC has already initiated discussions with the GNWT Department of Transportation to ensure proper maintenance, safety and signage is maintained on the ITH throughout the lifecycle of the project.

[14] GNWT Department if Infrastructure, "Inuvik to Tuktoyaktuk Highway (HWY No. 10) Lands Map" (January 2019).
[15] Discussions with Petroleum Resources Division of Infrastructure Tourism and Investment Department (June 2020).
[16] Hamlet of Tuktoyaktuk Department of Public Works, "Municipal Departments" (https://www.tuktoyaktuk.ca/index.php/governance/municipal-departments, accessed September 11, 2020).
[17] Discussions with Tuktoyaktuk Hamlet Office, September 2020.
[18] Hamlet of Tuktoyaktuk, "Community Services" (https://www.tuktoyaktuk.ca/index.php/services/community-services, accessed September 11, 2020).
[19] Hamlet of Tuktoyaktuk Department of Public Works, "Municipal Departments" (https://www.tuktoyaktuk.ca/index.php/governance/municipal-departments, accessed September 11, 2020); Discussions with Hamlet of Tuktoyaktuk Office.
[20] Hamlet of Tuktoyaktuk, "Community Services" (https://www.tuktoyaktuk.ca/index.php/services/community-services, accessed September 11, 2020).
[21] Hamlet of Tuktoyaktuk, "Community Services" (https://www.tuktoyaktuk.ca/index.php/services/community-services, accessed September 11, 2020).
[22] Royal Canadian Mounted Police, "Tuktoyaktuk Detachment" (https://www.rcmp-grc.gc.ca/detach/en/d/361, accessed September 4, 2020); Discussions with RCMP Detachment staff.
[23] Information obtained from TFD Fire Chief, Stanley Felix (September 11, 2020).
[24] Hamlet of Tuktoyaktuk, "Community Services" (https://www.tuktoyaktuk.ca/index.php/services/community-services, accessed September 11, 2020); Discussions with Health Centre staff.
[25] Hamlet of Tuktoyaktuk, "Community Services" (https://www.tuktoyaktuk.ca/index.php/services/community-services, accessed September 11, 2020); Discussions with Aklak Air staff.
[26] Hamlet of Tuktoyaktuk, "Community Services" (https://www.tuktoyaktuk.ca/index.php/services/community-services, accessed September 11, 2020).

The following additional community services are identified on the Hamlet of Tuktoyaktuk website:

- Cemetery – Plots are reserved at the Tuktoyaktuk Cemetery by contacting the Hamlet office.
- Churches – St. John's Anglican Church, Tuktoyaktuk Baptist Church, The Glad Tidings Mission and Our Lady of the Lourdes Catholic Church offer weekly Sunday services.
- Aurora College Community Learning Centre –Aurora College delivers programs and courses through a network of three regional campuses as well as Community Learning Centres.
- Environment and Natural Resource (ENR) Officers – ENR Officers provide conservation and enforcement services for Tuktoyaktuk, including working with problem wildlife. The Tuktoyaktuk office issues local hunting licenses, local fishing licenses, and wildlife export permits.
- Counselling Services – Support and counselling for individuals, couples and families are available in Tuktoyaktuk through the Beaufort Delta Health and Social Services programs.
- Home Care – The Rosie Ovayuak Health Centre offers home care and home support services in Tuktoyaktuk for elders and those who require addition medical support.
- Library – The Mangilaluk School Public Library is open on Tuesdays to Saturdays from 1 p.m. to 5 p.m. Story time takes place on Friday mornings from 10 a.m. – 11 a.m. for pre-school age children.

- Post Office – The Tuktoyaktuk Post Office is located in the Northern Store and is open Mondays to Fridays from 10:00 a.m. to noon and from 1:15 p.m. to 5:00 p.m.
- School – The Mangilaluk School offers Kindergarten to Grade 12 classes following the Alberta curriculum, 25 full and part time educators serve up to 225 students.

12.0 COMMUNITY ENGAGEMENT & CONSULTATION

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

Demonstrated community engagement, a list of issues and concerns identified during the engagement, and how the development design and implementation is addressing the issues and concerns identified. (Refer to subsection 4.5)

12.1 Introduction

The approach to engagement taken with respect to the IESP has three key features. First, it started very early in the project. Second, this engagement has been able to benefit from the well-tested governance framework established under the Inuvialuit Final Agreement and has supplemented this with highly individualize engagement on a person-by person, group-by-group, community-by-community basis. Third, residents of the Inuvialuit Settlement Region are very accustomed to consultation and engagement processes having led their own regional environmental assessments over the years, having recently engaged in the ITH pre-development work, having been the focal region for the Mackenzie Gas Project, having witnessed various offshore explorations and seismic studies, and having often been leaned upon for research projects of all kinds.

Over twenty years ago, prior to granting the Tuk 2 Concession to Petro Canada in 2000, Inuvialuit leadership, through the chairs of the six Inuvialuit community corporations engaged in discussion about the development of M-18. Since then, the Inuvialuit Corporate Group has waited for market conditions to align so that the well owners of the time could be enticed to develop the well. While southern markets may have been the target for the well owners, Inuvialuit were focused on providing an affordable source of energy to local residents and businesses.

Unfortunately, it became increasingly clear that a southern market for Arctic-sourced natural gas was not to be and that residents of the Inuvialuit Settlement Region were in an increasingly precarious situation. In response, between 2016-2018, the Inuvialuit Corporate Group, with important financial and informational support from the Government of Canada through CanNor and from the Government of the Northwest Territories through the Department of Infrastructure Tourism and Investment undertook an assessment of the feasibility of producing local natural gas for local consumption. This work entailed extensive engagement with both levels of government, the Northwest Territories Power Corporation, local businesses, and residents who were willing to share their experience with, for example, power and heating supply, logistics, conversion and more.

Once it was determined that the development of M18 was feasible from a technical and economic perspective, Inuvialuit and its partners set out in the summer of 2018 to complete field studies to assess the possible impacts of this development on the local environment and those who rely on it. This too involved engagement with Inuvialuit knowledgeable about the area. Further once it was determined that potential environmental impacts would not be significant, IPC undertook to determine the least impactful approach to the development of the local area through a geotechnical study in winter 2020. Again, this required communication with local businesses as well as wildlife and environmental monitors regarding the timing, location, and trajectory of components of the proposed project.

Finally, twenty years after the IRC and ILC granted the Tuk 2 Concession, IPC set out through the summer of 2020 to formally consult the residents of local communities on the elements of the proposed IESP. IPC also reached out to the co-management bodies established under the IFA to provide information, documentation, and

opportunities to have questions answered. This was an iterative process with presentations followed by written correspondence, subsequent meetings, question and answer brochures and telephone calls as individuals had questions. Contributions from stakeholders have been implemented in the design work for the IESP.

Engagement and consultation among IPC, Ferus NGF and stakeholders remains ongoing. As mentioned above, IPC has the advantage of being a member of the Inuvialuit Corporate Group. Non-confidential information about the IESP is able to flow through the Community Corporation Chairs through to their respective members. Further, the IRC's quarterly newsletter and IPC's website and social media, which are read by thousands of Inuvialuit on a regular basis provide additional ongoing sources of information for individuals and families. Regular visits to communities near the IESP by senior staff members of the Inuvialuit Corporate Group provide another great opportunity to inspire discussion, hear concerns and answer questions.

It should be noted, as indicated briefly above, that Inuvialuit and other residents of the Inuvialuit Settlement Region are relative experts in consultation and engagement. It is not uncommon for ISR stakeholders to direct proponents on what they need to cover. IPC and Ferus NGF have been the beneficiaries of strong contributions from a wide spectrum of people including Elders, community leaders, harvesters, and youth. All these contributions – including recommendations on who to further consult – have enriched the consultations and have improved IPC and Ferus NGF's planning and problem solving. A list of traditional knowledge holders who graciously contributed to this Project Description by agreeing to be interviewed are included in Section 20 – List of Contributors.

12.2 Engagement Approach

IPC is following the Traditional Knowledge Guide for the Inuvialuit Settlement Region, Northwest Territories Volume II: Using Traditional Knowledge In Impact Assessments (Kavik-Axys and FMW, 2008); the new Canada Energy Regulator Early Engagement Guide (2020); and the International Association for Public Participation (IAP2) best practices, for our community engagement approach.

12.2.1 International Association for Public Participation

The IAP2 spectrum spans from "inform", meaning "we will keep you informed"; to "empower", meaning "we will give you final decision making and implement what you decide". As described above, the IESP is owned and is being led by the Inuvialuit Corporate Group, the modern treaty holder under the Inuvialuit Final Agreement, which represents the rights and interests of Inuvialuit – the primary stakeholder group with respect to the IESP. This is a positive example of a stakeholder being empowered to participate directly in a project through its constitutionally entrenched governance framework.

Source: International Association for Public Participation, https://www.iap2.org/mpage/Home.
Accessed September 11, 2020

Insofar as an international standard provides a benchmark for consultations with by an Indigenous governing body with Indigenous communities within a modern treaty area, IPC and Ferus NGF have taken and continue to take, an approach to public consultations that mixes an "involve" approach with a "collaborative". In effect, this means that IPC and Ferus NGF are working directly with stakeholders throughout the process to ensure that public concerns and aspirations are consistently understood and considered; and, in cases of high community interest, such as training and job preparation, we are partnering with the potentially affected communities, through the leadership, in each aspect of the development, including the development of alternatives and the identification of the preferred solution.

Through close collaboration, we will continue to engage with the local communities to design the best approach for this project. IPC and Ferus NGF will problem solve and improve the IESP based on the advice and innovative ideas contributed through this collaboration.

Examples of this collaboration include sourcing of appropriate quality gravel sources, access road route selection, designing project lifecycle monitoring program, as well as our project impact mitigation measures. The early consultations have also influenced our training and capacity building programs.

12.2.2 Canada Energy Regulator

In the Inuvialuit Settlement Region, pursuant to the NWT Devolution Agreement, the Canada Energy Regulator (CER) regulates oil and gas operations. The CER's regulatory oversight typically spans the entire life of the regulated infrastructure, subject only to any authorities which cede to another regulatory body (i.e., a provincial body). Early engagement is just the first of many processes designed to support participation in CER-regulated infrastructure projects. Early engagement is followed by the application assessment process, which in turn is followed by open and transparent compliance processes during the construction and operation phases of approved facilities. (CER, 2020)

With respect to community engagement, the CER expects a company to undertake its engagement activities in a manner consistent with the principles of meaningful engagement. Table 12-1 provides a list of engagement activities expected by the CER, as taken from the Guide, and a note on the status of the activity in the IESP as of September 2020.

Table 12-1: IESP Status on CER Expectations for Engagement	
CER Expectation	**IESP Status**
Be initiated as soon as possible in the planning and design phase of a project.	Yes
Provide clear, relevant, and timely information to potentially affected persons and communities.	Yes
Be accessible to and inclusive of all potentially affected persons and communities.	Yes
Be shaped by input from potentially affected persons and communities (e.g., appropriate methods, timing, language, cultural aspects, and format).	Yes
Provide appropriate and effective opportunities for all potentially affected persons and communities to learn about a project, and to provide comments and concerns about a project to the company.	Yes
Be responsive to the needs, inputs and concerns of potentially affected persons and communities, and demonstrate how this input informed the proposed design, construction, and operation of the Project.	Yes
Continue throughout the regulatory process, as well as the construction and operation phases of a project.	Ongoing
Have an Engagement Program to anticipate, prevent, mitigate, and manage conditions which have the potential to affect persons and communities.	Yes

12.2.3 Traditional Knowledge

The Traditional Knowledge Guide for the Inuvialuit Settlement Region (Kavik-Axys and FMW, 2008) encourages developers and traditional knowledge holders to work extensively together prior to an environmental impact assessment to gain the full value of traditional knowledge during the project planning. IPC has used this philosophy to improve our Environmental Assessment for this Project Description.

Although the GNWT carried out extensive workshops to incorporate local traditional knowledge from Inuvik and Tuktoyaktuk (Kavik-Stantec 2012) for the ITH project, IPC decided to supplement that study and directly interview harvesters from Tuktoyaktuk about their use of the Project Local Study Area (LSA) and the Regional Study Area (RSA). Interviews were completed via telephone by Denise Atter, an Inuvialuk and former resident of Tuktoyaktuk. In-person sessions were held by Lucy Kuptana, IRC Director of Operations, and former resident of Tuktoyaktuk, and Elizabeth Kolb, IRC Communications Advisor with Special Advisor Kate Darling providing information as needed. Harvesters and other land users were asked about their use of the RSA and LSA, as well as to find out if they knew of anyone else who uses the area. The Inuvialuit Land Administration provided its record of Inuvialuit cabins in the region and IPC was able to contact the owners directly to discuss the IESP. Relying on the EISC registry for all outfitters or hunting guides using the area, IPC was able to reach out to these individuals as well. A list of outfitters was provided in Section 11. The list of cabin owners is considered confidential. The harvesters interviewed about traditional knowledge of the area are listed in Section 20 -Contributors of this PD.

12.3 Community Engagement to Date

Meetings with local leaders of the Inuvialuit Regional Corporation and the six Community Corporations about the IESP began in Fall of 2016 when the Feasibility Study was first contemplated. Regular updates were provided on the outcomes of the study through 2017 and 2018. Formal pursuit of the IESP began in 2018 with periodic presentations being made to Inuvialuit leadership as the concepts developed. Meetings with government leaders and co-management bodies were also held to problem solve specific issues and determine the overall level of support for the IESP. Details of these consultations are provided in Section 13. Specific meetings with communities

and community organizations were initiated in the summer of 2020 as soon as the basis of design was conceived, and conceptual plans were available for discussion. A list of community meetings and open houses to date is provided in Table 12-3.

Table 12-2: Community Engagement Meeting Log

Community Organization (See notes for acronyms)	Date	Place	Type of Meeting:	Details of project provided?	Potential impacts and benefits discussed?	Issues and concerns discussed?	Relevant TK discussed?	Outcome
THTC	09-Jun-20	Tuktoyaktuk	Teleconference	Y	Y	Y	Y	letter of support
TCC	09-Jun-20	Tuktoyaktuk	Teleconference	Y	Y	Y	Y	offer of support
ICC	11-Jun-20	Inuvik	Videoconference	Y	Y	Y	Y	letter of support
Town of Inuvik	15-Jun-20	Inuvik	Videoconference	Y	Y	Y	n/a	letter of support
IHTC	16-Jun-20	Inuvik	Videoconference	Y	Y	Y	Y	letter of support
Hamlet of Tuktoyaktuk	17-Jun-20	Tuktoyaktuk	Teleconference	Y	Y	Y	Y	letter of support
ACC	24-Jun-20	Aklavik	Teleconference	Y	Y	Y	n/a	offer of support
GTC	29-Jun-20	Inuvik	Teleconference	Y	Y	Y	n/a	offer of support
GDC	29-Jun-20	Inuvik	Teleconference	Y	Y	Y	n/a	offer of support
Tuktoyaktuk		Tuktoyaktuk	Open house	Y	Y	Y	Y	offer of support

Notes:
THTC – Tuktoyaktuk Hunters and Trappers Committee
TCC- Tuktoyaktuk Community Corporation
ICC - Inuvik Community Corporation
IHTC - Inuvik Hunters and Trappers Committee
ACC - Aklavik Community Corporation
GTC - Gwich'in Tribal Council
GDC - Gwich'in Development Corporation

Our approach to date has resulted in broad vocal support and five letters of support from the potentially affected communities. Letters of support for the IESP have been sent from the Town of Inuvik, the Hamlet of Tuktoyaktuk, the Tuktoyaktuk Hunters and Trappers Committee, the Inuvik Community Corporation, and the Inuvik Hunters and Trappers Committee. Copies of the letters of support are provided as Appendix 6.

12.4 Community Issues and Concerns

The issues and questions raised in the community meetings were compiled and presented back to the communities in the form of a plain-language brochure called "Project Information Update 2: FAQ" in August 2020. A copy of the FAQ brochure is provided in Appendix 8. The FAQ brochure was sent as a general mailout to all mailboxes in the Hamlet of Tuktoyaktuk.

At a high level, these contributions generally touched upon: how decisions regarding the IESP are going to be made; how IPC will continue to provide information and communications about the project; local benefits; employment, contracting and training opportunities; environmental impacts on surrounding lands and waters; anticipated emissions; engineering design relating to the well, the creek crossing, borrow sources and remediation of the waste site; design solutions in anticipation of changes to the climate; operations, including site safety and security, trucking, road maintenance; and future uses for the products.

A list of issues and concerns is provided in Table 12-4.

