PACIFIC FUTURE ENERGY

Building Our Future, Protecting Our Coast

PROJECT DESCRIPTION

PACIFIC FUTURE ENERGY REFINERY

June 2016

PROPONENT

Pacific Future Energy Corporation
701 West Georgia Street, Suite 1818
Vancouver | British Columbia | V7Y 1L2

PREPARED BY

SNC-Lavalin Inc.
Suite 500 - 745 Thurlow Street
Vancouver | British Columbia | V6E 0C5

SUBMISSION TO

British Columbia Environmental Assessment Office
836 Yates Street, 1st Floor
P.O. Box 9426 Stn. Provincial Government
Victoria | British Columbia | V8W 9V1

and

Canadian Environmental Assessment Agency
701 West Georgia Street Suite 410
Vancouver | British Columbia | V7Y 1C6

PREFACE

This Project Description is the start of our public conversation as we work to build our future and protect our coast in Northern British Columbia (BC) by creating the world's greenest bitumen refinery, while recognizing and respecting First Nations title and rights.

We will be listening very carefully to all of the feedback that we receive, and will incorporate community concerns and values in our Project's design. We believe that "social licence" or "permission" must be earned at the concept stage of this Project as well as throughout its lifecycle.

Approach

Pacific Future Energy Corporation (PFEC) was founded by like-minded leaders and entrepreneurs who fervently believe that a new approach is needed if Canada wants to gain new market access for Canada's bitumen.

We believe that this new approach must include building the greenest bitumen refinery in the world, transporting our feedstock in the safest manner over land, and not shipping any bitumen in tankers on the northwest coastal waters, in accordance with the oil tanker moratorium which is expected to be formalized and extended by the federal government.

There is overwhelming scientific evidence that our planet's climate is changing due to the use of fossil fuels. Innovative solutions will be required for the world to achieve its goal, established in the Paris Agreement (2016), of limiting temperature change to 1.5°C from pre-industrial levels. We believe that our "Near Zero Net Carbon (NZNC) emissions" facility will be one of those innovative solutions, as it will significantly reduce the overall carbon impact of the upstream feedstock we will be refining.

Industry will not gain market access through BC unless it is prepared to commit to the highest environmental standards. It must also be prepared to commit to the principle that BC should receive its "fair share" of fiscal and economic benefits associated with gaining market access. PFEC does not see these as burdens, but as opportunities for everyone.

First Nations First

One of PFEC's fundamental principles is that First Nations are a first order of government. We call this "First Nations First". We will proceed with our Project if we are welcomed and supported by First Nations.

PFEC is in full support of the UN Declaration on the Rights of Indigenous Peoples (UNDRIP). We know that we must respectfully request the free, prior and informed consent from First Nations who are the title-holders and affected by this Project. This is reflected in PFEC's commitment to directly engage Indigenous communities, including their families and citizens. This requires going beyond simply upholding the current legal requirements, to establishing meaningful relationships and in some cases, partnerships with the First Nation governing bodies and their business and administrative bodies.

We look forward to this conversation over the coming months. Together, we can build our future and protect our coast. Together we will make each other great and good.

TABLE OF CONTENTS

SNC·LAVALIN

TABLE OF CONTENTS (Cont'd)

Page

In-Text Figures

In-Text Schematics

In-Text Photographs

TABLE OF CONTENTS (Cont'd)

Page

In-Text Tables

P:\LOB\EIAM-BC\CP\PFE\631180\5.0 DEL\5.3 FINAL\R0617 PFEC_PROJECTDESCRIPTION_FINAL.DOCX

LIST OF ACRONYMS AND ABBREVIATIONS

AIA	Archaeological Impact Assessment
AIAF	Archaeological Information Assessment Form
AIP	Agreement in Principle
AIR	Application Information Requirements
AOA	Archaeological Overview Assessment
ARU	Amine Recovery Unit
ASME	American Society of Mechanical Engineers
ASU	Air Separation Unit
BC	British Columbia
BCEAA	BC Environmental Assessment Act
BCMF	BC Métis Federation
BFW	Boiler Feed Water
C_4	Refers to a hydrocarbon with four carbon molecules
CDC	BC Conservation Data Centre
CEA	Cumulative Effects Assessment
CEAA 2012	Canadian Environmental Assessment Act, 2012
CEMP	Construction Environmental Management Plan
CMT	Culturally Modified Tree
CN or CN Rail	Canadian National Railway Company
COP21	Conference of Parties 21
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CO	Carbon monoxide
CO_2	Carbon dioxide
CRA	Commercial, Recreational and Aboriginal (in relation to fish and fisheries)
CWHvm1	Coastal Western Hemlock, Submontane Very Wet Maritime
CWHws1	Coastal Western Hemlock, Submontane Wet Submaritime
CWHvm2	Coastal Western Hemlock, Very Wet Maritime
DCS	Distributed Control System
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EAO	BC Environmental Assessment Office
EC	Environment and Climate Change Canada

LIST OF ACRONYMS AND ABBREVIATIONS (Cont'd)

EHS	Environment, Health & Safety
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMA	BC Environmental Management Act
EURO V	Refers to Tier V (of VI) heavy-duty vehicle diesel emissions standards regulated by the European Union.
FLNRO	BC Ministry of Forest, Land and Natural Resources Operations
FRPA	Forest and Range Practices Act
FSR	Forestry Service Road
GIS	Geographic Information System
GPS	Global Positioning System
H_2S	Hydrogen sulphide
HCA	BC Heritage Conservation Act
IFRT	Internal Floating Roof Tank
IMBA	Impact Management and Benefits
INAC	Indigenous and Northern Affairs Canada
KMP	Kitimat Modernization Project
LNG	Liquefied Natural Gas
LOO	Licence of Occupation
LPG	Liquefied Petroleum Gas
LRMP	Land and Resource Management Plan
MARP	Measurement, Accounting & Reporting Plan
MBCA	Migratory Bird Convention Act
MBS	Migratory Bird Sanctuary
MCC	Motor Control Centres
MDEA	Methyl Diethanolamine
MHmm1	Mountain Hemlock Windward Moist Maritime
MoE	BC Ministry of Environment
MoF	BC Ministry of Forests
MoU	Memorandum of Understanding
MNBC	Métis Nation British Columbia
NAD	North American Datum
NEATBIT™	100% bitumen or raw bitumen with no diluent and no sand. Low-flammability.
NEB	National Energy Board

LIST OF ACRONYMS AND ABBREVIATIONS (Cont'd)

NH_3	Ammonia
NZNC	Near Zero Net Carbon
OGAA	Oil and Gas Activities Act
OGC	BC Oil and Gas Commission
OGMA	Old Growth Management Areas
OWS	Oily Water Sewer
PFEC	Pacific Future Energy Corporation
PNG	Pacific Northern Gas
PPE	Personal Protective Equipment
PTP	Pacific Trails Pipeline
RDKS	Regional District of Kitimat-Stikine
RDPA	Regulations for Designating Physical Activities
RTA	Rio Tinto Alcan Inc.
SARA	Species At Risk Act
SIS	Safety Instrument System
SNC-Lavalin	SNC-Lavalin Inc.
SRU	Sulphur Recovery Unit
SWS	Sour Water Stripper
TCF	Terrace Community Forest
TDG	Transportation of Dangerous Goods
TDS	Total Dissolved Solids
TGTU	Tail Gas Treatment Unit
TEK	Traditional Ecological Knowledge
the Agency	Canadian Environmental Assessment Agency
the Project	Pacific Future Energy Refinery
TSS	Total Suspended Solids
TUP	Temporary Use Permit
UNDRIP	UN Declaration on the Rights of Indigenous Peoples
UTM	Universal Transverse Mercator
UWR	Ungulate Winter Range
WHA	Wildlife Habitat Area
WHMIS	Workplace Hazardous Materials Information System
WWTP	Waste-Water Treatment Plant

UNITS OF MEASUREMENT

Bbls	Barrels
Bcf	Billion Cubic Feet
Bcf/day	Billion Cubic Feet Per Day
BPD	Barrels Per Day
°C	Degrees Celsius
DWT	Deadweight Tonnes
GJ	Gigajoule
ha	Hectares
Kg/hr	Kilograms Per Hour
km	Kilometres
km/h	Kilometres Per Hour
km^2	Square Kilometres
kPa(g)	Kilopascal Gauge
l/s	Litres Per Second
m	Metre(S)
m^2	Square Metres
m^3	Cubic Metres
m^3/d	Cubic Metres Per Day
m^3/hr	Cubic Metres Per Hour
m^3/yr	Cubic Metres Per Year
mm	Millimetres
MMPTA	Million Metric Tonnes Per Annum
MT	Metric Tonnes
MW	Megawatts
PJ	Petajoule

TABLE OF CONCORDANCE

Below is the Table of Concordance of the Project Description with the Prescribed Information for the Description of a Designated Project under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012).

Reference to Guidance Document(s)	Prescribed Information	Project Description Section(s)
Guide to Preparing a Description of a Designated Project under the *Canadian Environmental Assessment Act, 2012*		
1.0 General Information and Contact(s)		
1.1	Describe the nature of the designated project, and proposed location.	1.1, 3.0, 3.1, 11.0
1.2	Proponent information.	2.0
1.2.1	Name of the proponent.	2.1
1.2.1	Name of the designated project.	1.1
1.2.3	Address of the proponent.	2.1, 2.2
1.2.4	Chief Executive Officer or equivalent (include name, official title, email address and telephone number).	2.1
1.2.5	Principal contact person for purposes of the project description (include name, official title, email address and telephone number).	2.2
1.3	Provide a list of any jurisdictions and other parties including Aboriginal groups and the public that were consulted during the preparation of the project description.	8.0
1.4	Provide information on whether the designated project is subject to the environmental assessment and/or regulatory requirements of another jurisdiction(s).	3.0, 10.2
1.5	Provide information on whether the designated project will be taking place in a region that has been the subject of an environmental study. Proponents are advised to contact the Agency during the preparation of the project description for information regarding any regional environmental studies that may be relevant.	9.0
2.0 Project Information		
2.1	Provide a general description of the project, including the context and objectives of the project. Indicate whether the designated project is a component of a larger project that is not listed in the *Regulations Designating Physical Activities*.	1.0, 3.0
2.2	Indicate the provisions in the schedule to the *Regulations Designating Physical Activities* that describe the designated physical activities that are proposed to be carried out as part of the designated project.	3.0, 10.1
2.3	Components and Activities	

Reference to Guidance Document(s)	Prescribed Information	Project Description Section(s)
2.3.1	The physical works associated with the designated project (e.g., large buildings, other structures, such as bridges, culverts, dams, marine transport facilities, mines, pipelines, power plants, railways, roads, and transmission lines) including their purpose, approximate dimensions, and capacity. Include existing structures or related activities that will form part of or are required to accommodate or support the designated project.	1.1 (general), Table 4-1 (project components list), 4.1 (petroleum storage), 4.3 (rail yard), 4.4, 4.5, 4.6, 4.7, 4.7.1.1 (river intake), 5.4, 10.1, 11.0, Figures 2, 3, 5 and 6, Schematics 1, 2, 3
2.3.2	Anticipated size or production capacity of the designated project, with reference to thresholds set out in the *Regulations Designating Physical Activities*, including a description of the production processes to be used, the associated infrastructure, and any permanent or temporary structures. The production capacity does not refer to the planned production capacity of a project but the maximum production capacity based on the project's design and operating conditions.	Table 4-1, 4.1.5 (Refining process), Table 4-2 (petroleum storage volumes), Schematic 1, 4.2 (utilities), 4.3 (rail yard), 10.1, 11.0
2.3.3	If the designated project or one component of the designated project is an expansion, describe the size and nature of the expansion with reference to the thresholds set out in the *Regulations Designating Physical Activities*	3.0 10.1, 11.0 (Project is not an expansion)
2.3.4	A description of the physical activities that are incidental to the designated project. In determining such activities, the following criteria shall be taken into account: • nature of the proposed activities and whether they are subordinate or complementary to the designated project; • whether the activity is within the care and control of the proponent; • if the activity is to be undertaken by a third party, the nature of the relationship between the proponent and the third party and whether the proponent has the ability to "direct or influence" the carrying out of the activity; • whether the activity is solely for the benefit of the proponent or is available for other proponents as well; and • the federal and/or provincial regulatory requirements for the activity.	4.2.1, 4.2.1.2, 5.4
2.4	Emissions, discharges and waste	4.8
2.4.1	Sources of atmospheric contaminant emissions during the designated project phases (focusing on criteria air contaminants and greenhouse gases, or other non-criteria contaminants that are of potential concern) and location of emissions.	4.1.3, 4.1.5, 4.2 to 4.8
2.4.2	Sources and location of liquid discharges	4.1.5, 4.2, 4. 7, 4.8
2.4.3	Types of wastes and plans for their disposal (e.g., landfill, licenced waste management facility, marine waters, or tailings containment facility).	4.7
2.5	Construction, operation, decommissioning and abandonment phases and scheduling.	5.0
2.5.1	Anticipated scheduling, duration and staging of key project phases, including preparation of the site, construction, operation, decommissioning and abandonment.	5.5, Table 5-1

Reference to Guidance Document(s)	Prescribed Information	Project Description Section(s)
2.5.2	Main activities in each phase of the designated project that are expected to be required to carry out the proposed development (e.g., activities during site preparation or construction might include, but are not limited to, land clearing, excavating, grading, de-watering, directional drilling, dredging and disposal of dredged sediments, infilling, and installing structures).	5.1, 5.2, 5.3
3.0 Project Location		
3.1	Provide a description of the designated project's location including:	3.0, Figure 1, 2, 3
3.1.1	Coordinates (i.e., longitude/latitude using international standard representation in degrees, minutes, seconds) for the centre of the facility or, for a linear project, provide the beginning and end points.	3.2
3.1.2	Site map/plan(s) depicting location of the designated project components and activities. The map/plan(s) should be at an appropriate scale to help determine the relative size of the proposed components and activities.	Figures 2, 3, 5, 6
3.1.3	Map(s) at an appropriate scale showing the location of the designated project components and activities relative to existing features, including but not limited to: • watercourses and waterbodies with names where they are known; • linear and other transportation components (e.g., airports, ports, railways, roads, electrical power transmission lines and pipelines); • other features of existing or past land use (e.g., archaeological sites, commercial development, houses, industrial facilities, residential areas and any waterborne structures); • location of Aboriginal groups, settlement land (under a land claim agreement) and, if available, traditional territory; • federal lands including, but not limited to National parks, National historic sites, and reserve lands; • nearby communities; • permanent, seasonal or temporary residences; • fisheries and fishing areas (i.e., Aboriginal, commercial and recreational); • environmentally sensitive areas (e.g., wetlands, and protected areas, including migratory bird sanctuary reserves, marine protected areas, National Wildlife areas, and priority ecosystems as defined by Environment Canada); and • provincial and international boundaries.	Figures 1, 3, 4, 5, 7, 8, 9, 10, 11, 12.
3.1.4	Photographs of work locations to the extent possible.	Figure 3; Photograph 1 -7
3.1.5	Proximity of the designated project to: • any permanent, seasonal or temporary residences; • traditional territories, settlement land (under a land claim agreement) as well as lands and resources currently used for traditional purposes by Aboriginal peoples; and • any federal lands.	6.1, 6.2, Figure 7

Reference to Guidance Document(s)	Prescribed Information	Project Description Section(s)
3.2	Land and Water Use	6.3
3.2.1	Zoning designations.	6.3
3.2.2	Legal description of land to be used (including information on sub-surface rights) for the designated project, including the title, deed or document and any authorization relating to a water lot.	3.0, 6.3
3.2.3	Any applicable land use, water use (including ground water), resource management or conservation plans applicable to or near the project site. Include information on whether such plans were subject to public consultation.	6.3 and 7.1
3.2.4	Describe whether the designated project is going to require access to, use or occupation of, or the exploration, development and production of lands and resources currently used for traditional purposes by Aboriginal peoples.	6.4
4.0 Federal Involvement – Financial Support, Lands and Legislative Requirements		
4.1	Describe if there is any proposed or anticipated federal financial support that federal authorities are, or may be, providing to support the carrying out of the designated project.	3.3
4.2	Describe any federal lands that may be used for the purpose of carrying out the designated project. This is to include any information on any granting of interest in federal land (i.e., easement, right of way, or transfer of ownership).	6.3, 11.0
4.3	Provide a list of any federal permits, licences or other authorizations that may be required to carry out of the project.	10.1, 10.2
5.0 Environmental Effects		
5.1	A description of the physical and biological setting, including the physical and biological components in the area that may be adversely affected by the project (e.g., air, fish, terrain, vegetation, water, wildlife, including migratory birds, and known habitat use).	7.1, 7.2, 7.3, 11.0
5.2	A description of any changes that may be caused as a result of carrying out the designated project to: (a) fish and fish habitat, as defined in the *Fisheries Act*; (b) marine plants, as defined in the *Fisheries Act* ; and (c) migratory birds, as defined in the *Migratory Birds Convention Act*, 1994.	7.2, 7.3, 11.0
5.3	A description of any changes to the environment that may occur, as a result of carrying out the designated project, on federal lands, in a province other than the province in which the project is proposed to be carried out, or outside of Canada.	7.1.3, 11.0
5.4	A description of the effects on Aboriginal peoples of any changes to the environment that may be caused as a result of carrying out the designated project, including effects on health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.	6.1, 6.4, 6.5, 11.0

Reference to Guidance Document(s)	Prescribed Information	Project Description Section(s)
6.0 Proponent Engagement and Consultation with First Nations and Aboriginal Groups		
6.1	A list of First Nations and Aboriginal groups that may be interested in, or potentially affected by, the designated project.	6.1, 8.1, Figure 7
6.2	A description of the engagement or consultation activities carried out to date with First Nations and Aboriginal groups, including: • names of First Nations and Aboriginal groups engaged or consulted to date with regard to the designated project; • date(s) each First Nations and Aboriginal group was engaged or consulted; and • means of engagement or consultation (e.g., community meetings, mail or telephone).	8.3
6.3	An overview of key comments and concerns expressed by First Nations and Aboriginal groups identified or engaged to date, including any responses provided to these groups.	8.4
6.4	A consultation and information gathering plan that outlines the ongoing and proposed Aboriginal engagement or consultation activities, the general schedule for these activities and the type of information to be exchanged and collected (or, alternatively, an indication of why such engagement or consultation is not required).	8.1, 8.2
-	The proponent is encouraged to provide background information on First Nations and Aboriginal groups' potential or established Aboriginal or treaty rights. The proponent is also encouraged to provide information on the impact area of the designated project and how it overlaps with uses by First Nations and Aboriginal groups that have potential or established Aboriginal or treaty rights.	6.1, Figure 7
7.0 Consultation with the Public and Other Parties (other than Aboriginal consultation included above)		
7.1	An overview of key comments and concerns expressed to date by stakeholders and any responses that have been provided.	8.5.4
7.2	An overview of any ongoing or proposed stakeholder consultation activities.	8.5, 8.6
7.3	A description of any consultations that have occurred with other jurisdictions that have environmental assessment or regulatory decisions to make with respect to the project.	8.6
8.0 Summary of the Project Description		
-	Proponents are to include as part of the project description a standalone section that summarizes the information identified in Sections 1 to 7 of this Guide. Under CEAA 2012, the Agency is required to consult the public on a summary of the project description that has to be posted on the Agency's Internet site in both of Canada's official languages as required under the *Official Languages Act*. As a result, in order to be in a position to initiate the screening phase in a timely manner, the summary is to be prepared and submitted to the Agency in both English and French.	Stand-alone Document

CONTRIBUTING AUTHORS

Below is a list of qualified professionals who contributed to the development of this Project Description.

Contributors	Credentials	Brief Summary
Jacques Benoit	M.Sc. Atmospheric and Ocean Science Qualified Environmental Professional Certified Environmental Professional	Jacques Benoit has over 35 years experience in the environmental business in Canada and internationally and has authored over 40 technical papers on various environmental subjects. He has extensive experience in the oil and gas industry and in particular in site assessment / due diligence, contaminated site remediation, Environmental Management Systems, waste management and environmental impact assessments. Jacques has considerable experience in the management of environmental issues related to both the onshore and offshore oil and gas industry.
Eileen Miranda	B.Sc., Biology B.A., Sociology Registered Professional Biologist (R.P.Bio)	Eileen Miranda is an Environmental Assessment (EA) leader with expertise in the planning and execution of environmental impact assessment for projects subject to *Canadian Environmental Assessment Act* (CEAA) and BC *Environmental Assessment Act* (BCEAA). Eileen has over 10 years of experience in managing EAs of several small to large capital projects and technical programs for clients in the sectors of transportation infrastructure and energy.
Syamal Sen	B. Tech., Chemical Engineering B.Sc. (Hons.), Chemistry Professional Engineer (P.Eng.)	Syamal Sen has more than 30 years of experience in refineries/upgraders, petrochemicals, oil and gas-condensate gathering system/processing facilities, pipelines, and gas treatment facilities with associated auxiliaries/utilities; both in Engineering, Procurement and Construction and owner's organizations worldwide.
Brian Yates	Master of Public Administration (Policy) B.Sc., Biology R.P.Bio.	Brian Yates has more than 24 years of experience in leading large-scale EA, regulatory strategy, stakeholder consultation initiatives, and integrated planning efforts throughout British Columbia, across Canada, and internationally for a range of ports, energy, mining, and linear infrastructure clients.
Sarah McLaughlin	B.Sc., Environmental Sciences Biologist-in-Training (B.I.T.)	Sarah McLaughlin is a BIT with over two years of experience providing key support in the planning and coordination of large-scale EA projects. She has assisted in writing EA reports, management and technical workplans. Sarah has been involved in a full range of projects, allowing her to build on her knowledge of federal and provincial environmental regulations, as well as experience in environmental baseline data collection.
Katherine Taylor	B.Sc., Environmental Science Diploma in Integrated Environmental Planning Technology	Katherine Taylor has five years of experience in construction environmental management planning and monitoring, site assessment and reclamation, impact assessment and community engagement. She has participated and assisted in the planning of construction environmental monitoring and inspection for rapid transit, hydroelectric, and other infrastructure types of projects.

Contributors	Credentials	Brief Summary
Shadan Sanii	Masters of Geographic Information Systems B.Sc., Geomatics Engineering	Shadan Sanii has more than eight years of experience providing Geomatics and Geographic Information System (GIS) support for various projects in multidisciplinary consulting environments. She has excellent knowledge of cartography and geodatabase design, as well as technical knowledge of remote sensing, image processing, LiDAR, photogrammetry, global positioning system (GPS) and conventional land surveying.
Sara Jossul	B.Sc., Marine Biology B.I.T.	Sara Jossul has over 12 years of local and international experience in the field of marine biology, including temperate, tropical, and sub-tropical marine environments. She is trained in visual and passive acoustic marine monitoring and has extensive field experience with a variety of marine organisms. Sara also supports technical programs of EA in the area of fisheries and aquatics
Bryan McEwen	M.Sc., Atmospheric Science B.C. Teaching Certificate Dip. Meteorology B.Sc., Physics	Bryan McEwen is an Air Quality Meteorologist with specific experience in emissions modelling (including development of data management systems and assessment protocols), meteorological modelling (RAMS, MM5, WRF), dispersion modeling and technical / peer review. Bryan has managed and led air quality assessment, development of air contaminant and Greenhouse Gas assessment protocols, development of emission inventory models, development of communications and educational materials, meteorological and dispersion modelling, meteorological and air quality monitoring.
Lorraine Andrusiak	M.Sc. Ecology B.Sc., Biological Sciences R.P.Bio.	Lorraine Andrusiak has over 20 years of experience in assessing the effects of development on wildlife. Over her career she has worked on projects in the hydroelectric, transportation, mining and forestry sectors. She is RISC-certified for Terrestrial Ecosystem Mapping and has participated in mapping projects in the Cariboo, Thompson, Peace and Mid-Coast regions of British Columbia. She is familiar with the habitat needs of British Columbia wildlife and has a good knowledge of native plant species and terrestrial ecosystems. Ms. Andrusiak is skilled at data analysis, presentation and reporting, and has an excellent knowledge of information sources for wildlife and wildlife habitats.
Jason Casselman	M.Sc., Marine Biology B.Sc., Marine Biology R.P.Bio.	Jason Casselman is a fisheries biologist with nine years of experience working in BC and Alberta. He has been involved in numerous projects based around mining, hydroelectric, forestry, transmission lines, oil and gas, and transportation. He has led and supported fisheries components of environmental assessments and has acted as technical lead or support on large scale and complex projects in freshwater. Jason's experience includes the development and implementation of environmental management plans for both small and large scale construction projects.

Contributors	Credentials	Brief Summary
Andrea Paetow	Diploma in Environmental Sciences B.Sc., Process Engineering, Specialization Environmental Engineering R.P.Bio.	Andrea Paetow is a biologist with over 14 years of experience in terrestrial baseline studies and environmental impact assessments to CEAA, BCEAA and International Finance Corporation standards both in BC and internationally. Her areas of expertise include vegetation bio-inventories, species-specific surveys and habitat assessments for the mining, oil and gas, hydro, linear infrastructure, and other land development sectors in northern, temperate and tropical environments.
Eric Hertzman	Graduate Diploma in Urban Studies B.A., Urban Economic, Social Geography and Geographic Information Systems	Eric Hertzman has over 11 years of experience in GIS, on over 400 projects, including phase I, II, and III Environmental Site Assessments, trade area analysis, socio economic profiling, geodemographic, graphic design, cartography, environmental assessments, and much more. Eric Hertzman has extensive experience working with clients on both mapping and graphic related projects
Lyndon Hanson	B.Sc., Geology Professional Geologist (P.Geo.)	Lyndon Hanson has over 30 years of experience in environmental management, investigation and remediation for organic and inorganic contaminants in soil, sediments and groundwater at large industrial sites and petroleum retail, distribution and refining facilities. He managed the environmental assessment and remedial planning for two decommissioned oil refinery sites and a former coal gasification plant site in BC. Lyndon is a founding member of the BC Oil and Gas Association, a former Director of the Canadian Environmental Industry Association (BC Chapter) and a former member of the BC Contaminated Sites Roster of Professional Experts.
Rashaad Sader	M.Sc., Mechanical Engineering B.Sc., Mechanical Engineering	Rashaad Sader is a Project Manager with significant experience in facility engineering, procurement, and construction as well as strategic development. He has over 15 years of experience managing and leading engineering teams on small, medium, and mega projects

1 INTRODUCTION

1.1 Project Overview

The Pacific Future Energy Refinery Project (the 'Project' or 'Refinery') is a proposal to build and operate a bitumen oil refinery in northwest British Columbia (BC) between the City of Terrace and the District Municipality of Kitimat within an industrial-zoned site locally known as Dubose Flats (**Figure 1**). Pacific Future Energy Corporation (PFEC) is proposing to power the Project with clean energy[1], with the goal to open markets for Canadian bitumen through the creation of refined products.

The Refinery will have an input capacity of 200,000 barrels per day (BPD) or 31,795 cubic metres per day (m^3/d) of bitumen called NEATBIT™. NEATBIT™ (neat bitumen) is a term used to refer to bitumen that has a very low amount of diluent (less than 2%) compared to dilbit (diluted bitumen) which has 30% diluent. NEATBIT™ is a near-solid that has the consistency of peanut butter and does not flow unless heated (it must be heated to 81°C in order for it to flow easily). There is no sand in NEATBIT™. Since it has a very small amount of diluent – unlike other forms of oil transported by rail or pipeline – it has very low flammability. As a result, it is exempt from Transport Canada's *Transportation of Dangerous Goods Regulations* (Part 1, 1.33) and can be transported safely by rail car.[2]

The Project will refine NEATBIT™ into products such as EURO V[3] grade diesel and gasoline. Jet A-1 kerosene, liquefied petroleum gas (LPG) and butane will also be produced, in addition to sulphur and treated water as the main by-products.

Additional components of the Refinery will include:

- A new rail yard and associated buildings;
- An industrial railroad connection to connect the Refinery rail yard to the existing Canadian National (CN) rail line;
- On site storage for feedstock and refined products;
- Ancillary facilities for the Refinery such as control rooms, administration and maintenance buildings;

1 'Clean energy' as defined by the BC Clean Energy Act and the Clean or Renewable Resources Regulation. http://www.empr.gov.bc.ca/EAED/AEPB/Documents/CleanEnergyJune.pdf

2 Transport Canada rail safety legislation will still apply.

3 EURO V refers to light passenger vehicles and heavy-duty vehicle diesel and gasoline emissions standards regulated by the European Union. Diesel with a EURO V rating has strict emission limits for air pollutants such as carbon monoxide, nitrogen oxides, particulate matter and sulphur.

- Tie-in to an existing natural gas pipeline (possible options include an existing gas line located parallel to Highway 37 or a proposed third-party pipeline that overlaps the Refinery area);
- Electrical power infrastructure capable of producing 300 megawatts (MW) of clean energy during operations;
- Other plant utility infrastructure such as separate facilities for the intake and treatment of raw water, and treatment of wastewater;
- Potential surface water intake structure on the Kitimat River;
- A six inch water pipeline from the Refinery to Kitimat for the purpose of discharging treated water (approximately 100 m^3/hr) to Douglas Channel;
- Workforce housing accommodations for the construction phase;
- Upgraded road access to the Refinery from Highway 37; and
- A new module access road to the Refinery, approximately 40 kilometres (km) in length, with two clear-span crossings for the heavy-haul transportation of Refinery modules from an existing marine dock (former Eurocan dock) in Kitimat. The road will be used primarily during the construction phase; however, may continue to be used during operation subject to input from First Nations and the public.

A conceptual layout of the Refinery and rail yard is bounded within an estimated 1,000 hectares (ha) extent of land at Dubose Flats as shown in **Figure 2**.

The Project is in the early stage of engineering design. As design advances, it is expected that the location, size and footprint of the Project components listed above will be refined to take into consideration technical and social perspectives including: engineering and safety requirements; the results of the environmental impact assessment (EIA) and input received through engagement with the First Nations government and communities; other government agencies; and the general public.

This document provides a general project description for the Canadian Environmental Assessment Agency (the Agency) and the BC Environmental Assessment Office (EAO) to make a determination regarding the need for an environmental assessment (EA) of the Project in accordance with the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) and Section 10 of the BC *Environmental Assessment Act* (BCEAA). First Nations government, other government agencies and stakeholders may use this document to review the nature and extent of the Project to determine their interest and initiate discussion on the scope of the EA.

Legend

- Project Location
- Nearby Municipality
- Highway
- Road
- Ferry

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community, ©2016

0 12.5 25 50 75 Km

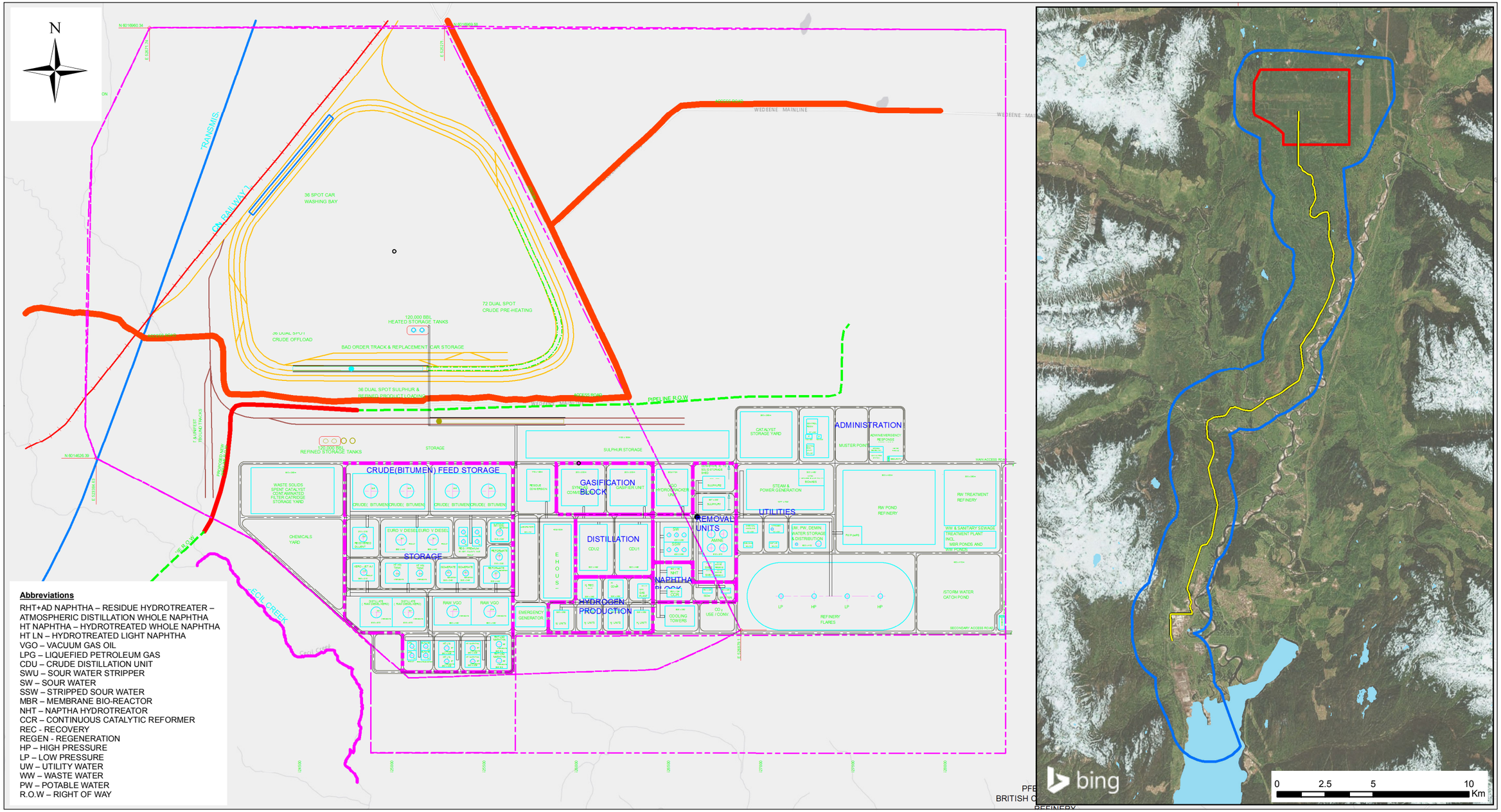
PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

SNC·LAVALIN

Pacific Future Energy Refinery
Project Location

By: ECH	Date: 2016/05/09	Scale: 1:1,750,000	Figure Number: 1	Rev.: 1
Chk'd: EM	Coord. Sys.: NAD 1983 UTM Zone 9N		Reference No.: 631180-101-001	

MXD Path: \\sll2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-001_Project_Location.mxd



Abbreviations

RHT+AD NAPHTHA – RESIDUE HYDROTREATER – ATMOSPHERIC DISTILLATION WHOLE NAPHTHA
HT NAPHTHA – HYDROTREATED WHOLE NAPHTHA
HT LN – HYDROTREATED LIGHT NAPHTHA
VGO – VACUUM GAS OIL
LPG – LIQUEFIED PETROLEUM GAS
CDU – CRUDE DISTILLATION UNIT
SWU – SOUR WATER STRIPPER
SW – SOUR WATER
SSW – STRIPPED SOUR WATER
MBR – MEMBRANE BIO-REACTOR
NHT – NAPTHA HYDROTREATOR
CCR – CONTINUOUS CATALYTIC REFORMER
REC - RECOVERY
REGEN - REGENERATION
HP – HIGH PRESSURE
LP – LOW PRESSURE
UW – UTILITY WATER
WW – WASTE WATER
PW – POTABLE WATER
R.O.W – RIGHT OF WAY

Legend

- Refinery Boundary
- Main Road
- Secondary Access Road'
- Existing CN Rail Line
- Manifest & Unifest Rail
- Unit Train Rail Tracks
- Existing Access Road
- Cecil Creek
- Pipeline Right of Way
- Proposed BC Hydro Power Trasmission Line
- Proposed New Pipeline Right of Way
- Refinery Infrastructure
- Project Area
- Refinery Location
- Potential Module Access Road
- Water Bodies

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.
4. Some smaller magnitude geohazards may exist that were too small to map.