Table 12-3: Issues and Concerns Raised During Community Engagement

Concern	Response
Who are the Project proponents?	The IPC is proposing the IESP with the support of Ferus Natural Gas Fuels (Ferus NGF). The IPC is a subsidiary of the Inuvialuit Regional Corporation with the mandate of engagement of Inuvialuit in the energy and resources sector. Ferus NGF is a private company specializing in small-scale LNG production and supply to the north. As Ferus NGF is a lesser known entity in the region, there is a consistent and considerable effort being made to establish and build credibility and trust.
How will each community benefit from the Project?	The key benefits of the IESP, include energy security, reduced cost of living, regional economic development, employment, contracting, training and capacity building opportunities, and a meaningful reduction of GHG emissions. IPC and Ferus NGF are committed to ensuring that local benefits are maximized throughout the entire lifecycle and scope of the IESP.
How will the community of Tuktoyaktuk benefit from this Project? Tuktoyaktuk is most impacted because of its proximity to the well yet will not necessarily benefit from reduced energy costs.	We understand the position Tuktoyaktuk is in and have had many conversations with members of the Tuktoyaktuk community to understand needs and concerns. There will be a meaningful number of full-time jobs created through this Project, many of which will require employees who live close to the facility. There will also be many contract opportunities. We will work with all stakeholders to help prepare them for these jobs. Tuktoyaktuk will benefit from reduced heating costs, and we are having discussions with the GNWT on how they might benefit more directly from reduced power costs as well.
Is the Project timeline realistic?	The timeline for this project is aggressive due to its urgency, but it is achievable. We are aiming for first gas production and transportation in Spring 2022. We are engaged in ongoing community consultations; we have made meaningful progress in the front-end engineering and design (FEED) and we will be submitting our regulatory permit applications in the fall with approvals anticipated in late 2020 and early 2021. If the IESP is approved, civil works will take place in early 2021 and plant construction is scheduled for the fall of 2021 and early winter of 2022.
Why was the M-18 well chosen, and will it have a better outcome than the Ikhil well?	The M-18 well is in a condition unlike any of the other exploratory wells that were drilled in the region. In its current state, it can be completed at a low enough cost to make the project feasible. The M-18 well is in a different formation than the Ikhil well. Its geology has been validated by experts and the size of the reservoir is considerably larger than Ikhil. M-18 has an estimated 335 billion cubic feet (BCF) of gas in place with 278 BCF identified as recoverable. This is enough gas to supply the region for approximately 100 years. In addition, M-18 sits above the gas-water line so it will not water-out like the Ikhil well did.
Will we continue to be consulted throughout construction and operation? How do we ensure the	The IESP project proponents formally consulted (virtually) with 8 regional leadership organizations, including Tuktoyaktuk Community Corporation,

Table 12-3: Issues and Concerns Raised During Community Engagement	
Concern	**Response**
general public receives every communication so that all members have an opportunity to comment?	Tuktoyaktuk Hunters and Trappers Committee, Hamlet of Tuktoyaktuk, Inuvik Community Corporation, Inuvik Hunters and Trappers Committee, Town of Inuvik, Gwich'in Tribal Council and Aklavik Community Corporation. We also hosted a subsequent virtual consultation with the broader membership of the Tuktoyaktuk Community Corporation. In order to ensure information is being disseminated broadly throughout the impacted communities, we have created digital materials which have been emailed and posted on the IRC website and social media channels, and we have printed hard copies for distribution in public places. These materials include an introductory project brochure, an FAQ document, a jobs poster and we are finalizing a comprehensive job opportunities guide. (*See Appendix 8). We are also developing a 2-hour educational seminar on natural gas development which will be delivered virtually throughout the communities to all interested people. We have expressed our willingness to host more public meetings and are looking into providing updates via local radio stations as recommended by a Tuktoyaktuk community member.
How much will our heat and power bills be reduced?	We are still working through these numbers. Our consistent objective and message is that heat and power costs should decrease meaningfully, not marginally.
How will Tuktoyaktuk power and heating be converted to gas?	Conversion of Tuktoyaktuk power to natural gas is in the GNWT's energy strategy and is part of their capital plan. We are working with the GNWT and NTPC to ensure their timeline is in line with when the IESP comes online. Converting Tuktoyaktuk home heating to natural gas is more difficult and possibly cost prohibitive because of the dispersed nature of Tuktoyaktuk and where the plant sits.
What is the capital cost of the IESP?	This is a work in progress. We will have a better understanding of the capital cost of this project once we complete the FEED work in the fall of 2020. No final investment decision will be made until the number is known and approved by Inuvialuit leadership.
What is the expected Return on Investment of the IESP, and when will it be achieved? What kind of royalties will be paid?	While the economics are important, the main priority of this project is the anticipated local benefits including energy security and affordability as well as local job creation and capacity building. That said, the return on investment (ROI) will be typical of other infrastructure projects and will depend to a considerable degree on demand. We are working closely with the GNWT and NTPC who will be our two main customers to secure contracts for the fuel. We do not know what the royalty rate will be yet. It will be considered along with other major priorities like reducing the cost of fuel, including different construction approaches, and making sure people have employment opportunities.
How many jobs will be created, and will they be filled locally?	We are anticipating the creation of 15-25 full time jobs and significant contracting opportunities during construction and operation of the facility. To the extent possible, every job and contract will be filled locally. We are finalizing an "IESP Opportunities Guide" that will describe the various full-time and contract job opportunities and how to prepare for them. As this project progresses and we are ready to hire, we will make all employment and contract opportunities known on IPC's webpage and through the Inuvialuit Corporate Group's website and social media platforms. Some of

Table 12-3: Issues and Concerns Raised During Community Engagement	
Concern	**Response**
	the employment opportunities will require several years of training. Where Inuvialuit or other residents are not yet ready to take those positions, IPC and Ferus NGF will establish a transition period to fulfill operational needs while individuals are pursuing their training and education. IPC is updating the Inuvialuit Business List (IBL) and is committed to using IBL members. Ferus NGF is committed to hiring student interns from the region to work in their shop in Grande Prairie, AB and just completed the first six-week summer internship program for two individuals from Tuktoyaktuk.
What are the environmental risks of the project?	The environmental and geotechnical feasibility of the project has been analyzed through a series of eight field studies conducted over the last three years with support of the Inuvik and Tuktoyaktuk Hunters and Trappers Committees, the Aurora Research Institute and the Inuvialuit Land Administration. The results of the field studies show that the wellsite and area can be developed without any significant impacts to wildlife, water, vegetation, permafrost, or any other aspect of the environment. Additional traditional knowledge is being gathered during our consultations which are being incorporated into the project planning and design. A plain language summary of the 2018 environmental studies was made available to stakeholders and we are currently working to prepare a plain language summary of the geotechnical report once regulatory submissions are complete.
Will this Project impact our use of the land in the area (berry picking, caribou and grizzly bear hunting, fishing in Iqalushaq lake, etc)?	During our community consultations, we have been asking specific questions about how the land is used and how we can mitigate against any disruptions. All traditional knowledge is being incorporated into the project planning and design.
Will air quality be impacted by flaring during well workover and ongoing operations?	We are working on flare design to minimize air quality impacts. There are no trace sulphur compounds in the gas being produced so concerns around SO_2 and H_2S are not an issue. Ambient air quality guidelines will not be exceeded, and we are designing for a smokeless flare during operation.
Will there be ongoing environmental monitoring, including emissions monitoring?	Yes. From a climate change perspective, we installed four ground thermistors in the project area this past winter which will monitor the ground temperatures at our site and along the road. During facility operation, the different fuels used will be metered and emissions will be reported on quarterly. During construction, emissions can be measured by gathering fuel usage data from the site construction activities and applying emission factors to the various sources. We will also be monitoring wildlife sightings, noise, air emissions, drainage, light intensity, road speed, nesting, and area usage.
Will a culvert or bridge be built for the creek crossing?	It was made clear during the first round of consultations that, for environmental reasons, culverts are not an acceptable option to the community for the creek crossing. A bridge is now included in the Site Works design for that crossing provided. Its structural feasibility is undergoing assessment.
Who is responsible for the M-18 sump remediation?	The well owners have indicated they wish to fulfill their responsibility for the remediation of the sump. If the IESP is approved remediation can begin once civil works are done on the road.
What will the impact be of truck traffic on the ITH, including safety?	Between the LNG and natural gas liquids, we are anticipating a maximum of five heavy-duty trucks per day on the ITH and a typical range of 1.5 to three trucks per day during start up. This is based on 24 hours per day of energy transport.

Table 12-3: Issues and Concerns Raised During Community Engagement	
Concern	**Response**
	Any other truck traffic will come from light duty vehicles (operators going back and forth daily to work) and the odd heavy truck for things like sewage removal or restocking of site industrial supplies. We have started discussions and will be working closely with the GNWT Department of Transportation to ensure adequate road maintenance and safety, including the construction of more pullouts on the highway.
Will there be year-round security at the plant?	Yes. We are gathering feedback during our consultations around the most effective security measures including a gate, plenty of signage, fencing and full-time personnel patrolling the highway and road to the facility.
What is the regulatory process for this project?	Regulatory approvals will be required from the Environmental Impact Screening Committee, the Canadian Energy Regulator, the Inuvialuit Land Administration, Fisheries and Oceans Canada, NWT Department of Transportation, and others. We are following all regulatory due processes.
What are the noise impacts of this facility?	The noise levels 1.6 km from the facility will be under 40 decibels. This is the level required by regulators and is about the same amount of noise as you would find in a quiet library.

GNWT restrictions to travel and public gatherings have prevented the ability of our southern geologists, engineers, scientists, and planners to visit the community, as we would prefer to do. Nevertheless, we have used available technology to interface and engage with the community. Additional efforts for face to face community engagement in the past month have included:

- Placement of documents containing information about the IESP (e.g. Opportunities Poster, FAQ Document) directly into residential mailboxes in Tuktoyaktuk.
- Placement of these same documents in high-traffic public areas.
- Posting of a request for information regarding:
    - Cabins
    - Annual harvesting interest in the RSA
    - Lakes used for fishing in the RSA
    - Trap lines in the RSA
    - Berry harvesting in the RSA
- Organization of one-on-one meetings with interested individuals at the ILA offices in Tuktoyaktuk. In these meetings, Lucy Kuptana provided all the documents that have been made available to date to the individual(s) and brought Kate Darling in by phone to answer specific questions and concerns that individuals had. In other one-on-one meetings, Elizabeth Kolb shared IESP information with individuals and recorded any questions or concerns that people had for referral back to the IESP team. Approximately 25 additional individuals who had not attended the public meetings were reached this way. Individuals included: Bruce Noksana, Richard Gruben, Robert Gruben, Roger Gruben, Maureen Pokiak, Peter Nogasak, Joe Nasogaluak, Joe David, Hester Inuaslurak, Jade Inuaslurak, Donna Inuaslurak, Billy Emaghok, Calvin Pokiak, Ernest Pokiak. Topics covered in these meetings included:
    - Location of the management of M-18, with interest in this being from Tuktoyaktuk
    - Desire to have a list of the contractors to date.
    - Recommendation to put updates on the Hamlet radio station.
    - Request for a plain language summary of the Geotech report so that Community Corporation resource people can understand what they are being asked to brief their boards about.
    - Proposal to have a local liaison person dedicated to the IESP.
    - Worries about noise.
    - Getting youth ready to take on the IESP opportunities.

- Organization of an Elders-specific meeting in Tuktoyaktuk on September 15, 2020
- Organization of Youth-specific meeting in Tuktoyaktuk with the help of the high school on September 15, 2020.

Finally, IPC has heard from several people in the community that they would like to better understand about the development and production of gas and natural gas liquids. IPC has engaged the expertise of the Canadian Energy Research Institute (CERI) and JWN Energy to develop a customized “Oil and Gas 101” course to meet this request. We hope to deploy this course, likely by virtual meeting technology due to the restrictions imposed by COVID-19 mitigation measures, in the month of October 2020.

IPC remains committed to ongoing communication and engagement with the potentially affected communities as well as all Inuvialuit organizations, co-management boards, and interested government leaders throughout the life of the project. Through the IRC Newsletter, the IPC website, Corporate Group social media, IRC training and capacity-building program and career counseling, Inuvialuit and other residents will remain up to date on the IESP and the opportunities that it offers to the communities.

13.0 CO-MANAGEMENT, INUVIALUIT ORGANIZATIONS & GOVERNMENT ENGAGEMENT & CONSULTATION

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

Demonstrated engagement with relevant government departments and agencies, Inuvialuit organizations and co-management organizations. A list of issues and concerns raised by these parties and methods the Developer proposes, or has already implemented, for dealing with them.

13.1 Early Engagement

The development of natural gas resources in the Inuvialuit Settlement Region with the intention, at least in part, of benefiting Inuvialuit and other northern residents has been a focus of the Inuvialuit for decades. High heat and power bills have been an unfair irony in a region endowed with abundant gas resources for far too long. The Ikhil reservoir was, from the beginning, intended to tie into the Mackenzie Gathering System once the Mackenzie Gas Project started to produce. Anticipating this, many residents in the Town of Inuvik converted their home heating systems to natural gas. Unfortunately, the MGP took much longer to progress than was initially heralded and it was ultimately cancelled in 2017. In the meantime, the first Ikhil well stopped producing and estimates conducted on the remaining Ikhil have suggested there is limited time left.

Acknowledging this irony, the precariously energy insecure position of Inuvialuit and other northern residents, the completion of the new Inuvik-Tuktoyaktuk Highway and the fact that market conditions were not such that industry was willing to fix the energy problem, Inuvialuit undertook to determine for themselves the feasibility of developing local resources for local use.

The Government of Canada and the Government of the Northwest Territories agreed that the situation was dire enough to explore the feasibility of this local solution. Canada, though CanNor, and GNWT, though ITI, provided funds to the Inuvialuit Regional Corporation to support its *Beaufort Delta Regional Energy Feasibility Study*. Through its industry partners, detailed environmental and geotechnical feasibility studies of the area were also completed in the summer of 2018. During this time, staff from IRC met and communicated regularly with government officials both at the territorial and federal levels to share information about a potential development and local energy security solution.

Based on the findings of these analyses and a careful weighing of the risks and benefits of the development for Inuvialuit and other residents, IRC leadership authorized the IPC to begin consultation and engagement and take the project initiation steps needed to prepare for a final investment decision on the IESP.

Within a week of this direction, IPC, along with Ferus NGF, initiated engagement, and consultation for the IESP including meetings with the Mayor of Inuvik and the NWT Minister of Industry, Tourism and Investment (ITI) in Yellowknife. Both meetings were positive, and both government leaders expressed support for the project.

Since that time, IPC and Ferus have held more than 60 meetings with co-management boards, Inuvialuit organizations and government departments. A list of organizations consulted to date and the highlights of the engagements is provided in Table 13-1. While, as expected, different groups and individuals have different priorities in mind for the IESP, support for the project has been unanimous. Government and community leaders

agree that this is a project that is urgently needed and can be done in such a manner that there will be no significant impacts to the environment or the communities. Engagement is ongoing and expected to continue through the life of the project.

Table 13-1: Organizations Consulted to Date (September 15, 2020)	
INUVIALUIT ORGANIZATIONS	**OUTCOMES**
Inuvialuit Regional Corporation (IRC)	Project Sponsor – unanimous support of Chair and Board
Inuvialuit Land Administration	Supportive of the Project. Revenue from this project will help fund the ILA.
Tuktoyaktuk Hunters and Trappers Committee (THTC)	Supportive of the Project. Requested a bridge rather than a culvert for the creek crossing.
Inuvik Hunters and Trappers Committee (IHTC)	Provided a letter of support. (See Appendix 6).
Tuktoyaktuk Community Corporation	Provided a letter stating they are keen to see the project happen. The TCC is requesting a project-specific benefits plan. (See Appendix 6).
Inuvik Community Corporation	Provided a letter of support. (See Appendix 6).
Aklavik Community Corporation	Supportive of the Project.
Inuvialuit Water Board	Supportive of the Project. Discussion about the remediation of the sump and potential water use.
Inuvialuit Community Economic Development Organization (ICEDO)	Supportive of the Project.
GOVERNMENTS	
Town of Inuvik, Mayor and Council	Provided a letter of support. (See Appendix 6). Discussed importance of training the fire department and first responders in LNG handling.
Hamlet of Tuktoyaktuk, Mayor and Council	Provided a letter of support. (See Appendix 6). Want to see opportunity for Tuktoyaktuk businesses and people.
Government of the Northwest Territories, Minister of Industry, Tourism and Investment; Minister of Infrastructure; and Minister Responsible for the Worker's Safety and Compensation Commission	Supportive of the Project.
Government of the Northwest Territories, Minister Responsible for the Northwest Territories Power Corporation, Minister of Environment and Natural Resources and Minister of Lands	Supportive of the Project.
Government of the Northwest Territories, MLA Inuvik Boot Lake	Supportive of the Project.
Government of the Northwest Territories, MLA Inuvik Twin Lake	Supportive of the Project.
Government of the Northwest Territories, MLA Nunakput	Supportive of the Project.
CO-MANAGEMENT BOARDS	
Wildlife Management Advisory Council (NWT)	Aware of the Project. Intend to review.
Fisheries Joint Management Committee	Supportive of the Project. Recommendation to use existing Imaryuk monitoring program for the IESP which already travels the ITH. Would assist with Imaryuk funding.
Inuvialuit Game Council	Aware of the project. Thanked IPC for the presentation.
Environmental Impact Review Board	Aware of the Project. Thanked IPC for providing information about the Project.
Environmental Impact Screening Committee	EISC thanked IPC for engaging early. “It is good to share information early in process to allow the Committee get prepared.”
FEDERAL (GOVERNMENT OF CANADA) ORGANIZATIONS	
Canada Energy Regulator (CER)	Provided positive advice on new processes and responded to IPC’s questions. No concerns.

Table 13-1: Organizations Consulted to Date (September 15, 2020)	
Fisheries and Oceans Canada (DFO)	Provided positive advice on new processes and responded to IPC's questions. No concerns.
Canadian Northern Economic Development (CanNor)	Supportive of the Project. Provided funding for the Beaufort Delta Energy Feasibility Study.
GNWT DEPARTMENTS	
GNWT Department of Education, Culture and Employment	Supportive of the Project. Discussed a training initiative that could be delivered in Q1, 2021 (including Oil & Gas awareness training); A follow up discussion is planned to determine the best way to combine resources.
GNWT Environment and Natural Resources	Aware of the Project. No immediate concerns. Will review the EISC application.
GNWT Industry, Tourism and Investment	Supportive of the Project. Offered to help determine markets for LNG and NGLs coming from well.
GNWT Department of Highways (Infrastructure)	Supportive of the Project. "The GNWT built the ITH to help build the local economy with this type of project." Cooperative discussion about Project use of the ITH are ongoing.
GNWT, Petroleum Resources Division	Supportive of the Project. Provided mapping support and other information.
Northwest Territories Power Corporation (NTPC)	Supportive of the Project. NTPC is interested in commercial agreement to purchase the gas from the Project.
OROGO – NWT Office of the Regulator of Oil and Gas Operations	Supportive of the Project. Provided help with questions regarding the NWT Oil and Gas Operations Act and Regulations.
Prince of Wales Northern Heritage Centre (PWNHC)	Aware of the project. Provided help with procedures for the chance discovery of heritage resources. No concerns.
OTHER ORGANIZATIONS	
Gwich'in Tribal Council	Supportive of the Project. GTC would like updates and follow-up materials on employment opportunities.
Gwich'in Development Corporation	Supportive of the Project. GDC would like updates and follow-up materials on employment opportunities.
Inuvik Gas Limited	Supportive of the Project. IGL are interested in commercial agreement to distribute the gas from the Project within Inuvik. Discussion of storage - short and long-term solutions for Inuvik.
Aurora Research Institute	Aware of the Project. No concerns.
Aurora College	Supportive of the Project. They are interested in the opportunity to provide training for the various trades and jobs needed for the project.
Mangilaluk School in Tuktoyaktuk	Excited about the Project. Offered to help identify students who might be interested in preparing for job opportunities and for providing guidance.

13.1 Letters of Support

IPC has received letters of support for the IESP from the Town of Inuvik, the Hamlet of Tuktoyaktuk, the Tuktoyaktuk Community Corporation, the Inuvik Community Corporation, and the Inuvik Hunters and Trappers Committee. Copies of the letters of support are provided in the EISC Registry for the Project Description as Appendix 6.

IPC remains committed to ongoing communication and engagement with all Inuvialuit organizations, co-management boards, and governments throughout the life of the project. Through the IRC Newsletter, the IPC

website, Corporate Group social media, IRC training and capacity-building, and career counseling, Inuvialuit and other residents will remain up to date on the IESP and the opportunities that it offers to the communities.

IPC and Ferus NGF are committed to ensuring that benefits and opportunities from the IESP flow to residents and stay in the communities. Revenues from the IESP will contribute to better land management through the ILA across the Inuvialuit Settlement Region. This will require ongoing engagement over the lifecycle of the IESP.

13.2 Engagement Outcomes

Although community and government leaders have been overwhelmingly supportive and positive about offering help, IPC has received and responded to input, questions, and concerns. At a high level, these contributions generally touched upon: how decisions regarding the IESP are going to be made; how IPC will continue to provide information and communications about the project; local benefits; employment, contracting and training opportunities; environmental impacts on surrounding lands and waters; anticipated emissions; engineering design relating to the well, the creek crossing, borrow sources and remediation of the waste site; design solutions in anticipation of changes to the climate; operations, including site safety and security, trucking, road maintenance; and future uses for the products.

A summary of the questions asked in our community consultations was prepared in an FAQ mailout. A copy of the brochure, and other brochures distributed thus far in the project are provided in Appendix 8. The FAQ mailout was sent to all the parties in Table 13-1, as well as a general mailout to all mailboxes in the Hamlet of Tuktoyaktuk. Issues and concerns raised during community consultations are provided in greater detail in Section 12.

As a result of our early engagement, traditional knowledge was generously shared with us by local harvesters and residents. This information has since been used to highlight areas of special interest and concern and to design specific mitigation measures for a much improved IESP. Feedback from the early engagement has also influenced our site works designs, including access road route selection, as well as our project impact mitigation measures. The early consultations have also influenced our training and capacity building programs.

Specifically, we have heard that the community of Tuktoyaktuk does not support a culvert crossing for the unnamed creek north of M-18. In response, IPC has adjusted its Design Basis to consider a bridge. In addition, we heard of potential bear denning in the area near our proposed access road route. IPC has adjusted its wildlife management plans to respond to this possibility. The communities were concerned about the condition of the ITH. In response, IPC has initiated contact with the GNWT ITI to discuss long-term maintenance.

Finally, the communities have expressed a strong desire to be involved in the job and training opportunities related to the project. IPC immediately responded by gathering information on the work of the Building Inuvialuit Potential Society, which received funding from the federal government through the Aboriginal Skills and Employment Partnership in 2010 and was later dissolved in 2013. Lessons learned will be incorporated into our approach to education, training, capacity building and identifying existing skillsets.

IPC and Ferus NGF have also created the content for an employment opportunities guide, including training and skills requirements, and are working with our communications teams to finalize the content into a presentable handout and website page. We will provide copies to the community organizations for further distribution as soon as they are printed. IPC is also working with other Inuvialuit departments to identify training funds and pathways.

14.0 ANALYSIS OF POTENTIAL SIGNIFICANT NEGATIVE ENVIRONMENTAL IMPACTS

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

• Identify those elements of the proposed development that could negatively impact on the important biophysical resources.
• Identify those elements of the proposed development that could negatively impact on resource harvesting activities.
• Assess the significance of the potential environmental impacts, including impacts on wildlife and wildlife habitat, before and after mitigation measures are implemented.
• Assess the significance of the potential impacts on wildlife and resource harvesting before and after mitigation measures are implemented.
• Rate the residual environmental and resource harvesting impacts to assess whether the proposed development could have a significant negative environmental impact or significant negative impacts on resource harvesting.

14.1 Overview

This section identifies those elements of the proposed development that could negatively impact important biophysical resources and/or resource harvesting activities and assesses the significance of the potential environmental impact before and after mitigation measures are implemented. Residual environmental and resource harvesting impacts are also rated for significance. A full description of proposed mitigation measures to address any potential impacts is provided in Section 16 and expanded upon in the Management Plans (Appended).

For the purposes of this Environmental Screening, all elements of the proposed development that could negatively impact important biophysical resources or resource harvesting activities were identified. These elements include:

- Site works (road and pad) construction
- Borrow removal
- M-18 sump remediation
- Well completion
- Traffic during pre-commissioning
- IESP Energy Centre Commissioning and Operations
- Waste from construction or operations
- Traffic during operations

The final selection and qualitative assessment of important resources (also commonly referred to as Valued Components (VCs) was based upon recent project descriptions from the EISC registry, Community Conservation Plans, legislation, available maps, community consultations, and the best professional judgment of experienced environmental assessment specialists, supplemented by available data from regulatory agencies and local traditional knowledge (TK).

Methods used in the assessment of environmental effects and mitigative measures conform to the requirements of the EISC Guidelines. Should environmental effects be deemed significant, follow-up initiatives (e.g., environmental monitoring) are recommended for implementation.

It is anticipated that with the implementation of the proposed mitigation measures, the IESP will result in low to negligible residual effect on the VCs and that IESP activities will not contribute measurably to cumulative effects in the area (see Section 15).

14.2 Spatial and Temporal Scale

The IESP has followed the Federal Cumulative Effects Assessment Practitioners' Guide (Hegmann, et al. 1999), still in use by the new Canada Impact Assessment Agency (2020), to define the geographic and spatial boundaries of the project.

The Guide defines a Regional Study Area (RSA), as: "The spatial area within which cumulative effects are assessed (i.e., extending a distance from the project footprint in which both direct and indirect effects are anticipated to occur)". The RSA selected for this project is conservative and includes an area extending in a ten kilometer radius from the M-18 wellsite (See Figure 5-2). This radius incorporates the entire watershed of Gunghi Creek upstream and downstream of the Project site and an area extensive enough to fully assess potential air quality impacts. For context, the emergency evacuation zone radius from a wellsite or sweet gas plant emergency in Alberta is 1.6 km.

The Guide defines Local Study Area (LSA) as: "The spatial area within which local effects are assessed (i.e., within close proximity to the action where direct effects are anticipated)". The LSA selected for the Project includes the area in the vicinity of the M-18 wellsite, including the private access road corridor and extending a setback of 250m from the proposed pad areas and the proposed access road; and a radius of 500 m from the wellsite itself. By comparison, a 500m setback is five times greater than the safety setback distance required by the Alberta Government for a sweet well in Alberta.

The Federal Guideline defines the Zone of Influence as "a geographic area, extending from an action, in which an effect is non-trivial." For the IESP, the Zone of Influence has been defined to include the most westerly portion of Husky Lakes, the Pingo Canadian Landmark site, the ITH, and the communities of Tuktoyaktuk and Inuvik. These areas could be affected by the transportation of fuels on the ITH; and the community of Tuktoyaktuk is a potentially affected community due to its proximity for housing and services.

The Temporal Boundary, or "the period of time examined in the assessment" varied by major activity, as based upon duration, as follows:

Table 14-1: Temporal Boundaries of the Environmental Assessment

Major Activity	Duration	Season
Site Works (Road and Pad Construction)	Less than six months	Winter
Sump Remediation	Less than one month	Winter
Well Completion	Less than one month	Winter
Facility Commissioning	Less than three months	Winter
Facility Operations (incl transportation)	Greater than 50 years	All Season
Facility Decommissioning	Less than three years	Undetermined

14.3 Valued Components

A VC is defined as an environmental, social, economic, or cultural component that is considered important by the proponent, local communities, technical specialists and/or government. As per the EISC Guidelines,

Candidate VCs in relation to the IESP were selected based on:

- Sensitivity to IESP activities;
- Importance to local communities and resource users;
- Territorial, national, or international importance (including status under the SARA); and/or
- Value as an indicator of effects on related resources and broader systems.

Candidate VCs were identified for the IESP based on the environmental overview and community consultation. Candidate VCs were screened to select final VCs based on their potential to be affected by Program activities. In this assessment, candidate VCs were excluded if they did not overlap temporally or spatially with the Program, or if there is no, or negligible, potential for the IESP to affect them.

Selected VCs and the rationale for selection are provided in Table 14-2. The selected VCs are the subject of further assessment and mitigation planning in Section 14. The component considerations for each VC were previously summarized in Section 5 (Table 5-4) of the Project Description and are provided for ease of reference in Table 14-3 below.

Table 14-2: Candidate and Selected Valued Components in the Project Study Areas and Rationale for Selection

Candidate VC	Selected (yes/no)	Selection Rationale
Wildlife Harvesting	Yes	Project LSA is within Category C and Category E Designated Lands
Terrain, Soil and Permafrost	Yes	Ground will be disturbed for borrow, road and pad construction. The entire program footprint is underlain by permafrost.
Hydrology (Drainage and flow)	Yes	Proposed Road runs near lakes, crosses a stream and low-lying areas. Potential for drainage impacts.
Water Quality	Yes	Sediment, spills or waste during construction or transport could impact local creeks and lakes.
Groundwater	No	Permafrost precludes the presence of groundwater. Active layer water is addressed in hydrology and water quality.
Fish and Fish Habitat	Yes	The proposed access road crosses a shallow stream.
Rare or “at Risk” Vegetation	Yes	Roads and Pads will cover existing vegetation.
Ecosystem Fragmentation	Yes	Project requires a linear feature (road) across an undisturbed landscape.
Mammals and Habitat	Yes	Proposed project construction, facility operations, and/or traffic may disturb wildlife depending on schedule.
Birds and Habitat	Yes	Proposed project construction, facility operations, and/or traffic may disturb birds depending on schedule.
Invertebrates, Insects, Amphibians or Reptiles	No	No indication that rare or unique species or habitats exist in the region. LSA and RSA outside of CCP important habitats.
Marine Life and Habitat	No	Project footprint, LSA and RSA are entirely onshore and are more than 20 km from the marine environment.
Climate Change	Yes	Project will reduce net GHG emissions from existing energy sources.

Table 14-2: Candidate and Selected Valued Components in the Project Study Areas and Rationale for Selection		
Air Quality and Noise	Yes	Project Operations will result in occasional flaring and traffic which may result in noise and/or local dust.
Traditional and Local Land Use	Yes	Project is located on Inuvialuit Private lands with a long history of traditional use near the area.
Heritage and Archaeological Resources	Yes	Project is located near previously discovered archaeological sites.

Table 14-3: Valued Components (VCs) for the IESP	
VC	Component Considerations
Wildlife Harvesting	Caribou, Fish, Grizzly Bear
Wildlife	Grizzly bear, wolverine, caribou, conservation areas; nesting birds, waterbirds
Fish	Fish habitat and free flow of local streams
Wildlife Habitat	Denning areas, caribou winter range, wolverine winter range, fish lakes and rivers
Lakes and Rivers	Discharge, bankfull width, wetted width, water depth, crown closure, dominant bed material; temperature, pH, conductivity, alkalinity, turbidity, dissolved oxygen content
Land Use	Fishing, harvesting, guide-outfitting, settlement, and transportation infrastructure, mineral and oil and gas activity, tourism and non-consumptive recreation, ITH use, and protected areas
Socio-economic conditions	Training opportunities, employment opportunities, business opportunities, traffic, strain on local public resources, and maintenance of traditional way of life
Permafrost and Soil	Permafrost thawing and erosion, ground temperatures; ice content, active layer thickness, drainage (lack of ponding)
Air Quality	Particulate matter, road dust, NO_X, carbon monoxide, and greenhouse gases
Traffic Issues	Number, length, and weight of trucks per day; traffic incidents with people, incidents with wildlife, accidents, spills
Noise	Noise levels at site facility, 100m from site facility, 1.5 km from site facility
Climate	Temperature, precipitation, snowpack, and wind
Vegetation	Rare plants, uncommon vegetation communities
Heritage resources	Historical, archaeological, and paleontological sites
Waste	Zero waste on site, waste disposal to certified facilities only
Borrow	Quality; noncompeting with other projects

14.4 Significance Determination

The Environmental Impact Screening Panel considers three main questions when making a significance decision (EISC 2014). These are:

- Whether a proposed development could have a significant negative environmental effect.
- Whether a proposed development could have a significant negative effect on wildlife or wildlife habitat.
- Whether any development of consequence that is likely to cause a negative environmental effect could have a significant negative impact on present or future wildlife harvesting.

The IESP considered three primary questions in our assessment of significance:

1. What are the project activities that could cause a negative effect?
5. What specifically about that activity could cause a negative effect?
6. Would the negative effect impact a Valued Component?

The potential to cause a negative effect considered duration, extent, frequency, reversibility and magnitude. Magnitude was assessed after Kavik-Axys (2002), as expressed in Table 14-4.

Table 14-4: Effects Criteria and Levels for Determining Significance

Effects Criteria	Effects Level Definition		
Magnitude	Low	Medium	High
	Effect results in decline in the LSA during construction but recover after.	Results in a decline in the VC in the LSA during the life of the IESP, but VC levels should recover to baseline after IESP closure.	Threatens the sustainability of the VC in the RSA, after IESP closure, and into the foreseeable future.
Geographic Extent	Localized	Within Project Area	Regional
	Effect is within Local Study Area.	Effect extends to the entire RSA, but not beyond.	Effect extends beyond the RSA.
Duration (of the effect)	Short-term	Medium-term	Long-term
	Recovery within one year or less.	Recovery within two to five years.	Recovery in more than five years.
Frequency	Occasional	Regular	Continuous
	Effect occurs infrequently.	Effect occurs at regular, although infrequent intervals.	Effect occurs at regular and frequent intervals.

The determination of significance (Table 14-5) considers the possible combinations of effects criteria. Low magnitude effects are not significant even if they are regional and continuous. (By definition, low magnitude effects are not long-term). High Magnitude effects are nearly always significant, unless they are localized, short duration and infrequent. (By definition, high magnitude effects are regional and long term).

Table 14-5: Determination of Significance

Magnitude	Geographic Extent	Duration	Frequency	Significance
Medium	RSA	Medium-term	Continuous	**Significant**
Medium	RSA	Long-term	All frequencies	**Significant**
Medium	Beyond RSA	Medium-term	All frequencies	**Significant**
Medium	RSA	Long-term	All frequencies	**Significant**
High	RSA	All durations	All frequencies	**Significant**
High	Beyond RSA	All durations	All frequencies	**Significant**

14.5 Assessment of Project Activities

Table 14-6 summarizes the potential effects on a VC from a particular project activity or aspect. The summary of potential impact Significance follows in Section 14.6

14.6 Summary of Potential Impact Significance

Residual IESP effects, once mitigations are applied, are predicted to be positive for the following VCs:

- Socio-economic: Energy security
- Socio-economic: Business and employment opportunities
- Socio-economic: Local infrastructure
- Net greenhouse Gas emissions
- Socio-economic: Local diesel fuel and gas costs
- Sump remediation

Residual negative IESP effects, once mitigations are applied, are predicted to be none to negligible for the following VCs:

- Heritage and archaeological resources
- Climate
- Water lakes and rivers
- Regional drainage
- Traditional land use
- Fish and fish habitat
- Wildlife harvesting
- Wildlife – waterbirds
- Waste
- Wildlife habitat

Residual IESP effects, once mitigations are applied, are predicted to be low for the following VCs:

- Air quality
- Permafrost and soil
- Noise
- Light
- Waste
- Increased access to the area because of the access road

The predicted residual effects from the IESP include:

- Loss of 15 ha of vegetation (road and pad footprints) within the LSA
- Disturbed local drainage
- Use of borrow from Borrow Source 312

- Potential for localized effects to barren-ground caribou from sensory disturbance
- Potential for localized effects to grizzly bears and wolverine from sensory disturbance
- Potential for localized effects to tundra-nesting birds, short-eared owl, gray-headed chickadee and rusty blackbird from sensory disturbance
- Land Use – increased traffic on ITH

Predicted significant impacts from the Project include:

- None

In summary, the IESP team's assessment indicates that all predicted impacts are reversible, and no predicted impacts exceed Level 3 magnitude. The only predicted impacts of any duration are sensory disturbance to humans or wildlife from noise, light and/or traffic. Detailed mitigations for these and all other potential impacts are provided in Sections 15 and 16 and in the Project Management Plans (appended). There are no predicted significant impacts to wildlife, wildlife harvesting or the environment from this Project. Extensive monitoring and management programs will ensure that, should effects or impacts develop, the Project management team can respond appropriately to mitigate and resolve.