References:
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
PFEC-0000-46DK-0001-Rev-PC.dwg

PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

SNC·LAVALIN

Pacific Future Energy Refinery
Refinery and Rail Yard Layout

By:	ECH	Date: 2016/06/15	Scale: As-Shown	Figure Number: 2	Rev: 2
Chk'd:	EM	Coord. Sys:	NAD 1983 UTM Zone 9N	Reference No.: 631180-101-013	

MXD Path: \\Sli2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\6331180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-0013-R2-Overall_Plot_Plan.mxd

1.2 Project Purpose and Rationale

The purpose of this Project is to establish key world-leading infrastructure necessary for opening world markets to Canadian oil and gas products by working closely with local First Nations. PFEC will build a state-of-the-art bitumen oil Refinery, powered by clean energy, in northwest BC, for the purpose of processing Canadian near-solid NEATBIT™ into fully refined products such as diesel, gasoline and jet fuel. This Refinery will lead the world in minimizing carbon emissions from the refining process.

Gaining market access is an important objective for Canada's national energy strategy. Canada's oil industry essentially relies on one customer: the United States, where most of Canada's oil is refined today. No new refineries have been commissioned in Canada since 1984, and with the United States' dependence on Canadian oil decreasing, our Project will create new opportunities for NEATBIT™ producers to access world markets, especially in Asia, the only market in the world with projected growth. We will also be opening up domestic markets for our products, offering the highest quality gasoline and diesel, anticipating future emissions requirements.

By using near-solid NEATBIT™, a feedstock with low flammability – transported by train – the potential for spills onto land and into water is substantially reduced.

By providing purchasers with refined products, as opposed to crude oil, the environmental harm to the Canada's northwest coast on the Pacific Ocean in the event of an accidental spill during shipping are also substantially reduced because refined liquid petroleum products return to a gaseous state at ambient temperatures.

By building the world's greenest bitumen refinery, PFEC recognizes that climate change is a fact and is dedicated to assisting governments with their obligation, committed in Paris in 2015 at the Conference of Parties 21 (COP21) summit, to limit global warming by 1.5°C. We recognize that a carbon-free economy is desirable and an achievable objective as a society, within one or two generations. In the interim, the prosperity of all British Columbians is dependent upon developing a cleaner, greener, natural resource sector.

We believe that BC can lead this transition to a carbon-free future by developing world leading intermediate technology solutions, such as our Near Zero Net Carbon (NZNC) emissions project design (**Section 4.1.3**) to reduce the well-to-wheel emissions from Western Canada-sourced heavy oil. We believe our Project will become a benchmark refining standard globally as governments attempt to transition our economies to a carbon-free future and make good on their promises at COP21.

By building this Refinery in northwest BC, there will be economic benefits including construction jobs, permanent jobs at the Refinery, and associated economic activity that comes along with the establishment of such infrastructure.

Economic benefits will also be realized in Northern BC through the use of biomass, a renewable resource that is used to generate clean energy, from the local forest industry.

PFEC believes that "social licence" or "permission" must be gained at the concept stage of any project, and earned throughout its lifecycle. This Project will be built in a manner that respects First Nations rights, title and treaty rights. PFEC recognizes First Nations as a first order of government in BC. We will fulfill the stated economic, social and environmental goals of all levels of government and we will fully comply with and/or exceed all of their regulatory requirements.

Some important features of this Project are:

- Use of best available technology to process Canadian resources;
- Optimized water management plan with maximum water recycling, on site water collection and water treatment;
- Inclusion of Traditional Ecological Knowledge (TEK) of local Indigenous experts;
- Production of high quality Euro V-grade Diesel and Gasoline;
- High sulphur recovery efficiency (>99.8%);
- Selection of technologies to minimize pollutants emission;
- Leading the industry in achieving NZNC emissions from an oil sands NEATBIT™ Refinery with the following approaches:
  - Maximize energy efficiency through design;
  - Efficient refinery operation;
  - Utilization of state-of-the-art technology for high conversion (>90%) of heavy residue to liquid fuel to eliminate coke[4] as a by-product of the Refinery;
  - Use of biomass to generate clean energy while providing a wood waste disposal solution for local forest harvesters and milling operations;
  - Use of other sources of clean energy such as hydro and natural gas to power the Refinery;
  - Capture ready carbon from various processes including hydrogen production; and
  - Carbon offset.

[4] A carbon based solid that forms during the cracking of vacuum residue fractions.

2 PROPONENT INFORMATION

2.1 Proponent

Vancouver-based **PFEC** is a company formed in 2014 to finance, design, construct and operate the Project. The management team consists of leaders from the venture-capital, corporate, engineering, First Nations and government sectors, who share the belief that while it is in Canada's national strategic interest to diversify its markets for oil, it should be done in a socially and environmentally responsible manner while ensuring the protection of Canada's West Coast. PFEC's Executive Committee includes:

Samer F. Salameh, Executive Chairman and Chief Executive Officer

Mark Marissen, Chief Strategy & Communications Officer

Jacques Benoit, Chief Operating Officer

Mike Bonshor, Chief Negotiator

David Coles, Vice President Partnerships & Sustainability

Robert Delamar, Senior Advisor

Shawn Atleo, Senior Advisor

Heather Squire, Senior Advisor

Stockwell Day, Senior Advisor

2.2 Project Contact

Communications on behalf of PFEC regarding the proposed Project should be directed to:

Jacques Benoit
Chief Operating Officer
Pacific Future Energy Corporation
701 W Georgia Street, Suite 1818
Vancouver, BC V7Y 1L2

Telephone: (604) 559-3611
Fax: (604) 336-1557
Email: info@pacificfutureenergy.com

The company website is http://www.pacificfutureenergy.com/

3 PROJECT INFORMATION

PFEC is proposing to develop a new bitumen refinery with an input capacity of 200,000 BPD or 31,795 m^3/d of NEATBIT™. The Refinery, proposed to be located on 1,000 ha of provincial Crown Land, will refine NEATBIT™ into products such as EURO V grade diesel and gasoline. Jet A-1 kerosene, LPG and butane will also be produced, in addition to sulphur and treated water as the main by-products. In December 2015, PFEC submitted an application to the province for Licence of Occupation (LOO) and Temporary Use Permit (TUP) to undertake investigative studies (i.e., geotechnical, hydrogeological and airshed) at the Refinery, and will begin the tenure application process in fall 2016.

The main components of the Project will include:

- A new bitumen oil refinery constructed from about 100 to 150 modules that will be manufactured and shipped via heavy-lift vessels or barges from Asia;
- A new module access road to be used primarily during the construction phase for the heavy-haul transportation of Refinery modules from an existing marine dock (former Eurocan dock) in Kitimat. The road may continue to be used during operation subject to input from First Nations and the public. The road will be approximately 50 m wide and 40 km in length, with a clear-span crossing on the Wedeene River and Little Wedeene River;
- A new rail yard and associated buildings. The rail yard will have seven yard tracks with a total length of 20.9 km. The Project will utilize the existing CN rail line to receive NEATBIT™ on dedicated unit trains. Three to four unit trains per day (120 rail cars per unit train) are anticipated;
- An industrial railroad connection to connect the Refinery rail yard to the existing CN rail line;
- On site storage for feedstock and refined products with a total storage capacity of greater than 500,000 m^3. The combined capability of storage would yield combustion greater than 3 Petajoule (PJ)[5] of energy;
- Ancillary facilities for the Refinery such as control rooms, administration and maintenance buildings;
- Upgraded road access to the Refinery from Highway 37;
- Tie-in to an existing natural gas pipeline (possible options include an existing gas line located parallel to Highway 37 or a proposed third-party pipeline that overlaps the Refinery area);
- Electrical power infrastructure capable of producing 300 MW of clean energy during operations. The Refinery will self-generate the majority of power requirements through the

[5] A unit of energy. One Petajoule is equal to 10^{15} Joules.

refining process; however, PFEC is assessing the feasibility of a cogeneration facility using wood-waste biomass and geothermal as an efficient and environmentally beneficial means of providing a portion of the Project's electrical power needs. Other clean-energy options will be considered through independent power producer(s) or a point of interconnection to the BC Hydro transmission system;

- Other plant utility infrastructures such as facilities for the intake and treatment of raw source water and treatment of wastewater. The Project will require approximately 48,000 m^3/d of raw source water for refining processes. PFEC is considering groundwater as the preferred source; however, surface water from the Kitimat River is also an option. Where possible, PFEC will recycle water through the refining process to reduce the amount of daily intake required;
- Potential surface water intake structure on the Kitimat River;
- A 6" water pipeline from the Refinery to Kitimat for the purpose of discharging treated water (approximately 100 m^3/hr) to Douglas Channel; and
- Workforce housing accommodations for the construction phase. PFEC is assessing the feasibility of new accommodations on site, as well as the use of existing accommodations in Terrace or Kitimat.

The Project and its components are not a part of an expansion. At this early stage of development, the Project or its components are not a part of a larger project that is not listed in the CEAA 2012 *Regulations for Designating Physical Activities* (RDPA).

The main components of the Project are described in more detail in **Section 4**.

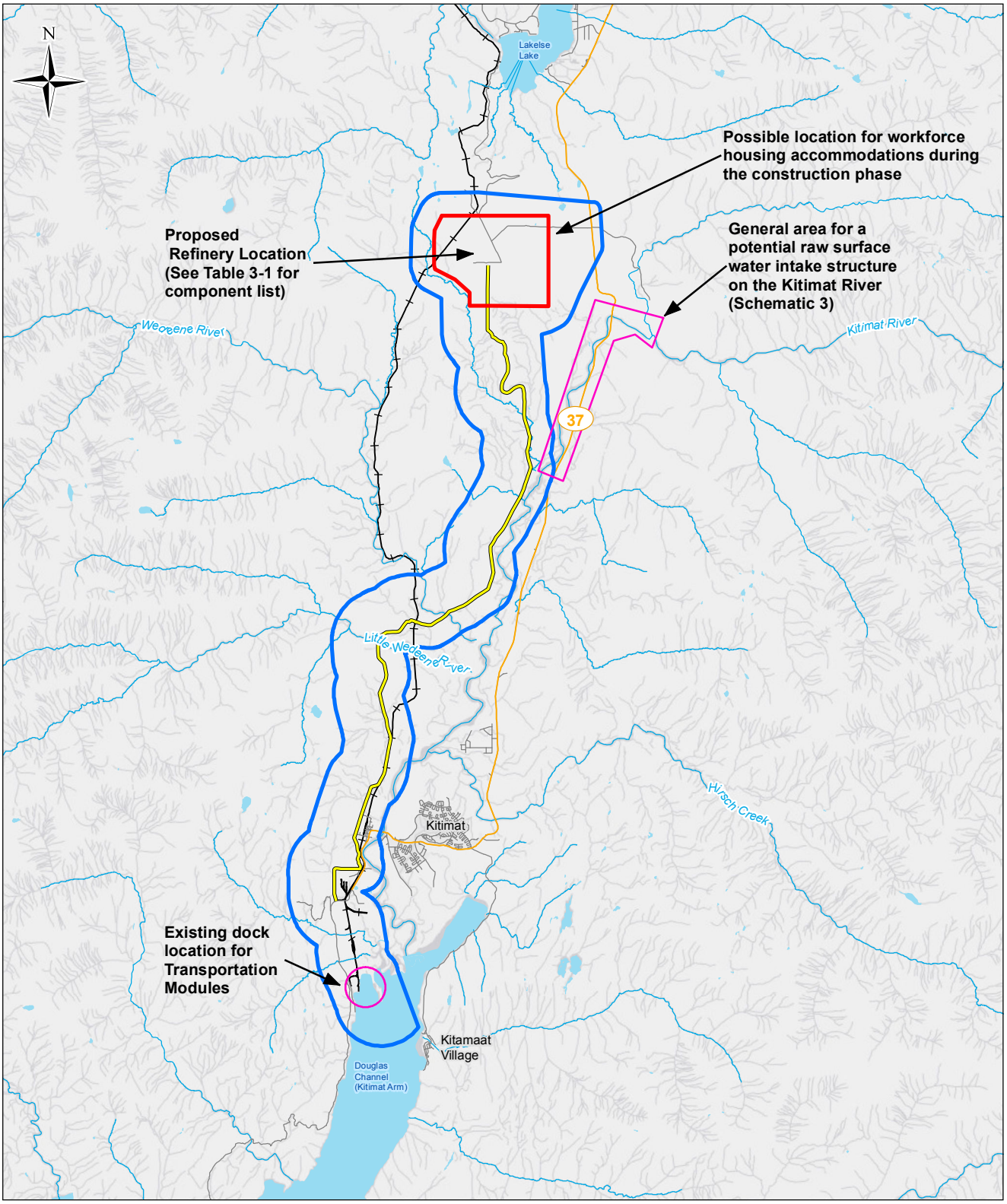
3.1 Project Area

The Project area extends from Dubose Flats to Kitimat, as shown in **Figure 3**. The areal extent of the Project area is 15,714 ha, and encompasses the footprint of the Refinery, associated components, existing marine dock (former Eurocan dock) for receipt of Refinery modules during construction, and the access road. The Project area is intentionally large to accommodate design flexibility in the Project footprint.

The Refinery footprint, estimated at 1,000 ha, includes the Refinery, rail yard, utilities and ancillary facilities. The potential access road will have an estimated 200 ha footprint (40 km long with a 50 m right-of-way).

A river water intake structure may need to be constructed on the Kitimat River. The general area for assessment is shown in **Figure 3**.

PFEC will incorporate engineering requirements, advice and guidance from local First Nations, other government agencies, the general public and EA studies in planning the footprint and configuration of the Project's components.



Legend

- Refinery Location
- Project Area
- Potential Module Access Road
- Highways
- Other Roads
- Rail Tracks
- Watercourses
- Water Bodies

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
©2016

0 2.5 5 10 Km

PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

SNC·LAVALIN

Pacific Future Energy Refinery Project Area

By: ECH	Date: 2016/06/16	Scale: 1:250,000	Figure Number: 3	Rev.: 2
Chk'd: SM	Coord. Sys.: NAD 1983 UTM Zone 9N		Reference No.: 631180-101-002	

MXD Path: \\Sll2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-002-R2_Project_Area.mxd

3.2 Project Location and Access

The Project and its components are wholly located in BC within the Regional District of Kitimat-Stikine (RDKS), Kalum Forest District, and Kalum Land and Resource Management Plan (LRMP) area, approximately 30 km south of the communities of Terrace and 32 km north of Kitimat, BC (**Figure 1**).

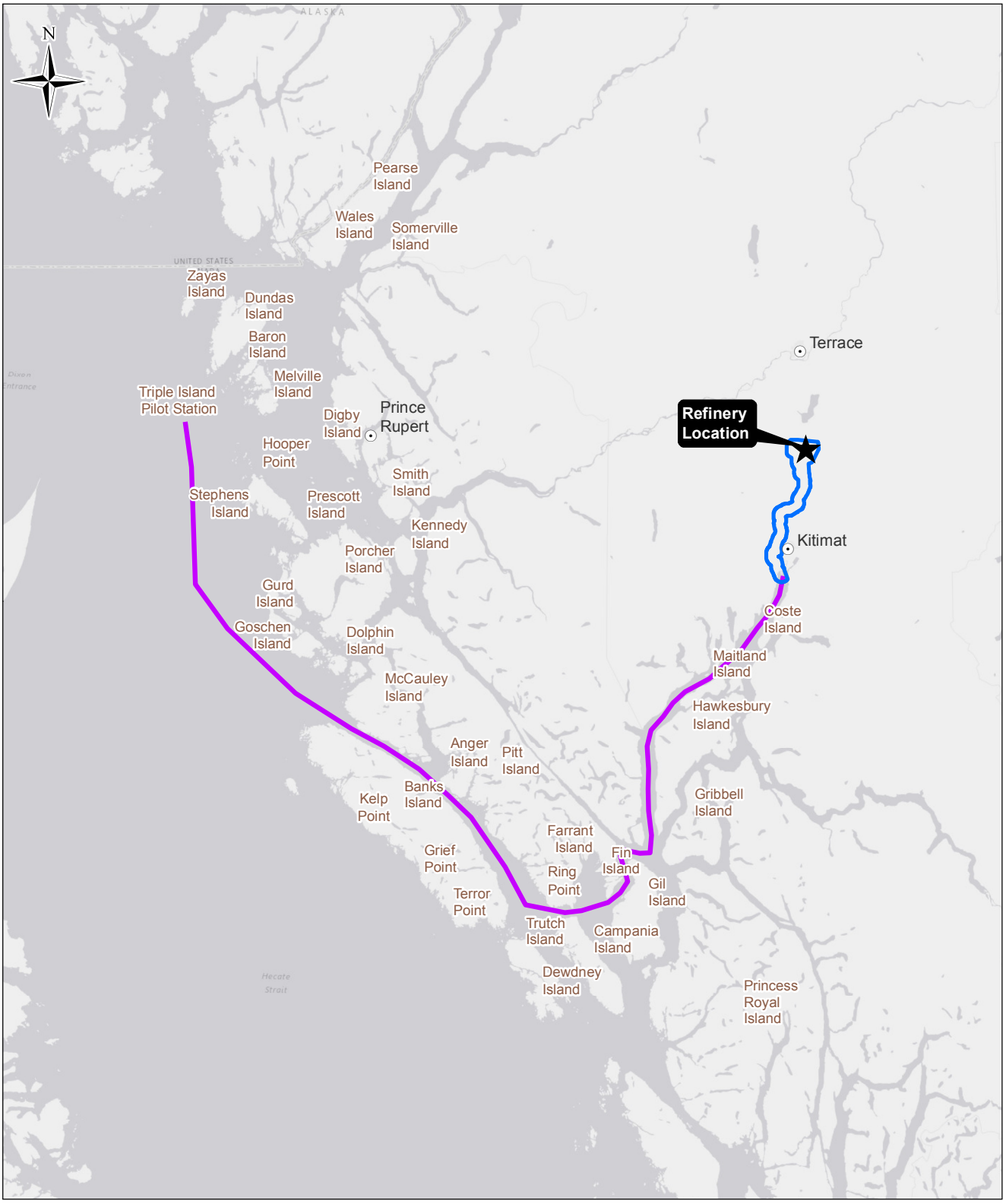
The centre coordinates of the Refinery are:

Universal Transverse Mercator (UTM):	NAD 83 9U 524897.2 m E 6015176.3 m N
Longitude and Latitude:	128°37'3.25" W 54°17'2.027" N

The Refinery will be accessed via the Wedeene Mainline and Highway 37 (Terrace-Kitimat Highway). CN Rail operates a branchline between Terrace and Kitimat, which overlaps the Refinery footprint (**Figure 2**). The branchline carries only freight trains. The nearest airport is the Terrace-Kitimat Regional Airport and is 20 km north on Highway 37. Vancouver is approximately 700 km to the south by air and 1,367 km via Highways 16, 97 and the TransCanada Highway. Prince George is 575 km to the east and Prince Rupert is 153 km to the west on Highway 16.[6]

The shortest marine access route is from the Triple Island Pilotage Station through Principe Sound and Douglas Channel to Kitimat Arm as shown in **Figure 4**. The marine access route is to serve the transport of Refinery modules from Asia to Kitimat during the construction phase.

6 http://www.Terrace.ca/visitors/about_Terrace



Legend

- Refinery Location
- Nearby Municipality
- Project Area
- Proposed Marine Route

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

0 15 30 60 Km

PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

SNC·LAVALIN

Pacific Future Energy Refinery Proposed Marine Access Route for the Refinery Modules

By: ECH	Date: 2016/05/09	Scale: 1:1,500,000	Figure Number: 4	Rev.: 1
Chk'd: SM	Coord. Sys.: NAD 1983 UTM Zone 9N		Reference No.: 631180-101-011	

MXD Path: \\Sll2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-011_MarineAccess.mxd

3.3 Capital Cost Estimate

Given that this Project is in the early conceptual stage, there is some uncertainty with the capital cost. However, as currently conceived, the Project is estimated to be between $12 to $14 billion Canadian dollars ($9 and $11 billion US dollars). No federal or provincial financial support is expected or proposed for the Project. The projected annual operating cost of the Project is $500 million.

3.4 Employment Estimate

The Project will require an estimated workforce of approximately 4,500 people throughout construction and operation. The construction workforce would consist of approximately 3,500 positions (12,000 person years) over a two-year period, while the operation of the Project would consist of 1,000 full-time positions. There will be an equality hiring program with a priority for the local population in Terrace, Kitimat and surrounding communities, including First Nations and equity-seeking groups.

4 PROJECT COMPONENTS

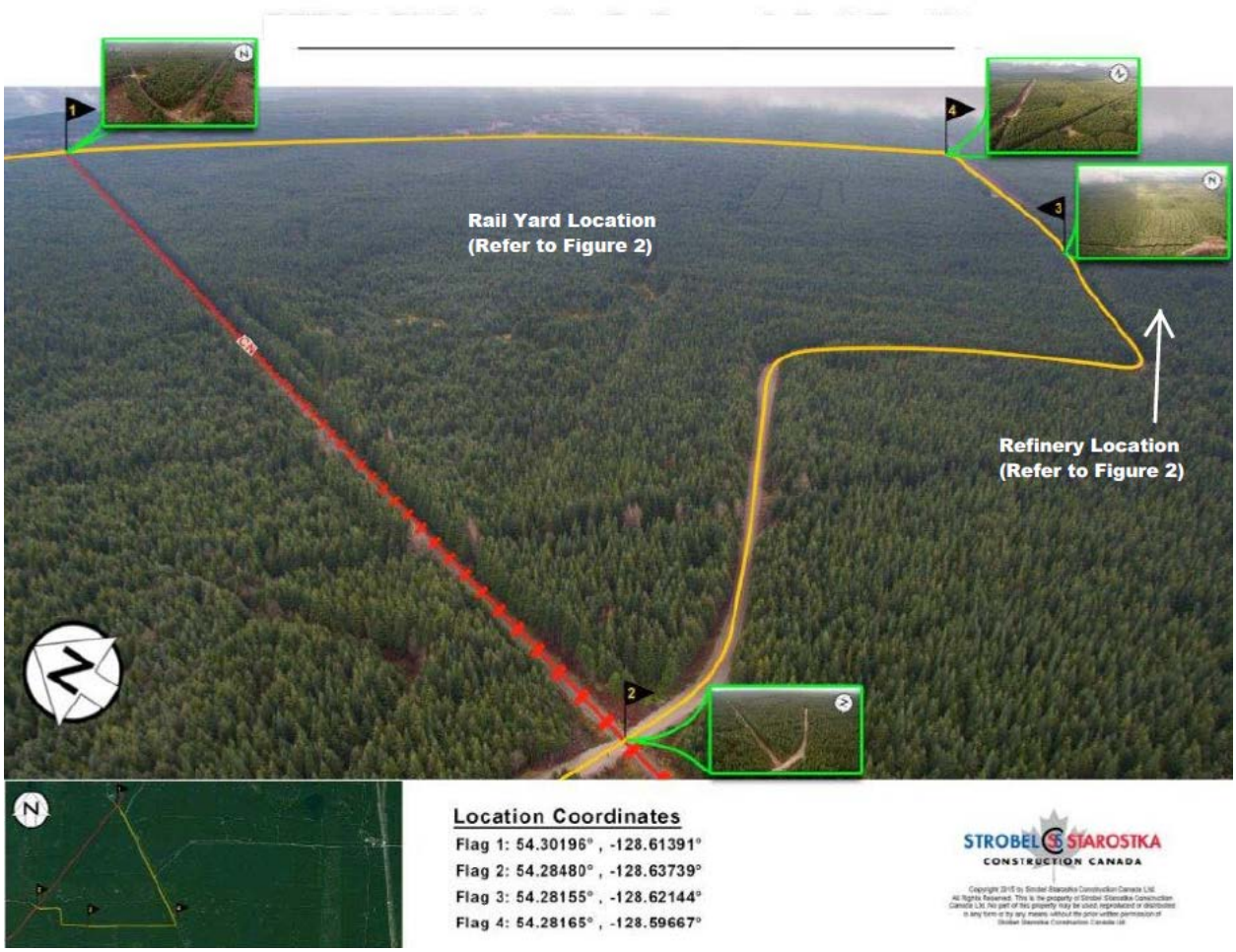
Key components of the Project are listed in **Table 4-1** and discussed in more detail below. A layout of the Refinery and rail yard are shown in **Figure 2**. Photograph 1 and 2 provide an aerial view of the location for the proposed Refinery and rail yard.

Table 4-1 Physical Components of the Project

Project	Components
Refinery Infrastructure (1,000 ha)	• Refer to Figures 2, 3, 5, 6; • Bitumen oil refinery built from 100 to 150 pre-fabricated modules, each weighing between 2,500 and 5,000 metric tonnes (MT) (**Figure 5**); • Rail yard(unloading and loading) with seven tracks, capable of receiving up to four unit trains per day (120 rail cars each) (**Figure 6**); • Upgraded road access to the site from Highway 37; • Tie-in to an existing natural gas pipeline; • On site storage for feedstock and refined products with a total capacity of greater than 500,000 m^3; • Administrative building to hold 100 persons (approximately 3 floors, each 1,000 m^2); • Four explosion-proof control rooms (approximately 800 m^2 each) that will be located in the proximity of the group of refining process units. There will be a control room for each of the following groups: – Distillate Hydrotreater, gas oil Hydrocracker/ Hydrotreater, Hydrogen Production Unit, Sour Water Stripper (SWS), Amine Recovery Unit (AMU) and Sulphur Recovery Unit (SRU); – Distillation Units, Isomerization Unit, and Catalytic Reforming Unit; – Residue Conversion Unit and Gasifier Unit; and – Oil Movement. • Building for laboratory analysis (approximately 500 m^2); • Control Room for Power Generation, Raw Water Treatment and Wastewater Treatment (approximately 800 m^2); • Shop for turbines for the power generation (approximately 2,000 m^2); • Shop for spare parts and Personal Protective Equipment (PPE) (approximately 2,000 m^2); • Shop for catalyst and chemicals (approximately 2,000 m^2); • Building for Electrical, Instrumentation and Maintenance (approximately 1,200 m^2); • Building for firefighting equipment and first aid (approximately 1,500 m^2); • Refinery Utility Infrastructure: – Electrical power infrastructure; – Biomass facility; – Emergency power; – Raw water system; – Boiler Feed Water (BFW) and steam; – Sanitary and potable water system; – Domestic sewage system; – Surface water management system;

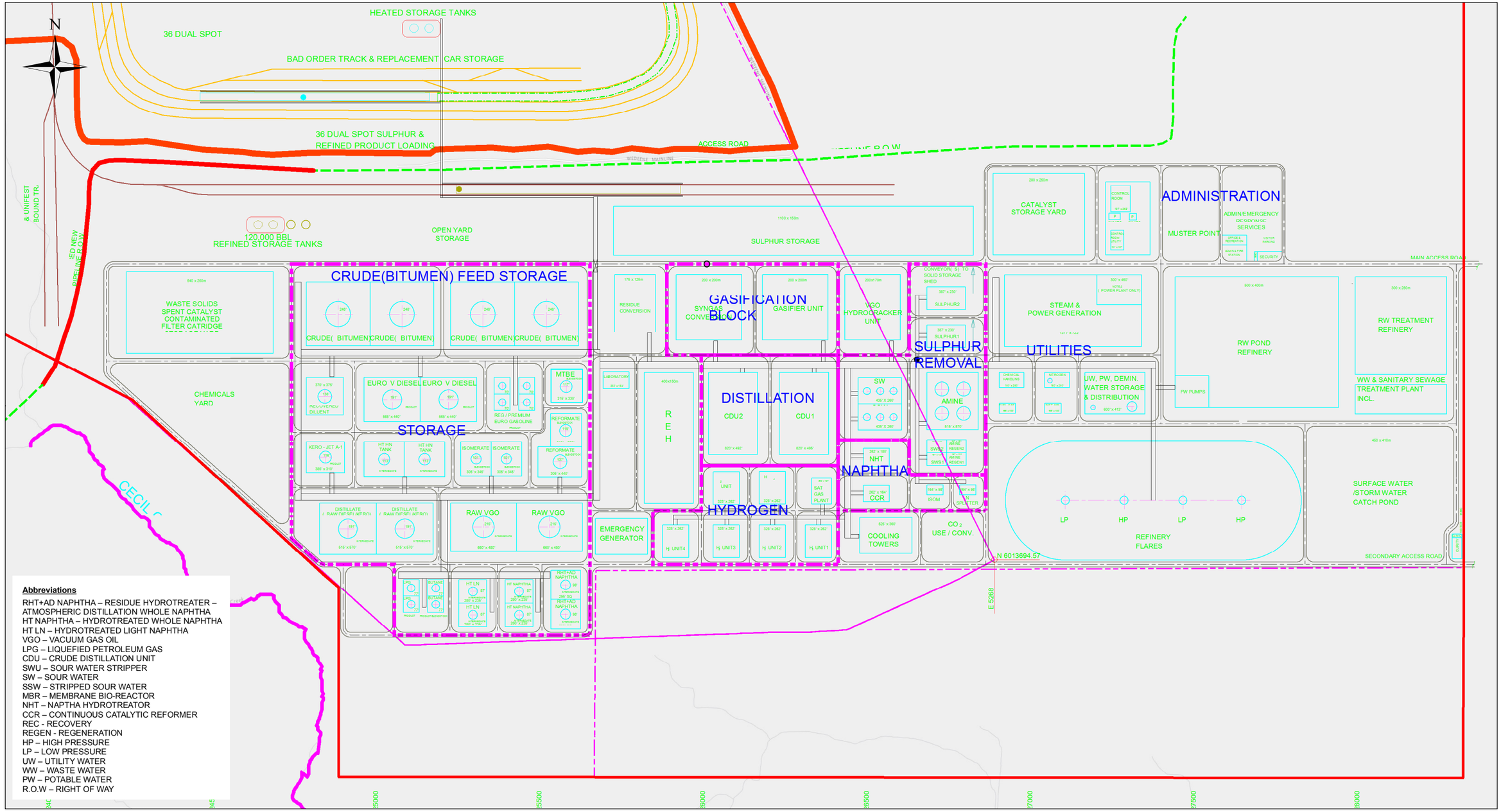
Table 4-1 (Cont'd) Physical Components of the Project

Project	Components
Refinery Infrastructure (1,000 ha) (Cont'd)	– Fuel gas and natural gas; – Instrument and Utility Air System; – Fire, gas and smoke detection; – Fire water system (oxygen and nitrogen); – Hydrocarbon drain system; and – Relief and flare. • Water and Waste Management; and • A 6" water pipeline from the Refinery to Kitimat.
Potential Surface Water intake structure	• Refer to **Schematic 3;** • Intake structure on Kitimat River (no diversion); • Minimum river depth of 0.7 m at point of intake; • Concrete structure; • Scour protection and wedge weir screen; • Protection of fish through screen; • Access road from Refinery to intake structure; • Pipe from the intake to the Refinery; • Dual pipes from structure to the pump station; and • Pump station at river bank at elevation to take care of flooding based on historical data.
Construction-related infrastructure	• Refer to **Figure 3;** • Trailers, fabrication shops, and material storage shop • Existing off-loading dock (former Eurocan dock) in Kitimat to receive Refinery modules during construction. • Access Road (200 ha; 40 km long by 50 m wide) with a clear-span crossing on Wedeene River and Little Wedeene River The road will be used primarily during the construction phase; however, may continue to be used during operation subject to input from First Nations and the public. • Workforce housing accommodations for the construction phase.



Photograph 1 Aerial view of the proposed Rail and Refinery Site.

Photograph 2 Aerial view of the proposed Rail and Refinery Site (Inset from Point 1).



Abbreviations

RHT+AD NAPHTHA – RESIDUE HYDROTREATER – ATMOSPHERIC DISTILLATION WHOLE NAPHTHA
HT NAPHTHA – HYDROTREATED WHOLE NAPHTHA
HT LN – HYDROTREATED LIGHT NAPHTHA
VGO – VACUUM GAS OIL
LPG – LIQUEFIED PETROLEUM GAS
CDU – CRUDE DISTILLATION UNIT
SWU – SOUR WATER STRIPPER
SW – SOUR WATER
SSW – STRIPPED SOUR WATER
MBR – MEMBRANE BIO-REACTOR
NHT – NAPTHA HYDROTREATOR
CCR – CONTINUOUS CATALYTIC REFORMER
REC - RECOVERY
REGEN - REGENERATION
HP – HIGH PRESSURE
LP – LOW PRESSURE
UW – UTILITY WATER
WW – WASTE WATER
PW – POTABLE WATER
R.O.W – RIGHT OF WAY

Legend

- Refinery Location
- Refinery Boundary
- Unit Train Rail Tracks
- Main Road
- Secondary Access Road'
- Manifest & Unifest Rail
- Existing Access Road
- Cecil Creek
- Pipeline Right of Way
- Proposed New Pipeline Right of Way
- Refinery Infrastructure

Notes:
1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.
4. Some smaller magnitude geohazards may exist that were too small to map.

References:
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
PFEC-0000-46DK-0002-Rev-PB.dwg

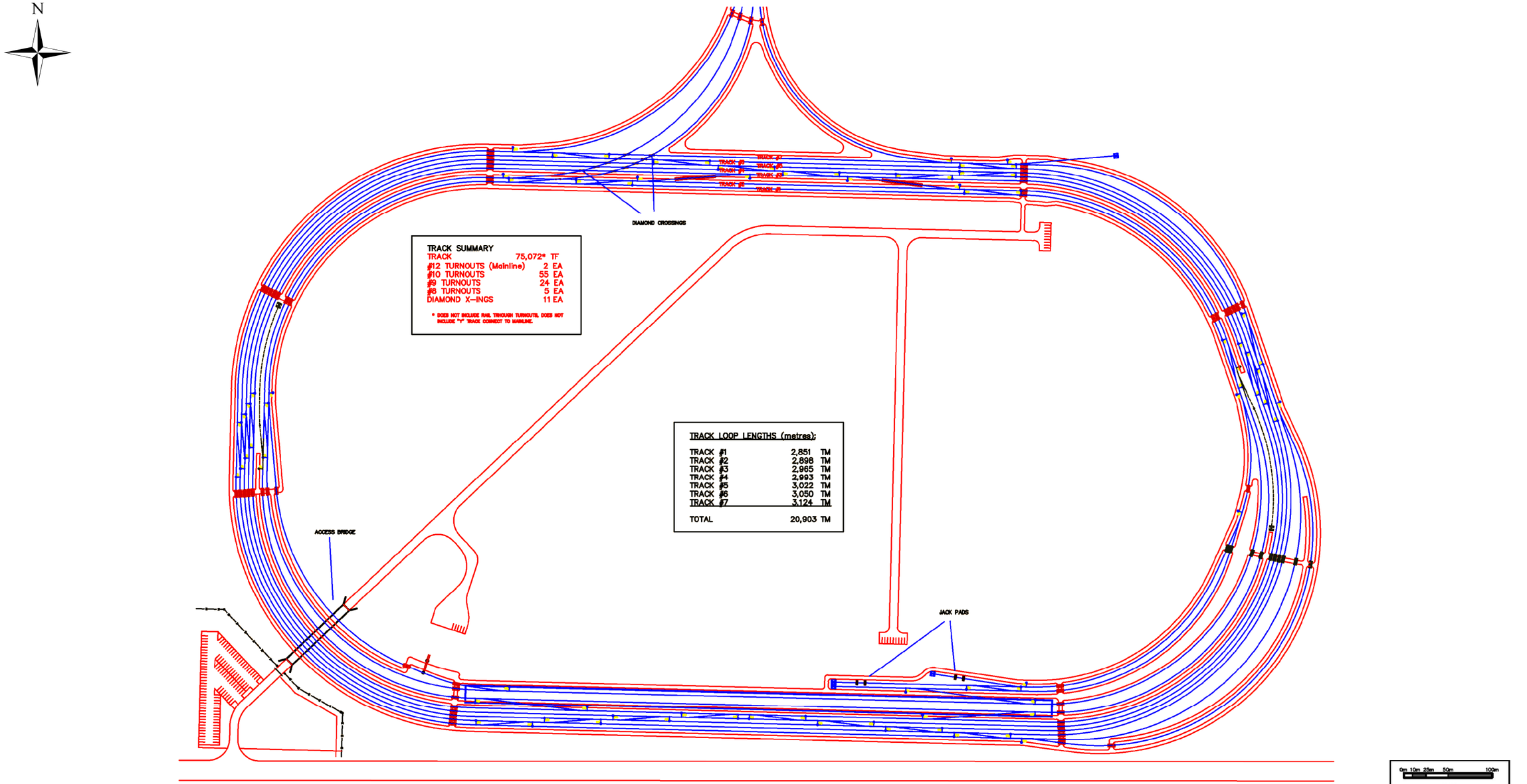
PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

SNC·LAVALIN

Pacific Future Energy Refinery Plan

By:	ECH	Date: 2016/06/15	Scale: As-Shown	Figure Number: 5	Rev: 2
Chk'd:	EM	Coord. Sys: NAD 1983 UTM Zone 9N		Reference No.: 631180-101-014	

MXD Path: \\Sli2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-0014-R2_-_Refinery_Plan.mxd



Legend

- Tracks
- Roads
- Future Track
- Fencing

Notes:

1. Intended for illustration purposes only.
2. Original in colour.
3. Site location is approximate.
4. Some smaller magnitude geohazards may exist that were too small to map.