Table 14-6: Summary of Potential Effects

Program Activity	Wildlife Harvesting	Terrain, Soils and Permafrost	Hydrology	Water Quality
Site Works (Road and Pad) Construction	Possible noise disturbance during construction, possible disturbance to dens; potential barrier to wildlife movement	Modify terrain, cover soils, possibly disturb permafrost, possible erosion, or subsidence	Alter local drainage patterns	Potential erosion and siltation of water courses, possible spills
Borrow Removal (Source 312)	Possible noise disturbance during construction	Site is already disturbed	None - no contact with watersheds	None - no contact with watersheds
Well Completion	Very localized, no harvesters use the LSA	Completed in winter, no impacts	None - no water required from local lakes or streams	Completed in winter, no impacts
Sump Remediation	Temporary winter-time activity, no impact	Positive impact, restoration of soil and permafrost	Positive impact, restoration of drainage patterns	Positive impact, control and stoppage of current seepage
Energy Centre Commissioning and Operations	Possible noise disturbance, possible disturbance to dens	Will be placed on pads, impacts already discussed in pad construction	No contact with watersheds	No contact with watersheds
Waste	Possible wildlife attraction	Waste removed weekly, no impact	No contact with watersheds	No contact with watersheds

Table 14-6: Summary of Potential Effects				
Program Activity	**Wildlife Harvesting**	**Terrain, Soils and Permafrost**	**Hydrology**	**Water Quality**
Traffic	Noise disturbance, potential for harm, increased access	No additional impact	No additional impact	Stream crossing, possibility of dusting from traffic
Site Works (Road and Pad) Construction	Potential siltation from erosion	Loss of vegetation under gravel roads and pads	Possible noise disturbance during construction, possible disturbance to dens; potential barrier to wildlife movement	Possible encroachment on nesting sites
Borrow Removal (Source 312)	No contact with fish or fish habitat	Brownfield operation, no new impacts	Potential sensory noise disturbance during blasting or excavation	Brownfield operation, no new impacts
Well Completion	Completed in winter, no impacts	Completed in winter, no impacts	Possible noise disturbance during activity, possible disturbance to dens	Temporary winter-time activity, no impact
Sump Remediation	Positive impact, stoppage of seepage from sump	Positive impact, restoration of native vegetation	Winter activity, possible noise disturbance during construction	Temporary winter-time activity, no impact
Energy Centre Commissioning and Operations	No contact with fish or fish habitat	Will be placed on pads, impacts already discussed, potential for introduction of invasive species	Possible noise disturbance, possible disturbance to dens	Will be placed on pads, impacts already discussed, attraction of birds, light disturbance
Waste	No contact with fish or fish habitat	Waste removed weekly, no impact	Possible wildlife attraction	Possible wildlife attraction
Traffic	Stream crossing, possibility of dusting from traffic, access to remote fish lakes	Possible dusting of vegetation adjacent to road ROW	Noise disturbance, potential for harm	Noise disturbance, potential for harm

Table 14-6: Summary of Potential Effects				
Program Activity	**Wildlife Harvesting**	**Terrain, Soils and Permafrost**	**Hydrology**	**Water Quality**
Site Works (Road and Pad) Construction	Linear ROW will disrupt four kilometres of wilderness; potential barrier to wildlife movement	No impacts to climate	Potential dust during construction	Local use of ITH
Borrow Removal (Source 312)	Brownfield operation, no new impacts	No impacts to climate	Dust during construction	Most intense truck traffic (estimate ## dump trucks/day on ITH at peak)
Well Completion	Temporary winter-time activity, no impact	No impacts to climate	No impacts	No impacts
Sump Remediation	Positive impact, restoration of native vegetation	No impacts to climate	No impacts	Positive impact, transforms industrial land use to parkland
Energy Centre Commissioning and Operations	Minor footprint of 10ha, no fragmentation impact.	Net GHG emissions benefit	Will operate within NWT AAQG, no impacts	Possibly aesthetic impact
Waste	Waste removed weekly, no impact	No impacts to climate	Waste removed weekly, no impact	No impacts
Traffic	No additional impact	Net GHG emissions benefit	Traffic dust	Additional highway traffic, ITH interchange, increased hunting or fishing access
Site Works (Road and Pad) Construction	Potential disturbance of sites and site contents due to surface/ subsurface impacts and crushing of shallowly buried sites/artifacts by heavy machinery	Equipment noise and light during construction		
Borrow Removal (Source 312)	Brownfield operation, no new impacts	Equipment noise and light during construction		
Well	No resources identified	Rig and generator		

Table 14-6: Summary of Potential Effects				
Program Activity	**Wildlife Harvesting**	**Terrain, Soils and Permafrost**	**Hydrology**	**Water Quality**
Completion	in the project footprint	noise during workover, temporary		
Sump Remediation	Brownfield operation, no new impacts	Equipment noise during construction		
Energy Centre Commissioning and Operations	No resources identified in the project footprint	Equipment noise during construction; facility and trucking noise during operations less than 40dB		
Waste	No impact	Waste removed weekly, no impact		
Traffic	No impact	Traffic noise		

15.0 CUMULATIVE ENVIRONMENTAL IMPACTS

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

The Developer should consider the following questions:

- *What other developments or activities are in the area (including past, present, and reasonably foreseeable developments and activities)?*
- *Do the effects of the other developments or activities overlap with the effects of the proposed development?*
- *What are the effects' interactions (i.e., describe the cumulative impact(s)?*

If it is found that the cumulative environmental effects of this project, in combination with others are likely to be significant, further mitigation measures should be considered to reduce or eliminate the environmental effect.

15.1 Summary

1. There are no other current or reasonably foreseeable activities within the Project Local Study Area (LSA). There are three types of activities within the Regional Study Area (RSA), which incorporates the area that extends in a circle ten kilometres from the wellsite known as M-18. Those activities include: Traditional Activities - there are infrequent, short duration, traditional harvesting activities in the Iqalushaq Lake area, four kilometres west of the proposed project facilities.
2. Research Activities: There are infrequent, short duration, research activities along the ITH four kilometres or more east of the proposed project facilities.
3. Industrial Activity: There are two current industrial activities — the Inuvik to Tuktoyaktuk Highway (ITH) and Borrow Source 177, located about 5.8 km southeast of the proposed project facilities.

There are no known reasonably foreseeable industrial activities in the RSA. Past activity within the RSA includes 13 abandoned oil and gas wells and numerous research activities. The area is within a No Hunting Zone for Caribou and is not widely used by harvesters.

Borrow Source 177 is infrequently used and for short durations. The effects of Borrow Source 177 are not expected to overlap with the IESP. The Borrow Source is nearly depleted and not expected to be used very much in the future.

The effects of the ITH (traffic-related) do overlap with the potential effects of the proposed development.

The potential cumulative effects and mitigations are discussed below. There are no significant cumulative effects anticipated from the IESP.

15.2 Background

Cumulative effects refer to the effect on the environment as it results from a development activity when combined with those of other past, existing, and reasonably foreseeable IESPs and activities. When individual activities or disturbances interact spatially or temporally, their combined effects can result in environmental impacts that may differ in nature or extent from the effects from individual activities. To assess potential cumulative effects from the proposed Project, any past, present and reasonably foreseeable human activities in and surrounding the proposed Project area must be considered as well.

Typically, cumulative effects assessments address effects which:

- Extend over a larger area;
- Are of longer-term duration;
- Act in conjunction with other projects/activities on the same Valued Components (VCs); and
- Are reasonably probable, considering possible future projects/activities and impacts.
- The assessment of cumulative effects involves the application of four basic considerations (Hegmann et al., 1999):
- There must be an environmental, social or cultural impact related to the project;
- The effect must be demonstrated to operate cumulatively, additively or synergistically with impacts from other projects or activities;
- The other projects or activities exist or are likely to be carried out and are not hypothetical;
- The cumulative effect is likely to result.

15.3 CEA Methodology

The Cumulative Effects Assessment (CEA) for the Project follows the guide for proponents developed for CEA in the ISR (Kavik-Axys 2002). Four steps were followed to evaluate possible cumulative impacts, as described below:

1. Determine negative effects on Valued Components (VCs). This step is based on the assessment of the anticipated environmental impacts and proposed mitigation, which included a prediction of the significance of the residual effects, as well as an assessment of the environmental or cultural consequences (See Sections 5 and 14).
2. Determine whether these residual effects act cumulatively with the effects of other activities. For the project effects to act cumulatively there must be other human activities affecting the same VC. Both the temporal and spatial scope of the activities need to be considered. Typically, activities that interact in either scope are considered in a CEA.
3. Determine how the Project-specific effects contribute to the cumulative effects. This involves an analysis of the relevance of the interactions between activities.
4. Assess the need for further mitigation measures if the cumulative effects are anticipated to be significant.

The IESP has followed the Federal Cumulative Effects Assessment Practitioners' Guide (“Guide”, Hegmann, et al. 1999), still in use by the new Canada Impact Assessment Agency, to define the geographic and spatial boundaries of the project.

The Guide defines a Regional Study Area (RSA), as: “The spatial area within which cumulative effects are assessed (i.e., extending a distance from the project footprint in which both direct and indirect effects are anticipated to occur)”. The RSA selected for this project is conservative and includes an area extending in a ten kilometer radius from the M-18 wellsite (See Figure 5-2). This radius incorporates the entire watershed of Gunghi Creek upstream and downstream of the Project site and an area extensive enough to fully assess potential air quality impacts. For context, the emergency evacuation zone radius from a wellsite or sweet gas plant emergency in Alberta is 1.6 km.

The Guide defines Local Study Area (LSA) as: “The spatial area within which local effects are assessed (i.e., within close proximity to the action where direct effects are anticipated)”. The LSA selected for the Project includes the area in the vicinity of the M-18 wellsite, including the private access road corridor and extending a setback of 250 m from the proposed pad areas and the proposed access road; and a radius of 500 m from the wellsite itself. By comparison, a 500 m setback is five times greater than the safety setback distance required by the Alberta Government for a sweet well in Alberta.

The Guide defines Temporal Boundary as “the period of time examined in the assessment”. The Temporal Boundaries for the IESP, varied by major activity, as based upon duration, are as follows:

Table 15-1: Temporal Boundaries of the Environmental Assessment

Major Activity	Duration	Season
Site Works (Road and Pad Construction)	Less than six months	Winter/early Spring/Fall
Sump Remediation	Less than one month	Winter
Well Completion	Less than one month	Fall
Facility Commissioning	Less than three months	Spring/Summer
Facility Operations (incl transportation)	Greater than 50 years	All Season
Facility Decommissioning	Less than three years	Undetermined

The Valued Components (VCs) assessed included a review of all biophysical or environmental components relevant to the project. Valued components were determined from community engagement, traditional land use interviews, previous Project Descriptions, recent field studies, government legislation and guidelines and the combined expertise of more than 25 subject matter experts involved in the project. The VCs selected for assessment of the project are listed in Table 5-4.

Details on the Project Impact Assessment Methodology, including VCs, spatial and temporal boundaries, and magnitude scale were provided in Section 5.4. The potential to cause a negative effect considered duration, extent, frequency, reversibility, and magnitude.

15.4 Past, Current and Reasonably Foreseeable Activities

For the purpose of this CEA, past activities include those that have occurred in the RSA; current activities include those that are occurring or have been approved in the RSA; and, reasonably foreseeable activities include those that are formally in EISC or ARI proposal stage and that are reasonably expected to occur. Activities that were screened for this CEA or considered to have the potential to interact cumulatively with the Project, include traditional activities, research activities and development (industrial) activities.

15.4.1 Traditional activities

Hunting and fishing are activities that have occurred historically throughout the Project area and are expected to continue to occur in the RSA west of M-18. Since the majority of these activities are not controlled nor entirely predictable, and are considered to have only minimal impact on wildlife, wildlife habitat, or any other aspect of the environment, hunting and fishing activities are not considered to have a negative cumulative impact with the Project and are not included in this CEA.

15.4.2 Research activities

The proposed project may have two types of cumulative effects related to research activities in the RSA – cumulative effects related to the use of helicopters by researchers and effects from the Project on ongoing

research activities (i.e. key research locations).

Helicopter traffic, as transportation used for the completion of environmental assessments and other studies in the Project area, may contribute to cumulative effects in the RSA. Several research studies have been conducted in the RSA, or are ongoing, none of which involves potential impacts on wildlife from helicopter traffic. The following research programs have taken place in the RSA and have been confirmed to have no impact from the Project to the monitoring, measuring, or sampling activities:

- Inuvialuit Joint Secretariat cumulative impact monitoring IESP, establishing one permanent research site near the community of Tuktoyaktuk (69°25'0.24"N, 133°1'51.77"W) to monitor current and future conditions of climate, permafrost, snow, ice and vegetation. (outside of RSA) (ARI License #: 14595, issued Aug 21, 2009)
- University of Victoria study to use remote sensing and field sampling and monitoring to assess and determine the causes and impacts of regional changes in vegetation and permafrost, including study locations near the ITH. Monitoring Station within RSA at 7.87 km from M-18. (ARI License #: 16077, issued Apr 19, 2017)
- Geological Survey of Canada long–term study monitoring permafrost and terrain sensitivity in the Mackenzie Valley, including a transect from Fort Simpson to Tuktoyaktuk. (ARI License #: 16034 issued Feb 3, 2017; and License #: 12905, issued Apr 22, 1997)
- UCLA Department of Geography study to understand the perspectives of residents in Inuvik and Tuktoyaktuk and government representatives in Yellowknife on the replacement of the seasonal ice road with a permanent all-weather road. (ARI License #: 15992, issued Dec 16, 2016)
- USArray/EarthScope study on deep geological structure of the earth, including earthquake hazard and induced seismicity related to human activity (disposal wells and carbon sequestration). The study proposed a long-term monitoring station near Tuktoyaktuk. (ARI License #: 15578, issued Jan 28, 2015)
- Arctic Borderlands Ecological Knowledge Coop study to monitor and assess changes in an area that covers the range of the Porcupine Caribou Herd and nearby coastal and marine areas, including the community of Tuktoyaktuk. No field work was completed. Interviews were conducted with residents. (ARI License #: 15030, issued Feb 27, 2012)
- Wilfred Laurier University Ph.D. student research project measuring and monitoring streams near the ITH within the RSA during 2017. To study the Winter Flow Regime and Icing Dynamics of Tundra Streams near the ITH. (EISC Registry File: 02/17-03, approved Mar 2, 2017)

Some of the research activities may overlap spatially with the Project area directly or with components of the Project such as transportation routes. Temporal overlap of the Project with research activities may also occur. The known research projects are not considered to have a negative cumulative impact with the Project and are not included in this CEA.

15.4.3 Development activities

The scope of this CEA considers known oil and gas exploration and proposed, or potential development projects located in the Delta. According to the most recent Oil and Gas Disposition for the Mackenzie Delta and Beaufort Sea area (as of July 2011) there were 11 Exploration Licenses (ELs), two Production Licenses (PLs) and 65 Significant Discovery Licenses (SDLs) issued by Aboriginal and Northern Development Canada (AANDC; 2011). At the time of this EISC application, there are no known plans to pursue the development of these locations. Within the RSA, there are 13 wells. Twelve of them are abandoned. M-18 is the only suspended well in the ISR. We expect no cumulative effect from other oil and gas activity near the Project at this time.

The only other past, current, or foreseeable developments within the RSA are Borrow Source 177 and the ITH. Borrow Source 177 was used in the past as a local gravel source. Currently, it is infrequently used and, if so, for short durations. The effects of Borrow Source 177 are not expected to overlap with the IESP. The Borrow Source is

nearly depleted and not expected to be used very much in the future.

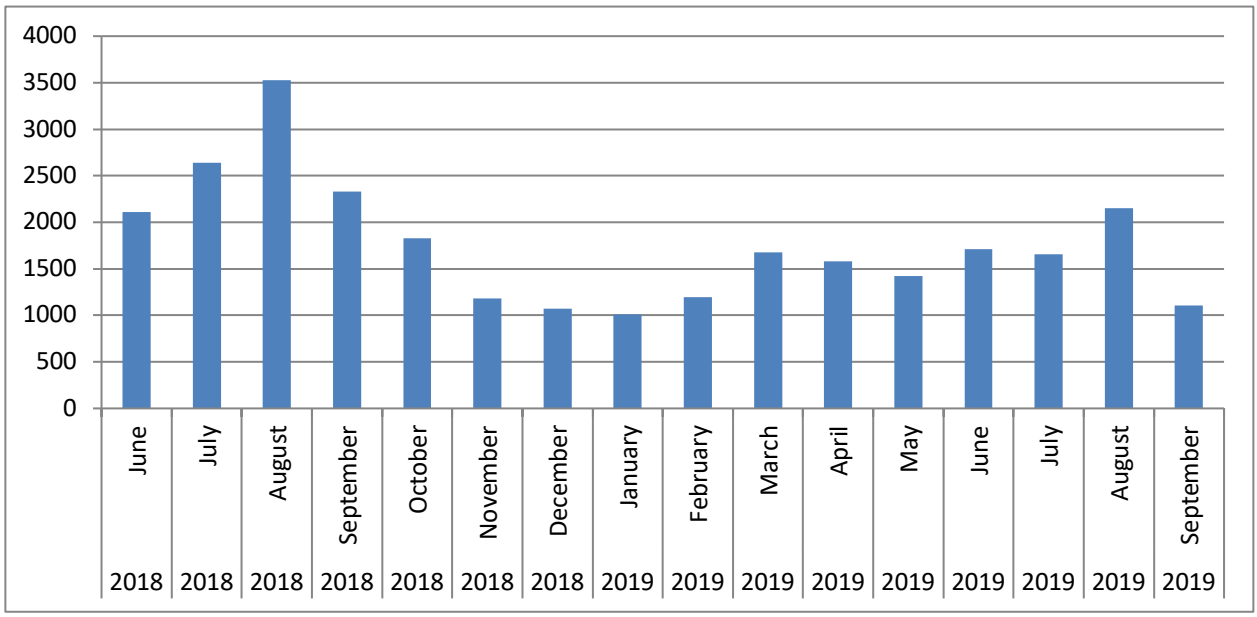
The only development activity that would overlap with the effects of the proposed development and meet the criteria for a potential cumulative effect is the Inuvik to Tuktoyaktuk Highway (ITH).

15.5 Inuvik to Tuktoyaktuk Highway

The Inuvik Tuktoyaktuk Highway (ITH) is a new, 138 km highway connecting Inuvik to Tuktoyaktuk. The all-season highway opened on November 15, 2017 after four years of construction. Previously, Tuktoyaktuk was only accessible by air or by ice road in the winter.

Traffic studies for the ITH indicate volumes between 1008 and 3526 vehicles per month from June 2018 to September 2019, with an average volume of 1762 vehicles per month. (See Table 15-2.)

Table 15-2: Total Traffic Volume per Month on the ITH (total number of vehicles)



Source: GNWT Department of Infrastructure

Study of the traffic patterns and volumes on the ITH are ongoing. A number of government and university research projects are focused on the various environmental effects of the ITH on permafrost, vegetation, water, and wildlife. (See Table 11-8). Tourism companies that utilize the ITH are listed in Table 11-9.

During IESP pre-commissioning, there will be heavy equipment travelling on the ITH from southern Canada to Inuvik and/or Tuktoyaktuk and to the site, as well as the service rig, and finally the large modules. Disruption of the ITH for pre-commissioning activities is expected to be of short duration, minimal extent and reversable. Magnitude is considered Class 2 – meaning there may be a potential for an effect during the activity, but recovery afterwards. IPC and Ferus will work closely with the GNWT to ensure that all oversize loads are properly escorted and flagged and safely driven to the site. Inasmuch as possible, we will try to move large equipment and modules by barge.

During peak operations, IPC and Ferus NGF expect that there will be five deliveries/trips in a day or about 150 vehicles per month to the ITH. IPC and Ferus NGF anticipate that the range at start-up will be between 1.5 and

three trips per day depending on the season.

During peak production, the IESP will deliver four LNG deliveries/day. The actual estimated winter demand is 2.5 LNG deliveries/day and the actual estimated summer demand is one LNG delivery/day. A tandem or tridem tractor and tridem trailer configuration is proposed for the transportation of LNG from the Energy Centre to customers. During Peak production, synthetic diesel deliveries are estimated at one delivery/day. The actual estimated demand is one delivery every two days. Synthetic diesel will be trucked to Tuktoyaktuk and Inuvik in current standard configuration fuel trucks.

Any other truck traffic will come from light duty vehicles (operators going back and forth daily to work) and the occasional three or five-ton truck for things like sewage removal or restocking of site industrial supplies.

15.6 Discussion of Potential Cumulative Effects and Mitigations

Potential effects from increased traffic include increased dust, noise, wildlife disturbance, wildlife mortality and safety related impacts. The IESP is expected to add 1.5 to five trips per day or 45 to 150 trucks per month to the ITH. On average this would represent an increase of 1.28% in the busiest month charted (August 2018) to 14.9% in the slowest month (January 2019).