References:

Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user communityConcept1GKGC_Rev3a.pdf provided by Strobel Starostka Construction Canada

PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

STROBEL STAROSTKA
CONSTRUCTION CANADA

SNC·LAVALIN

Pacific Future Energy Refinery
Rail Yard Concept

By:	ECH	Date: 2016/06/10	Scale: As-Shown	Figure Number: 6	Rev: 0
Chk'd:	EM	Coord. Sys: NAD 1983 UTM Zone 9N		Reference No.: 631180-101-015	

MXD Path: \\sl2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-0015_Rail_Yard_Concept .mxd

4.1 Refinery

PFEC is proposing to construct a new bitumen Refinery capable of processing 200,000 BPD or 31,795 m^3/d of NEATBIT™ from Western Canada, powered by clean energy. The Refinery will produce transportation fuel and refined product for new markets, while the design intent and approach will be such that carbon emission is mimized to achieve NZNC emissions. To cover the range of NEATBIT™ qualities that are produced in the larger reservoir areas in Western Canada, NEATBIT™ from both the Athabasca and Cold Lake regions will be considered in the design of the Project. NEATBIT™ will be brought to the Refinery by unit trains and unloaded to storage tanks located at Dubose Flats.

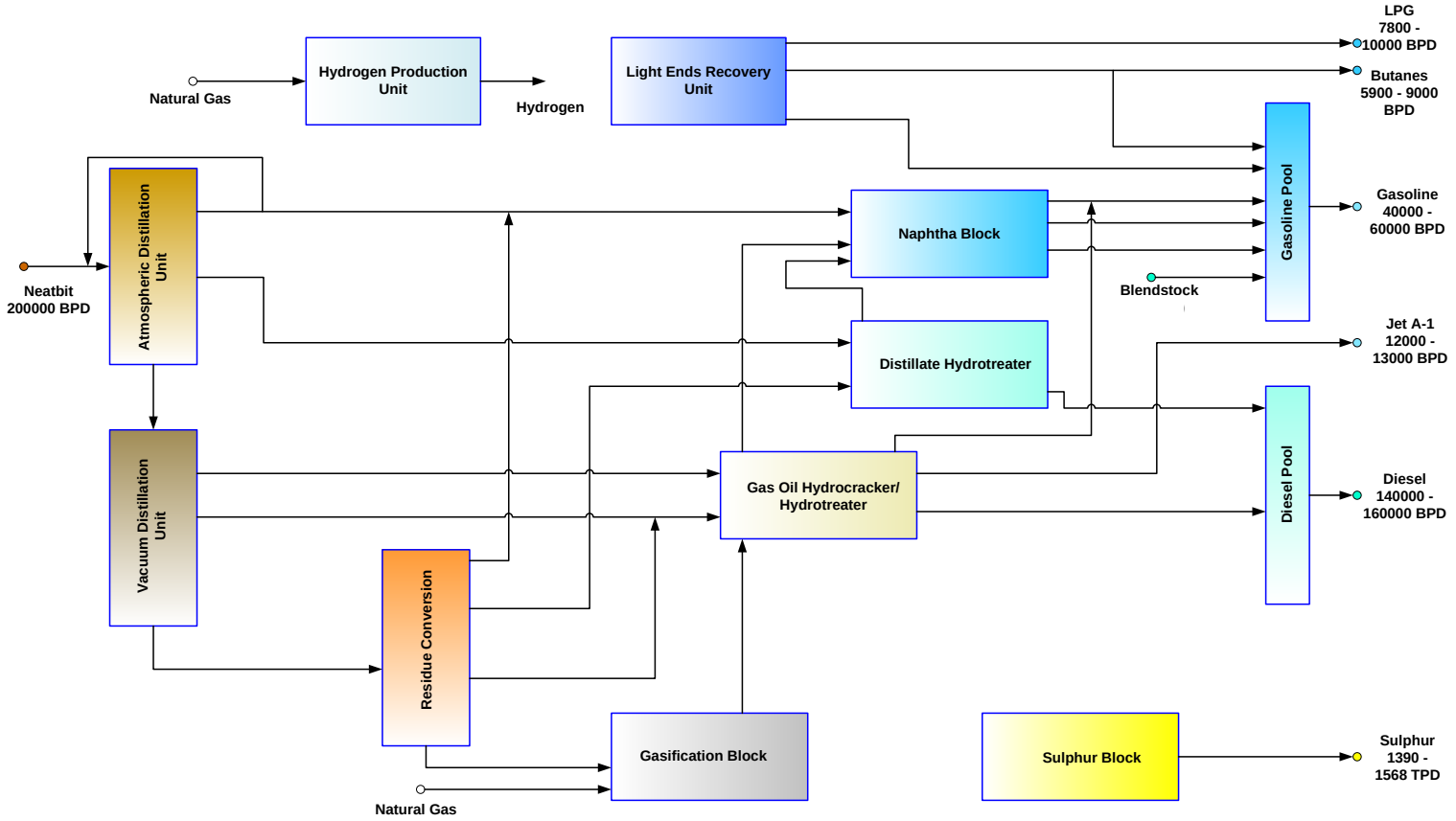
A Project process flowsheet is shown in **Schematic 1** and the refining process is described in detail in **Section 4.1.4.** Refer to **Figures 2** and **5** for the Refinery layout.

4.1.1 Refinery Modules

The Project is planning to purchase pre-built Refinery modules from Asia for transport to an existing off-loading terminal in Kitimat (**Figures 3** and **4**). The purchase of pre-manufactured modules from overseas is economical, reducing the capital expenditures required for the Project.

Approximately 100 to 150 modules will be required for the Refinery and assembled on site.

The dimensions of each module will range from 40-50 m in length, 35-47 m in width and 17-27 m in height. Each module is estimated to weigh between 2,500 and 5,000 MT.



1. Ranges in product quantities are due to variation in feedstock (Athabasca or Cold Lake origin), catalyst run and variation in technology selections.
2. Gasoline quantities include both regular and premium gasoline.
3. PFEC may produce other liquid hydrocarbons such as methanol from the Gasification Block.

PROCESS FLOW SCHEME

Schematic 1 Process Flow Scheme

4.1.2 Feedstock and Refined Product Storage

4.1.2.1 Feedstock

The primary feedstock for the Project will be NEATBIT™ from Western Canada. Blendstocks such as methanol will be produced on site and will be used to improve the quality of gasoline.

Natural gas (260 million standard cubic feet of gas per day) is planned to be delivered by pipeline. Natural gas will be used as feed gas for the steam methane reforming process (See **Section 4.2.8**). The Project is proposing to tie-in to an existing natural gas line, either from the anticipated 36-inch Pacific Trails Pipeline (PTP) (with an alignment running through Dubose flats, See **Figures 2** and **5**), the existing Pacific Northern Gas (PNG) pipeline (with a six or 10-inch pipe alignment parallel to Highway 37 on the east side) or the proposed 24-inch PNG looping pipeline (parallel to the existing PNG pipeline between Lakelse and Kitimat).

4.1.2.2 Products

EURO V grade diesel and gasoline will be the main products of the Project. Jet A-1 kerosene, LPG, butane, and sulphur will also be produced.

4.1.2.3 NEATBIT™ and Refined Product Storage

The proposed design for the Project includes a facility for NEATBIT™ and product storage tanks listed in **Table 4-2**. The storage facility will be located at the Refinery, as shown in **Figure 5**. The storage capacities shown in **Table 4-2** are preliminary estimates only and will be refined as design progresses. At this time, the combined storage quantity on site for both NEATBIT™ and refined products will be greater than 500,000 m^3. Each of the unit intermediates will have a day-storage tank other than the feed and products storage indicated in the following table.

Table 4-2 List of Materials Requiring Storage, Tank Numbers and Estimated Storage Capacities

Material	Number of Storage Tanks	Total Capacity (Bbls)	Total Capacity (m^3)	Type
NEATBIT™	4	1,600,000	254,400	Cone Roof Tank
Methanol	2	250,000	40,000	Internal Floating Roof Tank (IFRT)
Recovered Diluent	1	40,000	6,360	IFRT
LPG	2	30,000	4,770	Bullet
Butane	2	25,000	3,975	Sphere

Table 4-2 (Cont'd) List of Materials Requiring Storage, Tank Numbers and Estimated Storage Capacities

Material	Number of Storage Tanks	Total Capacity (Bbls)	Total Capacity (m3)	Type
Resid Hydrotreater – Atmospheric Distillation Whole Naphtha	2	150,000	23,850	IFRT
Hydrotreated Whole Naphtha	2	50,000	7,950	IFRT
Hydrotreated Heavy Naphtha	2	150,000	23,850	IFRT
Distillate (Raw Diesel - Kero)	2	560,000	89,040	Cone Roof Tank
Raw VGO	2	600,000	95,400	Cone Roof Tank
EURO V diesel	2	450,000	71,550	Cone Roof Tank
Reformate	2	150,000	23,850	IFRT
Isomerate	2	108,000	17,172	IFRT
Hydrotreated Light Naphtha	2	80,000	12,720	IFRT
Regular Euro Gasoline	2	120,000	19,080	IFRT
Premium Euro Gasoline	2	120,000	19,080	IFRT
Kero - Jet A-1	2	170,000	27,030	IFRT
Recycled Hydrocarbon (i.e., Slop)	3	300,000	47,700	IFRT
Sour Water	3	210,000	33,390	Cone Roof Tank
Stripped Sour Water	3	210,000	33,390	Cone Roof Tank
Nitrogen Storage	3	500	79.5	Vessel
Demineralized Water	3	26,000	4,134	Cone Roof tank
Potable Water	1	5,000	795	Tank
Amine Surge	2	2000	318	Cone Roof Tank
Amine Make-up	2	1000	159	Cone Roof Tank
Sulphur (tonnes)	1	48,000 MT	48,000 MT	Building
Total Capacity (m^3)			**860,042.5 m^3** (excludes sulphur as it is a solid)	

4.1.3 Carbon Management

PFEC is committed to reducing greenhouse gas emissions from this facility and will employ all means to achieve low carbon intensity and NZNC emissions. PFEC will use innovative but proven technologies in order to meet this commitment (**Section 4.1.4**). In particular, this Refinery will eliminate the production of coke. Coke products are a significant source of greenhouse gas emissions and will not be produced by this Refinery.

Some of the steps that will be taken by PFEC to reduce carbon emissions are:

1. Selection of refining technologies such as:
    - Heavy residue hydrocracking[7] that eliminates coke production. The elimination of coke production significantly reduces carbon dioxide (CO_2) emission per Gigajoule (GJ) (unit of energy);
    - Gasoline production without thermal catalytic cracking[8] processes. Thermal catalytic cracking produces some coke;
    - Selection of hydrocracking & hydrotreating technologies that produce EURO V quality diesel and gasoline. No heavy fuel oil will be produced from the Refinery; and
    - Converting carbon residue into fuels. A small portion of the feedstock will remain as pitch; this pitch will be further gasified into a syngas for the production of liquid hydrocarbon (diesel).
2. Minimize CO_2 emission with fuel gases through following means:
    - Use of fuel gas (natural gas) as clean fuel instead of fuel oil;
    - Improving energy efficiency of the processes through design;
    - Integration of multiple units;
    - Using steam generated from various processes for motor drives and power generation; and
    - Using biomass for power generation as carbon neutral fuel.
3. PFEC is considering capture of CO_2 emitted from various sources such as:
    - Process CO_2 from tail gas in the hydrogen production unit through the use of specific solvent;

[7] A conversion process which breaks down heavier oils to lighter products in presence of hydrogen.
[8] A conversion process that produces elemental sulphur and water vapour. The process is used for the removal of sulphur from gas.

- Process CO_2 from residue gasification/syngas treatment unit through the use of specific solvent; and
- Capture CO_2 from flue gases through the use of proprietary technology.

4. PFEC is in discussion with technology suppliers for the use of CO_2 for manufacturing of various products.

4.1.4 Refinery Process Technologies

PFEC has selected and will select advanced refining processes with the specific intent of reducing process technology risk while at the same time considering innovative but proven technologies to improve the energy efficiency of the Refinery to minimize the environmental impact. To ensure minimal risk of process failure, PFEC has consulted, and will continue to consult with, technology providers to the petroleum refining industry, incorporating their input on the design of the overall refining process, as well as the design of specific components. In addition, third-party reviews will be conducted at various times during design and construction to further mitigate risk of process failure.

4.1.5 Description of the Refining Process

The optimization process for the Refinery is in progress and the following description was prepared based on current available information. The final configuration may change based on optimization among various competing configurations and updated information from technology providers. Key process units that are part of the Refinery configuration are:

- Atmospheric Distillation Unit;
- Vacuum Distillation Unit;
- Residue Conversion Unit;
- Distillate Hydrotreater;
- Gasoil Hydrocracker/Hydrotreater;
- Gasification Block;
- Gasifier & Syngas Cleaning Unit;
- Syngas Conversion Unit;
- Naphtha Block;
- Naphtha Hydrotreater/ Splitter;
- Catalytic Reformer Unit;
- Isomerization Unit;

- Hydrogen Production Unit;
- Light Ends Recovery Unit/Gas Plant;
- Sulphur Block;
- SWS;
- ARU;
- SRU;
- Tail Gas Treatment Unit (TGTU); and
- Sulphur Forming Unit.

The Process Flow Scheme (**Schematic 1**) of the Project shows the major processing blocks included in the configuration and the distribution of the major streams to meet the target product qualities (EURO V gasoline and EURO V diesel).

4.1.5.1 Atmospheric & Vacuum Distillation Unit

Once NEATBIT™ is unloaded from the rail cars, it will be blended with diluent from the Refinery to produce diluted bitumen. Solids, chlorides and salts will be removed from the diluted bitumen by a process called 'desalting'. Desalting maintains the long-term integrity of the downstream equipment. After desalting and heating, the diluted bitumen will be fed to an Atmospheric Distillation Tower.

From the Atmospheric Distillation Tower, naphtha (including diluent), kerosene, distillate and atmospheric residue are produced. Naphtha will be sent to the naphtha hydrotreater/ splitter in the naphtha block while kerosene and distillate are sent to the distillate hydrotreater for quality adjustment prior to feeding other units for final-specification adjustment, or to a pool of product for final blending. The diluent stream is stabilized and recycled (via storage) to blend with the feed NEATBIT™.

Atmospheric residue is sent to a Vacuum Distillation Unit where it is heated and fed to the Vacuum Distillation Tower. Light vacuum gas oil, heavy vacuum gas oil and vacuum residue are produced from the Vacuum Distillation Tower.

The light vacuum gas oil and the heavy vacuum gas oil are sent to the Gas Oil Hydrocracker/ Hydrotreater. The vacuum residue specification is carefully chosen to limit the metals content in the heavy gas oil. This residue is sent to a Residue Conversion Unit.

4.1.5.2 Residue Conversion Unit

In a bitumen-based refinery, vacuum residue (bottom of the barrel) is more than 50% of the volume of the feed. Therefore, high conversion of the vacuum residue is a key factor to improve overall product yields and refinery economics.

In this unit, the residue is cracked in a hydrogen atmosphere at high pressure and moderate temperature to produce naphtha, distillate and gas oil. The naphtha from the Residue Conversion Unit is sent to the Naphtha Block. The distillate is sent to a Distillate Hydrotreating Unit, while the vacuum gas oil is sent to a Hydrocracking Unit. The unconverted pitch is sent to a Gasifier Unit in the Gasification Block.

4.1.5.3 Gas Oil Hydrocracker/ Hydrotreater

Gas oils from the Vacuum Distillation Unit and Residue Conversion Unit are catalytically cracked in a hydrogen atmosphere to produce lighter hydrocarbons. The feed is desulphurized and denitrified to meet the product grades of the finished fuel products. Jet fuel, diesel, and some naptha produced from this unit is directly sent to the product pool.

4.1.5.4 Distillate Hydrotreater

The distillate streams generated in the Atmospheric Distillation Unit and in the Residue Conversion Unit are sent to a Distillate Hydrotreater to produce light hydrocarbon gases (to gas plant), naphtha which is sent to naphtha hydrotreater/splitter and diesel on specification to the EURO V diesel pool. The feed mixture is treated in a hydrogen atmosphere for desulphurization, denitrification[9] and cetane index/number improvement.

4.1.5.5 Naphtha Block

The Naphtha Block consists of a naphtha hydrotreater/splitter, catalytic reformer unit, isomerization unit and product blending. All the naphtha products from various units are sent to the naphtha Hydrotreater/ splitter to produce two streams - light naphtha and heavy naphtha. The heavy naphtha stream is sent to the Catalytic Reformer to produce a high-octane reformate ready for blending in the gasoline pool. The light naphtha is sent to the isomerization unit. The isomerate from the isomerization unit is used for blending to meet gasoline product quality.

4.1.5.6 Gasification Block

The unconverted pitch from the Residue Conversion Unit is sent to a gasifier unit to produce syngas through a partial oxidation process. High-purity oxygen required for this process is supplied from an Air Separation Unit (ASU). The syngas produced from the gasification unit is cleaned to remove hydrogen sulphide (H_2S) and H_2S is routed to the SRU.

The syngas feed is passed through catalytic beds to produce liquid hydrocarbons in this syngas conversion unit.

[9] A process used to reduce or remove nitrogen from a substance.

This process essentially ensures a 'near complete' conversion of NEATBIT™ to finished fuel products.

4.1.5.7 Hydrogen Production Unit

The hydrogen required for the Residue Conversion Unit, Distillate Hydrotreater, and Gas Oil Hydrotreater is provided by a Hydrogen Production Unit. Most of the hydrogen is produced via a steam methane reformer unit. A small portion is produced by a Catalytic Reforming Unit. The two hydrogen-rich streams go to a purification unit to produce 99.9% pure hydrogen.

4.1.5.8 Light Ends Recovery Unit/ Gas Plant

The light hydrocarbons (C_4 and lighter) from different units are treated in amine contactors to remove H_2S and the treated gases are sent to a light ends recovery unit where refinery fuel gas, LPG and butanes are recovered.

4.1.5.9 Sulphur Block

The Sulphur Block consists of SWSs, ARU, SRU, TGTU and a sulphur forming unit.

The gases produced in the process units are sour gases. Before the recovery of any products, the sour gases are treated in a methyl diethanolamine (MDEA) amine contactor for acid gas removal. The rich amine from these amine contactors is regenerated in an ARU where acid gas is stripped off from rich amine by application of heat, and the lean amine is cooled and recycled. The acid gas from the regenerator is cooled and sent to the SRU.

Process water used in the process units is segregated into phenolic and non-phenolic streams. Each one is treated separately at independent SWSs. The SWS receives process waters from various units that have been in contact with H_2S and ammonia (NH_3). The SWS treats the process water to remove contaminants. The H_2S-rich gas (with NH_3) is then sent to the SRU. The stripped water is sent to a waste-water treatment plant (WWTP) to be processed for reuse within the Refinery.

Stripped water from the non-phenolic stream is reused as much as possible in the process units. The remaining volume is sent for treatment. The phenolic-stripped water stream is sent directly for treatment except for its reuse for the desalter and the gasifier unit. Gases produced from the stripping are sent to the SRU for sulphur production.

H_2S-rich streams from ARU, gasifier unit and SWSs are processed through a Claus[10]-type recovery unit where the H_2S is converted to elemental sulphur for sales. The recovery unit includes the Claus converters followed by proprietary TGTU and sulphur-collection and degassing facilities. The Claus converters/TGTU for the Project will be designed to achieve a minimum recovery of sulphur in the feed gases of approximately 99.8%.

Liquid sulphur is pumped to a sulphur forming unit to produce granular/pelletized sulphur. Granular/pelletized sulphur will be stored on site or purchased by offtakers. A dust-suppression system will be applied to minimize sulphur dust during handling.

4.1.6 Other Refinery Infrastructure

Besides the Refinery modules and process units that need to be built, there is a need for additional infrastructure, both temporary and permanent.

The temporary facilities will be built or installed at the early stage of Refinery construction. These include trailers, fabrication shops and material storage shops. These will be located at the Refinery site (Figure 3).

Permanent infrastructure necessary for the operation of the Refinery includes the following (Figure 5):

- Administrative building to hold 100 persons (approximately 3 floors, each 1,000 m^2);
- Four explosion-proof control rooms (approximately 800 m^2 each) that will be located in the proximity of the group of process units that will be controlled. There will be a control room for each of the following groups:
  - Distillate Hydrotreater, Gas Oil Hydrocracker/ Hydrotreater, Hydrogen Production Unit, SWSs, ARU and SRU;
  - Distillation units, Isomerization Unit, and Catalytic Reforming Unit;
  - Residue Conversion Unit and Gasifier Unit; and
  - Oil Movement.
- Building for laboratory analysis (approximately 500 m^2);
- Control Room for Power Generation, Raw Water Treatment and Wastewater Treatment (approximately 800 m^2);
- Shop for turbines for the power generation (approximately 2,000 m^2);
- Shop for spare parts and PPE (approximately 2,000 m^2);

[10] A two stage process that produces elemental sulphur and water vapour. The process is used for the removal of sulphur from gas.

- Shop for catalyst and chemicals (approximately 2,000 m^2);
- Building for Electrical, Instrumentation and Maintenance (approximately 1,200 m^2); and
- Building for firefighting equipment and first aid (approximately 1,500 m^2).

There will be a need for other smaller size buildings such as a substation, analyzer booth, etc.

4.2 Utilities at the Refinery

The operating utility requirements for the Refinery will be supported by the following systems:

- Electrical power (and biomass facility);
- Emergency power;
- Raw water system;
- BFW and steam;
- Sanitary and potable water system;
- Domestic sewage system;
- Surface water management system;
- Fuel gas and natural gas;
- Instrument and Utility Air System;
- Fire, gas and smoke detection;
- Fire water system (oxygen and nitrogen);
- Hydrocarbon drain system; and
- Relief and flare.

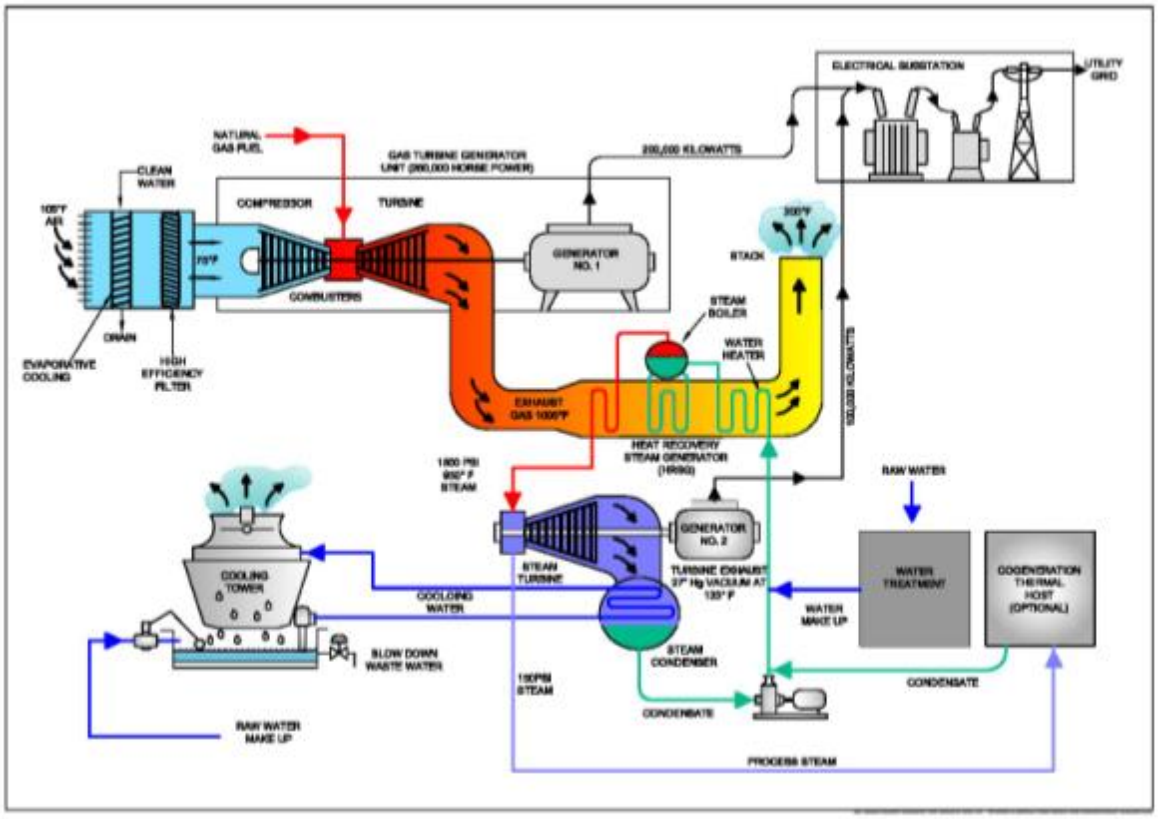
4.2.1 Electrical Power

PFEC is considering various options for power supply such as natural gas-fired cogeneration facility and biomass power generation; as well as external supply from the existing BC Hydro transmission grid, geothermal and combination of all or some of these options.The Project will require approximately 300 MW of electrical power.

The Refinery will produce a significant amount of steam for power generation and steam turbine drives of large compressors and pumps. A gas-turbine generator is proposed to provide the remaining load, the start-up load and to supply critical load for the Refinery.

For Combined Cycle Gas Turbine (CCGT) power plants, a widely used combination is the use of the hot exhaust generated from a gas turbine burning natural gas to power a steam power generation unit. **Schematic 2** shows the concept of a CCGT power plant.

For a 300 MW CCGT power plant, as an example, a gas turbine may generate 200 MW power and a steam turbine may generate 100 MW power. The power plant may export steam to the Refinery as an option. The water cooling may be replaced by air cooling to reduce water usage.



Schematic 2 Gas Turbine Combined Cycle

4.2.1.1 Biomass Facility

PFEC is proposing to utilize existing wood-waste biomass as part of a cogeneration facility for the Refinery (**Figure 5**). The supply of biomass is expected to originate from pulp wood and hog fuel (tree bark and forest residue) from ongoing timber harvest operations and from wood waste, a product of the milling process. The Refinery will receive wood waste shipments via rail along the existing rail transportation corridors between Prince George and Prince Rupert.

PFEC is currently assessing the reliability of this biomass-based cogeneration facility operation with respect to the Refinery operation. The biomass facility is anticipated to produce 25-75 MW (nameplate capacity) of the total 300 MW required to power the Refinery. Approximately one million tonnes of biomass equates to 75 MW of electricity. PFEC estimates the volume of biomass required could match or exceed the consumption of mid-level pulp mills located in the Prince George area, which consumes approximately one million cubic metres per year of pulp wood which is relatively equivalent to one million tonnes of wood fibre.

4.2.1.2 Other Options for Electrical Power

Other clean-energy options will be considered through independent power producer(s) (e.g., geothermal) or a point of interconnection to the existing 287 kV BC Hydro transmission line or the proposed 287 kV BC Hydro Terrace to Kitimat Transmission line on the west side of Highway 37 (**Figure 3**). This new transmission line is anticipated to meet the demands for electricity for the proposed LNG facilities and other future industrial developments in the Kitimat area (BC Hydro 2015). There are no ancillary facilities anticipated to be needed for these options.

4.2.2 Emergency Power

In the event of failure of the power supply from steam-turbine generators, critical plant loads will derive electricity from an emergency power system. The emergency power system will consist of a combination of standby fuel gas- or natural-gas-driven generators for critical loads. A battery-backed uninterruptible power supply will be available for critical functions such as the plant control systems and computer systems.

4.2.3 Raw Water System

Water to the Refinery is planned to be supplied from surface and/or groundwater. PFEC will undertake hydrogeological and hydrological investigations to determine the availability of the sources within the Project area.

Raw water may contain varying amounts of solids, salts, and very fine particles referred to as total suspended solids (TSS) or total dissolved solids (TDS). Raw water may require treatment before use at the proposed Refinery. Treatment of raw water entering a refinery may include screening and sedimentation to remove suspended solids, but subsequent treatment will depend on the

ultimate use for each water system. The water produced after primary treatment can be used as utility water and fire water. Subsequent treatment is required to use this water as cooling water, process (demineralized) water or BFW.

4.2.4 Sanitary and Potable Water System

A supply of sanitary and potable water is required throughout the construction phase of the Project, as well as for operations activities. PFEC will investigate options for the source of this water and seek relevant permits to obtain the water supply.

During initial site preparation and construction, it is expected that sanitary and potable water will be brought into Dubose Flats by truck transport until a permanent sanitary and potable water system is constructed. PFEC would ensure that proper equipment and operating procedures are in place to ensure that the potable water from its system meets all applicable guidelines (such as World Health Organization guidelines) for potable water use.

Sanitary water and potable water will be from the same supply at any given point during construction and/or operations.

Utility water used for cleanups (or similar activities) in the process area will be fed from a separate set of lines throughout the Refinery.

4.2.5 Boiler Feed Water and Steam

Ion-exchange resins with de-aeration will be considered for BFW preparation. Currently, it is envisaged that steam will be produced at three levels: high pressure, medium pressure, and low pressure. BFW quality will be adjusted accordingly. The BFW quality shall be as per American Society of Mechanical Engineers (ASME)-recommended quality.

The Project is expected to produce sufficient steam to meet most of the process and utility (heating, machine drive etc.) steam requirements of the Refinery. The following units will produce significant amount of steam:

- Hydrogen Production Unit;
- SRU; and
- Gasifier Unit.

Back-up high-pressure boilers will be installed to meet start-up demand and to provide back-up during operational upset of the producing units. During normal operation, these will be kept at low load.

Any shortfall in steam availability due to upset in the producing unit shall be compensated by package boiler(s). Excess steam, if any, will be condensed in an air cooler to recover the condensate after process heating, building heating and steam tracing.

Steam condensate produced from process units will be treated and returned to the BFW system. De-mineralized water will be generated for BFW makeup and process water requirements.

4.2.6 Domestic Sewage System

Domestic wastewater and sewage will be generated during construction and operation at the Refinery. PFEC will adapt the system for handling this waste stream as construction progresses.

At the earliest stage of construction, when numbers of personnel are relatively small, it is expected that individual portable toilet facilities will be available throughout the construction site, as required. These facilities would be maintained regularly. Waste will be removed by truck to an approved sewage disposal facility.

As construction progresses, PFEC will use a combination of individual toilet facilities and larger facilities until the construction of a domestic wastewater/sewage treatment system within the Refinery boundaries is complete. The sewage treatment plant will be used during operation. Relevant permits will be obtained for the construction and operation of a sewage treatment plant.

4.2.7 Surface Water Management System

Two streams of surface water runoff will be generated from the Project and water management systems will be developed for both.

The exterior of Refinery buildings, paved or concrete areas and other impermeable areas will generate runoff during storm events and snowmelt. Runoff from these areas will be contained in pond(s) located within the Project boundaries. The pond sizes will have a designed capacitysuitable for a 100 year rainfall event with a minimum one-day holding volume. The process areas will be curbed and will drain to the process-area water runoff pond(s). In process units where there is not enough gradient for gravity flow to the process-area water runoff pond, the runoff water will be collected in an open sump, and then will be pumped to the process-area water runoff pond(s).

Wash water and accidental spillages from the process areas will also be directed to the process-area water runoff pond(s). This water will normally be recycled back into the process units to supplement raw water provided from the external sources. The water may contain small amounts of hydrocarbons and/or suspended solids, which will be treated before recycling. PFEC is proposing a separation and treatment process to treat this water sufficiently for recycling.

Hydrocarbon storage tanks shall be provided with impervious dikes engineered to meet the environmental guidelines for secondary containment. The areas inside the dikes shall be sloped to a corner sump to collect rain or snowmelt water. This water shall be pumped out using portable pumps and directed to either the non-process area clean water pond(s), or the process-area runoff pond(s) depending on the chemical analysis of the water.

The process areas will be covered with fire-water protection. In the event of a fire in any process unit, the fire-water shall collect in the process-area runoff drains and be directed to process-area runoff pond(s). The drain system shall be designed to accommodate fire-water flows.

Surface runoff water collected from non-process areas will be collected into clean stormwater pond(s) through ditches and culverts provided around the Refinery. The water from such pond(s) will be recycled back into the process units to supplement raw water provided from the external sources.

4.2.8 Fuel Gas and Natural Gas

Primary fuel for the Refinery will be composed of light gas streams recovered from process units and, if required, a small amount supplied from off site. The fuel-gas operating pressure is a low pressure system, approximately 450 kPa(g).

Natural gas will be received through pipeline from external sources. The gas will be let down and heated, if required. Natural gas will be mainly used for the steam-methane reforming process as feed gas. Pilot-fuel gas, tank-blanketing gas and flare-purge gas for the Refinery will be supplied from the natural-gas system. The natural gas system will be connected to the fuel-gas system to provide back-up fuel when required.

4.2.9 Instrument and Utility Air System

Air will be supplied by the Refinery and instrument-air package that will draw air from the atmosphere. The Refinery and instrument-air package will be designed to meet the Refinery/ instrument air requirements during normal, intermittent, start-up and shutdown operation.

During normal operation, air is to be drawn from the atmosphere by a compressor through an air filter. Interstage knockout pots of the compressor will remove any free water droplets. Compressed air will be dried to meet the dewpoint specification. Air leaving the drier will be sent to an instrument air receiver prior to distribution to the instrument and Refinery air users.

Since air supply is essential to the safe operation of the Refinery, air must be made available for start-up and shutdown of the entire plant.

Refinery air is to be distributed throughout the site to a number of utility stations.

4.2.10 Fire, Gas and Smoke Detection

A fire, gas, and smoke monitoring system shall be provided to detect the presence of fire and flammable or toxic gases at an early stage and to initiate automatic safeguards, as required. Detectors will be located across the plant and specifically in sensitive locations where there is a higher probability of fire.

Gas and fire detectors will be directly connected to the safety instrument system (SIS). Smoke detectors will be connected to the Refinery control system.

Each process building that has a potential for gas leaks or fire will be equipped with fire and gas detection heads. Gas detectors will include heads for combustible gases,H_2S, and carbon monoxide (CO), as required by the potential for the presence of these gases. Flashing beacons will be provided inside buildings and outside at each entrance to warn of gas leaks or fire.

Hydrocarbon liquid pumps will be provided with fire detection.

4.2.11 Fire Water System

A fire-water system designed to provide water to process units/areas to provide fire exposure protection, control of burning and/or fire extinguishment. Water will be held in reserve in the raw water pond(s). A secondary source of fire-water will be surface runoff water collected from non-process areas (**Section 4.2.7**).

Fire-water will be distributed by centrifugal pump(s) into a continually pressurized fire-water distribution system. This distribution system will consist of looped distribution mains, hydrants, nozzles, and a deluge system. Process areas, tank areas, and other important facilities will have looped underground fire-water lines to ensure water supply from at least two directions.

The Refinery will be divided into fire-risk zones, and the water distribution system will be sized to meet the fire-water demand for any given zone. Fire-risk zones will be sectioned by gate valves from the main water grid to ensure that part of the system can be isolated and taken out of service for maintenance. Based on preliminary engineering design, it is expected that there will be two diesel driven fire-water pumps, and one electric motor-driven fire-water pump, each with a capacity of approximately 1,100 cubic metres per hour (m^3/hr).