As the proponent of the proposed ITH, the GNWT predicted residual effects to VCs, (GNWT 2010) some of which will overlap spatially and temporally with those predicted for the IESP. These included:

- Loss of vegetation
- Potential effects to caribou from direct habitat loss and sensory disturbance
- Potential effects to grizzly bears from den disturbance
- Potential effects to wolverine from den disturbance
- Direct mortality and indirect habitat loss through sensory disturbance for some species, including, waterbirds, short eared owl, rusty blackbird and gray-headed chickadee.

The residual cumulative effects of the IESP to vegetation, barren-ground caribou, denning grizzly bears and wolverine, and waterbirds, short-eared owl, rusty blackbird, and gray-headed chickadee are expected to be low in magnitude and not significant. These cumulative effects are discussed below.

15.6.1 Vegetation

Residual effects from the IESP to vegetation are predicted to be a small incremental loss in areal extent of three vegetation community types (Table 10-7) intersected by the proposed all-season access road. All three vegetation types; dry saxifrage tundra, dwarf shrub heath and riparian shrub are common in the area and will remain in the area surrounding the proposed all-season access road. Residual effects from the IESP could overlap spatially and temporally with ITH activities. However, given the abundance of the vegetation community types and the limited incremental loss from the IESP compared to the ITH, the IESP's contribution to cumulative effects on vegetation are considered not significant.

15.6.2 Barren-Ground Caribou

Residual effects from the IESP to barren-ground caribou that overlap temporally and spatially with ITH activity are mortality risk and indirect habitat loss through sensory disturbance.

Potential increases to direct mortality risk associated with increased access for hunters should not occur because caribou hunting is currently not allowed in the Project RSA. The risk of additional direct mortality resulting from vehicle traffic associated with the IESP will be reduced to levels that are not significant as a result of mitigation measures applied, such as speed reductions, safe driving practices, and the use of wildlife reports to promote awareness of caribou activity near roads and trails. Indirect habitat loss may occur through sensory disturbance resulting from construction and pre-commissioning activities; however, these effects will be short-term, localized, and reversible. The range for the Cape Bathurst herd and Bluenose-West caribou herd is within the IESP study area (Nagy et al 2005; Community of Tuktoyaktuk et al. 2008; Community of Inuvik et al. 2008) and frequency of use of the area is primarily during the fall and winter (Nagy et al. 2005). The cumulative effects of our IESP activities to indirect habitat loss for barren ground caribou compared to current ITH use are expected to be not significant.

15.6.3 Grizzly Bears

Residual effects from the IESP to grizzly bears that overlap temporally and spatially with the ITH are direct mortality risk and direct disturbance to denning habitat. IESP and highway activities may affect direct mortality risk for grizzly bears through human-bear conflicts. Human-bear interactions have the potential to occur when some bears may emerge from their dens. The risk of human-bear conflict will be reduced through application of our Wildlife and Wildlife Habitat Protection Plan (WWHPP) including appropriate wildlife attractant and waste management plans. Direct mortality risk to grizzly bears as a result of the cumulative effects of IESP added to already-present highway activities is therefore anticipated to be not significant. IESP and highway activities have the potential to disrupt denning bears during their winter dormancy period. However, the potential to disturb denning bears is considered not significant due to the mitigation measures in place, which include bear denning surveys and minimum setback distances around all known active grizzly bear dens.

15.6.4 Wolverine

Residual effects from the Project to wolverine that overlap temporally and spatially with ITH activities are direct mortality risk and direct disturbance to denning habitat. Due to the low densities and large home ranges of wolverine, (GNWT 2013), cumulative effects on natal den site disturbance or direct mortality risk from vehicle collision will be localized to relatively small scales. Mitigation measures during IESP such as minimum setback distances from known wolverine den sites will reduce the risk of disrupting a natal den. The cumulative effects to the risk of disrupting a wolverine den site are considered not significant. Wolverines are active all year and therefore direct mortality due to human conflict may occur during any highway activity. Appropriate plans for proper storage and disposal of wildlife attractants will mitigate direct mortality risk due to potential human-wolverine conflict. Cumulative effects to wolverine mortality risk are therefore predicted to be not significant.

15.6.5 Birds and Bird Habitat

When IESP operational activities occur in the summer, there is considered a low potential for direct mortality and indirect habitat loss through sensory disturbance for some species, including, waterbirds, short eared owl, rusty

blackbird and gray-headed chickadee. Residual effects from the IESP could overlap spatially with ITH activities. Appropriate mitigation measures, winter construction, and the short-term nature of the pre-commissioning will reduce the direct mortality risk for birds. Given that indirect habitat loss (sensory disturbance) for the IESP is predicted to occur at small spatial scales compared to the ITH, with appropriate mitigative measures (i.e. setback distances for active nests), cumulative effects to indirect habitat loss are considered not significant.

The cumulative effect of the new truck traffic travelling from M-18 to Tuktoyaktuk and Inuvik will be offset by the reduced traffic from Alberta and British Columbia to Tuktoyaktuk and Inuvik. As we consider that wildlife mortality is partly a function of the number of highway hours driven, by extension, wildlife mortality is predicted to decrease overall in the Yukon, NWT, and the provinces of B.C. and Alberta.

15.7 Traffic Volumes

During our community engagement in June 2020, the Inuvik Hunters and Trappers Committee (HTC) expressed concern about the current lack of pull-outs for parking along the ITH. The concern is safety, related to people parking on or near the highway and heading into the wilderness for days or weeks to visit cabins or be on the land. IPC responded by initiating discussions with the GNWT Department of Transportation (DOT) and will be working closely with the DOT going forward to ensure adequate road maintenance and safety, including the construction of more pullouts on the highway.

IPC also initiated a mapping exercise with the communities of Inuvik and Tuktoyaktuk to acquire local perspective and identify locations where the ITH needs pullouts. IPC will continue to advocate for highway safety with the GNWT and work actively with the GNWT and the communities of Inuvik and Tuktoyaktuk to monitor the effects of the IESP on the ITH and to ensure proper mitigations are in place.

IPC will monitor the potential effects of increased traffic on wildlife mortality. Although current statistics are reported to by under-reported, personal communication with GNWT ENR provided the following baseline:

Table 15-2: Wildlife Collisions on the ITH

2018	No roadkill was reported along the ITH.Word-of-mouth accounts indicated that a fox was killed in December 2018 however this was not reported to ENR directly.
2019	No roadkill was officially reported along the ITH. Word-of-mouth accounts indicated that a fox was killed in October, however again this was not reported to ENR directly.On December 13, there was a report of six reindeer or caribou on the ITH, one of which was hit by a vehicle but survived. It seemed to have an injured leg from the incident, but it walked off and ENR officers were unable to locate it the next day.

Source: Marsha Branigan, GNWT ENR. Sept 24, 2020. Personal Communication.

The ITH was built as a northern highway to a standard sufficient to handle heavy traffic and traffic volume. It is the final extension of the Dempster Highway. The long-term mitigation and monitoring IESPs proposed for the ITH will enable IPC, resource managers and the GNWT to evaluate the long-term impacts to these VCs, and the effectiveness of mitigations. As necessary, adaptive management may be applied to further mitigate impacts to valued components in the area.

16.0 PROPOSED MITIGATION MEASURES TO ADDRESS POTENTIAL IMPACTS

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

Describe the proposed mitigation measures to address potential negative environmental impacts, impacts on wildlife and impacts on resource harvesting.
Describe the mitigation that is required to manage the cumulative impact(s).
These should include:

- *Waste management plans (garbage, sewage (grey and black water), hazardous waste)*
- *Emergency response plans – outline of the Plan*
- *Contingency plans (this should include but not limited to: fuel spills, blowouts, permafrost degradation, accidents or malfunctions)*
- *Wildlife encounter management plans (including but not limited to: Bear Management Plans (Encounter and Response Guidelines, Inuvik Region, Department of Environment and Natural Resources, GNWT, and http://www.enr.gov.nt.ca/_live/pages/wpPages/Safety_in_Grizzly_and_Black_Be*
- *ar_Country.aspx)*
- *Wildlife and fisheries management plans to manage predicted long term environmental or harvesting impacts*
- *Operation timing and scheduling of activities*
- *Aircraft flight altitudes and landings*
- *Adaptive management plans*

16.1 Introduction

The Inuvialuit Petroleum Corporation (IPC) and Ferus Natural Gas Fuels (Ferus NGF) are committed to preventing, reducing, and/or controlling adverse effects to the environment resulting from the Inuvialuit Energy Security Project (IESP or Project). Giving effect to this commitment and drawing from precedent, IPC and Ferus NGF have developed an Environmental Management System and a series of Environmental Management Plans (EMPs) related to specific aspects of the Project to prevent, manage, and/or mitigate potential environment effects.

As per the requirements of the EISC Guidelines, IPC and Ferus NGF have developed a set of Management Plans. These plans are included as Appendices to the Project Description and include:

- Appendix 2: Wildlife and Wildlife Habitat Protection Plan (including wildlife encounter management)
- Appendix 3: Archaeological Site Management Plan
- Appendix 4: Waste Management Plan
- Appendix 5: Emergency Response Plan (Outline) and Contingency Plans

The IESP Emergency, Contingency and Management Plans are part of the Project's overall Environmental Management System (EMS), based upon the ISO 14000 PLAN-DO-CHECK-ACT cycle of continual improvement.

As per the ISO 14000 EMS Standard, our environmental planning (PLAN) includes impact assessment, stakeholder and community consultations, regulatory review, and risk, hazard, and opportunity assessments. Our implementation (DO) procedures include procedures for training and awareness, documentation, standardized processes, contingency (emergency) planning, and methods and mitigation measures to reduce or prevent direct

impacts from the implementation of the project. We will CHECK on the effectiveness of our implementation through regular reporting, monitoring, audits, and management review. Finally, we will ACT on the results of our checking using an adaptive approach to continual improvement to reflect changing site conditions, activity levels or lessons learned to continue to mitigate potential effects from the project on the environment or from the environment on the project.

16.2 Hazard, Risk, Vulnerability, and Capability Assessment

A planning exercise was held on June 29, 2020 with IPC, Ferus NGF and the IESP engineers and consultants. The planning session used a well-established methodology used in the oil and gas industry known as HRVCA, or a Hazard, Risk, Vulnerability, and Capability Assessment. The HRVCA is a way of anticipating potential problems and solutions in order to prevent, reduce, mitigate impacts and ensure appropriate emergency response measures, processes and plans are defined and available. The process is intended to identify the following:

- Hazards: a source of potential harm, or a situation with the potential to cause harm;
- Risks: the measure of probability (likelihood) and severity (consequences) of an adverse effect, Risk = Severity x Probability;
- Vulnerabilities: people, environment, and critical infrastructure exposed to adverse effects from a hazard; and
- Capabilities: locally available plans, resources, and capacities to eliminate or reduce the adverse effects in the event of a hazard. Ensure all regulatory requirements are being appropriately addressed.

The IESP team identified 55 potential hazards, risks or vulnerabilities through the HRVCA. All of the potential risks were mitigable. 51 of the potential risks were ranked as low or negligible following mitigation. Four of the risks identified were ranked as moderate, even after the addition of safety controls or mitigation measures. These are: 1. Loss of Well Control (Blowout); 2. Wellbore Overheating Surrounding Permafrost Leading to a Loss of Well Control; 3. Major Liquids Spill; and 4. Explosion at the Facility While these risks are rare or infrequent, their consequences for health and safety, environment, financial, reputation and/or regulatory compliance can be so severe that they are ranked as a medium risk..

16.2.1 Loss of Well Control (Blowout)

The loss of well control, commonly known as a blowout, is a very serious incident where products from the well uncontrollably leave the wellbore causing serious environmental damage and the potential to seriously injure personnel in the near wellbore vicinity. Loss of Well Control (LOWC is a rare occurrence in industry and there are many safeguards in place to prevent this from happening during operations. For the M-18 well the required fluid densities for controlling the well are well known and two blowout preventors (BOP) are in place as another line of defense. If LOCW were to occur, in order to minimize the environmental impact, the well fluid will be ignited to burn the hydrocarbon products coming from the well. The details of our plans in the event of an LOCW are provided in Appendix 5– IESP Emergency Response and Contingency Plans.

16.2.2 Wellbore Overheating Surrounding Permafrost Leading to a Loss of Well Control

The M-18 well is in a region where the ground is in a permafrost condition. Reservoir temperature is significantly higher (~50^{o}C) then the surrounding ground temperature, so if left unprotected, a significant amount of heat would be transferred to the permafrost soil, causing it to thaw. Should this occur, the casing on the well could be

compromised leading to a loss of well control. To minimize the chance of this ever occurring the annulus (area between well casing and the production tubing) will be filled with a gelled fluid that will limit the heat transferred to the surrounding frozen ground. Special production tubing that is vacuum jacketed is being looked at to further protect the surroundings from heat transfer. Vacuum jacket tubing is a special configuration where the tubing contains an inner portion surrounded by a vacant space then an outer portion. The empty space between the inner and outer portions will then have all the air removed from it creating a vacuum in that space. In addition, the temperatures at the well and in the surrounding permafrost will be monitored carefully. The overheating of permafrost will not happen suddenly. This risk can be monitored and, if necessary, the well could be managed in time to prevent an LOCW.

16.2.3 Major Liquids Spill

The proposed facility will have many different types of liquid in storage including hydrocarbon liquids, synthetic diesel fuel and liquified natural gas. (See Table 6-7 for a list of storage tanks.) The hydrocarbon liquids and diesel fuel, if spilled in large quantities, have the potential for short-duration, localized environmental damage. The worst-case scenario would be the rupture or failure of a diesel storage tank, which will hold up to 500 barrels of diesel at maximum storage. To minimize the possibility of these types of spills, our Energy Centre storage tanks will be double walled. Double walled tanks have an inner shell that contains the product and an outer shell to contain product if the inner shell were to have a failure. The space between the shells is monitored digitally to detect if there is a failure of the inner shell. The truck loading connections for the product will utilize equipment that is designed to prevent spills during product transfer and will include spill trays for small spills, as well as Emergency Shut Off buttons will be available throughout the plant to close valves or piping immediately in the event of a spill.

The details of our contingency plans in the event of a major liquid spill are provided in Appendix 5– IESP Emergency Response and Contingency Plans.

16.2.4 Explosion at the Facility

An explosion at the facility has the potential for serious damage to the facility, the environment, and staff on site. Therefore, the facility will be equipped with many different safeties that are intended to prevent an explosion from occurring. Throughout the facility there is a gas detection system that will detect leaks from the process, immediately place the facility in a safe operating condition, and notify the operations team of the leak. Working in conjunction with the gas detection systems, there are emergency shutdown devices (ESD) that can be used to shut off the gas going to the process and automatically direct flow to the enclosed ground flare. The purpose of the ground flare is to be able to handle such a scenario and safely combust all process gases in a controlled manner. The details of our contingency plans in the event of a fire or explosion at the facility are provided in Appendix 5– IESP Emergency Response and Contingency Plans.

16.2.5 Other Contingency Plans

IPC and Ferus NGF are working on a long list of contingency plans that will be complete prior to operations. These plans include:

- Structural Fire
- Hydrocarbon jet (from piping/valves) fire
- Hydrocarbon pool fire

- Wildfire (brush fire)
- Major seismic event
- Structural Collapse
- Natural / Propane Gas Leak (Utility Leak)
- Serious Injury (fatality)
- Lost / Missing worker
- Severe Weather
- Security Breach
- Prolonged Power Outage
- Prolonged Loss of Communications
- Violent Intruder / General Violence
- Bomb Threat/ Act of Terrorism
- Vehicle Collison
- Well kick / Blow-out
- Damaged Pipeline (failure)
- Pressure Vessel Failure
- Liquid Hydrocarbon Spill
- Gaseous Hydrocarbon Release
- Release of Toxic Product
- Transportation (Dangerous Goods) Emergency

The IESP will follow an international standard known as ICS, or Incident Command Systems, to provide structure to any incident at the facility. It will be our intention to train ICS to local RCMP and other first responders and run mock emergencies whereby each party will know in advance their roles and responsibilities in the event of an emergency. IPC and Ferus NGF intend to be self-reliant for emergency response; but, may need support for medical or public management situations. IPC intends to contract the transport of fuels from the IESP Energy Centre to the local communities. Although IESP management and staff will be prepared to assist any incident involving IESP products, especially if it occurs on the Access Road, it will be the responsibility of the transport contractors to lead a response to any incidents regarding the trucking aspect of the Project.

16.3 Proposed Mitigation Measures

Mitigation measures to address potential impacts are woven throughout this Project Description as well as the IESP management plans. They are numerous. A summary of some of the most important proposed mitigation measures for the project is provided in Table 16-1.

Table 16-1: Potential Effects and Proposed Mitigations for Valued Components

Potential Effect on Valued Components		Proposed Mitigation Measure
1.0	Terrain, Soils and Permafrost	
1.1	Disturbance of terrain, soils and permafrost	1. There will be no new disturbance of soils. All pad and road construction will be directly upon undisturbed ground. Borrow will be removed from existing disturbed borrow pits. 2. The IESP will utilize arctic-proven pad and road construction methods.