The design of this system will be such that all piping, hydrants, monitors and other equipment exposed to potential freezing will be protected by automatic draining, insulation, and/or heat tracing. The system will be designed to handle the maximum pressure developed by the fire pumps and for any pressure surges.

Note that the surface-water management system will be designed to contain any fire-water that may be used within the boundary of the Refinery, as described in **Section 4.2.7**.

4.2.12 Oxygen and Nitrogen

Oxygen is required to feed the burners in the gasifier and the SRU (for oxygen enrichment). The ASU of the gasifier will produce 99.5% pure oxygen for these purposes. PFEC may install the air-separation unit within the Refinery boundary or may choose to buy it from an external agency with an own-and-operate contract.

Nitrogen is required to free the system of air at start-up and to prevent the release of hydrocarbon vapours during shutdown. Required nitrogen purity is a minimum of 99.9%. Nitrogen is a product from the ASU. Consequently, any continuous nitrogen requirements will be drawn from the ASU directly. Excess nitrogen will be vented to the atmosphere. To provide sufficient nitrogen for start-up / shutdown purging, liquid nitrogen storage vessels will be used.

The storage vessels shall be double-walled with an internal vacuum between the shells, and insulated to minimize heat gain from the atmosphere. The vapour losses of nitrogen shall be minimized. However, there will be some heat gain and venting to maintain the storage-vessel pressure, which will result in gradual nitrogen losses. Consequently, when the minimum operating level is reached, nitrogen will be ordered to re-fill the vessels. As required, nitrogen will be drawn from storage, vapourized into a gas in the vapourizer and distributed to the necessary users. The storage vessels will be refilled as nitrogen is consumed. After meeting the nitrogen storage requirements, the ASU will supply nitrogen gas to meet any continuous nitrogen requirements. Any excess nitrogen produced from the ASU will be vented to atmosphere.

Liquid nitrogen will provide the nitrogen necessary for initial Refinery start-up and meet any continuous nitrogen demands until the ASU is operating.

4.2.13 Hydrocarbon Drain Systems

The Refinery is expected to have the following drain systems:

Closed Drain System: All hydrocarbon drains will be routed to a closed drain system. The number of drain vessels will be decided based on the topography of the Refinery and the location of different units. During subsequent engineering of the Project, a separate NEATBIT™ (hot) drain system requirement will be evaluated. Automatic process drain/ process blowdown[11] requirements, if any, will be identified and routed separately (usually recycled). Hydrocarbon collected from these drain vessels will be returned to the slop tank and water will be routed to the WWTP (through a slop tank, if required). Vessels will be vented to a flare.

[11] A technique used to remove periodically accumulated solids in vessels and boilers.

Open Drain/Oily Water Sewer (OWS) Drain System: This system consists of wastewater from desalters, process oily water drains, intermittent maintenance drains etc. Water from this system will be collected in atmospheric vessels and returned to the slop tank.

4.2.14 Relief and Flare

The Refinery will be protected by three flare systems:

- A High-Pressure Hydrocarbon Flare;
- A Low-Pressure Hydrocarbon Flare; and
- An Acid Gas Flare.

The flares are all emergency flares for protection of environment, personnel and property through safe disposal of releases from the refining process during process upset, start-up and shutdown. This safe disposal is achieved through complete combustion of releases. During normal operation, only pilot flame will be on in these flares.

Each flare system will include:

- Liquid knockout facilities;
- Flame ignition; and
- Burner management.

Methods for optimized smokeless burning – steam assist and air assist – will be evaluated and the optimal method will be implemented to achieve smokeless burning.

A flare derrick structure will be considered and the possibility of placing the High-Pressure and Low-Pressure flares on the same derrick will be evaluated during subsequent engineering. The flare stack heights will be based on maximum ground-level heat radiation and dispersion modelling for a flame-out scenario.

The acid gas flare will be mounted on the SRU incinerator with steam-assisted smokeless burning.

4.3 Rail Yard

The rail yard (with seven yard tracks for a total length of 20.9 km) will have a capacity to handle 200,000 BPD of NEATBIT™ and will allow the delivery of three to four unit trains per day on the CN Rail branchline (**Figure 6** and **Photograph 1**).

The rail yard will allow for two unit trains at once, where one unit train is unloaded and the other is heated while in queue. Each unit train will typically consist of 2 locomotives, 2 buffer cars and 120 tankcars of NEATBIT™. Once on site, the NEATBIT™ in the tankcars will go through a process

of preheating (to reduce the viscosity[12] of the NEATBIT™ and allow it to be easily pumped out of the tankcars) and then offloading where it will be pumped into the NEATBIT™ storage tank awaiting processing by the Refinery.

After the offloading process is completed, each tankcar will undergo an inspection that will determine if any preventative maintenance is required. Tankcars requiring preventative maintenance will be removed from service and sent to an onsite repair facility.

The rail yard will be equipped with adequate additional facilities for regular operation and maintenance of the yard.

4.4 Off-loading Dock for the Refinery Modules

The 100 to 150 Refinery modules will arrive on heavy-lift vessels or barges from Asia (**Figure 4**). PFEC will use the former Eurocan dock in Kitimat harbour to receive the modules (**Figure 3**). The existing dock in the Kitimat area will not require upgrades or expansion in order to accept PFEC's pre-built Refinery modules which are estimated to weigh between 2,500 and 5,000 MT (up to 50 m long and 47 m wide). The District of Kitimat (2015) notes that the Port of Kitimat has a vehicle clearance to 320,000 deadweight tonnes (DWT) according to a recent Transport Canada TERMPOL[13] assessment. Kitimat harbour is 130-180 metres (m) deep and currently has four inner harbour anchorages and four holding areas (District of Kitimat 2015).

The existing off-loading terminal and main staging area for these components is in the traditional territory of the Haisla First Nation. PFEC will work with Haisla to best determine the location of the staging area and off-loading terminal.

4.5 Access Road

PFEC plans to construct a 50 m wide access road, extending from the former Eurocan dock in Kitimat to the Refinery. A possible route has been identified on the west side of the Kitimat River (**Figure 3**) and is estimated at 40 km in length. **Photographs 3** through **5** provide on-the-ground views of various locations along the existing access road leading into the proposed Refinery location. The current alignment will not cross the Kitimat River; however, clear-span crossings are planned for the Wedeene River and Little Wedeene River.

[12] A property of fluids that indicates their resistance to flow. High viscosity has low flow. Fluids with low viscosity flow easily.
[13] "TERMPOL" stands for "Technical Review Process of Marine Terminal Systems and Transhipment Sites."

The current route was chosen based on grade, local geology and minimized water crossings (as a way to minimize impacts to fish). Engineering, geotechnical and environmental input will be incorporated into a finalized route as Project design is advanced. First Nations advice and guidance as well as public input will be taken into consideration.

The access road will be used primarily during construction to transport the Refinery modules; however, subject to input from First Nations and the public, the road may continue to be maintained and operational once the Refinery is commissioned. The 100 to 150 modules will arrive in pairs and once on land, the modules will be driven to the Refinery site by heavy-haul transport truck at a speed of no more than 5 kilometres per hour (km/hr). A two-day trip is estimated for each pair of modules.

Photograph 3 View of existing access road looking north west towards the entry to the proposed Refinery.

Photograph 4 View of existing access road approximately 5 km south east of the proposed Refinery.

Photograph 5 Cecil Creek crossing along an existing access road located approximately 7 km south east of the proposed Refinery.

4.6 Workforce Housing

Workforce housing will be required for the construction phase. PFEC is assessing the feasibility of constructing new accommodations on site, as well as the use of existing accommodations in Terrace or Kitimat.

4.7 Water and Waste Management

4.7.1 Water Supply, Water Management and Wastewater Streams

4.7.1.1 Water Supply

The Project will require a source of raw water to meet the following needs:

- Makeup water for cooling tower evaporative losses and blowdown;
- BFW makeup for steam losses and blowdown;
- Process water makeup;
- Utility water purposes throughout the Refinery, including wash water;
- Sanitary and potable water; and
- Fire-water.

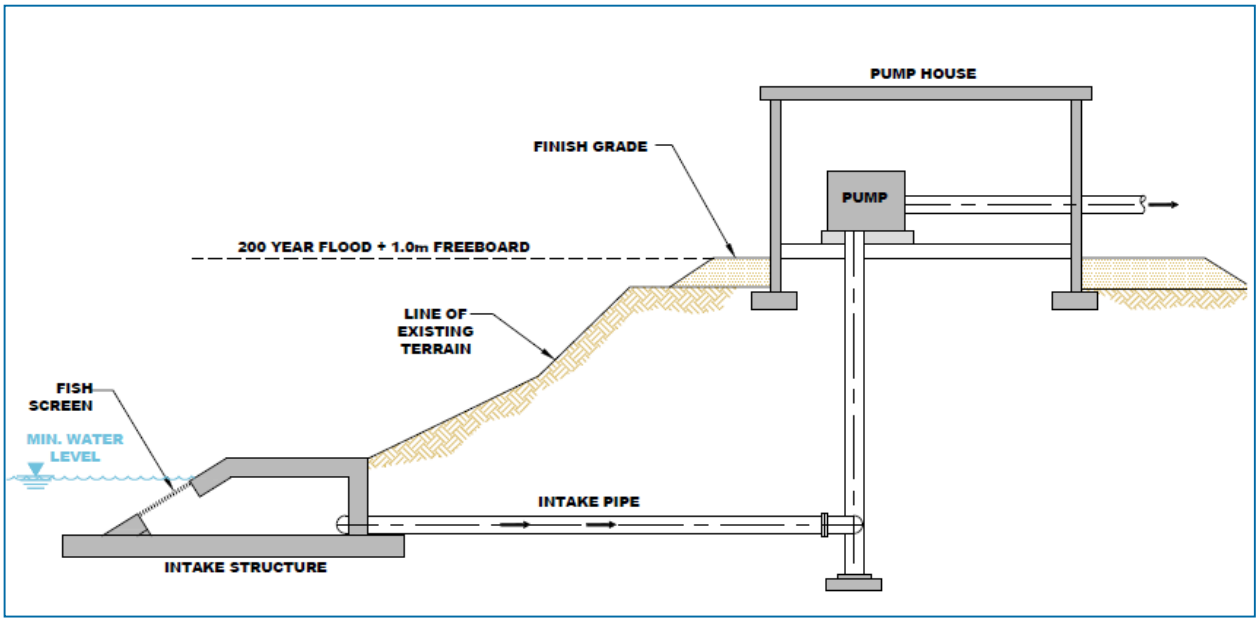
The preferred source for the raw water for the facility is groundwater. The adequacy and quality of raw water supply will be a crucial factor in determining the site location. Different sources of water supply may be evaluated if hydrogeological investigations determine the groundwater source is insufficient for use.

If groundwater is insufficient, surface water will be considered as a source for raw water. **Photograph 6** provides a view of the location for the potential surface water intake location. In this scenario, the construction of a river water intake structure at the Kitimat River, raw water transfer pumps and a pipeline to the Refinery, and a water treatment plant (**Figure 2** and **5**) at Dubose Flats will be required.

Photograph 6 Looking downstream along the Kitimat River at the potential surface water intake location.

Intake structure (**Schematic 3**) will be sited to draw water from the river in regions where the sediments concentration is low (e.g., at or near, the water surface, and at the outside of a bend in the river). It will be preferably placed where a minimum water depth more than 0.7 m is available (less than 0.7 m will likely require a weir to extract 1,500 m^3/hr). Concrete material will be used for the intake structure. Scour protection will be provided (e.g., riprap). Water entering the intake will flow through wedge wire screens. Intake design will consider protection for all types of fish in the river in order to prevent potential losses of fish due to impingement and entrainment upon the intake screens. Two pipes in parallel will carry water from the intake to the pump station. The pump station will be built on the river bank, for easy access and maintenance, to a minimum top elevation corresponding to the 1:100-year flood level. It will house pumps, air compressor for backwashing the intake screen, electrical and control equipment.

As discussed within **Section 4.2.7**, PFEC will collect surface water runoff into pond(s) on site. Surface water runoff from non-process area pond(s) will be collected into clean stormwater pond(s) and recycled into the process units to supplement the raw water supply. The amount of surface water runoff is expected to vary based on seasonal precipitation in the region.



Schematic 3 Water Intake Structure

4.7.1.2 Water Management

As currently envisaged, water for process and utility use will be supplied from groundwater and/or surface water, into raw water ponds within the Project boundary. Water uses are as described in **Section 4.2.3** above.

The design of the Refinery will incorporate the maximum practical capability to recycle, reuse waste and stormwater during operation. Opportunities for reducing water use, maximizing water recycling and thus reducing raw water intake, will continue to be evaluated and implemented as practical throughout the design and operating life of the Refinery.

Surface water will be managed as discussed in **Section 4.2.7**. Domestic wastewater and sewage will be managed as discussed in **Section 4.2.6**. Sanitary and potable water will be managed as discussed in **Section 4.2.4**.

Surface runoff during construction will be directed to the surface water runoff pond(s). An erosion and sediment control plan will be implemented during construction. Similar stormwater management, and erosion and sediment control plans will be implemented in the construction letdown area(s).

PFEC, with expertise from local First Nations, will continue to evaluate any appreciable effect on the water source and take action as required during further Project development and design / engineering.

4.7.1.3 Wastewater Streams

The major types of wastewater streams from the Refinery operation, and the management and discharge of waste-water streams are as follows:

- **Potentially oily water and oily surface water runoff streams:** These streams will be sent to the water treatment plant, where they will be treated to remove suspended oil, and then treated to remove dissolved oil or other organics. Systems expected to be used to treat this wastewater stream include gravity separation, dissolved air flotation, equalization pond, bio-treatment, filtration/clarification, and then recycling back into the raw water treatment system to reduce the intake of raw water from the external source. Treated water may need to be discharged periodically.

  The method for disposal may be deep well injection; however, PFEC will assess the feasibility of other options such as disposal into the marine environment within the Douglas Channel via a 6" pipe from the Refinery. The discharged water will be mostly saline water with TDSs that may contain traces of other contaminants such as oil/ grease, phenol, sulphides etc. Detailed speciation of the discharge water will be developed during subsequent stages of the design and PFEC will ensure that it meets regulatory criteria. Photograph 7 provides an approximate view of the possible discharge location on the Douglas Channel.

Permit needs for deep-well injection or discharge into the marine environment will be discussed with and obtained from FLNRO, Fisheries and Oceans Canada (DFO) and Environment and Climate Change Canada (EC), if determined to be required. PFEC, with expertise from local First Nations, will continue to evaluate wastewater systems and take action as required during further Project development and design/ engineering.

Photograph 7 View of possible discharge location within the Douglas Channel.

- **High TDS streams:** These are streams from the water treatment unit, from the regeneration of ion-exchange beds, and blowdown water from cooling towers and boilers. Wastewater streams containing high dissolved solids are not easily treated because these ions are not separated by normal physical or chemical methods. PFEC will employ technologies to maximize recycling of water from these streams. Residual waste streams will be held in waste-water tanks or sumps prior to disposal. The methods for disposal are as described above.
- **Oils and high TDS streams:** This effluent stream is from the crude desalter. This stream will be pre-treated to remove oils and organics before being treated for high TDS as described above.

- **High suspended solids streams:** These are the streams from filter backwashes in the raw water treatment unit and demineralized water treatment units. These streams will be recycled back to the raw water treatment unit for solids removal.
- **Caustic soda effluent with hydrocarbon contaminant:** This effluent stream is from the hydroprocessing unit. This stream will be treated first to remove oils and organics. The caustic is then either neutralized to pH 7 to 9 by the addition of acid or caustic, or recycled back to the process units.
- **Water from gasifier:** During subsequent engineering phases, treatment required for wastewater from the gasifier will be evaluated to enable recycling of this wastewater.
- **Sour water streams:** These streams will be stripped of NH_3 and H_2S in the SWS units. Non-phenolic stripped water will be recycled to the process. Phenolic sour water will be used for desalters.
- **Domestic wastewater and sewage stream:** This stream is managed as described in **Section 4.2.6**.

The wastewater treatment system will be designed to remove contaminant material from the various waste streams generated and collected on the site. The treatment processes will be designed to maximize the potential for wastewater reuse within the complex. The specific requirements of the treating systems will be developed during detailed engineering as specific information on the volumes of water and nature of the contaminants becomes available from the licensors and process unit designs.

4.7.2 Hydrocarbons, Chemicals & Waste Management

4.7.2.1 Waste Management

A comprehensive waste management system will be developed with First Nations and used for the Project. Waste management practices will be prepared so that:

- The most representative information is available on each form of waste; and
- Procedures and guidelines are current with legislation and corporate policy.

Waste generated will be managed to minimize environmental impacts by:

- Selecting and using materials effectively;
- Using, where practical, the principle of reduce, reuse and recycle for non-hazardous and hazardous materials;
- Informing employees, contractors and customers of the risks associated with managing waste; and

- Identifying third-party business opportunities, such as for recycling, to increase the effectiveness of waste management.

PFEC's waste management plan will meet the requirements under the BC *Environmental Management Act* (EMA). Storage and transportation of waste material will be conducted in accordance with the *Transportation of Dangerous Goods Act*, Workplace Hazardous Materials Information System (WHMIS) and any other government agency regulations.

4.7.2.2 Solid Waste

All catalysts and chemicals will be delivered to the Refinery site by truck or rail.

Where allowable, PFEC will utilize local contractors to remove industrial and contaminated waste by rail car or truck. PFEC will initiate discussions with local waste disposal facilities for the handling of Project solid waste. The following facilities have been identified:

- For non-contaminated materials:
  - Terrace Landfill, 555 Kalum Lake Rd, Terrace, BC
  - Thornhill Landfill, at 3016 Old Lakelse Road in the Terrace area (RDKS plans to decommission this landfill once Forceman Ridge is constructed)
- Contaminated materials must be disposed of at a permitted facility. For materials of this type:
  - Tervita Terrace Bioremediation Facilities, 555 Kalum Lake Rd, Terrace, BC; and
  - Forceman Ridge Landfill, across Highway 37 from Dubose Flats (under construction).

In addition to the above, solid waste may be sent to these regional facilities:

- Kitimat Valley Disposal at 717 Commercial Ave, Kitimat, BC;
- Kitimat Landfill on Highway 37 approximately 5 km north of Kitimat townsite; and
- Thornhill Landfill.

Table 4-3 summarizes typical wastes generated at the Refinery. Further effort will be made to identify waste reduction, reuse and recycling initiatives.

Table 4-3 Waste Disposal Management

Waste Group	Waste Disposal Method
Oily sludge	Sent to an approved disposal facility
Spent catalyst	Reconstituted and reused
Hydrocarbon contaminated materials such as filter cartridges etc.	Sent to an approved hazardous waste disposal or destruction site
Used pipe insulation	Sent to insulation contractor for reuse
Scrap metal	Sent to contractor for reuse
Used oil	Sent to re-refining with contractor
Used drums	Sent to insulation contractor for reuse and reconditioning
Pallets	Sent to contractor for reuse
Pop cans, bottles, plastic, paper, cardboard	Recycled

4.8 Summary of Emissions, Discharges and Waste

PFEC will develop environmental management plans for all Project phases for the handling, storage and monitoring of emissions, discharges and waste. During construction, general sources and locations of discharges, emissions and wastes will be from construction vehicles and equipment, work sites at the Refinery site, along the potential transportation module access road and at the potential river intake site. During operation, general sources and locations of discharges, emissions and wastes will be from refining process and biomass facility at the Refinery site. A comprehensive list of sources and locations of discharges, emissions and wastes will be developed as engineering design advances. These will be taken into consideration as part of the EA.

The types of emissions, discharges and waste that will likely be generated during the Project phases include the following:

Atmospheric Emissions:

- CO;
- Greenhouse Gases (CO_2, methane, nitrous oxide, fluorinated gases)[14];
- Sulphur oxides;
- Nitrogen oxides;
- Particulate Matter (PM); and
- Fugitive hydrocarbons.

[14] http://www3.epa.gov/climatechange/ghgemissions/gases.html

SO_X Emission: The Refinery will use natural gas with a zero to negligible amount of sulphur as fuel (natural gas is typically sulphur-free). No liquid or solid fuel will be used as fuel in the refining processes. Produced gases from the Refinery will be cleaned with solvent for sulphur removal. Refinery residue will be partially oxidized in the gasifier wherein the sulphur compounds from the gases will be removed. In SRU, tail gases will be treated with proprietary TGTU. SO_X emission from the Refinery will be kept very low.

NO_X Emission: A low NO_X combustion equipment/ system will be employed in the Refinery. During subsequent engineering development, NO_X emission from each combustion equipment will be assessed. If required, proven and established NO_X reduction technologies will be employed for large combustion equipment such as cracking furnaces, power station etc.

During subsequent engineering, if either SO_X or NO_X remission is found high, then reduction technologies will be employed.

PM Emission: Due to use of gaseous fuels in the Refinery, PM emission is expected to be very low. In the sulphur storage area (**Figure 5**), dust suppression techniques will be employed to minimize particulate emission.

Biomass combustion: Some NOx and PM release is expected from the Biomass facility.

Liquid Waste:

- Sewage during construction; and
- See **Section 4.4.3** for Refinery wastewater streams.

Solid Waste:

- Refer to **Table 4-2**.

4.8.1 Carbon Emissions

PFEC is in the early stages of engineering design and the carbon emission estimates are based on current knowledge. See below for the captured CO_2 million metric tonnes per annum (MMTPA):

	Produced (MMTPA)	**Captured (MMTPA)**	**Emitted (MMTPA)**
Estimated Process Sources	3.1	3.0	**0.0**
Flue Gas	3.9	3.4	**0.5**
Total CO_2 (Estimated)	**7.0**	**6.4**	**0.5**

'Process CO_2' refers to pure CO_2 that is produced as a by-product of hydrogen production. No new technology is required to capture this CO_2 (other than compressing the gas and preparing it for export from the facility.

To capture CO_2 from flue gas, PFEC will use a solvent-based capture system. PFEC is currently in negotiations with licensors for this technology.

4.8.1.1 Estimated Range of Carbon Emissions and General Sources of Carbon Emissions

The initial estimates of carbon emissions from the Refinery are between 444,000 kilograms per hour (kg/hr) to 500,000 kg/hr. The general sources of carbon emissions from the facility include the following:

Unit	Number of Stacks
Atmospheric Distillation Unit	2
Vacuum Distillation Unit	2
Residue Conversion Unit	3
Gasoil Hydrocracker/Hydrotreater	2
Distillate Hydrotreater	
Naphtha Hydrotreater Unit	1
Catalytic Reformer Unit	2
Isomerization Unit	1
Hydrogen Production Unit	4
Tail Gas Treatment Unit	2
Gasifier & Syngas Cleaning Unit	2
Syngas Conversion Unit	
Steam Generation	9
Bio-mass Power	1
Natural Gas Power	1
Miscellaneous	1

4.8.1.2 Proposed Approach for Carbon Offsetting

A combination of technological solutions will be utilized to design a facility that will have NZNC emissions (also see **Section 4.1.3)**:

- Significant reduction in CO_2 emissions through elimination of coke production.
- No heavy fuel oil will be produced; only Euro V quality diesel and gasoline.
- No carbon residue will remain from refining. Residues will be converted to liquid hydrocarbon.

- Use of clean energy and cogeneration to power the facility.

PFEC endeavors to develop a comprehensive long-term GHG emissions / Air Quality monitoring program to ensure adherence to NZNC. At a minimum, this will include:

- Combination of technological solutions to advance project design.
- Regulatory engagement on the application of best available technologies or best available control technologies.
- Regulatory engagement on current GHG and air emissions regulations as it relates to EA and ongoing monitoring.
- Data collection of ambient air quality (meteorological data and contaminants).
- Knowledge base development for current air quality conditions in the region through data collection.
- An air quality impact assessment (emissions inventory, air dispersion modeling) to enable the environmental impact assessment and EA Application.
- Acquisition of, and compliance with air-related permits for construction and operation.

5 PROJECT ACTIVITIES

The following section describes the Project's activities during construction, operation and decommissioning phases. The Project schedule is also summarized in this section.

5.1 Construction

If welcomed by local First Nations and communities, and the required regulatory approvals and permits are received, activities during the construction phase would include:

- Access-road construction from Kitimat to the Refinery for the purpose of transporting Refinery modules by heavy-haul truck;
- Modifications to existing roads, as needed, to support the size and weight of the Refinery modules;
- Modifications to the existing access road from Highway 37 to the Refinery;
- Connection with the natural gas supply pipeline;
- Site preparation: clearing and grubbing vegetation; placement of appropriate fill material; grading and compacting; construction of suitable foundation; and the installation of erosion, sediment and storm water control;
- Worker accommodation construction and set-up;
- Preparation of lay down and staging areas;
- Set up of temporary auxiliary buildings such as temporary offices, maintenance buildings, equipment fuelling areas and permitted waste facilities;
- Marine transport of Refinery modules to the former Eurocan dock in Kitimat;
- Transport of Refinery modules to the site along access road;
- Installation of utilities described in **Section 4.2** (raw and potable water, power supply, wastewater collection and treatment, storm water collection etc.);
- Construction of a 6” water discharge pipeline to Kitimat;
- Construction of permanent Refinery infrastructure;
- Construction of the rail car loading/unloading facilities and interconnections;
- Installation of storage tanks for feed stock and product; and
- Construction of associated buildings.

All work would be conducted in accordance with a site-specific Construction Environmental Management Plan (CEMP). These documents will prescribe measures to store materials, refuel and maintain equipment safely and in a manner, that does not pose a risk to the environment. The plan will also identify specific measures to be taken to minimize light, noise, emissions, congestion, and other potential issues resulting from access to and activities at the construction site.

PFEC will ensure that layout and operability of the project respects local First Nations culture and traditions, and commits to supporting First Nations resource development initiatives during construction and operations.

5.2 Operation

The PFEC Refinery is planned to be in service by 2021. Operation and maintenance activities will occur in three shifts over a 24-hour period, 365 days a year. There will be preventive maintenance for some units during some days of the year. Critical support units (such as boiler, power generation etc.) will be operational year-around and in some cases multiple trains of those units will be provided to support the Refinery.

It is envisaged that administrative and management personnel will work 40 hours a week during standard day shifts and operating personnel will work eight (8) hours in three different shifts. Preliminary estimates for employment are a total of 1,000 direct employees while the maintenance work (buildings and turnarounds and minor projects in the process units), cleaning, landscaping will be subcontracted. The departments needed to operate the Refinery are:

- General Management;
- Operations;
- Maintenance;
- Technical;
- Environment, Health & Safety (EHS);
- Loss Prevention; and
- Administration and support services.

Below is a general description of the main and conventional responsibilities of each department listed above. Detailed responsibility distribution will be developed during execution of the Project and subsequent operation of the Refinery.

5.2.1 General Management

General Management will handle core business of the Refinery. General Management will be responsible for overall operations, which includes receiving, storage and processing of raw materials (NEATBIT™ and blendstock) and storage of refined products and by-products.

5.2.2 Operations

The operation team is in charge of daily operation of the process units, as well as monitoring and continuous inspection of the process units described in **Section 4.1**; storage, blending and unloading the feedstock from rail cars; and storage of product.

The operations are planned to be conducted by areas of responsibility, based on the major interrelation between the process units. It is envisaged that the areas will be divided as:

- Area 1: Distillation units, light ends, Isomerization, Naphtha treating/ splitting, Isomerization and Reforming;
- Area 2: Hydrotreatment, Hydrogen production, SWS's, Amine System and Sulphur;
- Area 3: Residue Hydrogenation & cracking, Gasification and Syngas conversion process;
- Area 4: NEATBIT™ Movement (loading and unloading) & Storage; and
- Area 5: Power and Steam Generation, Raw Water Treatment and Wastewater Treatment.

Each area will be composed of multiple units and will have a control room where all major operating information will be available, including any prevailing upset scenario in any unit. Local motor control centres (MCC) will also be housed adjacent to the control room. Shift supervisor offices and other administrative offices may also be located in proximity, as well as operator room(s) depending on the distance from main control room and the process unit.

The Refinery will be controlled through a distributed control system (DCS) or equivalent sophisticated control system architecture. A dedicated shutdown system will be separate from the control system providing high-integrity protection to the environment, personnel and assets.

Each area will be assigned an Area Manager with responsibilities such as general administration, inventory and supply of catalyst and chemicals to the process units, utilities consumption, providing operational instruction for the units, frequency of sampling for lab analysis, work with maintenance for turnarounds, predictive or preventive maintenance planning. The Area Manager will report directly to an overall Refinery Operation Manager.

Each area will have one to two Area Supervisors per shift depending on unit complexity. The Area Supervisor(s) report directly to the Area Manager. Area Supervisor(s) will be responsible for approval of hot and cold permits for works inside the units (maintenance, electrical, instrumentation, etc.), follow-up of instructions given by the Area Manager, overview of the unit's behaviour, coordination of minor maintenance, and assurance that all instrumentation and control is working properly.

Under the direction of the Area Supervisor, a Console Operator is responsible for the monitoring and control of the units assigned to the console. Depending on the complexity of the unit, one to four field operator(s) will be responsible for the physical monitoring of the process unit, reporting on perceived anomalies, sampling and identifying of the input/output streams according to the laboratory schedule, reviewing drains and steam traps, making visual checks of instruments (levels, temperature, and pressure), and opening and closing hand valves in an emergency situation.

The engineering design will take into account all possible emergency scenarios and contingency situations. These will be identified in the EA and evaluated as part of the impact assessment of potential accident and malfunctions during operation (and construction). Furthermore, PFEC will implement a comprehensive emergency safety plan as part of their EHS and Loss Prevention Program.

Upset or unusual operation in any part of the Refinery will be regularly reported through shift logs, daily operations meetings and weekly area management meetings. There will be adequate reporting mechanisms within the Refinery to ensure that all operational issues are dealt with expeditiously.

5.2.3 Maintenance

The Maintenance group comprises the mechanical, electrical, automation, pipefitters, and general turnaround-discipline personnel. Areas of responsibility include preventive, predictive and scheduled maintenance, to ensure the reliability of the process units and Refinery operations. In addition to regularly planned maintenance activities, this group will also integrate regular feedback from Operations and Technical Services into maintenance duties, as well as, arrange maintenance over-and-above regular maintenance, as and when required.

5.2.4 Technical Support/ Services

This group is composed of the following teams/ functions:

- Compliance Monitoring & Reporting: Data collection related to emissions, effluent discharge etc. Reports to Refinery management and regulatory authorities as per agreed reporting structure and frequency. All measurements will be collected through approved instruments (i.e., Measurement, Accounting & Reporting Plan [MARP] meters).

- Measurement & Production Measurement: Maintains logs of imported raw materials (feedstocks, blendstocks, natural gas, water etc.) and products (gasoline, LPG, diesel, sulphur etc.). All data are collected through approved fiscal meters. Production data, qualities of raw materials and products are recorded to ensure specifications compliance.
- Planning and Economics: Optimization of the Refinery operation, Linear Programming and the analysis of markets and price.
- Process Engineering: Technical support to Operations and carries out optimization of the process units and propose troubleshooting if any problem arises.
- General Engineering: Technical support to handle small optimization/ modification projects in the Refinery.

5.2.5 Environment, Health & Safety and Loss Prevention

PFEC will have a world-class EHS Program that is participatory from the Executive management to the entry-level employee. PFEC has the commitment of executive management towards sustainable environmental management for all Project activities, through co-creation with First Nations.

The EHS Program approach will be responsive to the dynamic nature of the surrounding environment to effectively minimize or avoid environmental impacts or compromising the health and safety of PFEC's employees and the local population (human and ecosystems).

The EHS team and Loss Prevention team are responsible for the continuous monitoring of the facilities to ensure protection of the environment, workers and visitors. EHS will work in conjunction with Refinery operations to monitor, but are not limited to the following:

- Atmospheric emissions generation;
- Noise and vibration generation;
- Wastewater generation;
- Wastewater discharge quality;
- Water consumption;
- Impacts to source-water quantity and quality;
- Waste generation;
- Energy consumption;
- Use and consumption of chemicals and gases;
- Other natural resources consumption;
- Work in sensitive areas such as watercourse, forest, wildlife habitat or protected areas; and
- Emergency and contingency situations.

EHS will provide in-house training to all staff for health and safety procedures, emergency and contingency procedures and environmental compliance requirements. Sustainable environmental management will be communicated to all employees and people working on PFEC's behalf. EHS will educate staff in the EHS resources available to them. EHS resources may include Environmental Management Systems, Health and Safety manuals, Emergency and Contingency Plans, Operations Manuals, Standard Operating Procedures, Environmental Risk Register, tracking logs and records keeping, PPE, equipment and instrumentation.

EHS responsibilities will also include audits to guarantee that all the EHS resources are in order and available for proper functioning of the Areas described in **Section 5.2.2**. An incident reporting procedure will be developed by EHS. The execution of emergency and contingency plans (e.g., alerting nearby residents) will be managed by EHS in close coordination with General Management.

The Loss-Prevention team will work closely with the EHS team to protect assets and the security of the installations.

5.2.6 Administration and Support Services

This includes all administration and support staff such as Fire Fighting, Finance and Accounting, Legal, Document Control and Library, Public Affairs, Communications, Medical and Buildings Management.

5.3 Decommissioning

The life of the Project is expected to be a minimum of 60 years. At the end of its life, the Project will be decommissioned pursuant to an approved decommissioning plan conducted in accordance with the applicable regulations at the time. Decommissioning activities would include, but are not limited to road deactivitation, dismantling and removal of all above-ground components and land reclamation.

5.4 Physical Activities which are Incidental to the Project

The following is a brief description of the physical activities that are incidental to the Project.

5.4.1 Transport of Refinery Modules to the Refinery

The Refinery modules will be purchased from manufacturers in Asia and be shipped to the former Eurocan dock in Kitimat. The marine access route within Canadian waters will likely be from the Triple Island Pilotage Station west of Prince Rupert and north of Hecate Strait as shown in **Figure 4**. The Pine Island Pilotage Station north of Vancouver Island in Gordon Channel is an alternate marine route option currently used by vessels calling on the Port of Kitimat[15].

[15] http://www.bccoastpilots.com/bc-coast-pilots/bc-coastal-waterways/

The marine access route will be used only during the construction phase to serve the transport of Refinery modules from Asia to Kitimat. No new marine infrastructure will be built for this Project.

The 100 to 150 modules will arrive in pairs and once on land, the modules will be driven to the site along a new access road by heavy-haul transport truck at a speed of no more than 5 km/hr. A two-day trip is estimated for each pair of modules for up to 75 trips. PFEC will work with the manufacturers to ensure the safe transport of these modules, and will confer with the relevant government agencies to determine permitting requirements during transport. It is anticipated this activity of module transport would occur over a four to six month period of low water flow to minimize the potential for impact to local watercourses and fish habitat.

The marine and land transport of the modules is assumed at this time to be wholly under the care and control of the manufacturer or a transport logistics company contracted by PFEC to ensure the safe delivery of the modules to the Refinery site. The activity is for the sole benefit of the Proponent; however, economic benefits extend to the organizations involved in the transportation logistics.

5.4.2 Transport of NEATBIT™ to the Refinery

The Project will utilize existing rail infrastructure to receive NEATBIT™ on dedicated unit trains. Three to four unit trains per day are anticipated. Each train will have approximately 120 rail cars, with the appropriate specifications to safely transport NEATBIT™. PFEC will take custody of the NEATBIT™ once it arrives at the rail yard. PFEC will work with CN to ensure the safe transport of the feedstock to minimize the incidence of spill into sensitive areas in compliance with Transport Canada railway safety legislation.

5.4.3 Transport of Wood Waste Biomass to the Refinery

PFEC is proposing to utilize existing wood-waste biomass as part of a cogeneration facility for the Refinery. The supply of biomass is expected to originate from pulp wood and hog fuel (tree bark and forest residue) from ongoing timber-harvest operations and from wood waste, a product of the milling process. The Refinery will receive wood-waste shipments via rail along the existing transportation corridors between Prince George and Prince Rupert. The responsibility for shipment to the Refinery would be within the care and control of the shipper.