Table 16-1: Potential Effects and Proposed Mitigations for Valued Components		
Potential Effect on Valued Components		**Proposed Mitigation Measure**
		3. The design of the road, including embankment thickness, will consider the local terrain conditions as well as the potential presence of ice-rich permafrost and drainage conditions in the area. 4. The road alignment will be designed to avoid unfavorable thick organic and ice-rich polygonal terrain. 5. Drainage culverts will be placed along the road as needed to allow for cross drainage and to avoid water ponding along the edge of the road.
1.2	Access road, pads and permanent structure alteration of surface insulation and permafrost	1. Construction of road and well site pad and Energy Centre Pad will be completed during winter months under stable, frozen ground conditions. 2. Limit the use of construction equipment to the immediate footprint of the all-season access road or drilling area, camp, staged equipment, and storage areas 3. Vegetation removal will be minimized and conduct progressive reclamation at the culvert installations at the watercourse crossing. 4. Vegetation removal (brushing) will be conducted without removing the underlying root and/or peat layer to maintain an insulating barrier to protect the underlying permafrost and prevent soil erosion. 5. The gas processing facilities and storage will be mounted on trailers or modules and piles off the ground. 6. Rig mats will be used to ensure additional insulation when appropriate. 7. All buildings will be placed on thick gravel pads and/or piles to provide insulation.
1.3	Production gas heat transfer to surrounding ground and melt permafrost	1. Assessment of whether vacuum-jacketed tubing will be utilized in the well bore to a depth exceeding the permafrost layer (estimated at 400m) to insulate the well bore from the permafrost. Thermal analysis is underway. 2. Additionally, if necessary, we will install well annulus fluids to help insulate the wellbore.
1.4	Subsidence or erosion after construction	1. Erosion control techniques (e.g., silt fences) will be utilized if there is a potential for soil surface erosion alongside the road or pad embankments. 2. Drainage culverts will be placed along the road as needed in order to allow for cross drainage and to avoid water ponding along the edge of the road.
1.5	Monitoring	1. The road conditions will be monitored regularly for potential erosion, subsidence or permafrost degradation.
1.6	Dusting and/or Emissions impacts on vegetation resulting in soil exposure and permafrost melting	1. Ambient (static) air quality stations will be installed to capture particulates for monthly analysis. We will adapt management as information is gathered during operations. 2. GNWT Guidelines for Dust Suppression on Roads (2013) will be closely followed.
1.7	Changes to soil quality resulting from spills	1. An Emergency Response Plan (Appendix 5) will be in place to handle spills of hydrocarbons or hazardous materials. 2. Contingency Plans (Appendix 5) will be in place for (1) Loss of Well Control; (2) Major Spills; and (3) Gas Processing Facility Fire or Explosion. 3. All fuel or heavy liquid hydrocarbon storage tanks will include secondary containment (double walled with interstitial monitoring) so that spills or ruptures remain contained on site.
2.0	Hydrology (Drainage and Flow)	

Table 16-1: Potential Effects and Proposed Mitigations for Valued Components		
Potential Effect on Valued Components		**Proposed Mitigation Measure**
2.1	Flow changes to regional drainage from road and pads	1. The IESP lies within an Arctic Ocean drainage basin. Drainage runs largely in parallel to the north-south orientation of the ITH. There will be no impacts to the regional drainage nor the Husky Lakes drainage systems. 2. The road route has been planned to minimize creek crossings. Only one creek will be crossed. 3. Appropriately sized culverts to maintain current drainage patterns based on hydrological assessments and local knowledge will be installed. 4. The creek crossing will be designed to avoid unfavorable thick organic and ice-rich permafrost or polygonal terrain.
2.2	Alteration of surface drainage patterns from road and pads	1. Watercourse crossing will be constructed during the winter period. 2. Crossing structures that are acceptable to the community and appropriate for site-specific flow conditions will be used. 3. Appropriately designed culvert or bridge will be used at the watercourse crossing. 4. Appropriate sizing and installation of additional culverts, if needed and based on hydrological assessments and local experience, to avoid freeze dams, backwatering, and washouts. 5. An appropriate number and location of drainage culverts will be installed in the road embankment and pads to prevent or minimize potential water ponding due to surface drainage. 6. When the watercourse crossing is completed, disturbed materials will be replaced with similar-sized substrates and the stream bed and banks of the watercourse will be stabilized and restored. 7. Installation guidelines such as the DFO Land Development Guidelines (1993) and the INAC Northern Land Use Guidelines for Roads and Trails (2010) will be followed. 8. Erosion and sediment control best management practices and culvert installation guidelines, as appropriate (e.g. DFO Land Development Guidelines, 1978), will be implemented.
2.3.	Temporary reductions to lake levels due to water extraction for well workover	1. The Project does not require any water withdrawal from lakes or streams. 2. The Project will not require or use lake or stream water during pre-commissioning or gas plant operations.
3.0	Water Quality	
3.1	Introduction of sediment or deleterious material resulting in reduced water quality	1. Potential effects resulting from erosion and sedimentation will be mitigated by the construction schedule (i.e. winter construction) 2. Sedimentation and erosion control best management practices, as appropriate, will be implemented. 3. Installing silt fencing and/or check dams as necessary to minimize siltation in runoff near waterbodies. 4. Employing DFO Measures (2016), where possible, and measures outlined in the DFO (1993) Land Development Guidelines for the Protection of Aquatic Habitat. 5. Complete construction activities during the winter months and cleanup all debris to prevent spring runoff moving the debris and impacting the water courses. 6. All construction activities, excluding the watercourse and drainage crossings, will be conducted 100 m or greater from any waterbodies. 7. Water will be used on the alignment to control dust during summer operation activities. Water will be provided by truck from Tuktoyaktuk.

Table 16-1: Potential Effects and Proposed Mitigations for Valued Components		
Potential Effect on Valued Components		**Proposed Mitigation Measure**
		8. All wastes will be properly contained and managed (see the Waste Management Plan – Appendix 4). 9. Monitoring of pre-commissioning and operations activities by Inuvialuit environmental and wildlife monitors. 10. Routine monitoring and inspections at the watercourse crossing will be carried out to confirm the proper performance of the culvert (this will include examination for debris buildup, subsidence or lifting, and stream bank or bed erosion). 11. Where necessary, maintenance activities will be carried out in conformance with the DFO Measures (2016) 12. Maintenance will include the removal of accumulated debris (e.g., woody debris, boulders, garbage, and ice build-up) that may prevent the efficient passage of water and fish through any culverts and may also include the reinforcement of eroding inlets or outlets.
3.2	Sediment release during road operation and maintenance	1. Implement erosion and sediment control best management practices as appropriate. 2. GNWT Guidelines for Dust Suppression on Roads (2013) will be followed.
3.3	Road and pad drainage discharge sediment to watercourses	1. Filtration by natural vegetation 2. Silt fences installed at each road-stream intersection 3. Regular spacing of cross-drainage culverts
3.4	Sediment released during culvert maintenance	1. Apply erosion and sediment control best management practices 2. Inspect and maintain culverts, as needed, in the spring and fall 3. Follow the DFO Measures (DFO 2016) as appropriate
3.5	Spills impacts on water quality	1. A Spill Contingency Plan is in place to address spills of fuel or hazardous materials. 2. Sites for storage of fuels, lubricating oils, chemicals, or other hazardous materials will be located a minimum of 100 m away from water bodies, and surface drainages. 3. Storage tanks will include secondary containment (double-walls) so that spills or ruptures remain contained. 4. Hazardous material handlers (including truckers and operators) will be trained, certified for TDG and adhere to approved emergency response and spill response plans. 5. All vehicles and equipment will be conducted 100 m or greater from a waterbody. 6. Equipment used in or near water during construction will be clean and free of oil, grease or other deleterious substances. 7. Equipment maintenance will take place off-site at a proper garage with cement flooring.
3.6	Wastewater disposal effects on receiving water bodies and biota	1. All sewage and grey water will be collected and transported to Tuktoyaktuk for appropriate disposal. 2. All waste from well completions or facility operations will be collected and transported to the Town of Inuvik or further south for appropriate disposal, as per regulations.
4.0	Fish and Fish Habitat	

Table 16-1: Potential Effects and Proposed Mitigations for Valued Components		
Potential Effect on Valued Components		**Proposed Mitigation Measure**
4.1	Disturbance of instream or riparian habitat due to watercourse crossing	1. The project does not require crossing of critical fish habitat nor traditional fishing areas. 2. Appropriate crossing structures based on community preference and site conditions will be designed. 3. When the watercourse crossing is completed, disturbed materials will be replaced with similar-sized substrates and the stream bed and banks of the watercourse will be stabilized and restored.
4.2	Culvert acting like a barrier to fish migration	1. Best management practices for culvert installation will be employed. 2. If culverts are used, two culverts with one culvert vertically higher than the other will be installed so that it will remain ice-free over the winter. 3. Annual monitoring to detect culvert subsidence or lifting. Adaptive management as needed.
4.3	Reduced habitat quality due to sediment release during construction of stream crossing	1. Construction during winter. 2. Apply appropriate design and erosion and sediment control best practices.
4.4	Reduced habitat quality due to sediment release from road or pad drainage during construction	1. Apply erosion and sediment control best practices. 2. Complete construction activities during the winter months. 3. All construction activities, excluding the watercourse and drainage crossings, will be conducted 100 m or greater from the drainage and other waterbodies.
4.5	Increased harvest pressure due to improved access to remote fishing areas	1. The Project area is not traditionally used for fishing according to interviews with local harvesters. Residents prefer nearby Husky Lakes. 2. Support the FJMC's Inuvialuit Plan for Fishing on the Inuvik to Tuktoyaktuk Highway (2017) 3. Installation of signage and gates at entrance to access road to discourage access to remote fishing areas. 4. Access road will be private for safety reasons, with controls and 24/7 monitoring.
5.0	Rare or "at Risk" Vegetation	
5.1	Disturbance to vegetation	1. Complete all construction activities during winter months. 2. Construction disturbance to vegetation will be limited to the all-season access road RoW and pads. 3. Frozen ground and snow cover will allow travel over most vegetation without damage to the root systems. 4. Final site inspection by Inuvialuit Land Monitors and clean-up will be conducted with site-specific clean-up conducted on foot after or prior to migratory bird season to avoid disturbance to vegetation and nests.
5.2	Removal or burial of vegetation	1. Minimize project footprint. 2. Minimize development on vegetation types with restricted distribution. 3. Restrict off-site activities (e.g., ATV use). 4. Reclaim to native, viable and self-sustaining vegetation types.
5.3	Potential disturbance to sensitive or rare plant species	1. We have conducted a rare plant survey along the proposed road alignment and well pad area. 2. We will avoid sensitive or rare plant vegetation types. If the disturbance of rare plants cannot be avoided, then they will be transplanted to a location agreeable to the ILA prior to construction season. 3. Construction and Well Workover will occur in winter, which will coincide with the dormant period for herbaceous plants.

Table 16-1: Potential Effects and Proposed Mitigations for Valued Components		
Potential Effect on Valued Components		**Proposed Mitigation Measure**
		4. Minimum snow/ice cover of 20 cm will help to mitigate possible effects to low-lying vegetation. 5. Natural revegetation will be promoted by avoiding disturbance of the root zone.
5.4	Potential reduction in vegetation health and productivity due to dust deposition	1. Application of dust suppressants, as per the GNWT Guideline for Dust Suppression (2013). 2. Ambient (static) air quality stations will be installed to capture particulates for monthly analysis along the access road. We will adapt management as information is gathered during operations.
5.5	Potential introduction and spread of invasive plants	1. All well completion and construction equipment will be cleaned in Inuvik or Tuktoyaktuk prior to mobilization to the site to limit the introduction of weeds or invasive species. All trailers from the south will also be cleaned in Inuvik prior. 2. Monitoring of access road for invasive species will be conducted each year of operation and invasive vegetation will be controlled immediately to eliminate seed production and long-term establishment.
5.6	Reduction in vegetation health and productivity due to spills	1. All spills will be contained and cleaned-up immediately. 2. Spill containment equipment appropriate to the activity will always be available on site and in transport trucks. 3. Regulatory authorities will be contacted immediately, and reports will be issued to regulatory authorities within 24 hours for all spills greater than the minimum thresholds as defined by the Government of Northwest Territories. 4. Respond according to site-specific Spill contingency plans (Appendix 5 and the contractor's HSE manual and procedures. 5. All impacted areas will be re-vegetated and reclaimed to the highest requirements of the day.
6.0	Mammals and Habitat	
6.1	Disturbance to caribou habitat	1. Minimize Project footprint and use previously disturbed areas wherever possible. 2. A Wildlife and Wildlife Habitat Protection Plan will be implemented for both construction and operations phases (See Appendix 2). 3. Drilling waste will be trucked out, rather than using a sump. 4. Application of dust suppressants (water) during the summer, as per the GNWT Guideline for Dust Suppression (2013), to limit potential reduction in caribou winter forage quality and productivity.
6.2	Sensory disturbance (caribou) during construction	1. Workers or construction equipment will be directed to maintain a minimum distance of 500 m from caribou. 2. Wildlife Monitors will scout ahead of equipment to avoid disturbing any observed caribou. 3. Temporary construction suspensions may be recommended by Wildlife Monitors, in consultation with ENR, if deemed necessary to protect caribou from potential disturbances. 4. Wildlife Monitor may gently encourage individual or small numbers of caribou to move away from the area using methods pre-approved by ENR. 5. The Field Supervisor and Safety Advisor will educate all field workers on the applicable practices contained within the Wildlife and Wildlife Habitat Protection Plan (Appendix 2). 6. All sightings of caribou will be reported to the Wildlife Monitor.

Table 16-1: Potential Effects and Proposed Mitigations for Valued Components		
Potential Effect on Valued Components		**Proposed Mitigation Measure**
		7. Workers must avoid all interactions with caribou unless crew safety is at risk. 8. Field workers will not feed, harass, or approach caribou. 9. Any caribou encountered will have the right-of-way. 10. All human/caribou conflicts and incidents will be reported to the Wildlife Monitor, Field Supervisor and Safety Advisor and documented.
6.3	Disturbance to denning bears or wolverines	1. Prior to any winter construction, fall surveys will be conducted to locate active and suspected active bear dens within setback distances (800 m) of areas scheduled for winter work. 2. If an active grizzly bear or wolverine den is observed during winter operations (October 1 – May 15) within 800 m of construction activity, activities will be immediately suspended within this exclusion zone and ENR will be contacted to determine appropriate mitigation. 3. Personnel will be directed to maintain a minimum distance of 800 m between sighted and/or known grizzly bear or wolverine den sites. 4. Prior to denning season, Wildlife Monitor may gently encourage bears or wolverines to move away from the area using methods pre-approved by ENR.
6.4	Disturbance to grizzly bears, or wolverines, and their habitat	1. Project personnel will be provided with wildlife awareness training (see Wildlife and Wildlife Habitat Protection Plan (Appendix 2). 2. Wildlife monitors will be on-site during construction to monitor wildlife and manage risks. 3. Workers will not walk off-site onto land at any time of year, unless there is a specific requirement (i.e., waste recovery), and these activities will be scheduled to avoid sensitive wildlife periods.
6.5	Interactions between wildlife (e.g., caribou, grizzly bears, and wolverine) and workers/equipment resulting in incidents or mortality	1. Wildlife will always have the right-of-way. 2. During construction, the presence of wildlife in the areas of construction and access road will be communicated to other drivers. 3. Construction and maintenance vehicles will stop or reduce speeds when wildlife is on the road or near the road, respectively. 4. The Wildlife Monitor and designated, trained staff will have access to wildlife deterrent materials including bear spray, cracker shells, and a 12-gauge shotgun with plastic slugs. The use of any deterrent method will be reported to ENR. 5. All work crews will have at least one can of bear spray while bears are active. 6. Snow will be removed around buildings and work areas to increase visibility. 7. Buildings will be designed to exclude wildlife. Options including installing adequate lighting, incorporating proper waste management, cleaning, and maintaining the kitchen and dining area, and wildlife detection. 8. The gas processing facility will be surrounded by a fence to deter curious wildlife from entering the facility. 9. Wildlife observations by project personnel will be reported to Wildlife Monitors. 10. Project activities will not destroy or damage muskrat push-ups. 11. No hunting by construction and maintenance workers, including Inuvialuit workers, during work shift/hours. 12. Any wildlife mortalities will be reported to ILA and ENR.
6.6	Spills or leaks may harm wildlife (e.g., caribou, grizzly bears, wolverines, etc.)	1. Spill contingency plans (Appendix 5) will be implemented to prevent and address leaks and spills.

Table 16-1: Potential Effects and Proposed Mitigations for Valued Components		
Potential Effect on Valued Components		**Proposed Mitigation Measure**
		2. In the event of a spill, all efforts will be made to properly contain and manage the spill. 3. All spills greater than the minimum thresholds will be reported to the GNWT Spill Line and other appropriate agencies. 4. The spill area will be monitored closely and appropriate deterrents (e.g., warning noises, flagging) will be employed to discourage grizzly bears or other wildlife from entering the affected area.
6.7	Wildlife attracted to camp/work areas and waste products	1. IESP personnel will ensure proper storage, transportation, and disposal of all wastes to avoid attracting carnivores (e.g., bears, wolverines, foxes, etc.) to the work site. 2. Site will be kept clean. 3. Kitchen or food related waste will be removed weekly and disposed in Tuktoyaktuk. 4. Wildlife Monitors will communicate bear sightings. 5. Personnel will have bear safety training. 6. Waste removal crews will be sent out to areas surrounding the access road and pads to collect and properly dispose of any waste material that have blown off site. 7. Follow the Waste Management Plan (Appendix 4)
7.0	Birds and Habitat	
7.1	Wildlife mortality	1. If an active nest is found during summer operations, setback distances (as defined in the Wildlife and Wildlife Habitat Protection Plan – Appendix 2) will be applied and maintained until the nest is no longer active, unless exceptions are approved in consultation with ILA and ENR and/or CWS. 2. ENR and local HTCs will be consulted to map and plan around migratory bird seasons. 3. Well completion and construction activities will be planned to avoid any overlap or conflicts with migratory birds.
7.2	Encroachment on habitat and/or nesting sites	1. Minimize Project footprint. 2. Workers will not walk off-site onto the land at any time of year, unless there is a specific need (e.g., waste clean-up, emergency). 3. Minimum snow cover requirements will help to mitigate possible effects to low-lying vegetation. 4. Rigs and Facilities will be constructed on ice or gravel pads.
7.3	Spill or leak impacts on bird habitat	1. Spill contingency plans (Appendix 5 will be implemented to prevent and address leaks and spills. 2. In the event of a spill, all efforts will be made to properly contain and manage the spill. 3. All spills greater than the minimum thresholds will be reported to the GNWT Spill Line and other appropriate agencies. 4. The spill area will be monitored closely and appropriate deterrents (e.g., warning noises, flagging) will be employed to discourage birds or other wildlife from entering the affected area.
8.0	Ecosystem Fragmentation	
8.1	Linear ROW disturbs animal movements	1. The access road is not expected to disturb animal or fish movement. 2. Minimize Project footprint and use previously disturbed areas wherever possible. 3. A wildlife and wildlife habitat protection plan will be implemented.
8.2	Pads and Roads create new habitat opportunities, attracting wildlife	1. Wildlife Monitor may gently encourage wildlife to move away from the area using methods pre-approved by ENR.