PFEC will work concurrently with the EA process to obtain the relevant permits and approvals for the operation of an on site cogeneration facility.

5.4.4 Export of Refined Product from the Refinery

The export of products is planned via a tolled process, whereby purchasers or offtakers will be responsible for the transport of product from the Refinery. By extension, this activity would benefit the Proponent and purchasers. It will be the responsibility of offtakers to obtain the necessary permits and approvals to construct the necessary infrastructure to enable export. PFEC would expect that a separate EA process would be required for an export project, in addition to acquiring an export licence from the National Energy Board (NEB).

PFEC will engage third parties who have expressed interest in supporting the development of a marine export terminal to export refined products to Asian markets via Ocean Going Vessels of up to Panamax-size[16]. PFEC will only export refined products via any future marine terminal developed in conjunction with PFEC's values, which include recognition of First Nations rights, titles and interest to the marine terminal site, and our full commitment to support and develop only those projects that are welcomed by supportive host First Nations.

Early third-party studies suggest a marine terminal could be situated along the Portland Inlet, in the event such a development were to secure the support of a host First Nation. If such a marine terminal were to be developed, we anticipate that two (one for gasoline and one for diesel) short (275 km) pipelines, developed in partnership with First Nations along the route, could be built to support the marine terminal's operations.

5.4.5 Supply of Electrical Power

Please refer to **Section 4.2.1** and **4.2.1.2** for options on the supply of electrical power to the proposed Refinery. Any connection to an external power grid, such as a BC Hydro transmission line or IPP would be coordinated between PFEC and the power supplier.

5.5 Project Schedule

The Project is proposed to start construction in 2018; however, this will be dependent on the successful completion of consultation and permitting, including a provincial EA Certificate, federal EA approval and other regulatory authorizations, permits or approvals.

A proposed schedule for the EA process, construction, and commissioning of the Project is provided below (**Table 5-1**).

Table 5-1 Anticipated Project Schedule

Milestone	Date
Project Start	2014
Completion of Feasibility Study (Engineering)	February 2016
Submit EA Certificate Application (provincial) and/or Environmental Impact Statement (EIS) (federal)	March 2017
Anticipated EA Approval	January 2018
Commence Construction (including Site Preparation)	Summer 2018
In Service Date	2022 to 2082
Decomissioning (Early Date)	2082 to 2083

[16] Panamax-sized vessels have capacities of 50,000 to 80,000 dead weight tonnes (DWT) and can carry 350,000 to 500,000 Bbls (http://www.britannica.com/technology/tanker).

6 SOCIO-ECONOMIC PROFILE

The following sections provide an overview of the socio-economic setting of the Project area (**Figure 3**). A preliminary list of potential interactions between the Project components and socio-economic environment is provided in **Section 6.5**.

6.1 Overview of First Nations near Project

The following is a brief recognition and introduction of the First Nations who may be affected by the Project and associated activities. PFEC recognizes and works to uphold the United Nations Declaration of the Rights of Indigenous Peoples. As such, PFEC respects and recognizes the First Nations traditional territories, title and rights, that are within the Project Area, as shown in **Figure 7**. The EAO would confirm its requirements for consultation with First Nations and Aboriginal groups early in the provincial EA process.

6.1.1 Tsimshian Nation

There are seven Tsimshian First Nations: Gitga'at, Kitasoo/Xaixais, Kitselas, Lax Kw'alaams, Kitsumkalum, Kitkatla and Metlakatla and other groups, who have organized into collectives which reflect their understanding of Tsimshian law, custom and social organization.[17] Gitga'at, Kitasoo/Xaixais, Kitselas, Kitsumkalum and Metlakatla are members of the Tsimshian First Nations Treaty Society. The socio-economic profile recognizes that these nations have a relationship and need consideration both in the role as a larger nation as well as at the individual First Nation community level.

6.1.1.1 Kitselas First Nation

The Kitselas First Nation is one of the First Nations in the Tsimshian First Nations Treaty Society[18]. The Kitselas Nation government is an autonomous government, that has responsibility for the Kitselas in a number of areas including treaty-making with BC and Canada. The Kitselas history speaks to a presence in the Kitselas Canyon and surrounding region for at least the past 5,000 years[19].

Kitselas First Nation is made up of 644 registered members who currently reside both on- and off-reserve (INAC, 2015). There are 301 members currently living on reserve. Chief Joseph Bevan and Council were appointed in June 2015 by election under the *Indian Act.* The appointment is for a period of two years.

[17] http://www.bctreaty.net/soi/soitsimshian.php
[18] http://www.kitselas.com/
[19] http://www.kitselas.com/index.php/about-kitselas/history/

The Kitselas, through the BC Treaty Process signed an Agreement in Principle (AIP) on August 4, 2015[20]. This AIP is an understanding leading to a potential Final Agreement that will provide jurisdiction to the Kitselas and full ownership and management of over 36,000 ha of lands, including the 1,000 ha of current reserve lands.

Kitselas has 10 reserves with a total land base of 1,004 ha: Chimdimash 2, Chimdimash 2a, Ikshenigwolk 3, Ketoneda 7, Kitselas 1, Kshish 4 (includes Kshish 4a), Kshish 4b, Kulspai 6, Port Essington and Zaimoetz 5.

There are no reserve lands within the PFEC Project area; however, the Refinery and the north half of the access road are within the Kitselas traditional territory (**Figure 7**) and proposed treaty settlement lands.

6.1.1.2 Haisla Nation

The Haisla, located in current-day Kitimat, BC have occupied lands for over 9,000 years, and for hundreds of years have occupied many village sites throughout their territory.[21] The Haisla Nation comprises two historic bands; the Kitamaat and Kitlope[22]. The Haisla have eight matrilineal clans, each with a resource area, winter village and chief. The matrilineal clans include Eagle, Beaver, Crow, Killer whale, Wolf, Frog, Raven and Salmon[23].

There are approximately 1,851 members with over half residing off-reserve as of September 2015. Approximately 700 members reside in Kitamaat Village located 10 km southwest of Kitimat at the head of the Douglas Channel.

Chief Ellis Ross and six council officials were elected to Haisla Nation governing council in 2013 for a four-year term, with an additional five councillors elected in 2015 under Custom Electoral System.

There are 19 reserves within Haisla territory, with a total land base of 655.6 ha (INAC, 2015): Crab River (Crab Harbour) 18, Gander Island 14, Giltoyees 13, Henderson's Ranch 11, Ja we yah's 99, Jugwees (Minette Bay) 5, Kemano 17, Kildala River (Thala) 10, Kitamaat 1, Kitamaat 2, Kitasa 7, Kitlope 16, Kuaste (Mud Bay) (Kildala Arm) 8, Misgatlee 14, Tahla (Kildala) 4, Tosehka (Eagle Bay) 12, Walth 3 and Wekellals 15.

The traditional territory of Haisla Nation overlaps the Project area, including the Refinery and the potential module access road (**Figure 7**). None of the reserve lands are expected to be directly affected by the Project.

[20] http://www.bctreaty.net/nations/agreements/Kitselas_AIP.pdf
[21] http://www.haisla.ca/community-2/history
[22] http://haisla.ca
[23] http://haisla.ca/community-2/about-the-haisla/

6.1.1.3 Lax Kw'alaams Band

Lax Kw'alaams includes the "Nine Tribes" of the lower Skeena River[24]. These tribes are represented currently by the Allied Tsimshian Tribes, and are among a total of 14 tribes of the Tsimshian nation. Lax Kw'alaams includes Giluts'aaw, Ginandoiks, Ginaxangiik, Gispaxlo'ots, Gitando, Gitlaan, Gits'iis, Gitwilgyoots and Gitzaxlaal. Mayor John Helin and Council were elected under the Custom Electoral System in late November, 2015 for a four-year period (INAC, 2015).

There are 3,351 members of Lax Kw'alaams with 871 residing on reserves (INAC, 2013). The total land base of Lax Kw'alaams Band is 16,496.2 ha over 81 reserves, villages and settlements (INAC, 2015). Lax Kw'alaams 1 is the most populated and is located at Port Simpson on the Tsimpsean Peninsula. The traditional territory of Lax Kw'alaams Band is adjacent to the north boundary of the Refinery site and intersects portions of the Project area (**Figure 7**). None of these reserves overlap with the Project area.

6.1.1.4 Metlakatla First Nation

The Metlakatla people have occupied an ancient site 5 km north of Prince Rupert for thousands of years[25]. As of November 2015, Metlkatla First Nation has 899 registered members with over 800 living away from reserve land. Chief Harold Leighton and Council were elected in 2013 under Custom Electoral System. The current appointment concludes in August 2016 (INAC, 2015).

There are 21 reserves within Metlakatla traditional territory, with a total land base of 7,740.7 ha (INAC, 2015): PFEC's Project area neighbours the traditional territory of Metlakatla First Nation to the north (**Figure 7**). The traditional territory of Metlakatla overlaps the Refinery and intersects portions of the Project area (**Figure 7**).

6.1.1.5 Kitsumkalum First Nation

Kitsumkalum is a galt'ap and original Tribe of the Tsimshian Nation[26]. As of November 2015, Kitsumkalum First Nation has 745 members with 238 people living on reserve. Kitsumkaylum 1 is the most populated reserve and is located on right bank of the Skeena River at mouth of the Kitsumkalum River about 5 km west of Terrace (INAC, 2015).

The Kitsumkalum signed an AIP with BC and Canada on August 4, 2015. The AIP includes approximately 45,406 ha of land, north and west of Terrace. Topics such as governance, taxation and natural resources (surface and subsurface) are within the AIP.

[24] http://laxkwalaams.ca/who-we-are/test-topic/
[25] http://www.metlakatla.ca/
[26] http://www.kitsumkalum.bc.ca/aboutus.html

Chief Don Roberts and Council were appointed in 2013 by election under the *Indian Act.* The current appointment concludes in March 2017 (INAC, 2015).

There are 4 reserves within Kitsumkalum territory, with a land base of 597 ha. There are no reserve lands within the PFEC Project area; however, the Refinery is within the Kitsumkalum traditional territory (**Figure 7**).

6.1.2 Métis Peoples

According to the 2006 Census, almost 400,000 people in Canada reported they were Métis[27]. The Métis people have established themselves with their own unique culture, traditions, language (Michif), way of life, collective consciousness and nationhood.

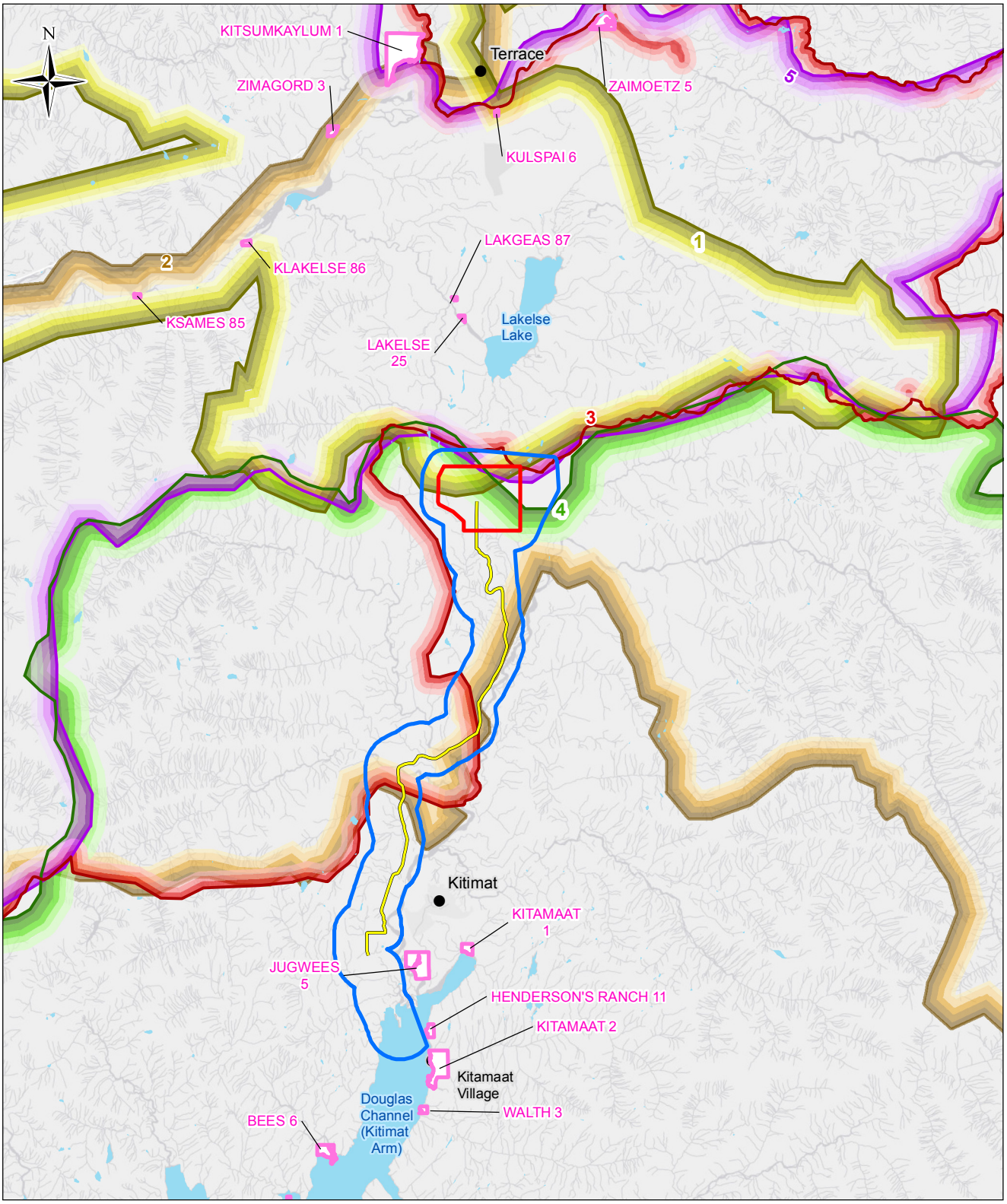
Métis Nation British Columbia (MNBC) is a Governing Member of the Métis National Council and is recognized as the official governing Métis organization in BC.[28] MNBC represents the political, legal, social and economic interests to over 12,500 Métis citizens throughout BC (MNBC 2016). Their mandate is "develop and enhance opportunities for Métis communities by implementing culturally relevant social and economic programs and services".

The MNBC Constitution was ratified in 2003, establishing a democratically-elected governance structure which has since enacted the Senate, Métis Nation Governing Assembly, Youth representation, Women's representation, an Electoral Act, and citizenship process[25].

MNBC has seven regions with over 25 chartered communities in BC. The Project is situated in MNBC's Northwest region (MNBC 2016).

In addition to MNBC, the BC Métis Federation (BCMF) is a non-profit association that works with Métis communities to ensure the well being of grassroots BCMF members[29].

[27] http://www.metisnation.ca/index.php/who-are-the-metis
[28] http://www.mnbc.ca/about-mnbc
[29] http://bcmetis.com/about/



Legend

- Refinery Location
- Project Area
- Potential Module Access Road
- 1 Kitsumkalum Territory
- 2 Kitselas Territory
- 3 Lax Kw'alaams Territory
- 4 Haisla Territory
- 5 Metlakatla Territory
- Indian Reserves
- Water Bodies

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data downloaded from GeoBC in September and October of 2015.
2. Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
3.Traditional Territories boundaries have been digitized from First Nation Interests Map produced by the Government of British Columbia on Oct 23, 2012, ©2016

0 2.5 5 10 15 Km

PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

SNC·LAVALIN

Pacific Future Energy Refinery First Nations Territories

By: SS	Date: 2016/05/19	Scale: 1:350,000	Figure Number: 7	Rev.: 3
Chk'd: EM	Coord. Sys.: NAD 1983 UTM Zone 9N		Reference No.: 631180-101-004	

MXD Path: \\Sll2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-004-R3_TraditionalTerritories.mxd

6.2 Overview of Other Communities near the Project Area

The following is a brief overview of communities near the Project area. Within the Project area there are no known permanent or temporary residences. The nearest known permanent residence is at Lakelse Lake, located 8 km north on Highway 37.

6.2.1 City of Terrace and Area

The City of Terrace is considered the centre of Northwest BC and is situated along the Skeena River about 30 km north of the Refinery site. Terrace is home to approximately 11,500 local residents and covers an area of approximately 60 square kilometres (km^2). The Greater Terrace area, with a population of nearly 20,000, includes the unincorporated community of Thornhill (population of 4,000) and the neighbouring communities within Electoral Area C: New Remo, Old Remo, Brauns Island, North Terrace, Jack Pine Flats, Lakelese Lake and Copperside (Adams, 2015).

Highway 37 is the main route connecting the Greater Terrace area to Kitimat and Kitamaat Village. Terrace's economic advantage lies in its location, as it is strategically placed in a hub for highway, rail and air transportation routes. As a result, the City is the location for many of the region's business, retail, medical and government services.

6.2.2 District of Kitimat

The District of Kitimat is a coastal community located approximately 32 km to the south of the Project. The townsite covers an area of approximately 750 ha at the end of the Kitimat Arm off Douglas Channel. Kitimat and the neigbouring community of Kitamaat Village is located within the base of a Kitimat River valley containing areas of flat industrial land near high tide levels.

Kitimat is home to over 9,000 residents, the greatest proportion of the population between 45 and 65 years of age (2011 Census). The community has over 4,300 housing units, where three-quarters are owner-occupied. Kitimat had a labour force of 4,270 in 2011, where 28.2% were employed in manufacturing. Construction, retail trade, health care and social assistance were other primary employment sectors.

6.3 Land and Resource Use

The Refinery is proposed on a provincial Crown map reserve zoned for industrial purposes and proposed Kitselas Treaty Settlement Lands. The legal description is *All that unalienated and unencumbered Crown land in the vicinity of Lakelse River, Lakelse Lake, and Kitimat River*.

The Refinery location overlaps with proposed pipeline projects including the Enbridge Pipeline, PTP and the BC Hydro Terrace to Kitimat Transmission Line (**Figure 8**)**.** PNG is proposing to loop their existing pipeline from Summit Lake, BC to Kitimat. The existing pipeline is just east of the Project, along the west side of Highway 37 (**Figure 8**).

A geothermal-use permit is in place northeast of the Refinery abutting Dubose Flats. Other land use types surrounding the Refinery include waste disposal, sand and gravel (**Figure 9**).

The Refinery is also adjacent to the Terrace Community Forest (TCF) (**Figure 9**). The TCF is a community-managed forest (by the City of Terrace) for the benefit of the local community. The TCF tenure was issued by the provincial government in 2007 with an allowable annual timber cut of over 30,000 m^3/yr located in two large parcels as well as a number of small parcels surrounding Terrace.

There are 42 tenures within the Project area categorized into nine types of land use **(Table 6-1)** which include the following:

- Commercial Recreation;
- Environment, Conservation & Recreation;
- First Nations proposed Treaty Area;
- Industrial – Heavy and light industrial, miscellaneous;
- Institutional – Local/Regional Park;
- Quarrying;
- Transportation;
- Utility; and
- Waterpower – Investigative phase.

Of these 42 tenures, there are 11 that intersect the Refinery site. These 11 tenures have five types of land use: Industrial (miscellaneous); Transportation (roadway); proposed Treaty Area; Utility (power line), and Environment, Conservation & Recreation. These are shaded in blue in **Table 6-1**.

In general, the Project area is known for year-round recreation with easy access via several Forestry Service Roads (FSRs). Included are several km of hiking trails, snowmobiling trails, and Forest recreation areas and campsites around the Clearwater and Onion Lakes. Through a tenure lease with FLNRO, the Ski Valley Nordics operate the Onion Lake cross-country ski trails, which span around both the Clearwater and Onion Lakes.

There are five (5) provincial parks within a 15 km distance from the Refinery location including Hai Lake-Mount Herman Park, Lakelse Lake Wetlands Park, Lakelse Lake Park, Nalbellah Creek Wetlands Park and Kitimat River Park, with the latter two located in the potential access road corridor (**Figure 9**). There are no Migratory Bird Sanctuaries (MBS) or National Parks within the Project area; nor is there overlap with federal land, including First Nations reserve land.

Table 6-1 Summary of Tenure Types within the Project Area

Type	Tenure Purpose	Tenure Subpurpose	Tenure Location	Legal Description	Tenure Area (Ha)
Investigative Licence	Waterpower	Investigative Phase	Dahl Creek	All that unsurveyed crown land in the vicinity of dahl creek and wedeene river, range 5 coast district, containing 378.37 hectares, more or less.	378.367
Investigative Licence	Waterpower	Investigative Phase	Bowbyes Creek	All that unsurveyed crown land in the vicinity of bowbyes creek and wedeene river, range 5 coast district, containing 325.34 hectares, more or less.	325.342
Investigative Permit	Industrial	Miscellaneous	Kitimat River	Unsurveyed r/w over ucl and over dl2696. C-38-a, d-37-a, d-35-a, c-32-a/103-i-7	0.47
Investigative Permit	Industrial	Miscellaneous	Cecil Creek	Unsurveyed right of way over unsurveyed crown land . A-92-j/103-i-2 c-11-b, b-21-b, c-21-b, c-40-a/103-i-07	1.16
Licence of Occupation	Institutional	Miscellaneous	Various Sites	All that unsurveyed crown land in the vicinity of clearwater lakes, together with that part of district lot 2684, range 5, coast district (sites 1 - 12), containing 0.113 hectares, more or less.	0.113
Licence of Occupation	Commercial Recreation	Heli Ski	Sw Of Terrace	All that unsurveyed crown land in the vicinity of weedeen river, little weedeen river, bish creek and mt. Jackman,valp, shroud and carthew together with district lots 5629, 5630, 5631, 5632, 5633, 5634, 5635, 5636 and 5643 and those parts of district lots 5621, 5622, 5624, 5625, 5626, 5628, 4935, 4936, 4938, 4940, 4804, 4805, 601 and 2653, all within range 5, coast district (excluding all private land and those areas covered by ministry of agriculture and lands' tenures).	105622.351
Licence of Occupation	Commercial Recreation	Guided Freshwater Recreation	Various Rivers	All that unsurveyed crown foreshore being part of the beds of wedeene & kitimat rivers, range 5, coast district, containing 999.525 hectares, more or less.	999.525
Licence of Occupation	Quarrying	Sand and Gravel	Little Wedeene	All that unsurveyed crown land in the vicinity of little wedeene river, range 5 coast district, containing 19.739 hectares, more or less.	19.739
Licence of Occupation	Industrial	Light Industrial	Cecil Creek	All that unsurveyed crown land in the vicinity of cecil creek, range 5 coast district, containing 106.211 hectares, more or less.	106.211
Licence Of Occupation	Transportation	Roadway	Cecil Creek	All that unsurveyed crown land in the vicinity of cecil creek , together with that parts of district lots 2701 and 2697, range 5 coast district, containing 5.897 hectares.	5.897

Table 6-1 (Cont'd) Summary of Tenure Types within the Project Area

Type	Tenure Purpose	Tenure Subpurpose	Tenure Location	Legal Description	Tenure Area (Ha)
Licence of Occupation	Institutional	Local/Regional Park	Kitimat	All that unsurveyed crown land in the vicinity of bowbeys creek, range 5 coast district, containing 354.88 hectares, more or less.	354.88
Licence of Occupation	Quarrying	Rock For Crushing	Kitimat	That part of district lot 6072, range 5, coast district.	8.05
Licence of Occupation	Institutional	Local/Regional Park	Kitimat	All that unsurveyed crown land in the vicinity of bowbeys creek, together with that part of right of way as shown on plan 5372 filed in prince rupert land title office, all range 5 coast district, containing 1,457.16 hectares, more or less.	1457.16
Notation of Interest	Environment, Conservation, & Recr	Science Measurement/Research	Soflakelselk	District lot 2689, range 5 coast district; district lot 2693, range 5 coast district; unsurveyed crown land, vicinity of lakelse lake, range 5, coast;	4047
Notation of Interest	Industrial	Heavy Industrial	Kitimat	That part of district lot 981 and 7940, range 5 coast district, containing 30.426 hectares, more or less.	30.426
Notation of Interest	Utility	Gas and Oil Pipeline	Kitimat/ Dawson Creek	Unalienated and unencumbered crown land being a 2 kilometre wide reserve from kitimat to groundbirch (near dawson creek).	131963.635
Notation of Interest	First Nations	Treaty Area	Douglas Channel/Kitimat Arm	All that unsurveyed crown land in the vicinity of kitimat arm together with district lot 3124 and those parts of district lots 310, and 3083, range 4 coast district, containing 10,053.01 hectares, more or less.	10053.01
Sec 16 Map Reserve	Transportation	Navigation Aid	South of Lakelse Lake	All that unsurveyed crown land in the vicinity of cecil creek, range 5, coast district, containing 0.37 hectares, more or less.	0.37
Sec 16 Map Reserve	Miscellaneous Land Uses	Planning/Marketing/ Develop Projects	Kitimat	Uns fs within kitimat arm as in red on sketch;	80
Sec 16 Map Reserve	Environment, Conservation, & Recreation	Forest Management Research	Onion Lake	That part of district lot 2684, range 5, coast district, containing 0.40 hectares, more or less.	0.4
Sec 16 Map Reserve	Environment, Conservation, & Recreation	Forest Management Research	South of Lakelse Lake	All that unsurveyed crown land lying west of district lot 2693, range 5, coast district, containing 60.70 hectares, more or less.	60.7
Sec 16 Map Reserve	Environment, Conservation, & Recreation	Forest Management Research	Deception Creek	All that unsurveyed crown land in the vicinity of deception creek, range 5, coast district, containing 80.0 hectares, more or less.	80

Table 6-1 (Cont'd) Summary of Tenure Types within the Project Area

Type	Tenure Purpose	Tenure Subpurpose	Tenure Location	Legal Description	Tenure Area (Ha)
Sec 16 Map Reserve	Environment, Conservation, & Recreation	Fishery Facility	Kitimat	All that unsurveyed crown in the vicinity of district lots 6057 and 7954, range 5, coast district, containing 0.53 hectares, more or less.	0.53
Sec 16 Map Reserve	Quarrying	Sand and Gravel	Lakelse Lake	That part of the s1/2 of se1/4, district lot 2693, range 5 coast district, containing 42.04 hectares, more or less.	42.04
Sec 16 Map Reserve	Industrial	Miscellaneous	Terrace-Kitimat Corridor	All that unalienated and unencumbered crown land in the vicinity of the kitimat river, range 5 coast district, containing 27,355.64 hectares, more or less.	27355.64
Sec 16 Map Reserve	Industrial	Miscellaneous	Douglas Channel	All that unalienated and unencumbered crown land in the vicinity of kitimat, and all that unalienated and unencumbered crown foreshore being part of the bed of kitimat arm and kildala arm, both range 4 and range 5 coast districts, containing 89,110.67 hectares, more or less.	89110.67
Sec 16 Map Reserve	Industrial	Miscellaneous	Dubose	All that unalienated and unencumbered crown land in the vicinity of dubose, and those parts of district lots 2689, 2697, and 2701, range 5 coast district, containing 582.35 hectares, more or less.	582.35
Sec 17 Designated Use Area	First Nations	Treaty Area	Kitselas	All that unalienated and unencumbered crown land in the vicnity of lakelse river, lakelse lake, and kitimat river; together with block a district lot 928, block a district lot 5146 except plan prp3510, block b district lot 5146 except plan prp3510, block c district lot 4782, and district lots 993, 995, 1719, 1731, 4472, 5147, 5148, 5964, 6255, 6260, 6261, 6264, 6796, 6797, 6798, 6799, 7725, 8026; together will those parts of district lots 928, 930, 994, 997, 1720, 1721, 1722, 1723, 2660, 2684, 2693, 2695, 2697, 2702, 3980, 3982, 4471, 4473, 4480, 4473, 4480, 4782, 5135, 5143, 5145, 5146, 6261, 6257, and 7726; and those parts of rights of way as show on plans 4346, 4361, 4362, 5353, 5354, 5445, 5484, 6213, 6214, 6478, 6509, 10877, and 10881 filed in prince rupert land title office and plan 41417 filed in prince george land title office, all range 5 coast district, containing 3,979.54 hectares, more or less.	3979.54
Sec 17 Designated Use Area	Industrial	Miscellaneous	South of Forceman Ridge	All that unsurveyed crown land lying 5outh of forceman ridge, excluding rights of way as shown on plans 4346, 5336, 5354, 6489, 6509, 10873 and 10877, together with those parts of district lots 2663, 2680 and 2684, range 5 coast district, containing 1,172.076 hectares, more or less.	1172.076

Table 6-1 (Cont'd) Summary of Tenure Types within the Project Area

Type	Tenure Purpose	Tenure Subpurpose	Tenure Location	Legal Description	Tenure Area (Ha)
Sec 17 Designated Use Area	Industrial	Miscellaneous	Terrace to Kitimat Corridor	Unsurveyed right of way over unsurveyed crown land in the vicinity of lakelse lake and kitimat river together with those parts of district lots 996, 2275, 2657, 2658, 2661, 2675, 2676, 2677, 2678, 2689, 5147, block a and block b, district lot 5149, 5969, 5970, 6051, 6094, 6095, 6101, and 6108, and that part of right of way over unsurveyed crown land, as shown on plan 5515 filed in prince rupert land title office, all range 5 coast district, containing 4,263.39 hectares, more or less.	4263.39
Standard Lease	Industrial	Log Handling/Storage	Kitimat	District lot 7940, except block a of district lots 7940 and 981, all range 5, coast district.	13.436
Standard Lease	Industrial	Heavy Industrial	Kitimat Arm	District lot 981, range 5 coast district, except block a.	15.7
Statutory Right of Way(Or Easement)	Utility	Electric Power Line	Kitimat-Terrace		121.058
Statutory Right of Way(Or Easement)	Utility	Electric Power Line	Kitimat Rvre	Rw over ufs on pl 15&16t488 bed of kitimat r vic l6034,6266,&6271;	1.04
Statutory Right of Way(Or Easement)	Utility	Electric Power Line	Kitimat-Terrace	West 1/2 of district lot 6165, range 5 coast district; west 1/2 of district lot 6183, range 5 coast district; west 1/2 of district lot 6184, range 5 coast district; east 1/2 of district lot 6199, range 5 coast district; east 1/2 of district lot 6200, range 5 coast district; east 1/2 of district lot 6201, range 5 coast district; east 1/2 of district lot 6206, range 5 coast district; west 1/2 of district lot 6211, range 5 coast district; west 1/2 of district lot 6212, range 5 coast district; west 1/2 of district lot 6213, range 5 coast district; west 1/2 of district lot 6214, range 5 coast district; west 1/2 of district lot 6215, range 5 coast district; west 1/2 of district lot 6216, range 5 coast district; west 1/2 of district lot 6217, range 5 coast district; east 1/2 of district lot 6244, range 5 coast district; west 1/2 of district lot 1725, range 5 coast district; remainder of w 1/2; district lot 2285, range 5 coast district; district lot 990, range 5 coast district; district lot 2665, range 5 coast district; district lot 6155, range 5 coast district; district lot 6164, range 5 coast district; district lot 6185, range 5 coast district; district lot 6187, range 5 coast district; district lot 6198, range 5 coast district; district lot 6209, range 5 coast district; district lot 6210, range 5 coast district; district lot 6225, range 5 coast district; district lot 6242, range 5 coast district; district lot 6243, range 5 coast district; district lot 1722, range 5 coast district; district lot 1723, range 5 coast district; district lot 1726, range 5 coast district; district lot 1734, range 5 coast district; district lot 6188, range 5 coast district; district lot 4469, range 5 coast district;	118.9

Table 6-1 (Cont'd) Summary of Tenure Types within the Project Area

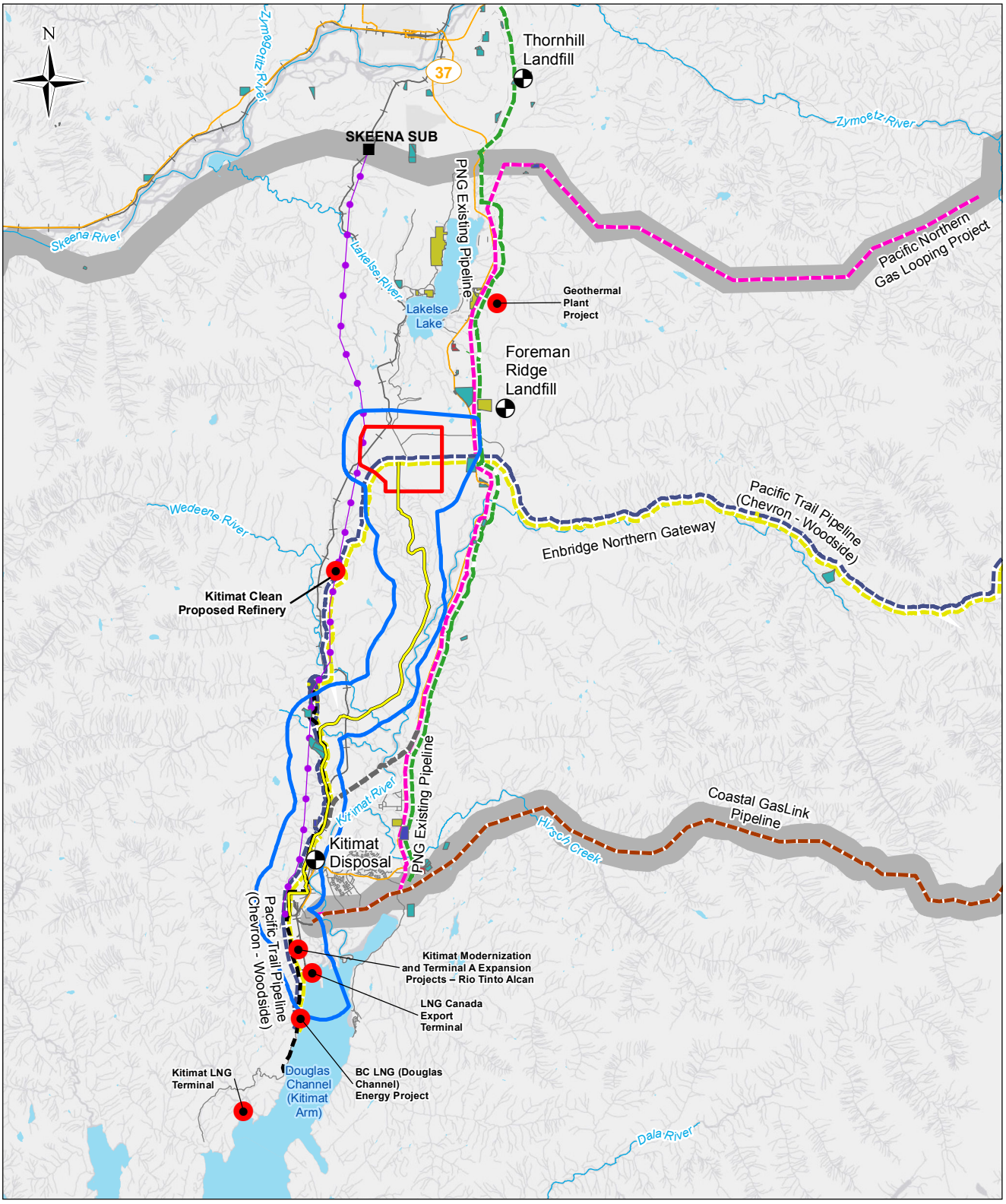
Type	Tenure Purpose	Tenure Subpurpose	Tenure Location	Legal Description	Tenure Area (Ha)
Statutory Right of Way(Or Easement)	Utility	Gas and Oil Pipeline	Summit Lake	District lot 197, range 5 coast district; district lot 241, range 5 coast district; district lot 242, range 5 coast district; r/w over ucl r5c, plan 8264; r/w over ucl r5c, plan 8265; r/w over ucl r5c, plan 8267; r/w over ucl r5c, plan 8278; r/w over ucl r5c, plan 8297; r/w over ucl r5c, plan 8386; r/w over ucl r5c, plan 7429; r/w over ucl r5c, plan 7437; r/w over ucl r5c, plan 6947; r/w over ucl r5c, plan 6927; r/w over ucl r5c, plan 7096; r/w over ucl r5c, plan 7097; r/w over ucl r5c, plan 7015; r/w over ucl r5c, plan 7011; r/w over ucl r5c, plan 6151; r/w over ucl r5c, plan 6399; r/w over ucl r5c, plan 6418; r/w over ucl r5c, plan 6417; r/w over ufs (being the bed of the telkwa river) plan 6314; r/w over ucl r5c, plan 6398; r/w over ucl r5c, plan 6438; r/w over ucl r5c, plan 6436; r/w over ucl r5c, plan 6509; r/w over ucl r5c, plan 6489; r/w over ucl r5c, plan 6478; r/w over ucl r5c, plan 6488; r/w over ucl r5c, plan 6516; r/w over ucl r5c, plan 6435; r/w over ucl r5c, plan 6503; r/w over ucl r5c, plan 6574; r/w over ucl r5c, plan 6571; r/w over ufs (the bed of the stellako river) r5c, plan 6609; r/w over ucl r5c, plan 6525; r/w over ucl r5c, plan 6508; r/w over ucl r5c, plan 6523; r/w over ucl r5c, plan 6519; r/w over ucl r5c, plan 6522; r/w over ucl r5c, plan 6541; r/w over ufs being the bed of the bulkley river r5c, plan 6592; r/w over ucl r5c, plan 10817; r/w over ucl r5c, plan 8268; r/w over ucl r5c, plan 10993; r/w over ucl r5c, plan 6456; r/w over ucl r5c, plan 6390; r/w over ucl r5c, plan 6457; right of way over district lots 1930, 1932, 4004, 4005, 423, range 5 coast district and parts of district lot 1918, range 5 coast district, as shown on plan 6479 filed in prince rupert land title office. Right of way over district lots 446, 449, 634, range 5 coast district, as shown on plan 6437 filed in prince rupert land title office.	10.2553
Statutory Right of Way(Or Easement)	Utility	Gas and Oil Pipeline	Terrace-Kitimat	Lot a of district lot 422, range 5 coast district, plan 5750; west 1/2 of district lot 6165, range 5 coast district; west 1/2 of district lot 6183, range 5 coast district; east 1/2 of district lot 6200, range 5 coast district; east 1/2 of district lot 6201, range 5 coast district; east 1/2 of district lot 6204, range 5 coast district; east 1/2 of district lot 6206, range 5 coast district; westW 1/2 of district lot 6211, range 5 coast district; west 1/2 of district lot 6212, range 5 coast district; west 1/2 of district lot 6213, range 5 coast district; west 1/2 of district lot 6214, range 5 coast district; west 1/2 of district lot 6215, range 5 coast district; west 1/2 of district lot 6216, range 5 coast district; west 1/2 of district lot 6217, range 5 coast district; east 1/2 of district lot 6244, range 5 coast district; west 1/2 , and east 1/2 of district lot 1725, range 5 coast district; bk d plan 1304 on plan 10762; district lot 7725, range 5 coast district; district lot 7726, range 5 coast district; district lot 5133,	91.2404

Table 6-1 (Cont'd) Summary of Tenure Types within the Project Area

Type	Tenure Purpose	Tenure Subpurpose	Tenure Location	Legal Description	Tenure Area (Ha)
Statutory Right of Way(Or Easement) (Cont'd)	Utility	Gas and Oil Pipeline	Terrace-Kitimat	range 5 coast district; district lot 6264, range 5 coast district; district lot 2285, range 5 coast district; district lot 1051, range 5 coast district; district lot 1431, range 5 coast district; district lot 2663, range 5 coast district; district lot 2664, range 5 coast district; district lot 2684, range 5 coast district; district lot 2693, range 5 coast district; district lot 2702, range 5 coast district; district lot 3980, range 5 coast district; district lot 5964, range 5 coast district; district lot 6155, range 5 coast district; district lot 6164, range 5 coast district; district lot 6184, range 5 coast district; district lot 6187, range 5 coast district; district lot 1729, range 5 coast district; district lot 6198, range 5 coast district; district lot 6199, range 5 coast district; district lot 6209, range 5 coast district; district lot 6222, range 5 coast district; district lot 6225, range 5 coast district; district lot 6242, ran	
Statutory Right of Way(Or Easement)	Utility	Electric Power Line	Kitimat-Princer	Lot 1, block 228, and lot 2, block 228, and lot 3, block 228, and lot 4, block 228, and lot 5, block 228, and lot 1, block 218, and lot 1, block 219, and lot 1, block 220, and lot 1, block 221, and lot 1, block 222, and lot 1, block 223, and lot 1, block 224, and lot 2, block 218, and lot 2, block 219, and lot 2, block 220, and lot 2, block 221, and lot 2, block 222, and lot 2, block 223, and lot 2, block 224, and lot 3, block 218, and lot 3, block 219, and lot 3, block 220, and lot 3, block 221, and lot 3, block 222, and lot 3, block 223, and lot 3, block 224, and lot 4, block 218, and lot 4, block 219, and lot 4, block 220, and lot 4, block 221, and lot 4, block 222, and lot 4, block 223, and lot 4, block 224, and lot 5, block 218, and lot 5, block 219, and lot 5, block 220, and lot 5, block 221, and lot 5, block 222, and lot 5, block 223, and lot 5, block 224, and lot 6, block 218, and lot 6, block 219, and lot 6, block 220, and lot 6, block 221, and lot 6, block 222, and lot 6, block 223, and lot 6, block 224, and lot 7, block 218, and lot 7, block 219, and lot 7, block 220, and lot 7, block 221, and lot 7, block 222, and lot 7, block 223, and lot 7, block 224, and lot 1, block 205, and lot 2, block 205, and lot 3, block 205, and lot 4, block 205, and lot 5, block 205, and lot 6, block 205, and lot 7, block 205, and lot 1, block 201, and lot 2, block 201, and lot 3, block 201, and lot 4, block 201 of district lot 607, range 5 coast district, plan 1136; west 1/2 of district lot 6075, range 5 coast district; east 1/2 of district lot 6081, range 5 coast district; east 1/2 of district lot 6085, range 5 coast district; west 1/2 of district lot 6100, range 5 coast district; east 1/2 of district lot 6104, range 5 coast district; east 1/2 of district lot 6204, range 5 coast district; east 1/2 of district lot 6206, range 5 coast district; west 1/2 of district lot 6211, range 5 coast district; west 1/2 of district lot 6212, range 5 coast district; west 1/2 of di	726.9

Table 6-1 (Cont'd) Summary of Tenure Types within the Project Area

Type	Tenure Purpose	Tenure Subpurpose	Tenure Location	Legal Description	Tenure Area (Ha)
Temporary licence	Utility	Electric power line	Kitimat to terrace	Unsurveyed right of way over unsurveyed crown land in the vicinity of lakelse river and kitimat river, together with that part of block a, district lot 5146, and those parts of district lots 996, 2658, 2676, 5147, 6095, and 6096, range 5 coast district, containing 40.34 hectares, more or less.	40.34
Temporary licence	Utility	Electric power line	Kitimat to terrace	Unsurveyed right of way over unsurveyed crown land in the vicinity of lakelse lake and kitimat river together with those parts of district lots 996,2275, 2657, 2658, 2661, 2675, 2676, 2677, 2678, 2689, 5147, block a and block b, district lot 5149, 5969, 5970, 6051, 6094, 6095, 6101, and 6108, and that part of right of way over unsurveyed crown land, as shown on plan 5515 filed in prince rupert land title office, all range 5 coast district, containing 4,263.39 hectares, more or less.	4263.39
Temporary permit	Transportation	Roadway	Kitimat arm	Unsurveyed right of way over unsurveyed crown land (from d-57-j to a-94-f, 103-h-15).	104.38
Temporary permit	Industrial	Miscellaneous	Bish fsr	All that unsurveyed crown land in the vicinity of bish creek forest service road, range 5 coast district, containing .852 hectares more or less.	0.852
Temporary permit	Transportation	Roadway	Kitimat river	From b-51-l/93-l-4 to c-24-g/103-i-2	59.82



Legend

- Refinery Location
- Project Area
- Landfill
- Projects
- Proposed Module Access Road
- Other Pipeline Projects
- PNG Existing Pipeline
- Pacific Trail Pipeline
- Enbridge Northern Gateway
- Coastal GasLink Pipeline
- Pacific Northern Gas Looping Project Pipeline
- Kitimat Clean Proposed Pipeline
- Proposed TKTP Transmission Line

Quarrying

- Rip Rap
- Rock for Crushing
- Sand and Gravel
- Waste Disposal Site
- O&G Utilities Tenures
- Highways
- Other Roads
- Rail Tracks
- Watercourses
- Water Bodies

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data downloaded from GeoBC in September and October of 2015.
3.Landfills were mapped based on The Regional District of Kitimat-Stikine website and GoogleEarth
3.Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
©2016

0 3.5 7 14 Km

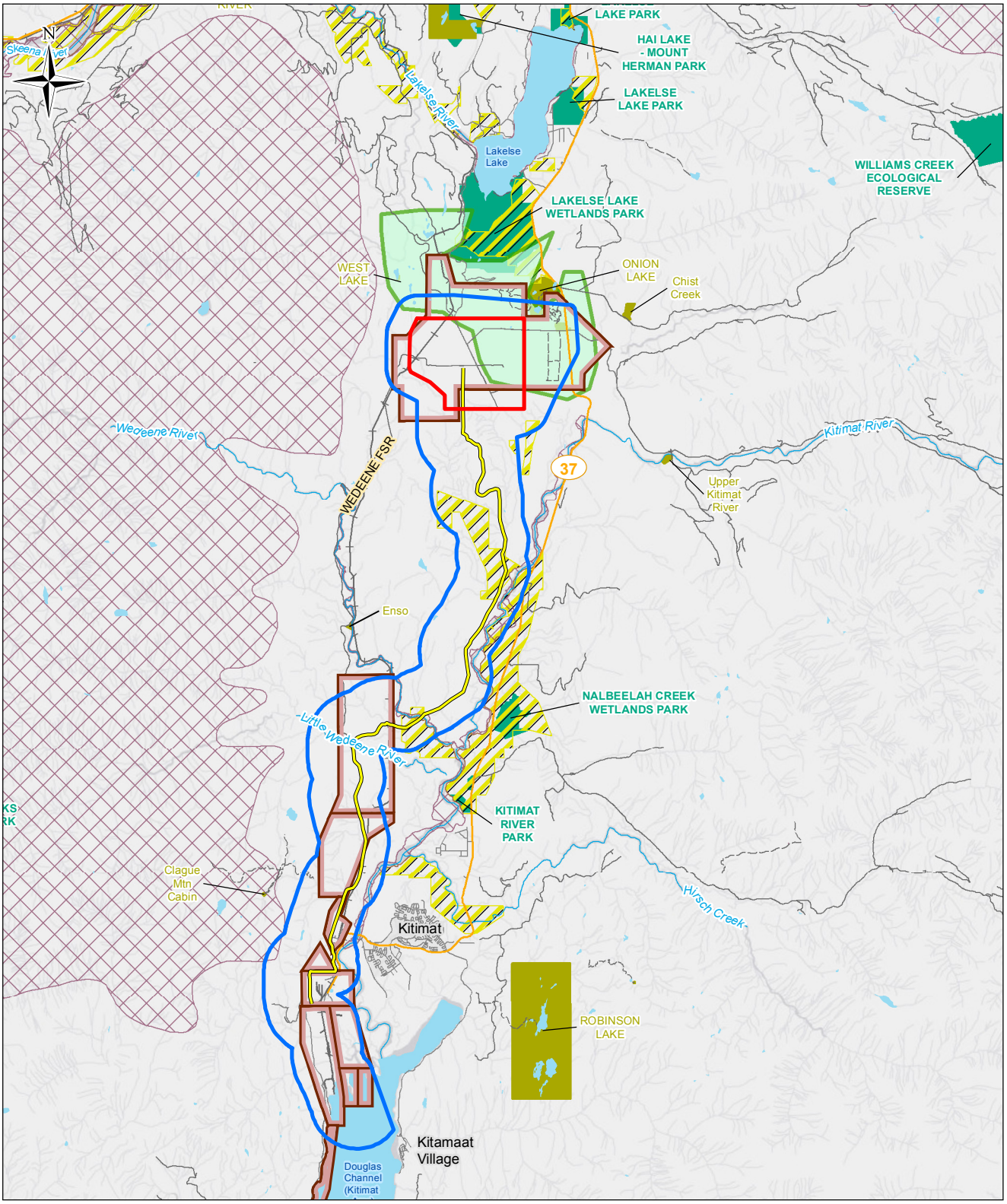
PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

SNC·LAVALIN

Pacific Future Energy Refinery Current and Proposed Projects near the PFEC Refinery

By: ECH	Date: 2016/06/10	Scale: 1:350,000	Figure Number: 8	Rev.: 2
Chk'd: EM	Coord. Sys.: NAD 1983 UTM Zone 9N		Reference No.: 631180-101-010	

MXD Path: \\Sll2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-010-R2_Projects.mxd



Legend

- Refinery Location
- Project Area
- Potential Module Access Road
- Terrace Community Forest
- Commercial Recreation Sites
- Proposed Industrial Development Areas
- Agricultural Land Reserve
- Recreation Areas
- Parks and Protected Areas
- Highways
- Other Roads
- Forestry Roads
- Recreation Trails
- Rail Tracks
- Watercourses
- Water Bodies

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data downloaded from GeoBC in September and October of 2015.
2. Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
©2016

0 2.5 5 10 Km

PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

SNC·LAVALIN

Pacific Future Energy Refinery Land and Resource Use

By: SS	Date: 2016/05/09	Scale: 1:250,000	Figure Number: 9	Rev.: 2
Chk'd: SM	Coord. Sys.: NAD 1983 UTM Zone 9N		Reference No.: 631180-101-005	

MXD Path: \\Sll2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-005-R2_Land_And_Resource_Use.mxd

6.4 Heritage Resources

The archaeological values near the proposed Refinery are considered to be of "moderate potential" in the area around Cecil Creek and high potential around Chist Creek. Portions of the proposed transportation corridor may also have areas of "high potential", in particular where clear-span crossings, or works near watercourses are required during construction.

An Archaeological Overview Assessment (AOA) completed by Bastion Group Heritage Consultants in 2007 for the PTP project used the following criteria to develop a scheme for archaeological potential. Portions of PTP AOA overlap with the PFEC Project area. According to Bastion Group (2007), these criteria tend to be indicators for moderate or high archaeological potential:

- Presence/absence of terrace landforms adjacent to or in close proximity to a stream, lakeshore, wetland or other water body;
- Presence/absence of hilltops or knoll features (often associated with lithic scatter sites);
- Presence/absence and proximity to known fish-bearing streams, game trails, game crossings or documented First Nations settlements or documented natural resource exploitation areas;
- Proximity to previously documented archaeological resources or traditional use sites;
- Major river and stream crossings - especially if associated with salmon bearing streams;
- Cave and rock features such as rock shelters and steep cliffs (sometimes found to contain rock art sites, human burial remains or evidence of occupation); and
- Areas of mature first-growth timber, considered to have a potential for containing culturally modified trees (CMTs).

As shown in Figure 7, the Project area is within the traditional territory of five First Nation groups: Kitselas First Nation, Haisla Nation, Lax Kw'alaams Band, Metlakatla First Nation and Kitsumkalum First Nation. Engagement and consultation with these Nations has been preliminary; PFEC recognizes that the Project and its activities will affect lands and resources currently used by First Nations for traditional purposes. In an effort to minimize the Project's effects on heritage-related values, PFEC will engage affected First Nations gathering information on traditional land and resource use and Traditional Ecological Knowledge through consultation. AOA and Traditional Use Studies will also be undertaken for the Project. The results of these studies will be integrated into the EA.

6.5 Summary of Potential Project Interactions with Socio-Economic Values

Taking into consideration the brief socio-economic profile described above, PFEC has identified a number of potential interactions between the Project components (identified in **Table 4-1**) with

social-, economic-, health- and heritage-related values which are likely of relevance to the Project area and general region. These interactions are categorized by Project phase (C – Construction, O – Operation, D – Decommissioning and Reclamation, A – All phases) and are presented in **Table 6-2**.

Table 6-2 Preliminary Identification of Potential Project Component – Socio-Economic Interactions

Project Components		Socio-economic Environment							
		Economy	Community services	Land and Resource Use	Traditional Land and Resource Use	Archaeology	Human Health	Visual Aesthetic	Traffic (road, rail, marine)
Refinery Infrastructure	Bitumen oil refinery (built from 100 to 150 pre-fabricated modules, each weighing between 2,500 and 5,000 MT)	A	A	A	A	A	A	O	A
	Rail yard (unloading and loading) with seven tracks (total length of 20.9 km), capable of receiving up to four unit trains per day (120 rail cars each)	A	A		A	A	A		A
	Upgraded road to the site from Highway 37	CO			A	A	A		A
	Tie-in to an existing natural gas pipeline	C			C	C	A		CD
	On site storage for feedstock and refined products with a total capacity of greater than 500,000 m3	C		C	C	C	C		CD
	Administrative building to hold 100 persons (approximately 3 floors, each 1,000 m2);	C		C	C	C	C		A
	Four explosion-proof control rooms (approx. 800 m2 each) for process unit groups: • Distillate Hydrotreater, Gas Oil Hydrocracker/ Hydrotreater, Hydrogen Production Unit, SWSs, ARU and SRU; • Distillation units, Isomerization Unit, and Catalytic Reforming Unit; • Residue Conversion Unit and Gasifier Unit; and • Oil Movement.	C		C	C	C	C		CD
	Building for laboratory analysis (approximately 500 m2);	C		C	C	C	C		CD
	Control Room for Power Generation, Raw Water Treatment and Wastewater Treatment (approximately 800 m2);	C		C	C	C	C		CD
	Shop for turbines for the power generation (approximately 2,000 m2)	C		C	C	C	C		CD
	Shop for spare parts and PPE (approximately 2,000 m2)	C		C	C	C	C		CD
	Shop for catalyst and chemicals (approximately 2,000 m2)	C		C	C	C	C		CD
	Building for Electrical, Instrumentation and Maintenance (approximately 1,200 m2)	C		C	C	C	C		CD
	Building for firefighting equipment and first aid (approximately 1,500 m2)	C		C	C	C	C		CD

Project Components		Socio-economic Environment							
		Economy	Community services	Land and Resource Use	Traditional Land and Resource Use	Archaeology	Human Health	Visual Aesthetic	Traffic (road, rail, marine)
Refinery Utilities Infrastructure	Electrical power infrastructure (steam-turbine and gas-turbine generator)	C	C	A	C	C	A		CD
	Electrical power infrastructure: Biomass facility (supply from pulp wood and hog fuel)	A		A	C	C	A		CD
	Emergency power (combination of standby fuel gas- or natural- gas-driven generators for critical loads)								
	Raw water system (surface and/or groundwater)	CO		CO	C	C	CO		CD
	BFW and steam	CO							CD
	Sanitary and potable water system	CO	O						CD
	Domestic sewage system	CO	O						CD
	Surface water management system (runoff ponds)	CO		C	C	C	CO		CD
	Fuel gas and natural gas (supplied from off site)	CO		O			O		CD
	Instrument and Utility Air System	CO							CD
	Fire, gas and smoke detection System	CO							CD
	Fire water system (oxygen and nitrogen)	CO		C	C	C	A		CD
	Hydrocarbon drain system (Closer Drain System and Open Drain/ OWS Drain System)	CO		C	C	C	A		CD
	Relief and flare	C		C	C	C		CO	CD
	Waste Management System	A	A		C	C	C		A
	A 6” water pipeline from the Refinery to Kitimat for the discharge of treated wastewater from the Refinery.	C	O	A	C	C	O	C	CD
Potential Surface Water Intake Structure	Intake structure on Kitimat River (no diversion, min. river depth of 0.7m at point of intake, concrete structure, scour protection and wedge weir screen, protection of fish through screen)	C		A	C	C		CO	CD
	Access road from Refinery to intake structure	C		A	C	C		CO	A
	Dual pipes from structure to the pump station	C		A	C	C		C	C
Construction-related Refinery Infrastructure	Trailers, fabrication shops, and material storage shop	C							C
	Existing off-loading dock (former Eurocan dock) in Kitimat to receive Refinery modules during construction								C
	Potential Refinery Module Access Road (40 km long by 50 m wide) with a clear-span crossing on Wedeene River and Little Wedeene River	A	A	C	C	C	A	CO	C
	Workforce housing accommodations	A	A	C	C	C	A		C

7 ENVIRONMENTAL PROFILE

The following sections provide an overview of the environmental setting of the Project area (**Figure 3**). A preliminary list of potential interactions between the Project components and biophysical environment is provided in **Section 7.3**.

7.1 Physical Resources

The Project area is situated within the Coastal Mountain Resource District (FLNRO, 2013), Kalum Timber Supply Area (MoF, 1998) and RDKS. The proposed Refinery is on provincial Crown land locally known as Dubose or Onion Lake Flats. Much of the area is part of the TCF (McElhanney, 2015a). Based on historical records provided by RDKS (RDKS, 1998), almost all of the timber resource within the Refinery site and surrounding area was logged prior to 1980.

The Project area is located within the Kalum LRMP boundary. Legal old-growth management areas (OGMAs) have been delineated around Clearwater Lakes, on Iron Mountain, in the Wedeene and Little Wedeene drainages, and along the Kitimat River (iMapBC, 2015). The Project area overlaps four landscape units: Hot Springs and Kitimat (low biodiversity emphasis option), and Wedeene and Hirsch (intermediate biodiversity option).

7.1.1 Hydrology and Groundwater

In general, the proposed Refinery is situated on a natural plateau bench approximately 1,000 ha in plan area. The overall Project dimensions range between about 10 km wide east-west by 5 km long north-south with topographic elevations ranging between about El. 210 m and 190 m (north to south). The Project is contained by steep mountain valley slopes to the east and west (McElhanney, 2015a). The existing plateau bench ground surface slopes down towards the south at less than 1%, and beyond the bench area, the ground slopes down to the north towards Lakelse Lake and the south towards Kitimat at slopes ranging between 5 – 20%. The area for the potential access road extends for a distance of approximately 40 km from Kitimat to the Refinery.

Geological Survey of Canada Map 1136A Geology Terrace, BC (published 1964) indicates the Project is underlain by Quaternary (Pleistocene and Recent) deposits of sand, gravel, clay and alluvium. The online BC Water Resources Atlas (http://maps.gov.bc.ca/ess/sv/wrbc/) indicates that the Project is underlain by two aquifers: a larger aquifer of moderate productivity in unconsolidated deposits and a smaller aquifer of higher productivity. As many as five wells are completed in the moderate productivity aquifer while four wells are completed in the higher productivity aquifer. The wells are indicated to be used for commercial and industrial purposes.

The Refinery, proposed in the southwest corner of Dubose Flats is in Kitimat River watershed, which flows south into Douglas Channel. The Kitimat River is approximately 4.5 km southeast of the Refinery. While the Refinery has no overlap with local watercourses, there are three major tributaries near the site. These include Clearwater Creek, which is within the Lakelse River watershed (flows north to the Skeena River), Cecil and Chist Creeks (Kitimat River watershed). In addition to the tributaries, a number of small lakes and wetlands are present near the Refinery, such as Clearwater Lake and Onion Lake.

The Project will require approximately 48,000 m^3/d of source water for the refining process. PFEC has begun investigating options for the water source, with groundwater being the preferred option. Once a TUP is in place, PFEC will undertake groundwater investigations to determine the feasibility of using groundwater as the preferred water source. As an alternative, PFEC will consider a surface water source such as the Kitimat River, located 4.5 km southeast of the Refinery, for Project needs during operation. As part of the EIA, PFEC will study the potential impacts of water extraction to the aquifers noted above, hydraulic connection to local surface watercourses (if any), as well as the Kitimat River. First Nations will be involved in hydrogeological and hydrological field studies.

7.1.2 Bedrock and Surficial Geology

The bedrock geology in the vicinity of the Project area consists of Lower and Middle Jurassic aged Hazelton Group bedrock consisting of andesite, breccias, tuff, greywacke and argillite and Upper Cretaceous or Later Coast Intrusions consisting of hornblende diorite, quartz diorite and migmatite. At the southeast edge of the proposed transportation corridor, Triassic aged limestone, boulder conglomerate, greywacke, banded volcanic sandstone and chert are exposed (GSC Map 1136A). The valley is controlled by bedrock faults, which cause movement over time, resulting in hot-spring activity along the boundary fault at Lakelse Lake. Surrounding the Refinery site, historical glacial melt has resulted in the near-level glaciofluvial plateau bench and marine deltaic sediments, as spotted by numerous circular or kettle depressions such as Onion Lake or Clearwater Lakes. Along the southern extent of the plateau, the exposed glaciomarine sediments show evidence of slope instability and appear to be readily erodible along the Kitimat River and drainage channels (McElhanney, 2015a).

As part of the EIA, PFEC will undertake geotechnical studies with First Nations to identify and assess potential geohazards associated with constructing a refinery, module road and other ancillary facilities for this Project.

7.1.3 Climate and Air Quality

The Project area between the proposed Refinery and Kitimat is influenced by Pacific air streams, resulting in small seasonal temperature differences compared with communities further inland (Stantec, 2013). The Terrace A weather station indicates temperatures hover around freezing in the winter, with a mean minimum of -5.4˚C, and rarely exceed 20˚C in the summer (Hectares BC, 2015); however, extreme temperatures have been recorded at -26.7°C in December and 37.3°C in

July (EC, 2015). The Annual Heat Moisture Index is 10.3, and the Hargreaves Climatic Moisture Deficit is 132 mm. Mean annual precipitation in the site vicinity is approximately 1,609 millimetres (mm) (Hectares BC, 2015). Daily precipitation maxima generally occur in October, December and January, and are in the range of 111 mm to 115 mm**.** The average estimated wind speed in the area is 11 km/h, with an annual maximum of 44 km/h. Prevalent winds are from the south from March to October, and north from November to February (EC, 2015).

Air quality at the Refinery site has been influenced by existing and past industrial development. There are currently six active air quality monitoring stations near Kitimat and one near Terrace (BC Gov, 2015). Overall air quality can be considered 'good' (i.e., low health risk) based on the data over the past several years.

At present, the main concern for air quality around the proposed Refinery is from dust due to the significant number of FSRs in the surrounding region (McElhanney, 2015b), in addition to the potential cumulative effects on the Kitimat airshed from other nearby projects. In 2013, ESSA and BC Ministry of Environment (MoE) conducted an airshed study of the Kitimat Valley including Rio Tinto Alcan Inc.'s (RTA) existing and planned infrastructure, four proposed liquefied natural gas (LNG) facilities, a proposed oil refinery, gas-turbine powered electrical generation facilities, as well as related marine transportation sources. The 2013 assessment area covered 6,772 km^2. PFEC's Refinery is within the assessment area.

PFEC's goal is to develop a Refinery with NZNC emissions, and is employing innovations and proven technologies to achieve this goal. As specified in **Section 4.1.3**, PFEC's carbon management strategy is to significantly reduce CO_2 emissions from the refining process thereby minimizing the Project's contribution to global greenhouse gas emissions. The Refinery footprint and potential access road alignment will not overlap with federal land; however, PFEC will assess the potential effects of the Project on air quality within the Kitimat airshed where federal land is present (Figure 7).

Once a LOO is in place, PFEC plans to install a meteorological tower within the 1,000 ha site to collect baseline data on the local airshed to assess the potential combined effects of the Project and other projects (**Section 9**) from industrial air emissions on the environment and human health. First Nations will be involved in these studies.

7.2 Biological Resources

7.2.1 Vegetation and Ecosystems

The majority of the Project area is in the submontane variant of the Coastal Western Hemlock wet submaritime subzone (CWHws1) in the Nass Mountains Ecosection (iMapBC, 2015). The CWHws1 has moist summers with significant dry spells, and relatively heavy snowfall (Banner *et al*., 1993). Original forests in the region were typically composed of western hemlock (*Tsuga heterophylla*), amabilis fir (*Abies amabilis*), western redcedar (*Thuja plicata*), and Sitka spruce (*Picea sitchensis*) (McElhanney, 2015b).

The southern portion of the Project area near Kitimat is located within the submontane variant of the CWH very wet maritime subzone (CWHvm1). The climate of the CWHvm1 is wet, humid and maritime with a long growing season and comparatively little snow during the winter (Banner *et al.,* 1993). Dominant tree species include western hemlock, western redcedar, Sitka spruce and amabilis fir. Before development, the majority of the valley was in a mature or old growth structural stage with wind and fire being the most dominant natural disturbances (McElhanney, 2015b).

The Project area is a mosaic of coniferous and mixed forest, riparian and shrubby habitat, with fen and bog ecosystems in low-lying areas. A total of 20 ecological communities at risk have the potential to occur within CWHws1 and CWHvm1. Five have Red-listed status and 15 are Blue-listed in BC (**Table 7-1)**.

The BC Conservation Data Centre (CDC) reports three rare plant occurrence records within the Kitimat River valley between Kitimat and Lakelse Lake. These include two vascular plants that are provincially Blue-listed and a lichen that is federally protected under Schedule 1 of *Species at Risk Act* (SARA) as a species of Special Concern (**Table 7-2**).

Figure 10 provides an overview of vegetation resources within the Project area. There are four other biogeoclimatic subzones within the Project area; however, their footprints are minimal. These include CWH montane wet submaritine subzone (CWHws2), CWH montane very wet maritime subzone (CWHvm2), and Mountain Hemlock windward moist maritime subzone (MHmm1).

Table 7-1 Ecological Communities at Risk Potentially Present in the Vicinity of the Project

Scientific Name	English Name	BC Status[1]
CWHws1		
Abies amabilis - Thuja plicata / Gymnocarpium dryopteris	amabilis fir - western redcedar / oak fern	Blue
Abies amabilis - Thuja plicata / Oplopanax horridus Moist Submaritime	amabilis fir - western redcedar / devil's club Moist Submaritime	Blue
Carex limosa - Menyanthes trifoliata / Sphagnum spp.	shore sedge - buckbean / peat-mosses	Blue
Menyanthes trifoliata - Carex lasiocarpa	buckbean - slender sedge	Blue
Picea sitchensis / Rubus spectabilis Wet Submaritime 1	Sitka spruce / salmonberry Wet Submaritime	Red
Pinus contorta / Arctostaphylos uva-ursi	lodgepole pine / kinnikinnick	Red
Populus trichocarpa - Alnus rubra / Rubus spectabilis	black cottonwood - red alder / salmonberry	Blue
Thuja plicata - Picea sitchensis / Lysichiton americanus	western redcedar - Sitka spruce / skunk cabbage	Blue
Tsuga heterophylla - Pinus contorta / Pleurozium schreberi	western hemlock - lodgepole pine / red-stemmed feathermoss	Blue

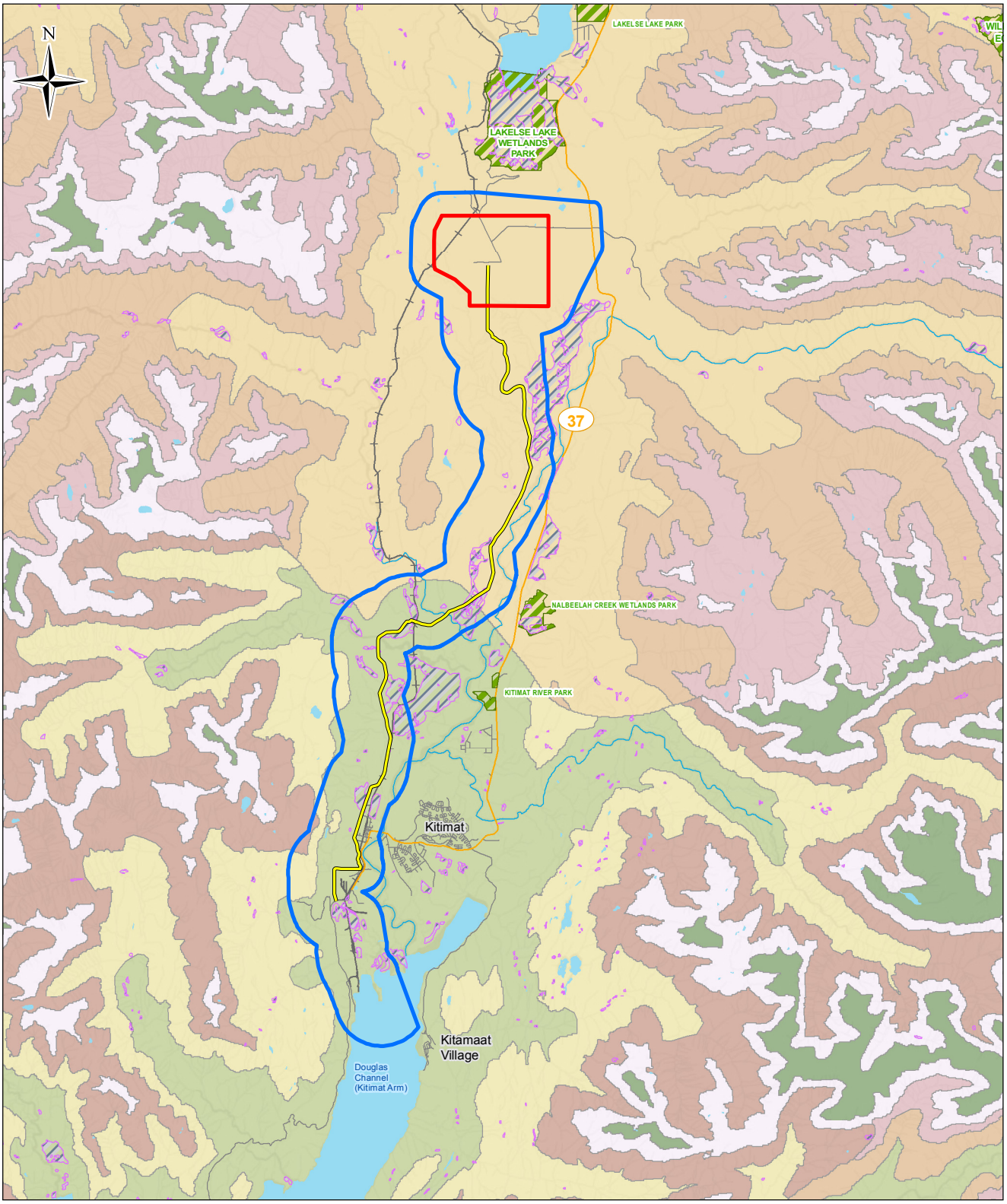
Table 7-1 Cont'd) Ecological Communities at Risk Potentially Present in the Vicinity of the Project

Scientific Name	English Name	BC Status[1]
CWHvm1		
Abies amabilis - Picea sitchensis / Oplopanax horridus	amabilis fir - Sitka spruce / devil's club	Blue
Carex sitchensis / Sphagnum spp.	Sitka sedge / peat-mosses	Red
Leymus mollis ssp. mollis - Lathyrus japonicas	dune wildrye - beach pea	Red
Picea sitchensis / Rubus spectabilis Very Wet Maritime	Sitka spruce / salmonberry Very Wet Maritime	Red
Populus trichocarpa - Alnus rubra / Rubus spectabilis	black cottonwood - red alder / salmonberry	Blue
Rhododendron groenlandicum / Kalmia microphylla / Sphagnum spp.	Labrador-tea / western bog-laurel / peat-mosses	Blue
Salix sitchensis / Carex sitchensis	Sitka willow / Sitka sedge	Blue
Thuja plicata - Picea sitchensis / Lysichiton americanus	western redcedar - Sitka spruce / skunk cabbage	Blue
Thuja plicata - Tsuga heterophylla / Polystichum munitum	western redcedar - western hemlock / sword fern	Blue
Tsuga heterophylla - Abies amabilis / Blechnum spicant	western hemlock - amabilis fir / deer fern	Blue
Tsuga heterophylla - Thuja plicata / Gaultheria shallon Very Wet Maritime	western hemlock - western redcedar / salal Very Wet Maritime	Blue

[1] Red-listed: Indigenous species, or subspecies that have, or are candidates for, Extirpated (XT), Endangered (E) or Threatened (T) status in BC. XT: A species that no longer exists in the wild in Canada, but occurring elsewhere, E: A species facing imminent extirpation or extinction, T: A species that is likely to become endangered if limiting factors are not reversed.
Blue-listed: Indigenous species or subspecies considered to be of Special Concern (SC) in BC. SC: A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

Table 7-2 Vegetation Species at Risk Potentially Present in the Vicinity of the Project

Scientific Name	English Name	BC Status	SARA Status
Malaxis brachypoda	white adder's-mouth orchid	Blue	-
Malaxis paludosa	bog adder's-mouth orchid	Blue	-
Nephroma occultum	cryptic paw	Blue	1-Special Concern



Legend

- Refinery Location
- Project Area
- Potential Module Access Road
- Parks And Protected Areas
- Wetlands

BGC Zone Code

- CMAun
- CWHvm1
- CWHvm2
- CWHws1
- CWHws2
- MHmm1
- MHmm2
- MHmmp
- Highways
- Other Roads
- Rail Tracks
- Watercourses
- Water Bodies

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1.1. Data downloaded from GeoBC in September and October of 2015.
2.Sources: Esri, DeLorme, USGS, NPS Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
©2016

0 2.5 5 10 Km

PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

SNC·LAVALIN

Pacific Future Energy Refinery Vegetation Resources

By: ECH	Date: 2016/05/09	Scale: 1:250,000	Figure Number:10 Rev.: 2
Chk'd: EM	Coord. Sys.: NAD 1983 UTM Zone 9N		Reference No.: 631180-101-007

MXD Path: \\Sll2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-007-R2_Terrestrial_Veg.mxd

7.2.2 Wildlife Resources

Habitat within the Project area supports a variety of wildlife groups including herptiles (amphibians and reptiles), birds and mammals. In addition, portions of the transportation corridor overlap provincial Wildlife Habitat Areas (WHA) and Ungulate Winter Range (UWR). **Figure 11** provides an overview of wildlife resources within the Project area.