Table 16-1: Potential Effects and Proposed Mitigations for Valued Components		
Potential Effect on Valued Components		**Proposed Mitigation Measure**
		2. Facility structures will be regularly monitored for nests or animals setting up home. We will adapt management as information is gathered during operations.
9.0	Climate Change	
9.1	Greenhouse Gases	1. This project will result in a very significant reduction of GHGs related to the transport of fuels from M-18 rather than Alberta and B.C. 2. The feasibility of a gas powered truck fleet will be analyzed and consulted upon. 3. The potential for the local use of waste heat from the facility operations will be analyzed and consulted upon.
9.2	Climate change may require adaptation to road and pads for changes in precipitation and/or temperatures resulting in overland flooding or permafrost degradation	1. All roads and pads will be built on high ground, wherever possible. 2. Gas Plant equipment will be built on skids suitable for mobilization and elevation. 3. Overland flooding will be addressed in the Emergency Response Plan.
10.0	Air Quality and Noise	
10.1	Project activities can impact air quality by emissions or dusting	1. Operational air emissions will meet or exceed government requirements. 2. There is no Sulphur content in the gas stream. 3. Flaring is essential for safe operations. Flaring will only be for short periods of time or emergency pressure relief – specifically during startup or upsets. 4. Number of vehicles, heavy equipment and diesel generators will be limited. 5. Ensure proper maintenance of heavy equipment to minimize air emissions. 6. Restrict speed limits along the access road to minimize dust. 7. Implementation of dust suppression measures during construction and summer operation activities. 8. Follow the GNWT's Guideline for Dust Suppression (2013) during both construction and operation phases. 9. Ambient (static) air quality stations will be installed to capture particulates for analysis. We will adapt management as information is gathered during operations.
10.2	Project activities resulting in increased noise levels in the area	1. Noise will be restricted to the immediate vicinity of the work in progress. 2. The gas processing facility will be prefabricated in Alberta, minimizing construction related noise and durations. 3. The highest noise levels will likely occur during well completion or the flaring of gas, both of which will occur during a short time frame only in a localized area. 4. Maintenance of equipment in good repair and provision of appropriate mufflers for all internal combustion engines. 5. Engine breaks will be prohibited in communities and at the project site. 6. Generators and gas processing will be housed in noise-reducing structures. 7. Limit construction activity during sensitive periods (based on recommendations from wildlife experts) to minimize effects on wildlife. 8. Respond immediately to any noise complaints. 9. Monitor noise levels quarterly (daytime and nighttime) and adapt our facility and management processes based upon any new information about our noise levels.

Table 16-1: Potential Effects and Proposed Mitigations for Valued Components		
Potential Effect on Valued Components		**Proposed Mitigation Measure**
		10. The Energy Centre will be designed and constructed utilizing technologies and equipment to mitigate noise from rotating equipment noise sources such as heat exchanger fin fans, compressors, and generator engine exhaust. 11. Additional noise mitigation methods may include selection of lower noise fan designs with slower speeds, sound baffling systems, perforated wall panels for compressor buildings, and use of high-grade mufflers for generator engine exhaust.
11.0	Traditional and Local Land Use	
11.1	Disturbance to harvest activities	1. The Inuvik and Tuktoyaktuk HTCs will be consulted prior to project start and regularly (as agreeable to the HTCs) over the life of the project. 2. Impacts to those traditional land uses in the RSA identified through consultations, will be mitigated. 3. The IESP will abide by the applicable Community Conservation Plans in design and implementation. 4. The IESP will have no impact to the Husky Lakes Special Area. 5. Appropriate signage, fencing and gates will be utilized to ensure local wildlife are not impacted. 6. Support the FJMC's Inuvialuit Plan for Fishing on the Inuvik to Tuktoyaktuk Highway (2017) 7. Signage and gates at entrance to access road to discourage new access to remote fishing areas 8. Follow the Wildlife and Wildlife Habitat Protection Plan (see Appendix 2).
11.2	Disturbance to local community and ITH use from traffic	1. with the IESP team will work with the GNWT Department of Transportation to ensure access and egress to/from the IESP access road and to/from the ITH in order to meet all regulatory requirements for lane widths, signage, visibility, etc. 2. The IESP team will continue to meet with local community organizations to identify and address issues or concerns related to the IESP. 3. Signage will be posted along with 24/7 contact information for the public to contact us in the event of a concern. 4. Residents will be informed, and additional signage will be installed on the ITH during road and pad construction and during more intensive gravel hauling periods
11.3	Aesthetic (Visual) impacts to community	1. The facility will be placed far enough from the ITH to avoid causing distracted drivers. 2. Light disturbance will be addressed through various measures outlined in the Light Mitigation Measures (14.0).
11.4	Disturbance to local community and/or region due to fire or explosion	3. During operations, we will develop and implement a regional facility emergency response plan in the event of a major emergency. 4. We will meet regularly with local responders to plan and update training, communications, and lines of reporting. 5. We will regularly practice emergency response exercises including the communities of Tuktoyaktuk and Inuvik, DOT, Airports, RCMP, fire and medical responders
12.0	Archaeological and Heritage Resources *(Heritage and Archaeological Sites)*	
12.1	Potential disturbance of sites and site contents due to surface/ subsurface impacts and damage to shallowly buried sites/artifacts by heavy machinery	1. local communities have been consulted and a certified archaeologist has been employed to identify any potential heritage or archaeological sites within the IESP footprint. 2. Any sites discovered prior to construction will, in consultation with the ILA, the Prince of Wales Northern Heritage Centre, and local communities be managed in accordance with the IESP Archaeological Site Management Plan (see Appendix 3).

Table 16-1: Potential Effects and Proposed Mitigations for Valued Components		
Potential Effect on Valued Components		**Proposed Mitigation Measure**
		3. If a previously undiscovered archaeological resource is encountered during construction, work will cease at that location and the Archaeological Site Management Plan will be followed (see Appendix 3). The ILA, PWNHC, and the communities will be notified and consulted for advice on mitigation. 4. Known archaeology sites that have been identified in the region surrounding the Project Area will be avoided by at least 100m. (Note: NWT Regulations require 30 m)
13.0	Light Mitigation	
13.1	Potential aesthetic issue to the local community at night and/or sensory disturbance to wildlife	1. Lighting will be sufficient to meet the demands of the construction activity with minimal spillage, reflectivity or spread to areas outside of the requirement zone or to the night sky. 2. Lighting will use spot optics with precise beam angles when practicable to illuminate only the required area. 3. Automate lighting systems where feasible with timers and sensors to respond to reduced / increased lighting requirements as needed. 4. Utilize digital lighting systems where practicable combining solid-state lighting (SSL) with smart controls. 5. Utilize full cutoff fixtures with light shields to reduce contribution to sky glow. 6. Install motion or other types of sensors in outdoor areas where access is required on a minimal or indeterminate basis (e.g. access gates and limited use roadways / passages / corridors).
14.0	**Socio Economic Impacts and Benefits**	
		1. The use of capable local businesses, suppliers and contractors will be maximized. 2. The Inuvialuit Business List will be used to source capable services. 3. The IESP team will visit local schools to explain and discuss the IESP and to encourage interest in pursuing training relevant to the long-term positions available in accordance with COVID-19 related restrictions. 4. Funding will be sourced to support training for qualified individuals for long-term, full-time positions associated with the IESP. 5. with the IESP team will continue to meet with elders, local leaders, Community Corporations and HTCs; hospitals and healthcare centres, fire departments and RCMP detachments; and, community public works to address questions and to better understand how the IESP can be a positive contributor and good corporate citizen in the community. 6. We will provide 24-7 security for the facility to ensure public safety, particularly of youth.

17.0 CLEAN-UP, DECOMMISSIONING & RECLAMATION PLAN

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

Plans for clean-up, reclamation, disposal and or decommission of the various elements of the proposed development. A decommissioning plan is necessary for all developments involving facilities construction (i.e., construction of permanent structures). (From EISC Guidelines Appendix F (2014))

The Inuvialuit Petroleum Corporation (IPC) will ensure that future Decommissioning and Reclamation (D&R) activities will meet the requirements in place at the relevant time. Because we are planning toward a facility and wellsite lifecycle of 50 to 100 years, we are not able to predict with any certainty the requirements that might apply that length of time into the future. Our D&R plan, therefore, is based upon existing regulations (including Inuvialuit Land Administration (ILA) Rules), best practices, and common sense.

17.1 Well Completion

At the end of the life for the well (anticipated to be many tens of years from now), the M-18 gas well will be abandoned in accordance with the legislation and best practices of the time. See Section 17.3 for details.

Following well completion, scheduled for 2021 or early 2022, all equipment, tanks, waste, and infrastructure associated with the well completion will be removed from the site. All wastes will be managed and disposed off site at licensed waste facilities according to waste type, and NWT regulations. The drilling pad will be left intact to allow for future workovers and/or well servicing. The pad will be kept free of vegetation using non-chemical methods. Drainage will be managed to ensure that there is no ponding and the pad and permafrost are protected. The drilling pad will be integrated with the new sump cap (see Figure 6-9), however, there will be no heavy equipment or regular traffic ever allowed on the sump area.

17.2 Existing Drilling Waste Sump

There are currently two sumps at the M-18 wellsite - a drilling waste sump that was used for two drilling projects in 2002-03 and a kitchen sump that was never used. Neither sump contains hazardous materials nor solid wastes. The reclamation of the existing drilling waste sump at M-18 is the responsibility of the existing well owner and is under discussion with IPC and the well owner. Alternatives for the remediation of the sump were discussed in Section 7 of the PD.

Based upon factors including the protection of the M-18 well asset, the protection of the permafrost, regulatory and community feedback, and cost, the preferred remediation alternative is to contain the sump contents and surrounding permafrost and to leave the sump in place until final site closure.

The recommendation of our geotechnical consultant is the same:

“Kiggiak-EBA’s geotechnical recommendation given the proposed development for the Study Area is to allow the sump to remain in place, increase the cap cover thickness, provide sufficient cap cover overlap, and restore positive drainage away from the sump. Basically, sump remediation would involve capping the sump with backfill

material, and aggrading permafrost into the sump and cap cover materials to immobilize the sump in frozen ground. The sump cap should be thickened an additional one meter with clean backfill material to be greater than two metres total thickness and the cap overlap should extend approximately ten metres in all directions beyond the existing perimeter of the sump cap. The cap will need to be contoured so not to trap and accumulate snow on the cap. The cap must maintain positive grades to prevent water ponding on the cap. Ideally water should not be allowed to pond adjacent to the sump cap but should minor ponding occur due to thaw settlement of the native ice-rich permafrost surrounding the sump then the cap overlap would be sufficient to keep the ponding sufficiently away from the contents of the sump. Restoring the sump area to promote revegetation is good practice but the vegetation also tends to preferentially accumulate snow in the winter months. Re-contouring the sump cap might be necessary in the future if subsidence is impacting positive drainage and resulting in ponding." (Kiggiak EBA 2020)

The final remediation and reclamation of the drilling waste sump will be completed at the end of the project life and will follow all regulatory requirements and best practices of that time.

17.3 Gas Processing Facility and Supporting Infrastructure

With respect to the M-18 Gas Processing Facility (GPF), infrastructure and associated roads, pads and facilities, the reclamation goal will be achieved following the decommissioning and removal of all site structures. Structures may be disposed appropriately and/or transferred, upon request and mutual agreement, should they have a useful purpose, to an Inuvialuit organization. Our current engineering design provides for easy removal of these structures. Following the removal and proper disposal of ground structures and materials from the site, all piles will be cut off to a depth agreeable to ILA. Remaining pads, gravel, roads, and water crossings will be decommissioned, levelled, and reclaimed as applicable in accordance with the requirements of the ILA and any applicable regulations. Any soils requiring remediation will be remediated and the land disturbed by remediation will be reclaimed to equivalent land capability or the requirements in place at the relevant time. All debris will be cleaned up and removed. There will be no landfills or contamination left on the site. The M-18 well will be properly plugged and abandoned to the requirements in place at the relevant time. The wellhead will be removed, and a location marker will be left at the wellsite. A summary of infrastructure components considered in this D&R Plan is provided in Table 17-1.

Table 17-1: Components Considered as Part of the D&R Plan

Site/Feature	Components	
Gas Processing Facility (GPF) Site	• Gas, Water and Condensate Separator skid • Gas Dehydration Unit skid • Liquefaction Unit skids • Distillation Unit skids • Flare Structure and Piping • Generators Building • Operator Office/Trailer • Parts Storage C-Container • Front End Loader Garage/Quonset • Piping, Loading and Metering Equipment	• Electrical Supply and Distribution System • Fire Suppression Systems • Trailer Storage and Laydown Area • Fuel Storage Area (Tanks and Berm) • Chemical Storage C-Container • Temporary Waste Storage C-Container • Emergency Response Equipment C-Container • Telecommunications Tower • Weather Station • Gravel and/or Concrete Pads

Table 17-1: Components Considered as Part of the D&R Plan		
	• Grounding Station and Egress Shack • Water Treatment Unit • Site Lighting System	• Site Drainage Systems (ditches, channels, surface runoff outfall)
Well Site	• M-18 Well • M-18 Wellhead • Piping from wellhead to GPF and Anchor Points	• M-18 2002 Drilling Waste Sump • Well Pad
Linear Features	• Private Access Road (four kilometres) • Road Modifications (culverts and aprons) • Turn Lane and Signage at ITH • Turnoff Light Standard • Access Road Signage and Gate	• Powerlines • Erosion Control Fences • Security Fencing and Signage • Access Road Bridge

17.4 Best Practices

Table 17-1 presents a summary of all infrastructure components that may require decommissioning. These components will be removed or made safe following the project. Our approach will follow best practices in place at the relevant time. At a minimum, based on CCME National Guidelines for Decommissioning Industrial Sites, (Canadian Council of Ministers of the Environment, 1991) and modified to the extent necessary to comply with the Inuvialuit Final Agreement and the ILA Rules. These practices will include:

1. "Development of a Decommissioning plan in conjunction with the applicable regulatory authorities and other interested parties;
2. Removal of all above ground and below ground structures that will not be used during future land use;
3. Removal, treatment, and disposal or secure isolation and/or treatment of contaminated materials, whether present on-site or off-site, to the extent necessary to ensure attainment and maintenance of the (regulatory) cleanup criteria;
4. Access controls for physical structures remaining on-site that are unsafe or hazardous to humans or animals;
5. Monitoring of contaminant containment, control or treatment systems remaining on-site;
6. Remediation of aesthetically unacceptable portions of the site (filling of pits, removal of stained soil and odorous materials, levelling of mounds, disposal of waste rock);
7. Cleanup of the site to a level which will provide long –term environmental protection and will be safe for the intended future use;
8. Registration on the title to the property of any structures left on site that restrict future land use and/or that require periodic monitoring to ensure continued integrity; and
9. Submission to the applicable regulatory agency, and other required jurisdictions, of a report confirming that decommissioning and cleanup has been completed."

The abandonment of the well would follow the OROGO Well Suspension and Abandonment Guidelines and Interpretation Notes (2017) issued under section 18 of the Oil and Gas Operations Act – or whatever the equivalent legislation or best practice is at the time of abandonment. Abandonment is not expected for more than 50 years, but the main components are likely to be similar, as follows:

1. Remove the tubing and associated equipment from the well;

2. Install a mechanical bridge plug immediately above the casing perforations;
3. Pressure test the plug;
4. Set a cement plug on top of the mechanical plug;
5. Fill the well with a suitable fluid for indefinite casing protection, ensuring that fluid over the permafrost section will not freeze; and
6. Cut the casing off a minimum of one meter below the final ground level and cap it.

17.5 Pre-Disturbance Characterization

Geotechnical, soils, permafrost, vegetation, archaeology, water, fish, bathymetry, topography and wildlife field studies have been conducted by IPC at M-18, including the footprint of the proposed pads and road right of way, to characterize baseline (background) site conditions. (See Table 17-2) Characterizing background conditions is critical to the goal of eventually reclaiming the lands used as part of the project (i.e. Project Footprint) to equivalent land capability.

We are aware that Phase 1 and Phase 2 Environmental Site Assessments (ESAs) have been conducted by the previous and current wellsite owners, including soil and water sampling, and borehole drilling, with chemical analyses, to characterize the existing drilling mud sump. These reports are confidential to the current wellsite owner and cannot be listed in this public document. A summary of the characterization is provided in Section 6. There is no evidence of dangerous chemicals in or around the drilling mud sump.

Table 17-2: Recent Environmental Investigations at M-18

Dat	Study Title	Study Author	Scope of Work
2018	August 2018 Archaeological Overview Assessment of the M-18 Study Area	Kiggiak EBA Consulting Ltd. and Soriak Consulting	To identify and map the presence of any archaeological or heritage resources in the local and regional study areas (LSA/RSA).
2018	August 2018 Baseline Aquatic Assessment	Kiggiak EBA Consulting Ltd.	To determine stream size, flow and basic water chemistry of the stream that must be crossed in the LSA; and to identify fish and/or fish habitat in the stream.
2018	August 2018 Baseline Environmental Field Report – Vegetation	Kiggiak EBA Consulting Ltd.	To identify and map the presence of any rare or “at risk” plant species or communities in the LSA.
2018	August 2018 Baseline Environmental Field Report – Wildlife	Kiggiak EBA Consulting Ltd.	To identify the presence of critical, endangered, or protected animals and birds in the LSA.
2018	August 2018 Geotechnical Field Reconnaissance Report	Kiggiak EBA Consulting Ltd.	To study the permafrost and local soil conditions. Soils from numerous test pits across the LSA were analyzed and the depth of active layer was probed to map the surficial geology of the LSA. The existing sump cap was also assessed.
2018	LIDAR and Ground Survey of the Topography of the IESP Local Study Area	Inukshuk Surveys	To provide highly accurate survey information of the LSA for planning purposes.
2018	Bathymetric Survey of the unnamed Lake east of M-18	Inukshuk Surveys	To provide information concerning the depth and subsurface bathymetry of the unnamed lake

Table 17-2: Recent Environmental Investigations at M-18			
Dat	**Study Title**	**Study Author**	**Scope of Work**
2020	South Tuktoyaktuk Study Area Geotechnical Site Investigation and Preliminary Recommendations Report	Kiggiak EBA Consulting Ltd.	Collection and analyses of subsurface geotechnical strata using a track-mounted Sonic drilling rig, including borehole logs, laboratory analyses, ground temperature measurements, interpreted stratigraphy, and preliminary recommendations and engineering considerations for advancing civil design.

17.6 Extraordinary Restitution Items

Extraordinary restitution items include decommissioning tasks or facility components that may require special or extraordinary effort or expense during the restitution phase, such as difficult underground removals or hazardous materials management or contamination. At present, the existing sumps, proposed culverts, the bridge at the unnamed Creek and proposed gravel pads and roads have been identified as extraordinary restitution items.

Current ILA Rules do not require the removal of gravel pads and roads. Given the potential impact to the permafrost of gravel removal, unless a method for removing gravel without disrupting drainage, fisheries, and permafrost is discovered by the time we decommission the M-18 project, we anticipate that gravel will remain in situ following decommissioning. We expect that the gravel pads and road would remain in place without an impact to local ecology or traditional land use in the area.

In the event that some of the gravel is recovered for use elsewhere (as gravel is always in high demand in the arctic), the remaining gravel footprint would be seeded with native vegetation species in such a way as to minimize disturbance to local drainage and permafrost; and to encourage re-growth of the area to natural vegetation communities. However, any proposed “mining” of the gravel should consider potential impacts to drainage and permafrost.