Nine species of herptiles are known to occur within the vicinity of the Project area. These include wood frog (*Lithobates sylvaticus*), Columbia spotted frog (*Rana luteiventris*), northwestern salamander (*Ambystoma gracile*), roughskin newt (*Taricha granulosa*), long-toed salamander (*Ambystoma macrodactylum*), common gartersnakes (*Thamnophis sirtalis*) and western terrestrial gartersnakes (*T. elegans*). Western toad (*Anaxyrus boreas*) and coastal tailed frog (*Ascaphus truei*) are also confirmed present. Both of these amphibians are blue-listed in BC and Special Concern under SARA (Schedule 1). A WHA for coastal tailed frog (6-067) has been established on a tributary to the Little Wedeene River, west of the potential access road corridor (**Figure 11**). Other known occurrences of tailed frogs exist for various watercourses west and east of the proposed Refinery, including Coldwater Creek, Wedeene River, Bowbyes Creek, Hirsch Creek, Chist Creek, Schulbuckhand Creek and the headwaters of the Kitimat River (iMapBC, 2015)

Avian habitat in the vicinity of the Project includes upland coniferous forests of various ages, riparian areas, wetlands and waterbodies. Waterfowl and shorebirds breed north of the Project at the Lakelse Lake and Nalbeelah Creek wetlands. Several species of raptors (e.g., eagles, hawks, falcons, and owls) occur within the Project area. In 2015, McElhanney identified over 40 species of songbirds, resident and migratory, at Dubose Flats (McElhanney, 2015b). According to Bird Studies Canada (2015), approximately 291 species of birds have been sighted in the Kitimat-Stikine region, which extends west to Haida Gwaii and north of Iskut. Most of these species are considered migratory under the *Migratory Bird Convention Act* (MBCA). The Project area is within the geographic range of 12 at-risk birds including 10 SARA Schedule 1 species (CDC, 2015; McElhanney, 2015b) (**Table 7-3**). There are no MBS in the vicinity of the Project. The closest MBS is the Nechako River MBS, approximately 500 km to the east in Vanderhoof, BC.

Table 7-3 Bird Species at Risk Potentially Present in the Vicinity of the Project

Scientific Name	English Name	BC List	Identified Wildlife	SARA Status
Accipiter gentilis laingi	Northern Goshawk, *laingi* subspecies	Red	Yes	1-Threatened
*Ardea herodias**	Great Blue Heron, *fannini* and *herodias* subspecies	Blue	Yes	1-Special Concern (*fannini* subspeces only)
*Brachyramphus marmoratus**	Marbled Murrelet	Blue	Yes	1-Threatened

Table 7-3 (Cont'd) Bird Species at Risk Potentially Present in the Vicinity of the Project

Scientific Name	English Name	BC List	Identified Wildlife	SARA Status
*Chordeiles minor**	Common Nighthawk	Yellow	-	1-Threatened
*Contopus cooperi**	Olive-sided Flycatcher	Blue	-	1-Threatened
*Cypseloides niger**	Black Swift	Blue	-	1-Special Concern
*Euphagus carolinus**	Rusty Blackbird	Blue	-	1-Special Concern
Falco peregrinus pealei	Peregrine Falcon, *pealei* subspecies	Blue	-	1-Special Concern
*Hirundo rustica**	Barn Swallow	Blue	-	-
Megascops kennicottii kennicottii	Western Screech-Owl, *kennicottii* subspecies	Blue	-	1-Special Concern
*Patagioenas fasciata**	Band-tailed Pigeon	Blue	-	1-Special Concern
*Podiceps nigricollis**	Eared Grebe	Blue	-	-

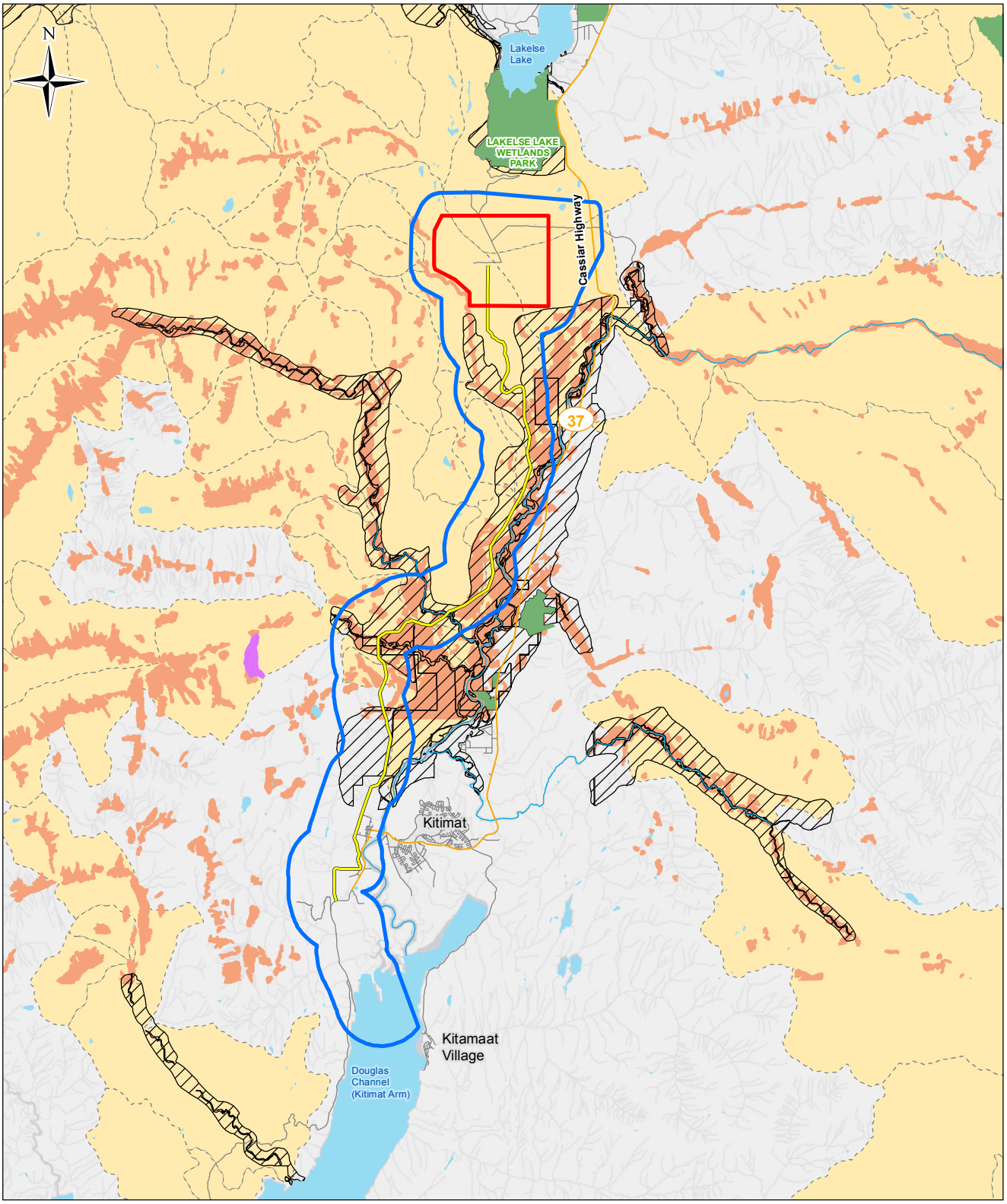
* Designated under the MBCA.

Several species of mammals have known presence within the Project area. At least four species of mustelids have been documented within or near the Project. Rodents and insectivores are expected to be present, as well as snowshoe hare (*Lepus americanus*). Mule deer (*Odocoileus hemionus*) and moose (*Alces americanus*) are ungulates common to the region. Winter forage is readily available for these species, where shrubby browse habitat is abundant. The Project area overlaps with moose winter range (u-6-009) south of the Refinery in the Kitimat River valley and along larger tributaries (iMapBC, 2015).

Large predators with known presence include cougar (*Puma concolor*), grizzly bear (*Ursos arctos*) and black bear (*U. americanus*). Low-lying habitats of the Kitimat River valley, Cecil Creek and Little Wedeene River provide high-value grizzly bear habitat, portions of which have been proposed to be designated as WHAs by FLNRO.

Three of the mammal species are considered species at risk: grizzly bear, wolverine (*Gulo gulo*) and fisher (*Pekania pennanti*) are provincially Blue-listed, and are also listed as Identified Wildlife under provisions of the *Forest and Range Practices Act* (FRPA). They are not SARA-listed.

PFEC has begun field studies, with involvement from First Nations, to assess the potential Project impacts on wildlife, vegetation and ecosystems. Through co-creation with First Nations, PFEC will work towards ensuring a sustainable environment in the region.



Legend

- Refinery Location
- Project Area
- Potential Module Access Road
- Parks And Protected Areas
- Wildlife Habitat Area - Legal - Coastal Tailed Frog
- Ungulate Winter Range - Moose
- Proposed Wildlife Habitat Area - Grizzly Bear
- Grizzly Bear Identified Watersheds
- Highways
- Other Roads
- Watercourses
- Waterbodies

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data downloaded from GeoBC in September and October of 2015.
2. Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
©2016

0 2.5 5 10 Km

PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

SNC·LAVALIN

Pacific Future Energy Refinery Wildlife Resources

By: ECH	Date: 2016/05/09	Scale: 1:250,000	Figure Number: 11	Rev.: 2
Chk'd: EM	Coord. Sys.: NAD 1983 UTM Zone 9N		Reference No.: 631180-101-008	

MXD Path: \\Sll2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-008-R2_Terrestrial_Wildlife.mxd

7.2.3 Aquatic Resources

The proposed Refinery is located within the southern portion of the Kitsumkalum-Kitimat Trough at the height of land that divides two distinct watersheds: Lakelse River and Kitimat River. The Lakelse watershed lies in the northern portion of Dubose Flats and flows northward into the Skeena River, whereas the Kitimat watershed lies on the southern portion and flows south into the Douglas Channel. Three major tributaries have been identified near the Refinery site: Clearwater Creek (Lakelse River watershed), Cecil and Chist creeks (Kitimat River watershed). In addition to the tributaries, a number of small lakes and wetlands are present (i.e., Clearwater Lake, Onion Lake).

The potential access road is situated entirely within the Kitimat watershed and extends from the Refinery to Kitimat. There are a number of high-fisheries-value watercourses within the access road corridor that include the Kitimat River, Wedeene River, Little Wedeene River, Nalbeelah Creek, Humphrys Creek, Moore and Anderson creeks. A complex myriad of wetlands and small lakes have also been identified.

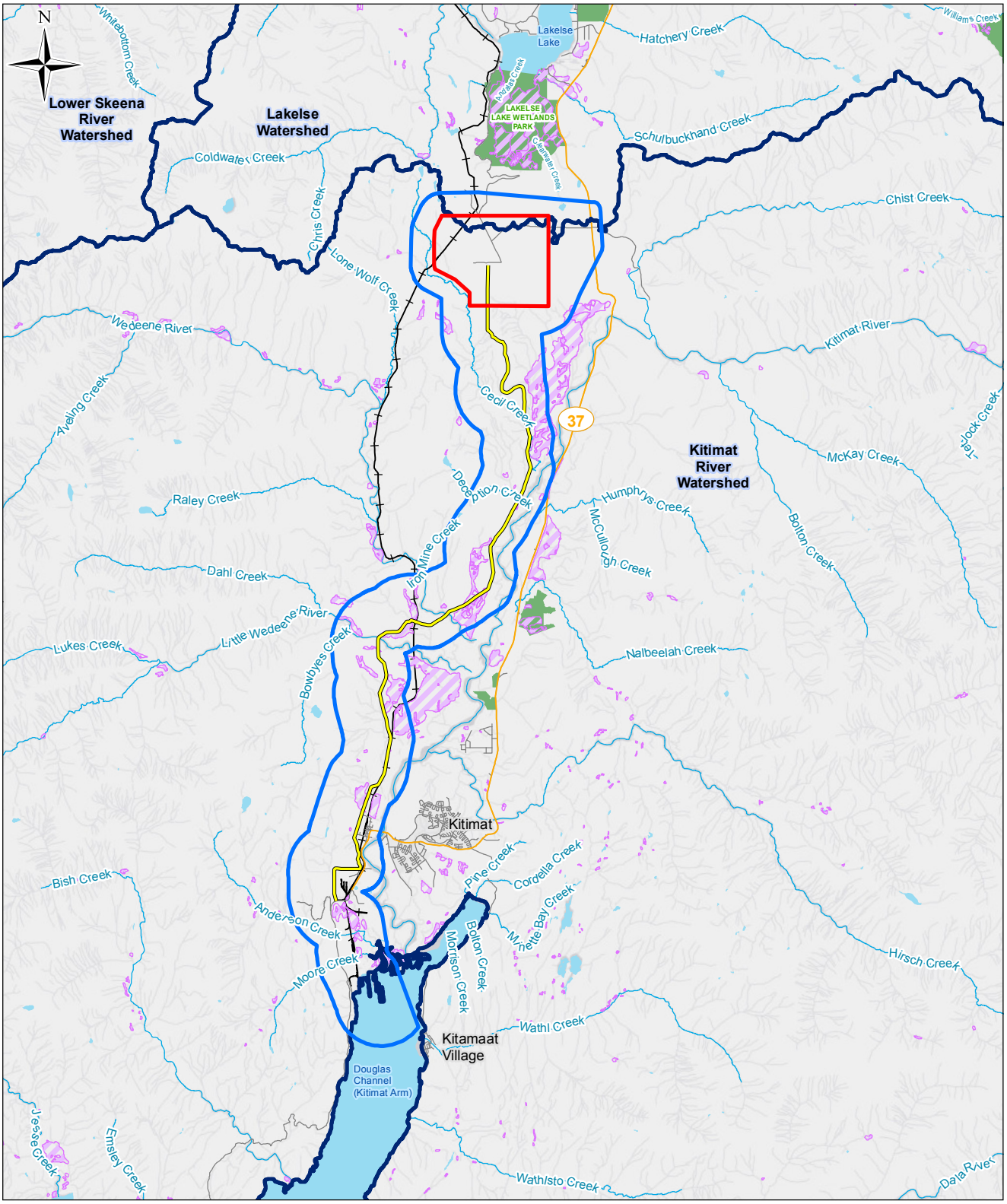
Both Lakelse River and Kitimat River watersheds are well documented and provide important habitat for an array of recreational, commercial and traditionally important fish species including Coho Salmon (*Oncorhynchus kisutch*), Pink Salmon (*O. gorbuscha*), Chinook Salmon (*O. tshawytscha*), Chum Salmon (*O. keta*) and Sockeye Salmon (*O. nerka*), as well as Dolly Varden Trout (*Salvelinus malma*), Bull Trout (*Salvelinus confluentus*), Coastal Cutthroat Trout (*O. Clarkii clarkii*), and Rainbow Trout/Steelhead (*O. mykiss*). Eulachon (*Thaleichthys pacificus*) have also been documented in the Kitimat River; however, very little is known and runs are not regular (Stantec, 2013).

Of the fish species documented within the Lakelse and Kitimat watersheds, none are designated under SARA or red-listed in BC. However, three species (i.e., Coastal Cutthroat Trout, Bull Trout, and Eulachon) are blue-listed. Eulachon have been historically documented in the Kitimat River, but the population has yet to recover from a drastic decline in the 1990's (Stantec, 2013). Although the status of Kitimat Eulachon has not been formally assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), given that populations have declined over 90% in the past 15 years, COSEWIC has recommended an "Endangered" status (COSEWIC, 2011).

As part of the EA, PFEC will complete fish studies, with involvement from First Nations, to assess the potential impacts on fish and fish habitat (including impacts on water quality such as acidification) during the construction and operation. During construction, fisheries values may be impacted during the installation of clear-span crossings at Wedeene and Little Wedeene rivers for the potential access road (**Figure 12**). Other crossings may be needed, but have not been identified

at this stage. During operation, impacts to fisheries values could occur from groundwater or surface water extraction for the refining process. For example, fish habitat can be altered as a result to changes to instream flow. The Project also anticipates some treated water release to Douglas Channel; the potential effects of which will be assessed. Habitat loss from module road infrastructure is also a potential effect on fish habitat that will be considered in the assessment. PFEC will work with First Nations to develop a plan for monitoring fish species which may be of primary importance to the local communities. PFEC commits to ensuring the layout and operability of the Project respects First Nations culture, traditions and natural resources.

Figure 12 provides an overview of aquatic resources features, including all waterbodies in the vicinity of the Project.



Legend

- Refinery Location
- Project Area
- Potential Module Access Road
- Parks And Protected Areas
- Watershed Boundary
- Wetlands
- Highways
- Other Roads
- Rail Tracks
- Watercourses
- Water Bodies

Notes:
1. Intended for Illustration purposes only.
2. Original in colour.
3. Site location is approximate.

References:
1. Data downloaded from GeoBC in September and October of 2015.
2. Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
©2016

0 2.5 5 10 Km

PACIFIC FUTURE ENERGY
Building Our Future, Protecting Our Coast

SNC·LAVALIN

Pacific Future Energy Refinery Aquatic Resources

By: ECH	Date: 2016/05/09	Scale: 1:250,000	Figure Number: 12	Rev.: 2
Chk'd: EM	Coord. Sys.: NAD 1983 UTM Zone 9N		Reference No.: 631180-101-009	

MXD Path: \\Sll2606\projects\LOB\EIAM-BC\Current Projects\Pacific Future Energy\631180 Dubose Flats - PFEC Refinery\4.0 Execution\4.5 GIS and Drawings\GIS\Maps\MXD\Report Figures\631180-101-009-R2_AquaticRes.mxd

7.3 Summary of Potential Project Interactions with Biophysical Values

Taking into consideration the brief environmental profile described above, PFEC has identified a number of potential interactions between the Project components (identified in **Table 4-1**) with environment-related values (geophysical, hydrological, hydrogeological, atmospheric, vegetation and wildlife, fish and aquatic) which are likely of relevance to the Project area and general region. These interactions are categorized by Project phase (C – Construction, O – Operation, D – Decommissioning and Reclamation, A – All phases) and are presented in **Table 7-4**.

Table 7-4 Preliminary Identification of Potential Project Component – Biophysical Interactions

	Project Components	Biophysical Environment													
		Terrain Stability	Soils	Hydrology	Hydrogeology	Carbon Emissions	Air Quality	Noise	Fish	Water Quality (Ground, Surface, Marine)	Marine (Habitat and Species)	Rare Plants	Rare and Sensitive Ecosystems (including wetlands)	Birds	Herptiles	Mammals
Refinery Infrastructure	Bitumen oil refinery (built from 100 to 150 pre-fabricated modules, each weighing between 2,500 and 5,000 MT)	CO	A	A	A	A	A	A	A	A	C	C	C	A	A	A
	Rail yard (unloading and loading) with seven tracks (total length of 20.9 km), capable of receiving up to four unit trains per day (120 rail cars each)	CO	A			A	A	A		A		C	C	A	A	A
	Upgraded road to the site from Highway 37	C	C				C	C				C	C	CO	CO	CO
	Tie-in to an existing natural gas pipeline	C	A		C	C	C	C				C	C	C	C	C
	On site storage for feedstock and refined products with a total capacity of greater than 500,000 m3	CO	A		O	CO	A	CD		A		C	C	C	C	C
	Administrative building to hold 100 persons (approximately 3 floors, each 1,000 m2);	C	C		A		CD	C				C	C	C	C	C
	Four explosion-proof control rooms (approx. 800 m2 each) for process unit groups: • Distillate Hydrotreater, Gas Oil Hydrocracker/ Hydrotreater, Hydrogen	C	C			C	C					C	C	C	C	C

Project Components	Biophysical Environment														
	Terrain Stability	Soils	Hydrology	Hydrogeology	Carbon Emissions	Air Quality	Noise	Fish	Water Quality (Ground, Surface, Marine)	Marine (Habitat and Species)	Rare Plants	Rare and Sensitive Ecosystems (including wetlands)	Birds	Herptiles	Mammals
Production Unit, SWSs, ARU and SRU; • Distillation units, Isomerization Unit, and Catalytic Reforming Unit; • Residue Conversion Unit and Gasifier Unit; and • Oil Movement.															
Building for laboratory analysis (approximately 500 m2);	C	C			C	C	C				C	C	C	C	C
Control Room for Power Generation, Raw Water Treatment and Wastewater Treatment (approximately 800 m2);	C	C			C	C	C				C	C	C	C	C
Shop for turbines for the power generation (approximately 2,000 m2)	C	C			C	C	C				C	C	C	C	C
Shop for spare parts and PPE (approximately 2,000 m2)	C	C			C	C	C				C	C	C	C	C
Shop for catalyst and chemicals (approximately 2,000 m2)	C	C			C	C	C				C	C	C	C	C
Building for Electrical, Instrumentation and Maintenance (approximately 1,200 m2)	C	C			C	C	C				C	C	C	C	C
Building for firefighting equipment and first aid (approximately 1,500 m2)	C	C			C	C	C				C	C	C	C	C

Project Components		Biophysical Environment														
		Terrain Stability	Soils	Hydrology	Hydrogeology	Carbon Emissions	Air Quality	Noise	Fish	Water Quality (Ground, Surface, Marine)	Marine (Habitat and Species)	Rare Plants	Rare and Sensitive Ecosystems (including wetlands)	Birds	Herptiles	Mammals
Refinery Utilities Infrastructure	Electrical power infrastructure (steam-turbine and gas-turbine generator)	C	CO	O	O	A	A	A				C	C	A	A	A
	Electrical power infrastructure: Biomass facility (supply from pulp wood and hog fuel)	C	A			A	A	A				C	C	A	A	A
	Emergency power (combination of standby fuel gas- or natural- gas-driven generators for critical loads)	C	A				C	C				C	C	C	C	C
	Raw water system (surface and/or groundwater)	C	A	A	A	C	C	C	A	A		C	C	C	C	C
	BFW and steam	C	C				C	C				C	C	C	C	C
	Sanitary and potable water system	C	C	CO			C	C				C	C	C	C	C
	Domestic sewage system	C	A		O		A	C	O			C	C	C	C	C
	Surface water management system (runoff ponds)	C	A				C	C	O	O		C	C	C	C	C
	Fuel gas and natural gas (supplied from off site)	C	OD				O		O	O				O	O	O
	Instrument and Utility Air System	C	C				C	C				C	C	C	C	C
	Fire, gas and smoke detection System	C	C				C	C				C	C	C	C	C
	Fire water system (oxygen and nitrogen)	C	C				C	C	OD	OD	C	C	A	A	A	A
	Hydrocarbon drain system (Closer Drain System and Open Drain/ OWS Drain System)	C	C				C	C	OD	OD	C	C	A	A	A	A
	Relief and flare	C	C			CO	CO	C				C	C	CO	C	C
	Waste Management System	C	OD			CO	CO	CO				C	C	A	A	A
	A 6” water pipeline from the Refinery to Kitimat for the discharge of treated wastewater from the Refinery.	C	A		A	C	C	C	A	A	A	C	C	C	C	C

Project Components		Biophysical Environment														
		Terrain Stability	Soils	Hydrology	Hydrogeology	Carbon Emissions	Air Quality	Noise	Fish	Water Quality (Ground, Surface, Marine)	Marine (Habitat and Species)	Rare Plants	Rare and Sensitive Ecosystems (including wetlands)	Birds	Herptiles	Mammals
Potential Surface Water Intake Structure	Intake structure on Kitimat River (no diversion, min. river depth of 0.7m at point of intake, concrete structure, scour protection and wedge weir screen, protection of fish through screen)	C	CD	O	O	C	C	C	A	A		C	C	C	C	C
	Access road from Refinery to intake structure	C	CD			C	C	C				C	C	A	A	A
	Dual pipes from structure to the pump station	C	A	O	O			C	C	C		C	C	C	C	C
Construction-related Refinery Infrastructure	Trailers, fabrication shops, and material storage shop	C	C		C	C	C	C				C	C	C	C	C
	Existing off-loading dock (former Eurocan dock) in Kitimat to receive Refinery modules during construction															
	Potential Refinery Module Access Road (40 km long by 50 m wide) with a clear-span crossing on Wedeene River and Little Wedeene River	C	A	C	C	A	A	A	A	A		C	C	A	A	A
	Workforce housing accommodations	C	A		A	A	A	A		A		C	C	A	A	A

8 ENGAGEMENT AND CONSULTATION

During the preparation of this document, PFEC invited early-stage engagement with the Kitselas Government, the Haisla Nation, FLNRO, EAO and the Agency. This included providing a copy of an initial draft of the Project Description to all First Nations in the Project area, seeking review and comment. PFEC will continue to engage and consult these groups, as well as others throughout Project development.

8.1 First Nation Government Consultation & Participation

The Project is within the traditional territories of the Haisla, Kitselas, Lax Kw'alaams, Metlakatla and Kitsumkalum. The Project also has impacts for the other Tsimshian First Nations and Tsimshian peoples as a whole. PFEC recognizes that all engagement activities must respect, recognize and be implemented with the understanding both of the individual communities' title and rights, and the larger collective governance structure of the Tsimshian First Nations.

The Project is also within the Northwest BC governing region of MNBC (MNBC 2016), including the BCMF.

The Refinery site is located in the proposed Treaty Settlements Lands of the Kitselas First Nation as identified in the AIP[30] between the Kitselas, BC, and Canada (August 4, 2015). Given this, PFEC has engaged the Kitselas at the early planning stage to build a positive and effective working relationship throughout the Project's development.

Also integral to the Project is an existing offloading terminal in Kitimat, which is planned to be the main staging/routing area for the delivery of key Refinery components during the construction phase. This location, extending from Kitimat is in the traditional territory of Haisla Nation.

8.2 First Nations Government Approach

PFEC has adopted a 'First Nations First' approach that is a governing pillar of the entire company. PFEC also is operating within the context of upholding the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). This means that the approach is fully integrated throughout all aspects of the project and includes PFEC's role in the development of relationships with First Nations, which includes meaningful consultation and accommodation of First Nations title and rights in our Project area. While there are legal and regulatory requirements that will be upheld, PFEC understands these as minimum requirements and strives for meaningful partnerships and relationships that result in a co-created approach.

[30] http://www.bctreaty.net/nations/agreements/Kitselas_AIP.pdf

We recognize First Nations as first-order governments, with title and rights. Our fundamental objective in engaging with First Nations is to recognize, respect, and reconcile title and rights with our Project's objectives. PFEC will be an advocate, and a participant, in ensuring that the consultation and accommodation processes, partnerships, and relationship-building associated with our Project serve to achieve reconciliation, allowing for the full recognition and respect of First Nations title and rights, and treaty rights.

PFEC began engaging with First Nations at the earliest stage of our Project's concept. This will allow opportunity for First Nations full participation and co-creation into our Project's design, and early recognition of concerns, so that they can be addressed together.

PFEC will seek the approval of First Nations through a process that is mutually designed and agreed to. PFEC's overall intent is to ensure that the approval process meets the legal standard in terms of consultation and accomodation for the First nations that will be involved. PFEC anticipates that this process will work in conjunction with, and will coincide with, the processes set out under the provisions of BCEAA and CEAA 2012.

PFEC's engagement strategy with First Nations is based on our foundational principal that First Nations are a first order of government and that we will proceed with our Project if we are welcomed and supported by the First Nations who are the title-holders and affected by this Project. This engagement process will require that PFEC understand that the success of our Project is based on the full adoption that our approach is 'First Nations First'.

In addition to our 'First Nations First' approach, PFEC is also in full support for the UNDRIP. This is reflected in PFEC's commitment to directly engage Indigenous communities, including their families and citizens. This requires going beyond simply upholding current legal requirements, to establishing meaningful relationships and in some cases, partnerships with the First Nation governing bodies and their business and administrative bodies.

This approach is reflective of PFEC's business principles as they relate to First Nation interests, namely:

- First Nations as governments not stakeholders; with the necessary approach and consideration given;
- Alignment of PFEC's corporate Vision, mandate and approach with First Nations interests; and
- Support of First Nation institutional development at a local, regional and provincial level.

PFEC has commenced to develop relations and early engagement with all First Nations identified in **Section 6**. Concurrently, PFEC has initiated and invited preliminary engagement with the Kitselas Government and Haisla Nation and will continue to engage all affected Nations throughout the Project's development.

8.3 Summary of Engagement with First Nations and Aboriginal Groups to Date

8.3.1 Kitselas Nation

Following a number of meetings and discussions, PFEC signed a Memorandum of Understanding (MoU) with the Kitselas Government on September 1, 2015. The MoU acknowledges the Kitselas territory and First Nations rights and creates a framework to enable discussions, community engagement and communication between the parties.

The MoU speaks to the intent of the parties to enter into further agreements up to, and including an Impact Management and Benefits Agreement (IMBA) that coincides with Project development. PFEC understands that while direct relationships must be built with each community, this must be done in the context and with further engagement activities within the broader understanding and recognition of the Tsimshian Nation as a collective whole.

PFEC most recently met with Kitselas Lands and Resources Department on May 26, 2016 to present the Project Description and have an open dialogue about the EA process, current activities and project-related concerns.

8.3.2 Haisla Nation

PFEC formally introduced the Project to the Haisla Nation in October 2015 via formal correspondence to the Haisla Chief and Council. The objective is to extend the relationship beyond the consultative level and enter into a mutual understanding, under a MoU, which will prescribe how each party will engage in Project discussions, both within the EA process and outside.

Our goal is to develop an engagement process that is unique to our relationship with the Haisla, founded on trust, so that we can co-create a process to explore the potential development of our Project.

Planned activities moving forward include exploring opportunities related to commercial and economic benefits, participation and review of this Project Description as the initial step in the EA process and scoping the EA and identification of valued components. There will also be opportunities to participate in field studies throughout Project development in areas of interest to the Haisla.

8.3.3 Lax Kw'alaams Band

PFEC introduced the Project to the Lax Kw'alaams Band in November 2015 via formal correspondence to Chief and Council who were appointed in late November. This initial introduction was at a high level regarding the key aspects of our Project, with an invitation for a face-to-face formal introduction to our Project as it is currently developed. Our objective, as with other

First Nations, is to engage at an early stage and work towards an initial understanding that can describe how a working relationship will be developed to begin to share information and gain a greater understanding of each other.

Our goal is to develop an engagement process that is unique to our relationship with the Lax Kw'alaams Band, founded on trust, so that we can co-create a process to explore the potential development of our Project.

Initial work undertaken by PFEC has been to gain an initial understanding of Lax Kw'alaams Band governing structure and processes, as well as their traditional territory and where it coincides with our Project area.

PFEC understands that while direct relationships must be built with each community, this must be done in the context and with further engagement activities within the broader understanding and recognition of the Tsimshian Nation as a collective whole.

8.3.4 Metlakatla First Nation

PFEC introduced the Project to the Metlakatla First Nation in November 2015 via formal correspondence to Chief and Council. This initial introduction was at a high level regarding the key aspects of our Project, with an invitation for a face-to-face formal introduction to our Project as it is currently developed. PFEC most recently met with Metlakatla council on May 26, 2016 to introduce the PFEC team and to have an open dialogue about the Project. Topics included, among others, the Environmental Assessment process in BC, best practices during sensitive biological time periods and protection of water resources. Hard copies of the Project Description were presented, including a hard copy with cover letter for Chief Councillor Harold Leighton, who was unable to attend.

Our objective, as with other First Nations, is to engage at an early stage and work towards an initial understanding that can describe how a working relationship will be developed to begin to share information and gain a greater understanding of each other.

Further, our goal is to develop an engagement process that is unique to our relationship with the Metlakatla First Nation, founded on trust, so that we can co-create a process to explore the potential development of our Project.

Initial work undertaken by PFEC has been to gain an initial understanding of the Metlakatla First Nation governing structure and processes, as well as their traditional territory and where it coincides with our Project area.

PFEC understands that while direct relationships must be built with each community, this must be done in the context and with further engagement activities within the broader understanding and recognition of the Tsimshian Nation as a collective whole.

8.3.5 Kitsumkalum First Nation

PFEC is at the very early stages of introducing the Project to the Kitsumkalum First Nation. Formal correspondence was sent in November 2015 to Chief and Council. This initial introduction was at a high level, and without prejudice, regarding the key aspects of our Project, with an invite for a face-to-face formal introduction to our Project as it is currently developed. PFEC most recently met with Chief and Council on May 27, 2016 to introduce the PFEC team and have an open dialogue about the Project. Chief shared a brief history on Kitsumkalum people, culture and traditions. PFEC listened to meeting attendees concerns regarding the compartmentalization of the BC EA process, rail transportation and safety. Hard copies of the Project Description were presented at the meeting.

Our objective, as with other First Nations, is to engage at the front end, the earliest stage, and work towards an initial understanding that can describe how a meaningful working relationship will be developed to begin to share information and gain a greater understanding of each other.

Further, our goal is to develop an engagement process that is unique to our relationship with the Kitsumkalum First Nation, founded on trust, so that we can co-create a process to explore the potential development of our Project.

Initial work undertaken by PFEC has been to gain an initial understanding of the Kitsumkalum First Nation; this includes a review of the recently executed AIP with BC and Canada (August 2015).

PFEC understands that while direct relationships must be built with each community, this must be done in the context and with further engagement activities within the broader understanding and recognition of the Tsimshian Nation as a collective whole.

8.3.6 Métis Nation

The MNBC was identified as a potential interested Aboriginal group in February 2016. PFEC will initiate communications with MNBC in 2016. Additionally, in 2016, PFEC will initiate communications with BCMF.

8.4 Key Comments and Concerns from First Nations to Date

At this very early stage, PFEC has received only preliminary feedback from First Nations as we are just beginning the conversations. In keeping with our all-encompassing First Nations First approach, our focus is on building meaningful and respectful relationships based on title and rights; seeking an effective, working relationship where we can begin and continue to share and shape information together. We will thus work towards addressing feedback and specific issues as they arise. Key comments and concerns heard from First Nations to date include:

- Ensuring that First Nations have the opportunity to review project-related documents prior to government
- Lack of knowledge on the operation of a bitumen refinery;
- Rail transportation safety and increase in rail traffic;
- Impacts to local water and fish resources, including acidification;
- Impacts to aboriginal rights;
- Extent of tree clearing; and
- Change to accessibility to areas currently used for traditional purposes.

8.5 Public Consultation

PFEC's plans for public consultation can be broadly divided into three categories:

- Public opinion research;
- Direct community engagement; and
- Social/media engagement.

Each element will be used to continually refine our approach not only in addressing public concerns but also in adapting our Project plans to acknowledge and, where possible, mitigate those concerns as well.

8.5.1 Public Opinion Research

PFEC has already undertaken initial quantitative and qualitative public opinion research so that we understand where the public's concerns - particularly in the proposed Project area - are focused. PFEC has already used the results of this work in shaping our commitment to a NZNC emissions standard, for example.

In public-opinion research conducted to date, results found that a majority of British Columbians expressed an opinion supporting the building an oil refinery on BC's North Coast. This support grows to higher levels in the Terrace/Kitimat area, with approximately two-thirds of those polled expressing an opinion supporting the building an oil refinery in their area.

Key reasons for supporting a refinery included the belief that refining oil in Canada means that more value is added and Canadians get more benefit in terms of price, jobs and tax revenues. Generally, the feeling is that it is better to build a refinery in Canada because of our high environmental and labour standards; and that building a refinery allows Canada to take environmental responsibility for the full processing of bitumen from Canada.

PFEC will continue to undertake public opinion research at regular intervals in order to gauge any changes in public mood or the appearance of any new concerns in a timely fashion.

8.5.2 Direct Community Engagement

PFEC's expectation is that we will host and/or participate in a number of meetings in the communities potentially affected by the Project, such as Terrace and Kitimat. Some meetings will be with local community organizations and/or governments, others will be open public meetings hosted by PFEC. The direct community engagement will be done in coordination and with integrated understanding of First Nations engagement.

We expect that the frequency of meetings will ebb and flow based on the amount of information about the Project in the public domain. For example, PFEC will proactively host meetings in the affected communities to answer questions on the PD during the federally-legislated 20-day public comment period, in addition to any open houses hosted by the EAO to support public comment periods during the provincial EA process.

PFEC is also planning to open a Project office in Terrace, which will be open during regular office hours, staffed by local Project personnel, to answer questions and engage with the community.

8.5.3 Social/Media Engagement

PFEC believes that social and mainstream media are invaluable tools in communicating about our Project, as well as understanding the concerns of the public in real time. We have a strong team focused on both social and mainstream media and expect to become increasingly active as the Project develops.

Additionally, we will use both social and mainstream media to enhance public awareness around particular, significant milestones in the Project's life. For example, during the 20-day public comment period for the Project Description, PFEC expects there will be much more discussion on social media platforms about the Project's pros and cons. The PFEC team will actively engage in those discussions to ensure the public has ready access to reliable information.

8.5.4 Issues or Concerns Raised

Key concerns identified in the public-opinion research centred around crude oil and bitumen and its effect on the aquatic environment in the case of an ocean spill. Our Project works to address these concerns because of the reduced risk that refined products pose. There was also concern expressed about a refinery's effects on a local airshed, which we address with our NZNC emissions project design (see **Section 4.7**).

8.6 Municipal, Regional, Provincial and Federal Government Consultation

PFEC has met with FLNRO, EAO, the Agency and the BC Oil and Gas Commission (OGC) to introduce the PFEC team, the proposed Project and to seek guidance on the anticipated regulatory processes to support advancement of the Project. A summary of each meeting is described below:

- February 2015. Meeting with EAO and OGC to introduce the PFEC team and describe the Project. EAO described the provincial EA process and suggested a follow-up meeting prior to PD submission.
- February 2015. Introductory meeting with the Agency to describe the Project and gain an understanding of the federal EA process. CEAA also suggested a follow-up meeting prior to the PD submission.
- September 2015. Meeting with FLNRO to discuss provincial tenure application requirements.
- November 2015. Follow-up meeting with EAO. Project updates were discussed, anticipated timelines for PD submission as well as additional guidance on Project Description preparation.
- November 2015. As above, with the Agency.
- December 2015 and February 2016. PFEC and SNC-Lavalin Inc. (SNC-Lavalin) met with EAO and the Agency for feedback on draft versions of the PD.
- February 2016. PFEC and SNC-Lavalin met with OGC to introduce the Project and seek guidance on the anticipated regulatory process and permits relevant for Project development.
- May 2016. PFEC and SNC-Lavalin met with EAO and the Agency separately to provide a Project development update which included an introduction of PFEC's First Nations First approach.

As EA planning proceeds, PFEC fully expects to engage other authorizing agencies (refer to **Section 11**) to discuss information requirements to support their permit or approval processes.

8.7 Engagement and Consultation Plans and Communications

PFEC is in the process of developing plans for engagement and consultation with First Nations and with the Public (including other government entities). The plans will also include tools for tracking and documenting issues and concerns raised during Project development. PFEC aims to build the relationships and partnerships necessary to co-create these tools with the First Nations communities to ensure they are reflective and responsive to the communities. PFEC's First Nations

First approach recognizes that the process and the tools for how engagement and consultation and communications are recorded is situated in a larger relationship context. All processes and tools are considered and developed in the context of the spirit and intent of the relationships with the First Nations, and Aboriginal groups. The issues identified through ongoing community engagement will be critical inputs to the overall EA process, particularly in the early stages of issues scoping, valued component selection and drafting the AIR.

9 PAST AND CURRENT ENVIRONMENTAL STUDIES

Several studies and assessments have been conducted near the Refinery and surrounding region. **Figure 6** shows the location of all past, present and reasonably foreseeable projects within and near the Project area. These include the following:

- **The Kitimat Airshed Emissions Effects Assessment** (**ESSA, MoE**). The 2013 assessment was completed as a scoping-level assessment of the potential combined effects on the environment and human health from NO_2 and SO_2 emissions from existing and proposed industrial facilities in the Kitimat area (including existing aluminum smelter, four proposed LNG terminals, possible oil refinery, and gas-turbine powered electrical generation facilities, as well as related marine transportation sources). The assessment area covers 6,772 km^2. PFEC's proposed Refinery is within the assessment area.
- **Terrace to Kitimat Transmission Project (BC Hydro):** BC Hydro is building a single new 287 kV transmission line along the west side of the Kitimat Valley, which will provide enough capacity to meet electricity needs in the area (BC Hydro, 2015). Target in-service date is 2018/2019. The Project will occur between the Minette Substation near Douglas Channel and the Skeena Substation northeast of Lakelse Lake, with a section of the transmission line occurring within PFEC's Refinery site.
- **Coastal GasLink Pipeline Project (TransCanada PipeLines Limited):** The project is to develop a 670-km natural gas pipeline 1219 mm (48 inches) diameter across BC, from the Groundbirch area near Dawson Creek in northeast B.C. to the proposed LNG Canada Export Terminal near Kitimat. The initial capacity would be approximately 2.1 billion cubic feet (bcf)/day with the potential for expansion up to approximately 5 bcf/day with up to 8 compressor stations (BC EAO, 2015). Coastal GasLink received an EA Certificate from the EAO in October 2014 with 32 conditions. Construction is proposed to start in 2016. The proposed pipeline intersects at the southeast end of PFEC's access road in Kitimat.
- **Pacific Northern Gas (PNG) natural pipeline (PNG Ltd.):** An existing natural gas pipeline from Summit Lake, BC to Kitimat, BC. The pipeline is 525 km in length (PNG, 2015). From Lakelse Lake to Kitimat the route is parallel to Highway 37 (**Figure 6**). The pipeline is about 3.5 km to the east of the Refinery.
- **PNG Looping Project (PNG Ltd.):** PNG is proposing to loop the existing natural gas transmission pipeline noted above. The majority of the project is within the same corridor as the existing pipeline; however, the route between Telkwa and Lakelse Lake will be aligned in a new corridor (PNG, 2015). The project is in the pre-application stage of provincial EA (EAO, 2015).

- **Douglas Channel LNG Project (AltaGas DCLNG Lease Limited Partnership):** The project is for the construction of a floating LNG facility, located on the west bank of the Douglas Channel near Kitimat, BC (BC Gov, 2015). It consists of a floating LNG terminal, a floating LNG storage unit, jetty structure and mooring facilities, and ancillary services and infrastructure (including a tug berth, access road, site office and metering station) (DC LNG, 2015). A new 8-km pipeline spur will connect the terminus of the existing PNG pipeline to the site to provide natural gas to the project. An NEB application was submitted in June 2015 and in July an LNG Facility Permit Application was submitted to the OGC for review. DCLNG does not require provincial or federal EA review.
- **Enbridge Northern Gateway Project (Northern Gateway Pipelines Limited Partnership):** A proposed twin condensate pipeline from Bruderheim, Alberta to Kitimat, BC for a total length of 1,177 km (District of Kitimat, 2015). The project includes a two-berth marine terminal and tank farm north of Bish Creek on the west side of Douglas Channel. A federal EA approval was granted in 2014 following a joint review by the Agency and NEB. The proposal entered the provincial EA process in April 2016. The proposed project intersects with PFEC's Refinery location.
- **Kitimat LNG Terminal Project (Chevron Canada and Woodside Canada):** A proposed LNG terminal in Kitimat, BC. The project includes a new marine facility, vessel path to existing shipping lane, LNG terminal and storage facilities, pipelines and ancillary facilities, supporting facilities and infrastructure. The project received provincial and federal EA approvals in 2006.
- **Pacific Trail Pipeline Project (Chevron Canada and Woodside Canada):** A 480 km natural gas pipeline proposed to deliver gas from Summit Lake, BC to the Kitimat LNG Terminal Project.[31] Federal and provincial environmental approvals were granted in 2009 and 2008, respectively (District of Kitimat, 2015). Tree clearing work was undertaken in 2015. The pipeline corridor through PFEC's Refinery site has been cleared (T. Anderson 2015, pers.comm., 8 Dec).
- **LNG Canada Export Terminal Project (LNG Canada):** The proposed project received federal and provincial EA approvals in 2015 (EAO, 2015) and an LNG Facility Permit from the BC OGC in December 2015. LNG Canada, a joint venture between Shell Canada, PetroChina Co., KOGAS and Mitsubishi, is proposing to construct an LNG plant and marine terminal facilities on the former Methanex methanol plant site (District of Kitimat, 2015). The proposed project may overlap with PFEC's potential access road near Kitimat.
- **RTA Terminal A Extension and Modernization Project (RTA):**

Rio Tinto proposed an **extension** of an existing marine terminal (Terminal A, the existing deep-sea marine terminal) and construction of a barge ramp, tug dock, a possible breakwater, and laydown facility to replace the existing facilities for the import and export of bulk materials in

[31] http://www.chevron.ca/our-businesses/kitimat-lng/pacific-trail-pipeline

Kitimat BC. The upgraded facility will serve as replacement infrastructure and will be situated near Rio Tinto's existing facilities. An EA Certificate from the province was granted on December 21, 2015. The project may overlap with PFEC's access road in Kitimat.

Kitimat Modernization Project (KMP) is **modernization** of the existing Kitimat Smelter. It will increase the smelter's current production to approximately 420,000 tonnes per year. The project reached full ramp-up production and full capacity in March 2016.

- **Kitimat Clean Refinery Project (Kitimat Clean Ltd.):** A proposed 400,000 BPD oil refinery, pipeline and export terminal in the Kitimat area. The project entered the provincial EA process in May 2016.

Geothermal Power Plant (Kitselas First Nation, Enbridge and Borealis GeoPower)[32]: A proposed geothermal plant in the Mount Layton hot springs area. In 2014, the consortium acquired subsurface rights to 2,865 ha site located south of Lakelse Lake.

- **Forceman Ridge Landfill and the Thornhill Transfer Station (RDKS):** The Forceman Ridge Landfill is in the pre-construction stage located approximately 30 km south of Terrace and 600 meters off Highway 37 (Chist Creek Main logging road). BC MoE has approved an Operational Certificate for this facility. The new landfill is adjacent to Dubose Flats northeast of the PFEC Refinery.

The existing **Thornhill Landfill** will be closed and reconstructed as a transfer station. The new transfer station will be located north of Lakelse Lake.

[32] http://www.terracestandard.com/news/249147481.html

10 PERMITS AND APPROVALS

PFEC anticipates that the Project will require an EA pursuant to the BCEAA and CEAA 2012 based on the following Project components:

- A new oil refinery with an input capacity of 200,000 BPD or 31,795 m^3/d of NEATBIT™ (Figures 2 and 5);
- A new rail yard with seven tracks with a length of 20.9 km (**Figures 2** and **6**); and
- Anticipated feedstock and product storage with a total storage capacity of greater than 500,000 m^3 (**Figures 2** and **5**) The total storage capacity will have the capability to yield by combustion greater than 3 PJ of energy.

The following permits and approvals will likely be required from federal and provincial authorities for the Project.

10.1 Federal Permits and Approvals

Based on the input capacity of the Refinery and size of the rail yard, the Project is expected to be a "designated project" pursuant to **Section 14(a), 14(e) and 25(b)** of the *Regulations Designating Physical Activities*, and may require a federal EA for the construction, operation, decommissioning and abandonment of a new:

- **Section 14(a)** – oil refinery, including a heavy oil upgrader, with an input capacity of 10,000 m^3/day or more;
- **Section 14(e)** petroleum storage facility with a storage capacity of 500 000 m^3 or more; and
- **Section 25(b)** – railway yard with seven or more yard tracks or a total track length of 20 km or more.

The Project will not include the construction, operation, decommissioning or abandonment of a new:

- **Section 2(a)** – fossil fuel-fired electrical generating facility with a production capacity of 200 MW or more. PFEC plans to use clean energy sources to power the Refinery;
- **Section 6** – structure for the diversion of 10,000,000 m^3/yr or more of water from a natural water body into another natural water body;
- **Section 24(c)** – marine terminal designed to handle ships larger than 25,000 DWT. The Project use an existing marine facility in Kitimat;
- **Section 25 (a)** – railway line that requires a total of 32 km or more of new right of way; and

- **Section 25(c)** – all-season public highway that requires a total of 50 km or more of new right-of-way.

PFEC will work with CN Rail and transporters of the NEATBIT™ to ensure that the feedstock is transported safely on rail and in accordance with Transport Canada rail safety legislation.

Table 10-1 is a preliminary list of the federal permits, licences or other authorizations that may be needed under an Act of Parliament to carry out the Project. A *Navigation Protection Act Permit* is not likely required.

Table 10-1 Federal Authorizations Which May Be Applicable to the Project

Permit Required	Act or Legislation	Governing Agency	Need for Permit
EA Approval	CEAA *(as amended in 2012, c.19, s.52)* *Regulations Designating Physical Activities*	the Agency	Designated project under section14(a) of *Regulations Designating Physical Activities*
Fisheries Act Authorization	*Fisheries Act*	DFO	Required if the work, undertaking or activity will likely result in serious harm to fish that are part of a commercial, recreational or Aboriginal (CRA) fishery, or to fish that support such a fishery. This could include in-stream works such as the construction of clear-span crossings in salmon-bearing rivers or the release of treated water into the marine environment at Douglas Channel.
SARA Permit	SARA	EC, DFO	May need if the salvage or handling of listed species is required during construction or operation.

10.2 Provincial Permits and Approvals

An energy storage facility with ≥ 3 PJ capacity (~112,000 m^3) is considered a "reviewable project" pursuant to the *Reviewable Project Regulations* (Part 4, section 10, Table 8) under BCEAA. Based on the currently expected permanent on site storage capacity, the Project would constitute a provincially reviewable project.

At this time, PFEC is contemplating groundwater as the preferred source water for the Refinery; however, the feasibility of groundwater is pending further investigative studies including knowledge and understanding from First Nations. If groundwater is deemed suitable for the needs of the Refinery at a rate ≥75 litres per second (l/s), the Project would also expect to be reviewable in accordance with the Regulations (Part 5, section 11, Table 9) which specify that a new groundwater

extraction facility designed to extract groundwater at a rate of ≥75 l/s is considered a provincially reviewable project. The Refinery will require approximately 48,000 m^3/d which equates to approximately 555 l/s.

There is no section under the Regulations that requires the EA of an oil refinery.

A preliminary list of permits, approvals, and authorizations anticipated to be required from the Province of BC, following the issuance of an EA Certificate for construction and operation of the Project, are summarized in **Table 10-2**.

Table 10-2 Provincial Authorizations Which May Be Applicable to the Project

Permit Required	Act or Legislation	Governing Agency	Need for Permit
Approval or Notification under Section 9 Approval under Section 8	BC *Water Sustainability Act* BC *Water Sustainability Regulation*	MoE	If instream works are associated with the Project. If short-term use of water from surface water bodies (i.e., lakes and/or streams) is required (e.g., for construction camp, concrete production, dust suppression, or other temporary uses during construction).
Archaeological Information Assessment Form (AIAF)	BC *Heritage Conservation Act (HCA) (1996)(Section 14)*	OGC	All oil and gas developments proposed in BC require an AIAF to be submitted with the application package to OGC. The AIAF indicates whether the proposed development will require further archaeological studies, such as an Archaeological Impact Assessment (AIA).
Construction Permit for a Potable Water Well (if applicable)	*Drinking Water Protection Act*	Ministry of Health	Prior to drilling well. For camp and/or plant, domestic use.
Drinking Water System Operations Permit	*Drinking Water Protection Act*	Ministry of Health	Required prior to operation of system.
EA Certificate	BCEAA S.B.C. 2002 c.43 BC *Reviewable Projects Regulation*	EAO	Reviewable project under *Reviewable Project Regulation.*
Heritage Inspection Permit	BC HCA (Section 14)	FLNRO, Archaeology Branch	May need permit if AIA is undertaken; a Heritage Inspection Permit will only be required for AIAs on provincial and private lands in BC.

Table 10-2 (Cont'd) Provincial Authorizations Which May Be Applicable to the Project

Permit Required	Act or Legislation	Governing Agency	Need for Permit
Heritage Investigation Permit	BC HCA (Section 14)	FLNRO, Archaeology Branch	A Heritage Investigation Permit may be required to authorize systematic study and data recovery from an archaeological site that cannot be avoided during development activities. A Heritage Investigation Permit is typically used during mitigation of significant archaeological sites.
Heritage Site Alteration Permit	BC HCA (Section 12)	OGC	A Heritage Site Alteration Permit will be required to alter (meaning to change in any manner) an archaeological site. Typically follows a Heritage Inspection Permit and/or Heritage Investigation Permit.
Licence/permit	BC *Forest Act*	FLNRO	May need Licence to Cut or Timber Transport permit.
New Permit Holder Application Form	BC *Oil and Gas Activities Act* (OGAA)	OGC	The OGC will not accept any additional permit applications until registered with the Corporate Land Management Unit.
Oil and Gas Facility Permit Application	OGAA	OGC	Required prior to any construction activities.
Waste Discharge Permit – Approval for Introduction of Waste	*Oil and Gas Waste Regulation* under the EMA – Section 15	OGC	May approve the introduction of waste into the environment for a period of up to 15 months without issuing a Section 14 permit.
Waste Discharge Permit – Permits for Introduction of Waste	*Oil and Gas Waste Regulation* under the EMA – Section 14	OGC	Required prior to operations. Permits required for all air emissions, solid wastes and wastewater discharges.
Water Discharge Permit	BC EMA	MoE	Air and water emissions
Water Licence Drilling Authorization	BC *Water Sustainability Act* BC *Groundwater Protection Regulations*	OGC MOE	Necessary if a project will cause diversion of surface waters. Necessary if there is a project requirement to construct a well(s)
Water System Construction Permit	BC *Drinking Water Protection Act*	Ministry of Health	Required prior to construction of system.
Wildlife Act Permit	BC *Wildlife Act*	MoE	If wildlife salvages and surveys are required, or bird nest removal/relocation.

11 ANTICIPATED SCOPE OF THE PROJECT AND ENVIRONMENTAL ASSESSMENT

PFEC understands that EA regulators will determine the need for an EA based on the Project Description, and in turn will determine the scope of the Project based on the physical works and activities described within the Project Description. Those physical works and activities identified within the scope of the Project are subject to EA review. The Project's key components are described below (also summarized in **Table 4-1**):

Refinery facility (1,000 ha):

- NEATBIT™ refining facilities capable of processing 200,000 BPD or 31,795 m^3/d;
- Storage facilities for feedstock and refined products with a total storage capacity of greater than 500,000 m^3;
- Rail yard (unloading and loading) with seven tracks (total track length of 20.9 km), capable of receiving up to four unit trains per day (120 rail cars each);
- Tie-in to an existing natural gas pipeline;
- Permanent infrastructure including administrative and control rooms;
- Refinery utilities infrastructure:
  - Electrical power infrastructure capable of producing 300 MW of clean energy during operations;
  - Biomass facility (to generate approximately 25-75 MW of the 300 MW required during the refining process);
  - Emergency power system;
  - Raw water system including intake and treatment for 48,000 m^3/d of water. Where possible, PFEC will recycle treated water;
  - Potential surface water intake structure on the Kitimat River (including intake structure, pump station, scour protection and wedge weir screen, fish screen, access road between Refinery and river intake, dual pipes between the intake and the Refinery.
  - BFW and steam system;
  - Sanitary and potable water system;
  - Domestic sewage system;
  - Surface water management and treatment system for refining process water run-off and non-refining process water run-off;
  - Fuel gas and Natural gas;
  - Instrument and Utility Air System;

- Fire, gas and smoke detection;
- Fire water system (oxygen and nitrogen);
- Hydrocarbon Drain system; and
- Relief and flare systems.

- Water and Waste Management;
- A six inch water pipeline from the Refinery to Kitimat for the purpose of discharging treated water (approximately 100 m^3/hr) to Douglas Channel.

Construction-related infrastructure:

- Existing off-loading dock (former Eurocan dock) in Kitimat to receive Refinery modules during construction;
- Access Road (200 ha; 40 km long, 50 m wide) with clear-span crossing on Wedeene River and Little Wedeene River (with potential for use post-construction based on input from First Nations and the public); and
- Workforce housing accommodations for the construction phase.

Additionally, there are activities that may be secondary or incidental to the Project, carried out by a third party (Section 5.4). These activities would not be within the scope of the Project, but may be considered in the cumulative effects assessment (CEA) if interactions are identified. These include the following activities:

- Transport of Refinery modules along the marine access route from the nearest pilotage station;
- Transport of NEATBIT™ to the Refinery;
- Transport of wood-waste biomass to the Refinery; and
- Export of the refined petroleum products from the Refinery.

A CEA will be completed for the Project and will take into consideration other past, present and reasonably foreseeable future projects and activities that have the potential to interact with the Refinery and its components. PFEC will compile an inclusive list of projects and reports for the CEA, and may include the following:

- ESSA and BC MoE Kitimat Airshed Emissions Effects Assessment (2013);
- BC Hydro Terrace to Kitimat Transmission Project (proposed in-service date is 2018/2019);
- TransCanada Pipelines Limited Coastal GasLink Pipeline Project (proposed construction start in 2016);

- PNG natural pipeline (in operation);
- PNG Looping Project (proposed);
- AltaGas DC LNG Lease LP Douglas Channel LNG Project (proposed);
- Enbridge Northern Gateway Project (proposed);
- Chevron and Woodside Canada Kitimat LNG Terminal Project (pre-construction);
- Chevron and Woodside Canada Pacific Trail Pipeline Project (pre-construction);
- LNG Canada Export Terminal Project (proposed);
- RTA marine terminal and Kitimat smelter (in operation);
- RTA Terminal A Extension and Modernization Project (proposed expansion and upgrades);
- Kitimat Clean Refinery Project (proposed);
- Geothermal Power Plant (proposed); and
- RDKS Forceman Ridge Landfill and the Thornhill Transfer Station (in pre-construction).

In compiling socio-economic and biophysical information to prepare this Project Description, and taking into consideration the EA requirements outlined in CEAA 2012 and BCEAA, and in recognition of First Nations title and rights, UNDRIP, and considerations outlined in the BC First Nations Energy and Mining Council environmental assessment toolkit[33], PFEC anticipates the EA will assess the potential effects of the Project on the following:

- **Environment:** erosion and stability of terrain, climate and air quality; groundwater and surface water resources; vegetation and wildlife resources, fish and fish habitat;
- **Social:** demand on community services, emergency services and housing; changes to traffic (road, rail and marine transport); change to recreational activities;
- **Economy:** employment and business opportunities, existing local and regional industry;
- **Health:** air, noise and water emissions; visual aesthetic;
- **Heritage:** archaeological resources within and near the Refinery and along the potential access road;
- The interests of First Nations and Aboriginal groups;
- Accidents and malfunctions on the biophysical and human environment;
- Effects of the environment on the Project; and
- Cumulative effects.

[33] http://fnemc.ca/?portfolio=environmental-assessment-toolkit

The above-noted values may have an interaction with the Project components. The potential interactions are presented in **Section 6.5** (socio-economic) and **Section 7.3** (biophysical), and are further categorized into general Project phases.

Under CEAA 2012, the Project Description must address the potential for changes to the following:

- **Fish and Fish Habitat**: Changes to or loss of fish and fish habitat, as defined by the *Fisheries Act.* Project interactions with fish and fish habitat may occur during the construction of the potential access road, which will require clear-span crossings on two salmon-bearing rivers as shown in **Figure 12** (Wedeene and Little Wedeene Rivers). Changes to local water availability or quality as a result of water intake activities from groundwater and/or surface water sources (from aquifers with possible hydraulic connection to local fish-bearing water bodies, or from the Kitimat River) for the refining process may also impact local fish resources (species and habitat). Other potential effects leading to the loss of or change to fish and fish habitat include the discharge of treated wastewater into the marine environment and acidification of water bodies as a result of CO_2 emissions from the Project. The accidental release of untreated wastewater or deleterious substances from runoff and retention ponds at the Refinery (**Figure 5**) to nearby waterbodies such as Cecil Creek, would also result in impacts to fish or fish habitat.
- **Aquatic species**: Change to a fish or marine plant as defined in SARA. Project interactions with aquatic species may occur from the release of treated wastewater to the Douglas Channel. Wastewater from the Refinery will be treated on site and tested to ensure water quality and temperature meet regulated requirements for release into the marine environment.
- **Wetlands:** Change to a wetland ecosystem. There are several wetland ecosystems in the Project area which have the potential to be directly affected by the construction of the module road and intake structure. Such effects include reduced functionality due to habitat loss or fragmentation. Accidental spills of deleterious material or sedimentation could also impact overlapping wetlands during construction and road operation. Wetlands in the vicinity of the proposed intake structure or watercourse crossings may be affected by changes to waterflow (drawdown or flooding).
- **Migratory Birds**: Changes to migratory birds, as defined in the *Migratory Birds Convention Act, 1994*. The Project area is an mix of upland forest, riparian and wetland ecosystems which are suitable for a diversity of migratory and resident avian species. Project interactions, such as loss or disturbance (noise, visual) of breeding habitat, with migratory birds may occur as a result of clearing and grubbing activities during construction of the Refinery, associated infrastructure and access road. Operational activities (noise and visual disturbance, gas flaring and venting) may deter the bird use of habitat in the vicinity for nesting or foraging; however, other suitable bird habitat is still available within the region.

Bird mortality from collision with Refinery infrastructure will also be considered as a potential effect in the EIA. The closest MBS is nearly 500 km east in Vanderhoof, BC.

- **Federal and Other Lands**: No environmental effects are anticipated on federal lands, in a province other than the province in which the Project is proposed to be carried out, or outside of Canada. The Refinery footprint and potential access road alignment will not overlap with federal land; however, PFEC will assess the potential effects of the Project on air quality within the Kitimat airshed where federal land is present (**Figure 7**). Furthermore, PFEC is committed to reducing greenhouse gas emissions from the Project through the means described in **Section 4.1.3**. There are several First Nations reserves near the Project area; however, there is no overlap of reserve lands. Refer to Figure 7 for the relative distance of reserves to the Project footprint.
- **Effects of Environmental Changes on First Nations and Aboriginal Peoples**: Change to the social and economic structure, individual and community health, loss or degradation of heritage resources, traditional and cultural activities. Engagement and consultation with local First Nations and Aboriginal peoples described in **Section 6.1** will help to inform how the Project may affect community, current use of lands and resources for traditional purposes and impacts to health (country foods). As shown in **Figure 7**, there are five First Nations traditional territories within PFEC's Project area which suggests there will likely be effects of environmental changes on First Nations. These include Kitselas First Nation, Haisla Nation, Lax Kw'alaams Band, Metlakatla First Nation and Kistumkalum First Nation. The Project is also within MNBC's Northwest governance region, and that of the BCMF. Some potential effects on these First Nations and Aboriginal groups may include:

- Socioeconomic:
    - Potential economic benefits for First Nations and Aboriginal peoples such as through short term and long term employment, training opportunities, business opportunities;
    - Reduced availability and access to community and emergency services to the local community; and
    - Incremental increase of vehicle traffic on Highway 37, rail traffic on the CN Rail line and vessel traffic in Kitimat harbour.
- Human health:
    - Degradation of air quality and noise effects through construction of the Refinery and access road;
    - Degradation of air quality from Refinery operations (air emissions as described in **Section 4.7.3**);
    - Light emission from the Refinery and reduced visual aesthetics of the landscape; and
    - Safety hazards from Refinery operations.

- Heritage resources:
  - Damage to archaeological, spiritual, and heritage sites through earthwork activities such as site preparation and road building; and
  - Loss or modification of CMTs and access to traditional use area.
- Traditional and cultural activities:
  - Changes to traditional harvesting activities through effects to terrestrial resources as the result of land clearing:
    - Loss of ecosystem community diversity; i.e., wetlands and riparian systems;
    - Loss of species diversity; i.e., listed species, traditional use plants;
    - Changes in habitat availability; i.e., habitat loss, degradation and fragmentation;
    - Reduced habitat use from sensory disturbance as the result of project construction and operation; and
    - Direct wildlife mortality as the result of increased project activity interaction.

12 REFERENCES

Adams, P. 2015. Greater Terrace/Thornhill Governance Diagnostic Inventory. Prepared for RDKS. Prepared by Peter Adams, Victoria Consulting Network Ltd. September 4, 2015. Available at: http://www.rdks.bc.ca/news/greater-Terracethornhill-governance-diagnostic-inventory. [Accessed: December, 2015].

Anderson, T. Personal Communication. December 8, 2015.

Banner, A. W.H. MacKenzie, S. Haeussler, S. Thomson, J. Pojar, and R.L. Trowbridge. 1993. A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region (Part 1, Part 2, and Supplement No. 1). Land Management Handbook 26. Research Branch, BC Ministry of Forests.

Bastion Group Heritage Consultants. 2007. Archaeological Overview Study for the Proposed Kitimat-Summit Lake Natural Gas Pipeline Looping Project. Prepared for Pacific Trails Pipelines Limited Partnership. January 2007.

Bird Studies Canada. 2015. British Columbia Coastal Waterbird Survey. Available: http://www.birdscanada.org/volunteer/bccws/index.jsp?targetpg=index. [Accessed: October, 2015].

BC Conservation Data Centre (CDC). 2015. BC Species Ecosystems Explorer. BC Ministry of Environment (MoE). Victoria, BC. Available at: http://a100.gov.bc.ca/pub/eswp/. [Accessed: October, 2015].

BC Environmental Assessment Office (EAO). 2015. Project Information Centre (e-PIC). Available at: http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_home.html [Accessed: December, 2015].

BC Government (BC Gov). 2015. B.C. Air Quality Readings Available at: http://www.bcairquality.ca/readings/index.html. [Accessed: October, 2015].

BC Hydro. 2015. Terrace to Kitimat Transmission Project. Available at: https://www.bchydro.com/energy-in-bc/projects/tkt.html. [Accessed: December 2015].

BC Ministry of Forests (MoF). 1998. Timber Supply Review Kalum Timber Supply Area Information Report. BC Ministry of Forests, date January 1998.

BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO). 2013. Coastal Mountain Resource District Geomatics Services. BC Ministry of Forests, Lands and Natural Resource Operations, dated February 2013.

BC Water Resources Atlas. 2015. Available at: http://maps.gov.bc.ca/ess/sv/wrbc/. [Accessed: October, 2015].

Canadian Environmental Assessment Agency. 2015. Guide to Preparing a Description of a Designated Project under the *Canadian Environmental Assessment Act, 2012*. Updated March 2015. Available at: https://www.ceaa-acee.gc.ca/default.asp?lang=En&n=3CA9CEE5-1. [Accessed: October, 2015].

City of Terrace. 2011. The City of Terrace Official Community Plan. Available at: http://www.Terrace.ca/documents/bylaws-general/Bylaw-Terrace-2011-OCP-Schedule-A-(Bylaw-No.-1983-2011)27.pdf. [Accessed: October, 2015].

COSEWIC. 2011. COSEWIC assessment and status report on the Eulachon (Thaleichthyspacificus) Nass/ Skeena Rivers population, Central Pacific Coast population and the Fraser River population in Canada. Committee on the status of endangered wildlife in Canada. Ottawa. Xv +88 pp. (www.sararegistry.gc.ca/status/status_e.cfm)

District of Kitimat. 2015. Major Projects. Available at: http://www.Kitimat.ca/EN/main/business/invest-in-Kitimat/major-projects.html. [Accessed: December, 2015].

District of Kitimat. 2008. District of Kitimat Official Community Plan. Available at: http://www.Kitimat.ca/assets/Business/PDFs/official-community-plan-2008.pdf. [Accessed: October, 2015].

Douglas Channel LNG Project (DC LNG). Available at: http://douglaschannellng.com/. [Accessed: December, 2015].

Environment and Climate Change Canada (EC). 2015. Canadian Climate Normals 1981-2010 Station Data for Terrace A Station. Climate ID: 1068130. Available at: http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?stnID=441&radius=25&proxSearchType=coordinates&degreesNorth=54&minutesNorth=28&secondsNorth=07&degreesWest=128&minutesWest=34&secondsWest=42&proxSubmit=go&dCode=1. [Accessed: December, 2015].

Habitat Wizard. 2015. Available at: http://maps.gov.bc.ca/ess/sv/habwiz/. [Accessed: October, 2015].

Hectares BC. 2015. Available at: http://hectaresbc.org/app/habc/HaBC.html. [Accessed: October, 2015].

iMapBC. 2015. Data BC online mapping application. Province of British Columbia. Available at: http://www.data.gov.bc.ca/dbc/geographic/view_and_analyze/imapbc/index.page. [Accessed: October, 2015].

Indigenous and Northern Affairs Canada (INAC). 2015. Registered Indian Population by Sex and Residence. Available at: http://publications.gc.ca/collections/collection_2012/aadnc-aandc/R31-3-2011-eng.pdf [Accessed: October 2015].

INAC. 2013. Lax-kw'alaams – Connectivity Profile. Available at: https://www.aadnc-aandc.gc.ca/eng/1357840941740/1360159783308 [Accessed: December 2015].

Kitselas. 2015. Kitselas First Nation. Available at: http://www.kitselas.com/. [Accessed: October, 2015].

McElhanney Consulting Services Ltd. 2015a. Geotechnical Overview: Industrial Development, Dubose Flats, BC. April 9, 2015.

McElhanney Consulting Services Ltd. 2015b. *Preliminary Environmental Review: Dubose Site*. Report prepared for Pacific Future Energy Corporation. Vancouver, BC. 24p.

McElhanney Consulting Services Ltd. 2015c. *Preliminary Dubose Site Assessment: Breeding Bird Inventory and Cecil Creek Stream Walk*. Report prepared for Pacific Future Energy Corporation. Vancouver, BC. 26p.

Métis Nation British Columbia (MNBC). 2016. MNBC at a Glance. Updated on January 20, 2016. Available at: http://www.mnbc.ca/app/webroot/uploads/About_Us/MNBC_at_a_Glance_Updated_01-20-2016_Signed.pdf. [Accessed: February 2016].

National Energy Board. 2010. Written Evidence of the Haisla Nation. Report prepared for the Enbridge Northern Gateway Project. Available at: https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/384192/620327/624910/693017/774474/D80-22-02_-_Haisla_Nation_-_1_OVERVIEW_OF_HAISLA_NATION_EVIDENCE%281%29_-_A2K0U6.pdf?nodeid=774478&vernum=-2. [Accessed: October 2015].

Pacific Northern Gas Ltd. (PNG). 2015. PNG Looping Project. Available at: http://www.png.ca/png-looping-project/. [Accessed: December 2015].

RDKS. 1998. Industrial Site Profiles. April 1998. Regional District of Kitimat-Stikine, dated April 17, 1998.

Stantec. 2013. *LNG Canada Project: Project Description*. Report prepared for LNG Canada Development Inc., Vancouver, BC. 74p.