The crossing of the Creek at KM2 of the proposed access road will require a bridge or large culvert. Our intention will be to decommission the crossing in such a manner as to minimize long term maintenance requirements and to minimize impacts to the fisheries, the natural drainage and the permafrost.

As discussed in Section 17.2, there are currently two sumps at the M-18 wellsite - a drilling waste sump that was used for two drilling projects in 2002-03 and a kitchen sump that was never used. It is anticipated that both the sumps will remain contained and frozen in place. The drilling waste sump will be remediated in 2021 as part of the project. Should the sumps require additional maintenance or work, IPC will consult with the ILA and/or the Inuvialuit Water Board on a mutually agreeable program for maintenance and final reclamation of these sumps.

17.7 Remediation of Potential Contamination

Due to the nature of the process involved with this project, it is not expected that any significant quantity of liquid or solid hazardous wastes will be generated or stored on site. All chemicals will be stored securely and isolated from the environment. Liquid condensate transfers will be completed by trained, certified truck drivers using best practices on transfer and spill containment aprons at the loading area. The potential for a liquid spill is low and the potential for a spill to impact the environment is lower. For this reason, we do not expect there to be any

contaminated snow, soil or vegetation following the life of the Gas Processing Facility. However, if there is any contamination resulting from construction or operations during the project life cycle, the contamination will be immediately dealt with, using best efforts as soon as it is reasonable and safe to do so. As stated above, from the CCME Guidelines, all contaminated snow, soil or other materials will be removed, treated, and disposed or securely isolated and/or treated whether present on-site or off-site, to the extent necessary to ensure protection of the environment, and attainment and maintenance of regulatory cleanup criteria current to that date.

17.8 Reclamation of Project Footprint

Following cleanup, the decommissioning and removal of all infrastructure, and the remediation of any potential surface or sub-surface contamination, the M-18 wellsite and gas plant processing areas will be reclaimed in a manner consistent with ILA Rules and any applicable regulations. Reclamation activities may include the following:

- Natural drainage may be restored
- Pre-disturbance topography may be restored
- Soils may be restored to equivalent land capability
- Revegetation efforts may include planting and successful restitution of native plant species

Reclamation efforts will be monitored to ensure all reclamation activities achieve the regulatory requirements in place at the relevant time.

17.9 Closure Monitoring

After decommissioning and final remediation and reclamation activities have been completed, a period of monitoring in accordance with ILA Rules will be implemented in a way that ensures the success of closure activities.

If the closure monitoring provides results that meet established guidelines, and the program is considered successful, ongoing monitoring will not be required. At that time IPC would apply for a final clearance letter (or relevant requirement of the time) from the ILA. If guidelines are not met, ongoing monitoring will be required in the affected area. Details of the monitoring programs will be presented to the ILA for approval one year prior to the closure of the site.

18.0 OTHER ENVIRONMENTAL ASSESSMENTS

REFERENCE REQUIREMENTS FOR REVIEWER CONVENIENCE

Provide an indication of whether this proposed development has been subject to a previous environmental assessment.
Provide a copy of the assessment and decision reports (where available).
Indicate what changes to the development resulted from the environmental assessment process, the regulatory process, or the implementation of the development.

Table 18-1 provides a list of previous Environmental Assessments submitted to the EISC or the EIRB that overlap with either the Local Study Area (LSA) or the Regional Study Area (RSA) or both. Copies of the previous assessments are available from the EISC Registry. The results of the previous environmental assessments and their Registry File numbers are also included in Table 18-1. Copies of all available Decision Letters are provided in Appendix 9. Table 18-2 provides a list of previous studies and regulatory applications relevant to the Project.

The abundance of field studies, engineering work and mitigation assessments already conducted in this area have provided the IESP opportunities to better evaluate our own proposed approach, and, we believe, has improved our Project planning. The information available on the EISC, IWB, and EIRB websites have further enriched our project planning and design.

The broader RSA for the IESP has been researched for more than five decades for numerous projects. The area's proximity to the Hamlet of Tuktoyaktuk has made this area an ideal place to study of the land, soils, vegetation, waters, coast, permafrost, pingos, climate, fish, archaeology, ecology, and wildlife. Valuable traditional knowledge relating to this area has also been collected. An additional ten environmental assessments were also carried out under Federal review for oil and gas projects that occurred inside the RSA prior to the creation of the EISC. Some of the current and proposed research projects in the RSA were provided in Section 11.

At the more focused level of the LSA, environment and wildlife, the potentially affected community, regional land uses, and, traditional land uses are well-studied and documented. To date, the LSA has been subject to eight previous environmental assessments for EISC Project Descriptions and the RSA has been subject to dozens of environmental studies. For example, nearly 50% of the LSA was included in the RSA of the comprehensive Environmental Impact Assessment for the Inuvik to Tuktoyaktuk Highway (ITH), including the area's most valued lake (Tiktaliq Lake) and the IESP's most important watershed, Gunghi Creek. In addition, the 2012 GNWT-sponsored Summary of Existing Traditional Knowledge for the Inuvik to Tuktoyaktuk Highway Study Area (Kavik-Stantec 2012), the recently updated Tuktoyaktuk and Inuvik Community Conservation Plans (2016) and the new Environment Canada Beaufort Regional Coastal Sensitivity Atlas (2015) incorporated traditional knowledge of the area at a scale and comprehensiveness that has not been seen prior.

While a robust baseline of knowledge exists for this area, work in relation to the IESP has added considerably to that baseline. Eight studies of the LSA have been commissioned to date to provide detailed information about the area. This has involved an expenditure to date of more than a million dollars ($1,000,000) and hundreds of hours work by Inuvialuit and other experts. These previous studies, along with the assessment provided in this submission support the conclusion that there will be no significant adverse impacts on the environment, local people or the harvesters that use this area.

We note that this accumulation of knowledge and understanding has led to consistency in decision-making over

time in the broader region. For example, of the 229 wells explored and drilled in the ISR onshore to date, all have been approved to proceed without further environmental impact review and assessment under the Inuvialuit Final Agreement.

Table 18-1: Previous Environmental Assessments Relevant to the Project						
Previous Project Descriptions that Overlap the Study Area	**Year**	**Overlap**	**Proponent**	**Consultant**	**EISC File Number**	**Decision**
EISC Project Description - South Tuktoyaktuk Feasibility Study - Geotechnical Investigation	2020	LSA	Inuvialuit Regional Corporation	Kiggiak EBA	[01/20-10]	"Project qualifies for an exemption from environmental impact screening under Exclusion Item # 16 of the EISC Guidelines."
EISC Project Description - Gunghi Creek Crossing Replacement	2019	RSA	Government of the Northwest Territories Department of Infrastructure	Wood	[10/19-02]	"The development, if authorized subject to environmental terms and conditions recommended by the Screening Committee, will have no such significant negative impact and may proceed without environmental impact assessment and review under the Inuvialuit Final Agreement."
EISC Project Description - Mackenzie Beaufort Energy Pre-Feasibility Studies	2018	LSA	ATCO Midstream NWT Ltd.	Kiggiak EBA	[06/18-04]	Project qualifies for an exemption from environmental impact screening under Exclusion Item #16
Project Description Report for Construction of the Inuvik to Tuktoyaktuk Highway, NWT	2010	LSA	Hamlet of Tuktoyaktuk, Town of Inuvik, Government of Northwest Territories	Kiggiak EBA	[02/10-05]	"The development could have significant negative impact on the environment and Inuvialuit wildlife harvesting in the Inuvialuit Settlement Region and is subject to further assessment and review."
EISC Project Description - Tuktoyaktuk to Granular Source 177 Access Road	2008	Both	Government of the Northwest Territories and Hamlet of Tuktoyaktuk	Kiggiak-EBA	not available	not available
EISC Project Description - Tuk 2 Winter 2001/2002 Drilling Program	2001	LSA	Anderson Resources Ltd.	Inuvialuit Environmental and Geotechnical Inc.	[08/01-10]	"The development will have no such significant negative environmental impact and may proceed without further environmental impact review and assessment under the Inuvialuit Final Agreement."
EISC Project Description - Tuk South Winter 2001/2002 3D Seismic Program	2001	LSA	Anderson Resources Ltd.	Inuvialuit Environmental and Geotechnical Inc.	[08/01-09]	"The development will have no such significant negative environmental impact and may proceed without further environmental impact review and assessment under the Inuvialuit Final Agreement."
EISC Project Description - Tuk 2 (Winter 2001/2002) Drilling Program Water Licence Application	2001	LSA	Anderson Resources Ltd.	Inuvialuit Environmental Inc.	[07/01-04]	"The development will have no such significant negative environmental impact and may proceed without further environmental impact review and assessment under the Inuvialuit Final Agreement."
EISC Project Description - Tuktoyaktuk Peninsula Winter 2000/2001 Seismic Program	2000	LSA	Anderson Resources Ltd.	Inuvialuit Environmental Inc.	[11/00-02]	"The development will have no such significant negative environmental impact and may proceed without further environmental impact review and assessment under the Inuvialuit Final Agreement."

Table 18-1: Previous Environmental Assessments Relevant to the Project						
Development Proposal - ESSO Winter Seismic Program 1991/92	1991	LSA	Esso Resources Canada Limited	none	[10/91-03]	"The development will not have significant negative environmental impact on the Inuvialuit Settlement Region, and may proceed without further environmental impact review and assessment under the Inuvialuit Final Agreement."
Previous Impact Assessments (EIRB) that Overlap the Study Area						
Construction of the Inuvik to Tuktoyaktuk Highway, Northwest Territories	2010	Both	Hamlet of Tuktoyaktuk, Town of Inuvik, Government of Northwest Territories	Kiggiak EBA	EIRB: 2002-10-05	https://eirb.ca/projects/inuvik-tuk-highway/
Mackenzie Gas Project	2002	RSA	Imperial Oil Resources Ventures Limited	Tera-Golder-AMEC-Axys	NEB: GH-1-2004	https://www.cer-rec.gc.ca/pplctnflng/mjrpp/archive/mcknzgs/mcknzgs-eng.html

Table 18-2: Previous Studies and Regulatory Applications Relevant to the Project			
Study Title	**Year**	**Proponent**	**Consultant/Author**
Beaufort Delta Energy Feasibility Study	2018	Inuvialuit Regional Corporation	Hatch Engineering
Feasibility Study for LNG Fuelled Electrical Generation in Tuktoyaktuk	2017	GNWT PWS	Jenmar Concepts
Submission to the EISC - ITH Borrow Source 312 West All Season Access Road Construction and Operation Program	2015	GNWT DOT	Kavik Stantec
Submission to the EISC - ITH Borrow Source 1401A All Season Access Road Construction and Operation Program	2014	GNWT DOT	Kavik Stantec
Submission to the EISC: Project Description Solid Waste Landfill	2014	Hamlet of Tuktoyaktuk	AECOM
ITH (Inuvik to Tuktoyaktuk Highway) Sedimentation and Erosion Control Plan	2014	GNWT DOT	Kavik Stantec
ITH Permafrost Monitoring Plan	2014	GNWT DOT	GNWT DOT
Aquatic Effects Monitoring Plan and Surveillance Network Program: Construction of the ITH	2014	GNWT DOT	GNWT DOT
ITH Fish and Fish Habitat Protection Plan	2014	GNWT DOT	Kavik Stantec
A Vision for the NWT Power System Plan	2013	NT Energy	Northwest Territories Power Corporation
Northwest Territories Energy Action Plan	2013	GNWT	GNWT
ITH Archaeological Site Management Plan	2013	PWNHC	GNWT DOT
ITH Spill Contingency Management Plan	2013	GNWT DOT	EGT Northwind Ltd.
ITH Emergency Response Management Plan	2013	GNWT DOT	EGT Northwind Ltd.
ITH Waste Management Plan	2013	GNWT DOT	EGT Northwind Ltd.
ITH 2013 Bathymetric Survey-Rev. 1	2013	EGT Northwind Ltd.	Kiggiak EBA
ITH Wildlife and Wildlife Habitat Protection Plan: (1) Construction	2013	GNWT DOT	Kavik Stantec
ITH - Baseline Data Acquisition Program: Vegetation Mapping and Rare Plant Surveys	2012	GNWT DOT	Kavik Stantec
ITH Baseline Data Acquisition Program: Wildlife Habitat Potential Mapping	2012	GNWT DOT	Kavik Stantec
ITH Hydrotechnical Assessment of Stream Crossings	2012	GNWT DOT	Kavik Stantec
ITH Traditional Knowledge Workshops	2012	GNWT DOT	Kavik Stantec
Summary of Existing Traditional Knowledge for the Inuvik to Tuktoyaktuk Highway Study Area	2012	GNWT DOT	Kavik Stantec
ITH Potential Borrow Source Geotechnical Investigations Program	2012	GNWT DOT	Kavik Stantec
Mackenzie Valley Community Gas Conversion Preliminary Feasibility Study	2012	GNWT ITI	Canadian Gas Services International

Table 18-2: Previous Studies and Regulatory Applications Relevant to the Project			
Study Title	**Year**	**Proponent**	**Consultant/Author**
Inuvik Wood Pellet Infrastructure Study	2012	GNWT ENR	Arctic Energy Alliance
Submission to the EISC: Project Description for the South Parsons Lake Gas Supply Project, NWT	2011	Utilities Group Facilities Inc. (UGFI)	Canadian Petroleum Engineering Inc. and IMG Golder
Emergency Response Plan UGFI IKHIL Production Well Project	2011	Inuvialuit Petroleum Corporation	Canadian Petroleum Engineering Inc.
Archaeological and Fisheries assessment of the Inuvik to Tuktoyaktuk Highway	2011	GNWT DOT	IMG-Golder
Spring 2010 Aquatic Field program Results	2010	GNWT DOT	Kiggiak EBA
Submission to the EISC Inuvik to Tuktoyaktuk Highway / Spring – Summer 2010 Field Stream Crossing Assessment	2010	GNWT DOT	Kiggiak EBA
Project Description Report for Construction of the Inuvik to Tuktoyaktuk Highway, NWT	2010	Hamlet of Tuktoyaktuk, Town of Inuvik and GNWT	Kiggiak EBA
Town of Inuvik Community Energy Plan	2010	Town of Inuvik	Kavik-Axys and Stantec Consulting
Archaeological and Fisheries Assessment of the Tuktoyaktuk to Source 177 Road	2009	GNWT DOT	IMG-Golder
Submission to the EISC: Construction Phase Environmental Management Plan for the Tuktoyaktuk to Granular Source 177 Access Road	2009	GNWT DOT	Kiggiak EBA
Submission to the EISC: Construction Phase Wildlife Management Plan for the Tuktoyaktuk to Granular Source 177 Access Road	2009	GNWT DOT	
Foundation for a Sustainable Northern Future - Report of the Joint Review Panel for the Mackenzie Gas Project (Volumes I and II)	2009	National Energy Board	Joint Review Panel fof the Mackenzie Gas Project
Submission to the EISC: MGM Energy Corp. Ogruknang 2D Seismic Program, 2007/2008, 2008/2009 and 2009/2010	2007	MGM	IMG-Golder
Review of the Ikhil Gas Development and Pipeline Regulatory and Environmental Process: Lessons Learned	2007	Environmental Studies Research Fund	Kavik Axys
Inuvik Gas Pipeline Lessons Learned	2004	Imperial Oil Resources Ltd.	North of 60 Engineering
Mackenzie Gas Project	2002	Imperial Oil Resources Ventures Limited	EIA including numerous field studies and reports
Tuktoyaktuk Peninsula Lake and Fish Habitat Survey	2000	Anderson Exploration Ltd.	Inuvialuit Environmental Inc.
Town of Inuvik gas supply environmental overview: A report	1996	Inuvialuit Petroleum Corporation	Webb and McDougall (1996)

Table 18-2: Previous Studies and Regulatory Applications Relevant to the Project			
Study Title	**Year**	**Proponent**	**Consultant/Author**
submitted to the Inuvialuit Petroleum Corporation			
Beaufort Region Environmental Assessment and Monitoring Program (BREAM)	1986 to 1994		BREAM analysis reports
Mackenzie Environmental Monitoring Program (MEMP)	1985 to 1994		Government and industry reports
Inuvialuit Organizations (Joint Secretariat, FJMC, Wildlife Management Advisory Council (NWT), Inuvialuit Game Council, HTC, ILA)	1984 to present	Various	Surveys, management plans, co-management plans, harvest studies, etc.

19.0 LIST OF ACRONYMS

ACC: Aklavik Community Corporation
AECOM: Public Services and Procurement Canada
AHTC: Aklavik Hunters and Trappers Committee
ARI: Aurora Research Institute
°**C:** Degrees Celsius
CCME: Canadian Council of Ministers of the Environment
CEAA: Canadian Environmental Assessment Agency
cm: centimetre
COSEWIC: Committee on the Status of Endangered Wildlife in Canada
CWS: Canadian Wildlife Service
DFO: Department of Fisheries and Oceans Canada
EA: Environmental Assessment
EC: Environment Canada
EIA: Environmental Impact Assessment
EIRB: Environmental Impact Review Board
EISC: Environmental Impact Screening Committee
ENR: GNWT Department of Environment and Natural Resources
EPP: Environmental Protection Plan
ERP: Emergency Response Plan
FJMC: Fisheries Joint Management Committee
GNWT: Government of the Northwest Territories
GTC: Gwich'in Tribal Council
HTC: Hunters' and Trappers' Committee
ICC: Inuvik Community Corporation
ICCP: Inuvik Community Conservation Plan
IFA: Inuvialuit Final Agreement
IGC: Inuvialuit Game Council
INAC: Indian and Northern Affairs Canada
IRC: Inuvialuit Regional Corporation
ISR: Inuvialuit Settlement Region
km: Kilometre
L: Litre
LSA: Local Study Area
M: Metre
m3: Cubic metre
masl: Metres above sea level
mm: Millimetre
NWT: Northwest Territories
PD: Project Description
RSA: Regional Study Area
SARA: Species at Risk Act
SC: Steering Committee
SOP: Standard Operating Procedure
TCC: Tuktoyaktuk Community Corporation
TCCP: Tuktoyaktuk Community Conservation Plan
TDG: Transportation of Dangerous Goods
TK: Traditional Knowledge
TLU: Traditional Land Use
VC: Valued Component
WMAC NS: Wildlife Management Advisory Council North Slope
WWHPP: Wildlife and Wildlife Habitat Protection Plan

20.0 CONTRIBUTORS

This comprehensive Project Description relied upon the experience, traditional knowledge, and subject matter expertise from an inter-disciplinary team of more than 60 people. Our subject matter experts and lead contributors are listed below.

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